

# **NOTICE**

## **(FOR INFORMATION PURPOSES ONLY)**

### **STAKEHOLDER AND COMMUNITY ENGAGEMENT BY CONTRACTORS**

The TTC supports and encourages contractors to engage the community via various available youth apprenticeship and training programs including, but not limited to Hammer Heads, LIUNA BOLT, Carpenter Council of Ontario 'CHOICE', Helmets to Hardhats, etc. which provide participants with leadership and mentoring opportunities that will lead to development of valuable skill sets, self-confidence and promote positive self-awareness.

### **SAFETY CERTIFICATION PROGRAM FOR CONSTRUCTION PROJECTS**

***NOTE: The below target implementation dates have been updated as of December 20, 2018.***

This will serve to notify that the TTC has implemented the Certificate of Recognition (COR™) safety program for its construction projects. The COR™, issued by the Infrastructure Health and Safety Association (IHSA) will supplement TTC's current safety requirements, such as WSIB clearance certification and corporate and site specific safety plans, prior to commencement of any construction work. Construction contractors' bidding on future TTC projects will be required to have COR™ in order to be considered for any award and further, must maintain certification in good standing for the duration of any awarded contract.

TTC has implemented the COR™ requirement as detailed below:

- As of July 1, 2018: For contracts estimated at greater than \$5M – Contractors must be COR™ certified.
- As of July 1, 2018: For all contracts irrespective of value – Contractors must be COR™ registered.

TTC will continue implementing the COR™ requirement in a phased approach to ensure that the number of certified contractors is sufficient to allow for competitive bidding. Consequently, contractors interested in bidding TTC construction work are encouraged to familiarize themselves with COR™ and the respective requirements for the program.

The revised target implementation dates for mandatory COR™ for TTC construction contracts are as follows:

- July 1, 2019 for all contracts irrespective of value - Contractors must be COR™ certified.

Contractors who do not yet possess COR™ and wish to obtain information about the certification, are advised to contact:

Centre for Health and Safety Innovation (CHSI)  
5110 Creekbank Road, Suite 400  
Mississauga, Ontario L4W 0A1  
E-Mail: [cor@ihsa.ca](mailto:cor@ihsa.ca) Internet: [www.ihsa.ca/cor](http://www.ihsa.ca/cor) Telephone: 1-800-263-5024





# **Sheppard Station**

## **Station Managers Office and Zone Hub**

**Contract SH35-8**

**Issued by Toronto Transit Commission**







**TORONTO TRANSIT COMMISSION  
REQUEST FOR BIDS  
FOR**


**SHEPPARD STATION  
STATION MANAGERS OFFICE AND ZONE HUB  
CONTRACT SH35-8  
BID NO. T11PJ19727**

**CLOSING: AS SET OUT IN SUB-ITEM 1.3 OF  
SECTION 00 21 00**





**BID SUBMISSION TO: MERX ELECTRONIC BID SUBMISSION**

May, 2019  
Toronto Transit Commission



<b>TITLE:</b> Sheppard Station – Station Manager's Office and Zone Hub.		
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Stamp applies to Relevant Sections: See Table of Contents.

<b>ARCHITECT (A)</b>		<b>STRUCTURAL ENGINEER (S)</b>	
<b>MECHANICAL ENGINEER (M)</b>		<b>ELECTRICAL ENGINEER (E)</b>	



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## REFERENCE DRAWINGS

Reference drawings listed below are provided for information and convenience. TTC accepts no liability or responsibility for completeness or accuracy of reference drawings. Reference drawings are not to scale.

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065	SH-51-11-A-291	SH35-8-REF-5	Std Details/Schedules/Misc North Concourse Collector's Booth
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079	SH-51-11-M-028	SH35-8-REF-19	Yonge Line North Concourse, North Plumbing and Drainage
080	SH-51-11-M-045	SH35-8-REF-20	Yonge Line North Concourse, South Fire Protection
081	SH-51-11-M-046	SH35-8-REF-21	Yonge Line North Concourse, North Fire Protection
082	SH-51-11-M-048	SH35-8-REF-22	Sheppard Line West Concourse Fan Room Fire Protection
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085	SH-51-11-M-077	SH35-8-REF-25	Sheppard Line North Concourse Part Plan Plumbing and Drainage
086	SH-51-11-E-174	SH35-8-REF-26	Yonge Line N/Concourse South Power
087	SH-51-11-E-175	SH35-8-REF-27	Yonge Line N/Concourse North Power
088	SH-51-11-E-189	SH35-8-REF-28	Yonge Line N/Concourse North Systems
089	SH-51-11-E-160	SH35-8-REF-29	Yonge Line N/Concourse North Lighting

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## APPENDICES

### APPENDIX A – CONTRACTOR REFERENCE CHECK REPORT



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**1 SPECIAL INSTRUCTIONS**

- 1.1 This Request for Bids (RFB) is issued by the Toronto Transit Commission (TTC).
- 1.2 Any subsequent Contract will be between TTC and the successful Bidder.
- 1.3 **Closing:** Thursday, June 6, 2019 by 2:00:00 p.m. Toronto time, through the use of MERX Electronic Bid Submission (EBS). Bidders shall be solely responsible for the delivery of their Bids in the manner and time prescribed.
- 1.4 **Contract Administrator:** Anna Spadafora E-mail: [anna.spadafora@ttc.ca](mailto:anna.spadafora@ttc.ca). The individual named in Paragraph 1.4 may, at his or her sole discretion, delegate any of his or her responsibilities as set out in the Bid Documents.
- 1.5 **Date, Time and Place of Site Tour:**
  - 1.5.1 TTC will conduct a mandatory Site tour on Thursday May 23, 2019 at 10:00 a.m. Toronto time for Bidders to examine the Site and adjacent premises. The Bidder's representative is not permitted within any Non-Public Areas of the Site unless accompanied by TTC's representative(s).
  - 1.5.2 The Bidder's representative(s) should assemble at: Sheppard Station at the North Collector's Booth at 20 Sheppard Avenue West, North York, Ontario.
  - 1.5.3 The Bidder's representative(s) shall wear the following safety apparel in order to attend the Site tour: Safety shoes, construction hard hat, safety glasses, and safety vest.
  - 1.5.4 On-site parking will not be available for Site tour attendees.
  - 1.5.5 The Bidder must have a representative present at the mandatory Site tour, and have signed the attendance sign-in sheet, in order for its Bid to be evaluated and accepted by TTC. A subsequent Site tour will not be conducted during the RFB period.
- 1.6 **Minutes for Site Tour:**
  - 1.6.1 The minutes of the Site tour will be available via MERX to all listed companies.
- 1.7 **Submission Requirements:**
  - 1.7.1 The Bidder shall submit the completed documents as listed below:
    - 1.7.1.1 The executed Bid Form included as Section 00 41 00;
    - 1.7.1.2 An executed Bid Bond form, included as Section 00 43 13 or in a form approved by TTC, in the amount of \$150,000.00. The Bid Bond shall be submitted in PDF format, and original shall be submitted within two Business Days upon request from the TTC, to the Contract Administrator identified in Paragraph 1.4;
    - 1.7.1.3 The executed Agreement To Bond form included as Section 00 43 14, or in a form approved by TTC. The Agreement to Bond shall be submitted in PDF format, and original shall be submitted within two Business Days upon

request from the TTC, to the Contract Administrator identified in Paragraph 1.4;

1.7.1.4 A list of contracts of similar scope, nature complexity and cost completed within five years prior to the date of Closing, included as Section 00 45 13, or in a form approved by TTC, verifying the Bidder's ability to perform the Work forming the basis of this Contract. The information provided should include for each contract the following:

1.7.1.4.1 The names and telephone numbers of a representative of the owner and a representative of the appropriate consulting engineering firm or architectural firm involved in each listed contract which may be used for reference check purposes in accordance with Article 9. TTC reserves the right to request further references and/or further information.

1.7.1.4.2 A detailed description of the work performed highlighting the commonality and similarity of the work performed including relevant experience on the following:

1.7.1.4.2.1 Multi-disciplinary retrofit type projects involving civil, mechanical (including elevators), electrical and structural disciplines including the tie-in and interface with existing site structures and systems;

1.7.1.4.2.2 Projects with limited working and staging areas;

1.7.1.4.2.3 Projects in transit or similar operating environments involving complex constraints due to limited access and restrictive operating hours, various shifts and complex sequencing/staging of work required to accommodate continuous operations of the facility; and

1.8 **Pre-Qualified Companies: N/A**

1.9 **Certificate of Recognition:**

1.9.1 The Bidder (including every participant of a Joint Venture, if applicable) must be Certificate of Recognition (COR™) registered, with Infrastructure Health and Safety Association (IHSA), at the time of the Closing and for the duration of the term of Contract. The name identified on the COR™ registration must be exactly as stated in Section 00 41 00 (and any Joint Venture participant, if applicable).

1.9.2 Prospective Bidders who are not COR™ registered and wish to obtain information about the registration and certification are advised to contact:

Centre for Health and Safety Innovation (CHSI)  
5110 Creekbank Road, Suite 400  
Mississauga, Ontario  
L4W 0A1  
E-Mail: [cor@ihsa.ca](mailto:cor@ihsa.ca)  
Internet: [www.ihsa.ca/cor](http://www.ihsa.ca/cor)  
Telephone: 1-800-263-5024



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## 2 DEFINITIONS AND INFORMATION

### 2.1 Additional Definitions:

- 2.1.1 The following additional definitions shall apply to all Bid Documents and references to the singular throughout the Bid Documents shall be considered to include the plural and vice versa as the context requires.
- 2.1.2 All capitalized terms unless otherwise defined in this Section shall have the meaning as set out in the General Conditions and/or Supplementary Conditions of the Bid Documents.
  - 2.1.2.1 **“Addendum” or “Addenda”** means any documents as defined in Article 6;
  - 2.1.2.2 **“Bid Documents”** means the Instructions to Bidders, Information Available to Bidders (if applicable), Bid Form, Bid Bond, Agreement to Bond, List of Similar Contracts Completed, General Conditions, Supplementary Conditions, Specifications, all Contract Drawings, any Addenda, and any other documents identified as being Submission Requirements in Paragraph 1.7;
  - 2.1.2.3 **“Closing”** means, subject to any amendment by way of Addendum, the Closing date and time specified in Paragraph 1.3;
  - 2.1.2.4 **“Contract Administrator”** means the person identified as such from time to time by TTC;
  - 2.1.2.5 **“Instructions”** means this Section;
  - 2.1.2.6 **“MERX”** means [www.merx.com](http://www.merx.com) a web based electronic tendering system;
  - 2.1.2.7 **“Submission Requirements”** means the submission requirements set out in these Instructions, and in particular the requirements set out in Paragraph 1.7;
  - 2.1.2.8 **“Total Bid Price”** means the all-inclusive total price for performing all of the specified Work under the Contract.

### 2.2 Additional Information:

- 2.2.1 This RFB is available only through MERX, a web based electronic tendering system. For further information about MERX, call 1-800-964-MERX or visit the MERX website at [www.merx.com](http://www.merx.com).
- 2.2.2 It is the responsibility of the Bidder to carefully examine the Bid Documents, ensure it has received all issued communications from MERX and TTC and to seek clarification from the Contract Administrator on any matter it considers to be unclear. TTC shall not be responsible for any misunderstanding on the part of a Bidder concerning the RFB, the Bid Documents or the process to be followed by TTC. Each Bidder is requested to report any errors, omissions or ambiguities in the Bid Documents to TTC. If a Bidder has a question or wishes to seek clarification, the Bidder shall direct questions or seek additional information or clarifications from the Contract Administrator as shown in Paragraph 1.4.

- 2.2.3 Where these Instructions indicate that particular information is to be provided on or in a standard form document provided by TTC to Bidders as part of the Bid Documents, that information shall be set out and provided on that form.
- 2.2.4 The Bidder is solely responsible for ensuring that its Bid is complete and correct and for ensuring that it is submitted to the address specified below on or before the Closing. Failure to complete the documents fully, or to provide all required documents and other information, or to comply with the Instructions to Bidders, may result in a Bid being rejected or in the Bidder being considered non-compliant.
- 2.2.5 The Bidder shall complete, execute and submit the Bid Form, including all required pricing information, together with the completed documents as listed in Paragraph 1.7.
- 2.2.6 All such information shall be submitted on, and in accordance with, forms supplied by the TTC. All responses are to be submitted to the TTC through the use of MERX EBS. Bidders shall be solely responsible for the delivery of their Bids in the manner and time prescribed.

Questions concerning submitting through MERX should be addressed to:

MERX: CUSTOMER SUPPORT  
PHONE: 1-800-964-6379  
EMAIL: [MERX@MERX.COM](mailto:MERX@MERX.COM)

MERX EBS does not allow submissions to be uploaded after the Bid submission deadline, so the Bidder should ensure they allow plenty of time to upload the documents.

- 2.2.7 Bids transmitted by facsimile or sent by any other electronic means shall not be considered. Notwithstanding anything to the contrary contained in any applicable statute relating to electronic documents transactions, any notice, submission, statement, or other instrument provided in respect of the RFB may not be validly delivered by way of electronic communication, unless otherwise provided for in this RFB.
- 2.2.8 Prior to the Closing, a Bidder may:
- 2.2.8.1 Withdraw its Bid by deleting its entire bid on MERX EBS prior to the Closing; or
  - 2.2.8.2 Submit a revised Bid prior to the Closing in the same manner specified in Paragraph 2.2.
  - 2.2.8.3 Subject to Paragraph 2.2, a Bid may not be otherwise withdrawn or amended. No Bid may be withdrawn after Closing of the RFB.
  - 2.2.8.4 Any Bids submitted later than the Closing shall not be accepted by MERX EBS.

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**3 BID CLOSING**

- 3.1 Within two Business Days following the Closing, the names of Bidders and the Total Bid Prices submitted for this RFB will be published on MERX.

**4 BID INQUIRIES**

- 4.1 All inquiries or requests for information during the RFB and Bid evaluation stages until execution of Contract must be in writing, with the exception of questions raised during a pre-bid meeting/Site tour, if applicable, and must be directed only to the Contract Administrator as shown in Paragraph 1.4.
- 4.2 Questions and answers during the Bid period will be posted on MERX for information purposes only and shall not be relied on.
- 4.3 This RFB shall only be amended by an Addendum, issued in accordance with these Instructions.
- 4.4 TTC shall attempt to respond to all requests for information received no less than five Business Days prior to the Closing. No assurances are given by TTC that responses will be made to inquiries received after that time.

**5 COMMUNICATION RESTRICTIONS**

**5.1 Prohibited Contacts and Lobbying Prohibition:**

- 5.1.1 A Bidder, Bidder's team members and all of the Bidder's respective advisors, employees and representatives are prohibited from engaging in any form of political or other lobbying, of any kind whatsoever, to influence the outcome of the RFB process.
- 5.1.2 Without limiting the generality of the RFB, no Bidder, Bidder's team members or the Bidder's respective advisors, employees and representatives shall contact or attempt to contact either directly or indirectly, at any time during the RFB process, any of the following persons or organizations on matters related to the RFB process, the RFB documents or the Bids, with the exception of the individual named in Paragraph 1.4:
- 5.1.2.1 Any employee or advisor to TTC;
- 5.1.2.2 Any member of the TTC Board;
- 5.1.2.3 Any member of the City of Toronto Council.
- 5.1.3 If a Bidder or a Bidder's team member or any of their respective advisors, employees or representatives, in the opinion of TTC, contravenes this Article 5, TTC may at its sole discretion disqualify the Bidder(s) from further consideration for award.
- 5.1.4 Anyone who "lobbies" (as defined in the City of Toronto Municipal Code, Chapter 140) or is expected to lobby a Member of the TTC Board (i.e., Commissioner), their staff, or any TTC officer or employee must comply with the requirements as set out in the City of Toronto Municipal Code, Chapter 140 – Lobbying. For the purposes of Chapter 140 of the City of Toronto Municipal Code, the TTC is a "local board (restricted definition)". For further information, please refer to City of Toronto website at: [www.toronto.ca/lobbying](http://www.toronto.ca/lobbying).

- 5.1.5 Failure to comply with the requirements of Chapter 140 of the City of Toronto Municipal Code, may, at TTC's sole discretion, be considered in the evaluation of the Bidder's current Bid or future bid submissions and award of the current or future contracts. TTC reserves the right, at its sole discretion, to not award a contract to a Bidder who has failed to comply with the requirements of Chapter 140 of the City of Toronto Municipal Code.

**5.2 Exception to Paragraph 5.1:**

- 5.2.1 The individual named in Paragraph 1.4 may, at his or her sole discretion, delegate any of his or her responsibilities as set out in the Bid Documents. With the written approval from the individual named in Paragraph 1.4, the Bidder or any representative of the Bidder may have contact and may communicate with any individual as set out in Subparagraphs 5.1.2.1 - 5.1.2.3 to the extent permitted in the written approval.

**5.3 Media Releases, Public Disclosures and Public Announcements:**

- 5.3.1 A Bidder shall not, and shall ensure that its advisors, employees, or representatives do not, issue or disseminate any media release, public announcement or public disclosure (whether for publication in the press on the radio, television, internet, or any other medium) that relates to the RFB process, the RFB, the Bid Documents or any matters related thereto, without the prior written consent of TTC.
- 5.3.2 A Bidder, Bidder's team members and all of the Bidder's respective advisors, employees and representatives shall not make any public comment, respond to questions in a public forum, or carry out any activities to either criticize another Bidder or Bid or to publicly promote or advertise its own qualifications, interest in or participation in the RFB (procurement) process without TTC's prior written consent, which consent may be withheld in TTC's sole discretion. Notwithstanding Paragraph 5.3, the Bidder, Bidder's team members and all of the Bidder's respective advisors, employees and representatives are permitted to state publicly that it/they are participating in the RFB process.
- 5.3.3 For the purposes of greater clarity, Paragraph 5.3 does not prohibit disclosures necessary to permit the Bidder to discuss the RFB with prospective subcontractors' participation in the RFB.

**5.4 Restrictions on Communications between Bidders – No Collusion:**

- 5.4.1 A Bidder shall not discuss or communicate, directly or indirectly, with any other Bidder, any information whatsoever regarding the preparation of its own Bid or the Bid of other Bidders in a fashion that would contravene applicable law. Bidders shall prepare and submit Bids independently and without any connection, knowledge, comparison of information or arrangements, direct or indirect, with any other Bidder. This obligation extends to all team members of a Bidder and all of the Bidder's respective advisors, employees and representatives.

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**6 ADDENDA**

- 6.1 TTC may, in its sole discretion, amend or supplement the Bid Documents prior to the Closing by the issuance of an Addendum in accordance with Article 6. No statement, whether oral or written, made by TTC or its advisors, employees (whether orally or in writing) shall be deemed or construed to add to, subtract from or otherwise amend the Bid Documents unless issued as an Addendum in accordance with Article 6.
- 6.2 During the Bid period, any changes to the Bid Documents will be made by the issuance of an Addendum, which will be transmitted via MERX to the potential Bidders. The onus is on the Bidder to ensure the Bidder has received all Addenda related to this RFB.
- 6.3 A written Addendum will be issued in the form of the complete replacement of the entire affected "Section(s)", which is to be inserted in the Bid Documents, discarding the replaced "Section(s)". Each page is marked at the bottom with the Addendum number.
- 6.3.1 Revisions for modified or added text are indicated by the use of bold italicized attributes.
- 6.3.2 New paragraphs are marked by the use of bold italicized attributes for the entire paragraph. Subsequent paragraphs that become renumbered are not highlighted, bolded or italicized.
- 6.3.3 Revisions for deleting the text of an entire Article or an entire Part, Paragraph and/or Subparagraph are indicated by inserting the bracketed word "(Deleted)" in bold italicized attributes adjacent to the Article, Paragraph and/or Subparagraph number or at the beginning of the deleted Article, Paragraph and/or Subparagraph.
- 6.3.4 Deleted words in a sentence are indicated by highlighting the entire revised sentence in bold italicized attributes.
- 6.3.5 Deleted sentences in a Paragraph and/or Subparagraph will be indicated by highlighting of the entire revised Paragraph and/or Subparagraph in bold italicized attributes.
- 6.3.6 If a subsequent Addendum affects a page that has previously been revised, the bold and italicized attributes are removed from the previously changed text and only the modified text of the latest Addendum will be highlighted by the use of bold italicized attributes and only the latest Addendum number will be marked on the bottom of the Section.
- 6.3.7 A new added Section will be marked by the word "NEW" in the centre of the Section header on the same line as the section number, and the header will be in bold italicized attributes.
- 6.3.8 A newly added Appendix will be marked by the word "NEW" in the centre of the top of each page.
- 6.3.9 A deleted Section will have all of its text in the body of the Section deleted, and will be marked by the bracketed word "(DELETED)" in bold italicized attributes centred directly below the header. The header identifying the Section will remain.
- 6.3.10 A deleted Appendix will be marked by the bracketed word "(DELETED)" in bold italicized attributes as a watermark diagonally across every page.
- 6.4 A revised Drawing issued with an Addendum supersedes the previously issued Drawing with the same Drawing number.

6.4.1 The Drawing change is marked within a cloud marked by a numbered triangle indicating the revision number. The Addendum number and date are recorded in the revision box at the bottom left corner of the Drawing sheet. The number in the triangle does not refer to the Addendum number. It refers to the sequential change made on that Drawing page regardless of the Addendum number. For example, the Addendum number may be "3", but if it is the first change on the sheet, the number in the triangle will be "1".

6.5 A sketch issued with an Addendum revises a previously issued Drawing. Upon Notification of Award the successful Bidder will be issued Drawings incorporating issued sketches.

## **7 INVESTIGATION BY THE BIDDER**

7.1 The Bidder shall examine all of the documents included in the Bid Documents, exercising due diligence, and the skill and professional judgement of a reasonable professional in the Bidder's line of business. This duty extends to all Specifications, maps, plans and data referred to in the Bid Documents.

7.2 Should the Bidder find discrepancies in, or omissions from, the Drawings, Specifications, or other RFB documents, or should be in doubt as to their meaning, the Bidder shall notify the named Contract Administrator immediately in writing, in accordance with Article 4.

7.3 The Bidder shall be responsible for examining the Site, the premises adjacent thereto and the access to the Site. Bidders are responsible for all:

7.3.1 Patent defects or other conditions of the Site;

7.3.2 Latent defects or other conditions that would have been discovered by a reasonable and prudent contractor through the exercise of due diligence in the course of preparing a Bid; and

7.3.3 Latent defects or other conditions expressly disclosed, or reasonably identifiable from the information that is disclosed.

7.4 No changes to the Work or extensions to milestone dates shall be granted where delay or additional costs results from a failure to exercise due diligence as provided in Paragraph 7.1.

7.5 The Bidder shall make all investigations that a reasonable and prudent contractor would consider necessary or advisable when submitting a Bid, to inform itself thoroughly as to the character and magnitude of the Work, the facilities for delivering, placing and operating the necessary machinery and equipment and for delivering and handling Products and equipment at the Site.

7.6 The Bidder shall be responsible for informing itself as to the conditions which may prevail at the juncture of the Contract with all adjacent contracts that are identified as adjacent works in the Bid Documents.

7.7 Subject to O. Reg. 213/91 under the Occupational Health and Safety Act, where the Contract is awarded to the Bidder, it shall be a term of the Contract that the Bidder shall provide reasonable accommodation to Other Contractors to TTC who are performing work under adjacent contracts, including any adjacent contracts entered into following the award of the Contract to which this Section relates.

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**8 BID PRICING**

- 8.1 Unless specifically agreed to the contrary, Bid prices shall be a binding offer to Contract at that price, and shall be understood to have been expressed in Canadian funds.
- 8.2 Unless expressly agreed in writing by TTC, the Total Bid Price shall be deemed to have been quoted on an all-inclusive basis, and the successful Bidder shall accept the Total Bid Price as full payment for performing all of the specified Work under the Contract.
- 8.3 The Total Bid Price shall be deemed to include all:
- 8.3.1 Applicable taxes including, but not limited to, the Harmonized Sales Tax (HST) either in force or announced prior to the Closing, even if the effective date is subsequent to the Closing;
  - 8.3.2 Other duties applicable under relevant law; and
  - 8.3.3 Allowances, freight, and including fees for applicable Permits, Approvals and notices, with the exception of Permits identified in the Specifications as being supplied by TTC.

**9 BID EVALUATION AND ACCEPTANCE**

- 9.1 Without prejudice to any reserved right of TTC, each Bidder shall submit a RFB that is fully compliant with and responsive to the Bid Documents, including all required pricing information and shall include all information required in Paragraph 1.7.
- 9.2 Bids may be evaluated taking into account the following rules, subject to the reserved rights of TTC set out in the RFB:
- 9.2.1 Prices shall be evaluated on the basis of the Total Bid Price as set out in the Bid Form of each respective Bidder;
  - 9.2.2 The award of any Contract shall be subject to satisfactory references, as determined at the TTC sole discretion, security clearances, and the absence of any actual or potential conflict of interest;
  - 9.2.3 Determination of satisfactory completion of work of similar scope, nature, complexity and cost will be performed based on commonalities and similarities of the Work forming basis of this Contract and in accordance with the Specification, including Section 01 11 00 – Summary of Work and based on the items described in subparagraph 1.7.1.4 of these Instructions to Bidders. Determination if references demonstrate satisfactory completion of work of similar scope, nature, complexity and cost shall be made at the sole and unfettered discretion of the TTC. The questionnaire used for the purpose of reference verification is attached to these Instructions to Bidders as Appendix A. TTC reserves the right to ask supplementary questions, request further references and/or further information; and
  - 9.2.4 Any Bid Irregularities found during evaluation of the Bids shall follow the rules as set out in TTC's website at: [www2.ttc.ca/TTC\\_Business/Materials\\_and\\_procurement/Bid\\_Irregularities.jsp](http://www2.ttc.ca/TTC_Business/Materials_and_procurement/Bid_Irregularities.jsp).
- 9.3 By submitting a Bid, a Bidder warrants that to its best knowledge and belief, having made all reasonable inquiries with respect thereto, no actual or potential conflict of interest exists with respect to the submission of its Bid or performance of the contemplated Contract other than those disclosed in the Bid Form. In the event that TTC discovers a Bidder's failure to disclose

all actual or potential conflicts of interest, TTC may disqualify the Bidder or terminate any Contract awarded to that Bidder under this RFB.

- 9.4 The Bidder shall be deemed to have accepted all terms and conditions of the Bid Documents unless explicitly excepted or qualified in its Bid. Any exception as defined in TTC's Procurement Policy, to the Bid Documents requirements, may render the Bid unacceptable. TTC's Procurement Policy and list of common "Bid Irregularities" are located on TTC website at: [www2.ttc.ca/TTC\\_Business/Materials\\_and\\_procurement/Bid\\_Irregularities.jsp](http://www2.ttc.ca/TTC_Business/Materials_and_procurement/Bid_Irregularities.jsp).
- 9.5 Any errors, inconsistencies or ambiguities in the Bid submission shall be subject to the interpretation of TTC. Each and every alteration or erasure made in the Bid shall be initialled by an authorized representative of the Bidder. If applicable, whenever the amount tendered in a price schedule for an item does not agree with the extension of a Bid quantity and the tendered unit price, the unit price shall govern and the amount and the Total Bid Price shall be corrected accordingly. Mathematical discrepancies will be corrected by TTC by appropriate means to arrive at the correct Total Bid Price. If applicable, where a Bidder has made an error in transferring an amount from one part of the Bid to another, the amount shown before transfer shall, subject to any corrections as provided above, be taken to be correct, and the amount shown after transfer and the Total Bid Price shall be corrected accordingly.
- 9.6 In the event that the TTC receives two or more Bids identical in price, the TTC reserves the right to select one of the tied Bids by way of a coin toss (in the case of two identical bids), or lottery (in the case of more than two identical bids).
- 9.7 TTC's right to accept or reject any or all Bids or to accept a Bid including the lowest price Bid, whether or not it complies with the Bid Documents, or to cancel this RFB at any time prior to the Notification of Award is expressly reserved without liability to TTC.
- 9.8 For purposes of this RFB, "comply", "complies" and "compliance" mean that the Bid conforms to the requirements of the Bid Documents without material deviation. A "material deviation" in a Bid is any failure to comply with a Bid Document requirement that, in the sole discretion or opinion of TTC:
- 9.8.1 Impedes, in any material way, the ability of TTC to evaluate the Bid;
  - 9.8.2 Affects TTC's ability to enforce the Bidder's obligations pursuant to the Bid Documents; or
  - 9.8.3 Constitutes an attempt by the Bidder to revise the rights or obligations under the Bid Documents in a way not permitted by the RFB.
- 9.9 If at any stage of the evaluation process or at any time up to award of a Contract, TTC determines that a Bid is non-compliant pursuant to this RFB, TTC may, in its sole discretion and without liability, cost or penalty, declare the Bid to be non-compliant and the Bid shall not be given any further consideration.
- 9.10 For the purpose of clarity, each Bidder acknowledges and agrees that TTC's evaluation of compliance with the Bid Documents is not an evaluation of absolute compliance and that TTC may waive failures to comply that, in TTC's sole discretion, do not constitute a material deviation.
- 9.11 The award of a Contract will be based on which Bidder has provided a Bid which TTC determines, in their sole discretion, to provide the greatest value based on quality, service and



price and determined on the evaluation criteria contained in these Bid Documents. TTC may, in its sole discretion, require clarification of any Bid. TTC reserves the right, in their sole discretion, to waive any requirement of the Bid Documents where, in the sole opinion of TTC, there is an irregularity or omission in the information provided that is not a material deviation to the Bid Documents unless a specific consequence has been identified herein for TTC of such an irregularity or omission.

- 9.12 Every Bid shall be submitted on the prescribed Bid Form as set out in the Bid Documents, and shall:
- 9.12.1 Be completed without inter-lineation, alteration or erasure of or with respect to:
    - 9.12.1.1 Any of the pre-printed text provided on the form; or
    - 9.12.1.2 Information included on the Bid Form, unless the effect thereof is clear and unambiguous as is the assent of the Bidder to that inter-lineation, alteration or erasure (e.g., by initialling).
  - 9.12.2 Bear the signature of the Bidder (or, in the case of a Bid submitted by a corporation, a person represented to be an authorized signing officer of the corporation), inscribed in the space provided.
- 9.13 All words and phrases forming part of the Bid must be written out in full, and abbreviations should not be used. Where an abbreviation is used contrary to this requirement, any ambiguity or other uncertainty shall be as determined by TTC at its sole discretion.
- 9.14 TTC, in addition to any other remedies it may have in law or in equity, shall have the right to rescind any Contract awarded to a Bidder in the event that the Bidder made a material misrepresentation or submitted any inaccurate or incomplete information in the Bid Form, or made any unauthorized amendment to the terms and conditions set out in the Bid Form, other than inserting the information requested and signing the Bid Form. Where the Bidder is not disqualified despite a discrepancy or inconsistency between the Bid Form that it submitted and the Bid Form prescribed by TTC for the RFB, the Bid Form prescribed by TTC for the RFB will prevail.
- 9.15 TTC reserves the right at its sole discretion to refuse to consider or evaluate any Bid from a Bidder or award a Contract to a Bidder that:
- 9.15.1 Received an unsatisfactory "Contractor Performance Review" rating in relation to previous or on-going contracts with TTC, or any of the City of Toronto Agencies and Corporations or any other federal or provincial Government agencies;
  - 9.15.2 Had a previous contract with TTC, or the City of Toronto or any of the City of Toronto Agencies and Corporations, or any other federal or provincial Government agencies that was terminated for default or was issued notice of Event of Default;
  - 9.15.3 Was previously given a "Notification of Award" of contract by TTC and defaulted in proceeding with the work of the contract;
  - 9.15.4 Has submitted false or misleading disclosure in relation to Article 5;
  - 9.15.5 Failed or refused to comply with any applicable federal, provincial or municipal law governing this Bid or a prior contract with TTC;
  - 9.15.6 Has received written notification from TTC advising of or agreeing to any Bidding restrictions. The current list of companies restricted from performing work on TTC

requirements is located, for information purposes only, on TTC website at on:  
[http://www.ttc.ca/TTC\\_Business/Materials\\_and\\_procurement/About\\_Us/Contractor\\_Consultant\\_Reference\\_Materials/index.jsp](http://www.ttc.ca/TTC_Business/Materials_and_procurement/About_Us/Contractor_Consultant_Reference_Materials/index.jsp); or

- 9.15.7 Is an affiliate of or successor to any corporation described in Subparagraphs 9.15.1 to 9.15.6, including any Bidder that is controlled within the meaning of the Ontario Business Corporations Act by the same person or group of persons who so controlled any corporation described in Subparagraphs 9.15.1 to 9.15.6 above.
- 9.16 TTC also reserves the right to restrict a Bidder with whom an officer or director of that Bidder has, in the past, been associated, in any way, with a company that has been described in Subparagraphs 9.15.1 to 9.15.7 above.
- 9.17 TTC reserves the right at its sole discretion to reject any or all pricing with respect to "Unit Prices for Extra Work", if applicable.
- 9.18 All costs and expenses incurred by each Bidder in the preparation and delivery of its Bid or in providing any additional information necessary for the evaluation of its Bid shall be borne solely by the Bidder.
- 9.19 TTC will not be liable to pay any costs or expenses of any Bidder or to reimburse or compensate a Bidder in any manner whatsoever under any circumstances, including in the event of the rejection of any or all submissions or if a decision is made not to proceed with the Contract.

## **10 LIST OF BIDDERS**

- 10.1 A list of firms who have been issued Bid Documents is updated during the Bid period and is available on MERX.

## **11 FREEDOM OF INFORMATION & PROTECTION OF PRIVACY ACT**

- 11.1 A Bid submitted to TTC and all other correspondence, documents and information provided to the TTC by any Bidder in connection with, or arising out of this RFB, once reviewed by the TTC, shall become a record of the TTC and shall become subject to the *Municipal Freedom of Information and Protection of Privacy Act*, and may be released, pursuant to that Act or as otherwise required at law.
- 11.2 A Bidder's name and price may, at the sole discretion of the TTC, be made public.
- 11.3 Bidders may identify in their Bid any information that they consider to be scientific, technical, commercial, proprietary or similar confidential information. Should a Bidder identify information in accordance with this sub-item 11.3, such identification shall not be determinative and the Bidder acknowledges that such identification is subject to the requirements of the *Municipal Freedom of Information and Protection of Privacy Act*.

## **12 BID SECURITY**

- 12.1 The Bid shall be accompanied by a Bid security in the form of a Bid Bond in the amount set out in Paragraph 1.7.
- 12.2 Each Bid Bond shall be completed on a form satisfactory to TTC.

12.3 Each surety company executing a Bid Bond shall be duly licensed to issue policies of surety insurance in the Province of Ontario.

12.4 All costs for the Bid security shall be included in the Total Bid Price submitted for the Contract.

### **13 BONDING REQUIREMENTS**

13.1 The Bidder shall complete and submit an executed Agreement to Bond, in a form satisfactory to TTC for the provision of a Performance Bond and a Labour and Material Payment Bond, each for a sum equal to at least 50% of its Total Bid Price and in the form required by TTC.

13.2 All such bonds shall be issued by an insurer licensed under the Insurance Act, R.S.O. 1990, c. I.8, as amended, to write surety and fidelity insurance and, in the case of the Performance Bond, from a surety acceptable to TTC.

13.3 All costs for bonds required in relation to the Bid or Contract shall be included in the Total Bid Price submitted for the RFB.

### **14 INSURANCE REQUIREMENTS**

14.1 The successful Bidder shall be required to comply with the requirements as specified in SC2 - INSURANCE REQUIREMENTS of Section 00 73 00 and GC38 - WORKPLACE SAFETY INSURANCE BOARD (WSIB) CLEARANCE CERTIFICATE of Section 00 72 00 and provide the evidence of insurance as specified in SC3 - EVIDENCE OF INSURANCE of Section 00 73 00.

14.2 TTC will provide property insurance for the Contract under a blanket policy, as specified in Section 00 73 00 and will bear the costs of such insurance. The Bidder shall not include any costs for such insurance in its Bid price, other than to cover deductibles or exclusions contained in TTC's policy.

14.3 Copies of any applicable blanket policies provided by TTC are available for review, on Business Days between 8:00 a.m. and 4:00 p.m. at TTC's Office, 5160 Yonge Street, Toronto, Ontario. The Bidder shall contact the Contract Administrator identified in Paragraph 1.4 to make arrangements to review the applicable blanket policies.

14.4 The Bidder shall note the deductibles and exclusions in any applicable blanket policy and the Bidder may, at its option, take out additional coverage at its own expense to cover any or all of its responsibilities for the deductibles and exclusions contained in the applicable blanket policy.

### **15 EXECUTION AND SUBMISSION OF CONTRACT DOCUMENTATION**

15.1 If its Bid is accepted by TTC, the successful Bidder(s) shall sign and return the Purchase Order acknowledgement. Failure to sign and return the Purchase Order acknowledgement shall in no way, relieve the Bidder of its obligation under the Contract.

15.2 Included with the Notification of Award will be a request for submission of a valid WSIB clearance certificate, appropriate bond forms (Performance Bond and Labour and Material Payment Bond) and appropriate insurance certificates and the successful Bidder shall with its surety and insurance broker, as applicable, have these forms duly signed and/or executed and be submitted to TTC within ten Days of receipt of the Notification of Award.

- 15.3 In the event of default or failure to comply with Article 15 on the part of the Bidder, TTC shall enforce the Bid security, and may accept the next lowest or any other Bid, or to advertise for new Bids, or to have the Work executed in any other way it may deem best. The Bidder shall indemnify and save harmless TTC from all loss, damage, cost, charges and expenses which they may suffer or be put to by reason of any such default or failure on the part of the Bidder.
- 15.4 Where a Bidder has defaulted under this Article 15, then in addition to whatever other remedies to which it may be entitled, TTC may, at their sole discretion, bar:
- 15.4.1 that defaulting Bidder; and
  - 15.4.2 any other corporation, partnership or proprietorship that is or that becomes associated with whom a person who was at the time on the default an officer or director of that Bidder, from submitting a Bid in relation to any subsequent RFBs, for such period of time as may be deemed appropriate by TTC.

## **16 ACCESSIBLE CUSTOMER SERVICE TRAINING REQUIREMENTS**

- 16.1 The successful Bidder will be responsible to provide accessible customer service training for all its staff members, keep records of such training and make available to the relevant participant(s) on request, all in accordance with GC35 - APPLICABLE POLICIES of Section 00 72 00.

## **17 COMMENCEMENT OF THE WORK AND COST BREAKDOWN**

- 17.1 The successful Bidder shall be required to comply with the requirements in accordance with SC8 - COMMENCEMENT OF THE WORK of Section 00 73 00 and provide the specified documentation. The successful Bidder shall be responsible for any delay resulting from its failure to provide such acceptable documentation within the timeframes indicated.
- 17.2 In accordance with SC5 – PROGRESS AND HOLDBACK PAYMENTS of Section 00 73 00, the successful Bidder shall be required to submit a completed cost breakdown, acceptable to TTC, on TTC's form. Samples of typical cost breakdown forms are located on TTC website, for information purposes only, at [http://www.ttc.ca/TTC\\_Business/Materials\\_and\\_procurement/About\\_Us/Contractor\\_Consultant\\_Reference\\_Materials/index.jsp](http://www.ttc.ca/TTC_Business/Materials_and_procurement/About_Us/Contractor_Consultant_Reference_Materials/index.jsp). The applicable cost breakdown form will be issued to the successful Bidder(s) with the Notification of Award which will represent the various parts of the Work of the Contract.

## **18 PROHIBITION AGAINST GRATUITIES**

- 18.1 No Bidder and no employee, agent or representative of the Bidder, may offer or give any gratuity in the form of entertainment, participation in social events, gifts or otherwise to any member of the City of Toronto Council or Commissioner of TTC, or any officer or employee of TTC in connection with or arising from this RFB, whether for the purpose of securing a Contract or seeking favourable treatment in respect to the award of the Contract.
- 18.2 If TTC determines that Paragraph 18.1 has been breached by or with respect to a Bidder, TTC may exclude its Bid from consideration, or if a Contract has already been entered into, may terminate it without incurring any liability.

---

**19 JOINT VENTURES**

19.1 If a joint venture is proposed:

- 19.1.1 The joint venture shall state in its Bid the joint venture arrangements that form the basis on which the joint venture plans to carry out its obligations under the Contract. The joint venture shall not change its joint venture arrangement without the prior written approval of TTC.
- 19.1.2 One of the joint venture participants shall be nominated as being in charge during the Bid process and, in the event of a successful Bid, during finalization of the Contract (Participant in Charge). The Participant in Charge shall be authorized by the other joint venture participants to incur liabilities and receive instructions for and on behalf of any and all participants of the joint venture. Each joint venture participant shall demonstrate its authorization of the Participant in Charge by submitting with their Bid a power of attorney, or similar document, signed by a legally authorized representative of the joint venture participant.
- 19.1.3 All participants of the joint venture shall be legally liable, jointly and severally, during the Bid process and for carrying out the obligations pursuant to the Contract terms and conditions.

**END OF SECTION**



Name of Contractor:

Bid No. T11PJ19727

Contract No. : SH35-8

Contract Title: Sheppard Station – Station Managers Office and Zone Hub

REFERENCE 1				
Name of Company:				
Person Contacted:		Title:		
Work Performed:				
Value of Work:		Completion Date:		
PERFORMANCE RATING:				
- Communications	<input type="checkbox"/> Poor	<input type="checkbox"/> Fair	<input type="checkbox"/> Good	<input type="checkbox"/> Excellent
- Workmanship	<input type="checkbox"/> Poor	<input type="checkbox"/> Fair	<input type="checkbox"/> Good	<input type="checkbox"/> Excellent
- Supervision	<input type="checkbox"/> Poor	<input type="checkbox"/> Fair	<input type="checkbox"/> Good	<input type="checkbox"/> Excellent
- Change Order/Claims	<input type="checkbox"/> Excessive	<input type="checkbox"/> Average	<input type="checkbox"/> Reasonable	<input type="checkbox"/> None
Number of Liens registered:		<input type="checkbox"/> None		
Would you rehire this contractor:	<input type="checkbox"/> Yes	<input type="checkbox"/> No		
<b>Q1:</b> The TTC project has a public interface on a daily basis (regular interfaces at/adjacent to the Site with riders, local residents, businesses, City of Toronto ROW). Did your project have similarities?				
<b>Q2:</b> Did the project have complex constraints due to limited access and restrictive operating hours for: Deliveries, performance of the work, sequencing of the work, the coordination of work with other forces and Authorities having Jurisdiction (e.g. for panel tie-ins, service connections/disconnections, etc.)?				





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**TITLE:** Sheppard Station – Station Managers Office and Zone Hub

**BID NO.:** T11PJ19727

**PROCUREMENT PROCESS COMMENCEMENT DATE FOR THIS BID:** After July 2, 2018

**TO:** Toronto Transit Commission

**1 DECLARATION**

I/We, \_\_\_\_\_  
(Legal Name of Bidder)

the undersigned, having an office at \_\_\_\_\_  
(Office Address)

\_\_\_\_\_  
(Telephone No. Including Area Code) (Corporate Email Address and Signatory Email Address)

do hereby declare as follows:

- 1.1 That we have carefully examined the Bid Documents, and do hereby accept the same as part and parcel of the Contract;
- 1.2 That the shareholders or partners of the above company are the only persons interested in the Bid, and no other person has any interest in the Bid, or in the Contract proposed to be taken;
- 1.3 That our Bid is made without any knowledge, comparison of figures, or arrangements with any other party or parties making a Bid for the same Work and is, in all respects, fair and made without collusion or fraud;
- 1.4 That no member of the City of Toronto Council or Commissioner of TTC, or any officer or employee of the City of Toronto or of TTC is or shall become interested, directly or indirectly, as a contracting party, partner or otherwise in, or in the performance of the Contract or in the supplies, work or business to which it relates, or in any portion of the profits thereof, or of any such supplies to be used therein, or in any of the monies to be derived therefrom;
- 1.5 That we have not violated Article 5 - COMMUNICATION RESTRICTIONS of Section 00 21 00.

**2 SUBMISSION REQUIREMENTS**

- 2.1 In accordance with Paragraph 1.7 - SUBMISSION REQUIREMENTS of Section 00 21 00 we have submitted all information as required.

**3 STATEMENT OF COMPLIANCE**

- 3.1 We agree to accept and will comply with all terms and conditions of the Bid Documents.

**4 VALIDITY**

- 4.1 We agree that this Bid is valid for acceptance for a period of 90 Days from the date of Closing of Bids and that TTC may at any time within the said period accept this Bid whether or not any other Bid has been previously accepted.

**5 OFFER**

5.1 We do hereby Bid and offer to supply and perform the Work as specified within the Bid Documents, at and for the Total Bid Price in Canadian funds, as detailed in Paragraph 5.2.

5.2 Price Schedule:

Item No.	Description	Estimated Quantity	Unit	Unit Price	Extended Price
1	All Work of this Contract	N/A	Lump Sum	N/A	\$
13% HST					\$
TOTAL BID PRICE (In Canadian funds):					\$

5.3 Addenda:

5.3.1 We agree that this Bid incorporates all Addenda issued by TTC during the Request for Bid period.

**6 AUTHORIZATION AND CONSENT**

6.1 We agree and consent to TTC, at its sole discretion, using any information as set out in the Bid to conduct reference checks with respect to work previously performed and to conduct further investigations with respect to any information provided in the Bid.

6.2 We further authorize and direct any and all of the companies which are set out in the completed Section 00 45 13 to provide any additional information as may be requested by TTC with respect to work previously performed.

**7 SIGNATURE**

Dated this \_\_\_\_\_ day of \_\_\_\_\_ 2019.

Per: \_\_\_\_\_  
(Signature)

Name: \_\_\_\_\_

Title: \_\_\_\_\_

I/We have authority to bind the Bidder.

**END OF SECTION**

BE IT KNOWN BY THESE PRESENTS, that

hereinafter called the "Principal"

and

authorized to transact the business of suretyship in the Province of Ontario and hereinafter called the "Surety"

ARE JOINTLY AND SEVERALLY HELD AND FIRMLY BOUND UNTO TTC, in the penal sum of One Hundred Fifty Thousand dollars (\$150,000.00) of lawful money of Canada to be paid to TTC or to its attorneys, successors, or assignees for which payment well and truly be made, we jointly and severally bind ourselves, and each of our several and respective successors, heirs, executors, administrators and assignees and every one of them forever firmly by these presents.

WHEREAS the said Principal is herewith submitting to TTC its Bid for Sheppard Station – Station Managers Office and Zone Hub, Contract SH35-8 and the said Bid provides that it is to continue open to acceptance and to be irrevocable for a period of 90 Days from the Closing of the Request for Bids (RFB).

NOW THE CONDITION OF this obligation is such that if, on acceptance of the Bid of the aforesaid Principal in accordance with the terms and conditions of the said RFB within 90 Days from the Closing of the RFB, the said Principal shall, within the time required, enter into a Contract and give good and sufficient evidence of insurance and provide bonds as required by the said Bid Documents to secure the performance of the terms and conditions of the Contract, then this obligation shall be void; otherwise the Principal and Surety shall pay unto TTC the penal sum hereof.

AND IT IS HEREBY DECLARED AND AGREED that the Surety shall be liable as Principal and that nothing of any kind or matter whatsoever that will not discharge the Principal shall operate as a discharge or release of liability of the Surety, any law or usage relating to the liability of Sureties to the contrary notwithstanding.

IN WITNESS WHEREOF we have hereunto set our seals by the hands of our proper Officers in that behalf.

Dated this \_\_\_\_\_ day of \_\_\_\_\_ 2019.

\_\_\_\_\_  
(Name of Principal)

Per: \_\_\_\_\_  
(Signature)

Name: \_\_\_\_\_

Title: \_\_\_\_\_ (C/S)

Per: \_\_\_\_\_  
(Signature)

Name: \_\_\_\_\_

Title: \_\_\_\_\_

I/We have authority to bind the Corporation.

\_\_\_\_\_  
(Name of Surety)

Per: \_\_\_\_\_  
(Signature)

Name: \_\_\_\_\_

Title: \_\_\_\_\_ (C/S)

Per: \_\_\_\_\_  
(Signature)

Name: \_\_\_\_\_

Title: \_\_\_\_\_

I/We have authority to bind the Corporation.

**END OF SECTION**

NAME OF BIDDER \_\_\_\_\_

I/We, the undersigned, an insurer licensed under the Insurance Act, R.S.O. 1990, c. I.8, as amended, to write surety and fidelity insurance, hereby agree to become bound for the above named Bidder in the form of a Labour and Material Payment Bond in the form prescribed by the Ontario Construction Act, R.S.O. 1990, c. C.30, as amended and a Performance Bond in the form prescribed by the Ontario Construction Act, R.S.O. 1990, c. C.30, as amended, each for a sum equal to at least 50% of the Contract price, for the fulfillment of this Contract if its Bid for Sheppard Station – Station Managers Office and Zone Hub, Contract SH35-8 is accepted by TTC.

IN WITNESS WHEREOF we have hereunto set our Corporate Seal by the hands of our proper Officers in that behalf.

Dated this \_\_\_\_\_ day of \_\_\_\_\_ 2019.

Name of Surety \_\_\_\_\_

Surety's Address \_\_\_\_\_

\_\_\_\_\_

Per: \_\_\_\_\_  
(Signature)

Name: \_\_\_\_\_

Title: \_\_\_\_\_

(C/S)

Per: \_\_\_\_\_  
(Signature)

Name: \_\_\_\_\_

Title: \_\_\_\_\_

I/We have authority to bind the Corporation.

**END OF SECTION**





Notes:      ■      *Provide details of the work performed in accordance with item 1.7.1.4 of  
Section 00 21 00 – Instructions to Bidders.*

1)      Contract Work  
Description

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Contract Value

---

Name of Owner

---

Contact Name

---

Telephone No.

---

Arch/Eng

---

Telephone No.

---

Contract Title

---

Contract Duration

---

Date Completed

---

2)      Contract Work  
Description

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Contract Value

---

Name of Owner

---

Contact Name

---

Telephone No.

---

Arch/Eng

---

Telephone No.

---

Contract Title

---

Contract Duration

---

Date Completed

---

3) Contract Work  
Description

---

---

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---

Contract Value

---

Name of Owner

---

Contact Name

---

Telephone No.

---

Arch/Eng

---

Telephone No.

---

Contract Title

---

Contract Duration

---

Date Completed

---

4) Contract Work  
Description

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---

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---

Contract Value

---

Name of Owner

---

Contact Name

---

Telephone No.

---

Arch/Eng

---

Telephone No.

---

Contract Title

---

Contract Duration

---

Date Completed

---

5) Contract Work  
Description

---

---

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---

Contract Value

---

Name of Owner

---

Contact Name

---

Telephone No.

---

Arch/Eng

---

Telephone No.

---

Contract Title

---

Contract Duration

---

Date Completed

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**END OF SECTION**



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APPENDIX 1 – CONTRACTOR PERFORMANCE REVIEW FORM

**GC1 DEFINITIONS**

1.1 The following definitions shall apply to this Contract:

- 1.1.1 "90 Day Schedule" shall mean the schedule containing the Work which the Contractor will perform within the first 90 Days of issuance of a Purchase Order as more particularly set out in Division 01.
- 1.1.2 "Affiliate" shall have the meaning set out in the Business Corporations Act, as that term is defined herein.
- 1.1.3 "Applicable Laws" shall have the meaning as set out in GC6.1.
- 1.1.4 "Bid" shall mean the written offer to perform the Work.
- 1.1.5 "Basic Warranty Period" shall have the meaning as set out in GC10.3.
- 1.1.6 "Bidder" shall mean the party submitting a Bid for the Work.
- 1.1.7 "Business Corporations Act" shall mean the Canada Business Corporations Act R.S.C. 1985, c. C-44, as amended.
- 1.1.8 "Business Day" shall mean any Day that is not a Saturday, Sunday or public holiday in the Province of Ontario.
- 1.1.9 "Certificate of Substantial Performance" shall mean the document, in writing, provided and signed by TTC to the Contractor confirming that Substantial Performance has been achieved.
- 1.1.10 "Change Directive" shall mean a written instruction (and if applicable, an interim amount of Contract Price adjustment determined by TTC) issued by TTC directing a change in the Work within the general scope of the Contract, the Contract Time, Contract Baseline Schedule, Revised Contract Baseline Schedule, or a change to the terms of the Contract.
- 1.1.11 "GC28 Claim" means a demand or assertion by the Contractor seeking, as a matter of right, adjustment or interpretation of the Contract terms, payment of money, or extension of Contract Time or Milestone(s) or other relief with respect to the terms of the Contract and includes other disputes and matters in question by the Contractor arising out of or relating to the Contract, and made in accordance with the requirements of the Contract.
- 1.1.12 "Claim Notice" means a notice in writing by the Contractor, made in accordance with GC28.
- 1.1.13 "Construction Act" means the Ontario Construction Act, R.S.O. 1990, c. C.30, as amended.
- 1.1.14 "Contract" shall mean the undertaking by the TTC and the Contractor to perform their respective duties, responsibilities and obligations as prescribed in the Contract Documents.

- 1.1.15 "Contract Baseline Schedule" shall mean the schedule developed by the Contractor and reviewed by TTC, in accordance with Division 01, as the Contractor's plan to perform the Work in accordance with the duration(s) specified in the Contract, but in any event shall not mean a Recovery Schedule.
- 1.1.16 "Contract Change" shall mean a written instruction for an agreed final amount of change in the Contract Price and/or adjustment to the Contract Time, Milestone(s), Contract Baseline Schedule or Revised Contract Baseline Schedule, issued by the TTC to the Contractor for additions, deletions or other revisions to the Work or any other term of the Contract or an extension or reduction in Contract Time, Milestone(s), or Contract Baseline Schedule or Revised Contract Baseline Schedule.
- 1.1.17 "Contract Completion" shall mean the time at which the entire Work, except those items arising from the provisions of GC10.3, has been performed to the requirements of the Contract as determined by TTC on the date set out by TTC in a letter issued by TTC deeming "Contract Completion" and for greater clarity shall not have the same meaning as Deemed Complete as set out in these definitions.
- 1.1.18 "Contract Documents" shall mean the Contract Changes, Change Directives, Purchase Order, Supplementary Conditions, General Conditions, Specifications, Contract Drawings and the Contractor's Bid.
- 1.1.19 "Contract Drawings" or "Drawings" shall mean the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, and diagrams.
- 1.1.20 "Contract Price" shall mean the price stipulated in the Purchase Order, and unless otherwise stated, as may be adjusted in accordance with the terms of a Change Directive and/or Contract Change.
- 1.1.21 "Contract Time" is the time stipulated in the Contract Baseline Schedule or Revised Contract Baseline Schedule, as amended from time to time, to complete the Work, or a portion of the Work, including Substantial Performance and Contract Completion, which may be adjusted from time to time in accordance with a Change Directive and/or Contract Change.
- 1.1.22 "Contractor" shall mean the person or entity named in the Purchase Order as "Contractor", including its successors and/or assignees. The Contractor includes the Contractor's authorized representative as designated to TTC, in writing, from time to time.
- 1.1.23 "Critical Path" shall mean the sequence of those activities in any schedule in which delay in activities has a direct impact on any Milestone. An activity on the Critical Path cannot be started until its predecessor activity is complete. If an activity on the Critical Path is delayed by a certain amount of time, then the entire Work will be delayed by that same amount of time (unless another activity on the Critical Path can be accelerated). The Critical Path may change from time to time as activities are completed ahead of or behind schedule.



- 1.1.24 "Critical Path Method" or "CPM" shall mean a schedule using a Critical Path method to determine and demonstrate durations between activities. All schedules as required in accordance with Division 01 shall use and be based on the use of the Critical Path Method.
- 1.1.25 "Day" shall mean calendar day unless otherwise specified.
- 1.1.26 "Deemed Complete" shall mean when the Contract shall be deemed to be completed in accordance with section 2 of the Construction Act as determined by TTC on the date set out in a letter issued by TTC deeming the Contract "Deemed Complete", and for greater clarity shall not have the same meaning as Contract Completion as set out in these definitions.
- 1.1.27 "RFQ Costs" shall mean the price of all Products, services, labour and required, necessary or incidental to complete the Work as described in any request for quotation and includes all overhead and profit thereon.
- 1.1.28 "Event of Default" has the meaning as set out in GC16.1.
- 1.1.29 "Extended Warranty Period" shall have the meaning as set out in GC10.3.
- 1.1.30 "Float" shall mean the amount of time that an activity in the Contract Baseline Schedule or Revised Contract Baseline Schedule, as applicable, may be delayed without causing delay or impact to any Milestones or successor activities.
- 1.1.31 "Force Majeure Event" has the meaning as set out in GC22.1.
- 1.1.32 "Form 8" shall mean the form prescribed by s.31(6) of the Construction Act.
- 1.1.33 "Good Industry Practice" shall mean using standards, practices, methods and procedures to a good commercial standard, conforming to Applicable Laws, and exercising that degree of skill and care, diligence, prudence, and foresight which would reasonably and ordinarily be expected from a qualified, skilled and experienced person engaged in a similar type of undertaking under the same or similar circumstances.
- 1.1.34 "Limitations Act" shall mean the Limitations Act, 2002, S.O. 2002, c.24, as amended.
- 1.1.35 "Limitations Trigger Date" has the meaning as set out in GC29.2.
- 1.1.36 "Maximum Warranty" shall have the meaning as set out in GC10.3.
- 1.1.37 "Milestone" shall mean any event, date or time specified in the Contract by which the Work, or a certain portion or scope of the Work, shall be commenced and/or completed.
- 1.1.38 "Monthly Contract Baseline Schedule Update" shall mean the monthly schedule update as more particularly set out in Division 01.
- 1.1.39 "Notice to Proceed" shall mean written notification by TTC authorizing the Contractor to proceed with performing the Work on or at the Site.

- 1.1.40 "Notice of Suspension" has the meaning as set out in GC15.1.
- 1.1.41 "Notice of Termination" shall mean written notice of termination of the Contract by TTC in accordance with GC17.1 and for greater certainty shall not mean the form prescribed by s.31(6) of the Construction Act.
- 1.1.42 "Notice of Termination for Convenience" has the meaning as set out in GC30.1 and for greater certainty shall not mean the form prescribed by s.31(6) of the Construction Act.
- 1.1.43 "Notification of Award" shall mean the Purchase Order provided to the Contractor by TTC.
- 1.1.44 "Other Contractor" shall mean the individual, firm, partnership or corporation having a separate Contract with TTC for activities other than the Work required by the Contract.
- 1.1.45 "Parent Company" shall mean a company that controls the Contractor if the Contractor is a subsidiary body corporate, as defined by the Business Corporations Act.
- 1.1.46 "Period of Suspension" has the meaning as set out in GC15.1.
- 1.1.47 "Permits, Licences and Approvals" shall mean all permissions, consents, Approvals, certificates, Permits, Licences, agreements and authorizations to be obtained by the Contractor in accordance with this Contract and as required by Applicable Laws, and the Contractor shall pay for any associated fees.
- 1.1.48 "Products" shall mean materials, machinery, equipment, supplies and fixtures forming the Work, but excludes machinery and equipment used for preparation, fabrication, conveying, erection of the Work or otherwise performing the Work that is not incorporated into the Work, which is normally referred to as construction machinery and equipment.
- 1.1.49 "Purchase Order" or "P.O." shall mean the document issued by TTC, confirming the award of the Contract to the Contractor upon the terms and conditions as stated in the Contract Documents.
- 1.1.50 "Recovery Schedule" shall mean an interim schedule created by the Contractor that demonstrates how the Contractor intends to correct a Monthly Contract Baseline Schedule Update which indicates that any Milestone will not be met as more particularly set out in Division 01.
- 1.1.51 "Revised Contract Baseline Schedule" shall mean the proposed revision to the Contract Baseline Schedule arising from the issuance of a Contract Change or Change Directive, which schedule is submitted by the Contractor and reviewed by TTC in accordance with Division 01.
- 1.1.52 "RFI" has the meaning as set out in GC0.

- 1.1.53 "RFB" shall mean the Request for Bids documents to which the Bidder submitted a Bid to perform the Work. For greater certainty the "Closing" or "Closing date" of the RFB shall be the date and time deadline indicated in the RFB, as amended, by which Bids must be submitted.
- 1.1.54 "Schedule Delay Analysis" shall mean an analysis performed using a method defined in AACE International Recommended Practice 29R-03 – Forensic Schedule Analysis (dated April 25, 2011) as more particularly described in Division 01.
- 1.1.55 "Schedule to Cure Default" has the meaning as set out in GC16.3.
- 1.1.56 "Site" shall mean the land or actual place or location designated by TTC, as set out in Section 01 11 00, where the Work is to be carried out.
- 1.1.57 "Specifications" shall mean written descriptions or instructions pertaining to the performance of the Work under the Contract including, but not limited to, the qualitative requirements for Products, standards, services, construction systems, methods, processes and workmanship.
- 1.1.58 "Standby Time" shall mean, in respect of a unit of equipment, any period of time which is not considered Working Time and which together with Working Time does not exceed 8 hours in any one Day during which Work is being performed, and during which time that unit of equipment cannot practically be used on other Work but must remain on Site in order to continue with its assigned task and during which time the unit is in fully operable condition.
- 1.1.59 "Subcontractor" shall mean the person or entity having a direct Contract with the Contractor to perform a part or parts of the Work, which part of the Work may include the supply of Products; or a person or entity not having a direct Contract with the Contractor but who is retained to supply labour, services, materials, Products or equipment that the Contractor is required to provide pursuant to the Contract.
- 1.1.60 "Substantial Performance" shall mean when the Contract has been substantially performed in accordance with the Construction Act. For greater clarity, "Substantial Performance" shall be deemed to be on the date indicated on the Certificate of Substantial Performance that has been signed by TTC.
- 1.1.61 "Temporary Works" shall have the meaning as set up in GC19.3
- 1.1.62 "TTC" shall mean the Toronto Transit Commission continued pursuant to the City of Toronto Act, 2006, S.O. 2006, c. 11, Sched. A, as amended, and includes TTC's authorized representative as designated to the Contractor, in writing, from time to time, its employees, agents, Commissioners, construction management consultants, administrators, officers, or representatives.
- 1.1.63 "Warranty Requirements" shall have the meaning as set out in GC10.3.
- 1.1.64 "Working Time" shall mean each period of time during which a unit of equipment is actively and of necessity engaged on a specific operation and during which time the unit cannot practically be transferred to other work but must remain on the Site in order to continue with its assigned tasks and during which time the unit is in a fully operable condition.

- 1.1.65 "Work" shall mean the construction and related activities or any part thereof, required by the Contract.
- 1.1.66 "Worker" shall mean any individual that the Contractor or a Subcontractor employs, Contracts with or assigns to perform Work.

## **GC2 CONTRACT DOCUMENTS**

- 2.1 The documents constituting the Contract Documents are complementary to each other and any matter or thing included in any of such documents shall be considered to be included in all and they shall be read together as a whole.
- 2.2 In the event of any inconsistency or conflict, the Contract Documents shall be interpreted in accordance with the following order of precedence:
  - 2.2.1 Contract Changes;
  - 2.2.2 Change Directives;
  - 2.2.3 Purchase Order;
  - 2.2.4 Supplementary Conditions;
  - 2.2.5 General Conditions;
  - 2.2.6 Division 01 of the Specifications;
  - 2.2.7 Divisions 02 through 49 of the Specifications;
  - 2.2.8 Material and finishing schedules;
  - 2.2.9 Contract Drawings:
    - 2.2.9.1 Drawings of larger scale shall govern over those of smaller scale;
    - 2.2.9.2 Figured dimensions indicated on Contract Drawings shall govern over scaled dimensions.
  - 2.2.10 Contractor's Bid.
- 2.3 Documents of a later date shall govern over like documents.
- 2.4 The Contractor shall keep at least one copy of the Contract Documents, submittals and other documents required to perform the Work at the Site and available for inspection by TTC.

## **GC3 LANGUAGE OF THE CONTRACT**

- 3.1 Communications between the Contractor and TTC shall be in the English language and said communication shall include, but not be limited to, all documents, indicates on Drawings and submissions required under the Contract.

**GC4 INTENT OF THE CONTRACT**

- 4.1 The intent of the Contract is to provide for the construction, performance and completion in every detail of the Work described or implied by the Contract Documents.
- 4.2 The Contractor shall perform the Work stipulated in the Contract Documents, and shall furnish, unless otherwise provided in the Contract, everything necessary for the proper performance and completion of the Work.
- 4.3 The Contractor shall not assign, transfer, convey, sell or otherwise dispose of the whole or any part of the Contract without the written consent of TTC.
- 4.4 Nothing contained in the Contract Documents shall imply or create any contractual relationship between any Subcontractor and TTC.
- 4.5 The Contractor shall exercise its rights and perform its obligations at its own cost and risk without recourse to TTC, except as otherwise provided in this Contract, in which case the Contractor's sole recourse with respect to the subject matter of this Contract shall be TTC.
- 4.6 Any technical term used in this Contract that is not defined in this Contract will have the generally accepted industry or technical meaning given to such term.
- 4.7 Save and except for as provided in GC2, the division of this Contract into Conditions, Divisions, Sections, subsections, clauses, subclauses, paragraphs, subparagraphs, parts and articles and the insertion of headings are for convenience of reference only and shall not affect the construction or interpretation of this Contract.
- 4.8 In this Contract, words in the singular include the plural and vice versa and words in one gender include all genders. "Including" means "including without limitation" and is not to be construed as limiting any general statement which it follows to the specific or similar items or matters immediately following it.
- 4.9 The Contract, including all Contract Documents, constitutes the entire agreement between the Contractor and TTC pertaining to the Work.
- 4.10 Any reference in the Contract to any statute or Act, shall be deemed to include any Regulations made thereunder.
- 4.11 Severability:
- 4.11.1 Any condition, section, subsection or other subdivision of this Contract or any other provision of this Contract which is, or becomes, illegal, invalid or unenforceable, shall be severed from this Contract and be ineffective to the extent of such illegality, invalidity or unenforceability and shall not affect or impair the remaining provisions hereof.
- 4.11.2 Except as expressly provided herein, the Contract shall not be altered or changed in any way except in writing by TTC.

**GC5 OWNERSHIP**

- 5.1 The Contractor shall provide TTC with all necessary documents for securing title, if applicable, to the Work. The Contractor must provide the documents to TTC before Substantial Performance, unless otherwise set out in the Contract. The Contractor warrants that title, if applicable, to the Work shall be delivered free and clear of all liens, mortgages and encumbrances, financing statements, security agreements and claims and demands of any character including, but not limited to, any liens or other claims of the Contractor's suppliers, Subcontractors or employees.
- 5.2 All information obtained by the Contractor including drawings and other technical drawings and data, including environmental and technical reports, standard operating procedures, processes and manuals and all other information related to the Work shall be the property of TTC and prior to Contract Completion shall be provided or returned, as applicable, to TTC in electronic format acceptable to TTC, acting reasonably, where it exists in electronic format, and in its original format, when not in electronic format.

**GC6 LAWS TO BE OBSERVED**

- 6.1 In the performance of the Contract, the Contractor shall observe and comply with the statutes and regulations of Canada and the Province of Ontario and with the by-laws of the cities or municipalities within which the Site is located, so far as the said statutes, regulations and by-laws affect the Work or control or limit the actions of entities or individuals engaged in the Work ("Applicable Laws").
- 6.2 Wherever a statute, regulation, by-law, standard, code or document or any part thereof is quoted in the Contract Documents, it shall be deemed to refer to the latest amendment or revision in effect on the date of the closing of the RFB and shall be incorporated by reference as a part of the Contract as if it had been written in full herein.
- 6.3 The Contract shall be governed by and interpreted in accordance with the laws of the Province of Ontario and subject to GC29.1, any action or proceeding brought by the Contractor or TTC arising out or related to the Contract, shall be commenced in Ontario.

**GC7 TAXES AND DUTIES**

- 7.1 The Contract Price is inclusive of all applicable Canadian taxes, value added taxes and custom duties, either in force or announced prior to the RFB Closing date, even if the effective date of such taxes or duties is subsequent to the RFB closing date, including, but not limited to, the Harmonized Sales Tax (HST).
- 7.2 If a change in the tax or duty payable is announced subsequent to the RFB Closing date, any change in tax or duty payable will be to the account of TTC. No additional costs for administration or overhead and profit will be allowed on such changes and the Contractor shall supply, at no cost to TTC, sufficient documentation to permit a determination of the resulting change.
- 7.3 Where an exemption or recovery of government sales tax, value added tax, custom duties or excise taxes is applicable to the Contract, the Contractor shall provide TTC within 14 Days, upon written request, with all necessary cost information including original invoices and assistance, at no cost to TTC, to facilitate such exemption or recovery of taxes and duties to the credit of TTC.

- 7.4 The Contractor shall co-operate fully with TTC in order that TTC may obtain any rebates to which it may be entitled under the Customs Act, R.S.C., 1985, c. 1 (2nd Supp.), as amended, the Excise Tax Act, R.S.C., 1985, c. E-15, as amended, and the Retail Sales Tax Act, R.S.O. 1990, c. R.31, as amended.

#### **GC8 PERMITS AND THIRD PARTY INSPECTIONS AND APPROVALS**

- 8.1 The Contractor shall apply for and obtain in its own name Permits, Licences and Approvals and shall pay fees and give notices necessary and incidental to the due and lawful performance of the Work, in accordance with the Specifications.
- 8.2 In the performance of the Contract, the Contractor shall observe, abide by and comply with all permissions, consents, Approvals, certificates, Permits, Licences, agreements and authorizations which may be obtained by TTC and as required by Applicable Laws.
- 8.3 The Contractor shall ensure that any jurisdictional authorities are notified of the date for the commencement of the Work and the dates of activity of the Work for which inspectors including, but not limited to, municipal inspectors, are required to be present. The Contractor shall forthwith send a copy of all such correspondence to TTC.
- 8.4 If the Work is designated for special tests, inspection or approvals in the Contract Documents or by TTC's instructions or by Applicable Laws, TTC shall not be responsible or liable, in any way, for the actions, delays, or lack or omission to act of any inspectors, inspections, tests or approvals that may be required, including in obtaining any approval that is provided or required by an inspector or inspection. The Contractor shall not be entitled to any adjustments in Contract Price or Contract Time or Milestone(s) arising or resulting from any action, delays, or omission to act, in relation to an inspector, inspection, test or approval.

#### **GC9 PROTECTION OF THE WORK AND ADJACENT PROPERTY**

- 9.1 The Contractor shall protect the Work, the Site, and any property adjacent to the Site from damage which may arise as a result of its operations under the Contract and shall be liable for any damages which may be occasioned; and the Contractor shall be responsible for making good such damages at its expense in the manner instructed by and to the satisfaction of TTC.
- 9.2 The Contractor shall be solely responsible to provide for and bear the costs of preventative measures to accommodate the reasonably foreseeable forces of nature, which can result in freezing, flooding, overheating, or similar circumstances, which occur until Contract Completion.

#### **GC10 DEFICIENCIES AND WARRANTY**

- 10.1 Upon receiving notice of a defect or deficiency in the workmanship or the material (including the performance of the construction and related activities or any part thereof that does not comply or meet the requirements as set out in the Contract), the Contractor shall immediately correct, within 2 Days or some other reasonable time agreed to with TTC, and at the Contractor's own expense, all workmanship or material which appears defective, deficient or unable to meet the design, performance and operation criteria set out in the Contract. The Contractor shall also correct, at its own expense any damage to the Work resulting from any corrections required under this Section. If the Contractor after such notification shall delay or default in making good the Work, then TTC may arrange to correct

the defect or deficiency and the Contractor shall be liable for all costs, changes and expenses in connection therewith.

- 10.2 If the Contractor is not expedient in correcting defective or deficient workmanship or material (including the performance of the construction and related activities or any part thereof that does not comply or meet the requirements as set out in the Contract), then TTC may, in its sole discretion, deduct from the monies otherwise due to the Contractor, the cost, as determined by the TTC, of correcting the defect or deficiency.
- 10.3 The Contractor shall promptly correct at its own expense any defect or deficiency in the workmanship or material of the Work which appears within a period of two years from the date of Substantial Performance ("Basic Warranty Period" or such longer period as may be specified for certain Products or Work as set out in the Specifications ("Extended Warranty Period") (the Basic Warranty Period and the Extended Warranty Period are defined collectively as the "Warranty Requirement"). Corrected workmanship or material shall be further warranted by the Contractor for a period of two years, or such longer period as may be specified for certain Products or Work as set out in the Specifications, from the date the defect or deficiency is last corrected, but in no event shall the warranty as provided in this GC10.3 exceed a multiple of 1.5 of the Warranty Requirement ("Maximum Warranty"). For greater clarity, if the Warranty Requirement is two years, the Maximum Warranty shall be three years from Substantial Performance (2 years x 1.5 = 3 years).
- 10.4 Neither testing, inspection, payment nor acceptance of the Work by TTC shall relieve the Contractor of its responsibilities under this GC10.

#### **GC11 PROPRIETARY RIGHTS**

- 11.1 If any design, device, process or material covered by a letters patent or trade mark, copyright, industrial design, trade secrets or other forms of intellectual property, is provided by the Contractor under the Contract, the Contractor shall indemnify, defend and save TTC harmless from any action or claim arising out of the infringement or alleged infringement of any valid or allegedly valid patent, trademark, copyright, industrial design, trade secret or other forms of intellectual property and shall indemnify TTC for any cost, expense and damages which it may suffer or be obliged to pay by reason of such action or claim.
- 11.2 The Contractor shall pay royalties and patent fees required for the performance of the Contract.
- 11.3 Any drawings, documents, technical data, methods, processes, tooling, inventions or any form of intellectual property, whether conceived, or developed or produced during the course of the Contract specifically for the purposes of performing or completing the Contract, shall be the property of TTC, who shall have sole exclusive rights for subsequent use of same, except as may otherwise be granted by TTC.
- 11.4 TTC has the right, within the scope of the Contract and for the sole purpose of operating, maintaining and subsequently modifying the Work, to use, duplicate, or disclose internally within TTC, the technical data and the information conveyed therein, in whole or in part, and to have or permit others to do so, as set out below:
- 11.4.1 Manuals or instructional materials prepared for installation, operating, maintenance or training purposes;



- 11.4.2 Technical data pertaining to items, components or processes which were prepared for the purpose of identifying sources, size, configuration, mating and attachment characteristics, functional characteristics and performance requirements;
  - 11.4.3 Other technical data which has been or is normally furnished without restriction by the Contractor or Subcontractors;
  - 11.4.4 Computer and microprocessor software documentation including program design language or pseudo-code listings, fully annotated source code and machine level listings;
  - 11.4.5 In the event that the Contractor and/or its Subcontractors require an agreement prior to providing confidential technical data to TTC, then TTC will enter into a non-disclosure agreement acceptable to said parties to ensure delivery of confidential technical data pursuant to the Contract;
  - 11.4.6 Other specifically described technical data, which the parties agree will be furnished without restriction.
- 11.5 No such copyrighted matter, shall be included in technical data furnished hereunder unless the written permission of the copyright owner has been obtained by the Contractor for use by TTC in the manner herein described.
- 11.6 The Contractor shall report to TTC promptly and in written detail each notice, allegation or claim of copyright infringement or other infringement of intellectual property rights received by the Contractor with respect to any technical data delivered hereunder.
- 11.7 The Contractor hereby permanently waives in favour of TTC, any moral rights, as defined in the Copyright Act, R.S.C. 1985. c.C-42, which it may have in or to any copyrighted material and shall provide to TTC at Contract Completion, or at such other time as TTC may require, a written permanent waiver, in a form acceptable to TTC, of moral rights of every author who contributed to such copyrighted materials.

## **GC12 AUTHORITY OF TTC**

- 12.1 TTC has the authority to reject Work which does not conform to the Contract and to require special inspection or testing of the Work, whether or not such Work is fabricated, installed or completed.
- 12.2 TTC will prepare and issue, if appropriate, Contract Changes and Change Directives in accordance with the terms of the Contract.
- 12.3 TTC may for cause, instruct that any part of the Work to be commenced and/or completed in priority to any other part of the Work or otherwise instruct any part of the Work or Contract to be commenced and/or completed in accordance with TTC's instructions.
- 12.4 In the event of a dispute between the Contractor and TTC as to the interpretation of the Contract, TTC's interpretation shall govern and the Contractor shall proceed with the Work of the Contract in accordance with the Contract Documents as interpreted by TTC. The Contractor shall proceed diligently with the performance of the Contract as interpreted by TTC without any interruptions or delays.

**GC13 INSPECTION OF THE WORK BY TTC OR THIRD PARTIES**

- 13.1 TTC shall, at all times, have access to the Work. If portions of the Work are being performed at locations other than the Site, TTC shall be given access to such Work wherever it is in progress. Work to be done under the Contract shall be done to the satisfaction of TTC who has the authority to reject Work which, in TTC's opinion, does not conform to the requirements of the Contract.
- 13.2 If the Work is designated for special tests, inspection or approvals in the Contract or by TTC's instructions or by Applicable Laws, the Contractor shall give TTC timely notice regarding such inspections. Inspections by TTC will be made promptly. The Contractor shall arrange for inspections by other authorities and shall give TTC a minimum of 48 hours prior notice of such inspections, unless otherwise agreed to, in writing, by TTC.
- 13.3 If the Contractor covers, or permits to be covered, Work that has been designated for special tests, inspections or approvals before such special tests, inspections or approvals are made, given or completed, the Contractor shall, if so instructed by TTC, uncover, at the Contractor's own cost, such Work in such a manner as to have the inspections or tests satisfactorily completed and make good such Work at its own expense.
- 13.4 At all material times TTC may examine, inspect or test any aspect of the workmanship or material used by the Contractor to determine compliance with the Contract and, if so ordered by TTC, the Contractor shall provide all necessary approvals and access to perform such examinations, inspections or tests. If, upon examination, inspection or testing, such workmanship or material is found not to be in accordance with the Contract, the Contractor shall correct such workmanship or material and pay the cost of TTC's examination, inspection or test. The Contractor shall also pay the costs of correcting the workmanship or material to ensure compliance with the Contract. If such examination, inspection or test as performed by or on behalf of TTC determines that the workmanship or material, as applicable, is found to be in accordance with the Contract, TTC will pay the cost of examination, inspection or test and reinstatement.
- 13.5 Neither testing, inspection, payment or acceptance of the Work by TTC or third parties shall relieve the Contractor of its responsibilities under the Contract.

**GC14 EMERGENCIES**

- 14.1 TTC has the discretionary authority in an emergency to immediately stop the progress of the Work or issue instructions to perform certain other work whenever such stoppage may be necessary to ensure the:
- 14.1.1 Health and safety of the public, TTC employees or a Worker;
  - 14.1.2 The safety of the Work, or adjacent or nearby personal or real property; or
  - 14.1.3 To avoid the disruption of TTC's operations.
- 14.2 The discretionary authority as provided by GC14.1 shall include TTC's right to make changes in the Work as deemed necessary by TTC. In such a case, if work has been performed by the Contractor under direct order or instruction of TTC, the Contractor shall be compensated for its costs in accordance with SC9 - VALUATION OF CHANGES IN THE WORK for complying TTC's order, unless such "emergency" situation was caused or contributed to by the Contractor in which case the Contractor's and TTC's costs shall be to the Contractor's account.

- 14.3 Any stoppage of the Work under GC14.1 which is not due to an "emergency" that was caused or contributed to by the Contractor shall not:

- 14.3.1 Result in termination of the Contract; or
- 14.3.2 Be governed by the provisions of GC15, unless such provisions are specifically invoked by TTC.

#### **GC15 SUSPENSION OF THE WORK**

- 15.1 When, in TTC's opinion, it is necessary or desirable to suspend the Work, TTC will issue a written notice to the Contractor instructing the Contractor to discontinue or delay the Work ("Notice of Suspension"). The Contractor shall not resume the Work until so instructed by TTC, in writing. The time period from the issuance of the Notice of Suspension until the instruction to resume Work is the "Period of Suspension".
- 15.2 The Contractor, upon receiving the Notice of Suspension, shall, unless expressly stated in the Notice of Suspension, immediately suspend all operations, except those necessary for the safety and protection of personnel and the public and for the care, preservation and protection of the Work, the Site, Products, tools, construction materials, machinery and equipment and, subject to any instructions in the Notice of Suspension, the Contractor shall discontinue ordering and suspend existing Contracts for Products, materials, facilities and supplies required for the Work.
- 15.3 If the Work is suspended, the Contractor shall forthwith take all reasonable necessary measures for the protection of the Work against damage from rain, snow, frost, ice or other causes and shall so maintain the Work and shall be fully responsible for any failure to do so.
- 15.4 During the Period of Suspension, the Contractor shall not remove from the Site any part of the Work, Products, construction materials and machinery, equipment or tools without the written permission of TTC. During the Period of Suspension, rented or Contractor-owned equipment remaining on the Site, shall be deemed to be on standby and the Contractor shall be reimbursed in accordance with the applicable standby rates in accordance with SC9 - VALUATION OF CHANGES IN THE WORK of Section 00 73 00 unless the reason for such suspension was caused or contributed to by the Contractor, in which case the Contractor's and TTC's costs as a result of the suspension shall be to the Contractor's account.

#### **GC16 DEFAULT BY THE CONTRACTOR**

- 16.1 The Contractor shall be in default of the Contract and TTC may terminate the Contract if the Contractor:
- 16.1.1 Suspends the whole or any part of the Work without cause before Contract Completion;
  - 16.1.2 Fails or refuses to proceed with the Work with due diligence;
  - 16.1.3 Fails to submit when required or refuses to maintain the Contract Baseline Schedule, Revised Contract Baseline Schedule or Recovery Schedule;

- 16.1.4 Ceases or threatens to cease to carry on its business, or if there occurs, at any time, an act or event of bankruptcy or insolvency of the Contractor (as defined or provided for in any applicable statute), or if any proceedings, voluntary or involuntary, by or against the Contractor under any statute or statutory provisions relating to bankruptcy, insolvency, liquidation, arrangement, re-organization or dissolution are commenced, or if the Contractor makes any proposal under the Bankruptcy and Insolvency Act, R.S.C., 1985, c. B-3, as amended, or if the Contractor or the property or assets of the Contractor become subject to the Winding-up and Restructuring Act, R.S.C., 1985, c. W-11, as amended, or if any application is made with respect to the Contractor under the Companies' Creditors Arrangement Act, R.S.C., 1985, c. C-36, as amended, or under similar legislation, or if any order shall be made or a resolution passed for the winding up, liquidation or dissolution of the Contractor or if any receiver, receiver and manager, trustee, liquidator or similar official is appointed for the property or assets of the Contractor;
  - 16.1.5 Continually or repeatedly refuses or fails to supply sufficient skilled Workers, or Products, plant or equipment of the proper quality or quantity;
  - 16.1.6 Fails to make payments promptly to suppliers or Subcontractors which it is obligated to pay for materials, Products and labour;
  - 16.1.7 Disregards or fails to comply with Applicable Laws or the instructions of TTC;
  - 16.1.8 Fails to comply with the schedule submitted and accepted by TTC in accordance with GC16.3;
  - 16.1.9 Refuses or fails to perform this Contract in strict accordance with the Contract; or
  - 16.1.10 Fails to respond to a TTC request for a meeting to address unsatisfactory performance issues or fails to submit an action plan or fails to address unsatisfactory performance in accordance with GC34. (The "Event of Default").
- 16.2 If an Event of Default occurs, TTC may provide written notice to the Contractor specifying the default and instructing the Contractor to remedy such default within 3 Days.
- 16.3 If the Event of Default cannot be corrected within the 3 Days specified, the Contractor shall be in compliance with TTC's instructions if it commences the correction of the Event of Default within the 3 Days specified and provides TTC with a schedule acceptable to TTC for such correction ("Schedule to Cure Default") and completes the correction in accordance with such Schedule to Cure Default. Should TTC accept the Schedule to Cure Default as proposed by the Contractor in accordance with this GC16.3, the Contractor shall be responsible to maintain the Schedule to Cure Default. Should at any time the Contractor fail to comply with the Schedule to Cure Default, the Event of Default shall be deemed not be to corrected and TTC may terminate the Contract, without further notice in accordance with GC17.

16.4 If the Contractor fails to correct the Event of Default within the time specified in GC16.2 or the time set out in the Schedule to Cure Default, if applicable, TTC, without prejudice to any right or remedy it may have under GC17, or any other provision of the Contract, may correct such default.

16.5 If TTC or any other party under Contract to it, suffers any expense caused by the Event of Default then TTC shall have the right to deduct the value of such expenses from the Contract Price, notwithstanding the correction of the Event of Default within the time specified or subsequently agreed upon.

#### **GC17 TERMINATION FOR DEFAULT**

17.1 In the event that the Contractor has been put on notice of the Event of Default and the Contractor fails to:

17.1.1 Correct the Event of Default within the time set out in GC16.2 or such other time periods as agreed to, in writing, by TTC;

17.1.2 Fails to maintain the Schedule to Cure Default, if applicable; or

17.1.3 Fails to correct the Event of Default within the time specified in the Schedule to Cure Default, if applicable,

17.1.4 TTC may at any time serve upon the Contractor, written notice of termination of the Contract ("Notice of Termination") and the Contract shall be terminated as of the date of the Notice of Termination.

17.2 Within 7 Days of the date of the Notice of Termination TTC may take possession of the Products, tools, construction materials and machinery, equipment, and appliances on the Site and complete the Work by whatever method it deems expedient.

17.3 Upon the date of the Notice of Termination, the Contractor shall deliver, free from all encumbrances, such part of the Work as have been constructed and such Products and items of plant and equipment as have been procured. The Contractor shall also deliver to TTC all documents, manuals, warranties and other Contract documentation available as of the date of the Notice of Termination relating to the design, construction and completion for the Work.

17.4 The Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price,

17.4.1 Exceeds the cost of completing the Work and any damages incurred by reason of the Contractor's termination, including the application of liquidated damages, such excess shall be paid to the Contractor; or

17.4.2 Is less than the cost of completing the Work and any damages incurred by reason of the Contractor's termination, including the application of liquidated damages, then the Contractor shall be liable to TTC for any additional cost in completing the Work.

- 17.5 The cost of completing the Work referred to in GC17.4 shall include, but is not limited to, the cost for warranty items, costs incurred by TTC for delay in completing the Work, the costs and expenses to correct any Contractor defaults, costs of correcting any deficiencies and completing the Work, legal costs incurred by TTC, and a reasonable amount to cover any costs and expenses incurred or which may be incurred by TTC in curing or correcting any Work subject to any warranty or guarantee or obligation of the Contractor under the Contract. Furthermore, the cost of completing the Work referred to in GC17.4 shall also include TTC's overhead of 10% of the costs as incurred in accordance with this GC17.5.
- 17.6 For greater clarity, TTC and the Contractor understand that neither is entitled to further payment from the other under this GC17 until the Work is completed and agree, for the purpose of the Limitations Act, that a claim pursuant to GC17.4 shall be discovered on the date the Work is completed, and that GC17.6 is intended to be an agreement to suspend or extend the basic limitation period as contemplated by section 22(3) of the Limitations Act. However, nothing in this GC17 shall be deemed to be a waiver or relieve the Contractor's surety of its obligations pursuant to any bonding issued in respect of this Contract in accordance with GC39.
- 17.7 Notwithstanding anything to the contrary in this Contract, where the Contractor has been given a notice for an Event of Default as listed in GC16.1.1 to GC16.1.10 (inclusive), TTC may immediately terminate this Contract by serving a Notice of Termination upon the Contractor regardless of whether the Contractor has previously rectified any default(s).
- 17.8 Notwithstanding GC17.4, TTC may, without prejudice to any right or remedy it may have under this Contract or at law, in its sole discretion, at any time after the issuance of a notice of an Event of Default or a Notice of Termination, make demand on any bonding issued in accordance with GC39.
- 17.9 In the event the Contract is terminated for default by TTC, TTC will cause a completed Form 8 to be published, in accordance with the Construction Act, on a date following the date of the Notice of Termination and in such case the Contractor shall not publish a completed Form 8.

#### **GC18 USE AND OCCUPANCY PRIOR TO COMPLETION**

- 18.1 TTC has the right to take possession of or use any completed or partially completed portions of the Work provided that at least 30 Days written notice has been given to the Contractor.
- 18.2 Such possession or use of the portions of the Work shall not be considered acceptance of Work not completed in accordance with the Contract. In addition, the use or occupancy of the Work shall not relieve the Contractor or its surety from any liability that has arisen, or may arise, from the performance of the Work. TTC will be responsible for any damage to the Work that occurs as a result of TTC's use or occupancy of the completed portions of the Work.

#### **GC19 CONTRACTOR'S RESPONSIBILITIES**

- 19.1 The Contractor shall have complete control of the Work and shall effectively direct and supervise the Work so as to ensure conformance and compliance with the Contract. The Contractor shall be solely responsible for construction means, methods, techniques, sequences and procedures and for co-ordinating the various parts of the Work under this Contract.

- 19.2 The Contractor shall employ the services of a Professional Engineer, licensed in the Province of Ontario, as needed, to fulfil the requirements of the Applicable Laws and the Contract.
- 19.3 The Contractor shall have the sole responsibility for the design, supply, erection, operation, maintenance and removal of temporary structures and other temporary Work and the design and execution of construction methods required for same.
- 19.3.1 "Temporary Works" are:
- 19.3.1.1 Installations providing access, protection, support or services for Workers, equipment and materials during construction, renovation, maintenance or demolition of permanent Work; and
- 19.3.1.2 Temporary service or support for any part of permanent Work until the permanent Work has achieved a state of completion allowing the Temporary Works to be removed;
- 19.3.1.3 Other Work of a temporary nature.
- 19.4 Without limiting the Contractor's sole responsibility for the design, supply, erection, operation, maintenance and removal of Temporary Works, the Contractor shall as a minimum comply with any design criteria for the design of Temporary Works contained in the Contract. Notwithstanding the provisions of GC19.1 and GC19.3, the Contractor shall not be held responsible for that part of the design or the specified method of construction where the Contract includes designs for temporary structural and other temporary facilities or specifies a method of construction in whole or in part where such facilities and methods shall be considered to be part of the design of the Work. The Contractor shall, however, be responsible for the execution of such design or specified method of construction in the same manner as for the execution of the Work.
- 19.5 The Contractor shall keep all portions of the Work properly and efficiently drained during construction and until Contract Completion, and shall be held responsible for all damage which may be caused or result from water or other liquids backing up or flowing over, through, from or along any part of the Work or which any of its operations may cause to flow elsewhere.
- 19.6 The Contractor shall provide skillful and efficient management of the Work and, as a minimum, shall provide a competent, dedicated, full-time superintendent, directly employed by the Contractor, present on the Site for the duration of the Contract. Instructions given to the superintendent by TTC shall be deemed to have been given to the Contractor and the superintendent shall represent the Contractor and shall have the authority to carry out such instructions. Prior to the commencement of Work at Site, the Contractor shall notify TTC in writing of the name of the proposed superintendent. The superintendent shall not be replaced, except under extraordinary circumstances and with prior written notice given to TTC.
- 19.7 The Contractor shall maintain good order and discipline among its employees and Subcontractors engaged in the Work and shall not employ or permit any Subcontractor to employ a person on the Work who is not fully qualified to perform the assigned Work. TTC shall have the right to require either the temporary or permanent removal from the Site of any person employed in any capacity by the Contractor or any Subcontractor. Should questions of union jurisdiction arise, the Contractor shall immediately take steps to resolve

such disputes and shall use labour, as may be determined to have jurisdiction, at no additional cost to TTC.

- 19.8 The Contractor shall prepare and update, as required by TTC, a schedule in accordance with the requirements contained in Division 01 of the Specifications.
- 19.9 The Contractor shall be as fully responsible to TTC for the acts and omissions of its Subcontractors, manufacturers, suppliers, agents, consultants, even if specified by the TTC, and persons directly or indirectly employed by the Contractor as it is for its own acts or omissions.
- 19.10 The Contractor shall be solely responsible for the proper distribution of Work among the various sub-trades having due regard for trade work and union jurisdictions irrespective of the Divisions or Sections contained in the Specifications.
- 19.11 Upon completion of the Work, the Contractor shall remove all Temporary Works, construction materials and machinery as well as rubbish accumulated on account of construction operations and shall leave the Site in a condition satisfactory to TTC.
- 19.12 The Contractor shall, at its own cost and risk, perform all Work:
- 19.12.1 In compliance with all Applicable Laws;
  - 19.12.2 In accordance with Good Industry Practice;
  - 19.12.3 In a manner consistent with the Contract;
  - 19.12.4 In a timely and professional manner;
  - 19.12.5 With due regard to the health and safety of persons and property; and
  - 19.12.6 In accordance with all other terms and conditions of this Contract.

**GC20 WORK AREAS AND ACCESS**

- 20.1 Upon the date identified in the Notice to Proceed, the Contractor shall assume full responsibility for the Site, and confine construction operations to areas within the Site.
- 20.2 Access to the Site for personnel and delivery of Products, construction materials and machinery is restricted to the specific points of access identified in the Contract Documents or as approved by TTC.
- 20.3 The Contractor shall keep the Site in a safe and tidy condition during the progress of the Work.

**GC21 WAGE RATES**

- 21.1 The Contractor shall engage, or cause to be engaged by it or its Subcontractors, competent Workers who are members of local trade unions having appropriate affiliations, if available, for Work normally performed on the Site in the execution of the Contract.
- 21.2 During the term of the Contract, the Contractor and its Subcontractors shall pay or cause to be paid for the Work, the union rate prevailing in the area in which the Work is to be performed and shall comply with the local union working conditions.



- 21.3 If there is no such union rate for any class of work, the Contractor shall pay the rate of wages prevailing and generally accepted.

**GC22 FORCE MAJEURE**

- 22.1 Subject to GC9 and GC19, if the Contractor's performance of any component of the Work is delayed in accordance with the latest expressly accepted Contract Baseline Schedule or Revised Contract Baseline Schedule, as applicable, in effect as of the date of the Force Majeure Event, by acts of God, public enemies, acts of governments or foreign states, epidemics, quarantine restrictions, abnormal weather, fires or floods that were not caused or contributed to by any act, fault or omissions of the Contractor, strikes, lockouts or organizations of workers, embargoes by transportation companies or public authorities, riots, insurrections, wars, pestilence, lightning, earthquakes, cyclones, issuance of a stop Work order by a court of competent jurisdiction or other public authority provided that such order was not issued as a result of any act, fault or omission of the Contractor, or by other causes which TTC determines in its sole discretion to be wholly beyond the control of the parties ("Force Majeure Event"), with the effect that the Milestone(s) or Contract Time are affected, then, to the extent affected, upon request by the Contractor, a non-compensable extension to any affected Milestone(s) or Contract Time shall be granted. The Contractor shall not be entitled to any compensation on account of any extension to any Milestone(s) or Contract Time under GC22. Further, TTC shall have no liability to the Contractor for costs, losses, expenses or damages incurred by the Contractor as a result of any Force Majeure Event.
- 22.2 Abnormal Weather means either air temperature under -18°C or above 45°C, or an extreme climatic condition characterized by total precipitation or snow on ground that is less than or greater than 25% of the historical average, determined from weather records for the 15 years immediately preceding the date of the Notification of Award.
- 22.3 To determine if the weather encountered during the term of the Contract constitutes Abnormal Weather, weather records from Environment Canada are to be used, available at <http://climate.weather.gc.ca/>. For further clarity, the weather station nearest to the location of the Work shall be used.
- 22.4 The Weather measurements, whether total precipitation or snow on ground shall be compared for the exact same time periods for each year as the Abnormal Weather period claimed during the term of the Contract. No extension of time shall be granted unless the Contractor, within 14 Days after the Force Majeure Event first occurred or that the Contractor should reasonably have known first occurred, submits to TTC in writing its notice of request for extension of time stating the nature of delay, its causes, the portions of the Work affected thereby and the date when they become so affected.
- 22.5 Within 30 Days of delivery of the notice of delay for a Force Majeure Event, or such other period of time as may be requested by the Contractor and agreed to in writing by TTC, the Contractor shall submit a request in writing for an extension to the Contract Baseline Schedule, Revised Contract Baseline Schedule, Contract Time, or any Milestone(s), any period(s), part(s) or portions(s) thereof. If requested by TTC, the Contractor shall provide a detailed Schedule Delay Analysis supporting the Contractor's request and any additional supporting documentation as requested by TTC.

- 22.6 Changes to the Contract Baseline Schedule, Revised Contract Baseline Schedule, Milestone(s) or Contract Time under GC22 shall be administered by issuance of a Contract Change, unless TTC and Contractor cannot mutually agree to an extension of time then TTC at its sole discretion may determine the length of the extension the Contractor is entitled to and grant an extension of time accordingly by issuance of a Change Directive.

**GC23 OTHER CONTRACTORS**

- 23.1 TTC reserves the right to enter into separate contracts or have certain activities performed by its own forces, in connection with the Work and, in such cases, the Contractor shall:
- 23.1.1 Afford TTC's forces and/or Other Contractors, facilities and time as agreed with TTC to introduce and store their Products and use their construction machinery and equipment to perform their construction activities;
  - 23.1.2 Co-ordinate and schedule the Work with the construction activities of TTC's forces and/or Other Contractors and interface as specified or shown in the Contract Documents;
  - 23.1.3 Participate with TTC's forces and/or Other Contractors in reviewing their construction schedules when instructed to do so; and
  - 23.1.4 Prior to proceeding with any part of the Work, promptly report in writing to TTC any apparent deficiencies in the construction activities of TTC's forces or of Other Contractors when part of the Work is affected by the construction activities of TTC's forces or of Other Contractors, or when the proper execution of the Work is dependent upon the construction activities performed by TTC's forces or by Other Contractors. Failure by the Contractor to do so shall invalidate any claims against TTC by reason of deficiencies in the construction activities performed by TTC's forces and/or by Other Contractors except for those deficiencies not then reasonably discovered.

**GC24 ADVERTISING AND PUBLIC RELATIONS**

- 24.1 TTC reserves the right to review and approve all public relations material and advertising related to the Contract prior to publication. The Contractor shall ensure that any material or advertising to be published is submitted in writing to TTC for such approval. TTC will provide a decision within 21 Days of receiving such request for approval.

**GC25 ERRORS, OMISSIONS, DISCREPANCIES OR REQUEST FOR INFORMATION**

- 25.1 Notwithstanding the provisions of GC2, the Contractor shall carefully check the Contract Documents for any errors; omissions or discrepancies prior to proceeding with the Work, and the Contractor shall notify TTC of same and shall not proceed with any such Work affected until it has received instruction from TTC.
- 25.2 In the event the Contractor determines that a provision or requirement of the Contract Documents requires clarification or interpretation, the Contractor shall submit a Request for Information ("RFI") in writing to TTC on a specified form as provided by TTC, which form may be amended from time to time by TTC. Unless otherwise agreed to by TTC, in writing, RFIs may only be submitted by the Contractor on the form provided by TTC. Each RFI shall be limited to a single subject or matter of inquiry. A copy of the most recent RFI form can be found on TTC's website at:

[http://www.ttc.ca/TTC\\_Business/Materials\\_and\\_procurement/About\\_Us/Contractor\\_Consultant\\_Reference\\_Materials/index.jsp](http://www.ttc.ca/TTC_Business/Materials_and_procurement/About_Us/Contractor_Consultant_Reference_Materials/index.jsp).

- 25.3 On the RFI form, the Contractor shall set forth the issue for which clarification or interpretation is sought and why a response is needed and a suggested timeframe for a response.
- 25.4 If TTC determines that the Contractor's submitted information is not consistent with the RFI requirements as set out in GC25, TTC shall request that the Contractor resubmit the RFI in accordance with the requirements as set out in GC25.
- 25.5 If TTC determines that the submitted RFI is requesting information that is already set out in the Contract Documents; or the Contractor is requesting substitutions of Products; or the Contractor is requesting design changes considered as not necessary by TTC; or any other reason deemed as unjustified by TTC, the RFI will be returned to the Contractor without response.
- 25.6 If TTC determines that the RFI is incomplete or unjustified, TTC may seek damages from the Contractor, for the time and resources used to process and review such documents.
- 25.7 Responses to RFIs shall be issued within 10 Business Days of receipt of the RFI from the Contractor unless TTC determines that a longer period of time is necessary to provide an adequate response. If a longer period of time is determined necessary by TTC, TTC will, within 10 Business Days of receipt of the RFI, notify the Contractor of the anticipated response time.
- 25.8 If the Contractor does not submit a RFI well in advance of scheduled dates for the Work to allow adequate time for review and response, the Contractor shall not be entitled to any time extension attributable to the time it takes TTC to respond to the RFI provided that TTC responds in accordance with GC25.7.
- 25.9 A response by TTC to a submitted RFI shall not change, amend or modify any requirement of the Contract Documents unless so noted by TTC in the response to the RFI. In the event the Contractor believes that a response to a RFI will cause a change, amendment or modification to the requirements of the Contract Documents, the Contractor shall provide written notice to TTC, in accordance with the requirements of GC26, stating that the Contractor considers the response to the RFI to be a change to the requirements of the Contract. Failure to provide such written notice shall waive the Contractor's right to seek additional Contract Time or changes to the Contract Price under GC26 of this Section.

## **GC26 CHANGES IN THE WORK**

- 26.1 TTC may make changes in the Work or the Contract without invalidating the Contract by altering, adding to or deducting from the Work by issuance of a Contract Change or Change Directive.
- 26.2 Subject to GC14, no change in the Work or the Contract shall be undertaken without a Contract Change or Change Directive signed by TTC and no change in the Contract Price, Contract Baseline Schedule, Revised Contract Baseline Schedule, Contract Time and/or Milestone(s) shall be valid without a Contract Change or Change Directive signed by TTC. The value of Work performed under Contract Change or Change Directive shall be included for payment with the regular payment applications and shall be identified separately. A copy of the most recent Contract Change/Change Directive form can be found on TTC's website

at [http://www.ttc.ca/TTC\\_Business/Materials\\_and\\_procurement/About\\_Us/Contractor\\_Consultant\\_Reference\\_Materials/index.jsp](http://www.ttc.ca/TTC_Business/Materials_and_procurement/About_Us/Contractor_Consultant_Reference_Materials/index.jsp).

- 26.3 TTC will issue a request for quotation in writing to the Contractor on TTC form indicating the scope of the proposed change to the Work or change in the Contract.
- 26.4 The Contractor shall, within 21 Days of receipt of a written request to provide a quotation for a proposed change to the Work or Contract or such other period as may be specified by TTC, submit to TTC for approval its:
- 26.4.1 Proposed extension of time to the Contract Time and/or Milestone(s) in Days, if any, identifying the number of Days of the extension which are proposed as compensable and which are proposed as non-compensable in accordance with the requirements of SC7 - DELAYS BY TTC of Section 00 73 00; and
  - 26.4.2 RFQ Costs, if any, of the proposed change to the Work or Contract;
  - 26.4.3 The Contractor shall also supply such additional information as may be requested by the TTC.
- 26.5 If the Contractor fails to identify a specific number of Days for adjustment to the Contract Time or Milestone(s) in its response to a request for quotation, it shall be deemed to have requested zero (0) Days of extension and waives all entitlement to any extension. The Contractor shall supply a Schedule Delay Analysis and sufficient documentation to substantiate such proposed adjustment to Contract Baseline Schedule, Revised Contract Baseline Schedule, Contract Time and/or Milestone(s).
- 26.6 If TTC accepts the Contractor's proposed RFQ Costs and/or extension of time to the Contract Time and/or Milestone(s) as set out in its response to the request for quotation, TTC shall issue a Contract Change for that part of the response to the request for quotation that is accepted. If a Contract Change is issued for that part of the response to the request for quotation that is accepted, the Contractor's entitlement, if any, with respect to any part of the response to the request for quotation that is not accepted shall be determined in accordance with the Contractor's entitlements as set out in this Contract.
- 26.7 If the Contractor's proposed RFQ Costs and/or extension of time to the Contract Time and/or Milestone(s), cannot be promptly agreed upon and proceeding with proposed change to the Work or Contract is, in the opinion of TTC, essential, TTC will issue a Change Directive to proceed with that change to the Work or Contract. TTC reserves the right to increase or decrease the Contract Price pursuant to the Change Directive, as it determines in its sole discretion.
- 26.8 TTC may issue a Change Directive at any time prior to issuance of a Contract Change. Upon receipt of a Change Directive, the Contractor shall immediately proceed as identified therein. The Contractor is responsible for any delay and any damages, expenses or additional costs incurred by TTC or any Other Contractor arising from the Contractor's failure to proceed with a Change Directive or Contract Change immediately or as otherwise instructed or agreed to by TTC.

- 26.9 In the event that the proposed change to the Work or Contract in the request for quotation proceeds by way of Contract Change or Change Directive, and no agreement can be reached between TTC and the Contractor with respect to an extension of time to the Contract Time or Milestone(s), then the Contractor's entitlement shall be determined in accordance with SC7 - DELAYS BY TTC of Section 00 73 00.
- 26.10 In the event that the proposed change to the Work or Contract in the request for quotation proceeds by way of Contract Change or Change Directive and no agreement can be reached between TTC and the Contractor with respect to RFQ Costs, then the Contractor's entitlement shall be for the value of the Work performed in accordance with GC26 and SC9 - VALUATION OF CHANGES IN THE WORK of Section 00 73 00.
- 26.11 Work of any Contract Changes agreed to proceed by way of force account and Work of all Change Directives shall be compensated by TTC on a force account basis in accordance with SC9 - VALUATION OF CHANGES IN THE WORK of Section 00 73 00 and the Contractor shall proceed with the Work in an expeditious and cost effective manner so as to prevent or mitigate any delay to the Contract Baseline Schedule, Revised Contract Baseline Schedule or Contract Time or additional cost to TTC. When Work relative to any Contract Changes is to proceed by way of force account or the Work of any Change Directive is carried out, the Contractor shall complete "Daily Work Activity" sheets using TTC's form, itemizing the labour, equipment and materials used to carry out such Work. Completed "Daily Work Activity" sheets shall be submitted weekly to TTC for verification. The Contractor shall only be entitled to payment for amounts of "Daily Work Activity Sheet(s)" or portions thereof approved by TTC. The Contractor shall advise TTC:
- 26.11.1 On the Day(s) when Work proceeding by way of force account is being carried out, prior to that Work commencing and;
- 26.11.2 When approximately 75% of the authorized funds, as set out in the Change Directive, has been expended and provide adequate substantiation of expended funds.
- 26.12 In the case of a dispute in the value of Work performed under a Contract Change agreed to proceed by way of force account or under a Change Directive, TTC will determine the final value of Work performed in accordance with GC26 and SC9 - VALUATION OF CHANGES IN THE WORK of Section 00 73 00 and issue a revision to the Change Directive and the Contractor shall identify said Change Directive and the determined value by TTC and it shall be included for payment with the regular payment applications as the Work is being completed. If the Contractor disputes TTC's final determination of the value of the Work in the revision to the Change Directive, the Contractor may claim in accordance with GC28.

## **GC27 CHANGES IN SUBSURFACE OR CONCEALED PHYSICAL CONDITIONS**

- 27.1 Subject to GC27.2, the Contractor shall be entitled to the value of the Work performed and/or an extension of time to the Contract Time or Milestone(s) in accordance with SC7 - DELAYS BY TTC of Section 00 73 00 and GC26, if applicable, in the event there is a substantial and material difference between the subsurface or concealed physical conditions at the Site contained in, or as may be reasonably anticipated based on the information provided in the Contract Documents or such other documents provided by TTC during the Bid period and the actual subsurface or concealed physical conditions encountered by the Contractor at the Site in performing the Work.

- 27.2 The Contractor shall have no entitlement pursuant to GC27.1 unless, within 5 Days of when the Contractor knew or ought to have reasonably known such substantial and material difference in subsurface or concealed physical conditions it provides written notice to TTC of the different conditions. Failure to provide said notice shall disentitle the Contractor to any compensation or extension of time due to changes in the subsurface or concealed physical conditions.

**GC28 CLAIMS AND CONTINUANCE OF THE WORK**

- 28.1 The Contractor shall give to TTC written notice of its intention to make a GC28 Claim called a "Claim Notice". Such Claim Notice must be provided within 10 Days after the commencement of the event giving rise to the GC28 Claim or within 10 Days of the date it is reasonable to expect that the Contractor ought to have known that event giving rise to the GC28 Claim commenced, otherwise the Contractor will forfeit its right to a GC28 Claim. Such Claim Notice must set forth particulars of the GC28 Claim, the probable extent of the Work subject of the GC28 Claim, the estimated monetary value involved and/or the relevant provisions of the Contract, or it will not constitute a valid Claim Notice of intent to a GC28 Claim and the Contractor will forfeit its right to a GC28 Claim.
- 28.2 If any on-site work related to the GC28 Claim is carried out, the Contractor shall complete "Daily Work Activity" sheets using TTC's form itemizing the labour, equipment and materials used to carry out such Work and shall proceed with the Work expeditiously so as to prevent or mitigate any delay to the Contract Baseline Schedule, Revised Contract Baseline Schedule or Contract Time or additional cost to TTC. Completed "Daily Work Activity" sheets shall be submitted weekly for verification by TTC. Work performed off-site that is related to a GC28 Claim which cannot be verified by TTC, shall be subject to valuation in accordance with SC9 - VALUATION OF CHANGES IN THE WORK of Section 00 73 00.
- 28.3 If the Contractor fails to comply with the above requirements for providing a Claim Notice or to keep and submit "Daily Work Activity" sheets, if applicable, as specified above, it will be deemed that payment for the GC28 Claim is already included in the Contract Price and the Contractor shall have no entitlement to additional payment, increase to the Contract Price, or extension to time to the Contract Time or Milestone(s).
- 28.4 Within 30 Days of submitting a Claim Notice, or such other period as may be agreed by TTC in writing, the Contractor shall submit a comprehensive written GC28 Claim statement which shall contain a sufficient description of the facts and circumstances of the occurrence that is the subject of the GC28 Claim, together with any supporting or substantiating documents, to enable TTC to determine whether or not the GC28 Claim is justified. Further, the Contractor shall supply such additional information and documentation to justify its GC28 Claim as TTC may request from time to time.
- 28.5 If the Contractor cannot submit its written GC28 Claim statement within the 30 Days, or such other period as agreed by TTC, then the Contractor shall notify TTC prior to expiration of the 30 Days or agreed upon period, and request an extension to the date for the submission of its GC28 Claim statement and provide justification for such extension. If the Contractor fails to submit its written GC28 Claim statement within the specified 30 Days or such other period as agreed to in writing by TTC, then the Contractor shall forfeit its right to a GC28 Claim.
- 28.6 TTC may instruct the Contractor in writing to proceed with any portion of Work as per TTC's interpretation of the Contract which is the subject of a GC28 Claim by the Contractor as set out in a Claim Notice or GC28 Claim statement at any time by issuance of a notice in writing

unless the GC28 Claim relates to a Change Directive which has already been issued by TTC and, in such case, said Change Directive shall be deemed to be the instruction to proceed in writing. Upon receipt of such written notice, the Contractor shall proceed with the Work as so instructed and in doing so, neither party will jeopardize any rights it may have with respect to a GC28 Claim. If it is subsequently determined by an arbitrator or court of competent jurisdiction that such instructions were in error or at variance with the Contract, TTC shall pay the Contractor's costs incurred in carrying out such instructions which was required to do outside the terms of the Contract, as valued in accordance with SC9 - VALUATION IN CHANGES OF THE WORK of Section 00 73 00 and/or SC7 - DELAYS BY TTC of Section 00 73 00, if applicable.

- 28.7 Upon receipt of the written GC28 Claim statement in accordance with GC28.4 by TTC the following process shall be applicable:
- 28.7.1 Within 60 Days, or such other period of time that may be advised by TTC in writing, of receipt of the GC28 Claim statement and all supporting and substantiating documentation including any such further documentation as requested by TTC, TTC will advise the Contractor, in writing, of TTC's determination with regard to the validity of the GC28 Claim; and
  - 28.7.2 If TTC determines that there is a valid basis of GC28 Claim, it will initiate negotiations to resolve the issue. Upon reaching a settlement, TTC will issue a Contract Change implementing a full and final settlement of all costs, compensation and extensions of time, if any, resulting from the GC28 Claim.
- 28.8 Within 30 Days after certification of Substantial Performance or such other times as requested by TTC, the Contractor shall submit a list which indicates the status of all outstanding GC28 Claims for which it has submitted prior written Claim Notice.
- 28.9 TTC will not be liable for interest or financing costs on GC28 Claims by the Contractor, whether the Contractor ultimately receives compensation for a GC28 Claim or a portion of a GC28 Claim, from TTC, or otherwise.
- 28.10 It is agreed that no act or failure to act by either party shall be construed as a renunciation or waiver of any of its rights or recourse it has under GC28, provided it has given the notices in accordance with, and has carried out the instructions, as provided in GC28.

## **GC29 SETTLEMENT OF DISPUTES**

- 29.1 If a GC28 Claim or any other dispute arising between TTC and the Contractor cannot be resolved to the satisfaction of both parties, then the parties may between themselves agree to submit the particular GC28 Claim and/or dispute for binding arbitration in accordance with the provisions of the Arbitration Act (Ontario), as amended, and upon such terms and conditions as mutually agreed upon by the parties.
- 29.2 For the purpose of GC29, the "Limitations Trigger Date" shall mean, the earlier of:
- 29.2.1 The date of Notice of Termination;
  - 29.2.2 The date the Contract is certified as Substantially Performed; or
  - 29.2.3 The date of Contract Completion.

- 29.3 Except in the case where both parties agree that a matter in dispute is of such nature as to require earlier adjudication, no action, suit, proceeding (or arbitration if both parties agree) related to or arising out of this Contract shall be commenced by either TTC as against the Contractor or the Contractor as against TTC, including actions, suits and proceedings (or arbitrations if both parties agree) claiming contribution or indemnity, until at least 60 Days after the Limitations Trigger Date.
- 29.4 The basic limitations period in respect of any claim related to or arising out of this Contract that was discovered or ought to have been discovered before the Limitations Trigger Date shall be extended to the second anniversary of the Limitations Trigger Date as if, for the purpose of calculating the basic limitation period, a claim which was discovered or ought to have been discovered before the Limitations Trigger Date is deemed to have been discovered or ought to have been discovered on the Limitations Trigger Date.
- 29.5 This provision is intended to be an agreement to suspend or extend the basic limitation period as contemplated by section 22(3) under the Limitations Act, 2002, S.O. 2002, c.24, as amended.
- 29.6 The Contractor shall complete the Work, in accordance with the Contract, notwithstanding any dispute, arbitration or any legal action initiated by either or both of the parties.
- 29.7 No arbitration, action, suit or proceeding may be brought by the Contractor against TTC unless a Claim Notice and GC28 Claim statement in accordance with GC28 has been received by TTC prior to the commencement of such arbitration, action, suit or proceeding.

**GC30 TERMINATION FOR CONVENIENCE**

- 30.1 Notwithstanding any other provisions relating to TTC's rights to terminate this Contract, TTC may, by written notice to the Contractor, terminate this Contract for its own convenience at any time if TTC deems such action necessary or in the best interests of TTC ("Notice of Termination for Convenience"). TTC's right to terminate the Contract for its convenience shall be absolute and unconditional and exercisable by TTC in its sole discretion. Such Notice of Termination for Convenience shall specify the date upon which such termination becomes effective. Upon receipt of such Notice of Termination for Convenience, the Contractor shall cease all operations, except as may be instructed by TTC to complete any unfinished portion of the Work, or except as may be deemed necessary by TTC in the interests of the safety of the Work and the public.
- 30.2 The Contractor, upon receiving such Notice of Termination for Convenience from TTC, shall immediately carry out any instructions given and shall proceed with such work as instructed by TTC in the Notice of Termination for Convenience. Subject to any instructions in the Notice of Termination for Convenience, the Contractor shall immediately discontinue ordering Products and issuing subcontracts related to the cancelled Work and shall make every reasonable effort to cancel existing orders and subcontracts related to the Work, on the best terms available.
- 30.3 In the event the Contract is terminated for the convenience of TTC pursuant to GC30.1, the Contractor shall only be entitled to payment of the following amounts:
- 30.3.1 In the event that no Work is performed on Site and no Products have been purchased by the Contractor prior to cancellation of the Contract, the costs incurred in Bidding for the Contract providing such costs can be proven in accordance with GC33; or



- 30.3.2 That portion of the Contract Price relating to Work performed to the date of the Notice of Termination for Convenience in accordance with the Contract; and
- 30.3.3 Subject in all cases to TTC being informed of all details relating thereto and the prior written approval of TTC being obtained (which approval may not be unreasonably withheld) demobilization costs of the Contractor and its Subcontractors defined to be limited to equipment and office dismantling, transportation to Contractor's storage facility, lease or rental cancellation costs, provided each such demobilization cost shall be reasonable and substantiated (to TTC's reasonable satisfaction) by the Contractor and Subcontractors; and
- 30.3.4 The Contractor will be paid for any additional Work in complying with instructions contained in the Notice of Termination for Convenience in accordance with GC26 and SC9 - VALUATION OF CHANGES IN THE WORK of Section 00 73 00; and
- 30.3.5 The lesser of:
- 30.3.5.1 \$100,000 inclusive of all applicable taxes; or
- 30.3.5.2 Two per cent (2%) of the Balance of the Contract Price as of the date of the Notice of Termination for Convenience.
- 30.3.6 For the purpose of this GC30.3.5.2, "Balance of the Contract Price as of the date of Notice of Termination for Convenience" shall mean:
- 30.3.6.1 A) The Contract Price as set out in the Purchase Order issued by TTC;
- plus
- 30.3.6.2 B) The total value of any Contract Changes and Change Directives issued by TTC as of the date of the Notice of Termination for Convenience;
- less
- 30.3.6.3 C) Any amounts paid by TTC as against the original Contract Price set out in the Purchase Order issued by TTC;
- less
- 30.3.6.4 D) Any amounts paid by TTC on Contract Changes and Change Directives issued by TTC as of the date of Notice of Termination for Convenience.
- 30.3.7 For greater clarity: Balance of the Contract Price as of the date of Notice of Termination for Convenience = (A + B) - (C + D).

- 30.4 Once the total effect on the Contract of the termination for the convenience of the TTC has been established, the change to the Contract shall be formalized by the issuance of a Contract Change, in accordance with GC26. However in the event that there is conflict between GC26 and GC30, GC30 shall govern.
- 30.5 TTC shall not be liable for any loss of anticipated profit or loss of opportunity.
- 30.6 In the event the Contract is terminated for convenience by TTC, TTC will cause a completed Form 8 to be published in accordance with the Construction Act on a date following the date of the Notice of Termination for Convenience and in such case the Contractor shall not publish a completed Form 8.

**GC31 CERTIFICATE OF SUBSTANTIAL PERFORMANCE**

- 31.1 Upon written request by the Contractor and when TTC determines that the Contract has been substantially performed in accordance with the requirements of the Construction Act, the Contractor and TTC shall sign a Certificate of Substantial Performance. The Contractor shall publish the Certificate of Substantial Performance once signed by TTC and the Contractor in accordance with the Construction Act no less than 14 Days after the date of certification and shall provide TTC with a copy of the certification of publication no less than 7 Days after the date of publication.

**GC32 DEEMED COMPLETE AND CONTRACT COMPLETION**

- 32.1 When the entire Work of the Contract, except those items arising from the provisions of GC10.3, has been performed to the requirements of the Contract Documents the Contractor shall notify TTC in writing and TTC shall verify within 14 Days whether the Work has been so completed, and if TTC determines that it has been completed, TTC shall issue a letter deeming "Contract Completion" which shall be deemed to have been achieved on the date identified in the letter.
- 32.2 TTC may in its sole discretion issue a Deemed Complete letter to the Contractor, prior to Contract Completion.

**GC33 RECORDS AND AUDIT**

- 33.1 TTC may inspect and audit the books, payrolls, accounts and records, whether in electronic format or hard copy, of the Contractor at any time as deemed necessary by TTC prior to Contract Completion and thereafter for a period of two years, to verify the Contractor's valuations of:

- 33.1.1 Contract Changes which proceeded by way of force account,
- 33.1.2 Change Directives, or
- 33.1.3 Cancelled Work,

and the Contractor shall provide certified copies of the books, payrolls, accounts and any other records, whether in electronic format or hard copy, to TTC or access to same as required by TTC.

33.2 In the case of the Contractor's neglect or failure to observe fully and in good faith the requirements of GC33.1 to validate such valuations of:

33.2.1 Contract Changes which proceeded by way of force account,

33.2.2 Change Directives, or

33.2.3 Cancelled Work,

the Contractor shall forfeit all right to payment therefore, which it otherwise might have had and is not entitled to make any claim in respect thereof; and if made, TTC may reject the same as invalid, and the Contractor shall not have any right of recovery in respect thereof at law or otherwise, unless written consent of TTC to the making of such a claim is obtained.

33.3 Should an audit by TTC or any other party disclose any overbilling on the part of the Contractor, the Contractor shall be responsible to repay to TTC all monies owed by the Contractor as a result of the overbilling or TTC may at its discretion deduct the overbilling from monies owed to the Contractor, if applicable. Further, TTC shall have the right at its sole discretion to:

33.3.1 Restrict the Contractor, from submitting a Bid on future Bid Requests, for a period of time deemed appropriate by TTC;

33.3.2 Reject any bid submitted or refuse to consider or evaluate any bid submitted by the Contractor or by any Affiliate of the Contractor, or by a successor of the Contractor or by any entity with whom an officer or director of that entity has in the past been associated in any way with the Contractor;

33.3.3 Refuse to award any Contract to the Contractor or to any Affiliate of the Contractor, or to a successor of the Contractor or to any entity with whom an officer or director of that entity has in the past been associated in any way with the Contractor.

33.4 The above information may be provided to the City of Toronto and/or any of the City of Toronto Agencies, Boards, Commissions or Corporations, which may rely on such information to reject a Bid on any current or future requests for Bids or to not award a Contract.

#### **GC34 CONTRACTOR WORK PERFORMANCE RATING**

34.1 TTC shall, during the term of a Contract, maintain a record of the performance of the Contractor completing the Contract for TTC. This information shall be used to complete a "Contractor Performance Review" report, a copy of which will be provided to the Contractor upon completion. (See attached Appendix 1 "Contractor Performance Review" form). "Contractor Performance Review" reports may be issued, as deemed appropriate by TTC, at any time during the term of the Contract. The "CONTRACTOR PERFORMANCE REVIEW PROCESS" is located on TTC's website at: [http://www.ttc.ca/TTC\\_Business/Materials\\_and\\_procurement/About\\_Us/Contractor\\_Consultant\\_Reference\\_/Materials/index.jsp](http://www.ttc.ca/TTC_Business/Materials_and_procurement/About_Us/Contractor_Consultant_Reference_/Materials/index.jsp), which requirements shall be incorporated into these General Conditions by reference and may be updated or changed from time to time at the sole discretion of TTC without notice. TTC reserves the right to use any version of the "CONTRACTOR PERFORMANCE REVIEW PROCESS" issued or in effect during the term of the Contract.

- 34.2 TTC will consider the performance rating of the Contractor for Work performed for TTC, the City of Toronto or any of the City of Toronto's Agencies, Boards, Commissions or Corporations, and it may be considered in the evaluation of future bids from the Contractor.

**GC35 APPLICABLE POLICIES**

- 35.1 The Contractor shall ensure that at all material times during the term of the Contract its Workers receive proper training in accordance with requirements as set out in the Accessibility for Ontarians with Disabilities Act and its Regulations including, but not limited to, training on Customer Service and the Integrated Accessibility Standards. The Contractor further agrees to comply with the requirements as set out in TTC's "ACCESSIBILITY FOR ONTARIANS WITH DISABILITIES ACT TRAINING REQUIREMENTS" located on TTC's website at [http://www.ttc.ca/TTC\\_Business/Materials\\_and\\_procurement/About\\_Us/Contractor\\_Consultant\\_Reference\\_Materials/index.jsp](http://www.ttc.ca/TTC_Business/Materials_and_procurement/About_Us/Contractor_Consultant_Reference_Materials/index.jsp), which requirements shall be incorporated into these General Conditions by reference and may be updated or changed from time to time at the sole discretion of TTC without notice and the Contractor agrees to comply with the updated or changed requirements.
- 35.2 With respect to the provision, or receipt, as applicable, of the Work and access to the premises, property and employees of TTC, the Contractor and its Workers shall comply with such applicable policies, procedures and protocols of TTC as are provided to the Contractor in writing and in advance. TTC may, from time to time, amend its policies, protocols and procedures or add new policies, protocols and procedures and, upon providing notice to the Contractor of such requirement, the Contractor and its Workers shall have an obligation to comply. The Contractor shall be responsible to ensure that its Workers comply with such applicable policies, protocols and procedures. Without limiting the generality of the foregoing, the Contractor shall comply with the requirements of TTC's "RESPECT AND DIGNITY POLICY", "WORKPLACE VIOLENCE POLICY" and "FITNESS FOR DUTY POLICY – EXPECTATION FOR CONTRACTORS PROCEDURE", "WHISTLE BLOWER REPORTING AND PROTECTION POLICY", "CODE OF CONDUCT POLICY", "CRIMINAL MISCONDUCT POLICY" located on TTC's website at: [http://www.ttc.ca/TTC\\_Business/Materials\\_and\\_procurement/About\\_Us/Contractor\\_Consultant\\_Reference\\_Materials/index.jsp](http://www.ttc.ca/TTC_Business/Materials_and_procurement/About_Us/Contractor_Consultant_Reference_Materials/index.jsp), which requirements shall be incorporated into these General Conditions by reference and it may be updated or changed from time to time at the sole discretion of TTC without notice and the Contractor agrees to comply and/or ensure its Workers comply, as applicable, with the updated or changed requirements.

**GC36 PROHIBITION AGAINST GRATUITIES**

- 36.1 No Contractor and no employee, agent or representative of the Contractor, may offer or give any gratuity in the form of entertainment, participation in social events, gifts or otherwise to any member of the City of Toronto Council or Commissioner of TTC, or any officer or employee of TTC in connection with or arising from this Contract, whether for the purpose of securing a future Contract or seeking favourable treatment in respect to this Contract.

**GC37 THIRD PARTY CLAIMS FOR PROPERTY DAMAGE**

- 37.1 GC37 applies to claims made by third parties in respect of damage to a third party's personal or real property.

- 37.2 Without limiting the obligations of the Contractor under GC19, or SC4 - INDEMNIFICATION AND LIMITATION OF LIABILITY of Section 00 73 00, the Contractor, or the Contractor's insurer, shall:
- 37.2.1 Respond to all third party claimants of property damage in a timely manner;
  - 37.2.2 Ensure that third party claimants of property damage are provided with accurate information about the status of their claim; and
  - 37.2.3 Where appropriate, notify third party claimants of property damage of the relevant activity on their claims and provide them with information.
- 37.3 If the Contractor receives notice of a third party claim for property damage from a claimant relating to or arising out of the Contract, the Contractor shall immediately forward the notice of claim to TTC.
- 37.4 In the event that the Contractor receives notice of a third party claim for property damage from TTC relating to or arising out of the Work or Contract, the Contractor, or the Contractor's insurer, shall:
- 37.4.1 Within 5 Business Days of receiving notice of the claim, send a letter to the claimant acknowledging receipt of the claim and provide the claimant with the contact information of the Contractor, or another person representing the Contractor, to whom the claimant can refer questions regarding the claim;
  - 37.4.2 Conduct an investigation of the claim and make a decision regarding the claim that is based on a proper consideration of the facts;
  - 37.4.3 Within 25 Business Days of receiving notice of the claim, provide the claimant with a letter advising of the results of the investigation and clearly explaining the Contractor's decision regarding the claim or, should the Contractor require the involvement of their insurance company to resolve the claim, this shall be forwarded to the insurance company and the claimant notified within the allotted time above.
- 37.5 An extension of time for responding to the claimant may be provided in writing by TTC, if the Contractor or the Contractor's insurer, in writing, provides TTC with a request for an extension as well as the reasons for the extension. In considering whether to provide an extension under this GC37.5, TTC shall consider the Contractor's, or the Contractor's insurer's, reasons for the request and all of the surrounding circumstances including good customer service standards. Once the Contractor forwards the claim to their respective insurer, the resolution of the claim shall follow the insurance industry standards for claim investigation.
- 37.6 If an extension of time is provided under GC37.5, the Contractor, or the Contractor's insurer, shall write to the claimant advising that the investigation is on-going, advise of the date by which the Contractor or its insurer will report the results of the investigation to the claimant, and explain the reasons why additional time is required to make a decision on the claim.
- 37.7 A copy of all letters sent to the claimant by or on behalf of the Contractor, including letters sent by the Contractor's insurer, pursuant to GC37 shall be copied to TTC.

- 37.8 If the Contractor fails to meet any of its obligations under GC37.2 to GC37.6, inclusive, TTC shall provide the Contractor with notice that these obligations must be fulfilled.
- 37.9 If the Contractor does not meet its obligations under GC37.2 to GC37.6, inclusive, within 5 Business Days from receipt of the notice provided to the Contractor pursuant to GC37.8, TTC may retain an amount of \$10,000.00 from monies payable to the Contractor under this Contract.
- 37.10 Subject to its right to exercise any other right of hold back or set-off, including TTC's rights under SC4 - INDEMNIFICATION AND LIMITATION OF LIABILITY of Section 00 73 00, TTC will release the monies held back pursuant to GC37.9 once it has received evidence that the Contractor has sent the claimant both letters referred to in GC37.4.1 and GC37.4.3.
- 37.11 Where appropriate, the Contractor shall ensure its insurer takes all of the appropriate steps to meet the obligations under GC37.2 to GC37.6 inclusive, failing which the Contractor shall be responsible for undertaking these obligations itself.
- 37.12 The Contractor shall provide to TTC regular monthly, or of such time periods as may be mutually agreed upon, updates on the status of all third party claims received until claim resolution.

**GC38 WORKPLACE SAFETY INSURANCE BOARD (WSIB) CLEARANCE CERTIFICATE**

- 38.1 Within 10 Days after the Notification of Award and prior to the commencement of Work at the Site, the Contractor shall promptly provide TTC with a valid WSIB clearance certificate.
- 38.2 The Contractor shall provide with each invoice a WSIB clearance certificate indicating that no outstanding assessments exist, and which shall be valid until the payment for that invoice is due.

**GC39 BONDING**

- 39.1 The Contractor shall provide within 10 Days after the Notification of Award and shall maintain the following bonding requirements throughout the term of the Contract (including all Basic Warranty Periods but excluding Extended Warranty Periods), and such bonds shall be issued by an insurer licensed under the Insurance Act, R.S.O. 1990, c. I.8, as amended, to write surety and fidelity insurance:
- 39.1.1 Performance Bond - The Contractor shall execute a Performance Bond in the form prescribed by the Construction Act in a sum equal to at least 50% of the Contract Price (rounded up to the nearest dollar).
- 39.1.2 Labour and Material Payment Bond - The Contractor shall execute a Labour and Material Payment Bond in the form prescribed by the Construction Act in a sum equal to at least 50% of the Contract Price (rounded up to the nearest dollar).
- 39.2 In respect of the Performance Bond, should any surety company or companies fail financially or be considered as insufficient security, as determined by TTC in its sole discretion for the fulfillment of the Contract, then TTC may, upon giving 10 Days written notice thereof, require the Contractor to execute new bonds with such surety company or companies acceptable to TTC.

**GC40 CONTRACTOR EMERGENCY CONTACT PERSON**

- 40.1 The Contractor is required to provide an emergency contact person(s) who shall be available 24 hours a Day, 7 Days a week for the duration of the Contract to receive instruction from TTC for any emergency situations that may occur within the limits of the Contract.
- 40.2 The emergency contact person(s) will be the Contractor's main point of contact for TTC to report emergency situations.
- 40.3 The emergency contact person(s) provided by the Contractor shall have the following minimum qualifications:
- 40.3.1 Be accessible 24 hours a Day, 7 Days a week for the duration of the Contract to receive emergency calls;
  - 40.3.2 Return all calls no later than 30 minutes;
  - 40.3.3 Have the required level of authority within the Contractor's organization to immediately respond to the emergency response instruction received from TTC, including having the authority to immediately organize and approve all required resources to carry out the specified emergency response instruction;
  - 40.3.4 Be knowledgeable of the Contract's scope of Work.
- 40.4 Immediately after receiving emergency response instruction from TTC, the emergency contact person(s) shall implement the necessary actions to resolve the emergency situation.
- 40.5 The emergency contact person(s) shall record details of all emergency calls received in writing, addressing the time of the call, name, address and phone number of the caller, description of the emergency, instruction received from TTC and the action taken by the Contractor to resolve the emergency situation. The Contractor shall provide this information in writing to TTC within 24 hours from the time that each emergency call is received.

**GC41 NOTIFICATION OF WRITTEN NOTICES OF LIEN**

- 41.1 In addition to any requirements of the Construction Act, the Contractor shall provide by email to the address(es) designated by TTC a copy of any written notice of lien under the Construction Act of the Contractor on the same Day that it takes any step to serve one in respect of the Work or the Contract.
- 41.2 The Contractor shall provide by email to the address(es) designated by TTC a copy of any written notice of lien under the Construction Act of any Subcontractor in respect of the Work or the Contract on the earlier of a) the Day that it receives a copy of the Subcontractor's written notice of lien or b) the Day that TTC requests a copy of the Subcontractor's written notice of lien.

**END OF SECTION**







## Contractor Performance Review (CPR)

☐ Final

☐ Interim #
COR™ Certification Current ☐ YES ☐ NO

Evaluation Period:

dd/mm/yyyy - dd/mm/yyyy

CONTRACTOR:	CONTRACTOR'S PROJECT MANAGER:						
CONTRACT TITLE:	CONTRACTOR'S SITE SUPERINTENDENT:						
P.O. NUMBER:	APPROVED TIME EXTENSION:	RANKING For Definitions Refer to Backup Sheets					
CONTRACT No.:	AWARD DATE:	1	2	3	4	5	
ORIGINAL/PRESENT CONTRACT AMOUNT:	CONTRACT SP DATE:	U	I	ME	EE	EX	N/A


## SAFETY &amp; COMPLIANCE - SCORE CRITERIA


1 Did the Contractor comply with OHSA requirements?						
2 Did the Contractor adhere to environmental, (non-OHSA) safety requirements, and other laws & policies?						
3 Did the Contractor take adequate precautions with any hazardous materials and designated substances?						
4 Did the Contractor comply with safety documentation submissions & requirements?						
5 Did the Contractor maintain COR™ certification during the evaluation period?						
					Safety Score	


## CONTRACT EXECUTION - SCORE CRITERIA

<b>A. QUALITY - Compliance with Contract</b>		sub-score		Weight	25%
1 Did the contractor comply with the Drawings and Specifications requirements?					
2 Was the quality and workmanship in compliance with the Contract and reviewed Quality Plan?					
3 Did the Contractor promptly & effectively correct defective work as the Work progressed?					
<b>B. ORGANIZATION - Construction Management</b>		sub-score		Weight	25%
1 Did the Contractor submit a satisfactory Contract Baseline Schedule in compliance with the Contract?					
2 Did the Contractor submit schedule updates in accordance with the Contract?					
3 Did the Contractor provide adequate coverage & competent full time Site supervision?					
4 Did the Contractor provide adequate staff and resources in compliance with the Contract?					
5 Did the Contractor effectively coordinate and manage the work of its subcontractors?					
6 Did an authorized representative with decision making authority represent the contractor at Contract meetings?					
7 Did the Contractor submit timely, relevant requests for information (RFIs)?					
8 Were all shop drawings submitted according to Contract Baseline Schedule and in compliance with the Contract?					
<b>C. EXECUTION - Work Performance</b>		sub-score		Weight	35%
1 Did the Contractor achieve Milestones in accordance with the Contract?					
2 Did the Contractor provide effective quality assurance & quality control (QA/QC)?					
3 Did the Contractor maintain housekeeping on the Site in compliance with the Contract and applicable law(s)?					
4 Did the Contractor achieve Contract Completion within the specified period?					
5 Did the Contractor proceed with Change Directive (CD) Work in accordance with the Contract?					
6 Did the Contractor coordinate to minimize disruption to the public & TTC operations?					
7 Was the quality and submission timelines of the following items in accordance with the Contract?					
7.1 Look ahead schedules					
7.2 As-Builts					
7.3 Operations and maintenance manuals					
7.4 Permits and approvals					
7.5 Commissioning related submittals					
7.6 Training plan and manuals					
7.7 Other submittal requirements					
<b>D. ADMINISTRATION - Contract Administration</b>		sub-score		Weight	15%
1 Did the Contractor effectively communicate in a professional manner and cooperate with the TTC & others?					
2 Did the Contractor participate in resolving problems and mitigate any negative Contract impacts?					
3 Did the Contractor demonstrate accountability for problems for which they were responsible?					
4 Did the Contractor submit accurate, acceptable and complete invoices in accordance with the Contract?					
5 Did the Contractor provide reasonable and timely pricing including adequate justification for Requests for Quotations (RFQs)?					
6 Did the Contractor submit proper, complete and justified claims in accordance with the Contract?					
Note 1: In order to achieve an overall satisfactory rating the Contractor <u>must</u> receive a minimum rating of 75% in the Safety Score and a minimum rating of 60% in the Contract Execution Score.				Contract Execution Score	
Note 2: If the Contractor disagrees with the evaluation, they are directed to the appeals procedure found in GC34.1 of the Contract Documents.				Contract Execution (Percentage)	


	Print Name	Signature	Date
Construction Site Manager:			
Construction Manager:			
Chief Project Manager:			


 <b>Contractor Performance Review Definitions &amp; Comments -</b>		
<b>EX - EXCEPTIONAL</b> <b>EE - EXCEEDS EXPECTATIONS</b> <b>ME - MEETS EXPECTATIONS</b> <b>I - IMPROVEMENT NEEDED</b> <b>U - UNSATISFACTORY</b>		
<b>For scores of U, I and EX, Evaluator must provide comments with references to Contract administration documentation. Comments for ME and EE scores are optional.</b>		
SAFETY & COMPLIANCE - SCORE CRITERIA		COMMENTS
1	Did the Contractor comply with OHSA requirements?	
	EX - n/a EE - n/a ME - Compliance with OHSA requirements. I - Inconsistent compliance with OHSA requirements; minor contraventions that are corrected; few if any lost time injuries and no critical injuries. U - Does not comply with an appropriate safety program; lost time injuries, including but not limited to critical injuries; serious OHSA contraventions, incidents, convictions and/or repeated non-compliances.	
2	Did the Contractor adhere to environmental, (non-OHSA) safety requirements, and other laws & policies?	
	EX - n/a EE - Fully complies with environmental and (non-OHSA) safety requirements, including contractors safety policy and site specific plans and other laws and policies required by the Contract. ME - Fully complies with environmental and (non-OHSA) safety requirements including contractors safety policy and site specific plans and other laws and policies required by the Contract. Minimal critical non-compliance issues. I - Inconsistent compliance with (non-OHSA) safety requirements including contractors safety policy and site specific plans or other laws and policies required by the contract; minor contraventions that are corrected. U - Failure to adhere to environmental and (non-OHSA) safety requirements, including contractors safety policy and site specific plans or other laws and policies required by the Contract; not responsive to directives.	
3	Did the Contractor take adequate precautions with any hazardous materials and designated substances?	
	EX - n/a EE - Strict compliance with the Contract requirements and applicable laws and policies. ME - Complies with the Contract requirements and applicable laws and policies; minor contraventions with immediate correction I - Inconsistent compliance with the Contract requirements and applicable laws and policies. U - Failure to comply with the Contract requirements and applicable laws and policies.	
4	Did the Contractor comply with safety documentation submissions & requirements?	
	EX - n/a EE - Strict timely compliance with TTC's Contract requirements for submittals listed in 01 59 00 and all subsequent required resubmissions. ME - Complies with TTC's Contract requirements for submittals listed in 01 59 00 and all subsequent required resubmissions . I - Inconsistent compliance with TTC's Contract requirements for submittals listed in 01 59 00 and all subsequent required resubmissions requires some additional TTC staff time/resources. U - Failure to comply with TTC's Contract requirements for submittals listed in 01 59 00 and all subsequent required submissions ; requires substantial additional TTC staff time/resources.	


		<b>Contractor Performance Review Definitions &amp; Comments -</b>	
<b>EX - EXCEPTIONAL</b> <b>EE - EXCEEDS EXPECTATIONS</b> <b>ME - MEETS EXPECTATIONS</b> <b>I - IMPROVEMENT NEEDED</b> <b>U - UNSATISFACTORY</b>			
<b>For scores of U, I and EX, Evaluator must provide comments with references to Contract administration documentation. Comments for ME and EE scores are optional.</b>			
<b>5 Did the Contractor maintain COR™ certification during the evaluation period?</b>			
	EX - n/a EE - n/a ME - COR™ certification maintained throughout the duration of the evaluation period. I - COR™ certification expired during the timeframe of the evaluation period and reinstated in accordance with COR™ recertification guidelines. U - COR™ certification not maintained and not reinstated during the evaluation period.		
<b>A. QUALITY - Compliance with Contract</b>		<b>COMMENTS</b>	
<b>A1 Did the contractor comply with the Drawings and Specifications requirements?</b>			
	EX - Strict adherence to Drawings and Specifications requirements. Approved substitutions added value. EE - Strict adherence to Drawings and Specifications requirements ME - Some CDR's but corrected in a timely manner. I - Problems with compliance with Drawings and Specifications requirements, CDR's not corrected in a timely manner; Requires some additional TTC staff time/resources. U - Work frequently does not adhere to the Drawings and Specifications requirements resulting in delays and/or claims. Requires substantial additional TTC staff time/resources.		
<b>A2 Was the quality and workmanship in compliance with the Contract and reviewed Quality Plan?</b>			
	EX - n/a EE - Workmanship is excellent. ME - The majority of workmanship is good and meets ..requirements of the Contract Documents. Minor rework required I - Moderate rework required. Some additional TTC staff time/resources required. U - Extensive rework required. Substantial additional TTC staff time/resources required.		
<b>A3 Did the Contractor promptly &amp; effectively correct defective work as the Work progressed?</b>			
	EX - n/a EE - Contractor promptly responds and addresses all defective work. ME - Timely responses to correct defective work. I - Unacceptable work is eventually corrected but not in a timely manner. Requires some additional TTC staff time/resources. U - Does not acknowledge or correct problems. Little or no response to repeated notifications of defective work Requires substantial additional TTC staff time/resources.		

 <b>Contractor Performance Review Definitions &amp; Comments -</b>		
<b>EX - EXCEPTIONAL</b> <b>EE - EXCEEDS EXPECTATIONS</b> <b>ME - MEETS EXPECTATIONS</b> <b>I - IMPROVEMENT NEEDED</b> <b>U - UNSATISFACTORY</b>		
<b>For scores of U, I and EX, Evaluator must provide comments with references to Contract administration documentation. Comments for ME and EE scores are optional.</b>		
<b>B. ORGANIZATION - Construction Management</b>		<b>COMMENTS</b>
<b>B1</b>	Did the Contractor submit a satisfactory Contract Baseline Schedule in compliance with the Contract?	
	EX - n/a EE - Contractor submitted Contract Baseline Schedule on time and complete, accelerating the project. ME - Contractor submitted Contract Baseline Schedule on time and complete I - Contractor submitted Contract Baseline Schedule late; Requires some additional TTC staff time/resources U - No satisfactory Contract Baseline Schedule submitted. Requires substantial additional TTC staff time/resources	
<b>B2</b>	Did the Contractor submit schedule updates in accordance with the Contract?	
	EX - n/a EE - Contractor submits timely, accurate schedule updates in accordance with the Contract, accelerating the Contract. ME - The Contractor submits schedule updates timely, accurate and in accordance with the Contract. I - The Contractor submits schedule updates inconsistently with some inaccuracies but largely in accordance with Contract . Requires some additional TTC staff time/resources. U - The Contractor frequently submits schedule updates late, inaccurate and not in accordance with the Contract. Requires substantial additional TTC staff time/resources.	
<b>B3</b>	Did the Contractor provide adequate coverage & competent full time Site supervision?	
	EX - n/a EE - n/a ME - Consistent presence on Site by a competent and experienced Superintendent throughout the duration of the Contract. I - Periodic failure to maintain presence on Site on a full time basis by a competent and experienced Superintendent with multiple requests by TTC e.g.. CDRs, emails, letters, etc.). U - Failure to maintain presence on Site on a full time basis by a competent and experienced Superintendent with many requests and by TTC (e.g.. CDRs, emails, letters, etc.).	
<b>B4</b>	Did the Contractor provide adequate staff and resources in compliance with the Contract?	
	EX - n/a EE - The Contractor provided sufficient staff and resources, capable of successfully maintaining an accelerated Contract schedule, appropriate equipment always well maintained and available when needed, adding significant value to the Contract. ME - The Contractor has adequate workforce and maintains an aggressive schedule. Equipment needed is usually available, no delays. I - Under-staffed, periodically hinders project, equipment needed often not available, minor delays. U - Poorly staffed, equipment is not available or reliable, sometimes resulting in major delays.	


# Section 00 72 00 - Appendix 1

		<b>Contractor Performance Review Definitions &amp; Comments -</b>	
<b>EX - EXCEPTIONAL</b> <b>EE - EXCEEDS EXPECTATIONS</b> <b>ME - MEETS EXPECTATIONS</b> <b>I - IMPROVEMENT NEEDED</b> <b>U - UNSATISFACTORY</b>			
<b>For scores of U, I and EX, Evaluator must provide comments with references to Contract administration documentation. Comments for ME and EE scores are optional.</b>			
<b>B5</b>	<b>Did the Contractor effectively coordinate and manage the work of its subcontractors?</b>		
	<p>EX - n/a</p> <p>EE - Contractor consistently and effectively coordinates and manages the work of its subcontractors.</p> <p>ME - Minimal problems, the majority of coordination and management of subcontractors is satisfactory .</p> <p>I - Some issues with coordination and management of subcontractors, moderate rework which required some additional TTC staff time/resources.</p> <p>U - Contractor does not effectively coordinate and manage the work of its subcontractors which may require extensive rework. Requires substantial additional TTC staff time/resources.</p>		
<b>B6</b>	<b>Did an authorized representative with decision making authority represent the contractor at Contract meetings?</b>		
	<p>EX - n/a</p> <p>EE - Contract meetings always attended by Contractors authorized representative with decision making authority. Adds value to the Contract.</p> <p>ME - Contract meetings always attended by Contractors authorized representative with decision making authority.</p> <p>I - Contract meetings usually attended by Contractors authorized representative with decision making.</p> <p>U - Contract meetings had little or no attendance by Contractors authorized representative with decision making authority.</p>		
<b>B7</b>	<b>Did the Contractor submit timely, relevant requests for information (RFIs)?</b>		
	<p>EX - Timely, warranted and in accordance with Contract, anticipating and avoiding problems and delays.</p> <p>EE - Timely, warranted and in accordance with Contract.</p> <p>ME - Usually timely, warranted and in accordance with Contract.</p> <p>I - Frequently late, sometimes inaccurate, and sometimes not in accordance with Contract. Requires some additional TTC staff time/resources.</p> <p>U - Constantly late, unwarranted, requiring frequent reminders, seldom in accordance with Contract. Requires much additional TTC staff time/resources.</p>		
<b>B8</b>	<b>Were all shop drawings submitted according to Contract Baseline Schedule and in compliance with the Contract?</b>		
	<p>EX - All shop drawings submitted in accordance with the Contract Baseline Schedule and complete. Proposed substitutions added value to the Contract.</p> <p>EE - All shop drawings submitted in accordance with the Contract Baseline Schedule and complete. With some approved extensions.</p> <p>ME - Most shop drawings submitted in accordance with the Contract Baseline Schedule and complete.</p> <p>I - Some shop drawings submitted in accordance with the Contract Baseline Schedule and not consistently complete resulting in problems/delays. Requires some additional TTC staff time/resources.</p> <p>U - Few or no shop drawings submitted in accordance with the Contract Baseline Schedule and not consistently complete, causing problems. Requires substantial additional TTC staff time and resources.</p>		

 <b>Contractor Performance Review Definitions &amp; Comments -</b>		
<b>EX - EXCEPTIONAL</b> <b>EE - EXCEEDS EXPECTATIONS</b> <b>ME - MEETS EXPECTATIONS</b> <b>I - IMPROVEMENT NEEDED</b> <b>U - UNSATISFACTORY</b>		
<b>For scores of U, I and EX, Evaluator must provide comments with references to Contract administration documentation. Comments for ME and EE scores are optional.</b>		
<b>C.</b>	<b>EXECUTION - Work Performance</b>	<b>COMMENTS</b>
<b>C1</b>	<b>Did the Contractor achieve Milestones in accordance with the Contract?</b>	
	EX - Contractor completes the Work in advance of the Milestone dates. EE - Contractor completes the Work in accordance with the Milestone dates, with no extensions. ME - Contractor completes the Work in accordance with the Milestone dates, with some approved extensions. I - Contractor misses Milestone dates. Some delays occur. Requires some additional TTC staff time/resources. U - Contractor misses Milestone dates. Significant delays occur. Requires substantial additional TTC staff time/resources.	
<b>C2</b>	<b>Did the Contractor provide effective quality assurance &amp; quality control (QA/QC)?</b>	
	EX - Exceptional QA/QC. No deficiencies. Adds value to Contract. EE - Excellent QA/QC. Minor if any deficiencies which are corrected quickly. ME - Adequate QA/QC. Few deficiencies which are corrected quickly. I - Poor QA/QC. Some deficiencies which takes additional TTC staff time /resources to correct. U - Unacceptable QA/QC. Many deficiencies which requires substantial additional TTC staff time /resources to correct.	
<b>C3</b>	<b>Did the Contractor maintain housekeeping on the Site in compliance with the Contract and applicable law(s)?</b>	
	EX - n/a EE - n/a ME - Housekeeping on the Site attended to on a daily basis. I - Periodic housekeeping on the Site with minimal prompting by the TTC. U - Non-responsive to repeated instructions to clean up the Site. Substantial additional TTC staff time/resources required.	
<b>C4</b>	<b>Did the Contractor achieve Contract Completion within the specified period?</b>	
	EX - n/a EE - Contractor has achieved Contract Completion ahead of the specified period. ME - Contractor has achieved Contract Completion within the specified period. I - Contractor did not achieve Contract Completion within the specified period, with minor delays. Required some additional TTC staff time/resources. U - Contractor did not achieve Contract Completion within the specified period with major delays. Required substantial additional TTC staff time/resources.	
<b>C5</b>	<b>Did the Contractor proceed with Change Directive (CD) Work in accordance with the Contract?</b>	
	EX - n/a EE - n/a ME - Contractor always proceeded with CD Work in accordance with the Contract. I - Contractor occasionally proceeded with CD Work in accordance with the Contract. Requires some additional TTC staff time/resources. U - Contractor occasionally proceeded with CD Work in accordance with the Contract. Requires substantial additional TTC staff time/resources.	
<b>C6</b>	<b>Did the Contractor coordinate to minimize disruption to the public &amp; TTC operations?</b>	
	EX - Contractor coordinated all work and had no disruptions to the public & TTC operations. EE - Contractor coordinated all work and had minor disruptions to the public & no disruptions to TTC operations. ME - Contractor coordinated all work and had minor disruptions to the public & TTC operations caused by site conditions (warranted or unavoidable). I - Contractor did not coordinate all work and had minor disruptions to the public & TTC operations NOT caused by site conditions (unwarranted and avoidable). U - Contractor did not coordinate all work and had major disruptions to public & TTC operations.	

 <b>Contractor Performance Review Definitions &amp; Comments -</b>	
<b>EX - EXCEPTIONAL</b> <b>EE - EXCEEDS EXPECTATIONS</b> <b>ME - MEETS EXPECTATIONS</b> <b>I - IMPROVEMENT NEEDED</b> <b>U - UNSATISFACTORY</b>	
<b>For scores of U, I and EX, Evaluator must provide comments with references to Contract administration documentation. Comments for ME and EE scores are optional.</b>	
<b>C7</b>	<b>Was the quality and submission timelines of the following items in accordance with the Contract?</b>
<b>C7.1</b>	<ul style="list-style-type: none"> <li>Look ahead schedules</li> </ul>
<b>C7.2</b>	<ul style="list-style-type: none"> <li>As-Builts</li> </ul>
<b>C7.3</b>	<ul style="list-style-type: none"> <li>Operations and maintenance manuals</li> </ul>
<b>C7.4</b>	<ul style="list-style-type: none"> <li>Permits and approvals</li> </ul>
<b>C7.5</b>	<ul style="list-style-type: none"> <li>Commissioning related submittals</li> </ul>
<b>C7.6</b>	<ul style="list-style-type: none"> <li>Training plan and manuals</li> </ul>
<b>C7.7</b>	<ul style="list-style-type: none"> <li>Other submittal requirements</li> </ul>
	<p>EX - All submittals on time and of exceptional quality, adding value to the Contract.</p> <p>EE - All submittals on time and of excellent quality.</p> <p>ME - Most submittals on time and of good quality. Remaining revised and resubmitted quickly.</p> <p>I - Some submissions late and of poor quality. Remaining submittals revised and resubmitted slowly requiring some additional TTC staff time /resources.</p> <p>U - Most submittals late and of poor quality. Much revision and resubmittal requiring substantial additional TTC staff time/resources.</p>
<b>D.</b>	<b>ADMINISTRATION - Contract Administration</b>
	<b>COMMENTS</b>
<b>D1</b>	<b>Did the Contractor effectively communicate in a professional manner and cooperate with the TTC &amp; others?</b>
	<p>EX - Communication with the TTC's Representative(s) was excellent and in accordance with the Contract documents, adding significant value to the Contract.</p> <p>EE - Communication with the TTC's Representative(s) was excellent and in accordance with the Contract documents.</p> <p>ME - Communication with the TTC's Representative(s) was timely, satisfactory and in accordance with the Contract documents.</p> <p>I - Communication with the contract TTC's Representative(s) was poor and caused periodic problems. Requires some additional TTC staff time/resources.</p> <p>U - Contractors communication with the TTC's Representative(s) was poor and the cause of frequent problems. Strongly impacts the success of the Contract. Requires substantial additional TTC staff time/resources.</p>
<b>D2</b>	<b>Did the Contractor participate in resolving problems and mitigate any negative Contract impacts?</b>
	<p>EX - Cooperates in solving Contract problems often mitigating them. Creative solutions add value.</p> <p>EE - Cooperates in solving Contract problems sometimes mitigating them.</p> <p>ME - Consistently cooperates in solving Contract problems.</p> <p>I - Reluctant to cooperate. Few reasonable solutions offered. -Requires some additional TTC staff time/resources to resolve.</p> <p>U - Rarely cooperates. Few reasonable solutions offered. Requires substantial additional TTC staff time/resources to resolve.</p>
<b>D3</b>	<b>Did the Contractor demonstrate accountability for problems for which they were responsible?</b>
	<p>EX - Always cooperates in solving and/or mitigating their problems. Creative solutions add value. Always accepts responsibility for their errors with quick resolution.</p> <p>EE - Cooperates in solving problems often mitigating them. Always accepts responsibility for their errors with quick resolution.</p> <p>ME - Consistently cooperates in solving problems usually accepting responsibility.</p> <p>I - Reluctant to solve problems, frequently avoiding responsibility for their errors. Requires some additional TTC staff time/resources to resolve.</p> <p>U - Rarely acknowledges problems, avoiding responsibility and/or compounds them. Requiring substantial additional TTC staff time/resources to resolve.</p>

# Section 00 72 00 - Appendix 1

		<b>Contractor Performance Review Definitions &amp; Comments -</b>	
<b>EX - EXCEPTIONAL</b> <b>EE - EXCEEDS EXPECTATIONS</b> <b>ME - MEETS EXPECTATIONS</b> <b>I - IMPROVEMENT NEEDED</b> <b>U - UNSATISFACTORY</b>			
<b>For scores of U, I and EX, Evaluator must provide comments with references to Contract administration documentation. Comments for ME and EE scores are optional.</b>			
<b>D4</b>	<b>Did the Contractor submit accurate, acceptable and complete invoices in accordance with the Contract?</b>		
	EX - n/a EE - No errors, accurate representation of Work completed including all applicable supporting documentation. ME - Few billing errors, minor corrections required and submitted with all applicable supporting documentation. I - Some billing errors and corrections required; requiring some additional TTC staff time/resources to resolve. U - Frequent return of invoices for corrections; Requiring substantial additional TTC staff time/resources to resolve.		
<b>D5</b>	<b>Did the Contractor provide reasonable and timely pricing including adequate justification for Requests for Quotations (RFQs)?</b>		
	EX - N/A EE - All quotations are reasonable and timely including adequate justification. ME - Quotations are reasonable and timely usually with adequate justification, few unresolved issues. I - Reluctant to negotiate; quotations not submitted in a timely and complete manner. Requires some additional TTC staff time/resources to resolve. U - Contractor is not willing to negotiate. Quotations were unreasonable and lack adequate justification; Many unresolved issues requiring substantial additional TTC staff time/resources to resolve.		
<b>D6</b>	<b>Did the Contractor submit proper, complete and justified claims in accordance with the Contract?</b>		
	EX - N/A EE - N/A ME - All claims were warranted and submitted timely with proper justification for cost and/or delay. Significant effort made by the contractor to reduce the impact to the Contract Price and/or Contract Baseline Schedule. I - Some claims were warranted and submitted with proper justification. Contractor negotiated in good faith. Some effort to reduce price and negative impact to Contract Baseline Schedule. Requires some additional TTC staff time/resources. U - Most claims were unwarranted and unsubstantiated: Causing unnecessary disruption to the Contract. Little or no efforts made by the contractor to reduce impacts to the Contract. Requiring significant additional TTC staff time/resources to resolve.		



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**SC1 SCOPE OF SUPPLEMENTARY CONDITIONS**

- 1.1 The General Conditions shall apply to the Contract except as amended in this Section.

**SC2 INSURANCE REQUIREMENTS**

- 2.1 Without restricting the generality of SC4 and unless TTC and the Contractor agree to obtain project – specific insurance or higher insurance limits, TTC and the Contractor shall provide, maintain and pay for the insurance coverage specified in SC2.
- 2.2 During the term of the Contract, TTC will maintain the following insurance;
- 2.2.1 Property Insurance:
- 2.2.1.1 TTC will keep the Works within the Site insured for the benefit of TTC, the Contractor, and Subcontractors as their interests may appear against the hazards of all risks of direct physical loss or damage to the property insured, subject to the standard all risks exclusions.
- 2.2.1.2 Monies received under such insurance shall be applied to or towards the replacement by the Contractor of the Works destroyed, and the Contract shall in all respects apply to the replacement of such Works.
- 2.2.1.3 Claims under this insurance shall be subject to a deductible of \$1,000,000 per claim as stated in the policy. The Contractor shall, at its own expense, be responsible for any and all deductible amounts hereunder. This shall apply either where the Contractor is responsible, or where the Contractor's Subcontractor(s) are responsible for the loss. The Contractor may, at its option take out additional coverage, at its own expense, to cover any or all of its responsibilities for the deductibles and exclusions contained in TTC's policy.
- 2.2.1.4 The Contractor shall provide TTC with written notice and all reasonable particulars and documents related to any damages, losses, notices, claims and potential claims as soon as practicable after damage, loss, incident or claim has been discovered, and cooperate with TTC's insurers in their investigation of any claim.
- 2.2.1.5 Upon notification of a claim being made, TTC shall be entitled to retain an amount of up to the value of the deductible with respect to such claim from the payment due to the Contractor until the claim has been settled or otherwise disposed. Such amount may be applied by TTC in satisfaction of that claim or be paid to the Contractor in the event and at such time as the claim is dismissed or withdrawn.
- 2.3 Throughout the term of the Contract, and for any applicable warranty period, the Contractor shall obtain and maintain the following insurance in relation to the Work, any services required to be performed by the Contractor under the Contract Documents, or otherwise, each such policy to be issued by an insurance company licensed to carry on the business of issuing such policies in Ontario, and possessing a Best's Financial Strength Rating of at least A-.

- 2.3.1 Commercial General Liability Insurance which shall not be more restrictive than the Insurance Bureau of Canada (IBC) Form 2100, or its equivalent replacement, and shall include the following:
  - 2.3.1.1 Contractual liability coverage;
  - 2.3.1.2 Damage to property of the TTC, not forming part of the Work;
  - 2.3.1.3 Products and completed operations coverage;
  - 2.3.1.4 Contingent employer's liability coverage, for any claims that might be brought against TTC by any employee of the Contractor;
  - 2.3.1.5 Owner's and Contractor's protective coverage for all subcontracted operations;
  - 2.3.1.6 Sudden and accidental pollution coverage;
  - 2.3.1.7 Non-owned automobile liability; and
  - 2.3.1.8 Cross liability and severability of interests clause;
  - 2.3.1.9 Hook liability, if applicable;
  - 2.3.1.10 Such insurance shall provide a combined single limit of not less than \$3,000,000 for any one occurrence or accident for all claims arising out of bodily injury (including death) and damage to property of others. Such liability insurance shall contain no exclusions in conflict with the character of the Work required to be performed under the Contract and shall include TTC as additional insured.
  - 2.3.1.11 Any other valid or collectible insurance available to TTC shall not apply to any loss until the coverage and limits available under the insurance policies maintained by the Contractor in accordance with SC2.3 have been exhausted.
- 2.3.2 Automobile Liability Insurance:
  - 2.3.2.1 Automobile liability insurance with a limit of not less than \$1,000,000 inclusive for any one accident or occurrence and shall insure against claims for bodily injury, including death, and for property damage arising out of the use of any vehicle owned, leased or operated by or on behalf of the Contractor in the performance of the Work.
- 2.3.3 Contractor's Equipment Insurance:
  - 2.3.3.1 The Contractor shall be responsible for any loss or damage to any of the Contractor's tools, materials, and/or owned, rented, leased or borrowed equipment and is required to maintain appropriate all risks property coverage for such property while it is being used in connection with the Work performed under the Contract.

- 2.4 The Contractor shall be responsible for deductible amounts under the policies except where otherwise provided in SC2 or where such amounts may be excluded from the Contractor's responsibility by the terms of GC9 - PROTECTION OF THE WORK AND ADJACENT PROPERTY of Section 00 72 00 and SC4.

**SC3 EVIDENCE OF INSURANCE**

- 3.1 Within ten Days after the Notification of Award and prior to the commencement of Work at the Site, and upon the placement, renewal, amendment, or extension of all or any part of the insurance, the Contractor shall promptly provide TTC with certificates of insurance originally signed by the insurer or its authorized representative and, if requested by TTC, a complete copy of the policies certified by an authorized representative of the insurer together with copies of any amending endorsements.
- 3.2 Each policy shall be endorsed with an undertaking from the insurance company that such insurance will not be cancelled, fail to be renewed or reduced in coverage without 30 Days prior written notice delivered by registered mail to TTC.
- 3.3 With the exception of automobile liability, each policy shall include an endorsement under which the insurer waives any right of subrogation it may have against TTC and its directors, officers, employees and agents.
- 3.4 Should TTC determine in its sole discretion that the insurance taken by the Contractor is unsatisfactory in any respect and for any reason whatsoever, it shall forthwith advise the Contractor of such determination and the reasons therefore and the Contractor shall forthwith take out insurance of a character satisfactory to TTC.
- 3.5 The taking out of the insurance as aforesaid shall not relieve the Contractor of any of its obligations under the Contract.
- 3.6 No Waiver - Failure of TTC to demand such certificate or other evidence of full compliance with these insurance requirements or failure of TTC to identify a deficiency from evidence provided will not be construed as a waiver of the Contractor's obligation to maintain such insurance.
- 3.7 No Acceptance – The acceptance of delivery by TTC of any certificate of insurance evidencing the required coverages and limits does not constitute approval or agreement by TTC that the insurance requirements have been met or that the insurance policies shown in the certificates of insurance are in compliance with the requirements.
- 3.8 If any of the required Contractor coverages are to remain in force after Contract Completion or for any applicable warranty period, an additional certificate evidencing continuation of such coverage will be submitted within 14 Days of Substantial Performance.
- 3.9 Non-Vitiation – The Contractor will ensure that no insurance required under this Contract will be invalidated or vitiated by any action or failure to act by the Contractor or any of the Contractor's personnel or by any breach by the Contractor or any other person of any declarations, warranties or other terms in such policies.

**SC4 INDEMNIFICATION AND LIMITATION OF LIABILITY**

- 4.1 The Contractor shall within 20 Days of any request by TTC, at its own costs and expense, forthwith cause to be discharged or vacated any claims for lien preserved or certificates of action registered that arise out of or are attributable to the Work. The Contractor further agrees to defend, indemnify and save TTC, its agents and employees harmless from claims or actions by Subcontractors, whether related to a construction lien or otherwise, against TTC and all costs, losses, damages and expenses incurred in connection therewith.
- 4.2 The Contractor shall hereby assume the defense of, fully indemnify and hold harmless the TTC, TTC's officers, employees, members (Commissioners), representative(s), consultants, and agents in respect of the amount of any claim, demand, loss, cost, expense (including reasonable legal expenses), action, suit, proceeding, liability, fine, penalty, interest, payment or damage by whomsoever (including, without limitation, TTC) which is incurred, made, sustained, brought or prosecuted in any manner based upon, occasioned by or attributable to any breach of the Contract by the Contractor, or to any willful misconduct, fault, or negligent act or omission of the Contractor or any person, agent, consultant, firm or corporation for whose acts the Contractor is liable at law (collectively referred to as "TTC Claims"). Further, the Contractor shall pay any amount of TTC Claims incurred by TTC on account of any injuries, including death or damages, received or sustained by any persons or property and if it fails to do so, TTC may pay such TTC Claims and deduct the amount thereof from any monies due, or to become due, to the Contractor, or otherwise recover such amounts or any balance thereof from the Contractor.
- 4.3 With the exception of any Supplementary Condition with respect to the payment of liquidated damages, if applicable, TTC shall not be liable to the Contractor for any loss of profit, loss of or damage to reputation, loss of opportunity, or any indirect, special, incidental, punitive, exemplary or consequential damages or any cumulative impact, inefficiency, or loss of productivity, for any reason whatsoever whether those are of the Contractor itself or any of its Subcontractors.
- 4.4 TTC will not be liable for interest or financing costs or charges for any reason whatsoever.
- 4.5 Notwithstanding anything to the contrary contained in the Contract, the Contractor's liability to TTC, excluding any proceeds of insurance, will not exceed the total Contract Price ("Limitation on Indemnity") for the Products or Work as set forth herein provided, however, this Limitation on Indemnity will not apply to:
- 4.5.1 Any deductible referred to in the Contract;
  - 4.5.2 Any obligation of Contractor to indemnify TTC based on claims of third parties on account of personal injury or property damage, including loss of use;
  - 4.5.3 To the amount of liquidated damages payable to TTC hereunder;
  - 4.5.4 Any liability related to the Contractor's gross negligence or willful misconduct; and
  - 4.5.5 Any injury to TTC, its consultants, agents, employees or TTC's property to the extent caused by the gross negligence or willful misconduct of the Contractor, its Subcontractors or agents.
- 4.6 The Contractor acknowledges and agrees that it shall be fully and completely responsible for the Work except where such responsibility has been expressly waived in writing by TTC

or as otherwise expressly set out in the Contract Documents. Any review, inspection or approval of the Work, including design and materials specified by TTC, or silence or acquiescence by TTC regarding the Contractor's failure to comply with the Contract, does not in any way relieve or waive the Contractor of its responsibility for the adequacy of the Work, the provision of design, materials and Work in accordance with the Contract and nor shall any liability be imposed, direct or implied on the part of TTC.

- 4.7 TTC shall have the right to satisfy any amount from time to time owing to it by the Contractor by way of a set-off against any amount from time to time owing to the Contractor by TTC including, but not limited to, any amount owing to TTC pursuant to the Contractor's indemnification of TTC or TTC's right to collect liquidated damages.
- 4.8 Notwithstanding anything else to the contrary contained in the Contract, SC4 shall govern. SC4 shall survive termination of the contract for any reason by either party, even in such cases where termination is improper, invalid or wrongful.

## **SC5 PROGRESS AND HOLDBACK PAYMENTS**

- 5.1 Within 30 Days after Notification of Award, the Contractor shall submit for review and acceptance, a cost breakdown acceptable to TTC on TTC's form, of the various parts of the Work, aggregating the total amount of the Contract Price and divided so as to facilitate evaluation of applications for payment. Each price entered shall be representative of the cost of such item to TTC, except for the items listed in the table below; each of which shall have the assigned value and shall be paid to the Contractor in accordance with the terms included in the table below. Further, in the event that the Contractor does not provide a cost breakdown acceptable to TTC, TTC reserves the right to adjust the Contractor's itemized cost breakdown, subsequent to Notification of Award, for the purposes of preparing progress payments to ensure adherence to the conditions described herein and TTC's cost breakdown shall be the basis to facilitate evaluation of applications for payment. Overhead and profit shall be distributed proportionately over the whole of the Work.

Ref	Item	Status Provided by TTC Required For Payment	Assigned Value (not including HST)	Frequency of Invoice for Assignment Value
1	Contract Baseline Schedule	"Reviewed"/ "Reviewed as Noted"	\$20,000.00	Once
2	Contract Baseline Schedule Updates	Submitted and confirmed to be in accordance with Contract Requirements	\$5,000.00 for each update required in the Contract	Monthly

Ref	Item	Status Provided by TTC Required For Payment	Assigned Value (not including HST)	Frequency of Invoice for Assignment Value
3	Commissioning Plan	"Reviewed"/ "Reviewed as Noted"	\$10,000.00	Once
4	Safety Submittals in accordance with Section 01 59 00	"Reviewed"/ "Reviewed as Noted"	\$20,000.00	Once
5	Test (Commissioning) Procedures	"Reviewed"/ "Reviewed as Noted"	\$10,000.00	Once, after "Reviewed"/ "Reviewed as Noted" status is achieved for <u>all</u> Test Procedures
6	Operating & Maintenance Training Plan	"Reviewed"/ "Reviewed as Noted"	\$5,000.00	Once
7	Training Course Material	"Reviewed"/ "Reviewed as Noted"	\$5,000.00	Once, after "Reviewed"/ "Reviewed as Noted" status is achieved for <u>all</u> Training Course Material
8	Operation & Maintenance Manuals	"Reviewed"/ "Reviewed as Noted"	\$15,000.00	75% of Assigned Value once "Reviewed as Noted" status is achieved; 25% of Assigned Value once "Reviewed" status is achieved



Ref	Item	Status Provided by TTC Required For Payment	Assigned Value (not including HST)	Frequency of Invoice for Assignment Value
9	As-Builts	"Reviewed"/ "Reviewed as Noted"	\$15,000.00	75% of Assigned Value once "Reviewed as Noted" status is achieved; 25% of Assigned Value once "Reviewed" status is achieved
10	Operation Training	All Training Sessions completed	\$5,000.00	Once, after <u>all</u> Training Sessions completed
11	Maintenance Training	All Training Sessions completed	\$5,000.00	Once, after <u>all</u> Training Sessions completed

Note: Invoices may only be submitted by the Contractor when "Status Provided by TTC Required for Payment" is attained at the frequency set out above.

- 5.2 The cost breakdown must have been accepted or adjusted by TTC in advance of the Contractor submitting its first invoice, save and except bonding and insurance.
- 5.3 Applications for payment on account shall be made no more than once per month as the Work progresses in the form of an invoice acceptable to TTC.
- 5.4 TTC and the Contractor agree that, even if TTC has no obligation to do so, TTC may in its sole discretion retain from any payment, an amount sufficient to satisfy any written notice of lien or claim for lien in respect of the Work or the Contract whether validly or invalidly served, received, registered, preserved, given, or delivered in respect of TTC or any other person or entity.
- 5.5 Invoices for amounts other than holdback required by the Construction Act shall be dated the last Day of the agreed monthly payment period and the amount paid, within 30 Days of receipt of an acceptable invoice, shall be for the value, at the date of the invoice, of Work performed on Site as determined by TTC, proportionate to the total value of the Work less applicable holdbacks or any other amount required by law, including, but not limited to, the holdback as stipulated in the Construction Act or any of the amounts as provided under this Contract. (In the event the 30<sup>th</sup> Day does not fall on a Business Day payment shall be made the next Business Day thereafter). The Contractor is prohibited from removing any Products or Work from the Site for which TTC has paid. Invoices that include force account work in accordance with Change Directive or Contract Change shall be supported by the supply of

the "Daily Work Activity" sheets as identified in GC26 - CHANGES IN THE WORK of Section 00 72 00.

- 5.6 Each invoice, including invoices for holdback required by the Construction Act, shall include a valid Workplace Safety and Insurance Board clearance certificate indicating that no outstanding assessments exist, and which shall be valid until the payment is due.
- 5.7 After the first invoice, each invoice, including invoices for holdback required by the Construction Act, shall include a statutory declaration, on TTC's form or equivalent (CCDC 9A), stating that all amounts payable for Products and labour incorporated in the Work up to the previous payment period, except lawfully retained holdbacks, have been paid.
- 5.8 If the Contractor, as determined by TTC, fails to comply with the requirements of Section 01 32 16 by either failing to submit or obtain acceptance, as applicable, on the Contract Baseline Schedule, or monthly Contract Baseline Schedule Updates thereto, a Recovery Schedule (if required by TTC) or the monthly cashflow update, then TTC shall retain an amount of 10% of any progress payment until the foregoing documents have been received and, if applicable, approved or accepted by TTC, at which time the retained amount may be invoiced by the Contractor with the subsequent progress payment.
- 5.9 If the Contractor, as determined by TTC, fails to comply with the requirements of Section 01 32 16 by either failing to submit or obtain acceptance, as applicable, on a Contract Baseline Schedule or a Monthly Schedule Update then TTC will issue a credit Contract Change/Change Directive to deduct the assigned value as noted in SC5.1 for the particular item from the Contract Price.
- 5.10 TTC shall retain an amount of up to 5% of any progress payment cost breakdown item until all commissioning applicable to that Section of Work has been successfully completed as specified in the Contract Documents.
- 5.11 TTC shall retain an amount up to 5% of any progress payment cost breakdown item, until all submittals (other than the ones covered under SC5.1 and SC5.9 above) applicable to that Section of Work, have been provided by the Contractor and obtained "Reviewed as Noted" status.
- 5.12 Each invoice for amounts other than holdback required by the Construction Act shall be based on measurements or estimates of the Work performed only as determined by TTC and shall not be taken or construed as an acceptance of the Work so estimated.
- 5.13 Monies previously retained as holdback required by the Construction Act authorized by a certificate of payment:
- 5.13.1 shall be invoiced by the Contractor no less than 30 Days before the expiry of any lien periods in respect of such holdback under the Construction Act and such invoice must include a valid Workplace Safety and Insurance Board clearance certificate and a statutory declaration referred to in paragraphs 5.6 and 5.7, respectively, of this Supplementary Condition; and
  - 5.13.2 will become due and payable 5 Business Days following the expiration of the applicable lien period stipulated in the Construction Act provided the Contractor has submitted the invoice and other documents referred to in paragraph 5.13.1.

- 5.14 TTC may retain out of such any monies, including monies previously retained as holdback required by the Construction Act, which become due and payable:
- 5.14.1 any sums required by law;
  - 5.14.2 other monetary claims against TTC, or against the Contractor and enforceable against TTC; or
  - 5.14.3 any other amounts as provided under this Contract.
- 5.15 No payment made by TTC under the Contract for partial or entire use or occupancy of the Work shall constitute an acceptance of the Work or any portion thereof which is not in accordance with the requirements of the Contract.

**SC6 RESTRICTIONS FROM BIDDING, EVALUATIONS OR AWARD OF CONTRACTS**

- 6.1 In the event that:
- 6.1.1 TTC provides written notice to the Contractor specifying an Event of Default;
  - 6.1.2 The Contractor is terminated for default by TTC;
  - 6.1.3 An audit conducted under GC33 - RECORDS AND AUDIT of Section 00 72 00;
  - 6.1.4 The Contractor receives an unsatisfactory performance rating issued by TTC under GC34 - CONTRACTOR PERFORMANCE RATING of Section 00 72 00 or by the City of Toronto and/or any of its Agencies, Boards, Commissions or Corporations; or
  - 6.1.5 TTC determines that the prohibition against gratuities set out in GC36 - PROHIBITION AGAINST GRATUITIES of Section 00 72 00 has been breached by or with respect to the Contractor;
- 6.2 TTC, City of Toronto or any of the City of Toronto Agencies, Boards, Commissions or Corporations shall have the right at its sole discretion to:
- 6.2.1 Restrict the Contractor, from submitting a Bid on future Bid requests for a period of time deemed appropriate by TTC;
  - 6.2.2 Reject any Bid submitted by or refuse to consider or evaluate any Bid submitted by the Contractor or by any Affiliate or successor of the Contractor or by any entity with whom an officer or director of that entity has in the past been associated in any way with the Contractor;
  - 6.2.3 Refuse to award any Contract to the Contractor or to any Affiliate or successor of the Contractor or to any entity with whom an officer or director of that entity has in the past been associated in any way with the Contractor.
- 6.3 TTC may provide information to the City of Toronto and/or any of the City of Toronto Agencies and Corporations and/or any other federal or provincial Government agencies, regarding any of the foregoing, which may rely on such information provided by TTC.

**SC7 DELAY BY TTC**

- 7.1 If any act, omission or neglect of TTC, or default of other parties under Contract with TTC, delays the Contractor's performance of any component of the Work on the Critical Path in the latest expressly accepted Contract Baseline Schedule or Revised Contract Baseline Schedule, as applicable, in effect as of the date of the act, omission or neglect giving rise to the delay occurred with the effect that the Milestone(s) or Contract Time are affected then, to the extent affected, upon request by the Contractor, an extension of time to the Contract Time or Milestone(s) shall be granted as TTC decides after consulting with the Contractor. If TTC and Contractor cannot mutually agree to an extension of time, TTC may at its sole discretion determine the length of the delay and grant an extension of time accordingly by issuance of a Change Directive.
- 7.2 Notwithstanding anything else in this Contract and for greater clarity, the Contractor shall not be entitled to any extension of Contract Time or Milestone(s) on account of any delay, by TTC or otherwise, that when accounted for, does not affect the Critical Path. TTC may utilize portions of the Float in the Contract Baseline Schedule or Revised Contract Baseline Schedule, as applicable.
- 7.3 If the Contractor is entitled to an extension of Contract Time or Milestone(s) pursuant to SC7.1, such extension will be non-compensable for any period(s), part(s) or portions(s) of time during such delay that the Contractor is concurrently responsible for any delay on that same Critical Path or for any period(s), part(s) or portions(s) of time during such delay that is concurrent with any delays due to a Force Majeure Event, as defined in the Contract, on that same Critical Path.
- 7.4 If the Contractor is entitled to an extension of Contract Time or Milestone(s) pursuant to SC7.1, such extensions will be compensable for any period(s), part(s) or portions(s) of time during such delay that TTC, or parties under Contract with TTC, are solely responsible for the delay, and such compensation shall be limited to the Per Diem Delay Costs, as defined below, for each Day of such compensable delay. Any other losses, costs, expenses, claims, demands or damages of any nature or kind whatsoever, whether incurred by the Contractor or by any of its Subcontractors, shall be the responsibility of the Contractor.
- 7.5 For the purpose of this Section, "Delay Costs" shall mean 15% of the tax-inclusive Canadian dollar Contract Price as of the date of the Purchase Order issuance and "Per Diem Delay Costs" shall mean Delay Costs divided by the total number of Days from the date of Purchase Order issuance to the date of Milestone for Substantial Performance identified in the Contract as of date of Purchase Order issuance.
- 7.6 However, the Contractor shall not be entitled to any compensable extension of Contract Time or Milestone(s), unless TTC has reviewed, in writing, a Contract Baseline Schedule or Revised Contract Baseline Schedule in effect as of the date the act, omission or neglect giving rise to the delay occurred. In the event TTC has not accepted, in writing, a Contract Schedule as of the date the act, omission or neglect giving rise to the delay occurred, the Contractor's entitlement to an extension of Contract Time or Milestone(s) pursuant to SC7.1 to this Section shall only be non-compensable.
- 7.7 No extension of Contract Time or Milestone(s), whether compensable or non-compensable, shall be granted unless the Contractor, within 14 Days after the act, omission or neglect giving rise to the delay first occurs or the Contractor should reasonably have known first occurs, submits to TTC in writing its notice of delay. The notice of delay shall state the

nature of the delay, its cause, the portions of the Work affected thereby, and the dates when such portions of the Work became so affected. The notice shall provide the anticipated direct and indirect impact of the delay.

- 7.8 Within 30 Days of delivery of the notice of delay, or such other period of time as may be requested by the Contractor and agreed to in writing by TTC, the Contractor shall submit a request in writing for an extension to the Contract Baseline Schedule, Revised Contract Baseline Schedule, Contract Time, or any Milestone(s), any period(s), part(s) or portions(s) thereof. The request shall identify the number of Days extension of Contract Baseline Schedule, Revised Contract Baseline Schedule, Contract Time or Milestone(s) and/or what period(s), part(s) or portions(s) of time during such extension it requests are compensable (adjustment to Contract Price) and/or non-compensable. Every request shall be accompanied by a Time Impact Analysis of the Contractor's Critical Path in a form or method acceptable to TTC in its discretion and any additional supporting documentation as requested by TTC.

## **SC8 COMMENCEMENT OF THE WORK**

- 8.1 The Contractor may commence the Work upon receipt of Notification of Award issued by TTC. The Contractor shall not begin the Work at the Site prior to receipt of a Notice to Proceed and such notice shall be issued within 5 Business Days of the TTC receiving and approving the following:
- 8.1.1 Contractor's evidence of insurance coverage as set out in SC3;
  - 8.1.2 Required bonds as set out in GC39 - BONDING of Section 00 72 00;
  - 8.1.3 Required safety submittals set out in Section 01 59 00;
  - 8.1.4 Valid WSIB clearance certificate set out in GC38 - WORKPLACE SAFETY INSURANCE BOARD (WSIB) CLEARANCE CERTIFICATE of Section 00 72 00; and
  - 8.1.5 Execution of the P.O. and submission to TTC.
- 8.2 The Contractor shall be responsible for any delay resulting from its failure to provide such acceptable documentation listed in SC8.1 within timeframes indicated and no extension of time will be granted as a result of such delay.
- 8.3 The Contractor shall commence the Work at the Site as stipulated in the Notice to Proceed and shall continuously perform the Work at a rate of progress acceptable to TTC.

**SC9 VALUATION OF CHANGES IN THE WORK**

- 9.1 Within 45 Days after Notification of Award, the Contractor shall submit for TTC's acceptance an itemized list of hourly billing rates for all labour to be utilized to determine the Contractor's entitlement to compensation of Contract Changes agreed to proceed by way of force account or by way of any Change Directive. The components comprising each trade rate listed shall be detailed in itemized format in order to separately identify the base hourly rate, individual benefits payable under union agreements, if applicable, statutory payments and company benefits. The rates are to be calculated in accordance with the Method of Price Calculation as set out in SC9.6.1 and SC9.6.2.
- 9.2 Changes in the Work which are to be performed on a unit price basis shall be in accordance with the supplementary condition entitled Measurement and Payment, if applicable, and accepted "Unit Prices For Extra Work" contained in the Contract Documents or if there are no accepted "Unit Prices For Extra Work", using unit prices actually paid by the Contractor, if reasonable as determined by TTC in its sole discretion.
- 9.3 Changes for reduction in the Work which is to be performed or to the Contract which results in a savings to the Contractor on the Contract Price on a unit price basis, shall be in accordance with the supplementary condition entitled Measurement and Payment, if applicable.
- 9.4 Work for Contract Changes performed under a lump sum basis shall be subject to negotiations between TTC and the Contractor.
- 9.5 Work for Contract Changes agreed to proceed by way of force account and compensation for the Work of all Change Directives, shall be valued in accordance with SC9.6.

9.6	COMPONENT	METHOD OF PRICE CALCULATION
9.6.1	LABOUR	<p>The actual rates of wages paid within various categories of each trade to:</p> <p>A) Workers,</p> <p>B) Forepersons in direct charge of the Work or any part or portion thereof, and</p> <p>C) Field superintendents above the grade of foreperson, for each hour actually performing such Work.</p>

9.6.2	EMPLOYEE BENEFITS	<p>The actual amount of contributions paid on behalf of the:</p> <p>A) Workers,</p> <p>B) Forepersons in direct charge of the Work or any part or portion thereof, and</p> <p>C) Field superintendents above the grade of foreperson, actually performing such work, or any part or portion thereof, in respect of statutory payments, benefits payable under union agreements, if applicable, and company benefits, excluding profit sharing schemes, regularly made by the Contractor on behalf of its employees when such employees are not engaged in Work. Other non-labour related issues such as financing, insurance, tools of the trade, small tools, inefficiency contingencies and vehicles shall not be included as labour or employee benefits.</p>
9.6.3	PRODUCTS	<p>The actual costs of acceptable Products ordered and received by the entity performing such Work, or any part or portion thereof, which, upon payment in part, shall become the property of TTC.</p>
9.6.4	OVERHEAD & PROFITS	<p>The mark-up for overhead and profit for SC9.6.1 to SC9.6.3 inclusive, shall include, but not be limited to, compensation for the following: Financing, insurance, head office and site office overhead, administration, coordination, management and clerical staff, tools of the trade/small tools/construction equipment having a capital value of less than \$2,000.00, vehicles used for Site services/supervision/transportation of personnel or tools, and profit.</p> <p>An aggregate total mark-up rate of up to a maximum of 15% calculated upon the total for components SC9.6.1, SC9.6.2 and SC9.6.3, without regard to whether such Work or any part or portion thereof is actually performed by the Contractor or any Subcontractor.</p>
9.6.5	EQUIPMENT <sup>1</sup>	
	Equipment listed in OPSS 127 with Working Time or Standby Time	<p>The actual costs for hours of working time to entity that is renting or owning the equipment plus a maximum of 10% for overhead and profit, the aggregate of which shall not exceed the maximum of the appropriate rate as shown in the latest edition of the Ontario Provincial Standard Specification 127 (OPSS 127) as of the date of Notification of Award. No additional overhead or profit shall be paid whether such</p>

		equipment is actually rented or owned by the Contractor or any Subcontractor.
	Equipment listed in OPSS 127 Standby Time in a Day during which Work is being performed	The actual costs for Standby Time to the entity that is renting or owning the equipment plus a maximum of 10% for overhead and profit, the aggregate of which shall not exceed 35% of the appropriate OPSS 127 rate for no more than: Eight hours per Day less any hours of working time. No additional overhead or profit shall be paid whether such equipment is actually rented or owned by the Contractor or any Subcontractor.
	Equipment not listed in OPSS 127	Actual rental costs to the entity that is renting the equipment provided such actual costs are reasonable as determined by TTC in its sole discretion, plus a maximum of 10% for overhead or profit without regard to whether such equipment is actually rented by the Contractor or any Subcontractor. In the event TTC determines the actual costs are not reasonable, compensation will be for such reasonable costs as determined by TTC at its sole discretion plus 10% for overhead or profit without regard to whether such equipment is actually rented by the Contractor or any Subcontractor.
	Tools of the Trade/Small Tools/Construction Equipment	No payment shall be allowed for tools of the trade/small tools/construction equipment having a capital value of less than \$2,000.00.

Notes: (1) The rates for SC9.6.5 shall include the cost of renting or owning and operating the equipment and includes, but not limited to, transportation, shipping, handling, fuel, oil, consumables, lubrication, repairs, maintenance, overhaul, depreciation, financing, storage, insurance, if applicable.

9.7 Any amounts paid or payable under this SC9 shall be subject to GC33 - RECORDS AND AUDIT of Section 00 72 00.

## **SC10 SURVIVAL UPON TERMINATION**

10.1 The rights and obligations of the Contract as set out in the following Subparagraphs shall survive abandonment or termination for any reason, even in such cases where termination is improper, invalid or wrongful:

10.1.1 GC1 DEFINITIONS of Section 00 72 00;

10.1.2 GC2 CONTRACT DOCUMENTS of Section 00 72 00;

10.1.3 GC3 LANGUAGE OF THE CONTRACT of Section 00 72 00;

10.1.4 GC4 INTENT OF CONTRACT of Section 00 72 00;

10.1.5 GC5 OWNERSHIP of Section 00 72 00;



- 10.1.6 GC10 DEFICIENCIES AND WARRANTY of Section 00 72 00;
- 10.1.7 GC11 PROPRIETARY RIGHTS of Section 00 72 00;
- 10.1.8 GC17 TERMINATION FOR DEFAULT of Section 00 72 00;
- 10.1.9 GC29 SETTLEMENT OF DISPUTES of Section 00 72 00;
- 10.1.10 GC30 TERMINATION FOR CONVENIENCE of Section 00 72 00;
- 10.1.11 GC33 RECORDS AND AUDIT of Section 00 72 00;
- 10.1.12 GC34 CONTRACTOR WORK PERFORMANCE RATING of Section 00 72 00;
- 10.1.13 GC36 PROHIBITION AGAINST GRATUITIES of Section 00 72 00;
- 10.1.14 GC39 BONDING of Section 00 72 00;
- 10.1.15 SC1 SCOPE OF SUPPLEMENTARY CONDITIONS;
- 10.1.16 SC4 INDEMNIFICATION AND LIMITATION OF LIABILITY;
- 10.1.17 SC6 RESTRICTIONS FROM BIDDING, EVALUATIONS OR AWARD OF CONTRACTS;
- 10.1.18 SC11 LIQUIDATED DAMAGES;
- 10.1.19 And any other Contract provisions or clauses referred to in any of the foregoing.

## **SC11 LIQUIDATED DAMAGES**

- 11.1 It is agreed by the parties to the Contract that in the event the Contractor fails to perform the Work in accordance with the Contract Documents within any Milestone, damages will be sustained by TTC. The parties acknowledge that it is and will be impractical and extremely difficult to ascertain and determine the actual damage, which TTC will sustain in the event of and by reason of such delay, and that the sum as calculated in accordance with SC11.2 represents a reasonable estimate of the actual damages. The parties hereto agree that the Contractor will pay TTC liquidated damages in the sum(s) identified below for each and every Day beyond which the Work pertaining to the Milestone(s), as specified in the Contract Documents, is delayed.
- 11.2 The Contractor shall pay TTC the following sum(s) (which is/are inclusive of applicable HST) for liquidated damages, and not as a penalty, for each and every Day the Work is delayed beyond the Milestone dates(s) as prescribed in Section 01 11 00:
  - 11.2.1 The sum of \$2,200.00 per Day for each and every Day beyond the date for Substantial Performance.

**SC12 CERTIFICATE OF RECOGNITION**

- 12.1 The Contractor must be Certificate of Recognition (COR™) registered, as issued by Infrastructure Health & Safety Association (IHSA), for the duration of the term of the Contract.

**SC13 ADDITIONAL DEFINITIONS**

- 13.1 Reference to "Commission's Representative" or "Commission" in the Contract Documents shall mean the "TTC" as defined in GC1 - DEFINITIONS of Section 00 72 00.
- 13.2 "Delay Costs" shall have the meaning as set up in SC7.5.
- 13.3 "Per Diem Delay Costs" shall have the meaning as set up in SC7.5.

**SC14 KEY CONTRACTOR STAFF**

- 14.1.1 In performing the Work, the Contractor shall utilize only skilled and competent staff and shall observe that degree of care and skill which is customary and usual for Contractors appointed in a similar capacity in performing work on a basis which is reasonably comparable to the Work.
- 14.1.2 Within ten Days from Notification of Award, the Contractor shall prepare a key Contractor staff list detailing the additional individuals to be utilized for the positions identified in Section 01 11 00 – Summary of Work, for the approval of the TTC.
- 14.1.3 If the Contractor, for reasons beyond its control, due to resignations or other unforeseen circumstances that will not allow the individual to continue to work for the Contractor on the Contract, has to change/substitute any key Contractor staff previously accepted/approved by the TTC, the Contractor shall immediately notify the TTC in writing of this occurrence. The Contractor shall propose to the TTC a change/substitution of any previously accepted/approved key Contractor staff being utilized pursuant to the Contract, at least 14 Days prior to such change/substitution commencing Work. The Contractor shall also provide to the TTC the date and nature of the proposed key Contractor staff change/substitution, and the name(s) and resume(s) of proposed replacement personnel possessing equivalent or better qualifications and experience, for approval by the TTC. TTC reserves the right to withhold its approval, acting reasonably, if the proposed personnel is not equal to or better in qualifications and experience than the previously approved key Contractor staff member who he/she is attempting to replace.
- 14.1.4 The individuals employed on the Contract by the Contractor shall be as indicated on the key Contractor staff list as approved by the TTC. The key Contractor staff list shall be updated as required due to any change in the information indicated in the approved key Contractor staff list or as otherwise requested by the TTC.
- 14.1.5 The TTC reserves the right, at its sole discretion, during the term of the Contract to direct, either temporarily or permanently, the replacement of any key Contractor staff performing Work on this Contract. The Contractor shall within four Days of the date of a written notification from the TTC, provide the name(s), resume(s) of proposed replacement personnel possessing equivalent or better qualifications and experience, for approval by the TTC.

**END OF SECTION**

**1 GENERAL**

- 1.1 The requirements of Division 01, General Requirements, apply to and govern all aspects of the Work.
- 1.1.1 Work described in this Specification is divided into Sections that are not intended to identify trade scopes of Work or contractual relationships or boundaries.
- 1.1.2 The Contractor is solely responsible for organizing the division of labour and the supply of Products and services essential for the detailed coordination and execution of the Work in accordance with the Contract Documents.

**2 LOCATION OF THE WORK**

- 2.1 The Work is located at Sheppard-Yonge Station, 20 Sheppard Avenue West, North York, Ontario.

**3 SCOPE OF WORK**

- 3.1 The Work of this Contract, designated SH35-8 - Sheppard Station – Managers Office and Zone Hub consists of: The supply of labour, equipment and materials to remove the existing Collector Booth and construct Station Managers Office and Zone Hub.
  - 3.1.1 The Work generally includes, but is not limited to, the following:
    - 3.1.1.1 Removal of the existing Collector Booth, Safe Room, anteroom and Washroom area including walls, concrete curbs, ceilings, floor finishes, and fixtures.
    - 3.1.1.2 Mechanical and electrical removals and modifications for new spaces.
    - 3.1.1.3 Install new concrete block walls, interior partition walls and doors for offices, workstation, and storage area.
    - 3.1.1.4 Install new suspended ceiling system and finishes.
    - 3.1.1.5 Provide power, lighting, data and voice to new spaces.
    - 3.1.1.6 Provide CCTV and security for new spaces.
  - 3.2 Power wash and videotape all storm and sanitary drains within the new Station Managers Office and Zone Hub areas and fareline area in accordance with Section 01 50 00 to extent required to confirm drainage systems are clear of debris.
  - 3.3 Designated Substances and Hazardous Materials Survey Report:
    - 3.3.1 Refer to the Designated Substances and Hazardous Materials Survey Report appended to the Contract Documents as Appendix 1 and as indicated in Section 01 59 00, and prepare the Site for safe construction operations prior to engaging in other Work, as required by governing legislation.
    - 3.3.2 Safely remove and dispose of designated substances and hazardous materials as required, in accordance with governing legislation, and the requirements of authorities having jurisdiction. Should concealed or unknown conditions be found to vary from those identified in the Designated Substances and Hazardous Materials Survey Report, notify TTC immediately.

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**4 EXISTING SITE CONDITIONS**

- 4.1 Verify Site conditions as they relate to the execution of the Work.
- 4.2 Submit a written report to TTC detailing inconsistencies between Site conditions and Contract Documents no later than ten (10) Business Days after completing the investigations as outlined in Article 5.2.

**5 COMPLETION OF THE WORK**

**5.1 Substantial Performance and Contract Completion:**

- 5.1.1 Substantial Performance of the Work shall be within 200 Days from the date of Notification of Award.
- 5.1.2 Contract Completion shall occur within 60 Days after Substantial Performance.

**5.2 Work Milestones:**

- 5.2.1 Schedule Site Safety walkthrough with TTC's Construction Safety Officer within 10 Days from the date of Notification of Award.
- 5.2.2 Confirm the location of buried or concealed services and energy sources in walls and slabs within 1 m of any surface penetrations, by completing utility locates as specified in Section 01 59 00, within 7 Days from the date of Notice to Proceed.
- 5.2.3 Commence Work on Site within 35 Days from the date of Notification of Award.
- 5.2.4 Hoarding to be in place for a maximum of 140 Days, site work to be completed within this time frame.

**5.3 Submittal Milestones:**

- 5.3.1 Submit the prescribed safety related Submittals specified in Section 01 59 00 within 15 Days from the date of Notification of Award.
- 5.3.2 Submit a proposed Contract Baseline Schedule within 15 Days from the date of Notification of Award.
- 5.3.3 Submit the Commissioning Plan specified in Section 01 91 00 within 3 months from the date of Notification of Award.
- 5.3.4 Submit the Functional Performance Testing Procedures specified in Section 01 91 00 within 3 months from the date of Notification of Award.
- 5.3.5 Submit the Training Plan specified in Section 01 79 00 within 3 months from the date of Notification of Award.
- 5.3.6 Submit the Training Course Materials specified in Section 01 79 00 within 3 months from the date of Notification of Award.
- 5.3.7 Submit Draft Operation and Maintenance Manuals specified in Section 01 78 23 no later than 3 months prior to the date of Substantial Performance.
- 5.3.8 Submit Final Operation and Maintenance Manuals specified in Section 01 78 23 no later than 15 Days after the date of Substantial Performance.

**5.4 Constraints:**

- 5.4.1 Refer to and comply with Section 01 14 00.
- 5.4.2 Maintain public access to existing entrances, elevators, and facilities.
- 5.4.3 Coordinate shutdowns of existing base building or facility systems including utilities, mechanical, electrical and communications systems, with TTC, at least twenty-one (21) Days in advance. Approved shutdowns will only be permitted during Non-Operating Hours as defined in Section 01 42 16. Contractor is responsible to supply back-up power during approved shutdowns.
- 5.4.4 Coordinate with TTC the temporary relocation of existing CCTV and speakers as required prior to hoarding installation.
- 5.4.5 Hoarding to be installed and removed during Non-Operating Hours.
- 5.4.6 Work outside of hoarded area to be performed during Non-Operating Hours.
- 5.4.7 Submit Contractor Access Request for review minimum seven (7) Days prior to performing the Work outside of the main Contractor Work Area.
- 5.4.8 Stairs are to be maintained for access and egress.
- 5.4.9 A floor area of approximately 10 m<sup>2</sup> will be provided in the Station for the Contractor's storage. Proposed location as shown on Contract Drawings, final location to be coordinated on Site with TTC. Provide suitable lock-up facilities for storage of tools and Products to the approval of TTC.
- 5.4.10 Public Washrooms and Service Rooms must remain accessible to the public and to TTC personnel.
- 5.4.10.1 Coordinate temporary signage and security mirror installation with TTC prior to hoarding installation.
- 5.4.11 The fareline must remain operational.
- 5.4.12 Hauling, loading, removal of debris and deliveries to be done during Non-Operating Hours.
- 5.4.13 An outside laydown area or disposal bin will not be provided. Removal of debris to be done during Non-Operating Hours.
- 5.4.14 On-site parking for the Contractor's and Subcontractor's vehicles is not permitted.
- 5.4.15 Contractor access to Site and for deliveries as shown on Contract Drawings.

**6 WORK BY OTHERS****6.1 Concurrent Contract(s) With Work Under The Contract:**

- 6.1.1 SH35-7 - Sheppard-Yonge Station - Subway Rule Book Hands On Training Facility.
- 6.1.2 Y60-17 - Sheppard-Yonge Station - Signal Room A/C System Upgrade.
- 6.1.3 Yonge Sheppard Centre Renovations.
- 6.1.4 Coordinate activities to minimize interference with the work of Other Contractors and TTC Workers.

**6.2 Work By TTC:**

- 6.2.1 Provide twenty-one (21) Days advance notice to TTC for coordination and scheduling of TTC Workers to attend the Site and perform the requested Work.
- 6.2.2 TTC Workers will remove the linear metal ceiling. Provide TTC twenty-one (21) Days advance notice for coordination and scheduling of TTC Workers to attend the Site and perform the requested Work.
- 6.2.3 TTC Workers will make all electrical and communication disconnections, connections, and reconnections with existing energized panels and equipment.
  - 6.2.3.1 Including, but not limited to, CCTV and speakers.
- 6.2.4 Only TTC's Wiring and Service Department personnel are authorized to enter, alter, make final terminations, or isolate TTC electrical panels or switchgear.
  - 6.2.4.1 Contractor's personnel found to be in violation of this instruction shall be removed from Site and the circumstances immediately reported to TTC.
- 6.2.5 Make arrangements with TTC for isolation and final termination within TTC's electrical installations.
- 6.2.6 Include details of the services required from TTC forces in request for such arrangements. For each service request, complete and submit to TTC a Wiring & Service/Traction Power Work Request form. The required form will be provided upon request. Provide twenty-one (21) Days advance notice to TTC for coordination and scheduling of TTC Workers to attend the Site and perform the requested Work.
- 6.2.7 Contractor shall provide empty conduit with pull strings and back boxes for Bell to run wiring and complete telephone connections. Provide twenty-one (21) Days advance notice to TTC for coordination and scheduling of Bell to attend the Site and perform the requested Work.
- 6.2.8 Contractor shall provide conduit, data cabling, inserts, jacks and face plates for TTC Communications to complete terminations and assign new port numbers.
- 6.2.9 Unless advised otherwise, TTC Workers will modify and re-instate the linear metal ceiling following Substantial Performance of Contract SH35-8.

**7 PERMITS**

**7.1 TTC-Obtained Permits:**

- 7.1.1 TTC to obtain the following Permits in connection with the Work:
  - 7.1.1.1 Building Permit.
  - 7.1.1.2 HVAC Permit.
  - 7.1.1.3 Plumbing Permit.

**7.2 Contractor-Obtained Permits:**

- 7.2.1 Obtain and pay for all other Permits not listed above including, but not limited to, Permits required for temporary utilities in accordance with Section 01 50 00 as required for the construction of the Work.
  - 7.2.1.1 Fire/Security Upgrade Permit.
  - 7.2.1.2 Electrical Safety Authority (ESA).

**8 ELECTRICAL COORDINATION**

- 8.1 Stop both wiring and conduit within 1 m of the existing service. Leave sufficient wiring to extend into and wrap once around the panel and complete connections. Arrange with TTC to make the final connections.
- 8.2 Access to electrical yards, rooms and equipment shall be in accordance with the Ontario's Building Code (OBC), Electrical Safety Authority (ESA) regulations, Occupational Health and Safety Act – Industrial Establishment Regulations and authorization from TTC. No rooms containing live electrical wires or equipment are to have doors blocked open or left unlocked allowing unauthorized entry.
- 8.3 Copies of passed ESA electrical inspection certificates to be forwarded to TTC, along with requests for connection of electrical equipment.

**END OF SECTION**





**1 GENERAL**

- 1.1 TTC transit system operations and passenger flow, safety, security and convenience take precedence over performance of the Work.

**2 WORK HOUR AND SAFETY RESTRICTIONS**

- 2.1 Perform Work in Public Areas at platform levels during Non-Operating Hours. Work in Public Areas at platform levels which does not interfere with passenger movement, may commence earlier upon written approval by TTC.
- 2.2 Unless noted otherwise, and with the written approval of TTC perform Work in the Public Areas other than at platform levels during Off-Peak Hours.
- 2.3 Perform Work at Track Level during Non-Operating Hours with planned traction power cut.
- 2.4 Before any Work commences at Track Level without a power cut, prepare a Safe Work Method in accordance with Section 01 59 00.
- 2.5 Perform Work which interferes with transit vehicle operations during Non-Operating Hours. This includes, but is not limited to, any Work which may be deemed by TTC to be hazardous or unduly inconvenient to the public.
- 2.6 When Work is performed at Track Level or in transit roadways during Non-Operating Hours, clean, vacate and make ready for transit use by 5:00 a.m. Monday to Saturday, (6:30 a.m. on Sunday).
- 2.7 Perform Work (including set up and removal of barricades, and clean up) on stairways, escalators and within 6 m of stairways and escalators during Non-Operating Hours.
- 2.8 Maintain existing exits and ensure proper and safe means of egress are clear at all times.
- 2.9 Times given herein are approximate only and may vary depending on TTC operational needs, movement of TTC maintenance work vehicles and the specific times of revenue service vehicles through each station.
- 2.10 Claims for increases in the Contract Price and/or extension to the Substantial Performance, Contract Completion or Milestone dates specified due to conditions stated herein will not be considered by TTC.

**3 NIGHT SHIFTS**

- 3.1 Night shifts are required for portions of the Work during Non-Operating Hours. During night shifts, a minimum of one (1) TTC staff is required to be present for the Work, except two (2) TTC staffs are required to be present for the Work requiring traction power cuts or the establishment of Work Zones at Track Level.
- 3.2 Schedule Work to minimize the amount of night shifts or need for traction power cuts and Work Zones. Give TTC at least fourteen (14) Days written notice prior to the need for night inspection and access or traction power cuts and establishment of Work Zones at Track Level.

- 3.3 Should cancellation of a power cut and establishment of Work Zone at Track Level be necessary for any reason, a minimum of twenty-four (24) hours written notice is required. Failure to provide this notice will result in the charge stated in Article 3.5 being made against the Contractor's progress payment.
- 3.4 Failure of the Contractor to be present or to have sufficient Workers to perform the Work scheduled shall be deemed to be a cancellation of a night shift or power cut and establishment of Work Zone at Track Level and accordingly will result in the charge stated in Article 3.5 being made against the Contractor's progress payment.
- 3.5 If the conditions described in Articles 3.2 or 3.4 occur, the Contractor shall be charged at the rate of \$800.00 per night shift for two (2) TTC staffs. Charges will be deducted monthly from the amount owed to the Contractor in the regular progress payment.

#### **4 PROPERTY PASSES**

- 4.1 One (1) week prior to the commencement of Work on TTC property, furnish TTC with names of Workers so that individual property passes may be issued. Submit updates to this list as required.
- 4.2 No property pass will be issued to Workers until successful completion of Subway/SRT Rule Book training and Safety Awareness training.
- 4.3 Workers will not be allowed access/egress to TTC property unless such passes are presented to TTC on a daily basis or as requested.
- 4.4 Property passes are issued only to permit access and egress to TTC property and will not be honoured for transportation purposes.
- 4.5 Property passes do not allow access to Track Level.
- 4.6 Property passes are required to be worn for identification at all locations.
- 4.7 Ensure that all passes are returned to TTC upon Contract Completion or when a Worker is no longer required on Site.

#### **5 KEYS**

- 5.1 During the course of the Work, if TTC issued keys are required, the signing of a Non-Employee Key Request form will be required to ensure control over the assignment and safekeeping of TTC issued keys.
- 5.2 TTC shall be notified in writing not less than twenty-one (21) Days prior to keys being required. A \$250.00 charge per key will apply to any key that requires replacement due to loss and any key not returned at Contract Completion.
- 5.2.1 Loss of keys must be reported to TTC immediately.
- 5.2.2 TTC keys must not be duplicated.
- 5.2.3 Keys issued must not be loaned to another person.
- 5.2.4 Keys must be returned to TTC upon Contract Completion.
- 5.3 Report deficiencies in the condition of the keys so that adequate replacement may be arranged. In the case of a broken key, present the remaining pieces of the key to TTC and a replacement key will be issued.

**6 WORK OUTSIDE OF REGULAR SCHEDULED WORKING HOURS**

- 6.1 If manufacturing, fabrication, installation, construction of the Work falls behind the Contract Schedule or in the opinion of TTC is necessary for safety or is in the public interest, the Contractor may be directed by TTC to Work at night, on holidays, or prior to, or after the regular scheduled working hours.
- 6.2 If the Contractor requires to Work on a designated statutory holiday, or carry out scheduled Work at night or on weekends, TTC shall be notified in writing not less than fourteen (14) Days prior to such time. Failing that, the Contractor shall not perform any Work which requires the presence of TTC.
  - 6.2.1 Schedule Work to minimize the number of shifts for Work outside of regular scheduled working hours.
  - 6.2.2 Should cancellation of a shift for Work outside of regular scheduled working hours be necessary for any reason, a minimum of twenty-four (24) hours notice is required. Failure to provide this notice will result in the stated charge being made against the Contractor's progress payment.
  - 6.2.3 Failure of the Contractor to be present or to have sufficient Workers to perform Work scheduled shall be deemed to be a cancellation of the shift and accordingly will result in the stated charge being made against the Contractor's progress payment.
  - 6.2.4 If the conditions described in Paragraphs 6.2.2 or 6.2.3 occur, the Contractor shall be charged at the rate of \$400.00 per shift for each TTC staff. Charges will be deducted monthly from the amount owed to the Contractor in the regular progress payment.
- 6.3 Work undertaken outside of normal working hours shall not contravene the requirements of local noise by-laws or any other regulatory requirements.

**END OF SECTION**



**1 PRECONSTRUCTION MEETING**

- 1.1 After Notification of Award, TTC will arrange and chair a preconstruction meeting. The Contractor and major Subcontractors shall be represented by senior field staff (full-time Site Superintendent). TTC will invite other interested parties whose coordination is required during construction to attend.
- 1.2 TTC will prepare and issue an agenda prior to the meeting.
- 1.3 Topics for discussion will include methods and means by which full cooperation and coordination of all participants can be achieved during construction.
- 1.4 TTC will minute the meeting and distribute copies to each participant.

**2 PROGRESS MEETINGS**

- 2.1 TTC will conduct, chair and document progress meetings on a weekly or biweekly basis throughout the construction period and will inform all parties concerned in advance, stating the time and venue of the meetings.
- 2.2 Contractor shall be represented by senior field staff (full-time Site Superintendent) authorized to act on behalf of the Contractor. The same senior field staff (full-time Site Superintendent) shall attend the meetings throughout the Contract period.
- 2.3 Subcontractors, material suppliers and others may be invited to attend meetings in which their aspects of the Work are discussed. The relations and discussions between such participants are not the responsibility of TTC and do not form part of the meeting's agenda.
- 2.4 Contractor shall present, at each meeting, scheduled Work activities in a format acceptable to TTC for the following two (2) weeks to facilitate coordination with TTC operations and staff. TTC may request a schedule of activities on a more frequent basis.
- 2.5 TTC will distribute copies of the minutes to all participants.

**3 COORDINATION MEETINGS**

- 3.1 TTC will conduct, chair and document coordination meetings on a weekly or biweekly basis throughout the construction period and will inform all parties concerned in advance, stating the time and venue of proposed meetings.
- 3.2 Ensure the superintendent or duly authorized representative authorized to act on behalf of the Contractor shall attend the meeting. Assign the same person(s) to attend such meetings throughout the Contract period.
- 3.3 Duly authorized representatives of the Contractor and Other Contractors working on Site, will be required to attend the coordination meetings. The purpose of these meetings is to coordinate the activities of the Contractor and Other Contractors. A schedule will be issued by TTC shortly after the meeting to confirm the sequencing and durations of activities discussed and agreed to at the meeting.

**4 OTHER MEETINGS**

- 4.1 TTC will conduct, chair and document other meetings on an as required basis throughout the construction period and will inform all parties concerned in advance, stating the time

and venue of the meetings. TTC will invite other interested parties whose input may be required during these meetings to attend.

- 4.2 Contractor shall be represented by senior field staff (full-time Site Superintendent) authorized to act on behalf of the Contractor. The same personnel shall attend the meetings throughout the Contract period.
- 4.3 Subcontractors, material suppliers and others may be invited by the Contractor to attend meetings in which their aspects of the Work are discussed. The relations and discussions between such participants are not the responsibility of TTC and do not form part of the meeting's agenda.
- 4.4 TTC will distribute copies of the meeting minutes to all participants.

**END OF SECTION**

**1 GENERAL**

- 1.1 Planning, scheduling, management and execution of the Work in accordance with the Contract Documents is the responsibility of the Contractor.
- 1.2 Proposed Contract Baseline Schedule (CBS) showing Milestone(s) beyond those indicated in the Contract Documents will be rejected.
- 1.3 Any CBS update indicating Milestone(s) at a later date other than those in the CBS will be rejected.
- 1.4 Failure to comply with the requirement to submit an acceptable CBS within the specified timeframe, will forfeit any claim for compensable time extension for any period of delay.

**2 DEFINITIONS**

- 2.1 Contract Float: The duration between the Contractor's target completion date and the completion date stated in the Contract Documents.

**3 CONTRACT BASELINE SCHEDULE**

- 3.1 Within 15 Days after receipt of Notification of Award of Contract, submit to TTC for approval, four (4) copies of proposed CBS in Gantt chart format.
- 3.1.1 Submission is to be clear, neat, and legible on sheets maximum 279 mm x 432 mm (11" x 17"), showing activity ID, description, original duration, start and finish dates, and Contract Float.
- 3.1 TTC reserves the right to require CBS to be prepared using suitable scheduling software such as Microsoft Project at no extra cost to TTC. Component activities of realistic duration are to be logically linked to demonstrate interdependency.
- 3.4 Define working calendars and apply these to activities in the schedule. Statutory holidays are to be indicated as non-working days in working calendars where applicable. Special calendars and appropriate working calendars (such as winter non-working period) are to be defined and applied against relevant activities.
- 3.5 Meaningful activity descriptions and realistic durations for completing the Work are to be assigned to each activity.
- 3.6 No logic constraints or periods of Work suspension shall be imposed which may affect the schedule logic and float.
- 3.7 A schedule narrative highlighting and explaining the essential sections such as cycle times and work sequence, work shifts assumed in determining the durations, interfaces with TTC and other parties, list of assumptions, list of constraints (if any) and justification.
- 3.8 In event the Contractor is of the opinion the Contract duration or scope of Work does not warrant preparing the CBS using standard scheduling software, the Contractor may make a written request to TTC citing the reasons for seeking acceptance to prepare the CBS using Microsoft Excel. However, CBS prepared using non-scheduling software may adversely impact future claims for time extensions.
- 3.9 CBS shall represent a practical plan to complete the Work within the period specified to achieve Milestone(s), and shall show in sufficient detail, the sequence in which the Work will be performed and dates in which each portion will be completed.

- 3.10 CBS shall be based on dates of Notification of Award, and Milestone(s) contained in the Contract. In addition to the Work to be performed, include major material and equipment delivery dates, restraints, and interface with activities by TTC, Other Contractors and other external parties.
- 3.11 CBS showing the Work to be completed in less time than required by the Contract Documents is considered to have Contract Float.
- 3.11.1 Amount of float in CBS shall not be less than 10% of total time allocated for completion of the Work.
- 3.12 Contract Float is considered as a resource available to both parties to the Contract. The Contract Float is to be available for TTC to allocate to either party, on a first come first serve basis. Float is not going to be allocated when the Contractor fails to meet Work Milestones defined in Section 01 11 00.
- 3.13 No time extensions will be granted for delays in parts of the Work, until the entire float time available for all parts of the Work involved is used, including Contract Float.
- 3.14 Once CBS submitted by the Contractor has been reviewed by TTC, it becomes CBS for the Contract, against which progress and delays will be measured. Date for Milestone(s) shall not be changed without direction from TTC.
- 3.15 If CBS submitted is rejected, the Contractor shall resubmit within seven (7) Days of notification.

#### **4 MONTHLY CONTRACT BASELINE SCHEDULE UPDATES**

- 4.1 Submit update of CBS on 1st Monday of every month (or Tuesday, if Monday is a statutory holiday), showing progress of the Work to last Day of previous month.
- 4.2 CBS update shall conform to stated requirements for Contract Schedule, unless noted otherwise.
- 4.3 CBS update is to record and report accurately as-built information, in particular, actual start and actual completion dates for each activity.
- 4.4 CBS update is to include estimated remaining durations for activities in progress and estimated start dates for future activities.
- 4.5 Changes to duration(s) and sequence of activities, and additional activities are to be highlighted.
- 4.6 Schedule update is to be formatted as follows:
- 4.6.1 Each activity in the Contract Schedule is shown as a solid bar, and is to remain the same for duration of Contract.
- 4.6.2 Actual progress is to be shown in different pattern bar directly above the Contract Schedule activity with percentage complete indicated as of data date.
- 4.6.3 Data date is to be the last Day of each reported month.
- 4.6.4 Actual start and finish dates are to be shown for activities in progress.
- 4.6.5 Show projection to completion for outstanding and incomplete activities.
- 4.7 TTC may review and check CBS updates. Should discrepancies be discovered, TTC shall request the Contractor to submit CBS update to correct discrepancies within seven (7) Days of notification.



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- 4.8 TTC's review of CBS updates shall not be construed as acceptance of reported as-built information and forecasted dates contained in the updated schedule.
- 4.9 Refusal, failure or neglect to take appropriate action to submit monthly CBS updates shall constitute reasonable evidence that the Contractor is not performing the Work with diligence to ensure Contract Completion by date(s) indicated in the CBS and may constitute sufficient basis for TTC to retain an amount from any progress payment in accordance with SC5 – Progress and Holdback Payments.
- 5 RECOVERY SCHEDULE**
- 5.1 When update to the CBS indicates that Milestone(s) will not be met, promptly undertake appropriate action, at no additional cost to TTC, to ensure Milestones are met.
- 5.2 Within seven (7) Days after request by TTC, the Contractor shall submit Recovery Schedule, together with a written recovery statement describing the cause of the slippage and the actions planned to recover the schedule within the shortest reasonable time.
- 5.3 Recovery Schedule is to be in same format and software as the CBS. Relate and logically link activities in Recovery Schedule back to the CBS.
- 5.4 Appropriate recovery actions may include, but not be limited to:
- 5.4.1 Assignment of additional labour, Subcontractors and equipment.
- 5.4.2 Additional shift and overtime Work.
- 5.4.3 Providing submittals well in advance of schedule dates for fabrication and installation, to provide adequate time for reviews, necessary approvals, possible revisions, resubmittals, placing orders, and securing delivery to avoid construction delays, as specified in Section 01 33 00 Submittals.
- 5.4.4 Overlapping of activities and sequencing changes to increase concurrent activities deemed appropriate, only if properly substantiated in the submission.
- 5.4.4.1 Contractor must demonstrate there are sufficient resources in the number of Workers, equipment, and supervision to overlap activities, and that it is physically possible to employ extra resources within confines of the Site.
- 5.5 Recovery Schedule is an interim schedule, and only used to monitor progress of recovery efforts. Submission of Recovery Schedule does not alleviate the Contractor from preparing and submitting regular updates to the CBS as specified elsewhere in this Section.
- 5.6 Refusal, failure or neglect to take appropriate recovery action, or to submit written recovery statement shall constitute reasonable evidence that the Contractor is not performing the Work with diligence to ensure Contract Completion by date(s) indicated in the CBS and may constitute sufficient basis for TTC to retain an amount from any progress payment in accordance with SC5 – Progress and Holdback Payments and order alternate recovery actions on the basis of information in the CBS or the Recovery Schedule.
- 5.7 Where the Contractor fails to take appropriate action, TTC may direct the Contractor to improve performance using remedies in the Contract.

## **6 SCHEDULE DELAY ANALYSIS**

- 6.1 If during performance of the Work the Contractor is delayed due to circumstances for which it considers an extension of time is due under terms and conditions of the Contract, a request for extension of time must be submitted and supported by Schedule Delay Analysis, using a method defined in AACE International Recommended Practice 29R-03 – Forensic Schedule Analysis (dated April 25, 2011).
- 6.2 Narrative submitted with the Schedule Delay Analysis is to state in detail the nature of the delay, its cause, what mitigation measures are to be taken, portions of the Work affected, dates when such portion(s) of Work became affected, and impacts to the CBS.
- 6.3 Submittal is to include detailed Schedule Delay Analysis, complete with schedule extracted from the CBS indicating relevant event that, in the Contractor's opinion, was the root cause of slippage or delay, and include only impacted activities leading up to the affected Milestone.
- 6.4 Activity delays shall not necessarily mean an extension to date(s) indicated in the CBS is warranted or due to the Contractor. A change or delay may not affect existing critical activities or cause non-critical activities to become critical. A change or delay may result in only absorbing a part of the total float that may exist within an activity chain of the network, therefore not affecting the date(s) indicated in the CBS.
- 6.5 No time extensions will be granted for delays in a portion or portions of the Work, until float time available for all portions of the Work involved is used, and agreed to by TTC.
- 6.6 TTC reserves the right to request a Recovery Schedule as an attempt to catch-up prior to considering requests for an extension of time.
- 6.7 Upon issuance of a Contract Change or Change Directive granting an extension to Milestone(s), the Contractor shall revise the CBS as indicated in Part 7.

## **7 REVISIONS TO CONTRACT BASELINE SCHEDULE**

- 7.1 Revisions to the CBS are to be made in same format and detail as the CBS. Revisions are subject to review by TTC in the same manner as the CBS.
- 7.1.1 Submittal requirements to be in accordance with requirements for the initial submission of the CBS.
- 7.1.2 Provide the required revision within seven (7) Days of notification by TTC.
- 7.1.3 Proposed revision to the CBS when reviewed and directed by TTC, becomes the revised CBS for the Contract, and is to be used as the baseline against which progress and delays are measured.

## **8 TWO WEEK LOOK AHEAD SCHEDULE**

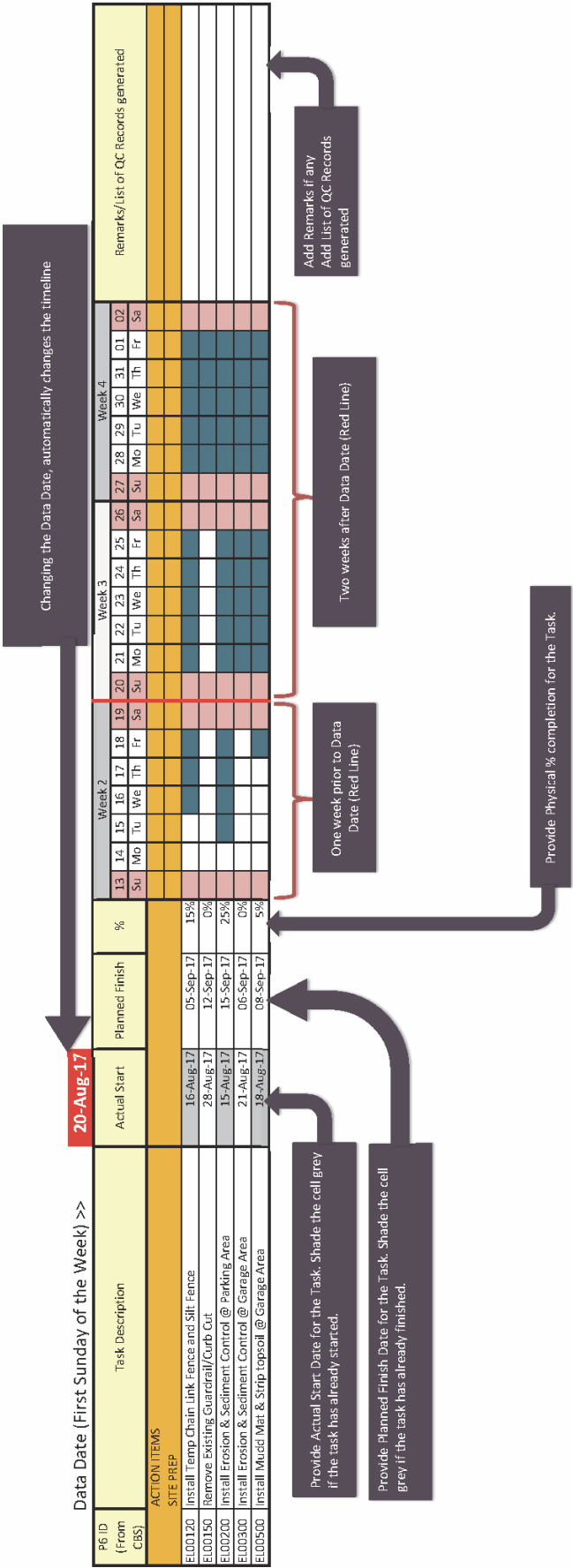
- 8.1 Submit a Two Week Look Ahead Schedule using attachment 01 32 16.01 as a guideline on Wednesday of every calendar week. Data date of the Look Ahead Schedule is to be on Wednesday of the current week.
- 8.2 Schedule, in form of a list or in Gantt chart format, is to show activities in progress or due to start or finish within the next two (2) calendar weeks. In addition, Two Week Look Ahead Schedule shall also show the actual activity progress for the one week prior to the data date.

- 8.3 Activities shown on Two Week Look Ahead Schedule are to be an amplification of and compatible with CBS.
- 8.4 Two Week Look Ahead Schedule is to contain sufficient detail to facilitate coordination of activities by TTC and other external parties affecting progress of the Work.
- 8.5 The Two Week Look Ahead Schedule shall contain sufficient detail to facilitate advance notifications to TTC customers and the community for Work that may cause disruptions to TTC service and inconveniences to the customers/community.
- 8.6 Changes, including delays, to activities shown on the Two Week Look Ahead Schedule are to be communicated to TTC in writing, immediately, and a Revised Two Week Look Ahead Schedule is to be submitted if requested by TTC.
- 8.7 No activity shown shall have duration exceeding seven (7) Days.
- 8.8 Two Week Look Ahead Schedule is not a substitution for notification to TTC or other external parties, as required in the Contract Documents.

**END OF SECTION**



CONTRACT [No.] - [Contract Name]  
2 WEEK LOOKAHEAD SCHEDULE





**1 GENERAL**

- 1.1 Submittals are to be written text, Drawing(s) or sample(s).
- 1.2 Prior to submission, be responsible for the following:
  - 1.2.1 Ensuring text and Drawing(s) are clear and legible.
  - 1.2.2 Accuracy and completeness of submittals.
  - 1.2.3 Field construction criteria, catalogue numbers, and similar data.
  - 1.2.4 Verification of field measurement.
  - 1.2.5 Coordination of each submittal with requirements of the Work and Contract Documents.
  - 1.2.6 Notifying TTC in writing at time of submission, of deviations in submittals from requirements of the Contract Documents.
- 1.3 Submittal List is attached to the Contract Documents as Appendix 2 for reference only. In the event of inconsistency or conflict, requirements of the technical Sections take precedence over the Submittal List.
- 1.4 Items listed as submittal package in technical Sections to be submitted at same time.
- 1.5 Make submittals well in advance of schedule dates for fabrication and installation.
- 1.6 Provide adequate time for reviews, necessary approvals, possible revisions, resubmittals, placing orders, and securing delivery to avoid construction delays.
- 1.7 Submittals may be provided electronically, accompanied by one (1) set of hard copy, as accepted by TTC.
- 1.8 Accompany each submittal with TTC Construction Department Submittal Form, containing pertinent information required for identification and checking of submittals.
- 1.9 Identify long lead time items with delivery time of more than six (6) weeks after order confirmation and include submittals affecting such items in the Contract Baseline Schedule.
- 1.10 Use separate Submittal Form for each type of submittal.
- 1.11 Allow minimum of ten (10) Days for review by TTC of each submission unless otherwise specified. Resubmit each submission as many times as required to attain reviewed status. Allow minimum of three (3) cycles for repeat submittal, in Contract Baseline Schedule.
- 1.12 Provide detailed Submittal Schedule within fifteen (15) Days of Notification of Award, which lists submittal items required by the Contract Documents, and provide monthly updates for duration of the Work.
- 1.13 Factor in number and size of documents.
- 1.14 Stagger submittal of documents.
- 1.15 If concurrent, prioritize submittals for processing.
- 1.16 Schedule in accordance with Contract Baseline Schedule, sequence of Work, and updates.

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- 1.17 Review of submittals by TTC will be for conformity to design concept and for general arrangement only. Such review will not relieve the Contractor of responsibility for errors or omissions in submittals, or of responsibility for meeting requirements of the Contract Documents.
- 1.18 Submit request for substitution in accordance with Section 01 62 00.
- 1.19 Submittals not providing sufficient context for review will be returned for correction in their entirety.
- 1.20 Submittals to contain the following identification:
- 1.20.1 TTC's Contract number.
- 1.20.2 Applicable Contract Drawing number(s).
- 1.20.3 Applicable 6-digit Specification Section number for the specified item(s).
- 1.20.4 Location (for example facility, station, unit, level, room number).
- 1.20.5 Name of Product.
- 1.20.6 Name of Subcontractor or supplier.
- 1.20.7 Stamp, date, and signature confirming the Contractor's review.
- 1.21 On submissions subsequent to first, submittals to contain the following additional identification:
- 1.21.1 TTC's submittal number.
- 1.21.2 Revision number.
- 1.21.3 Identification of item(s) revised.
- 1.22 Indicate dimensions and designations of elements in same system of measurement used on applicable Contract Drawings.
- 1.23 Reproductions of Contract Drawings submitted as submittals will not be accepted.
- 1.24 TTC reserves the right to refuse acceptance of submissions not meeting above requirements.
- 1.25 Submittals will be returned electronically to the Contractor marked as one (1) of the following:
- 1.25.1 Reviewed: Resubmission is not required.
- 1.25.2 Reviewed as Noted: Resubmission is not required.
- 1.25.3 Revise and Resubmit: Resubmission is required.
- 1.25.4 Not Applicable/Not Required: The submittal is not applicable or is not required.
- 1.26 The Contractor is solely responsible for commencing Work before submittals are returned marked Reviewed or Reviewed as Noted.
- 1.27 Verify Site dimensions prior to fabrication and installation. Be solely responsible for coordinating the Work of subtrades.
- 1.28 Resubmit updates to the Reviewed and Reviewed as Noted submittals whenever revisions occur during the execution of the Work.



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**2 SHOP DRAWINGS**

- 2.1 Prepare in accordance with Section 01 33 23.

**3 SCHEDULES**

- 3.1 Schedules include, but are not limited to, materials and finishing.

**4 SAMPLES**

- 4.1 Submit three (3) samples, unless specified otherwise in technical Sections.
- 4.2 Before delivery of Products to Site, submit samples of Products as required by the Specifications or as additionally requested by TTC.
- 4.3 Affix legible labels to samples with sample-specific information. Minimum information to include:
- 4.3.1 Specification Section number(s).
- 4.3.2 Product origin, and manufacturer's name and model number.
- 4.3.3 Intended use in the Work and requirements of the Specifications.
- 4.4 Samples are to be physical examples to illustrate materials, equipment or Work quality, and to establish standards by which completed Work is judged.
- 4.5 Ensure samples are of sufficient size and quantity, if not already specified, to illustrate full range of colours available.
- 4.6 Reviewed samples to be kept on file by TTC until Contract Completion. After Contract Completion, samples to be treated as Contractor's property and discarded by the Contractor.

**5 PLANS**

- 5.1 Plans include, but are not limited to, maintenance, training and commissioning.

**6 LISTS**

- 6.1 Lists include, but are not limited to, spare parts, special tools and extra stock materials.

**7 CERTIFICATES**

- 7.1 Clearly show on each certificate, name and location of the Work, name and address of Contractor or Subcontractor, quantity and date of shipment and delivery, and name of manufacturer or fabricating company. Ensure certificates are signed by an authorized representative of manufacturing or fabricating company.
- 7.2 Provide certificates to establish qualifications of personnel employed on the Work where such certification is required by authorities having jurisdiction, TTC or the Contract Documents.

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**8 REPORTS AND TEST REPORTS**

- 8.1 Reports include, but are not limited to, Test Reports, Pre-Start Health and Safety Report, Deficiency Reports, Commissioning Closeout Reports, and deferred Commissioning Reports.
- 8.1.1 Submit Pre-Start Health and Safety Report in accordance with Section 01 11 00.
- 8.2 Record date(s) of testing, specified requirements for which testing was performed, and results of test(s).

**9 MARKED-UP SHOP DRAWINGS**

- 9.1 Submit Marked-up Shop Drawings in accordance with Sections 01 78 23.

**10 AS-BUILT DRAWINGS**

- 10.1 Submit two (2) copies, unless specified otherwise in technical Sections.
- 10.2 Prepare As-Built Drawings in accordance with Section 01 78 39.

**11 EXTENDED WARRANTIES**

- 11.1 Submit in accordance with technical Sections.

**12 OPERATION AND MAINTENANCE MANUALS**

- 12.1 Draft version: Submit electronically on USB memory stick unless specified otherwise in technical Sections.
- 12.2 Final version: Submit electronically on USB memory stick, and accompanied by one (1) set of hard copy, unless specified otherwise in technical Sections.
- 12.3 Prepare Operation and Maintenance Manuals in accordance with Section 01 78 23.
- 12.3.1 Organize Operation and Maintenance Manuals in accordance with Operation and Maintenance Manuals Template 01 78 23.01.

**13 TRAINING**

- 13.1 Prepare training submittals in accordance with Section 01 79 00.

**END OF SECTION**



# TTC Construction Department Submittal Form

General Contractor to Complete (Use separate Submittal Form for each item listed on Submittal List)		
Contract No:	Submittal No:	Rev:
General Contractor (GC):	Submission Date:	
Sub-Contractor:	Change Order No. (If Applicable):	
Type of submittal (check one only): <div><input type="checkbox"/> Commissioning   <input type="checkbox"/> Samples   <input type="checkbox"/> Schedules   <input type="checkbox"/> Warranties   <input type="checkbox"/> Training   <input type="checkbox"/> As-Built Dwg's   <input type="checkbox"/> Certificates <input type="checkbox"/> Shop Drawings   <input type="checkbox"/> Lists   <input type="checkbox"/> Plans   <input type="checkbox"/> O&amp;M Manual   <input type="checkbox"/> Reports   <input type="checkbox"/> Test Reports   <input type="checkbox"/> Other</div>		
Submittal Description:		No of pages:
GC's Representative (Print name & date):		Substitution: (Documents attached conform to Section 01 62 00) <input type="checkbox"/> Yes
TTC Construction Office to complete		
Preliminary check by (Print name & date):	1 <sup>st</sup> Reviewer (Print name):	2 <sup>nd</sup> Reviewer (Print name):
Comments from Preliminary Review (if Applicable):	<input type="checkbox"/> Construction Safety	<input type="checkbox"/> Construction Safety
	<input type="checkbox"/> CC:	<input type="checkbox"/> CC:
	<input type="checkbox"/> CSM:	<input type="checkbox"/> CSM:
	<input type="checkbox"/> Designer:	<input type="checkbox"/> Designer:
	<input type="checkbox"/> Other:	<input type="checkbox"/> Other:
Submittal Reviewer to complete		
Review status: <input type="checkbox"/> Reviewed <input type="checkbox"/> Reviewed as Noted <input type="checkbox"/> Revise and Resubmit <input type="checkbox"/> Not Applicable / Not Required (Check one only)		
Comments:		
Reviewed by (Print name):	Title/Position:	Date:
TTC Representative to complete		
Comments:	Signature:	
	Date:	



**1 GENERAL**

- 1.1 Arrange for preparation of Shop Drawings for each technical Section as called for in the Contract Documents.
- 1.2 Prepare Contract-specific Drawings for non-catalogue items.
- 1.3 Clearly mark Product data and catalogue items to show items being supplied.
- 1.4 Clearly indicate materials and equipment being supplied, including details of construction, accurate dimensions, operating characteristics, capacity, and performance.
- 1.5 Provide sufficient information for comprehensive review of associated components and details of interfacing with other technical Sections.
- 1.6 Clearly mark each system and equipment with identification number or tag matching the Contract Documents.
- 1.7 Before submitting to TTC, check Shop Drawings to verify conformance to the Contract Documents and interference coordination with trades involved for the following:
  - 1.7.1 Field dimensions and field construction criteria.
  - 1.7.2 Construction methods and erection details.
  - 1.7.3 Equipment attachments and connections.
  - 1.7.4 Materials, catalogue numbers, and data.
- 1.8 Submittals of Shop Drawings not meeting above requirements will be returned without review.
- 1.9 Stamp, date, and sign each Shop Drawing by Contractor or authorized qualified person.
- 1.10 Submit Shop Drawings for review by TTC in accordance with Section 01 33 00. At time of submission, the Contractor shall notify TTC in writing of deviations in the Shop Drawings from requirements of the Contract Documents. TTC will review and return the Shop Drawings in accordance with Section 01 33 00.
- 1.11 Review of the Shop Drawings by TTC will be for conformity to design concept and for general arrangement only, and such review shall not relieve the Contractor of responsibility for errors or omissions in the Shop Drawings, or of responsibility for meeting requirements of the Contract Documents. The Contractor shall perform the Work in accordance with reviewed Shop Drawings unless change on the Shop Drawings has been approved in writing by TTC.
- 1.12 Resubmit new set of Shop Drawings for review when subsequent deviation from reviewed Shop Drawings is required.
- 1.13 Make changes on the Shop Drawings which TTC may require consistent with the Contract Documents and resubmit, unless otherwise directed by TTC. When resubmitting the Shop Drawings, notify TTC in writing of revisions other than those required by TTC.
- 1.14 Shop Drawings submitted by the Contractor are property of TTC who may use and duplicate such Shop Drawings where required in association with the Work of TTC.
- 1.15 Shop Drawings to have distinct, uniform letters, numerals, and line thicknesses to ensure production of clear legible prints and facilitate microfilming and reduced scale reproduction.

- 1.16 Copies of prints to be maximum 558 mm x 1016 mm (22" x 40") and minimum 279 mm x 432 mm (11" x 17"). Where catalogue items are specified, provide legible copies.

**END OF SECTION**

**1 DEFINITIONS**

- 1.1 Hold Point: An identified point beyond which work may not proceed without the authorization of TTC or authorities having jurisdiction. The Contractor shall give written notification to TTC of upcoming inspections, tests or work activities.
- 1.2 Inspection and Testing Plan: A document that includes Contract inspection, testing and monitoring requirements relevant to each Work activity.
- 1.3 Mock-ups: Full-size, physical assemblies that are constructed on-site. Mock-ups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation. They are not Samples. Approved Mock-ups establish the standard by which the Work will be judged.
- 1.4 Quality Assurance: Planned and systematic activities ensuring processes used to create the Work are developed, documented, effectively implemented, and monitored. The typical outcomes of Quality Assurance planning activities are the Quality Plan, Inspection and Testing Plan, and the training of Workers performing the Work.
- 1.5 Quality Control: Inspection, testing and monitoring activities used to verify that the Work meets the Contract requirements.
- 1.6 Quality Record: The documented evidence that processes are executed in accordance with the Quality Plan and Inspection and Testing Plan requirements, such as test report, inspection checklist, material certificate, non-conformance report, and audit report.
- 1.7 Witness Point: An identified point that provides a party (such as TTC, authorities having jurisdiction or the Contractor) with the opportunity to witness the inspection, test or work activity, at their discretion. The Contractor shall give written notification to TTC of the upcoming inspection, test or work activity.

**2 SUBMITTALS**

- 2.1 Submit the following in accordance with Sections 01 33 00 and 01 11 00:
  - 2.1.1 Inspection and Testing Plan in accordance with Paragraph 5.2.
  - 2.1.2 Inspection and Testing Records within two (2) Business Days electronically in accordance with Paragraph 5.9.

**3 QUALITY RESPONSIBILITY SUMMARY**

- 3.1 The Contractor is in control of its Quality Assurance and Quality Control activities and is solely responsible for the quality of the Work. Responsibilities include the quality of the Work carried out by Subcontractors.
- 3.2 The Contractor shall not rely on TTC's oversight of construction activities including independent inspections and tests to replace Contractor's quality responsibilities.
- 3.3 TTC reserves the right to:
  - 3.3.1 Witness Contractor's operations and inspection and testing activities;
  - 3.3.2 Perform independent inspections and tests in parallel of any and all inspection and testing performed by the Contractor to verify Contractor's results;

- 3.3.3 Check Contractor's records providing evidence of quality activities performed;
- 3.3.4 Perform Quality Audits.

#### **4 QUALITY PERSONNEL**

- 4.1 Appoint a Quality Manager for the duration of the Contract, as specified in Section 01 43 11. The Quality Manager is empowered to require conformity to Contract Documents.
- 4.2 The Quality Manager is the key liaison person with TTC on all matters related to quality.
- 4.3 Ensure that personnel responsible for quality have a thorough knowledge of the Work described in the Contract Documents, and the necessary qualification, experience, and training to carry out Quality Assurance and Quality Control activities required to ensure conformity to Contract Documents.

#### **5 INSPECTION AND TESTING**

##### **5.1 General**

- 5.1.1 Perform inspection, monitoring, and testing activities as required by the Contract Documents, statutes, regulations, by-laws, standards, or codes, and by authorities having jurisdiction.
- 5.1.2 Retain and pay for services of an independent testing company to carry out all field and laboratory quality control tests. The independent testing company shall maintain current certification by the Canadian Council of Independent Laboratories (CCIL), or the Canadian Standards Association (CSA), or by another company as appropriate to the testing performed.
- 5.1.3 Do not employ the same testing entity engaged by TTC for the Contract, unless agreed to in writing by TTC.
- 5.1.4 Specific inspection and testing requirements for individual construction activities are defined in the technical Sections.
- 5.1.5 Specified tests, inspections, and related actions do not limit Contractor's other Quality Control activities that facilitate conformity to the Contract Document requirements.
- 5.1.6 TTC will issue a written notice to suspend specific work activities, in accordance with Section 00 72 00, GC 15, where persistent or severe violations of Quality Control processes are resulting in or may result in Work not meeting the specified requirements. Costs and delays to the affected Work activity or subsequent Work activities resulting from the suspension of Work for reasons caused or contributed to by the Contractor will be at no additional cost to TTC. Resume Work only when TTC notifies in writing, and TTC is satisfied that the Contractor has planned and implemented adequate corrective and preventative actions that the process violations will not recur and any deficiency in the finished Work occasioned thereby has been resolved.

##### **5.2 Inspection and Testing Plan**

- 5.2.1 Prepare and submit an Inspection and Testing Plan that documents the required inspection and testing for the Work.
- 5.2.2 Inspection and Testing Plan to be consistent and traceable to the requirements set out in the Contract Documents. Inspection and testing activities shall be cross-referenced to the respective Work activity ID in the Contract Baseline Schedule.



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- 5.2.3 Inspection and Testing Plan to detail on and off Site inspection, testing and monitoring activities for stages and types of Contract Work performed by the Contractor, Subcontractors, TTC, and authorities having jurisdiction, as applicable.
- 5.2.4 Inspection and Testing Plan to include, but not limited to, the following:
- 5.2.4.1 Work activity title.
- 5.2.4.2 Inspection, testing, and monitoring activity description.
- 5.2.4.3 Frequency of inspection, testing, and monitoring.
- 5.2.4.4 Sample size.
- 5.2.4.5 Acceptance criteria.
- 5.2.4.6 Work activity schedule ID.
- 5.2.4.7 Reference to standards, codes, Specifications, and work instructions.
- 5.2.4.8 Record of inspection, testing, and monitoring activity (for example, forms, checklists, reports).
- 5.2.4.9 Responsibility (name of Contractor, Subcontractor, TTC, authorities having jurisdiction).
- 5.2.4.10 Identify if the activity is Witness Point or Hold Point.
- 5.2.4.11 Internal and external parties required to release Contract Work to next stage, as applicable.
- 5.2.5 Submit Inspection and Testing Plan in accordance with Section 01 11 00, Submittal Milestones.
- 5.2.6 Submit an updated Inspection and Testing Plan every six (6) months or as requested by TTC.
- 5.2.7 Incorporate the review comments and resubmit the final version of the Inspection and Testing Plan within three (3) weeks.
- 5.2.8 Implement the Inspection and Testing Plan to ensure that the Work is performed in accordance with the Contract Documents.
- 5.3 Notify TTC two (2) Business Days in advance of inspection and testing activities identified as Hold or Witness Points in Inspection and Testing Plan.
- 5.4 Notify the appropriate agency or authority having jurisdiction, of inspection and testing activities identified as Hold or Witness Points in Inspection and Testing Plan.
- 5.5 Re-work, repair or otherwise correct Work that has failed to demonstrate conformance with requirements as a result of inspection or testing activities, or resulting from damage after inspection and testing were completed.
- 5.6 Re-test and re-inspect nonconforming or indeterminate Work after correction.
- 5.7 Be fully responsible for the repair or replacement of all equipment and Work damaged as a result of required inspection and testing, at no additional cost to TTC.
- 5.8 **Inspection and Testing by TTC**
- 5.8.1 TTC will carry out inspection activities identified as TTC's responsibility in the Contract Documents. TTC may carry out inspection of the Work in addition to the Contractor's inspection activities. Inspection by TTC will not relieve the Contractor of their contractual responsibility.

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- 5.8.2 TTC may appoint an independent company to carry out inspection and testing of the Work in addition to the Contractor's inspection and testing activities. Such costs for inspection and testing will be paid by TTC.
- 5.8.3 TTC may carry out inspection and testing at an increased frequency if in the opinion of TTC the Contractor's Quality Control activities fail to deliver Work meeting specified requirements. Additional inspection and testing due to nonconforming Work to be at no additional cost to TTC. Cooperate with and provide access and assistance as required for inspection and testing personnel appointed by TTC to carry out their duties.
- 5.8.4 TTC may inspect and test Products during manufacture, fabrication, shop testing, installation, construction and commissioning phases of the Contract. Inspection and testing may be performed at the place of manufacture or fabrication, storage, or at the Site as designated by TTC. Where inspection and testing is done either during manufacture, fabrication, or at Site, ensure that proper facilities and assistance are provided.
- 5.9 Inspection and Testing Records**
- 5.9.1 Document the results of inspection, monitoring and testing activities.
- 5.9.2 Organize, index, cross reference and maintain comprehensive records of tests, inspections, certificates of compliance, and other Quality Records so that they are traceable to the Work they represent.
- 5.9.3 Inspection and testing records are to be signed and include the following:
- 5.9.3.1 Date of issue.
- 5.9.3.2 Contract title and number.
- 5.9.3.3 Name, address, and telephone number of organization performing tests.
- 5.9.3.4 Dates and locations of samples, tests, and inspections.
- 5.9.3.5 Names of individuals performing inspections and testing.
- 5.9.3.6 Description of the Work, test boundaries, and inspection and testing methods.
- 5.9.3.7 Identification of Product and Section.
- 5.9.3.8 Complete inspection and testing data.
- 5.9.3.9 Inspection and testing results, comparison with acceptance criteria and tolerances, and an interpretation of test results to assure that test requirements have been satisfied.
- 5.9.3.10 Reference to information on action taken in connection with test deviations and inspection non-conformances.
- 5.9.3.11 Record of temperature, weather conditions, and other pertinent test conditions at time of sample taking, inspecting and testing, if relevant.
- 5.9.3.12 Certification statement that indicates whether inspected or tested Work complies with the Contract requirements. Reports to be signed by the authorized personnel certifying that the test submitted either complies with the Contract requirements or comments on the outcome of the test are to be included, as applicable.
- 5.9.3.13 Name, signature, and date of responsible inspection or testing authority.
- 5.9.3.14 Recommendations on retesting and re-inspecting.

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- 5.9.3.15 List of measurement and testing equipment including serial number and calibration due date, for inspection and testing equipment that requires calibration, as applicable.
- 5.9.4 Report failed inspection and testing activities to TTC within twenty-four (24) hours.
- 5.9.5 Submit inspection and testing Records electronically within two (2) Business Days.
- 5.10 **Mock-ups**
- 5.10.1 Before installing portions of the Work requiring Mock-ups, build Mock-ups for each form of construction and finish, using materials specified for the completed Work.
- 5.10.2 Build Mock-ups in location and of size indicated.
- 5.10.3 Notify TTC seven (7) Days in advance when Mock-ups will be constructed.
- 5.10.4 Demonstrate the proposed range of aesthetic effects and workmanship.
- 5.10.5 Obtain TTC's approval of Mock-ups before starting work, fabrication, or construction.
- 5.10.6 Allow seven (7) Days for initial review and each re-review of each Mock-up.
- 5.10.7 Maintain Mock-ups during construction in an undisturbed condition as a standard for the completed Work.
- 6 NONCONFORMITIES**
- 6.1 **General**
- 6.1.1 Handle nonconformities to Contract requirements identified by TTC in accordance with TTC requirements and the Contractor's process for control of nonconformity and corrective action.
- 6.1.2 Products which do not conform to the requirements of the Contract will be considered as defective and are to be removed and replaced with acceptable Products at no additional cost to TTC. Defective Products which have been corrected are not to be used until TTC's review for conformity.
- 6.1.3 Disposition of nonconforming Work is to be as directed by TTC, and subject to segregation, quarantining, marking, tagging by the Contractor, as deemed necessary. Corrective action plans will be reviewed by TTC and are to be implemented only upon written acceptance by TTC.
- 6.2 **Control of Nonconformities and Corrective Action Process**
- 6.2.1 Report nonconforming Work detected by the Contractor to TTC via a Nonconformity Report (NCR) within one Business Day of being detected. Submit NCRs with records which indicate a deviation from the requirements of the Contract Documents and the proposed disposition.
- 6.2.2 If the proposed disposition of the nonconformity cannot be determined within one Business Day, submit a partially completed NCR identifying the nonconformity and noting when the proposed disposition will be submitted.
- 6.2.3 Do not cover up nonconforming Work unless a disposition has been accepted by TTC and implemented by the Contractor.
- 6.2.4 Where nonconformities can be resolved by removal and replacement of the Work, a NCR is required to be submitted but a Hold Point will not be required.

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- 6.2.5 With the exception of circumstances described in Paragraph 7.2.4, a NCR will automatically create a Hold Point which will remain in effect until conformance has been achieved.
- 6.2.6 Where the TTC's inspections, oversight, or audits detect a nonconformity to the Contract Documents, Quality Plan, or Inspection and Testing Plan, TTC will issue a Contract Deficiency Report (CDR). The CDR will specifically state if this will create or will not create a Hold Point. The Contractor is required to submit a NCR in accordance with this Paragraph.
- 6.2.7 In instances where there is a discrepancy between test results obtained by TTC and those provided by the Contractor, the results from TTC will govern, except where TTC may determine a specific audit test procedure to resolve the discrepancy.
- 6.2.8 Where required by TTC, a Hold Point will apply until TTC has inspected the accepted rectification Work.
- 6.2.9 Prepare a standard NCR form including:
- 6.2.9.1 Details of nonconformity.
- 6.2.9.2 Proposed disposition.
- 6.2.9.3 Provision for attachments.
- 6.2.9.4 TTC comment, acceptance, rejection.
- 6.2.9.5 Completion of disposition.
- 6.2.9.6 Release of Hold Point.
- 6.2.9.7 Corrective action to improve quality.
- 6.2.9.8 Closeout of NCR.
- 6.2.9.9 All actions shall be signed off by authorized representatives of the Contractor.
- 6.2.10 Number NCRs consecutively and cross-reference them to relevant CDRs.
- 6.2.11 Nominate a proposed disposition for nonconformities within 5 Business Days or provide cause to TTC for any further delay. Under no circumstances will the deliberation on disposition of nonconformity justify an extension of time to the Contract Baseline Schedule.
- 6.3 Disposition of Nonconformity**
- 6.3.1 Advise TTC in the NCR of the proposed disposition of the particular nonconformity. This proposed disposition will constitute corrective action for the Work referred to in the NCR and may comprise one of the following:
- 6.3.1.1 Propose additional works to bring the Work up to the specified standard; or
- 6.3.1.2 Replace all or part of the Work to bring it up to the specified standard.
- 6.3.2 Proposed dispositions shall be subject to the acceptance of TTC. Reworked or replaced Work is to be verified for conformity to the Contract Documents.
- 6.4 Corrective Action Plan**
- 6.4.1 Indicate on the NCR an appropriate corrective action plan that ensures the corrective action is effective in avoiding recurrence of the nonconformity.

**6.5 Nonconformity Tracking System**

6.5.1 Implement and maintain a tracking system to monitor the status of nonconformities identified by TTC or the Contractor.

6.5.2 Nonconformity tracking system is to be a single repository containing the NCRs, and supporting documentation.

**6.6 Nonconformity Records**

6.6.1 In addition to the maintenance of the nonconformity tracking system, maintain and make available to TTC upon request, the information related to nonconformities identified for the Contract.

**7 QUALITY AUDITS****7.1 TTC Quality Audits**

7.1.1 TTC reserves the right to carry out quality audits to assess the implementation of the Contractor's Quality Plan and Inspection and Testing Plan, as it considers appropriate.

7.1.2 Without limiting the Contractor's other obligations under the Contract, the Contractor is to provide and ensure that the Contractor's Subcontractors provide TTC with assistance as required by the auditors, including providing documents, records, and access to locations where the Work is carried on. TTC may carry out audits directly or through another party. Audits may be scheduled or unscheduled.

7.1.3 The Contractor is to prepare and provide Corrective Action Plans for nonconformities identified during TTC's quality audit. Ensure that corrective actions to eliminate detected nonconformities and their causes are taken without undue delay, verify that the actions taken are effective, and provide verification results to TTC.

7.1.4 The Contractor is to include and track TTC quality audit findings in their nonconformity log and provide corrective action in the same manner as other nonconformities.

7.1.5 TTC reserves the right to conduct follow-up quality audits at any time to determine if the Contractor implemented and adhered to the reviewed corrective actions.

**END OF SECTION**



## **1 GENERAL STANDARDS AND CODES**

- 1.1 Contract forms, codes, Specifications, standards, manuals and installation, application and maintenance instructions referred to in the Specifications, unless otherwise specified and unless otherwise stated in the governing building code, shall be the latest published editions at the date of the Contractor's Bid submission.
- 1.2 Conform to Contract forms, codes, Specifications, standards, manuals and installation, application and maintenance instructions referred to in the Specifications, in whole or in part, as specifically stated in the Specifications.
- 1.3 In case of conflict between individual requirements, comply with the most demanding and stringent requirement.
- 1.4 If there is a question regarding whether any Product or system is in conformance with applicable requirements, TTC reserves the right to have such Products or systems tested at the Contractor's cost to prove or disprove conformance.
- 1.5 The cost for testing will be borne by TTC in the event of conformance with the Contract Documents, or by the Contractor in the event of non-conformance.

## **2 DEFINITIONS**

- 2.1 Refer to the Contract Documents and Ontario's Building Code (OBC) for definitions applicable to the Contract.

## **3 ACRONYMS**

- 3.1 Refer to OBC and to the following list for descriptions of acronyms applicable to the Contract Documents:

AA	Aluminum Association
AAADM	American Association of Automatic Door Manufacturers
AABC	Associated Air Balance Council
AAMA	American Architectural Manufacturers Association (USA)
AASHTO	American Association of State Highway and Transportation Officials
ABMA	American Bearing Manufacturers Association
ACI	American Concrete Institute
ACGIH	American Conference of Governmental Industrial Hygienists
ACNBC	Associate Committee of the National Building Code
ADA	Americans with Disabilities Act
AFBMA	Anti-Friction Bearing Manufacturers Association
AGMA	American Gear Manufacturers Association
AHRI	Air Conditioning, Heating, and Refrigeration Institute
AIEE	American Institute of Electrical Engineers
AISI	American Iron and Steel Institute
ALI	Automotive Lift Institute
ALCTV	Automotive Lift Construction, Testing and Validation
ALOIM	Automotive Lift Operation, Inspection and Maintenance
AMCA	Air Movement and Control Association International, Inc.
AMEU	Association of Municipal Electric Utilities

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ANSI	American National Standards Institute
API	American Petroleum Institute
APTA	American Public Transportation Association
AREA	American Railway Engineering Association
AREMA	American Railway Engineering and Maintenance-of-Way Association
ARI	Air Conditioning and Refrigeration Institute
ASA	American Standards Association
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASHTO	American Association of State Highway and Transportation Officials
ASME	American Society of Mechanical Engineers
ASPE	American Society of Plumbing Engineers
ASSE	American Society of Sanitary Engineering
ASTM	ASTM International (formerly known as the American Society for Testing and Materials)
AWMAC	Architectural Woodwork Manufacturers Association of Canada
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturers Association
BSI	British Standards Institute
CAC	Cement Association of Canada
CAN	National Standard of Canada
CCA	Canadian Construction Association
CCDC	Canadian Construction Documents Committee
CCIL	Canadian Council of Independent Laboratories
CCMC	Canadian Construction Materials Centre
CCME	Canadian Council of Ministers of the Environment
CEAA	Canadian Environmental Assessment Act
CEC	Canadian Electrical Code
CEE	Consortium for Energy Efficiency
CEMA	Canadian Electrical Manufacturers' Association
CEPA	Canadian Environmental Protection Act
CETL	Conformance European (Commission) Testing Laboratories
CGA	Canadian Gas Association
CGS/CFEM	The Canadian Geotechnical Society, Canadian Foundation Engineering Manual
CGSB	Canadian General Standards Board
CIRI	Canadian Industrial Risk Insurers
CISC	Canadian Institute of Steel Construction
CLA	Canadian Lumberman's Association
CMAA	Crane Manufacturers of America
CMHC	Canada Mortgage and Housing Corporation
CPCA	Canadian Paint and Coatings Association
CPCI	Canadian Precast/Prestressed Concrete Institute
CPMA	Canadian Paint Manufacturers Association
CPPI	Canadian Petroleum Products Institute
CRCA	Canadian Roofing Contractors Association



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CSA	Canadian Standards Association
CSC	Construction Specifications Canada
CSDMA	Canadian Steel Door and Frame Manufacturers Association
CSI	Construction Specifications Institute (USA)
CSPI	Corrugated Steel Pipe Institute
CSSBI	Canadian Sheet Steel Building Institute
CTC	Canadian Transport Commission
CTI	Cooling Tower Institute
cUL	Underwriters Laboratories of Canada classification mark
cULus	Underwriters Laboratories of Canada and USA
CWA	Canadian Welding Association
CWB	Canadian Welding Bureau
CWC	Canadian Wood Council
DIN	German Institute for Standardization
EAA	Environmental Assessment Act
EEMAC	Electrical and Electronic Manufacturers Association of Canada
EIFS	Exterior Insulation Finish System Council of Canada (ECC or EIFS Council)
EPA	Environmental Protection Act
EPS	Environmental Protection Service
ESA	Electrical Safety Authority
ETL	Electrical Testing Laboratories
FED-STD	Federal Standards (USA)
FM	Factory Mutual
FS	Federal Specifications and/or Federal Standards (USA)
GAMA	Gas Appliance Manufacturers Association
GANA	Glass Association of North America
GRI	Geosynthetic Institute
HRAI	Heating, Refrigerating and Air-Conditioning Institute of Canada
IAO	Insurance Advisory Organization of Canada
IBR	Institute of Boiler and Radiator Manufacturers
ICEA	Insulated Cable Engineers Association
ICRI	International Concrete Repair Institute
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronic Engineers
IGMAC	Insulating Glass Manufacturers Association of Canada
ISA	Instrumentation Society of America
ISO	International Organization for Standardization
LSGA(SM)	Laminators Safety Glass Association (Standards Manual)
MIL	Military Specifications (Naval Publications and Forms Centre) (USA)
MPI	Master Painters Institute
MOECP	Ontario Ministry of the Environment, Conservation and Parks

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MOL	Ministry of Labour
MRTCA	Metropolitan Toronto Region Conservation Authority
MSS	Manufacturer's Standardization Society
MTC	Ministry of Tourism, Culture and Sport
MTO	Ministry of Transportation Ontario
NAAMM	National Association of Architectural Metal Manufacturers
NACE	NACE International, The Corrosion Society
NBC (NBCC)	National Building Code (of Canada)
NEBB	National Environmental Balancing Bureau
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association (USA)
NETA	International Electrical Testing Association (USA)
NFC	National Fire Code of Canada
NFPA	National Fire Protection Association
NHLA	National Hardwood Lumber Association (USA)
NICEIC	National Inspection Council for Electrical Installation Contracting
NLGA	National Lumber Grades Authority
NMS	National Master Specifications (Federal)
NOMMA	National Ornamental & Miscellaneous Metals Association
NRC	National Research Council of Canada
NRCA	National Roofing Contractors Association
NSC	National Standards of Canada
OBC	Ontario's Building Code
OCPA	Ontario Concrete Pipe Association
OESC	Ontario Electrical Safety Code
OFC	Ontario Fire Code
OFM	Ontario Fire Marshal
OH	Ontario Hydro
OHBDC	Ontario Highway Bridge Design Code
OHSa	Occupational Health and Safety Act and Regulations for Construction Projects
OIRCA	Ontario Industrial Roofing Contractors Association
OMCA	Ontario Masonry Contractors Association
OPC	Ontario Plumbing Code
OPCA	Ontario Painting Contractors Association
OPSD	Ontario Provincial Standards (for Roads and Public Works) Drawings
OPSS	Ontario Provincial Standard Specification
O.REG.	Ontario Regulations
OTM	Ontario Traffic Manual
OWRA	Ontario Water Resources Act
PALCAN	Program for the Accreditation of Laboratories – Canada
PDI	Plumbing and Drainage Institute
PEI	Porcelain Enamel Institute
PEO	Professional Engineers of Ontario
RMCAO	Ready Mixed Concrete Association of Ontario
RSIC	Reinforcing Steel Institute of Canada

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SAE	Society of Automotive Engineers International™
SCC	Standards Council of Canada
SJI	Steel Joist Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SSINA	Speciality Steel Industry of North America
SSPC	The Society for Protective Coatings
TDGA	Transportation of Dangerous Goods Act
TEMA	Tubular Exchange Manufacturers Association
TIAC	Thermal Insulation Association of Canada
THES	Toronto Hydro Energy Services
TRCA	Toronto and Region Conservation Authority
TTMAC	Terrazzo, Tile and Marble Association of Canada
TS	City of Toronto Transportation Services
TSS Act	Technical Standards and Safety Act
TSSA	Technical Standards and Safety Authority
UL	Underwriters Laboratories (USA)
ULC	Underwriters Laboratories of Canada
ULC/ORD	Underwriters Laboratories of Canada, Other Recognized Documents
USACE	U.S. Army Corps of Engineers
WHI	Intertek (Warnock Hersey)
WHMIS	Workplace Hazardous Materials Information System (Health Canada)

**END OF SECTION**



## 1 GENERAL

- 1.1 The TTC Master Specifications follow the recommended guidelines set out by Construction Specifications Canada (CSC), Manual of Practice (MOP) September 2006.
- 1.2 References:
- 1.2.1 CSC, Manual of Practice (MOP) September 2006.
- 1.2.2 NRCC, National Research Council Canada, Manual on Metric Building Drawing Practice.

## 2 ABBREVIATIONS AND SYMBOLS

- 2.1 The following are typical abbreviations and symbols frequently used in the Contract Documents.

°C	degree(s) Celsius
°F	degree(s) Fahrenheit
°K	degree(s) Kelvin
Ω	ohm(s)
μm	micrometer(s) (commonly called micron)
A	amp or ampere(s)
a.m.	ante meridiem
A/C	air-conditioning
AC	alternating current
AFF	above finished floor
AWG	American Wire Gauge
bhp	brake horsepower
Btu/BTU	British thermal unit
c/c	centre to centre
cc	cubic centimetre(s)
cd	candela
cfm	cubic foot/feet per minute
cfs	cubic foot/feet per second
cm	centimetre(s)
CPU	central processing unit
cu ft	cubic foot/feet
cu yd	cubic yard(s)
dB	decibel(s)
db	dry bulb
DC	direct current
dia	diameter
dm <sup>3</sup>	cubic decimetre
dwg	drawing(s)

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e.g.	for example
ECA	Environmental Compliance Approval
EMT	electrical metallic tubing
F/A	fresh air
fc'	flexural compressive strength
fig	figure(s)
fpm	foot/feet per minute
ft	foot or feet
g	gram(s)
g/cc	gram(s) per cubic centimetre
g/m <sup>2</sup>	gram(s) per metre squared
ga	gauge
gal	gallon(s)
gpm	gallon(s) per minute (equal 1.20 US gpm)
hr	hour(s)
ha	hectare(s)
hp	horsepower
HVAC	heating, ventilating and air conditioning
Hz	hertz
i.d.	inside diameter
igpd	imperial gallons per day
igph	imperial gallons per hour
in.	inch or inches
J	joule(s)
K	kelvin
K-factor	thermal resistance rating
kg	kilogram(s)
kg/°K	kilogram(s) per degree kelvin
kg/m <sup>2</sup>	kilogram(s) per metre squared
km	kilometre(s)
kPa	kilopascal(s)
kPaG	kilopascal gauge
ksi	kip(s) per square inch
kVA	kilovolt-ampere
kvar	kilovar
kW	kilowatt(s)
kWh	Kilowatt hour
L	litre(s)
L/D	length to diameter
L/min	litre(s) per minute
L/m <sup>2</sup>	litre(s) per metre squared
L/s	litre(s) per second
lb	pound(s)

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lb/ft <sup>2</sup>	pound(s) per square foot
lin ft	linear foot/feet
lin m	linear metre
lx	lux
m	metre(s)
m/L	metre(s) per litre
m/s	metre(s) per second
m <sup>2</sup>	metre squared
m <sup>3</sup>	cubic metre
mA	milliampere
max	maximum
mil	0.0254 mm (equal 25.4 µm)
min	minimum
mL	millilitre(s)
mm	millimetre(s)
MPa	mega pascal(s)
MPM	miles per minute
mV	millivolt
N	newton(s)
Nm or NM	newton metre
NPS	nominal pipe size
NPT	national pipe taper
o.c.	on centre
o.d.	outside diameter
o/h	overhead
oz	ounce(s)
PC	personal computer
p.m.	post meridiem
Pa	pascal(s)
pH	hydrogen ion concentration
ph	phase(s)
PLC	programmable logic controller
pphm	parts per hundred million
ppm	parts per million
psf	pound(s) per square foot
psi	pound(s) per square inch
psig	pound(s) per square inch gauge
PVC	polyvinyl chloride
rev	revision
rpm	revolution/rotations per minute
scfm	standard cubic feet per minute
sec	second(s)
spec.	specification(s)
sq m	square metre(s)

ss	stainless steel
t or T	tonne(s) (metric)
t/m <sup>3</sup>	tonne(s)/cubic metre
US gpm	US gallon(s) per minute (equal 0.8327 gpm)
V	volt(s)
VOC	volatile organic compound
W	watt(s)
wb	wet bulb
wc	water column
w.g.	water gauge
Yd	yard(s)

**END OF SECTION**



## 1 GENERAL

- 1.1 When the first letter of a word is capitalized in a sentence in any Specification Section, and that word is not grammatically required to be capitalized, the meaning of that word shall be its defined meaning where a definition is provided in the Contract Documents. Where a word is capitalized and appears as the first word in a sentence, assume that the defined meaning is intended unless it is clear from context that a different meaning is intended. In cases of uncertainty or dispute, TTC will determine the meaning.
- 1.2 Definitions found in the General Conditions and Supplementary Conditions of the Contract apply to all Sections of the Contract Documents.
- 1.3 Notwithstanding definitions found in the General Conditions and Supplementary Conditions of the Contract Documents, definitions listed in this Section and acronyms, abbreviations, and symbols in the following Sections also apply to all Sections of the Specifications:
  - 1.3.1 Section 01 41 00, Regulatory Requirements.
  - 1.3.2 Section 01 42 13, Abbreviations and Symbols.
- 1.4 Terms and definitions provided in other Sections of Division 01 and technical Sections, Divisions 02 through 49, are provided for the purpose of understanding the requirements of the Section in which they appear, and are not intended to be applied to other Sections or parts of the Contract Documents or to referenced standards or codes.

## 2 DEFINITIONS

### 2.1 As-Built Documents:

- 2.1.1 Documents prepared by the Contractor as it constructs the Contract and upon which it documents changes to original Contract Documents. As-Built Documents include, but are not limited to, As-Built Drawings, reviewed Shop Drawings, inspection reports, laboratory test reports, and field test reports.

### 2.2 Construction Equipment:

- 2.2.1 Machinery and equipment, either operated or not operated, and required for preparing, fabricating, conveying, erecting or otherwise performing the Work, but not incorporated into the Work.

### 2.3 Drawings:

- 2.3.1 Issued for Construction Drawings: Drawings prepared by TTC and issued to the Contractor after the issuance of Notice to Proceed.
- 2.3.2 Shop Drawings: Product data, drawings, CADD drawings, erection drawings, diagrams, illustrations, calculations, schedules, performance charts, and brochures that the Contractor provides to illustrate details of portions of the Work. Product data includes cut sheets, standard drawings, technical data, catalogue pages, manufacturer's requirements and instructions for installation, transportation, storage, and handling.

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- 2.3.3 Marked-up Shop Drawings: Red line mark-up of, but not limited to, the following: reviewed Shop Drawings, sketches, illustrations, diagrams, Product catalogue cuts, and CADD drawing(s) prepared by the Contractor to document changes that occurred during the installation of the Product(s).
- 2.3.4 As-Built Drawings: Red line mark-up of Issued for Construction Drawings prepared by the Contractor during the construction of the Contract to document actual locations of building components and changes.
- 2.4 **Non-Operating Hours:**
- 2.4.1 Time when the Subway systems are closed to public service. Only work trains are in operation. These periods are approximately:
- 2.4.1.1 Monday to Saturday: 2:30 a.m. and 5:00 a.m.
- 2.4.1.2 Sunday: 2:30 a.m. (1:00 a.m. for HLRT) and 6:30 a.m.
- 2.4.1.3 Maximum Work period during the Non-Operating Hours:
- 2.4.1.3.1 Monday to Saturday: One-and-a-half (1.5) hours, (three (3) hours for HLRT).
- 2.4.1.3.2 Sunday: Three-and-a-half (3.5) hours (five (5) hours for HLRT).
- 2.5 **Non-Public Areas:**
- 2.5.1 Areas of the transit system, such as service areas, accessible to TTC staff only.
- 2.6 **Off-Peak Hours:**
- 2.6.1 Time during the Day when the subway station does not experience heavy passenger usage:
- 2.6.1.1 Monday to Friday: Between 10:00 a.m. and 3:30 p.m., and after 7:00 p.m.
- 2.6.1.2 Saturday and Sunday: All Day.
- 2.7 **Off-Track Work Zone:**
- 2.7.1 Work area at Track Level where approved physical means (usually requiring the installation of hoarding) are established to prevent encroachment into dynamic envelope of trains, and is beyond limits of approach to subway vehicle traction power.
- 2.8 **Peak Hours:**
- 2.8.1 Time during the Day when all modes of the transit system experience heavy passenger usage:
- 2.8.1.1 As defined in the Subway/SRT Rule Book: 6:30 a.m. to 10:00 a.m. and 3:30 p.m. to 7:00 p.m. local time, Monday through Friday, or any other times as determined by the TTC.
- 2.9 **Provide:**
- 2.9.1 Supply and install.

**2.10 Public Areas:**

2.10.1 Area of the transit system accessible to passengers using the transit system.

2.10.1.1 During severe winter weather conditions, transit vehicles may be stored within station areas or may be operated during Non-Operating Hours. After these periods TTC operations shall take precedence over scheduled Work and associated costs will not be reimbursed by TTC. No claim will be accepted. Time lost, if any, for loss of night Work, will be given to the Contractor as non-compensable time extension.

**2.11 Safe Work Method:**

2.11.1 Method of work developed and proposed by the Contractor, where the Work to be performed at Track Level can be carried out safely without requiring a power cut.

**2.12 Section:**

2.12.1 Throughout the Contract Documents, the term Section means Section as defined by SectionFormat™ (a joint publication of the Construction Specifications Institute and Construction Specifications Canada).

**2.13 Senior Construction Inspector:**

2.13.1 The authorized representative of TTC under the Contract, responsible for the inspection, examination, on site work acceptance and preparation of reports on Work. The Senior Construction Inspector ensures that Work is performed in accordance with the Contract Documents.

**2.14 Temporary Work:**

2.14.1 Temporary supports, structures, facilities, services, and other temporary items, excluding Construction Equipment, required for execution of the Work, but not incorporated into the Work.

**2.15 Track Level:**

2.15.1 As defined in the Subway/SRT Rule Book: Any location off station platform, past platform end gate, wall to wall (any part of tunnel structure), fence to fence (any property between fences in an open cut area or any area within a Yard Area) or catwalk. Subway/SRT Rule Book Training is required in accordance with Section 01 59 00.

**2.16 Work Zone:**

2.17 As defined in the Subway/SRT Rule Book: Area identified with track-level warning devices to show where employees are working at Track Level. There are three (3) types of Work Zone: Minor, major, and impassable.

2.17.1 Only impassable Work Zone is permitted for the performance of the Work at Track Level without power cut.

**END OF SECTION**



**1 GENERAL**

- 1.1 Key contractor personnel to be committed for the duration of the Contract and to be employed directly by the Contractor.
- 1.2 Key contractor personnel to be dedicated exclusively to the Contract as specified in this Section.
- 1.3 Key contractor personnel to fulfill at minimum the qualification, experience, and roles and responsibilities specified in this Section.
- 1.4 If key contractor personnel is replaced prior to Contract Completion, at a minimum, the new key contractor personnel is to have equal qualifications and experience to the original key contractor personnel, in accordance with Section 00 72 00.
- 1.5 TTC has the right to require either temporary or permanent removal from the Site of any person employed in any capacity by the Contractor, if they do not meet the minimum qualification and experience or fulfill the roles and responsibilities specified in this Section.

**2 ACRONYMS**

- 2.1 AODA: Accessibility for Ontarians with Disabilities Act.
- 2.2 CDR: Contract Document Records.
- 2.3 CPR: Cardiopulmonary resuscitation.
- 2.4 CV: Curriculum vitae.
- 2.5 IHSA: Infrastructure Health & Safety Association.
- 2.6 ISO 9001: International standard specifying requirements for quality management systems.
- 2.7 JHSC: Joint Health and Safety Committee.
- 2.8 MOL: Ministry of Labour.
- 2.9 QMS: Quality Management System.
- 2.10 RFI: Request for information.
- 2.11 RFQ: Request for qualifications.
- 2.12 TRCA: Toronto and Region Conservation Authority.
- 2.13 WHMIS: Workplace Hazardous Materials Information System.
- 2.14 WSIB: Workplace Safety and Insurance Board.

**3 SUBMITTALS**

- 3.1 Submit in accordance with Section 01 33 00.
- 3.2 Submit the following prior to commencing the Work:
  - 3.2.1 Qualification of key Contractor personnel:
    - 3.2.1.1 Capsule CV of qualification and experience. Do not include generic CVs or company brochures.

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- 3.2.1.2 Directly related and relevant experience obtained in the proposed key contractor personnel role.
  - 3.2.1.2.1 Include a minimum of three (3) representative similar projects of comparable complexity and scope of the Work, completed by the key contractor personnel within the past ten (10) years from the Contract award date.
  - 3.2.1.2.2 Of the minimum three (3) representative similar contracts, at least one (1) shall be in excess of \$1 million CDN.
  - 3.3 Submit the following documents prepared by construction staging and traffic control expert:
    - 3.3.1 Construction Staging Traffic and Logistics Plan.
    - 3.3.2 Disruption management documents and other notices and plans.
    - 3.3.3 Communications Plan.
  - 4 PROJECT MANAGER**
    - 4.1 Dedication to Contract:
      - 4.1.1 Provide one (1) project manager dedicated to the Contract on a 25% part time basis.
    - 4.2 Qualification:
      - 4.2.1 Registered as a Professional Engineer (P. Eng.) or Certified Engineer Technologist (C.E.T.) in the Province of Ontario.
      - OR**
      - 4.2.2 Completed a two (2) year community college program combined with a minimum of five (5) years' work experience in construction.
      - OR**
      - 4.2.3 Completed a one (1) year community college program combined with a minimum of ten (10) years' work experience in construction.
      - OR**
      - 4.2.4 Attained a minimum of fifteen (15) years' work experience in construction.
    - 4.3 Experience:
      - 4.3.1 Minimum five (5) years' work experience as project manager, obtained on contracts of comparable complexity and scope.
    - 4.4 Roles and responsibilities:
      - 4.4.1 Holds authority to commit the Contractor to decisions made with TTC.
      - 4.4.2 Nominated as construction project team lead with overall responsibility for successful and timely delivery of the Contractor's obligations under this Contract.
      - 4.4.3 Nominated as single official point of contact between TTC and Contractor on technical and administrative matters throughout the duration of the Contract.
      - 4.4.4 Nominated as key team member for all liaisons with TTC or third parties on technical and administrative matters throughout the duration of the Contract.
      - 4.4.5 Nominated as key team member responsible for all technical or administrative reporting requirements throughout the duration of the Contract.

- 4.4.6 Nominated as key team member responsible for review of technical or administrative submittals throughout the duration of the Contract.
- 4.4.7 Ensures Subcontractors comply with Contract requirements.
- 4.4.8 Coordinates the activities of construction project team.
- 4.4.9 Coordinates the activities of Subcontractors.
- 4.4.10 Represents the construction project team at all meetings or presentations and addresses all issues raised by TTC.
- 4.4.11 Oversees billing related issues.
- 4.4.12 Oversees scheduling and field activities.
- 4.4.13 Oversees Contract Documentation.
- 4.4.14 Reviews and signs final reports.
- 4.4.15 Responds on time to all Work matters upon the request of TTC.
- 4.4.16 Ensures employees and Subcontractors adhere to company's health and safety policy.
- 4.4.17 Performs other duties which normally are the project manager's responsibility.

## **5 SITE SUPERINTENDENT**

- 5.1 Dedication to Contract:
  - 5.1.1 Provide one (1) Site superintendent dedicated to the Contract on a full time basis.
- 5.2 Qualification:
  - 5.2.1 At minimum, university or community college graduate in a relevant engineering or architectural technology discipline.
  - OR**
  - 5.2.2 Possessor of a certificate of qualification in a skilled construction trade.
  - OR**
  - 5.2.3 Completed a two (2) year community college program combined with a minimum of five (5) years' work experience in construction.
  - OR**
  - 5.2.4 Completed a one (1) year community college program combined with a minimum of ten (10) years' work experience in construction.
  - OR**
  - 5.2.5 Attained a minimum of fifteen (15) years' work experience in construction.
  - 5.2.6 Training, at minimum:
    - 5.2.6.1 Possessor of a valid WSIB JHSC Certification Part 1 Basic, Part 2 Hazard Specific.
    - 5.2.6.2 Valid Standard First Aid/CPR/AED.
    - 5.2.6.3 WHMIS Awareness.
    - 5.2.6.4 Working at Heights - Fall Prevention Training.
    - 5.2.6.5 Accessible Customer Service Training.

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**6 PROJECT COORDINATOR**

6.1 Dedication to Contract:

6.1.1 Provide one (1) project coordinator, dedicated to the Contract on a 50% part time basis.

6.2 Qualification:

6.2.1 At minimum, university or community college graduate in a relevant engineering or architectural technology discipline.

**OR**

6.2.2 Possessor of a certificate of qualification in a skilled construction trade.

**OR**

6.2.3 Completed a two (2) year community college program combined with a minimum of three (3) years' work experience in construction.

**OR**

6.2.4 Completed a one (1) year community college program combined with a minimum of six (6) years' work experience in construction.

**OR**

6.2.5 Attained a minimum of ten (10) years' work experience in construction.

6.3 Experience:

6.3.1 Minimum two (2) years' experience as a project coordinator, obtained on contracts of comparable complexity and scope.

6.3.2 Minimum one (1) year experience in construction, obtained on contracts of comparable complexity and scope.

6.4 Roles and responsibilities:

6.4.1 Assists the project manager and site superintendent in administrative and field duties. The duties and responsibilities include, but are not limited to:

6.4.1.1 Coordinates activities of the construction project team and Subcontractors.

6.4.1.2 Attends construction meetings in accordance with Section 01 31 19 and addresses issues raised by TTC.

6.4.1.3 Interprets the Contract Documents to ensure Work is completed as specified.

6.4.1.4 Generally reviews the Work, materials, and methods to ensure the requirements of the Contract Documents are met in a safe manner with the requisite quality.

6.4.1.5 Reviews Contract submittals and Shop Drawings for conformance with the Contract Documents prior to submitting to TTC.

6.4.1.6 Monitors the timelines of submissions to ensure the Work is not delayed by late submissions and reviews.

6.4.1.7 Prepares and reviews RFI and RFQ submissions for completeness prior to submitting to TTC.

6.4.1.8 Prepares and reviews Monthly Progress Payment submissions for completeness prior to submitting to TTC.

6.4.1.9 Prepares and reviews CDR responses for completeness prior to submitting to TTC.

6.4.1.10 Performs other duties which are normally the project coordinator's responsibility.



<b>7</b>	<b>CONSTRUCTION STAGING AND TRAFFIC CONTROL EXPERT</b>
7.1	Dedication to Contract:
7.1.1	Provide one (1) construction staging and traffic control expert dedicated to the Contract on a 25% part time basis.
7.2	Qualification:
7.2.1	At minimum, university or community college graduate in a relevant engineering or architectural technology discipline.
	<b>OR</b>
7.2.2	Possessor of a certificate of qualification in a skilled construction trade.
	<b>OR</b>
7.2.3	Completed a two (2) year community college program combined with a minimum of three (3) years' work experience in construction.
	<b>OR</b>
7.2.4	Completed a one (1) year community college program combined with a minimum of six (6) years' work experience in construction.
	<b>OR</b>
7.2.5	Attained a minimum of ten (10) years' work experience in construction.
7.2.6	Training at minimum:
7.2.6.1	Traffic Control - Temporary Work Zones (IHSA or equivalent).
7.3	Experience:
7.3.1	Minimum one (1) year experience as a construction staging and traffic control expert, obtained on contracts of comparable complexity and scope.
7.3.2	Minimum five (5) years' experience in construction, obtained on contracts of comparable complexity and scope.
7.4	Roles and responsibilities:
7.4.1	Nominated as direct liaison with TTC and authorities having jurisdiction on all matters pertaining to staging, traffic, and construction logistics.
7.4.2	Holds authority to commit the Contractor to subject matter decisions.
7.4.3	Coordinates and monitors permitting, staging, traffic, and logistics efforts.
7.4.4	Prepares, submits, and maintains a Construction Staging, Traffic and Logistics Plan.
7.4.5	Prepares, submits, and maintains (or is involved in the preparation and maintenance of) disruption management documents, and other notices and plans as required.
7.4.6	Works jointly with [Construction Community Communications Officer,] TTC, or other authorities having jurisdiction, to prepare, submit, and maintain a Communications Plan.
7.4.7	Attends and represents the Contractor at meetings. Convenes traffic meetings as required throughout the Contract.
7.4.8	Provides constant updates on Work being performed, utility impacts, detours, road closures, and other construction activities affecting the community.
7.4.9	Promptly responds to emergency situations.

- 7.4.10 Coordinates construction activities with private utilities and other construction teams to minimize impacts to the community.
- 7.4.11 Ensures that modified existing and temporary sidewalks, bus stops, and other pedestrian areas are well-marked and compliant with AODA and its Regulations. Coordinates installation of temporary traffic lanes and temporary sidewalks for the convenience of the public.
- 7.4.12 Ensures use of competent traffic control personnel, signs, signals, flasher beacons, delineators, and barricades as required.
- 7.4.13 Ensures Work is conducted in a manner that causes least interference with community.
- 7.4.14 Complies with arrangements made with authorities having jurisdiction.
- 7.4.15 Makes provisions at affected streets, driveways, and property entrances for the free passage of vehicles and pedestrians.
- 7.4.16 Coordinates multiple-stage traffic restrictions and closures.
- 7.4.17 Provides sufficient advanced written notice and coordinates with traffic and police authorities and TTC in restriction or closure of any intersection, street or lane. Coordinates all aspects of control of pedestrian, cyclist, vehicular, and construction operation traffic.
- 7.4.18 Under the direction of the police and traffic authorities and in accordance with the Ontario Traffic Manual Book 7 – Temporary Conditions, ensures provision of supplies, erection, maintenance, and subsequently removal of signs, signals, flasher beacons, and delineators, which are required by the traffic authorities for the diversion and guidance of vehicular and pedestrian traffic.
- 7.4.19 Arranges for the fabrication of signs and markers in accordance with the requirements of traffic authorities. Coordinates design, labour, Products, equipment, tools, supervision, and services as applicable and necessary for existing, temporary and new signage in accordance with Contract Documents and Ontario Traffic Manual and the requirements of traffic authorities.
- 7.4.20 Ensures compliance with maximum allowable periods of restrictions and closure.
- 7.4.21 Coordinates planning of location of Site access ramps to accommodate acceptable haul routes.
- 7.4.22 Coordinates provision of access roads, sidewalk crossings, ramps, and construction runways as may be required for access to the Work. Ensures access routes, sidewalks, Site roads, trailer area, storage areas, and Work areas are kept free of ice and snow. Coordinates prompt snow clearing from Site.
- 7.4.23 Arranges for and ensures temporary facilities, such as garbage receptacles, portable toilets, storage areas, and fencing, do not adversely impact a residence or business.
- 7.4.24 Coordinates construction parking on the street or private property as required.
- 7.4.25 Performs other duties which are described in Section 01 55 26 and are in accordance with scope of requested services of the construction staging and traffic control expert.

## **8 QUALITY MANAGER**

### **8.1 Dedication to Contract:**

- 8.1.1 Provide one (1) quality manager, dedicated to the Contract on a 25% part time basis.

- 8.2 Qualification:
- 8.2.1 Completed a two (2) years community college program combined with a minimum of three (3) years' work experience in construction.
- OR**
- 8.2.2 Completed a one (1) year community college program combined with a minimum of six (6) years' work experience in construction.
- 8.3 Experience:
- 8.3.1 Minimum two (2) years' experience as a quality manager obtained on contracts of comparable complexity and scope.
- 8.3.2 Minimum six (6) years' experience in construction, obtained on contracts of comparable complexity and scope.

## **9 SCHEDULER**

- 9.1 Dedication to Contract:
- 9.1.1 Provide one (1) scheduler, dedicated to the Contract on a 25% part time basis.
- 9.2 Qualification:
- 9.2.1 At minimum, university or community college graduate in a relevant engineering or architectural technology discipline.
- 9.2.2 PMI Scheduling Professional designation from Project Management Institute (PMI) is preferred.
- 9.3 Experience:
- 9.3.1 Minimum three (3) years' experience in scheduling and the application and analysis of computerized CPM network techniques and scheduling principles for construction contracts of the magnitude and complexity of this Contract.
- 9.4 Roles and responsibilities:
- 9.4.1.1 Holds responsibility to create, updater, and maintain schedules as specified in Section 01 32 16 for the planning, scheduling, management, and execution of the Work in accordance with the Contract Documents.
- 9.4.1.2 Attends construction meetings in accordance with Section 01 31 19 and addresses issues raised by TTC.

## **10 SAFETY PROFESSIONAL**

- 10.1 Provide one (1) safety professional for the Contract.
- 10.2 Dedication to Contract, qualification, training, and experience in accordance with Section 01 59 00.
- 10.3 Roles and Responsibilities:
- 10.3.1 Reports to the Contractor's corporate management team and not the Project Manager or the Site Superintendent.
- 10.3.2 Holds the authority to stop Work that is likely to endanger without fear of reprisal.

- 10.3.3 Holds the authority to report safety issues to the Contractor's company management team without fear of reprisal.
- 10.3.4 Is available on short notice when required and for the duration of the Contract.
- 10.3.5 Performs other duties which in accordance with scope of requested services are the safety professional's responsibility.

**END OF SECTION**

**1 TEMPORARY CONTROLS****1.1 General**

1.1.1 Temporary controls: Refer to the temporary site enclosures (including, but not limited to, hoarding, main line hoarding, fencing, covered walkways, canopies, guards and barriers around openings, weather enclosures, debris chutes, dust-tight partitions) and other types of protection.

1.1.2 Refer to Contract Drawings for required temporary controls.

**1.2 Submittals:**

1.2.1 Submit the following in accordance with Section 01 33 00:

1.2.1.1 Submit Shop Drawings in accordance with Section 01 33 23 for dust-tight partitions:

1.2.1.1.1 Stamped and signed by a Professional Engineer, licensed in the Province of Ontario, experienced in performing the design, inspection and installation certification services for temporary controls.

1.2.1.1.2 Submit for review prior to the erection of Work including, but not limited to, the following:

1.2.1.1.2.1 The codes used as basis for design.

1.2.1.1.2.2 Design loads (as applicable).

1.2.1.1.2.3 Material requirements.

1.2.1.1.2.4 Details necessary to describe the Work.

1.2.1.1.2.5 Connection and anchorage details.

1.2.1.1.2.6 Plan and section views.

1.2.1.1.2.7 Work required to restore existing finishes.

1.2.1.1.2.8 Temporary electrical lighting/systems to remain. Include all demolished and/or replaced items.

1.2.1.1.2.9 [Other].

1.2.1.2 Certificates:

1.2.1.2.1 Upon erection, inspect [main line hoarding] and submit installation certification stating compliance with the design requirements.

**1.2.2 Closeout Submittal:**

1.2.2.1 Provide As-Built Drawings for temporary electrical lighting/systems to remain.

**1.3 Installation and Removal:**

1.3.1 Provide temporary controls before commencing with the Work.

1.3.2 Maintain temporary controls in good state of repair during the construction period.

1.3.3 Remove from Site all temporary controls after the Work is completed.

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- 1.3.4 **Temporary Work Area within Operating TTC Facilities:**
- 1.3.4.1 Before commencing any Work outside of hoarded areas described above, but within an operating TTC Facility (i.e. Carhouse, Bus Garage, Subway Station, etc.), supply, erect and maintain a temporary separation around the Work area consisting of fencing, signs, delineators, flashers [ ] mm high around entire perimeter of temporary work area to protect the public, TTC employees and private property from injury or damage.
- 1.3.5 Ensure that TTC and the management of TTC Facility are informed of the Work being performed in the temporary Work area in advance of the Work commencement and that temporary signage is installed noting the nature of work being performed and any dangers that may result from the.
- 1.4 **Dust-tight Partitions:**
- 1.4.1 Before commencing operations, install dust-tight partitions during [Non-Operating Hours] [Restricted Non-Operating Hours].
- 1.4.2 Repair immediately dust-tight partitions that have been deemed to be unsafe. Remove or paint over graffiti immediately, wash the surface of partitions when required. Repair and restore to original condition any part of the original structure damaged as a result of the installation of the dust-tight partitions.
- 1.4.3 At Contract Completion, remove installed dust-tight partitions unless otherwise directed during [Non-Operating Hours] [Restricted Non-Operating Hours].
- 1.4.4 Mechanically fasten studs from floor to underside of structure.
- 1.4.5 Provide cross-bracing as indicated on Contract Drawings.
- 1.4.6 Wash the surface of the partitions when required. Except for Workers and authorized TTC staff, prohibit access through these partitions.
- 1.4.7 Access doors or gates provided in dust-tight partitions or other barriers/barricades or fencing shall open in towards the Work area.
- 1.4.8 Fit the access points with security hardware as follows:
- 1.4.8.1 One-and-a-half (1-1/2) pair butts: B411 - 125 mm x 100 mm - WS, in accordance with ANSI/BHMA A156.1. The pins shall be non-removable from both sides.
- 1.4.8.2 Two (2) hinged hasps: 6-224-150 mm, in accordance with ANSI/BHM A156.1.
- 1.4.8.3 Two (2) padlocks: Schlage 45-121 x G Broaching.
- 1.4.8.4 Two (2) additional staples for locking in open position plus the necessary screws which shall be non-removable.
- 1.4.9 Alternate security hardware must be approved by TTC prior to installation.
- 1.4.10 **Painting Dust-Tight Partitions:**
- 1.4.10.1 Painting of temporary partitions in Non-Public Areas is not required.
- 1.4.10.2 Paint the partitions on the public side with a high gloss, fast drying paint of colour and material compatible with the station finish and mark with POST NO BILLS signs.
- 1.4.10.3 Paint the partitions at the beginning of the Contract and once every month thereafter, during Non-Operating Hours. Paint two (2) horizontal yellow bands using reflective yellow paint as indicated on Contract Drawings.

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**1.4.11 Dust-tight partitions with gypsum boards for one (1) hour fire rating (Type B):**

1.4.11.1 Refer to Standard Drawing S01500.51.

**2 PROTECTION**

2.1 Protection of Public and Station Area:

2.1.1 Protect surrounding private and public property from damage during performance of the Work.

2.1.2 Fully cover openings over [track] [and] [Public Areas] to protect against falling articles during transit operation periods.

2.1.3 Design, construct and remove upon completion of the Work, screens, debris platforms, chutes and other types of protection as required to confine debris and construction materials to Work areas to prevent same from falling onto Track Level, roadways, sidewalks, Public Areas or areas used by TTC's personnel. Submit Shop Drawings in accordance with submittals as described in this Section.

2.1.4 Provide and maintain, at all times, appropriate protection to fully weatherproof all areas [of the facility] which may become exposed due to demolition, removals, and construction. Prevent ingress of water, snow, etc., into the station interior or building components. All costs for clean-up and restoration of damages resulting from failure to comply shall be the responsibility of the Contractor.

**2.2 Protection of Existing Equipment:**

2.2.1 Cover TTC's existing equipment and plant within the Site with 4 mil PVC sheet or equal, taped to make it dust-tight.

2.2.2 Equipment and existing Work moved or altered to facilitate construction, movement of material or equipment shall be stored and protected with dust-tight covers and subsequently returned to its original location.

2.2.3 The approval of TTC is required for the installation of temporary support devices into existing roof or wall members for the erection of equipment or machinery. Repair roof and wall members used for this purpose to restore them to their original condition. Provide necessary screens, covers and hoardings as required.

2.2.4 All existing (in use) and new equipment damaged while carrying out the Work shall be restored with new Products matching the original equipment at no additional cost to TTC.

**3 SECURITY**

3.1 Any security service provided by TTC on the Site is for the protection of TTC's interest in the Work and shall not relieve the Contractor of the responsibility to protect the Site and the Work of the Contract.

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**4 TEMPORARY UTILITIES**

**4.1 Installation and Removal:**

4.1.1 Provide temporary utilities controls in order to execute Work expeditiously.

4.1.2 Make the necessary arrangements for, and pay all costs for temporary services, including, but not limited to:

4.1.2.1 Equipment for utilities consumed.

4.1.2.2 Costs for utilities consumed.

4.1.2.3 Permits for temporary utilities which fall under Contractor's responsibility. Refer to Section 01 11 00.

**4.2 Temporary Electrical Plant and Temporary Lighting System:**

**4.2.1 General Supply and Installation:**

4.2.1.1 Make the necessary arrangements for, and pay the costs for, a temporary electrical service including the costs of energy consumed.

4.2.1.2 Provide the type and quantity of lighting equipment in each location to ensure adequate, continual illumination twenty-four (24) hours per Day, seven (7) Days per week. Barriers, signs, stairs, public passageways/areas shall be illuminated in accordance with Ontario's Building Code (OBC).

4.2.1.3 Install neatly and support adequately the electrical plant and distribution in locations approved by TTC.

4.2.1.4 Arrange for inspection by Electrical Safety Authority (ESA) at no additional cost to TTC. Submit inspection reports and certificates to TTC for review prior to use.

4.2.1.5 Upon Contract Completion, remove temporary installations.

**4.2.2 Temporary Electrical Plant and Temporary Lighting System - Existing Structure:**

4.2.2.1 Electrical power from duplex convenience outlets (wall receptacles on 15 A, 120 V circuits) within the Site may be used except those being actively used by TTC. Where these outlets are used as a supply for tools and portable equipment outdoors or in wet locations, fit outlets with GFCI.

4.2.2.2 In location where power is required in excess of duplex convenience outlets, power may be obtained from existing AC Switchboard subject to a load study for confirmation of spare capacity availability. Provide for the following:

4.2.2.2.1 Hire a third party to complete the load study at no additional cost to TTC.

4.2.2.2.2 Coordinate with TTC to complete load study and its review by the stakeholders.

4.2.2.2.3 Provide thirty (30) Days' notice to complete the load study and its review by the stakeholders.

4.2.2.2.4 Carry the cost of load study, electrical hook-up arrangements, ESA inspection and monthly power consumption revenue billing.

4.2.2.2.5 Provide any additional equipment (e.g., disconnect switch, splitter, circuit breaker, revenue meter/enclosure, cable, conduit, etc.) to TTC workers for final installation and/or termination to the existing AC Switchboard.



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- 4.2.2.2.6 If the load study proves that additional spare capacity for electrical load is not available in the existing AC Switchboard, arrange with the local utility company in accordance with their terms and conditions and obtain electrical power at no additional cost to TTC.
- 4.3 Temporary Water Usage:**
- 4.3.1 Temporary Water Usage - Supply and Installation in New Construction, Existing Structure and Temporary Buildings:
- 4.3.1.1 Supply and install a temporary water meter at connections to existing water supply piping. The costs for equipment, piping, piping heat tracing, piping insulation and water consumed shall be the responsibility of the Contractor. Location of such connections shall be as approved by TTC.
- 4.3.1.2 No connections shall be made to existing taps, hose bibs or faucets without prior approval of TTC.
- 4.3.2 Temporary Water Shutdown:
- 4.3.2.1 If in the performance of Work, it is necessary to shut off the facility water supply either completely or partially, Contractor shall inspect and operate before and after the shut-off, in the presence of TTC, plumbing fixtures, devices and equipment affected by the shut-off to ensure their proper operation.
- 4.4 Temporary Heating:**
- 4.4.1 Temporary Heating - Supply and Installation in New Construction and Existing Structure:
- 4.4.1.1 Provide temporary heating required during construction period including attendance, maintenance and fuel.
- 4.4.1.2 Temporary fuel fired heating devices to meet OHSA requirements.
- 4.4.1.3 Construction heaters used inside buildings must be vented to the outside or be flameless type. Solid fuel salamanders are not permitted.
- 4.4.1.4 Maintain temperatures of minimum 10°C in areas where construction is in progress unless otherwise indicated in the Specifications. [Maintain the areas beneath temporary road decking at a temperature of 5°C minimum at all times to protect exposed and adjacent services from freezing.] Repair at no additional cost to TTC any such services, buildings or other utilities disrupted by freezing.
- 4.4.1.5 Ventilate heated areas and keep structures free from exhaust combustion gases.
- 4.4.1.6 When Work takes place in an occupied area of an existing facility, and the permanent heating system is reduced or cut, provide sufficient temporary heating for the adjacent occupied areas.
- 4.5 Environmental Controls for Product Installation:**
- 4.5.1 The optimal environment for installation and application of Products shall be defined in accordance with their respective specifications and manufacturer's instructions.
- 4.5.2 To the extent practical, schedule Work to periods where ambient conditions are optimal for installation of the respective Product(s).
- 4.5.3 Where ambient conditions are not optimal provide temporary heating, cooling, humidification and/or dehumidification as required.

**Section 01 50 00**  
**CONSTRUCTION FACILITIES,**  
**TEMPORARY CONTROLS AND UTILITIES**  
**Page 6**

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- 4.5.4 Where specified Product(s) cannot be installed at the ambient conditions encountered, the Contractor may propose alternative Products in accordance with Section 01 62 00.
  - 4.5.5 Provide ventilation in accordance with applicable regulations and Product recommendations.
  - 4.5.6 Supervise operation of environmental controls (such as HVAC equipment) where the Work may be damaged by exposure to ambient conditions.
  - 4.6 **Elevators and Escalators:**
  - 4.6.1 Elevators and escalators shall not be used by construction personnel or for the transport of construction materials or equipment.
  - 4.7 **Potable Drinking Water and Sanitary Facilities:**
  - 4.7.1 Supply, install, and maintain in a clean condition in accordance with the OHSA and Regulations for Construction Projects:
    - 4.7.1.1 Potable drinking water.
    - 4.7.1.2 Sanitary facilities.
  - 4.7.2 Remove accommodations upon Contract Completion.
  - 4.7.2.1 One (1) master key shall be issued for access to the station Washroom facilities. This key remains the property of TTC and shall be returned to TTC promptly upon completion of the Work. Washroom facilities shall not be used for purposes other than personal hygiene.
    - 4.7.2.1.1 Contractor will be charged \$250 per key for each key that is lost or not returned to TTC.
  - 4.7.3 Smoking on TTC property is prohibited.
  - 5 **POWER WASHING AND VIDEOTAPING OF SANITARY AND STORM DRAINAGE SYSTEM**
  - 5.1 Power wash and videotape storm and sanitary drainage systems in accordance with this Section on two (2) occasions:
    - 5.1.1 Prior to construction activities.
    - 5.1.2 Prior to scheduling commissioning for final acceptance.
  - 5.2 Power wash and videotape all storm and sanitary drains within the new Station Manager's Office and Zone Hub areas and fareline area to extent required to confirm drainage systems are clear of debris.
  - 5.3 Coordinate and schedule with Work by plumbing trade. Power wash to remove existing drainage system debris and any construction debris. Drainage systems to be protected from debris at all times during construction.
  - 5.4 Repeat power washing and videotaping process where debris not cleared to satisfaction of TTC.
  - 5.5 Submit the following:
    - 5.5.1 Schedule for power washing and videotaping:
      - 5.5.1.1 Notify TTC a minimum of two (2) weeks in advance of scheduling power washing and videotaping. TTC may attend at their discretion.

- 
- 5.5.2 Power washing report identifying level of debris encountered.
  - 5.5.3 Videotape confirming drainage systems clear of debris.
  - 5.5.4 Videotape index correlating videotape counter with drawing entry points and distance travelled through drainage system (refer to Standard Drawings S01500.11 and S01500.12 attached).
  - 5.5.5 Drawings indicating system entry points (video start points) and extent of videotaping (video stop points) corresponding to videotape counter (refer to Standard Drawings S01500.11 and S01500.12 attached):
    - 5.5.5.1 Storm drainage system: Identify all the following fixtures and equipment on Drawings. Refer to the Contract Drawings for extent and details of the drainage system:
      - 5.5.5.1.1 Roof drains.
      - 5.5.5.1.2 Cleanouts.
      - 5.5.5.1.3 Rain water leaders (RWLs).
      - 5.5.5.1.4 Drainage piping.
      - 5.5.5.1.5 Underground storm mains.
      - 5.5.5.1.6 Maintenance holes/catch basins.
    - 5.5.5.2 Sanitary drainage system: Identify following fixtures and equipment on the Drawings. Refer to the Contract Drawings for extent and details of the drainage system:
      - 5.5.5.2.1 Cleanouts.
      - 5.5.5.2.2 Floor drains.
      - 5.5.5.2.3 Area drains/catch basins.
      - 5.5.5.2.4 Drainage piping.
      - 5.5.5.2.5 Underground sanitary mains.
      - 5.5.5.2.6 Maintenance holes.
- 6 PROJECT IDENTIFICATION**
- 6.1 The display of signs without TTC written consent is forbidden.
  - 6.2 Remove signs upon Contract Completion.
- 7 SITE MAINTENANCE**
- 7.1 Maintain the Site and adjacent areas in a clean and orderly condition, free from debris and other objectionable matter. Remove rubbish and surplus material, equipment and structures immediately. If the Site is not cleaned within twenty-four (24) hours after the Contractor has been instructed to do so, TTC may make arrangements to clean the Site and retain the cost from monies due, or to become due, to the Contractor.

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**8 PUBLIC CONVENIENCE AND SAFETY**

8.1 A floor area of approximately 10 m<sup>2</sup> will be provided in vicinity of Site for Contractor's storage. Provide suitable lock-up facilities for storage of tools and Products to the approval of TTC.

8.2 Station Facilities:

8.2.1 Do not use Service Rooms within the Station including, but not limited to, Cleaner's Rooms and janitor's closets for Contractor's storage or any other purpose.

**9 ACCESS AND EGRESS TO SITE**

9.1 Access and egress to operating subway system: Site access and egress shall be as indicated on Contract Drawings.

**10 PARKING**

10.1 No cars or trucks shall be parked on TTC's property without the approval of TTC. TTC shall not be held responsible for damage that may occur to any vehicle operated upon or parked upon TTC property.

**11 SITE VISITORS**

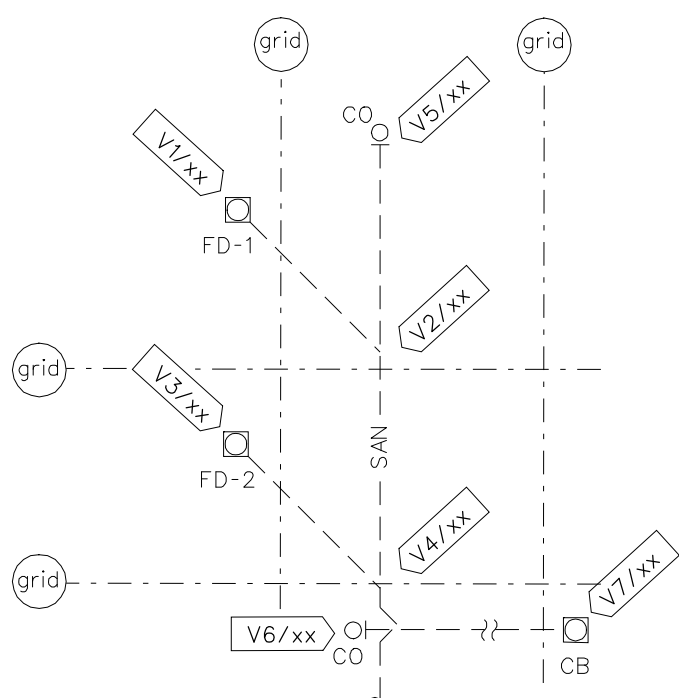
11.1 During the progress of the Work, facilitate access to authorized visitors and personnel authorized by TTC to carry out inspections and testing.

11.2 Ensure Site visitors wear appropriate safety apparel.

**12 SITE HAZARDS**

12.1 Refer to Section 01 59 00.

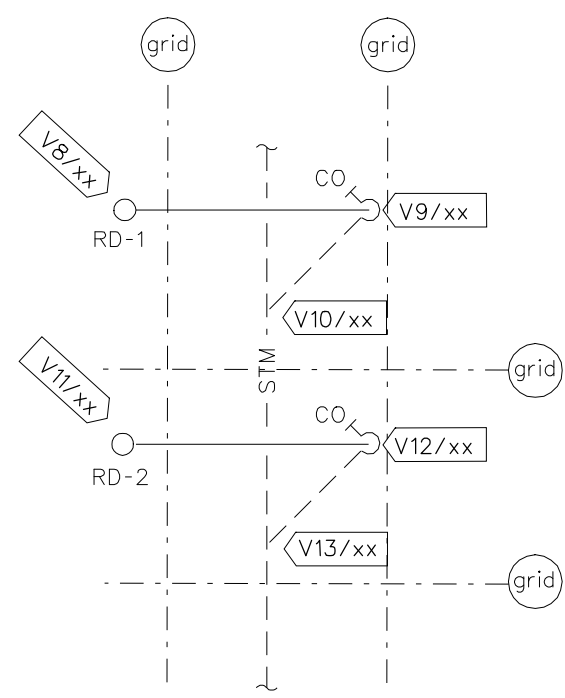
**END OF SECTION**



# PARTIAL PLAN

TYPICAL SANITARY DRAINAGE

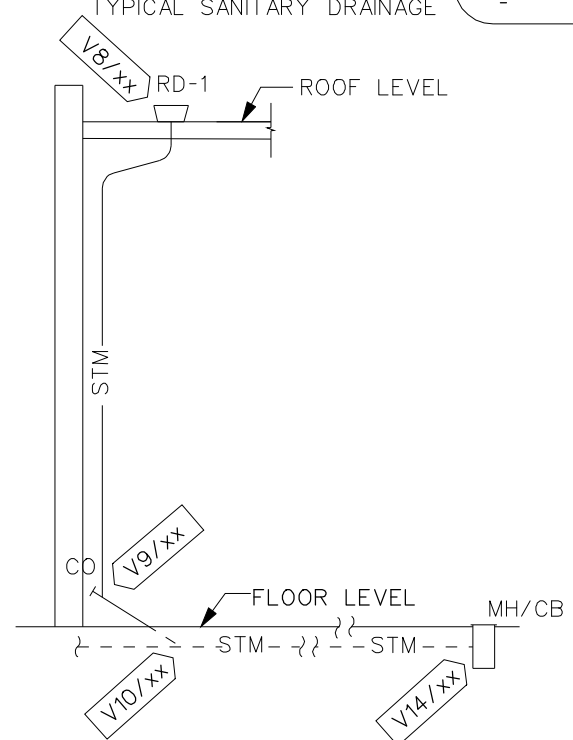
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# PARTIAL PLAN

TYPICAL STORM DRAINAGE

2  
-



# ELEVATION


TYPICAL STORM DRAINAGE

3  
-

VIDEO TAPE INDEX	
START TO END POINT	TIME (SECONDS)
V1 TO V2	xx
V3 TO V4	xx
V5 TO V4	xx
V8 TO V9	xx
V9 TO V10	xx

Filename Standards/standard\_dwgss01/final/S0150011.dgn

Plot date: 12-JUN-2008

Drawing <b>STANDARD</b>		Title <b>SANITARY &amp; STORM LINES FOR VIDEO TAPE INDEX</b>	
Drawn <b>e.LABERINTO</b>	Checked <b>M. BORAGINA</b>	Corrected <b>B. O'NEILL</b>	
Scale <b>Plotted Drawing Not To Scale</b>	Status <b>DRAFT</b>	Date <b>2007/09/30</b>	Dwg No. <b>S01500.11</b>
		Rev. <b>P3</b>	 <b>Toronto Transit Commission</b>



## VIDEO TAPE INDEX

[illegible]

Drawing

# STANDARD

Title
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## SANITARY & STORM LINES FOR VIDEO TAPE INDEX TABLE

Drawn

e. LABERINTO

Checked
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M. BORAGINA

Corrected
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B. O'NEILL

Scale

<b>Status</b>	
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DRAFT

Date	YEAR/MO/DY
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2007/09/30

Dwg No.
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S01500.12

Rev.

P3



Toronto Transit  
Commission

MASTER SPEC No. 01500  
CONSTRUCTION FACILITIES/  
TEMP CONTROLS

Filename Standards/standard\_dwggs/s01/final/S0150012.dgn

Plot date: 12-JUN-2008





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**1 DESCRIPTION**

- 1.1 This Section covers the Work for the protection of Environment as defined in this Section, during demolition and construction Work.

**2 REFERENCES**

- 2.1 CAN/CSA Z94.2, Hearing Protection Devices - Performance, Selection, Care, and Use.  
2.2 CAN/CSA Z107.56, Measurement of Noise Exposure.

**3 DEFINITIONS**

- 3.1 Adverse Effect: Impairment of the quality of the natural Environment for any use that can be made of it, or injury or damage to property, or to plant or animal life, or harm or material discomfort to any person, or an Adverse Effect on the health of any person, or impairment of the safety of any person, or rendering of any property, plant, or animal life unfit for human use, or loss of enjoyment of normal use of property, or interference with the normal conduct of business.
- 3.2 Contaminant: Any solid, liquid, gas, vapour, odour, sound, vibration, heat, radiation or combination thereof, resulting directly or indirectly from human activities, which causes or may cause an Adverse Effect.
- 3.3 Contaminated Materials: Includes, but is not limited to, any soil, sediment, groundwater or surface water that does not meet applicable Site Condition Standards; or any soil, sediment, groundwater or surface water that would be reasonably suspected to contain or be impacted by any Hazardous Material or Contaminant; or any equipment, tank, container, conduit, structure or thing that would be reasonably suspected to contain such, be associated with or be impacted by any Hazardous Material or Contaminant or any free-phase Hazardous Material or Contaminant.
- 3.4 Discharge: When used with reference to a Contaminant means any addition, placement, deposit, leak or emission.
- 3.5 Environment: The ambient air, all layers of the atmosphere, all water including surface water and underground water, all land, all living organisms and the interacting natural systems that include components of air, land, water, living organisms and organic and inorganic matter and includes indoor space.
- 3.6 Environmental Laws: Any Laws relating to the Environment and protection of the Environment, the regulation of chemical substances or Products, health and safety including occupational health and safety and the transportation of dangerous goods.
- 3.7 Hazardous Material: Any waste, substance, liquid matter, gaseous matter or solid matter that poses any risk to human health or the Environment if it is not handled, stored or disposed of appropriately or is deemed to be alone or in any combination hazardous, hazardous waste, solid or liquid waste, toxic, Pollutant, deleterious substance, Contaminant or source of pollution or contamination, regulated by any Environmental Laws.

- 3.8 Laws: All laws, statutes, codes, ordinances, decrees, rules, regulations, by-laws, statutory rules, principles of law, published policies and guidelines, judicial or arbitral or administrative or ministerial or departmental or regulatory judgements, orders, decisions, rulings or awards including general principles of common and civil law and the terms and conditions of any grant of approval, permission, authority or licence and the term applicable with respect to Laws and in a context that refers to one or more persons means that the Laws apply to the person or persons or its or their business, undertaking or property.
- 3.9 Pollutant: Any Contaminant other than heat, sound, vibration or radiation.
- 3.10 Sewage Works: Any Works for the collection, transmission, treatment and disposal of drainage, storm water or commercial/industrial wastes but not including plumbing, to which the OBC applies.
- 3.11 Site Condition Standards: The soil, groundwater and sediment concentration standards applicable as prescribed by Part IX of Ontario Regulation 153/04.
- 3.12 Spill: When used with reference to a Pollutant means a Discharge into the Environment from or out of a structure, vehicle or other container, abnormal in quality or quantity in light of all the circumstances of the discharge.

#### **4 CONTRACTOR'S RESPONSIBILITIES**

- 4.1 Be responsible for control, removal, handling, storage, disposal, and cleanup of Hazardous Material.
- 4.2 Comply with applicable standards, regulations, and Environmental Laws including, but not limited to, all approvals, licences, acts, regulations and municipal by-laws, as amended from time to time.
- 4.3 Standards, regulations and Environmental Laws may include, but are not limited to the following:
- 4.3.1 **Federal legislation:**
- 4.3.1.1 Canadian Environmental Assessment Act (CEAA) and Regulations.
- 4.3.1.2 Canadian Environmental Protection Act (CEPA) and Regulations.
- 4.3.1.3 Transportation of Dangerous Goods Act (TDG) and Regulations.
- 4.3.1.4 Fisheries Act and Regulations.
- 4.3.1.5 Migratory Birds Convention Act and Regulations.
- 4.3.1.6 Species at Risk Act and Regulations.
- 4.3.2 **Ontario legislation:**
- 4.3.2.1 Clean Water Act and Regulations.
- 4.3.2.2 Dangerous Goods Transportation Act (DGTA) and Regulations.
- 4.3.2.3 Endangered Species Act and Regulations.
- 4.3.2.4 Environmental Assessment Act (EAA) and Regulations.
- 4.3.2.5 Environmental Protection Act (EPA) and Regulations.
- 4.3.2.6 Lakes and Rivers Improvement Act and Regulations.

- 4.3.2.7 Occupational Health and Safety Act (OHSA) and Regulations.
- 4.3.2.8 Ontario Clean Energy Benefit Act and Regulations.
- 4.3.2.9 Ontario Water Resources Act (OWRA) and Regulations.
- 4.3.2.10 Pesticides Act and Regulations.
- 4.3.2.11 Technical Standards and Safety Act (TSS Act) and Regulations.
- 4.3.3 **City of Toronto by-laws:**
  - 4.3.3.1 Municipal Code Chapter 363 (Building Construction and Demolition) Chapter 3.6 (Construction Vibrations).
  - 4.3.3.2 Municipal Code Chapter 517 (Idling of Vehicles and Boats).
  - 4.3.3.3 Municipal Code Chapter 591 (Noise).
  - 4.3.3.4 Municipal Code Chapter 681 (Sewers).
- 4.3.4 **Regulations and standards:**
  - 4.3.4.1 Any noise and vibration protocols agreed to as a condition of the EAA or the ECA.
  - 4.3.4.2 Fill, Construction and Alteration to Waterways - Metropolitan Toronto and Region R.R.O. 1990, Regulation 158 under the Conservation Authorities Act.
  - 4.3.4.3 Ontario regulations and Ministry of Environment, Conservation and Parks (MOECP) policies and guidelines relating to the handling, deposition and disposal of excess soil and/or fill:
    - 4.3.4.3.1 Ontario Regulation 153/04 (Part XII - Soil).
    - 4.3.4.3.2 Site condition standards in accordance with Soil Ground Water and Sediment Standards for Use under Part XV.1 of the Environmental Protection Act.
    - 4.3.4.3.3 Fill Quality Guide and Good Management Practices for Shore Infilling in Ontario, MOECP.
    - 4.3.4.3.4 Management of Excess Soil - A Guide for Best Management Practices, MOECP.
  - 4.3.4.4 Legislation relating to the transportation and disposal of waste:
    - 4.3.4.4.1 Transportation of Dangerous Goods Act (TDG) and Regulations.
    - 4.3.4.4.2 Dangerous Goods Transportation Act (DGTA).
    - 4.3.4.4.3 Reg. 347, R.R.O. 1990, Regulation 347, General - Waste Management.

## **5 SUBMITTALS**

- 5.1 Submit in accordance with Section 01 33 00.
- 5.2 Submit following plans and reports:
  - 5.2.1 Environmental Controls and Methods Plan in accordance with Article 8 of this Section.
  - 5.2.2 Contingency Plan in accordance with Article 10 of this Section.

## **6 DISCOVERY OF UNEXPECTED CONTAMINATION**

- 6.1 If Contaminated Materials are encountered during the Work, immediately stop Work in the affected area, notify TTC, and request instructions.

**7 POLYCHLORINATED BIPHENYLS (PCBS)**

- 7.1 Comply with applicable Laws respecting the management, storage handling and disposal of PCBs including, but not limited to, the following:
  - 7.1.1 CEPA.
  - 7.1.2 TDGA.
  - 7.1.3 PCB Regulations - SOR/2008-273, under CEPA.
  - 7.1.4 EPA.
  - 7.1.5 Ontario Regulation 347 – General Waste Management, under CEPA.
  - 7.1.6 Ontario Regulation 362 - Waste Management – PCBs, under CEPA.
- 7.2 There are lighting fixture ballasts containing PCBs in the area of the Work.
  - 7.2.1 Remove light fixtures in accordance with Contract Drawings.
  - 7.2.2 Fixtures to be removed may contain PCBs in their ballasts.
  - 7.2.3 Remove ballasts from light fixtures, determine which ballasts contain PCBs and place those ballasts in approved containers and store on Site in location indicated by TTC.
  - 7.2.4 Dispose of remaining ballasts and light fixtures.
  - 7.2.5 When removing light fixtures, comply with applicable Laws relating to the storage, handling and disposal of PCBs material.
- 7.3 In the event of unexpected discovery of PCBs during the Work, immediately notify TTC orally and in writing and do not handle, disturb or remove items containing PCBs until expressly authorized in writing by TTC. Do not engage in any form of remedial Work until TTC has authorized the remedial Work, if any, in writing. Do such remedial Work at no additional to TTC.

**8 ENVIRONMENTAL CONTROLS FOR CUTTING, CORING AND DEMOLITION**

- 8.1 Before starting Work on Site, prepare a comprehensive Environmental Controls and Methods Plan for fugitive dust control, designated substances, PCBs removal and cleanup.
  - 8.1.1 Prepare Environmental Controls and Methods Plan meeting requirements in Sections 01 73 29 and 02 41 23.
- 8.2 Throughout the Work, provide air monitoring of crystalline silica, dust and other Contaminants (as applicable) as check of effectiveness on dust control measures. Complete monitoring in order to confirm and demonstrate airborne Contaminants are maintained below their respective occupational exposure limits in accordance with OHSA Regulation 833.

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**9 SPILLS**

- 9.1 Indemnify and hold harmless TTC or third parties for expense, loss or damage suffered by TTC which arises directly or indirectly from any Spill caused by an act or omission. The Contractor is solely responsible for and shall pay at its own expense for testing, documentation and reporting, remediation, repairs, removals, fines, penalties, civil damages, regulatory orders, and other expenditures arising from such Spill.
- 9.1.1 Provide Spill Response Kit for use by Site personnel including, but not limited to, Subcontractors and TTC. Include in Spill Response Kit materials and equipment capable of containing and disposing any Spill that could occur during course of this Contract.
- 9.2 In the event of a Spill:
  - 9.2.1 Immediately report Spill to TTC.
  - 9.2.2 Complete and submit an Environmental Incident Report to TTC.
  - 9.2.3 Proceed to cleanup, remediate and restore the Environment to conditions prior to the Spill in accordance with applicable Laws.
  - 9.2.4 Perform Spill cleanup and remediation in a safe manner and consult TTC on matters relating to investigation, cleanup and remediation.
  - 9.2.5 Immediately report to TTC Discharges of Contaminants that are not Spills.
  - 9.2.6 Contain Spill in a safe manner.

**10 CONTINGENCY PLAN FOR ENVIRONMENTAL CONTROL AND CLEANUP OF SPILL**

- 10.1 Prior to commencing construction, prepare a Contingency Plan for control and clean-up of Spills.
- 10.2 Contingency Plan to include, but not be limited to, the following information:
  - 10.2.1 Names and telephone numbers of persons in local municipalities and MOECP to be notified forthwith of a reportable Spill.
  - 10.2.2 Names and telephone numbers of representatives of fire, police and health departments of local municipalities responsible for responding to emergency situations.
  - 10.2.3 Provisions for Spills of Hazardous Materials and Spills, leaks, Discharges, releases and depositions of unknown materials.
  - 10.2.4 Site specific isolation methods, such as valves and Spill control equipment.
  - 10.2.5 Proposal for initiating immediate containment, control and clean-up of Spill procedures and take action to be taken to mitigate potential Environmental damage while awaiting additional assistance.
- 10.3 Prepare, implement, direct and supervise Contingency Plan.
- 10.4 Ensure immediate availability of Products which affect temporary repair to broken pipelines and other services so Spill or other emission of Pollutant is immediately controlled and stopped, and to mitigate damages.

**11 DESIGNATED SUBSTANCES**

- 11.1 Refer to Section 01 59 00.

**12 DUST CONTROL**

12.1 Refer to Section 01 59 00.

**13 WORKERS HEARING CONSERVATION**

13.1 Refer to Section 01 59 00.

**END OF SECTION**

**1 GENERAL**

- 1.1 This Section provides the Contractor with TTC expectations for executing the Work in a safe manner. The Contractor is expected to carry out the provisions as stated in this Section during all phases of construction, and identify, assess, and control potential Risks associated with the Work.

**2 ACRONYMS**

- 2.1 AODA: Accessibility for Ontarians with Disabilities Act.
- 2.2 CFCSA: Canadian Federation of Construction Safety Associations.
- 2.3 DPT: Damage Prevention Technician.
- 2.4 DSSR: Designated Substances Survey Report.
- 2.5 EPA: Environmental Protection Act and Regulations.
- 2.6 ESA: Employment Standards Act.
- 2.7 IHSA: Infrastructure Health & Safety Association.
- 2.8 JHSC: Joint Health and Safety Committee.
- 2.9 LSC: Locate Service Contractor.
- 2.10 MOL: Ministry of Labour.
- 2.11 OHSA: Occupational Health and Safety Act (Province of Ontario).
- 2.12 O. Reg.: Ontario Regulation.
- 2.13 ORCGA: Ontario Regional Common Ground Alliance.
- 2.14 R.R.O. 1990: Revised Regulations of Ontario.
- 2.15 SDS: Safety Data Sheets.
- 2.16 SH&E: Safety, Health and Environment.
- 2.17 SSO: Site Safety Observation.
- 2.18 TSSA: Technical Standards and Safety Authority.
- 2.19 WHMIS: Workplace Hazardous Materials Information System.
- 2.20 WHSR: Workplace Health and Safety Representative.
- 2.21 WSIA: Workplace Safety and Insurance Act.

**3 DEFINITIONS**

- 3.1 Awareness: A Site Specific session conducted by TTC that provides Workers with the basic knowledge and understanding of the potential Hazards and Controls related to the Work.
- 3.2 Certificate of Recognition (COR™): Certification nationally trademarked and endorsed by participating members of CFCSA of which IHSA in Ontario is a member. It provides Employers with an effective tool to assess their health and safety management system. COR™ is aimed at driving positive workplace behaviour and practices that lead to improved performance. The IHSA is the authority having jurisdiction to grant COR™ in the Province of Ontario.

- 3.3 Constructor: “A person who undertakes a Project for an Owner and includes an Owner who undertakes all or part of a Project by themselves or by more than one Employer”, as defined in OHSA. The Constructor has control over health and safety for the entire Project and is responsible for the health and safety of all Workers. The Constructor must ensure that all the Employers and Workers on the Project comply with OHSA and Regulations.
- 3.4 Contaminant(s): Any solid, liquid, gas, odour, heat, sound, vibration, resulting directly or indirectly from human activities that cause an adverse effect.
- 3.5 Contractor Work Area: An area controlled by the Constructor where activities associated with the Work take place. This area is where the majority of Contractor’s activities occur or an outside area within Public/Operating environment where Contractor may perform some Work. All areas where Contractor performs Work are controlled by the Constructor.
- 3.6 Controlled Product(s): A Product, material or substance with properties that could result in human illness or injury if not controlled, and meets the criteria of one or more classes of hazards established under WHMIS Regulations.
- 3.7 Controls: “Protective or preventive measures that reduce Risk”, as defined in CAN/CSA-Z1001, Occupational Health and Safety Training.
- 3.8 Designation of Project: MOL Director’s Designation of Project. A process where a Project Owner requests Director’s Designation whereby each designated Project would have its own separate Constructor. The Director may designate in writing a part of a Project as a Project and the designated Project is considered to be a Project in accordance with O. Reg. 213/91, s. 4 and O. Reg. 145/00, s. 2.
- 3.9 Devil Strip: “The narrow area between opposite direction tracks where there are no pillars or no centre bench”, as defined in Subway/SRT Rule Book.
- 3.10 Employer: “A person who employs one or more workers or contracts for the services of one or more workers and includes a contractor or subcontractor who performs work or supplies services and a contractor or subcontractor who undertakes with an Owner, constructor, contractor or subcontractor to perform work or supply services”, as defined in OHSA.
- 3.11 Fire Watch: A Contractor’s Worker, trained in the use of fire suppression equipment and alarm activation, assigned to monitor the area for any potential fire when Hot Work takes place, after Hot Work takes place as required, and when fire protection systems or any part thereof are isolated for purposes other than Hot Work.
- 3.12 Hand-held Scanning Device: An electronic device capable of accurately detecting location of rebar in concrete, estimating rebar size and depth of concrete cover required for non-destructive structural inspection, and a multipurpose detector capable of instantly locating rebar, metal or plastic pipes, live wire and wood, embedded in structures made of various base materials.
- 3.13 Hazard: A source or situation with a potential for harm in terms of human injury or ill health, damage to property, damage to the environment, or a combination of these.
- 3.14 Hot Work: Work that could produce a source of ignition, such as spark or open flame, and may require temporary disabling of the fire protection system. Such operations include, but are not limited to, welding, brazing, cutting, grinding, soldering and thawing pipes, torch-applied roofing and cad welding.



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- 3.15 Incident(s): A preventable, unplanned, work-related event or exposure or series of events or exposures that result or has the potential to result in personal harm and/or damage to equipment, structure, property, or damage to the environment.
- 3.16 Job Safety Analysis: An analysis that outlines the potential Hazards and applicable Controls required for a work assignment to ensure everyone involved is protected against harm.
- 3.17 Locate: "The provision of location information by an underground facility owner (or their agent) in the form of ground surface markings and/or facility location documentation, such as drawings, mapping, numeric descriptions or other written documentation", as defined in Canadian Common Ground Alliance Best Practices.
- 3.18 Locating: "The process of an underground plant owner/operator or their agent providing information to an excavator which enables them to determine the location of a facility", as defined in Canadian Common Ground Alliance Best Practices.
- 3.19 Non-Clearance Area: An area of tunnel where there is not enough room for a vehicle to pass a person without touching them. Identified by black and/or yellow stripes on the tunnel wall or walkway.
- 3.20 Notice of Project: "A notice that a Constructor must provide to the MOL prior to starting Projects that meets standards set out in O. Reg. 213/91: CONSTRUCTION PROJECTS.
- 3.21 Orientation: A Site Specific session conducted by Contractor that provides Workers with the basic knowledge and understanding of the potential Hazards and Controls related to the Work.
- 3.22 Owner: TTC and as defined in OHSA.
- 3.23 Project: "A construction Project, whether public or private including, the construction of a building, bridge, structure, industrial establishment, mining plant, shaft, tunnel caisson, trench, excavation, highway, railway, street, runway, parking lot, cofferdam, conduit, sewer, water main, service connection, telegraph telephone or electrical cable, pipe line, duct or well, or any combination thereof, the moving of a building or structure, and any Work or undertaking, or any lands or appurtenances used in connection with construction", as defined in OHSA.
- 3.24 Regulator: An agency responsible for exercising authority over some area of activity in a regulatory capacity.
- 3.25 Risk: The amount of harm that can be expected to occur during a given time period due to a specific harm event. It may also apply to situations with property or equipment loss. Level of Risk is the product of the probability of the occurrence of the harm event and the severity of that harm once exposed.
- 3.26 Safe Work Method: Method that is generally written to outline how to perform a task with minimum Risk to people, equipment, materials, environment, and processes.
- 3.27 Safety Professional: A person tasked with providing advisory services to the Contractor, including guidance, knowledge, and technical expertise in the administration and support of environmental health and safety programs to assure compliance with regulatory agency guidelines and institutional policies.
- 3.28 Site Specific: It means specific to the Site as defined in Section 00 72 00, General Conditions.
- 3.29 Site Specific Safety Plan: A complete and comprehensive document for the Contract developed by the Contractor comprised of all the elements for the protection of health and safety of Workers, TTC employees, and members of the public.

- 3.30 Supervisor in Charge: A person who is listed as Supervisor in Charge of a Project and has authority over a Worker.
- 3.31 Supervisory Personnel: Person who has authority over a Worker or an activity.
- 3.32 Track Level: As defined in Section 01 42 16.
- 3.33 Training: A session conducted by TTC aimed to familiarize Workers with a specific safety topic related to the Work. Training requires attendance in a formal Training class aimed at conveying information and instructions to improve the level of knowledge, performance, and skill of the Workers. Successful completion of Training is verified by passing a test.
- 3.34 Utility: "A private, publicly, or cooperatively owned entity whose purpose is to deliver a commodity or service such as communications, television/internet, power, electricity, light, heat, gas, oil, water, steam, and waste collection", as defined in the Canadian Common Ground Alliance Best Practices.

#### **4 CONSTRUCTOR**

- 4.1 For the purpose of the Project, the term Constructor shall mean the Contractor in charge of the Project as shown on the Notice of Project.
- 4.2 The Contractor shall provide in writing the name of the Contractor's representative who will be named on the Notice of Project as the Supervisor in Charge of the Project. The Contractor shall assume the duties of the Constructor and ensure these responsibilities are fulfilled on the Site.
- 4.3 The Constructor designation may be transferred to/from a Contractor at any time at no additional cost to TTC.
- 4.4 In the event that there are multiple Contracts on Site, TTC may apply for Designation of Projects with MOL. When Designation of Projects is obtained from MOL, the Contractor is responsible to take necessary steps to protect their Constructor designation in compliance with the MOL Designation of Projects letter at no additional cost to TTC. This may include initiating and/or participating in conjunction with TTC or Other Contractors any coordination necessary to ensure the conditions in the Designation of Projects are complied with.
- 4.5 The Contractor is responsible to identify to TTC immediately any potential overlap or conflicts that arise during the Contract with Other Contractors, and develop and advise on the plan to eliminate the conflict.
- 4.6 If there is potential conflict or overlap between different Contractors on Site, TTC at its discretion may issue a Contract Change or a Change Directive to accelerate or defer Work as may be necessary to resolve the conflict.
- 4.7 In the event that the Contractor is not able to fulfill the requirements of this Section, TTC may deem it necessary to require the Contractor to provide a Safety Professional, part time or full time on Site, to assist the Supervisor in Charge and fulfill their safety responsibilities at no additional cost to TTC.

#### **5 SAFETY PROFESSIONAL TRAINING QUALIFICATIONS**

- 5.1 Safety Professional must have successfully completed the following:
- 5.1.1 Five (5) years construction safety experience in civil infrastructure environment, including development of project level health and safety plans and procedures.

- 5.1.2 College level, at minimum, health and safety certification program.
- 5.1.3 Recognizable Safety Professional designation/certification, including any of the following:
  - 5.1.3.1 Canadian Registered Safety Professional (CRSP).
  - 5.1.3.2 Canadian Health and Safety Consultant (CHSC).
  - 5.1.3.3 Gold Seal Certification (GSC).
  - 5.1.3.4 National Construction Safety Officer (NCSO).

## **6 SUBMITTALS**

- 6.1 Submit in accordance with Section 01 33 00.
- 6.2 A Notice to Proceed can only be issued to the Contractor when all the critical submittals listed under Paragraph 6.3 have been reviewed by TTC.
- 6.3 **Critical Submittals:**
  - 6.3.1 Submit the following for a review within fifteen (15) Days after receiving the Notification of Award:
    - 6.3.1.1 Evidence of training qualifications of the Supervisor in Charge and any assistant. The Supervisor in Charge and assistant must have successfully completed the following at a minimum:
      - 6.3.1.1.1 IHSA Basics of Supervising training or equivalent within the last five (5) years.
      - 6.3.1.1.2 MOL Supervisor Health and Safety Awareness in 5 Steps within the last five (5) years.
      - 6.3.1.1.3 Valid First Aid and CPR Certificate suitable for the scope of Work.
      - 6.3.1.1.4 Working at Heights Training in accordance with the current MOL requirements.
      - 6.3.1.1.5 Valid WHMIS Training.
      - 6.3.1.1.6 AODA training in accordance with Section 00 72 00, GC35.
    - 6.3.1.2 Occupational health and safety policy and program which will be reviewed and evaluated in accordance with the following:
      - 6.3.1.2.1 Evaluation of Contractor's Health and Safety Policy and Program (see attachment).
      - 6.3.1.2.2 For Contractors who can provide evidence that they have valid COR™ Certification in Ontario, the Contractor's occupational health and safety policy and program will not be evaluated by TTC and will be accepted as submitted.
    - 6.3.1.3 Site Specific Safety Plan including associated procedures in accordance with the following:
      - 6.3.1.3.1 Site Specific Safety Plan Guideline (see attachment).
    - 6.3.1.4 Site Specific emergency response and evacuation plan in accordance with the following:
      - 6.3.1.4.1 Site Specific Emergency Response and Evacuation Plan Guideline (see attachment).
      - 6.3.1.4.2 Emergency Response Planning for Construction Projects reviewed and endorsed by the Provincial Labour-Management Health and Safety Committee (see attachment).
    - 6.3.1.5 Site Specific traffic protection and Control plan in accordance with the following:
      - 6.3.1.5.1 Site Specific Traffic Protection and Control Plan Guideline (see attachment).
    - 6.3.1.6 Site Specific Safety Orientation Package.

- 6.3.1.7 Work area separation plan and associated diagrams illustrating methods of separation from members of the public and/or TTC operational activities and Other Contractors in accordance with the following:
  - 6.3.1.7.1 Contractor Work Area Separation Plan Guideline (see attachment).
  - 6.3.1.7.2 Contractor Work Area Separation (see attachment).
- 6.4 **Other Submittals:**
  - 6.4.1 **Product submittals:**
    - 6.4.1.1 Submit the following for review a minimum of twenty-one (21) Days prior to delivering Controlled Products to Site:
      - 6.4.1.1.1 Copies of valid Safety Data Sheets (SDS) in accordance with the following:
        - 6.4.1.1.1.1 Request for Construction Product Safety Data Sheet Evaluation (see attachment).
  - 6.4.2 **Work-specific submittals:**
    - 6.4.2.1 Submit the following for review a minimum of fourteen (14) Days prior to performing the Work:
      - 6.4.2.1.1 Copies of the Notice of Project, any updated Notices of Project, and all MOL Form 016-1000E (commonly known as Form 1000) on the Project.
      - 6.4.2.1.2 Site Specific Worker Hearing Conservation Plan in accordance with Article 20, including the following:
        - 6.4.2.1.2.1 Worker Hearing Conservation Plan (Attachment 01 59 00.10).
      - 6.4.2.1.3 Prior to commencing Work that involves designated substances, submit a plan that complies with the appropriate designated substance regulation in accordance with Paragraph 21.5.
      - 6.4.2.1.4 For Projects involving asbestos, submit a plan in accordance with Subparagraph 21.5.1 and the following:
        - 6.4.2.1.4.1 Asbestos Abatement Plan (Attachment 01 59 00.11). No Work is to proceed until the plan is reviewed by TTC.
        - 6.4.2.1.5 Dust Control Plan in accordance with Article 23 and the following:
          - 6.4.2.1.5.1 Dust Control Plan (Non-Asbestos containing materials) (see attachment).
        - 6.4.2.1.6 Emission Control Plan for Work involving asphalt application, roofing, waterproofing, diesel exhaust, odourous products in accordance with Article 24 and the following:
          - 6.4.2.1.6.1 Emission Control Plan (Asphalt, Roofing, Waterproofing, Diesel Exhaust, Odourous Products) (see attachment).
  - 6.4.3 **As applicable submittals:**
    - 6.4.3.1 Submit the following for a review two (2) Days prior to performing the Work involving surface penetration:
      - 6.4.3.1.1 Information on Contractor Service and Utility Locate Notification and Verification in accordance with Article 14 and the following:
        - 6.4.3.1.1.1 Contractor Service and Utility Locate Notification and Verification (see attachment).

- 6.4.3.2 Submit the following for review a minimum of seven (7) Days prior to performing the Work outside of the main Contractor Work Area:
  - 6.4.3.2.1 Access request in accordance with the following:
    - 6.4.3.2.1.1 Contractor Request for Access to Public/Operating Area (see attachment).
    - 6.4.3.2.1.2 Access Request to Contractor Work Area (see attachment).
  - 6.4.3.3 Submit the following for review a minimum of seven (7) Days prior to performing the Work involving Hot Work:
    - 6.4.3.3.1 Hot Work Permit request in accordance with Paragraph 17.3 and the following:
      - 6.4.3.3.1.1 Section 1 of Contractor Hot Work Permit (see attachment).
    - 6.4.3.4 Submit the following for review a minimum of seven (7) Days prior to performing the Work involving access to Electrical Rooms (including Signal Rooms and Communication Rooms), Substations or Tie Breaker Rooms:
      - 6.4.3.4.1 Electrical Rooms (including Signal Rooms and Communication Rooms), Substations or Tie Breaker Rooms access request, in accordance with Article 16 and the following:
        - 6.4.3.4.1.1 Section 1 of Access Request for Electrical Room, Substation or Tie Breaker Room (see attachment).
        - 6.4.3.4.1.2 Job Safety Analysis/Safety Plan in accordance with Job Safety Analysis/Safety Plan Development Reference Sheet (see attachment).
    - 6.4.3.5 Submit the following for review a minimum of fourteen (14) Days prior to performing the Work:
      - 6.4.3.5.1 Documentation for Safety Professional's training qualifications in accordance with Article 5.
      - 6.4.3.5.2 Safe Work Method, Job Safety Analysis or equivalent to identify, assess, and control health and safety Hazards, if not already submitted as part of the Site Specific Safety Plan submission noted in Subparagraph 6.3.1.3.
      - 6.4.3.5.3 Safe Work Method for high Risk activities including, but not limited to, the following:
        - 6.4.3.5.3.1 Hazardous Energy Control.
        - 6.4.3.5.3.2 Confined Space Entry.
        - 6.4.3.5.3.3 Working at Heights.
        - 6.4.3.5.3.4 Crane lifts in accordance with Site Specific Crane Lift Plan Guideline (see attachment).
        - 6.4.3.5.3.5 Work at Track Level without traction power cut.
        - 6.4.3.5.3.6 Use of power actuated tools.
    - 6.4.3.6 Submit the following for review a minimum of twenty-one (21) Days prior to performing the Work involving energy/system isolation and restoration:
      - 6.4.3.6.1 Energy/system isolation request in accordance with Article 15 and the following:
        - 6.4.3.6.1.1 Section 1 of Energy/System Isolation & Restoration Request (see attachment).
      - 6.4.3.6.2 Energy/system restoration request in accordance with Article 15 and the following:
        - 6.4.3.6.2.1 Section 4 of Energy/System Isolation & Restoration Request (see attachment).

6.4.3.7 Submit for review a minimum of twenty-one (21) Days prior to performing the Work involving fire protection the following:

6.4.3.7.1 Heat detector diagram for fire protection in accordance with Article 17.

6.4.4 **For record submittals:**

6.4.4.1 Submit prior to commencing Work on Site copies of MOL Notice of Project and MOL Form 016-1000E filled out by each Employer.

## **7 AUTHORITY OF TTC**

7.1 TTC will conduct a safety start-up review using Contract Safety Start-up Review (see attachment).

7.2 TTC will periodically assess the implementation of the Contractor's Site Specific Safety Plan and the compliance with the requirements of OHSA and Regulations as applicable.

7.3 TTC will conduct periodic inspections of the Site and issue SSO reports. Upon receipt of the SSO reports, the Contractor shall respond to these reports in writing within forty-eight (48) hours. TTC will review the Contractor's response for compliance.

7.4 TTC may issue a Contract Deficiency Report for non-compliance with requirements of OHSA and Regulations as applicable, TTC policies and procedures, and with the Contractor's Site Specific Safety Plan.

7.5 If in the opinion of TTC the health and safety of a Worker or the public is endangered or the system put in place to ensure the health and safety of Workers on Site is not being implemented, TTC will advise the Constructor to rectify the safety concerns immediately.

7.6 In a case of imminent danger, TTC may take corrective action as it deems necessary and appropriate in the circumstance including, but not limited to, the following:

7.6.1 Require the Contractor to remedy the condition at no additional cost to TTC.

7.6.2 Require the Project or part thereof to be shut down completely or in part until the condition has been remedied.

7.6.3 Remedy the problem and back charge the Contractor for the cost of remedial Work, including the appropriate overhead, as determined by TTC.

7.6.4 TTC may find the Contractor to be in default in accordance with Section 00 72 00, GC16 and may proceed with termination in accordance with Section 00 72 00, GC17 without further liability in the event the Contractor fails to comply with the instructions of TTC with respect to safety violations.

7.6.5 TTC reserves the right to perform occupational hygiene testing for biological, chemical, physical or ergonomic hazards for the purpose of evaluating, controlling, and preventing exposures resulting from Work that may result in injury, illness or affect the well-being of Workers, TTC employees, and members of the public.

7.6.6 TTC reserves the right to request IHSA to conduct an interim COR™ Certification review of the Contractor's existing COR™ Certification at no additional cost to TTC.

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**8 CONTRACTOR'S RESPONSIBILITIES**

- 8.1 The Contractor shall ensure applicable Acts, regulations, standards, and guidelines are followed on Site including, but not limited to, the following:
  - 8.1.1 OHSA.
  - 8.1.2 Technical Standards and Safety Act, 2000.
  - 8.1.3 EPA.
  - 8.1.4 O. Reg. 213/91: CONSTRUCTION PROJECTS.
  - 8.1.5 R.R.O. 1990, Reg. 851: INDUSTRIAL ESTABLISHMENTS.
  - 8.1.6 WSIA.
  - 8.1.7 WHMIS.
  - 8.1.8 Ontario Electrical Safety Code.
  - 8.1.9 Ontario Traffic Manual, Book 7.
  - 8.1.10 Municipal by-laws.
- 8.2 COR™ Certification in Ontario must be maintained for the duration of the term of the Contract for Contracts requiring COR™ Certification.
- 8.3 Ensure that each Employer completes MOL Form 016-1000E prior to commencing Work on Site and provides a copy to TTC.
- 8.4 Establish a safe Site, using safe equipment, materials, and tools.
- 8.5 Maintain an up-to-date written Site Specific Safety Plan.
- 8.6 Install warning signage to alert public and Workers on Site of any hazards in accordance with O. Reg. 213/91: CONSTRUCTION PROJECTS, Section 44.
- 8.7 Ensure appropriate personal protective equipment for the task is available, used, and maintained.
- 8.8 Notice to MOL for all Incidents requiring such notice is completed in a timely manner. These notices are:
  - 8.8.1 Refusal to Work - OHSA, section 43, for all Incidents where a Worker has exercised their right to refuse Work.
  - 8.8.2 Notice of Death - OHSA, section 51.
  - 8.8.3 Notice of Accident, Explosion, Fire, Violence Causing Injury or Occupational Illness - OHSA, section 52.
  - 8.8.4 Notice of Accident - OHSA, section 53.
  - 8.8.5 Notice of Accident and Reports - O. Reg. 213/91: CONSTRUCTION PROJECTS, Sections 8 to 12.
- 8.9 Provide TTC with copies of all reports and correspondence with relevant information affecting the Incidents listed above, at the time of submission to MOL.
- 8.10 Correct immediately any unsafe condition.
- 8.11 Inspect the Site regularly.
- 8.12 Install and maintain the Contract Safety Notice Board in accordance with Article 10.

- 8.13 Report all Incidents immediately to TTC and investigate. When required by TTC, participate in Incident investigation with TTC at no additional cost to TTC.
- 8.14 Provide an initial Incident report within one (1) Day of the Incident. Provide an Incident investigation report within five (5) Days of the Incident.
- 8.15 Ensure Supervisor in Charge or their assistant, directly employed by the Constructor, is present on Site to supervise the Work at all times.
- 8.16 Ensure necessary Training is provided to Workers as required and in accordance with Article 25.
- 8.17 Ensure Subcontractors have safety programs and Training for their Workers.
- 8.18 Ensure all Workers participate in TTC Training and Awareness programs prior to access to TTC facilities, as necessary and in accordance with Article 25.
- 8.19 Establish a Site Specific safety Orientation and ensure each person, before entering the Site, attends this Orientation including new Workers, Subcontractors, TTC work forces, suppliers, and visitors. Ensure each participant receives a uniquely numbered Site Specific sticker required to be affixed on their hard hat to attest the safety Orientation participation.
- 8.20 Ensure all construction activities are communicated to TTC prior to start of Work.
- 8.21 Ensure Products are not delivered to Site without acceptance of TTC.
- 8.22 Ensure requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of hazardous materials, and regarding labelling and provision of Safety Data Sheets (SDS) are adhered to on Site.
- 8.23 Before Product delivery to Site and throughout the duration of the Contract, maintain SDS on Site and available to anyone on Site.
- 8.24 Ensure the health and safety of the general public, visitors and employees of TTC are protected in relation to the Work.

## **9 RECORDS TO BE RETAINED ON SITE**

- 9.1 Retain on Site original records of all documents required under this Section, and also provide copies of the following if requested:
  - 9.1.1 Communications, including all orders by MOL or other occupational health and safety authority having jurisdiction.
  - 9.1.2 Incident investigation reports. Each report must identify the cause and corrective actions taken to prevent a recurrence.
  - 9.1.3 Safety information and inspection reports made by the Contractor, Subcontractor, JHSC or external agencies.
  - 9.1.4 List of names of Workers requiring Training and participation in TTC safety Awareness programs.
  - 9.1.5 Evidence that Supervisory Personnel and Workers have appropriate competency Training and recertification for the Work performed.
  - 9.1.6 Operating manual(s), instructions, inspection, and maintenance records for the equipment on Site.



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**10 CONTRACT SAFETY NOTICE BOARD**

- 10.1 Install the Contract Safety Notice Board on Site in accordance with the attachment in a well-lit area where Workers have unobstructed access.
- 10.2 Protect the board from weather or damage by moisture.
- 10.3 Where it may not be feasible to install a Contract Safety Notice Board on Site, an alternate method of display is required.
- 10.4 Post the following Site Specific information on the board:
  - 10.4.1 Regulatory Notices:
    - 10.4.1.1 Notice of Project.
    - 10.4.1.2 Form 016-1000E Registration of Constructors and Employers Engaged in Construction, for each contractor.
    - 10.4.1.3 WSIB Form 82, In Case of Injury at Work.
    - 10.4.1.4 MOL Poster, Health & Safety at Work Prevention Starts Here.
    - 10.4.1.5 ESA 2000 Poster, Employment Standards in Ontario.
    - 10.4.1.6 OHSA (green book).
    - 10.4.1.7 MOL Regulatory Notices, such as MOL field visit Reports/Orders.
    - 10.4.1.8 Location of nearest MOL office.
  - 10.4.2 Contractor Policies:
    - 10.4.2.1 Safety, Health and Environment Policy and Program.
    - 10.4.2.2 Workplace Violence Policy.
    - 10.4.2.3 Respect and Dignity Policy.
    - 10.4.2.4 Accommodation in the Workplace Policy.
  - 10.4.3 Contractor Work Area Separation Plan:
    - 10.4.3.1 Separation Plan and MOL Designation of Projects (as applicable).
  - 10.4.4 Site Specific Safety Plan.
  - 10.4.5 Site Specific Environmental Plan.
  - 10.4.6 Safety, Health and Environment Notices and Meetings:
    - 10.4.6.1 Notices.
    - 10.4.6.2 Safety Meetings Agenda and Minutes.
  - 10.4.7 Safety Alerts.
  - 10.4.8 Hazard Reports.
  - 10.4.9 JHSC/WHSR:
    - 10.4.9.1 Names and location.
    - 10.4.9.2 JHSC Monthly Minutes.
  - 10.4.10 Emergency and Evacuation:
    - 10.4.10.1 Site Specific Emergency Response and Evacuation Plan.

- 10.4.10.2 First Aider's Certificate(s).
- 10.4.10.3 Emergency Phone Numbers.
- 10.4.10.4 Designated Assembly Area Information.
- 10.4.11 Contractor Safety, Health and Environment Related Information:
  - 10.4.11.1 Site Specific SDS.
  - 10.4.11.2 Site Specific DSSR.
  - 10.4.11.3 Site Specific Safety Orientation Package.
  - 10.4.11.4 Site Specific Traffic Protection and Control Plan.
  - 10.4.11.5 Completed Contract Safety Start-up Review (see attachment).
- 10.4.12 Other information as required.

## **11 DESIGNATED ASSEMBLY AREA**

- 11.1 Establish an area on Site or near the Site as a Designated Assembly Area where Workers are to assemble in the event of an emergency.
- 11.2 If the Designated Assembly Area is on Site, identify with a 900 mm x 900 mm plywood sign, painted yellow with red lettering at least 150 mm high x 50 mm wide, with the words Company Name - Designated Assembly Area.
- 11.3 If the Project is of a size and nature that requires more than one (1) Designated Assembly Area, identify the areas in the plan referred to above and, in addition, labelled A, B, C, etc., as deemed necessary.
- 11.4 Mount and support the Designated Assembly Area sign as deemed necessary in the circumstances.

## **12 SITE HAZARDS IN TRANSIT OPERATING AND MAINTENANCE ENVIRONMENT**

- 12.1 Under no circumstances shall any person associated with the Contract descend to or enter onto Track Level unless prior arrangements are made with TTC.
- 12.2 The following Hazards and restrictions may be encountered during Work:
  - 12.2.1 General:
    - 12.2.1.1 Movement of rail or wheeled vehicles and equipment in any direction, including tail swing area such as, but not limited to:
      - 12.2.1.1.1 Subway trains, streetcars, and work cars.
      - 12.2.1.1.2 Buses.
      - 12.2.1.1.3 Utility vehicles.
      - 12.2.1.1.4 Equipment with rotating parts.
    - 12.2.1.2 Spaces classified as a Confined Space as defined in O. Reg. 632/O5: **CONFINED SPACES**.
  - 12.2.2 Subway Stations, Bus Terminals, and Bus/Streetcar Terminals:
    - 12.2.2.1 Escalators and elevators.
    - 12.2.2.2 Potential diesel exhaust from work cars at track.

- 12.2.2.3 Unprotected platform edge.
- 12.2.3 Subway Main Line Track Level:
  - 12.2.3.1 Subway Track Level Hazards include:
    - 12.2.3.1.1 Electrical 600 V DC traction power rail (third rail).
    - 12.2.3.1.2 Signal voltage.
    - 12.2.3.1.3 Negative return voltage.
  - 12.2.3.2 Scarborough Rapid Transit Track Level Hazards include:
    - 12.2.3.2.1 Two (2) traction power rails, one (1) at -300 V DC, the other at +300 V DC.
  - 12.2.3.3 Moving parts (for example, switches).
  - 12.2.3.4 Non-Clearance Areas.
  - 12.2.3.5 Devil Strip.
  - 12.2.3.6 Trip arms.
  - 12.2.3.7 High air velocity areas throughout the tunnel.
- 12.2.4 Subway Carhouses and Yards:
  - 12.2.4.1 Live 600 V DC traction power rail.
  - 12.2.4.2 Live collector shoe at side of subway cars and vehicles.
  - 12.2.4.3 Traction/auxiliary power bug cords.
  - 12.2.4.4 Moving parts (for example, switches).
  - 12.2.4.5 Moving mechanical equipment (for example, hoists, platforms, and lifting devices).
  - 12.2.4.6 Maintenance pits.
- 12.2.5 Streetcar Track:
  - 12.2.5.1 Overhead traction power 600 V DC.
  - 12.2.5.2 Moving parts (for example, switches).
- 12.2.6 Streetcar Carhouses, and Yards:
  - 12.2.6.1 Overhead traction power 600 V DC.
  - 12.2.6.2 Moving parts (for example, switches).
  - 12.2.6.3 Moving mechanical equipment (for example, hoists, platforms, and lifting devices).
  - 12.2.6.4 Maintenance pits.
- 12.2.7 Streetcar Terminals and Loops:
  - 12.2.7.1 Overhead traction power 600 V DC.
  - 12.2.7.2 Moving parts (for example, switches).
  - 12.2.7.3 Moving mechanical equipment (for example, platforms, and lifting devices).
- 12.2.8 Bus Garages and Shops:
  - 12.2.8.1 Moving mechanical equipment (for example, hoists, overhead tail pipe exhaust hoses, lubricating and fuel hoses).
  - 12.2.8.2 Maintenance pits.

12.3 Equipment:

12.3.1 When traction power is ON, only non-conductive ladders, barriers, and scaffolding are permitted at Track Level and platforms.

### **13 WORK AREAS**

13.1 Contractor Work Area:

13.1.1 Contractor Work Area is the area identified in the Contractor Work Area Separation Plan where the majority of construction activities occur. Contractor is to perform Work only in this identified area.

13.1.2 Work area separation plan is accompanied by associated diagrams illustrating methods of separation from members of the public and/or TTC operational activities and Other Contractors. Refer to Subparagraph 6.3.1.7.

13.2 Public/Operating Work Areas:

13.2.1 Public/Operating Work Area is the area where Contractor may be required to perform some Work outside of the Contractor Work Area.

13.2.2 In order to perform Work in the Public/Operating Work Area, Contractor shall complete the Contractor Request for Access to Public/Operating Work Area form (see attachment), unless such areas have been already identified in the Contractor Work Area Separation Plan.

13.2.3 When Contractor takes control of the part of the Public/Operating Work Plan, this area then becomes Contractor Work Plan for the duration of the particular Work.

13.2.4 In the event that TTC, in order to perform their own activities, requires access to a Contractor Work Area or a Public/Operating Work Area that Contractor occupies, TTC will complete the Access Request to Contractor Work Area form (see attachment). Contractor shall review the request and provide a response.

### **14 UTILITY LOCATES**

14.1 TTC does not guarantee the accuracy of the underground or embedded utilities information indicated on the Contract Drawings.

14.2 Do not proceed with surface penetration Work unless utility Locates are valid for buried or concealed services and energy sources.

14.3 Obtain utility Locates by using a DPT certified in accordance with ORCGA DPT 100 course or equivalent.

14.4 Provide valid utility Locate reports prior to surface penetration Work.

14.5 Before penetrating any surface, scan proposed Locate areas using appropriate method (for example, Ground Penetrating Radar, pipe and cable locators, X-ray, or similar approved technology) as necessary to find reinforcements, electrical cables and conduit, pipe, utilities, and other items that may be concealed.

14.6 When concrete coring, drilling or cutting Work is scheduled, the rebar, pre- and post-tension cables, electrical conduits, radiant heating lines, and other objects embedded in concrete must be accurately located and marked.

- 
- 14.7 Locating TTC-Owned Services and Utilities:
    - 14.7.1 Contractor Service and Utility Locate Notification and Verification, (see attachment).
      - 14.7.1.1 Section 1 – Contract & Locate Information:
        - 14.7.1.1.1 Prior to commencing any surface penetration, provide completed Section 1 of form, along with relevant Contract Drawings and reference drawings, in accordance with Article 6.
        - 14.7.1.2 Section 2 – Pre-Locate Meeting:
          - 14.7.1.2.1 Arrange pre-Locate meeting to discuss approximate location and type of Work to be performed.
          - 14.7.1.2.2 Notify TTC to witness the pre-Locate meeting:
          - 14.7.1.2.3 Discuss approximate location and type of Work to be performed.
          - 14.7.1.2.4 Provide names and signatures of attendees, and meeting notes.
        - 14.7.1.3 Section 3 – Post-Locate Meeting:
          - 14.7.1.3.1 Arrange post-Locate meeting to discuss Locate report(s) and limitation of equipment used.
          - 14.7.1.3.2 Attendees to include LSC and DPT and TTC.
      - 14.7.2 Provide copy of the completed Contractor Service and Utility Locate Notification and Verification form.
      - 14.7.3 For concrete cutting or drilling:
        - 14.7.3.1 When there are TTC-owned electrical services embedded in concrete, request an energy isolation for the area to be cut through, in accordance with the Energy/System Isolation & Restoration Request (see attachment).
        - 14.7.3.2 Follow instructions as provided by:
          - 14.7.3.2.1 The utility owner.
          - 14.7.3.2.2 In accordance with Sections 01 73 29 and 02 41 23, as applicable.
        - 14.7.3.3 Maintain a clearance from all marks on the slab to be drilled, as noted on the Locate report, around the hole in all directions.
      - 14.7.4 Arrange to acquire a new Locate if the Work in the vicinity of the Locate does not occur by the expiration date of the Locate report.
      - 14.7.5 When using a Hand-held Scanning Device for scanning to a depth no greater than 50 mm, prior to use, provide a Safe Work Method including documentation to support that a certified individual, in accordance with ORCGA DPT 100 course or equivalent, will perform the scan. The submittal shall be done in accordance with Article 6.
      - 14.7.6 When the Locates are complete, incorporate information into the As-Built Drawings as specified in Section 01 78 39 indicating exposed utilities.
  - 15 ISOLATION OF ENERGY SOURCES**
    - 15.1 General:
      - 15.1.1 Energy sources include, but are not limited to, the following:
        - 15.1.1.1 Electrical.

- 15.1.1.2 Mechanical.
- 15.1.1.3 Pressure.
- 15.1.2 Review and identify energy source isolations prior to performing Work.
- 15.1.3 When Work produces dust and requires temporarily disabling smoke detectors, provide a Fire Watch in accordance with Section 2 of the Energy/System Isolation & Restoration Request (see attachment).
- 15.2 Energy Sources Outside TTC Control:
- 15.2.1 Follow utility owner's isolation procedures.
- 15.3 Energy Sources Under TTC Control:
- 15.3.1 Provide energy/system isolation & restoration request prior to working in close proximity, or on any energy source, or prior to commencing any surface penetration, in accordance with Article 6.
- 15.3.2 As part of the request, identify each Subcontractor being protected by the energy isolation.
- 15.3.3 Section 1 - Isolation Request:
- 15.3.3.1 Complete and include the following information:
- 15.3.3.1.1 Site Location.
- 15.3.3.1.2 Contract number.
- 15.3.3.1.3 Scope of Work requiring Isolation.
- 15.3.3.1.4 Isolation and Restoration start and finish dates.
- 15.3.3.1.5 Utility Locates, if required for isolation, must be attached.
- 15.3.3.1.6 Reference drawings, if available, must be attached.
- 15.3.3.1.7 Energy sources to be isolated.
- 15.3.3.1.8 Details of the isolation.
- 15.3.3.1.9 Panel number, circuit number and/or valve number.
- 15.3.3.1.10 Emergency systems affected, if applicable, by the isolation.
- 15.3.3.1.11 Name, signature, and office/cell number of requester.
- 15.3.4 Section 2 - Identification of Fire Watch, if applicable:
- 15.3.4.1 On the day of work, provide identification of primary Fire Watch and secondary Fire Watch where fire protection system or part thereof is isolated, and the Work does not involve Hot Work. For Hot Work Fire Watch identification, refer to Paragraph 3.14.
- 15.3.5 Section 3 - Isolation Confirmation:
- 15.3.5.1 Attend a meeting on Site to discuss the scope of Work, extent of energy isolation, and identification of service(s) to be isolated.
- 15.3.5.2 Witness TTC performed service isolation of listed energy sources and demonstration that energy sources are isolated.
- 15.3.5.3 When isolations are complete, TTC will lock-out the service(s) as applicable and sign-off on the Site Service Isolation & Restoration form.
- 15.3.5.4 Follow Lock-out/Tag-out procedure provided in the Site Specific Safety Plan.

- 15.3.5.5 Once the required service isolation, lock-out and tag-out including installation of appropriate locking devices, as applicable, are complete, sign Section 3 of the form.
- 15.3.5.6 Once required services are confirmed isolated by TTC in writing, the Work may proceed.
- 15.3.6 Section 4 - Restoration Request:
  - 15.3.6.1 Provide signed request to restore energy/system, and acknowledgement of the following:
    - 15.3.6.1.1 Work associated with the isolation complies with applicable codes, regulations, and authorities having jurisdiction.
    - 15.3.6.1.2 Work associated with the isolation is complete.
    - 15.3.6.1.3 Work area is clear and ready for restoration.
- 15.3.7 Section 5 - Restoration Confirmation:
  - 15.3.7.1 At conclusion of the Work, the electrical service will be re-energized if safe, and if applicable, the tags will be removed. At this point, the service is to be considered live.
  - 15.3.7.2 TTC performs the restoration and signs the Energy/System Isolation & Restoration Request form.
  - 15.3.7.3 Contractor signs the Energy/System Isolation & Restoration Request form.
  - 15.3.7.4 Once Energy/System Isolation & Restoration Request form has been signed by TTC and Contractor, forward the original Energy/System Isolation & Restoration Request (see attachment) to TTC for filing and archiving.
- 16 ACCESSING ELECTRICAL ROOMS, SIGNAL ROOMS, COMMUNICATION ROOMS, SUBSTATIONS OR TIE BREAKER ROOMS**
  - 16.1 Do not enter Electrical Rooms, Signal Rooms, Communication Rooms, Substations or Tie Breaker Rooms unless authorized by TTC.
  - 16.2 Controls must be in place at all times when Work is being performed inside Electrical Rooms, Signal Rooms, Communication Rooms, Substations or Tie Breaker Rooms.
  - 16.3 Doors must be secured during non-working periods. Doors must be closed and locked when Electrical Rooms, Signal Rooms, Communication Rooms, Substations or Tie Breaker Rooms are unoccupied and when Work is completed. When doors need to remain open, while Work is being performed (for example, due to excessive heat or other factors) necessary Controls (for example, hoarding, fencing, and warning signs) must be in place and identified in the Job Safety Analysis or Safety Plan.
  - 16.4 Attend safety Awareness session for accessing Electrical Rooms, Signal Rooms, Communication Rooms, Substations or Tie Breaker Rooms.
  - 16.5 Attend Work Protection Code Training for Work involving 750 V or higher.
  - 16.6 When accessing Electrical Rooms, Signal Rooms, Communication Rooms, Substations or Tie Breaker Rooms, follow the procedures below:
    - 16.6.1 Access Request for Visual Inspection:
      - 16.6.1.1 Prior to entry:
        - 16.6.1.1.1 Schedule time and date for inspection with TTC.
        - 16.6.1.1.2 Attend safety Awareness session, as applicable, provided by TTC.

- 16.6.1.1.3 Follow safety requirements for inspecting Electrical Rooms (including Signal Rooms and Communication Rooms), Substations or Tie Breaker Rooms in accordance with the Site Specific Safety Plan, the Contract Documents, and Paragraph 16.4.
- 16.6.1.2 Do not enter Electrical Rooms (including Signal Rooms and Communication Rooms), Substations or Tie Breaker Rooms without being accompanied by TTC for the entire duration of the inspection.
- 16.6.2 Access Request for Work:
  - 16.6.2.1 Submit request for access in accordance with Article 6.
  - 16.6.2.2 Section 1 – Request for Access:
    - 16.6.2.2.1 Provide the following:
      - 16.6.2.2.1.1 Completed Section 1 of Access Request for Electrical Room, Substation or Tie Breaker Room (see attachment) with Job Safety Analysis/Safety Plan attached.
      - 16.6.2.2.1.2 Applicable Permits/Request(s) for:
        - 16.6.2.2.1.2.1 Energy Isolation.
        - 16.6.2.2.1.2.2 Hot Work.
        - 16.6.2.2.1.2.3 Utility Identification.
    - 16.6.2.3 Section 2 – Documentation Review:
      - 16.6.2.3.1 To be completed by TTC.
    - 16.6.2.4 Section 3 – On Site Pre-entry Review:
      - 16.6.2.4.1 Proceed with On Site Pre-entry Review if documentation is reviewed by TTC.
      - 16.6.2.4.2 Prior to entry, review the Job Safety Analysis/Safety Plan including emergency procedures with all Workers.
      - 16.6.2.4.3 Install, as required, barriers and warning signage in front of an access door to Electrical Room, Signal Room, Communication Room, Substation or Tie Breaker Room.
  - 16.6.2.5 Section 4 - Completion of Work:
    - 16.6.2.5.1 Inspect completed Work area, ensuring all equipment and tools are removed.
    - 16.6.2.5.2 Sign the form to indicate completion of Work.

## **17 FIRE PROTECTION**

- 17.1 General:
  - 17.1.1 Take precautions to prevent fires when performing Work.
  - 17.1.2 Provide and maintain temporary fire protection measures suitable for the Work.
  - 17.1.3 Ensure every Worker who is required to use fire protection equipment is trained.
  - 17.1.4 Supply and install heat detectors, wiring, and end-of-line resistors on the construction side of the hoarding area and dust-tight partitions as required.
    - 17.1.4.1 The number of heat detectors installed shall be as required by the Ontario Fire Code.
      - 17.1.4.1.1 Provide heat detector diagram for fire protection in accordance with Article 6.
    - 17.1.4.2 Heat detectors and end-of-line resistors must be interconnected to the existing fire alarm panel.



- 17.1.4.3 Install heat detectors in accordance with CAN/ULC S524, Standard for the Installation of Fire Alarm Systems.
- 17.1.4.4 Verify heat detectors are in accordance with CAN/ULC S537, Standard for Verification of Fire Alarm Systems.
- 17.1.4.5 Interconnections with the existing fire alarm panel will be done by TTC personnel.
- 17.1.4.6 After the Work is completed, restore the fire protection system to its original state.
- 17.1.5 Provide fire extinguishers of suitable type in enclosures and on mobile equipment as required. Every fire extinguisher shall be inspected at least once a month by a competent Worker who shall record the date of inspection and initial a tag attached to the extinguisher.
- 17.1.6 Provide fire extinguishers in trailers in accordance with Section 01 50 00.
- 17.1.7 Use fire-proofed tarpaulins when required.
- 17.2 Storage of Materials:
  - 17.2.1 Store flammable liquids, compressed gases or combustible solids outside of TTC facilities, including roofs, subway stations, and subway tunnels.
  - 17.2.2 Quantities of materials for daily use only are permitted inside TTC facilities, including roofs, subway stations, and subway tunnels.
  - 17.2.3 Flammable liquids must be properly handled and stored in CSA approved containers that are labelled in accordance with WHMIS and maintained in good order, complete with all spouts, caps and gaskets, in accordance with the manufacturer's instructions.
  - 17.2.4 Keep containers for flammable liquids closed at all times when not directly in use.
  - 17.2.5 Empty flammable liquid containers must have their safety caps securely sealed to the spouts when stored.
    - 17.2.5.1 Store compressed gases in approved cylinders. The cylinders must be kept in an upright position for storage and secured to prevent unintended movement, and valves must be shut-off.
  - 17.2.6 Open burning of rubbish is not permitted on Site.
- 17.3 Hot Work:
  - 17.3.1 If deemed necessary by TTC, provide a specific Safe Work Method in accordance with Article 6. Safe Work Method shall outline Control measures to perform Hot Work for the Work area to prevent disruption to facility and transit vehicle operations.
  - 17.3.2 Provide Hot Work Permit request in accordance with Article 6 on the day of Hot Work and prior to performing the Work.
  - 17.3.3 Contractor Hot Work Permit form (see attachment):
    - 17.3.3.1 Section 1 – Request for Hot Work:
      - 17.3.3.1.1 Complete Section 1.
      - 17.3.3.1.2 If site energy isolation is required, provide Site Energy/System Isolation & Restoration Request form (see attachment) along with this form.
      - 17.3.3.1.3 Allow twenty-one (21) Days in the event a deactivation of energy/systems is required for the Hot Work.

- 17.3.3.2 Section 2 – Identification of Fire Watch:
  - 17.3.3.2.1 On the day Hot Work is to be performed, provide names of primary and secondary (for relief) Fire Watch.
  - 17.3.3.2.2 The Fire Watch's duties are the following:
    - 17.3.3.2.2.1 Understand the Hazard of the Hot Work being performed and the operation limitations listed in the Hot Work Permit.
    - 17.3.3.2.2.2 Be present for all Hot Work and when the fire systems are temporarily disabled or the water supply to the facility is turned off.
    - 17.3.3.2.2.3 Understand the Hazards associated with the location, and the need to maintain proper isolation of all Hot Work operations from combustible or flammable materials.
    - 17.3.3.2.2.4 Ensure the Hot Work area is maintained in a fire-safe condition throughout performance of the Work and stop the Work if unsafe conditions are observed.
    - 17.3.3.2.2.5 Be responsible for the area affected by the Hot Work, including identifying fire Hazards.
    - 17.3.3.2.2.6 Be trained in the use of alarm activation, manual, portable fire extinguishers and emergency notification procedures within the facility.
    - 17.3.3.2.2.7 Not perform any other duties while on Fire Watch.
    - 17.3.3.2.2.8 Continuously provide Fire Watch during the Hot Work and:
      - 17.3.3.2.2.8.1 Minimum one (1) hour after Hot Work is performed.
      - OR**
      - 17.3.3.2.2.8.2 Minimum three (3) hours after Hot Work is performed whenever an open flame torch or other ignition source was used for roofing membrane application.
      - OR**
      - 17.3.3.2.2.8.3 Until complete restoration of fire protection system.
    - 17.3.3.2.2.9 Fire Watch must perform visual checks of areas within 5 m radius of roof (including below and exterior of building).
  - 17.3.3.3 Section 3 – Site Checklist Review & Authorization:
    - 17.3.3.3.1 Provide a copy of the completed Contractor Hot Work Checklist (see attachment) on the day of Hot Work, prior to the Work being performed.
    - 17.3.3.3.2 Do not commence Hot Work without TTC's authorization of the Hot Work Permit.
    - 17.3.3.3.3 Permit is only valid for one (1) Hot Work Area and one (1) work shift.
  - 17.3.3.4 Section 4 – Notice and Confirmation of Complete Work:
    - 17.3.3.4.1 Upon completion of Hot Work and Fire Watch duties, notify TTC to conduct inspection to verify Work area is safe for operation.
    - 17.3.3.4.2 Accompany TTC on the inspection.
    - 17.3.3.4.3 Upon verification that Work area is safe for operation, the Contractor and TTC are to sign that the Hot Work is complete.
- 18 USE OF POWERED EQUIPMENT (INTERNAL COMBUSTION ENGINE, PROPANE, AND NATURAL GAS)**
  - 18.1 Provide sufficient supply of fresh air for combustion and sufficient natural or mechanical ventilation to ensure exhaust gases do not accumulate.

- 18.2 Ensure exhaust gases and fumes are discharged directly outside to a point sufficiently remote to prevent return of gases and overexposure of people.
- 18.3 Provide appropriate scrubbers and exhaust Controls.
- 18.4 In addition to the above means of Control, continuously monitor airborne carbon monoxide (CO) and nitrogen dioxide (NO<sub>2</sub>) levels when the Work takes place in:
  - 18.4.1 An excavation.
  - 18.4.2 A building.
  - 18.4.3 An enclosed structure.
  - 18.4.4 A tunnel, including subway and streetcar.
  - 18.4.5 Below grade areas as required by TTC.
- 18.5 Use air monitoring equipment capable of detecting CO and NO<sub>2</sub> whenever and wherever in proximity of propane, gasoline or diesel powered equipment and other internal combustion equipment that is used or operated in enclosed areas throughout TTC, including inside subway stations and tunnels where other means of gas detection is not available.
- 18.6 Conduct monitoring only by Workers trained and qualified in the field operation of air monitoring equipment.
- 18.7 Use only calibrated instruments in accordance with the manufacturer's recommendations.
- 18.8 Set up air monitoring equipment to provide low and high alarm set points for CO and NO<sub>2</sub> as follows:
  - 18.8.1 Low level visual, vibrating, and audible alarm activities at:
    - 18.8.1.1 25 ppm for CO and 3 ppm for NO<sub>2</sub>.
  - 18.8.2 High level visual, vibrating, and audible alarm activities at:
    - 18.8.2.1 75 ppm for CO and 5 ppm for NO<sub>2</sub>.
  - 18.8.3 Do not clear or reset air monitoring equipment when triggered due to heightened levels of CO and NO<sub>2</sub> until the situation is investigated.
  - 18.8.4 In case of low alarm:
    - 18.8.4.1 Turn off all known sources of CO and NO<sub>2</sub>.
    - 18.8.4.2 Notify TTC.
    - 18.8.4.3 Allow ventilation to clear area of CO and NO<sub>2</sub>.
  - 18.8.5 In case of high alarm:
    - 18.8.5.1 Stop Work immediately.
    - 18.8.5.2 Shut off all equipment.
    - 18.8.5.3 Leave the immediate Work area where excessive emissions were detected.
    - 18.8.5.4 Notify TTC.
    - 18.8.5.5 Ensure Workers and members of the public are kept out of the area in which CO emissions exceed 75 ppm or NO<sub>2</sub> emissions exceed 5 ppm.

- 18.8.5.6 If CO levels do not reduce to less than 75 ppm or the NO<sub>2</sub> levels to less than 5 ppm within fifteen (15) minutes, instruct remaining Workers to evacuate and contact TTC regarding evacuation.
- 18.8.5.7 Complete an Incident report and provide a copy to TTC.
- 18.8.5.8 Continue to monitor the area and attempt to increase air flow through the noted area to clear CO and NO<sub>2</sub> Hazards.

## 19 POWDER ACTUATED TOOLS

- 19.1 Do not use powder actuated fastenings on any portion of the Work unless written consent for a specific use is obtained from TTC.
- 19.2 Only low velocity tools are permitted. Operators to be qualified and to be in possession of a valid operator's certificate.

## 20 WORKER HEARING CONSERVATION

- 20.1 Provide Site Specific Worker Hearing Conservation Plan for the protection of Workers, other workers, and the public in the adjacent areas, in accordance with Article 6.
- 20.1.1 Plan shall include, but not be limited to, the following:
- 20.1.1.1 Actual and potential noise sources related to the Work.
- 20.1.1.2 Protective measures using engineering Controls, work practices and hearing protection devices, and administrative Controls.
- 20.1.1.3 Measurements of sound levels in the workplace that are done in order to determine what protective measures are appropriate.
- 20.1.1.4 Control measures to be implemented to prevent, or minimize noise exposure to Workers to sound levels greater than 85 dBA (L<sub>ex,8h</sub>) or as specified in the table below.
- 20.1.1.5 Maximum allowable exposure to noise for Workers without hearing protection is:

Sound Pressure Level (L <sub>eq,T</sub> (dBA))	Duration Allowed in Hours Per Day
85	8
88	4
91	2
94	1
97	0.5
100	0.25
Over 103	No exposure

- 20.1.1.6 Requirements for personal protective equipment, including hearing protection.
- 20.1.1.6.1 Training and instruction to the Worker in the care and use of the device, including its limitations, proper fitting, inspection and maintenance and, if applicable, the cleaning and disinfection of the device.
- 20.2 Noise Control Measures (Engineered and Source):
- 20.2.1 Provide noise monitoring to ensure Workers are not exposed over the limits provided in the table above.

- 20.2.2 Measurement of sound levels in the workplace that are done in order to determine what protective measures are appropriate shall be done without regard to the use of hearing protection devices.
- 20.2.3 Continuously assess whenever noise exposure level ( $L_{ex,8h}$ ) exceeds 85 dBA.
- 20.2.4 Upon request, provide noise exposure reports, including noise monitoring for compliance.
- 20.2.5 Identify major noise sources that exceed 85 dBA ( $L_{ex,8h}$ ).
- 20.2.6 Where practicable, implement noise Control solutions, including options for engineered noise Control to reduce Worker exposure to noise to a minimum.
- 20.2.7 Where practicable, post a clearly visible warning sign at every approach to an area in the workplace where the sound level regularly exceeds 85 dBA ( $L_{ex,8h}$ ), in accordance with OHSA, O. Reg. 381/15: NOISE.
- 20.2.8 Maintain noise Control measures.
- 20.2.9 Assess, recommend, and implement improved mitigation measures should values defined after implementation of the Site Specific Worker Hearing Conservation Plan be exceeded.
- 20.3 Noise Reduction and Hearing Protection Equipment:
- 20.3.1 Provide hearing protection when requested by Workers exposed to sound levels over 80 dBA ( $L_{ex,8h}$ ).
- 20.3.2 Use hearing protectors when sound levels are 85 dBA ( $L_{ex,8h}$ ) or higher.
- 20.3.3 Post warning signs in areas when sound levels exceed 85 dBA ( $L_{ex,8h}$ ) noting hearing protection required.
- 20.3.4 Strictly and consistently enforce hearing protection use where required.
- 20.3.5 Assess and use additional hearing protection equipment as mandated by CAN/CSA Z94.2, Hearing Protection Devices - Performance, Selection, Care, and Use.

## 21 DESIGNATED SUBSTANCES

- 21.1 Refer to DSSR if designated substance(s) are present at area of Work, where it is reasonable for TTC to have known about the substance(s).
- 21.2 Eleven (11) chemical agents are prescribed as designated substances in accordance with OSHA, O. Reg. 490/09: DESIGNATED SUBSTANCES:
  - 21.2.1 Acrylonitrile.
  - 21.2.2 Arsenic.
  - 21.2.3 Asbestos.
  - 21.2.4 Benzene.
  - 21.2.5 Coke Oven Emissions.
  - 21.2.6 Ethylene Oxide.
  - 21.2.7 Isocyanates.
  - 21.2.8 Lead.
  - 21.2.9 Mercury.

- 21.2.10 Silica (free crystalline silica).
- 21.2.11 Vinyl Chloride Monomer (not PVC).
- 21.3 Review DSSR(s) appended to the Contract Documents as Appendix 1 and comply with recommendations.
- 21.3.1 DSSR provides the types and locations of designated substances within the area of Work.
- 21.3.2 DSSR may not reveal all conditions that exist or can occur in the area of Work.
- 21.4 Notify TTC immediately should concealed or unknown conditions be found to vary from the DSSR.
- 21.5 Provide a plan that complies with the appropriate designated substance regulation or guideline. No Work is to proceed until the plan is reviewed by TTC.
- 21.5.1 For Work involving asbestos, provide completed Asbestos Abatement Plan (see attachment) in accordance with Article 6 for the protection of construction Workers, TTC workers, and the public.
- 21.6 Notify TTC immediately if material suspected of containing designated substances and not identified in DSSR is discovered.
- 21.7 Cease Work in the area and barricade area to prevent entry until such time as TTC confirms presence of designated substances.

## **22 MAN-MADE MINERAL FIBRE (MMMF)**

- 22.1 Comply with Synthetic Vitreous Fibres - Guidelines for Construction, Construction Safety Association of Ontario Document DS036 and R.R.O 1990, Reg. 833: CONTROL OF EXPOSURE TO BIOLOGICAL OR CHEMICAL AGENTS.

## **23 DUST CONTROL**

- 23.1 Prior to commencing Work, provide completed Dust Control Plan (Non-Asbestos containing materials) (see attachment) in accordance with Article 6.
- 23.2 During the progress of the Work:
  - 23.2.1 Provide air monitoring of contaminants as applicable to verify the effectiveness of dust Control measures.
  - 23.2.2 Confirm and demonstrate airborne Contaminants are maintained below their respective occupational exposure limits in accordance with OHSA R.R.O 1990, Reg. 833: CONTROL OF EXPOSURE TO BIOLOGICAL OR CHEMICAL AGENTS.
  - 23.2.3 Provide appropriate enclosure for the Work area to prevent dust from migrating to other areas.
  - 23.2.4 Provide sufficient local exhaust and ventilation.
  - 23.2.5 Periodically water unpaved construction areas, stock piles, and during concrete chipping.
  - 23.2.6 Limit speed of vehicular traffic.
  - 23.2.7 Use water sprays for dust generating loading and unloading of materials.
  - 23.2.8 Sweep and water flush entrances to the Site.

- 23.2.9 Wash down streets within the area of Work on a weekly basis and as required in accordance with the Dust Control Plan (Non-Asbestos containing materials).

## **24 EMISSION CONTROL**

- 24.1 Provide completed Emission Control Plan (Asphalt, Roofing, Waterproofing, Diesel Exhaust, Odourous Products) (see attachment), in accordance with Article 6.
- 24.2 During progress of the Work, provide sufficient measures to Control odours and other irritating chemical emissions including, but not limited to, the following:
- 24.2.1 Exhaust from powered equipment, such as vehicles, compressors, generators.
- 24.2.2 Asphalt odours.
- 24.2.3 Smoke from heating kettles, paints and sealers.
- 24.3 Prevent odours from entering the ventilation systems through placement options, sealing or shutting down air intakes, and use of positive pressure where possible.
- 24.4 Where possible, schedule activities known to generate noxious or irritating odours during off-hours to minimize impact on TTC employees, passengers, and neighbouring properties.
- 24.5 Ensure chemical Products used have been previously reviewed and approved by TTC for use regarding overall flammability, chemical and environmental Hazards and irritant properties.

## **25 TRAINING AND AWARENESS**

- 25.1 TTC to determine dates, times, and locations of training.
- 25.2 Prior to accessing the Site, ensure Workers participate in TTC safety Training and Awareness programs as follows:
- 25.2.1 Subway/SRT Rule Book Training and mandatory annual Re-certification Training for all Workers who will be performing Work and require access to Track Level including Service Room beyond the platform gate.
- 25.2.1.1 Duration one (1) Day.
- 25.2.2 Safety Orientation for Bus Garages, Streetcars Carhouses, and Shops – Contractors for all Workers who will be performing Work on bus garages, streetcars carhouses, and shops without accessing Track Level.
- 25.2.2.1 Duration half (1/2) Day.
- 25.2.3 Work Protection Code Training for isolation of Work within the vicinity of equipment operating at 750 V AC or higher for all Workers who will be performing Work inside and require access to Substations.
- 25.2.3.1 Duration half (1/2) Day.
- 25.2.4 Substation Awareness for all Workers who will be performing Work inside and require access to Substations.
- 25.2.4.1 Duration half (1/2) Day.

- 25.2.5 Contractor Contractual Safety Requirements Awareness Session conducted on the day of Safety Start-up Review for the Project for Supervisor in Charge and other Workers as applicable, and Safety Awareness for accessing Electrical Rooms, Signal Rooms, Communication Rooms, Substations or Tie Breaker Rooms.
- 25.2.5.1 Duration half (1/2) Day.
- 25.3 Submit request for Training and Awareness twenty-one (21) Days in advance of the anticipated date of Training.
- 25.3.1 Include Employer's name, list of Workers' names, and union affiliation on the submission.
- 25.3.2 Expect confirmation of Training by TTC seven (7) Days in advance of the date of Training.
- 25.3.3 Inform TTC a minimum of seven (7) Days in advance of any changes to the list of Workers identified for Training.
- 25.3.4 Any changes to the list of identified Workers may not be accommodated by TTC on the date of Training.
- 25.3.5 Rescheduling fee of \$500.00 per person payable to TTC applies in the event the Workers on the submitted list are not able to attend the Training date provided.

**END OF SECTION**



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<b>Attachment Title</b>	<b>Pages</b>
Evaluation of Contractor's Health and Safety Policy and Program	12
Site Specific Safety Plan Guideline	2
Site Specific Emergency Response and Evacuation Plan Guideline	2
Emergency Response Planning for Construction Projects	8
Site Specific Traffic Protection and Control Plan Guideline	2
Contractor Work Area Separation Plan Guideline	8
Contractor Work Area Separation Plan	1
Access Request for Electrical Room, Substation or Tie Breaker Room	1
Job Safety Analysis/Safety Plan Development Reference Sheet	1
Worker Hearing Conservation Plan	1
Asbestos Abatement Plan	2
Dust Control Plan (Non-Asbestos containing materials)	2
Emission Control Plan (Asphalt, Roofing, Waterproofing, Diesel Exhaust, Odourous Products)	2
Contractor Service and Utility Locate Notification and Verification	2
Energy/System Isolation & Restoration Request	2
Contractor Hot Work Permit	1
Contractor Hot Work Checklist	2
Request for Construction Product Safety Data Sheet Evaluation	2
Contract Safety Start-up Review	2
Contract Safety Notice Board	1
Site Specific Crane Lift Plan Guideline	3
Contractor Request for Access to Public/Operating Area	1
Access Request to Contractor Work Area	1



## Evaluation of Contractor's Health and Safety Policy and Program

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### 1. INTRODUCTION

Evaluation of the Health and Safety Policy and Program (H&S Program) as submitted by the Contractor is to determine the effectiveness of the program in creating a safe work environment for all parties on a construction site. Sound Contractor Health and Safety Program is capable of establishing safe operations and meet the requirements as required in the Health and Safety Act (OSHA), Construction Regulations and other applicable standards.

The term 'H&S Program' is used interchangeably with the 'Health and Safety Policy and Program' as far as this document is concerned.

The H&S Program(s) is evaluated according to the following 17 elements:

1. Health and Safety Policy Statement and Program Management
2. Hazard Identification, Assessment and Control
3. Safe Work Practices and Procedures
4. Company Safety Rules
5. Personal Protective Equipment
6. Preventative Maintenance
7. Training
8. Competent Supervision
9. Communication
10. Workplace Inspections
11. Incident Reporting and Investigations
12. Emergency Preparedness
13. Health and Safety Representative and JHS Committee
14. Workplace Violence and Harassment
15. Early and Safe Return to Work
16. First Aid Program
17. Subcontractor and Visitor Management

## Evaluation of Contractor's Health and Safety Policy and Program

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### 1. Contractor's Health and Safety Policy and Program Evaluation Procedure

#### Purpose

The purpose of the H&S Program Evaluation process is to verify the Contractor's policies and procedures for the effective management of their H&S Program against recognized industry best practices.

In addition, this is to provide reasonable assurance that the Contractor has measures and methods in place to establish effective controls for the Health and Safety of workers on a construction site.

#### Scoring

This process allows the TTC to review and score in a methodical manner the Contractor's Health and Safety Program.

Each sub-element is scored individually. When appropriate information is contained within the sub-element and substantial evidence found, the sub-element is scored as 'evidence found' and given a score of one (1). In cases where the sub-element does not contain substantial evidence, the sub-element is scored as 'evidence not found' and given a score of zero (0).

In order to achieve a PASS, the Contractor must achieve a score of one (1) for all the sub-elements identified as 'Mandatory' on the form.

#### Items to be completed by the Contractor

The Contractor must submit their H&S Program as well as any supporting documentation for the evaluation.

In addition, the Contractor must fill-out the title project information box including: Contractor, Contract Title/Number and Date Submitted.

The Contractor must also provide references (e.g., page numbers) to the specific H&S Program sub-elements in the column marked "Located on pages(s)" on pages 3 to 10.

#### Review

The TTC Representative will utilize the evaluation form, review submitted documents and score in accordance with the scoring process above.

The overall response will be provided to the Contractor as 'favorable' or 'non-favorable'.

## Evaluation of Contractor's Health and Safety Policy and Program

<b>Contractor</b>					
<b>Contract Title / Number</b>					
<b>Date submitted</b>					
<b>The Contractor must score at least 76% as an overall score and meet all the 'Mandatory' sub-elements</b>					
<b>Element #1</b>	<b>Health and Safety Policy Statement and Program Management</b>	<b>Located on page(s)</b>	<b>Mandatory</b>	<b>Evidence Found</b>	<b>Evidence Not Found</b>
1.1	Is H&S Policy reviewed annually and is it current to the year?		Yes		
1.2	Does the H&S Policy contain references to management's commitment to provide a Healthy and Safe work environment?		Yes		
1.3	Does H&S Program address responsibilities of all workplace parties?		Yes		
1.4	Is the H&S Program reviewed annually? Is there a process in place for Annual Management review of the H&S Program?		Yes		
Comments:				<b>Score for Element #1</b>	

## Evaluation of Contractor's Health and Safety Policy and Program

Element #2	Hazard Identification, Assessment, and Control	Located on page(s)	Mandatory	Evidence Found	Evidence Not Found
2.1	Is there a process for identifying of hazards, their assessment and control? Are there tools / templates for hazard identification, assessment and control?		Yes		
2.2	Are appropriate workplace parties involved in the hazard identification, assessment and control process e.g. workers, supervisors, safety representatives, technical positions, etc.?		No		
2.3	Is there a method for job specific hazard identification, assessment and control?		Yes		
Comments:				Score for Element #2	
Element #3	Safe Work Practices and Procedures	Located on page(s)	Mandatory	Evidence Found	Evidence Not Found
3.1	Does the H&S Program contain practices and procedures applicable to the Contractor's work environment?		Yes		
3.2	Do the practices and procedures referenced in 3.1 above provide appropriate information for employees?		No		
3.3	Is there a process for the implementation of job specific safe work practices and procedures?		Yes		
Comments:				Score for Element #3	

## Evaluation of Contractor's Health and Safety Policy and Program

Element #4	Company Safety Rules	Located on page(s)	Mandatory	Evidence Found	Evidence Not Found
4.1	Are company safety rules clearly stated?		No		
4.2	Are there clear expectations related to the adherence of company safety rules?		No		
4.3	Do the company safety rules include a progressive disciplinary policy?		No		
Comments:				Score for Element #4	
Element #5	Personal Protective Equipment	Located on page(s)	Mandatory	Evidence Found	Evidence Not Found
5.1	Is there a written policy, and / or procedure governing use of appropriate PPE for job tasks?		Yes		
5.2	Is there a statement related to the training of workers requiring the use of specialized PPE?		Yes		
5.3	Is there a system in place to regularly inspect and maintain PPE?		Yes		
Comments:				Score for Element #5	

## Evaluation of Contractor's Health and Safety Policy and Program

Element #6	Preventative Maintenance	Located on page(s)	Mandatory	Evidence Found	Evidence Not Found
6.1	Is there a reference related to the maintenance practices of tools and equipment?		No		
6.2	Does the maintenance program refer to the frequency of equipment inspections, etc.?		No		
Comments:				Score for Element #6	
Element #7	Training	Located on page(s)	Mandatory	Evidence Found	Evidence Not Found
7.1	Is there a procedure for mandatory and / or site specific safety training?		Yes		
7.2	Are there references related to mandatory training requirements for workers i.e.: training matrix?		Yes		
7.3	Is there a statement requiring only qualified, trained workers to operate specialized equipment?		Yes		
Comments:				Score for Element #7	



## Evaluation of Contractor's Health and Safety Policy and Program

Element #8	Competent Supervision	Located on page(s)	Mandatory	Evidence Found	Evidence Not Found
8.1	Are there references related to company's expectation for supervisory training i.e.: IHSA Basics of Supervision training or equivalent?		Yes		
8.2	Is there a process to ensure that all supervisors are expected to receive MOL Health and Safety in 5 Steps or equivalent?		Yes		
8.3	Are there defined roles and responsibilities for supervisors?		Yes		
Comments:				Score for Element #8	
Element #9	Communication	Located on page(s)	Mandatory	Evidence Found	Evidence Not Found
9.1	Does the organization have a communication procedure for safety messages?		No		
9.2	Are there documented roles and responsibilities for communication of safety?		No		
9.3	Is there a process of documenting safety communication?		No		
Comments:				Score for Element #9	

## Evaluation of Contractor's Health and Safety Policy and Program

Element #10	Workplace Inspections	Located on page(s)	Mandatory	Evidence Found	Evidence Not Found
10.1	Is there a documented workplace inspection procedure?		Yes		
10.2	Does the procedure define the inspection frequencies and responsibilities?		No		
10.3	Does the procedure define requirements for conducting and recording of pre-use inspections of vehicles, machines, tools and equipment?		Yes		
Comments:				Score for Element #10	
Element #11	Incident Reporting and Investigations	Located on page(s)	Mandatory	Evidence Found	Evidence Not Found
11.1	Is there a documented procedure and a form for conducting investigations and reporting of incidents?		Yes		
11.2	Are there clearly established roles and responsibilities for the appropriate personnel to be involved in investigations i.e.: supervisors, workers including the safety rep, or committee member(s), etc.?		Yes		
11.3	Are corrective and preventive actions taken and communicated to workers?		Yes		
Comments:				Score for Element #11	

## Evaluation of Contractor's Health and Safety Policy and Program

Element #12	Emergency Preparedness	Located on page(s)	Mandatory	Evidence Found	Evidence Not Found
12.1	Does the H&S Program include references to emergency preparedness and response plans (ERP) including responses to identified hazards and addressing of the potential for emergency situations?		Yes		
12.2	Do the plans define the roles and responsibilities of relevant emergency response personnel, and include training in emergency procedures?		Yes		
12.3	Is there a provision for transporting an injured worker to a hospital or medical facility?		Yes		
Comments:				Score for Element #12	
Element #13	Health and Safety Representative and Joint Health and Safety Committee	Located on page(s)	Mandatory	Evidence Found	Evidence Not Found
13.1	Does the organization have documented procedures for the selection, composition, roles and responsibilities and/or establishment criteria for JH&S Committees where required?		Yes		
13.2	Are the management and worker health and safety representatives certified in accordance with legislative requirements?		Yes		
13.3	Does worker(s) Health and Safety representative conduct regular workplace inspections?		Yes		
Comments:				Score for Element #13	

## Evaluation of Contractor's Health and Safety Policy and Program

Element #14	Workplace Violence and Harassment	Located on page(s)	Mandatory	Evidence Found	Evidence Not Found
14.1	Is there a Workplace Violence and Harassment Policy statement? Is it current? Is it reviewed annually?		Yes		
14.2	Does the H&S program include workplace violence and harassment assessment as well as reporting and investigation procedures?		Yes		
14.3	Is there a Drug and Alcohol Policy Statement?		No		
Comments:				Score for Element #14	
Element #15	Early and Safe Return to Work	Located on page(s)	Mandatory	Evidence Found	Evidence Not Found
15.1	Does the H&S program contain references to Early and Safe Return to Work?		Yes		
15.2	Are there references related to the company's commitment to provide 'modified work' to injured workers?		Yes		
15.3	Is there a reference that the 'modified work' is to be performed in accordance with the FAF (Functional Abilities Form)		Yes		
Comments:				Score for Element #15	

## Evaluation of Contractor's Health and Safety Policy and Program

Element #16	First Aid Program	Located on page(s)	Mandatory	Evidence Found	Evidence Not Found
16.1	Is there documentation stating that all injuries are to be reported immediately?		Yes		
16.2	Are there references to provide qualified First Aider on site?		Yes		
16.3	Are there references related to the First Aid kits appropriate size for the crew / project and expectations for inspections as required?		Yes		
Comments:				Score for Element #16	
Element #17	Subcontractor and Visitor Management	Located on page(s)	Mandatory	Evidence Found	Evidence Not Found
17.1	Is there a program for the management of Subcontractor(s) and Visitor(s)?		Yes		
17.2	Does the program address Health and Safety Training, PPE, Orientation etc. to subcontractors and visitors on site?		Yes		
Comments:				Score for Element #17	

## Evaluation of Contractor's Health and Safety Policy and Program

Overall Score for Program		'Mandatory' requirement (s) not met	No Evidence	Evidence Found
		1 or more = Fail	0 points per sub-element	1 point per sub-element
Possible Score:			Lowest: 0 points	Highest: 50 points
Achieved Scores				
Comments:				
Final Percentage Score:		Favourable or Non-Favourable:		
<b>Formula for evaluation is as follows:</b> <ul style="list-style-type: none"> <li>All 38 'Mandatory' elements must achieve a score of (1) at minimum</li> <li><math>[\text{Total 'Evidence Found' sub-elements} / 50 \times \text{Total sub-elements}] \times 100 = \text{final percentage score}</math></li> </ul>				
If 'No evidence' is found for any of the 38 'Mandatory' sub-elements, the result is in an automatic score of "Non-Favourable".				
EVALUATED BY				
Construction Safety Officer Name	Signature		Date	
REVIEWED BY (when evaluation contested by Contractor)				
Manager – Safety and Security Name	Signature		Date	

# Site Specific Safety Plan Guideline

The Contractor shall develop and implement a Site Specific Safety Plan and Procedures for the Contract.

This information serves as the basis for drafting procedures, assigning responsibilities, acquiring necessary equipment, and providing the training needed to manage jobsite level safety requirements.

When developing a Site Specific Safety Plan, the constructor should consider the following:

#	Item	Considerations
1	Supervisory Personnel	<ul style="list-style-type: none"><li>-Roles and Responsibilities of Supervisory personnel</li><li>-Contact list of supervisory personnel including after-hours when applicable</li><li>-Supervisory Training requirements</li></ul>
2	Project Information	<ul style="list-style-type: none"><li>-Project scope of work</li><li>-Regular Hours of operations</li><li>-Specific after-hours requirements</li><li>- Site roles and responsibilities,</li></ul>
3	Location / TTC Facility	<ul style="list-style-type: none"><li>-Location / TTC Facility Specific Requirements</li><li>-Work location / area separation diagrams</li><li>-Site access / egress including emergency vehicles</li><li>-Public protection</li><li>-Parking areas</li><li>-Location of sanitary facilities</li><li>-Traffic Control and Protection</li><li>-Traffic Flow diagrams</li><li>-Material Delivery and Storage diagrams</li></ul>
4	Site Signage	<ul style="list-style-type: none"><li>-Site specific signage including:<ul style="list-style-type: none"><li>• Warning signs</li><li>• Advisory signs</li><li>• Construction hazard sites</li><li>• Designated meeting area signs</li><li>• PPE signs</li></ul></li></ul>
5	Site Safety Documentation	<ul style="list-style-type: none"><li>-Safety Board posting requirements</li><li>-Jobsite specific procedures, instructions, etc.</li><li>-Site Safety Rules</li><li>-Safety Meetings including frequency and records keeping</li></ul>
6	JHSC / Trade Committee / Safety Representatives	<ul style="list-style-type: none"><li>-Site level JHS Committee / Trade Committee</li><li>-Safety Representative</li><li>- Worker rights under the Occupational Health and Safety Act</li></ul>
7	Personal Protective Equipment (PPE)	<ul style="list-style-type: none"><li>-General PPE requirements</li><li>-Specific PPE requirements</li></ul>
8	Hazard Recognition and Control / JHAs / JSAs	<ul style="list-style-type: none"><li>-Site and job specific assessment of anticipated hazards and controls based on Scope of Work including but not limited to:<ul style="list-style-type: none"><li>• Track Level Safety</li><li>• Subway Stations</li></ul></li></ul>

# Site Specific Safety Plan Guideline

		<ul style="list-style-type: none"> <li>• Fall Prevention &amp; Protection</li> <li>• Confined Spaces</li> <li>• Housekeeping and Storage</li> <li>• Traffic Control</li> <li>• Trenching and Excavation</li> <li>• Locates</li> <li>• Caissons</li> <li>• Designated Substances</li> <li>• Material handling</li> <li>• Hoisting and Rigging</li> <li>• Vehicle Safety</li> <li>• Traction Power / Energy Isolations / Lock-out Tag-out</li> <li>• Hot Work</li> <li>• Hand and Power Tools</li> <li>• Hot and Cold Weather</li> </ul>
9	Equipment & Machinery	-Manufacturer Operating Manuals / Instructions -Maintenance records
10	Workplace Inspections	-Roles and Responsibilities -Records keeping -Emergency equipment checks ie: fire extinguishers, eye wash stations, spill kits, etc.
11	WHMIS	-Training requirements -SDS -Information related to Designated Substance Surveys
12	Incident Reporting and Investigations	-Site roles and responsibilities for incident reporting and investigations -Reporting protocols: internal / external / MOL -Corrective and preventative actions
13	Site / Job Specific Safety Orientation	-Contractor Safety Orientation package including information on the above sections 1-12 to be provided to: <ul style="list-style-type: none"> <li>• Constructor personnel</li> <li>• Subcontractor personnel</li> <li>• TTC personnel</li> <li>• Visitors</li> <li>• Suppliers of materials and/or service</li> </ul> -Constructor Safety Training records management
<b>NOTE:</b>		
	Emergency Planning and Response, Environment, Occupational Hygiene and Security Plans	-Items related to Emergency Planning and Response, Environment. Occupational Hygiene and Security should be included in separate site specific plans

The Site Specific Safety Plan shall be specific for each work area and it should take into account the uniqueness of a work location, its anticipated hazards and controls.



# Site Specific Emergency Response and Evacuation Plan Guideline

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The Contractor shall develop and implement a Site Specific Emergency Response and Evacuation Plan and associated Emergency Response Procedures for the Contract.

This information serves as the basis for drafting procedures, assigning responsibilities, acquiring necessary equipment, and providing the training needed to respond effectively and quickly to any emergency.

The following IHSA Documents / Samples are attached for reference:

- Emergency Response Planning for Construction Projects - IHSA
- Emergency Numbers Form
- Emergency Plan Guidelines
- Emergency Procedures
- Emergency Response Planning Checklist
- Safety Harness Rescue Procedure

The Site Specific Emergency Response and Evacuation Plan must include a comprehensive emergency mitigation strategy for the events listed below but not limited to:

- Flooding
- Collapses of structures
- Critical injury
- Fire
- Explosions
- Security Threats
- Substantial Spill or Release
- Evacuation measures including Designated Meeting Area(s)
- References to the nearest Hospital
- References to the contractor key personnel contact numbers

The Site Specific Emergency Response and Evacuation Procedures shall be specific for each work area and should include a drawing of the areas where emergencies such as but not limited to flooding, fire, explosion, structural collapse, or chemical spills might occur.

For each type of hazard, the possible results are to be identified – fatalities, injuries, structural or environmental damage – and the required response, such as rescue, fire fighting, or evacuation.

The response plan must include step-by-step procedures and control measures for each type of emergency, including roles and responsibilities on Site for managing an emergency.

# Site Specific Emergency Response and Evacuation Plan

## Guideline

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The procedures must indicate plan activation protocol, key contractor emergency contact and key staff, Designated Assembly Area, anticipated resources to manage the scenarios including rescue equipment and medical supplies, as well as required repair materials should be on hand to deal with specific emergencies.

The response plan must determine the training required for effective response to emergencies

The mitigation strategy for each work location shall contain, for example and without limit to, the following:

1. Drawings of the work area for each Scenario showing:
  - Points of entrance / egress for emergency evacuation and emergency/rescue access.
2. Watermain Emergency Scenario
  - Watermain locations identified
  - Shut Off valve locations confirmed and shut-offs tested
  - Possible area of flooding identified
  - Number of pumps required and location of pumps;
  - Water Discharge locations identified
  - Any tools, kits, repair materials, etc.
  - Long lead materials available on site
3. Gasmain Emergency Scenario
  - Gasmain locations
  - Shut off valves locations
  - Possible emergency equipment
  - Tools, kits
4. Hydro Emergency Scenario
  - Service locations
  - Distribution substation locations
5. Shoring and Structural Emergency Scenario
  - Monitoring equipment locations
  - Available shoring posts or other equipment

# **Emergency Response Planning for Construction Projects**

Provincial Labour-Management Health and Safety Committee

This booklet has been reviewed and endorsed by the Provincial Labour-Management Health and Safety Committee and is fully a document of accord between labour and management authorities.

Additional copies can be ordered from

Construction Safety Association of Ontario  
21 Voyager Court South  
Etobicoke, Ontario M9W 5M7  
416-674-2726 1-800-781-2726 Fax: 416-674-8866  
info@csao.org

# Emergency Response Planning for Construction Projects

## OBJECTIVE

The *Occupational Health and Safety Act* requires that the constructor shall establish Emergency Response Procedures for every project. This document provides a plan to assist constructors in developing these procedures.

Emergency preparedness helps to minimize the human suffering and economic losses that can result from emergencies.

It should be understood that the size and complexity of projects, as well as their access and location, have a bearing on the degree of planning necessary for emergencies. It is therefore strongly recommended that the constructor ensure that a member of staff *on site* assist in developing the emergency response plan.

## HOW TO DEVELOP A PLAN

Planning shall begin before any work commences on the project. Although there may be little time between the award of the contract and the start of the project, a good emergency response plan can be generic and, with some minor changes, can be easily adapted to specific sites and readily implemented. This is especially the case where a constructor specializes in similar types of projects.

Development should include the following considerations:

- 1) hazard identification/assessment
- 2) emergency resources
- 3) communication systems
- 4) administration of the plan
- 5) emergency response procedure
- 6) communication of the procedure
- 7) debriefing and post-traumatic stress procedure.

Each of these points is explained in the following sections.

### Hazard Identification/Assessment

The process of hazard identification and assessment involves a thorough review that should include, but not be limited to, the following points:

- transportation, materials handling, hoisting, equipment or product installation, temporary structures, material storage, start-up, and commissioning activities
- environmental concerns
- consultation with the client regarding potential hazards when working in or adjacent to operating facilities
- resources such as material safety data sheets (MSDSs) to determine potential hazards from on-site materials
- proximity to traffic and public ways.

Because construction sites are frequently fast-changing, the process of hazard assessment must be ongoing to accommodate the dynamic environment. Once hazards are identified, the next task is to assess the potential or risk involved in each. For each hazard identified, ask:

- What can go wrong?
- What are the consequences?

For each potential hazard it is important to identify resources necessary for an appropriate emergency response. For most events in construction, a simple analysis based on the experience of the people involved on the project is likely sufficient.

## **Emergency Resources**

It is important to identify which resources are available and have contingency plans in place to make up for any deficiencies.

The most important resource on most projects will be a 911 system. It is essential to verify that 911 is in effect in the area. Most Ontario communities have a 911 system in place, but it is important to know the facilities or limitations available in that location. Is a high-reach rescue team available? What is the response time? What must site personnel do in the meantime?

Other on-site resources such as fire extinguishers, spills containment equipment, and first aid kits must be maintained and clearly identified. Construction equipment may be included among potential emergency resources. Personnel, especially on-site medical staff or workers trained in first aid, should be included in the plan.

There may be situations where outside resources are so far away that an adequate response is not possible. In these situations, resources may have to be obtained and kept on site. Examples would include fire protection or ambulance/medical resources in remote areas.

Whatever the situation may be, people, equipment, facilities, and materials are needed for emergency response. Where they will come from must be determined in advance. Moreover, the people supplying these resources must be made aware of their role in the plan.

## **Communication Systems**

An important key to effective emergency response is a communications system that can relay accurate information quickly. To do this, reliable communications equipment must be used, procedures developed, and personnel trained. It is a good idea to have a backup system in place, in case the system is rendered useless by the emergency. For example, telephone lines may be cut.

The type and location of emergency communication systems must be posted on the project. This will include location of telephones, a list of site personnel with cellular phones or two-way radios, and any other equipment available. Emergency phone numbers and the site address/location should be posted beside all site phones. On large sites, the location of emergency phones must be clearly marked. The poster *Emergency Response* (P103), available from CSAO, can be used to record this and other information.

A communication system must be made up of strategically placed equipment and properly defined responsibilities. The emergency response plan posted in a conspicuous place on the project must identify the designated equipment and the people to operate it.

### **Administration of the Plan**

The task of administering and organizing the plan is vital to its effectiveness. The person who has this task will normally be the person in charge of the emergency response operation. It is their task to ensure

- that everyone clearly understands their roles and responsibilities within the emergency response plan (a chart may be helpful in this regard)
- that emergency resources, whether people or equipment, are kept at adequate levels in step with the progress of the project.

It is very important to review the emergency plan on a regular basis and especially after an emergency has occurred. Changes may be necessary where deficiencies became apparent as the plan went into operation.

### **Emergency Response Procedure**

An emergency can be reported from any source—a worker on site, an outside agency, or the public. Remember that circumstances may change during the course of an emergency. Any procedures you develop must be able to respond to the ongoing situation.

The following list covers basic actions to take in an emergency. These steps apply to almost any emergency and should be followed in sequence.

- Stay calm.
- Assess the situation.
- Take command.
- Provide protection.
- Aid and manage.
- Maintain contacts.
- Guide emergency services.

***Stay calm*** – Your example can influence others and thereby aid the emergency response.

***Assess the situation*** – Determine what happened and what the emergency is. Look at the big picture. What has happened to whom and what will continue to happen if no action is taken? Try to identify the cause that must be controlled to eliminate immediate, ongoing, or further danger.

***Take command*** – The most senior person on the scene should take charge and call, or delegate someone to call, emergency services—generally 911—and explain the situation. Assign tasks for controlling the emergency. This action also helps to maintain order and prevent panic.

***Provide protection*** – Eliminate further losses and safeguard the area. Control the energy source

causing the emergency. Protect victims, equipment, materials, environment, and accident scene from continuing damage or further hazards. Divert traffic, suppress fire, prevent objects from falling, shut down equipment or utilities, and take other necessary measures. Preserve the accident scene; only disturb what is essential to maintain life or relieve human suffering and prevent immediate or further losses.

***Aid and manage*** – Provide first aid or help those already doing so. Manage personnel at the scene. Organize the workforce for both a headcount and emergency assignments. Direct all workers to a safe location or command post. This makes it easier to identify the missing, control panic, and assign people to emergency duties. Dispatch personnel to guide emergency services on arrival.

***Maintain contact*** – Keep emergency services informed of situation. Contact utilities such as gas and hydro where required. Alert management and keep them informed. Exercise increasing control over the emergency until immediate hazards are controlled or eliminated and causes can be identified.

***Guide emergency services*** – Meet services on site. Lead them to emergency scene. Explain ongoing and potential hazards and cause(s), if known.

### **Communication of the Procedure**

To be effective, an Emergency Response Procedure must be clearly communicated to all site personnel. The following activities should be considered:

- Review the procedure with new site subcontractors and new workers to ensure that it covers their activities adequately.
- Review the procedure with suppliers to ensure that it covers any hazards that the storage or delivery of their materials might create.
- Review new work areas in operating plants with owner/client to ensure that new hazards are identified and covered in the procedure.
- Review the procedure with the Joint Health and Safety Committee or Health and Safety Representative on a regular basis to address new hazards or significant changes in site conditions.
- Post the procedure in a conspicuous location.

The Emergency Response Procedure for a construction project must continually undergo review and revision to meet changing conditions.

### **Debriefing and Post-Traumatic Stress Procedure**

The recovery process, or what happens after the emergency response has been completed, is a critical step in the plan.



Many emergency tasks may be handled by people who are not accustomed to dealing with emergencies. People may have seen their work partners and friends badly injured and suffering great pain.

Once the emergency is over, the attitude should not be “Okay, let’s get back to work” or “Let’s go home.” Some of the people involved may need assistance in order to recover. In some cases professional counselling may be needed. As part of site emergency planning, construction companies should have measures in place to deal with post-traumatic stress. For more information, refer to the brochure *Post-Traumatic Stress* (F013), available from CSAO. Local hospitals, ambulance services, and medical practitioners may also be able to help.

Debriefing is necessary to review how well the plan worked in the emergency and to correct any deficiencies that were identified. Debriefing is critical to the success of future emergency response planning.

## **SUMMARY**

Slow response, lack of resources, or the absence of trained personnel will lead to chaos in an emergency. To minimize human suffering and financial losses, all personnel must know their responsibilities under the emergency response plan.

Remember – planning for emergencies should include the following points:

- 1) hazard identification/assessment
- 2) emergency resources
- 3) communication systems
- 4) administration of the plan
- 5) emergency response procedure
- 6) communication of the procedure
- 7) debriefing and post-traumatic stress procedure.

The plan should be used to set emergency procedures, implement and communicate the procedures, and ensure that any required training has been completed. The plan should also be evaluated regularly to ensure that it conforms to current operations and conditions.

In any Emergency Response Procedure, the following steps are basic and essential:

- Stay calm.
- Assess the situation.
- Take command.
- Provide protection.
- Aid and manage.
- Maintain contact.
- Guide emergency services.

**Construction Safety Association of Ontario**

21 Voyager Court South

Etobicoke, Ontario M9W 5M7

416-674-2726 1-800-781-2726 Fax: 416-674-8866

[info@csao.org](mailto:info@csao.org)

# Site Specific Traffic Protection and Control Plan Guideline

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The Contractor shall develop and implement a Site Specific Traffic Protection and Control Plan and related procedures for the Contract.

This information serves as basis for the development of traffic control and protective measures for TTC properties as well as public ways adjacent to TTC projects including assigning roles and responsibilities, acquiring necessary equipment and providing the training needed to manage traffic control and protection safety requirements.

When developing Site Specific Traffic Protection and Control Plan, the contractor should consider the following as applicable to work environment:

## **PUBLIC ROADWAYS AND AREAS**

#	Item	Considerations
1	General Considerations	<ul style="list-style-type: none"><li>-Roadway closure considerations per MTO Book 7 and Contract Document 01 55 26 - Traffic</li><li>-Roles and Responsibilities of Supervisory and Worker personnel for Temporary Work Zone Design, Set-up and Removal</li><li>-Supervisory and Traffic Control Personnel Training requirements for work in MTO Book 7 Temporary Conditions environment</li><li>-Traffic Control Plan communication to project parties</li></ul>
2	Special considerations and permits	<ul style="list-style-type: none"><li>-Hours of Operation</li><li>-After-hours requirements / special events</li><li>-Duration of work: mobile, very short, short and long duration</li><li>-Notifications and Road occupancy permits</li><li>-Paid Duty officers</li><li>-Overhead / Rail Tracks infrastructure considerations</li><li>-Work in low-light conditions</li><li>-Personal Protective Equipment</li></ul>
3	Temporary Work Zone Design Considerations	<ul style="list-style-type: none"><li>-Worker / motorist / cyclist safety</li><li>-Pedestrian protection</li><li>-Location of site entrance / exit</li><li>-Advance Warning</li><li>-Approach Area</li><li>-Transition Area</li><li>-Longitudinal Buffer Area</li><li>-Work Area</li><li>-Termination Area</li><li>-Work site identification</li></ul>
4	Work Zone Considerations	<ul style="list-style-type: none"><li>-Work Zone access / egress including workers, mobile deliveries, emergency vehicles, etc.</li><li>-Work Zone Set-up and Removal sequence and required resources</li><li>-Worksite conditions: road configuration / intersections, overhead utilities, excavations, rail tracks, traffic volume, speed, etc.</li><li>-Signage i.e. Construction Ahead, Road Work ahead, lane closures</li></ul>

# Site Specific Traffic Protection and Control Plan Guideline

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		<ul style="list-style-type: none"> <li>ahead, speed signs, TCP ahead, etc.</li> <li>-Delineators i.e. traffic cones, construction markers, barrels, barricades, concrete barriers, temporary pavement markers, other</li> <li>-Traffic Control Persons requirements</li> <li>-Specialized equipment i.e. buffer vehicles</li> <li>-Public protection i.e. fence, hoarding, etc.</li> <li>-Material Delivery haul routes and storage</li> <li>-Markings for after-hours storage of material, machinery and equipment</li> <li>-Parking areas</li> </ul>
5	Traffic Control Diagram	<ul style="list-style-type: none"> <li>-Illustration of protective signs, devices, equipment used for controlling traffic and protection of the workers</li> <li>-Traffic flow</li> </ul>
6	Traffic Protection Plan	<ul style="list-style-type: none"> <li>-Protective measures within work area i.e.: signs, delineators</li> <li>-Reversing vehicles / blind spots considerations</li> <li>-Mobile equipment back-up alarm requirements</li> <li>-Back-up persons / signallers including instructions and training</li> <li>-Traffic flow within the work area</li> <li>-Communication to workers</li> <li>-Work in inclement weather / low-light conditions</li> </ul>
7	Work Zone quality	<ul style="list-style-type: none"> <li>-Measures in place for work zone monitoring and inspection to ensure work zones are adequately protected</li> </ul>

## **ADDITIONAL CONSIDERATIONS FOR TTC PROPERTIES**

8	TTC Location / Facility	<ul style="list-style-type: none"> <li>-TTC Location / Facility Specific Requirements</li> <li>-Site access / egress including workers, mobile deliveries, emergency vehicles, etc.</li> <li>-Work zone separation and demarcation</li> <li>-Public / Employee protection</li> <li>-Signage / delineator requirements including: <ul style="list-style-type: none"> <li>-General information</li> <li>-Jobsite PPE Requirements</li> <li>-Construction hazards warning signs</li> <li>-Designated meeting areas</li> <li>-Zone identifiers</li> </ul> </li> <li>-Rail Tracks / Overhead considerations</li> <li>-Markings for storage of material, machinery and equipment where it may be a hazard to traffic</li> <li>-Site specific Traffic Flow diagram</li> </ul>
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The Site Specific Traffic Protection and Control Plan should be specific for each work location taking into account the uniqueness of work site, its anticipated traffic and controls.

# Contractor Work Area Separation Plan Guideline

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The Contractor must develop and implement a 'Contractor Work Area Separation Plan' for the Contract. The 'Contractor Work Area Separation Plan' must be specific of each work area and it should take into account the uniqueness of a work location, its anticipated hazards and controls.

This information serves as the basis for developing a 'Contractor Work Area Separation Plan'.

When developing a 'Contractor Work Area Separation Plan', the constructor should consider the following:

#	Item	Considerations
1	Contractor work area separation	-Provide a diagram/illustration related to the barriers that will be used on the project to separate and protect from harm members of the public, other contractors and/or TTC Operations including: -Access / egress to the work area -Parking areas -Material delivery routes -Material lay-down areas -Facilities -Waste disposal areas -Control of fugitive gases,fumes,dust,etc.
2	Type of separation:	-The plan should include details related to separation methods ie: fences, types of barriers, etc. Refer to page 2 and 3 for additional details
	Solid Hoarding	For contractor work where hazardous materials/objects could impact public/adjacent contractors/operations
	Fixed chain-link fence	For contractor work where solid hoarding may not be feasible
	Portable fence	For moveable contractor work
	Portable barrier	For moveable contractor work
	Signposts with warning tape	For small work areas away from personnel/public
	Signposts	For small work areas away from personnel/public
	Traffic cones	For work in traffic conditions
	Traffic barriers	For work in traffic conditions
3	Access to and from the contractor's work area	-Provide a diagram/illustration related to access to and from the contracts
4	Site Signage	-Site specific signage including: <ul style="list-style-type: none"><li>• Warning signs e.g. 'Danger Due to...'</li><li>• Advisory signs</li><li>• Construction hazard signs e.g. 'Danger Due to...'</li><li>• Designated emergency assembly area meeting signs</li><li>• PPE signs</li></ul>

# Contractor Work Area Separation Plan Guideline

**Construction Separation Barrier Matrix 1/7**

Type of Barrier	Commonly used	Construction Projects	Public Way / Roadway / Intersection			Greenfield / New Facility		Operational Offices / Buildings
			Public Way / Roadway Intersections	Service Right-of-way	Service Stop Platform	Perimeter Securement/Project Boundaries	Inside Project Boundaries	
Hoarding	Hoarding is commonly used in securing and maintaining separation from pedestrians and workers. Also hoarding is designed for dust tight partition.	Interior and Exterior use	✓	✓	✓	✓	✓	✓
Chain-link Fence 6' ft.	Chain-link fence is commonly used for temporary short or long term construction to maintain safety and security measures.	Exterior use	✓	✓	✓	✓	✓	✓
Roll out fence to Chain-link	Chain-link rolled out galvanized, PE, PVC power coated surface is durable for long term exterior projects.	Exterior use	✓	✓	✓	✓	✓	✓
Fast Fence 6' ft.	Fast fence is commonly used for temporary short or long term construction to maintain safety and security measures on a project.	Interior and Exterior use	✓	✓	✓	✓	✓	✓
Endura Fence 6' (Non - conductive)	Endura fence is commonly used to protect deep excavation pits and hazardous sites. Also non-conductive.	Exterior use	✓	✓	✓	✓	✓	✓
Jersey Barrier concrete or plastic with wood (non-conductive)	Jersey barrier is commonly used for heavy traffic control and a separation barrier surrounding a project or large parking area.	Exterior use	✓	✓	✓	✓ (Commonly used as additional protection in high vehicular traffic areas)	✓	✓
Traffic control steel barrier	Traffic control steel barrier is commonly used to separating and providing a directional path for pedestrians and workers.	Exterior use	✗	✗	✗	✗	✓	✗
Multi Panel	Multi panel is commonly used to section off escalator staircases maintenance/ service tasks.	Industrial use only	✗	✗	✗	✗	✓	✗
Portable and rapid roll barrier (non conductive)	Portable rapid roll is commonly used as a barrier to separate work area and public.	Interior and Exterior use	✗	✗	✗	✗	✓	✗

Legend	
✓ =	Applicable
✗ =	Non-applicable
✓ N.U. =	Never Unattended

# Contractor Work Area Separation Plan Guideline

**Construction Separation Barrier Matrix 2/7**

Type of Barrier	Commonly used	Construction Projects	Subway				
			Mainline Track	Yards	Carhouses	Stations excluding track level	Platform Level
Hoarding	Hoarding is commonly used in securing and maintaining separation from pedestrians and workers. Also hoarding is designed for dust tight partition.	Interior and Exterior use	✗	✓ (Only in areas that cannot affect track level/electrical conductors)	✓ (Only in areas that cannot affect track level)	✓	✗
Chain-link Fence 6' ft.	Chain-link fence is commonly used for temporary short or long term construction to maintain safety and security measures.	Exterior use	✗	✓ (Only in areas that cannot affect track level)	✓ (Only in areas that cannot affect track level)	✓	✗
Roll out fence to Chain-link	Chain-link rolled out galvanized, PE, PVC power coated surface is durable for long term exterior projects.	Exterior use	✗	✓ (Only in areas that cannot affect track level)	✓ (Only in areas that cannot affect track level)	✓	✗
Fast Fence 6' ft.	Fast fence is commonly used for temporary short or long term construction to maintain safety and security measures on a project.	Interior and Exterior use	✗	✓ (Only in areas that cannot affect track level)	✓ (Only in areas that cannot affect track level)	✓	✗
Endura Fence 6' (Non - conductive)	Endura fence is commonly used to protect deep excavation pits and hazardous sites. Also non-conductive.	Exterior use	✓	✓	✓	✓	✓
Jersey Barrier concrete or plastic with wood (non-conductive)	Jersey barrier is commonly used for heavy traffic control and a separation barrier surrounding a project or large parking area.	Exterior use	✓	✓	✓ (Commonly used as additional protection in high vehicular traffic areas)	✓ (Commonly used as additional protection in high vehicular traffic areas)	✗
Traffic control steel barrier	Traffic control steel barrier is commonly used to separating and providing a directional path for pedestrians and workers.	Exterior use	✗	✗	✗	✗	✗
Multi Panel	Multi panel is commonly used to section off escalator staircases maintenance/ service tasks.	Industrial use only	✗	✗	✗	✗	✓ (Only under certain conditions. Never unattended)
Portable and rapid roll barrier (non-conductive)	Portable rapid roll is commonly used as a barrier to separate work area and public.	Interior and Exterior use	✗	✗	✗	✗	✓ (Only under certain conditions. Never unattended)

Legend	
✓ =	Applicable
✗ =	Non-applicable
✓ N.U. =	Never Unattended

# Contractor Work Area Separation Plan Guideline

**Construction Separation Barrier Matrix 3/7**

Type of Barrier	Commonly used	Construction Projects	Bus		
			Garages	Parking Lots	Loops
Hoarding	Hoarding is commonly used in securing and maintaining separation from pedestrians and workers. Also hoarding is designed for dust tight partition.	Interior and Exterior use	✓	✓	✓
Chain-link Fence 6' ft.	Chain-link fence is commonly used for temporary short or long term construction to maintain safety and security measures.	Exterior use	✓	✓	✓
Roll out fence to Chain-link	Chain-link rolled out galvanized, PE, PVC power coated surface is durable for long term exterior projects.	Exterior use	✓	✓	✓
Fast Fence 6' ft.	Fast fence is commonly used for temporary short or long term construction to maintain safety and security measures on a project.	Interior and Exterior use	✓	✓	✓
Endura Fence 6' (Non - conductive)	Endura fence is commonly used to protect deep excavation pits and hazardous sites. Also non-conductive.	Exterior use	✓	✓	✓
Jersey Barrier concrete or plastic with wood (non-conductive)	Jersey barrier is commonly used for heavy traffic control and a separation barrier surrounding a project or large parking area.	Exterior use	✓ (Commonly used as additional protection in high vehicular traffic areas)	✓ (Commonly used as additional protection in high vehicular traffic areas)	✓ (Commonly used as additional protection in high vehicular traffic areas)
Traffic control steel barrier	Traffic control steel barrier is commonly used to separating and providing a directional path for pedestrians and workers.	Exterior use	✗	✗	✗
Multi Panel	Multi panel is commonly used to section off escalator staircases maintenance/ service tasks.	Industrial use only	✗	✗	✗
Portable and rapid roll barrier (non-conductive)	Portable rapid roll is commonly used as a barrier to separate work area and public.	Interior and Exterior use	✗	✗	✗

**Legend**

✓ =	Applicable
✗ =	Non-applicable
✓ N.U. =	Never Unattended



# Contractor Work Area Separation Plan Guideline

**Construction Separation Barrier Matrix 4/7**

Type of Barrier	Commonly used	Construction Projects	Streetcar			
			Track	Carhouse	Yard	Loops
Hoarding	Hoarding is commonly used in securing and maintaining separation from pedestrians and workers. Also hoarding is designed for dust tight partition.	Interior and Exterior use	✓ (Only in areas that cannot affect track level/electrical conductors)	✓ (Only in areas that cannot affect track level/electrical conductors)	✓ (Only in areas that cannot affect track level/electrical conductors)	✓ (Only in areas that cannot affect track level/electrical conductors)
Chain-link Fence 6' ft.	Chain-link fence is commonly used for temporary short or long term construction to maintain safety and security measures.	Exterior use	✓ (Only in areas that cannot affect track level/electrical conductors)	✓ (Only in areas that cannot affect track level/electrical conductors)	✓ (Only in areas that cannot affect track level/electrical conductors)	✓ (Only in areas that cannot affect track level/electrical conductors)
Roll out fence to Chain-link	Chain-link rolled out galvanized, PE, PVC power coated surface is durable for long term exterior projects.	Exterior use	✓ (Only in areas that cannot affect track level/electrical conductors)	✓ (Only in areas that cannot affect track level/electrical conductors)	✓ (Only in areas that cannot affect track level/electrical conductors)	✓ (Only in areas that cannot affect track level/electrical conductors)
Fast Fence 6' ft.	Fast fence is commonly used for temporary short or long term construction to maintain safety and security measures on a project.	Interior and Exterior use	✓ (Only in areas that cannot affect track level/electrical conductors)	✓ (Only in areas that cannot affect track level/electrical conductors)	✓ (Only in areas that cannot affect track level/electrical conductors)	✓ (Only in areas that cannot affect track level/electrical conductors)
Endura Fence 6' (Non - conductive)	Endura fence is commonly used to protect deep excavation pits and hazardous sites. Also non-conductive.	Exterior use	✓	✓	✓	✓
Jersey Barrier concrete or plastic with wood (non-conductive)	Jersey barrier is commonly used for heavy traffic control and a separation barrier surrounding a project or large parking area.	Exterior use	✓ (Commonly used as additional protection in high vehicular traffic areas)	✓ (Commonly used as additional protection in high vehicular traffic areas)	✓ (Commonly used as additional protection in high vehicular traffic areas)	✓ (Commonly used as additional protection in high vehicular traffic areas)
Traffic control steel barrier	Traffic control steel barrier is commonly used to separating and providing a directional path for pedestrians and workers.	Exterior use	✗	✗	✗	✗
Multi Panel	Multi panel is commonly used to section off escalator staircases maintenance/ service tasks.	Industrial use only	✗	✗	✗	✗
Portable and rapid roll barrier (non-conductive)	Portable rapid roll is commonly used as a barrier to separate work area and public.	Interior and Exterior use	✗	✗	✗	✗

**Legend**

✓ =	Applicable
✗ =	Non-applicable
✓ N.U. =	Never Unattended

# Contractor Work Area Separation Plan Guideline

**Construction Separation Barrier Matrix 5/7**

Type of Barrier	Commonly used	Construction Projects	Public Way / Roadway / Intersection			Greenfield / New Facility		Operational Offices / Buildings
			Public Way / Roadway Intersections	Service Right-of-way	Service Stop Platform	Perimeter Securement/ Project Boundaries	Inside Project Boundaries	
Delineator Post or pylons with Crossbar	Delineators are commonly used to separate work area from public and used in traffic control to direct public and vehicular path routes.	Interior and Exterior use	x	x	x	x	✓	✓ N.U.
Avalon Barrier	Avalon commonly used for pedestrian control around work areas and temporary excavations.	Interior and Exterior use	x	x	x	x	✓	✓ N.U.
Rubbermaid Collapsible	Rubbermaid collapsible is commonly used to create a quick barrier from the public to the work area.	Interior use	x	x	x	x	✓	✓ N.U.
X-Frame Collapsible	X-Frame is commonly used to create a quick barrier from the public to the work area.	Interior use	x	x	x	x	✓	x
Type 1 and 2 plastic traffic barricade	A Type plastic traffic barricade is commonly used to separate work area and road way from public.	Exterior traffic use only	x	x	x	x	x	x
Pylons and Yellow hazard cones	Pylons and yellow cones are commonly used as a immediate hazard marker.	Interior and Exterior use	x	x	x	x	x	x
Stanchions	Stanchions are commonly used to direct pedestrians through hallways, pathways, event booths.	NO	x	x	x	x	x	x
Caution and Danger tape	Caution or danger tape is commonly used to mark a immediate hazard to isolate and secure an area.	Temporary interior and Exterior use	x	x	x	x	x	x
Roll Fencing	Safety roll fence, silt, wood fence are commonly used to provide preliminary perimeter around sites to prevent unauthorized entry or enviromental exposure.	Exterior use	x	x	x	x	✓	✓ N.U.

Legend	
✓ =	Applicable
x =	Non-applicable
✓ N.U. =	Never Unattended

# Contractor Work Area Separation Plan Guideline

**Construction Separation Barrier Matrix 6/7**

Type of Barrier	Commonly used	Construction Projects	Subway				
			Mainline Track	Yards	Carhouses	Stations excluding track level	Platform Level
Delineator Post or pylons with Crossbar	Delineators are commonly used to separate work area from public and used in traffic control to direct public and vehicular path routes.	Interior and Exterior use	✓	✓	✓	✗	✓ N.U.
Avalon Barrier	Avalon commonly used for pedestrian control around work areas and temporary excavations.	Interior and Exterior use	✗	✓ N.U.	✓ N.U.	✗	✓ N.U.
Rubbermaid Collapsible	Rubbermaid collapsible is commonly used to create a quick barrier from the public to the work area.	Interior use	✗	✗	✗	✗	✗
X-Frame Collapsible	X-Frame is commonly used to create a quick barrier from the public to the work area.	Interior use	✗	✗	✗	✗	✗
Type 1 and 2 plastic traffic barricade	A Type plastic traffic baarricade is commonly used to separate work area and road way from public.	Exterior traffic use only	✗	✗	✗	✗	✗
Pylons and Yellow hazard cones	Pylons and yellow cones are commonly used as a immediate hazard marker.	Interior and Exterior use	✗	✗	✗	✗	✗
Stanchions	Stanchions are commonly used to direct pedestrians through hallways, pathways, event booths.	NO	✗	✗	✗	✗	✗
Caution and Danger tape	Caution or danger tape is commonly used to mark a immediate hazard to isolate and secure an area.	Temporary interior and Exterior use	✗	✗	✗	✗	✗
Roll Fencing	Safety roll fence, silt, wood fence are commonly used to provide preliminary perimeter around sites to prevent unauthorized entry or enviromental exposure.	Exterior use	✗	✗	✓ N.U.	✗	✓ N.U.

**Legend**

✓ =	Applicable
✗ =	Non-applicable
✓ N.U. =	Never Unattended

# Contractor Work Area Separation Plan Guideline

**Construction Separation Barrier Matrix 7/7**

Type of Barrier	Commonly used	Construction Projects	Bus			Streetcar			
			Garages	Parking Lots	Loops	Track	Carhouse	Yard	Loops
Delineator Post or pylons with Crossbar	Delineators are commonly used to separate work area from public and used in traffic control to direct public and vehicular path routes.	Interior and Exterior use	✗	✓ N.U.	✗	✓	✓	✓	✗
Avalon Barrier	Avalon commonly used for pedestrian control around work areas and temporary excavations.	Interior and Exterior use	✗	✓ N.U.	✗	✓ N.U.	✓ N.U.	✓ N.U.	✗
Rubbermaid Collapsible	Rubbermaid collapsible is commonly used to create a quick barrier from the public to the work area.	Interior use	✗	✓ N.U.	✗	✗	✗	✗	✗
X-Frame Collapsible	X-Frame is commonly used to create a quick barrier from the public to the work area.	Interior use	✗	✓ N.U.	✗	✗	✗	✗	✗
Type 1 and 2 plastic traffic barricade	A Type plastic traffic baarricade is commoonly used to separate work area and road way from public.	Exterior traffic use only	✗	✗	✗	✗	✗	✗	✗
Pylons and Yellow hazard cones	Pylons and yellow cones are commonly used as a immediate hazard marker.	Interior and Exterior use	✗	✗	✗	✗	✗	✗	✗
Stanchions	Stanchions are commonly used to direct pedestrians through hallways, pathways, event booths.	NO	✗	✗	✗	✗	✗	✗	✗
Caution and Danger tape	Caution or danger tape is commonly used to mark a immediate hazard to isolate and secure an area.	Temporary interior and Exterior use	✗	✗	✗	✗	✗	✗	✗
Roll Fencing	Safety roll fence, silt, wood fence are commonly used to provide preliminary perimeter around sites to prevent unauthorized entry or enviromental exposure.	Exterior use	✗	✓ N.U.	✗	✓ N.U.	✓ N.U.	✓ N.U.	✗

Legend	
✓ =	Applicable
✗ =	Non-applicable
✓ N.U. =	Never Unattended

## Contractor Work Area Separation Plan

Contract No. \_\_\_\_\_

Date: \_\_\_\_\_

Contract Title: \_\_\_\_\_

*This form is to be completed and submitted by the Contractor, acting in the capacity of a Constructor, to the TTC Representative. The Contractor is to describe the methods and measures that will be utilized by the Constructor to ensure adequate separation at all times (attachments may be used as necessary). Refer to Contractor Work Separation Plan Guideline for reference.*

### Contract Scope of Work:

--

Contractor Name:  
Address:

--

### Site Information:

Address:	
Contract Start Date:	
Contract Completion Date:	
Phase (if applicable):	
Phase start date:	
Phase end date:	
<b>Work Area Location:</b>  Attach drawing/sketch, detailing separation methods. e.g., warning signs, type of fence/barriers, etc. and site access, delivery routes, material lay-down areas if any, etc.	

### Contractor Acknowledgement:

Ministry of Labour Notice of Project filed and copy provided to TTC Representative	<input type="checkbox"/> Yes <input type="checkbox"/> N/A
Form 1000 for all employers provided to TTC Representative.	<input type="checkbox"/> Yes <input type="checkbox"/> N/A
Required contract documentation submitted to TTC Representative.	<input type="checkbox"/> Yes <input type="checkbox"/> N/A

Contractor Representative Name	Phone No:	Contractor Signature

<b>NOTE:</b>	1	Constructor is responsible for establishing proper separation methods through all phases of the project.
	2	For work to be performed <u>outside</u> of Work Area(s), as identified on this form, an ECE Contractor Access Request is required. Refer to Contractor Work Separation Area Plan Guideline for acceptable barriers outside of the designated Work area.
	3	This form must be updated and resubmitted by the Contractor as the Contract progresses through different phases, areas on-site or if amended, as applicable.



## Access Request for Electrical Room, Substation or Tie Breaker Room

<b>SECTION 1 - Request For Access (Requester to complete)</b>		
<b>- - - Job Safety Analysis (JSA)/Safety Plan Must Be Attached Along With This Request - - -</b>		
Name of Person requesting Access (Requester):		Contract No. / Request No:
Proposed Start Date & Time:	Proposed End Date & Time:	Request date: (7 Days Notice Required)
Site Location/Door No. & Room Description (e.g., battery, breaker, generator, relay, switchboard, substation, communication, signal, etc.):		
Description of Work:	Other Applicable Permits/Requests Attached: <input type="checkbox"/> Contractor Service and Utility Locate Notification & Verification <input type="checkbox"/> Site Service Isolation & Restoration Request <input type="checkbox"/> Contractor Hot Work Permit	
Any Specialized PPE or Clothing (e.g., Arc/Flame/Fire resistant) required? <input type="checkbox"/> Yes <input type="checkbox"/> No	If 'yes', list requirements:	
Any Specialized Training required? <input type="checkbox"/> Yes <input type="checkbox"/> No	If 'yes', list requirements:	
Fire system requires deactivation by TTC forces to prevent unnecessary actuation: (sprinkler/sprinkler head, fire alarm etc.)		<input type="checkbox"/> Yes <input type="checkbox"/> No
Does the work affect utilities 750 V or higher?		<input type="checkbox"/> Yes <input type="checkbox"/> No
Is an ESA Inspection required prior to tie in and/or before restoration of services?		<input type="checkbox"/> Yes <input type="checkbox"/> No
Requester Signature:	Office/Cell #:	
<b>Note to Requestor:</b> If there are any changes to the work, Requester must notify ECE Representative and Construction Safety Officer (CSO), and revise and resubmit this form and JSA (Safety Plan), as applicable.		
<b>SECTION 2 - Documentation Review (ECE Representative to complete)</b>		
JSA/Safety Plan reviewed by CSO.	<input type="checkbox"/> Yes <input type="checkbox"/> No	If 'no' - CSO must review
Applicable permits/requests/forms approved and attached.	<input type="checkbox"/> Yes <input type="checkbox"/> No	If 'no' - Requester must resubmit
For Battery rooms only, inspection of battery banks required before commencing construction work.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> N/A	If 'yes' - Contact Supervisor - Wiring & Service
ECE Representative Name (Print):	ECE Representative Signature:	Office / Cell #:
<b>SECTION 3 - On Site Pre-Entry Review (ECE Representative to complete)</b>		
Requester has reviewed JSA/Safety Plan and Emergency Procedures with workers before entry.	<input type="checkbox"/> Yes <input type="checkbox"/> No	If 'no' - Requester must discuss with workers
For Substation or Tie Breaker Room only, Requester has obtained on-site Safety Awareness for all workers.	<input type="checkbox"/> Yes <input type="checkbox"/> N/A	
For work affecting 750 V or higher only, Requester has obtained Worker Protection Code Training for all workers.	<input type="checkbox"/> Yes <input type="checkbox"/> N/A	
<b>NOTE:</b> 1. ECE Representative notifies Power Control x3535/416-393-3535 of work being conducted. 2. For Substations or Tie Breaker Room only, Substation Representative contacts Power Control on behalf of ECE. 3. For rooms at track level, permission from Transit Control is required prior to entry and after exit.* *Bloor/Danforth x4802/416-393-4802, Yonge/University/Spadina x4803/416-393-4803, Sheppard x3301/416-393-3301, Scarborough Rapid Transit x3777/416-393-3777		
ECE Representative Name (Print):	ECE Representative Signature:	Date & Time:
<b>SECTION 4 - Completion of Work (ECE Representative &amp; Requester to complete)</b>		
Inspection of Work Area upon completion by ECE Representative and requester: (Check all that apply)		
<input type="checkbox"/> All equipment and tools removed <input type="checkbox"/> Power Control notified work complete <input type="checkbox"/> Transit Control notified work complete <input type="checkbox"/> ESA Approved <input type="checkbox"/> All permits/requested closed/completed <input type="checkbox"/> Area is safe for operation <input type="checkbox"/> Equipment tested and back in operation		
Requester Name (Print):	Requester Signature:	Date & Time:
ECE Representative Name (Print):	ECE Representative Signature:	Date & Time:





## Job Safety Analysis / Safety Plan Development Reference Sheet

The Contractor/External Consultant shall develop and provide a Job Safety Analysis (JSA)/ Safety Plan for work to be performed in a TTC Electrical Room, Substation or Tie Breaker Room to the ECE representative for review.

When developing a JSA/ Safety Plan, the Contractor/External Consultant should consider the following elements:

Item #	Considerations
1	<b><u>Work</u></b> <ul style="list-style-type: none"> <li>- Type of work (include all pertinent details of the equipment and planned work), as it relates to specific area, e.g., battery, breaker, generator, relay, switchboard, wiring, substation etc.</li> <li>- Staging plans or comprehensive switching plan</li> <li>- Hazard identification and control (include any additional PPE, tools or equipment)</li> <li>- Live line work - if work is to be done on or near energized exposed parts of electrical equipment. e.g., testing, additional written procedures may be needed</li> <li>- Live electrical equipment that may require isolation. (Refer to Site Energy Isolation &amp; Energy Restoration Request, form 74-01-001)</li> <li>- Working in proximity to high voltage</li> <li>- Hot Work e.g., grinding, sparks, open flame. (Refer to Contractor Hot Work Checklist and Permit, Forms 74-05-001 &amp; 74-05-002)</li> <li>- Working in proximity to high voltage</li> <li>- Ventilation</li> <li>- Concrete penetrations - e.g., core hole drilling require locates (Refer to Contractor Service &amp; Utility Locate Notification and Verification, form 74-02-001)</li> <li>- Protection of the Fire system</li> <li>- Lock and tag out procedure and requirement</li> <li>- Workplace inspections</li> <li>- Designated Substance Surveys Report consideration</li> </ul>
2	<b><u>Personal Protective Equipment Requirement (PPE):</u></b> <ul style="list-style-type: none"> <li>- Head Protection</li> <li>- Foot Protection</li> <li>- Eye Protection</li> <li>- Hearing Protection</li> <li>- Respiratory Protection</li> <li>- Specialized PPE</li> <li>- Protective Clothing for: Arc Flash / Flame or Fire</li> <li>- Any other PPE not listed</li> </ul>
3	<b><u>Signage, Security and Public Protection</u></b> <p><b>Site Signage:</b></p> <ul style="list-style-type: none"> <li>- Warning Signs</li> <li>- Advisory Signs</li> <li>- Post permits (as applicable)</li> <li>- Construction hazard sites</li> <li>- Designated meeting area signs</li> </ul> <p><b>Security Requirements:</b></p> <ul style="list-style-type: none"> <li>- Public areas are adequately protected from construction, equipment or materials</li> <li>- Training requirements</li> <li>- Visitor Orientation</li> </ul> <p><b>Public Protection</b></p> <ul style="list-style-type: none"> <li>- Barriers, warning signs, etc. to demark from public areas</li> </ul>
4	<b><u>Equipment Protection</u></b> <ul style="list-style-type: none"> <li>- Non-conductive coverings (e.g., for water, dust, debris)</li> </ul>
5	<b><u>Power Supply Requirements</u></b> <ul style="list-style-type: none"> <li>- Pre-determine location of portable generator <u>and</u> routing of generator cables into station ensuring generator cables do not interfere with TTC operations or the public</li> <li>- Temporary portable generators (located outdoors)</li> <li>- ESA Inspections</li> </ul>
6	<b><u>Address and Hours of Operation</u></b> <ul style="list-style-type: none"> <li>- Regular Hours of operations</li> <li>- Specific after-hours requirements</li> <li>- Location - address and ancillary room door number</li> </ul>
7	<b><u>Emergency Plan and Reporting Protocols</u></b> <ul style="list-style-type: none"> <li>- Ensure work areas have emergency lighting available and is operational</li> <li>- Electrical Hazards - call Power Control @ 416-393-3535</li> <li>- Emergencies - call Transit Control @ 416-393-3555 or 9-911</li> <li>- Mechanical Hazards - call IMC @ 416-393-3545</li> <li>- Designated assembly area</li> <li>- Reporting protocols: internal / external / MOL</li> <li>- Site roles and responsibilities for incident reporting and investigations</li> <li>- Corrective and preventive actions</li> </ul>

**NOTE:** If the Scope of Work changes for any reason, re-submission of JSA/Safety Plan to the ECE Representative is required.



# Worker Hearing Conservation Plan

This information below serves as basis for the development of Worker Hearing Conservation Plan.

When developing Worker Hearing Conservation Plan, the contractor should consider the following as applicable to work environment:

#	Item	Considerations
1	<b><u>Project Description</u></b>	-Location -General Scope of work
2	<b><u>General Work Activity Overview</u></b>	E.g. -Phase 1 – Work Area Preparation -Phase 2 – Demolition -Phase 3 – Removal of Debris
3	<b><u>Work Hours and Schedule</u></b>	-Start date -Approximate project duration -Regular daily work hours
4	<b><u>Regulatory Requirements</u></b>	-Applicable occupational exposure limits (i.e. 85 dBA, Lex, 8 under O. Reg 381/15) and/or public exposure limits
5	<b><u>Master Specification – Requirements</u></b>	-Fill out Table 1 as applicable to the project
6	<b><u>Noise and Vibration – Sources and Controls</u></b>	-Fill out Table 2 as applicable to the project
7	<b><u>Noise and Vibration Monitoring</u></b>	-Instrumentation used -Duration -Locations -Contractor performing monitoring -Action levels and associated action e.g. <ul style="list-style-type: none"> <li>• TRIGGER of XXX dBA: Investigate on-going work and pathways to the measurement point</li> <li>• ACTION of XXX dBA: Suspend work. Consider additional controls.</li> </ul>
8	<b><u>Communication Plan</u></b>	-Tasks where <u>advance notification/updates</u> are required for TTC to communicate with workforce, customers or public – provide approximate dates and times -Triggers where notification of workforce, customers or public are required <u>during the work</u> (e.g., action level exceedance) -Process for reporting complaints received about the project (include Primary TTC Contact) -Primary TTC Contact
9	<b><u>Record Keeping</u></b>	-Field logs
10	<b><u>Conclusion</u></b>	-Author of plan -Primary contact for site



# Asbestos Abatement Plan

This information below serves as basis for the development of an Asbestos Abatement Plan.

When developing an Asbestos Abatement Plan, the contractor should consider the following as applicable to work environment:

#	Item	Considerations
1	<b><u>Project Description</u></b>	-Location -General Scope of work and types of asbestos removal being performed -Name of contractor performing removal -Name of contract for emergency spills -Name of contractor performing air and site monitoring (required for Type 3 operations)
2	<b><u>Work Hours and Schedule</u></b>	-Start date -Approximate project duration -Regular daily work hours
3	<b><u>General Work Activity</u></b>	E.g. -Phase 1 – Work Area Preparation -Phase 2 – Type 2 removal -Phase 3 – Type 3 removal
4	<b><u>Asbestos Inventory, Source of information, type of removal</u></b>	-Asbestos Containing Material: Ceiling texture coat -Area: 1000 square feet -Source of Info: Designated Substance Survey for Contract ABC by DEF Consultants, Oct. 10 2016 -Type of Removal (as required by O. Reg 278/05): Type 3 indoor
5	<b><u>Contingency Response Procedures</u></b>	-Spill containment, clean up and notification
6	<b><u>Sample Site Signage</u></b>	-Photographs of asbestos signage used during the work
7	<b><u>Training Certificates</u></b>	-Asbestos worker/asbestos supervisor/asbestos awareness
8	<b><u>Site Specific Asbestos Abatement Procedures</u></b>	-Work Area and Initial Setup, Abatement procedures, Teardown, Site Release, Waste Handling as itemized. E.g. <ul style="list-style-type: none"> <li>Phase 1 Type 2 Removal of vinyl floor tile, 10/12/2016 01:00, duration: 3 days</li> <li>Phase 1a Prepare Work Area – 10/12/2016 9:00 am to 10:30 am <ul style="list-style-type: none"> <li>Remove cabinets and tables</li> </ul> </li> </ul>

# Asbestos Abatement Plan

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		<ul style="list-style-type: none"> <li>- Post asbestos warning signs and caution tape and entrances</li> <li>- Pre-clean floors and other items in a rea with HEPA vacuums</li> <li>- Use rip-proof poly and duct tape to protect items not scheduled for removal</li> <li>- Seal all vents, duct work, doors or other openings with rip proof poly</li> </ul> <p>-Routes of waste transport through building -Chemical products used (e.g. encapsulant)</p>
9	<b><u>Emergency Clean-up Work Procedures</u></b>	<p>-Primary emergency contractor contact -Itemized Clean up procedures -Itemized Emergency response clean up kit</p>
10	<b><u>Air Sampling and Inspection (if required)</u></b>	<p>-Name of contractor performing air sampling -Air sampling procedures (include rush turnaround times if applicable) -Name of laboratory analyzing samples -Procedures regarding sample failure, site re-clean and site release</p>
11	<b><u>Conclusion</u></b>	<p>-Author of plan -Primary contract for site</p>
12	<b><u>Attachments</u></b>	<p>-Material Safety Data Sheets (MSDSs)</p>
13	<b><u>Incident Reporting and Investigations</u></b>	<p>-Site roles and responsibilities for incident reporting and investigations -Reporting protocols: internal / external / MOL -Corrective and preventative actions</p>

# Dust Control Plan (Non-Asbestos containing materials)

This information below serves as basis for the development of Dust Control Plan.

When developing Dust Control Plan, the contractor should consider the following as applicable to work environment:

#	Item	Considerations
1	<b><u>Project Description</u></b>	-Location -General Scope of work
2	<b><u>General Work Activity Overview</u></b>	E.g. -Phase 1 – Work Area Preparation -Phase 2 – Demolition -Phase 3 – Removal of debris
3	<b><u>Work Hours and Schedule</u></b>	-Start date -Approximate project duration -Regular daily work hours
4	<b><u>Contaminants of Concern</u></b>	-Silica, lead, other -Applicable occupational exposure limits and/or public exposure limits: <ul style="list-style-type: none"> <li>Contaminant: concrete</li> <li>Constituents: Silica, quartz</li> <li>C.A.S. #: 14808-60-7</li> <li>Occupational Exposure Limit: 0.1/m3 (8 hours)</li> <li>Public Exposure Limit: 5 ug/m3</li> </ul>
5	<b><u>Dust Control Measures</u></b>	-E.g. Ventilation, Dust Removal Systems (HEPA), Watering, Soil Binding, Vehicle Speed Limits, Suspension of Activity with high winds, Covering Stock piles/Debris Piles with Tarps, sealing off openings, hoarding, working off-hours, general housekeeping -With lead and silica, specific items should be reference from the Ministry of Labour Construction Project Guidelines
6	<b><u>Dust Monitoring</u></b>	-Applicable Occupational Exposure Limits -Instrumentation used -Duration -Locations -Contractor performing air monitoring -Laboratory performing analysis -Action levels and associated action e.g., <ul style="list-style-type: none"> <li>TRIGGER of 0.01 mg/m3: Investigate on-going work and pathways to the measurement point</li> </ul>

## Dust Control Plan (Non-Asbestos containing materials)

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		<ul style="list-style-type: none"><li>ACTION of 0.05 mg/m<sup>3</sup>: Suspend work and monitor until concentrations decrease to below trigger level. Consider additional controls</li></ul>
7	<u>Communication Plan</u>	<ul style="list-style-type: none"><li>-Tasks where <u>advance notification/updates</u> are required for TTC to communicate with its workforce, customers or public – provide approximate dates and times.</li><li>-Triggers where notification of workforce, customers or public are required <u>during the work</u> (e.g., action level exceedance)</li><li>-Process for reporting complaints received about the project (include Primary TTC Contact)</li></ul>
8	<u>Record keeping</u>	<ul style="list-style-type: none"><li>-Field logs</li></ul>
9	<u>Conclusion</u>	<ul style="list-style-type: none"><li>-Author of plan</li><li>-Primary contact for site</li></ul>
10	<u>Attachments</u>	<ul style="list-style-type: none"><li>- Safety Data Sheets (SDSs)</li></ul>



# Emission Control Plan (Asphalt, Roofing, Waterproofing, Diesel Exhaust, Odourous Products)

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This information below serves as basis for the development of Emission Control Plan.

When developing an Emission Control Plan, the contractor should consider the following as applicable to work environment:

#	Item	Considerations
1	<b><u>Project Description</u></b>	-Location -General Scope of work -Purpose of Plan (e.g. to inform and outline strategies to reduce exposure at Bloor-Young station)
2	<b><u>General Work Activity Overview</u></b>	E.g. -Phase 1 – Surface Preparation -Phase 2 – Product Application -Phase 3 – Curing Time / Clean-up
3	<b><u>Work Hours and Schedule</u></b>	-Start date -Approximate project duration -Regular daily work hours
4	<b><u>Contaminants of Concern</u></b>	-Products of concern and application phases (e.g. ABC Primer is a methacrylate product that has high VOC emissions and odours – applied in Phase 1) -People potentially exposed (e.g. employees, customers, residences) -Relevant occupational and public exposure limits e.g. <ul style="list-style-type: none"> <li>• Product: ABC Primer</li> <li>• Constituents: Methyl Methacrylate</li> <li>• C.A.S. #: 80-62-6</li> <li>• Occupational Exposure Limit: 50 ppm (8 hour)</li> <li>• Public Exposure Limit: 860 ug/m3 (24 hour)</li> </ul>
5	<b><u>Ventilation</u></b>	-Mechanical ventilation -Sealing of any openings and louvers, use of tarps -Ventilation monitoring and use of instruments (e.g. manometers, smoke tubes, fog machines) -Worker positioning
6	<b><u>Additional Controls</u></b>	-e.g. minimize mixing and coating times, keep containers covered and closed when not in use, waste placed in sealed containers, working off-

# Emission Control Plan (Asphalt, Roofing, Waterproofing, Diesel Exhaust, Odourous Products)

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		hours, communication plan for building occupants
7	<u>Air Monitoring</u>	-Chemicals being monitored -Air Monitoring Instrumentation -Duration of Monitoring Location of monitors (use a diagram if necessary)
8	<u>Action Levels</u>	-Occupational Exposure Limit/Public Exposure Limit Trigger and Actions e.g. <ul style="list-style-type: none"> <li>• TRIGGER of 5 ppm at the property line: Investigate on-going work and pathways to the measurement point</li> <li>• ACTION of 25 ppm at the property line or inside the station: Suspend work and monitor until concentration decrease to below trigger level. Consider additional controls e.g. decreasing application rate and local exhaust ventilation</li> </ul>
9	<u>Communication Plan</u>	-Tasks where <u>advance notification</u> /updates are required to communicate with its workforce, customers, or public – provide approximate dates and times. -Triggers where notification of workforce, customers or public are required <u>during the work</u> (e.g., action level exceedance) -Process for reporting complaints received about the project (include Primary TTC contact) -Primary TTC contact
10	<u>Conclusion</u>	-Author of plan -Primary contact for site
10	<u>Attachments</u>	- Safety Data Sheets (SDSs)

Contractor Service and Utility Locate Notification and Verification		Page 1 of 2
Section 1 Contract & Locate Information		
Contract Number	General Contractor Name	Locate Number (e.g., 001, 002)
Location of Intended Locate (Address, Intersection, Area, etc.)	Scheduled Date & Time of Locate	Scheduled Date of Work
Relevant Contract Drawings attached and reviewed by General Contractor and Damage Prevention Technician? <input type="checkbox"/> Yes, provide list below  <input type="checkbox"/> No, reason:	Relevant Reference Drawings attached and reviewed by General Contractor and Damage Prevention Technician? <input type="checkbox"/> Yes, provide list below  <input type="checkbox"/> No, reason:	
Type of Work to be done (excavating, saw cutting, concrete coring/chipping, etc.)	Dimension of Locate area	Description of area surface (Smooth, Rough, etc.)
Area of Work clearly marked by General Contractor? <input type="checkbox"/> Yes <input type="checkbox"/> No, reason:	<input type="checkbox"/> New Scan <input type="checkbox"/> Rescan	
Area of Locate clearly defined and marked by General Contractor? <input type="checkbox"/> Yes <input type="checkbox"/> No, reason:		
Area of Locate clear of obstructions? <input type="checkbox"/> Yes <input type="checkbox"/> No, reason:		
Access to electrical room required for Radio Frequency attachment? <input type="checkbox"/> Yes <input type="checkbox"/> No, details:		

Section 2 PRE-Locate Meeting		Meeting Date / Time	Meeting Location
Purpose – To discuss approximate location & type of Work to be done			
General Contractor (GC)			
Company:	GC's signature acknowledges that he/she has fully described the location and type of Work to be done as noted in Section 1 of this form.		
Name:			
Signature:			
Locate Service Contractor (LSC) / Damage Prevention Technician (DPT)			
Company:	DPT's signature acknowledges that he/she has fully understood the location and type of Work to be done as noted in Section 1 of this form.		
Name:			
Signature:			
<b>Meeting Notes:</b>			
Attended By	Title	Signature	

Note: The General Contractor makes the arrangement for the Utility Locate, Pre and Post-Locate meetings and completes this form in its entirety and distributes a copy to TTC.

**Contractor Service and Utility Locate Notification and Verification**

Page 2 of 2

**Section 3 POST-Locate Meeting**

Meeting Date / Time

Meeting Location

Purpose – To discuss Locate report(s) and limitation of equipment used

Original Locate report(s) received from LSC, report(s) #: (List all)

1. GC reviewed all relevant Contract Drawings provided as they relate to the proposed work area, i.e., Demolition and/or Cutting and/or Coring and/or Excavation. ☐
2. LSC provided written locate report(s) identifying the approximate location of the Work, embedded object(s) if any, distances and limitations of the scanning unit(s) used. ☐
3. GC reviewed visually the vicinity of the proposed work area of Demolition and/or Cutting and/or Coring and/or Excavation to identify utilities potentially omitted. ☐
4. GC reviewed and discussed with DPT, all Locate report(s) for the proposed work area of Demolition and/or Cutting and/or Coring and/or Excavation and verified that all utilities shown on drawings have been located. ☐
5. GC has reviewed and discussed all information with relevant contractors, including safe work practices associated with the work (Demolition and/or Cutting and/or Coring and/or Excavation). ☐
6. GC has provided TTC copy of all Locate reports prior to start of work. ☐

**Meeting Notes:**

Attended By

Title

Signature

**General Contractor (GC)**

Name

Signature

GC's signature acknowledges that all 6 points above have been discussed and Locate report(s) have been understood including the limitation of equipment used.

**Locate Service Contractor (LSC) / Damage Prevention Technician (DPT)**

Name

Signature

DPT's signature acknowledges that all 6 points above and Locate report(s) have been discussed including the limitation of equipment used.

Note: The GC makes the arrangement for the Utility Locate, Pre and Post-Locate meetings and completes this form in its entirety and distributes a copy to TTC.

**For TTC Use Only – Form Received by:**

Print Name

Signature

Date / Time

**- Work Not To Proceed Until All Signatures Are Obtained -**

SECTION 4- Restoration Request			
General Contractor acknowledges that all work done during this isolation comply with applicable codes, regulations, and authorities having jurisdiction. <b>Work associated with this isolation is complete, and work area is clear and ready for restoration.</b>			
Name: <small>Print name of Foreperson, Supervisor or Person in Charge</small>		Signature:	
		Date:	
SECTION 5 - Restoration Confirmation			
General Contractor Representative <sup>1</sup> (Print Name)		General Contractor Representative Signature	
		Date / Time	
ECE Group Representative <sup>2</sup>		Operations Group Representative <sup>3</sup>	
Name:		Name: Refer to OPS Form <input type="checkbox"/>	
Employee #:	Phone #:	Employee #:	Phone #:
ECE Representative Signature		Operations Representative Signature	
		Date / Time	
SCI notified Transit Control at Ext. 3444 fire protection system <b>restored</b> (if applicable). <input type="checkbox"/> Yes <input type="checkbox"/> N/A			

Energy Sources		
Energy	Hazard	Example
Electrical	600 Volts DC	power rail, overhead traction
	110/220 Volts AC	exposed/bare live electrical wire and/or bus
	> 110/220 Volts AC	exposed/bare live electrical wire and/or bus
	Static	stored energy discharge
Mechanical	Contact	moving and rotating equipment parts
	Collision	moving vehicles (trains, streetcars)
	Crushing	rail switches, unsecured hoists, lifting devices, pinch points, squeezing
	Spring	stored mechanical energy in a compressed spring
Pressure	Hydraulic/Pneumatic	leaks, pipe/vessel/duct rupture, tire pressure, contents under pressure

Notes, as applicable:

*Distribution: SCI; Contract Files; GC*

## Contractor Hot Work Permit

**FORM MUST BE PRINTED ON YELLOW PAPER**

### SECTION 1 - Request for Hot Work (General Contractor (GC) to complete)

Site Location (address, intersection, etc.):	Proposed Hot Work Date:	Contract No. / Hot Work # (e.g. 001, 002):
Name of Person requesting Hot Work:	GC Name:	
Location of Work:	Request date (7 Days notice required):	

**NOTE: Two Fire Watch personnel to be identified on day of work (Section 2) and must be available for entire duration of Hot Work.**

Nature of Work: <input type="checkbox"/> Brazing <input type="checkbox"/> Cutting <input type="checkbox"/> Grinding <input type="checkbox"/> Soldering <input type="checkbox"/> Thawing pipe <input type="checkbox"/> Welding <input type="checkbox"/> Other (Specify):		
Fire system requires deactivation by TTC forces to prevent unnecessary actuation: (sprinkler/sprinkler head, fire alarm, etc.).		** <input type="checkbox"/> Yes <input type="checkbox"/> No
Any other equipment that requires protection and/or deactivation (e.g., roof equipment, water system, etc.).		** <input type="checkbox"/> Yes <input type="checkbox"/> No
GC's authorized representative/requester (print/sign):	Office/Cell #:	<b>** If 'Yes' - submit Energy/System Isolation and Restoration Request, Form 74-01-001</b>

### SECTION 2 - Identification of Fire Watch (GC to complete on day of Hot Work)

Name/Signature of Fire Watch Person:	Company Name:
Name/Signature of 2nd Fire Watch Person:	Company Name:
GC's authorized representative (print/sign):	Office/Cell #:

### SECTION 3 - Site, Checklist Review & Authorization (SCI to complete on day of Hot Work)

GC reviewed and completed Hot Work Checklist on day of Hot Work being performed.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<i>If 'no' - permit will not be issued. GC must resubmit request.</i>
SCI reviewed Hot Work area and confirms completed Hot Work Checklist is consistent with work area.	<input type="checkbox"/> Yes <input type="checkbox"/> No	
SCI confirmed Fire Watch Person(s) are as listed above.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<i>If 'no' GC makes corrections on form.</i>
SCI notified Transit Control at 416-393-3444 of Hot Work being conducted.	<input type="checkbox"/> Yes	
SCI confirmed the Fire System has been isolated in accordance with Energy/System Isolation and Restoration Request.	<input type="checkbox"/> Yes <input type="checkbox"/> N/A	
SCI notified and consulted with Facility Manager/Designate by email of upcoming work.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<i>If 'no' - email must be sent before authorization</i>
SCI confirmed with Facility Manager and GC no hazards to ongoing operations and Hot Work	<input type="checkbox"/> Yes <input type="checkbox"/> No	<i>If 'no' - any hazards must be addressed before authorization</i>
Print Facility Manager Name and Title:		Phone No:

**THIS PERMIT IS VALID FOR ONE HOT WORK AREA AND ONE WORK SHIFT ONLY**

The Hot Work Permit is authorized by :		<b>NOTE: SCI to Photograph Authorized Permit &amp; Email to Construction Office</b>
SCI Name:	SCI Signature:	
Permit Valid from / to:		
Start Date:	Time: <input type="checkbox"/> AM <input type="checkbox"/> PM	End Date: Time: <input type="checkbox"/> AM <input type="checkbox"/> PM

### SECTION 4 - Notice and Confirmation of Completed Work (SCI & GC to complete)

Name of GC Representative:	Date Notified:	Time: <input type="checkbox"/> AM <input type="checkbox"/> PM
Title:	Phone No:	
Inspection of Hot Work Area upon completion of work by SCI & GC: (Check all that apply)		
<input type="checkbox"/> Final check after 1 hour or 3 hour requirement TIME: <input type="checkbox"/> AM <input type="checkbox"/> PM <input type="checkbox"/> Area is safe for operation <input type="checkbox"/> Fire system restored, if applicable <input type="checkbox"/> Transit Control notified work is complete		
SCI Signature:	GC Signature:	

**PERMIT MUST BE DISPLAYED PROMINENTLY AT THE WORK SITE**

**IN CASE OF EMERGENCY CALL TRANSIT CONTROL: 416-393-3555 OR 911 (FROM TTC PAX PHONES: 3555 OR 9911)**



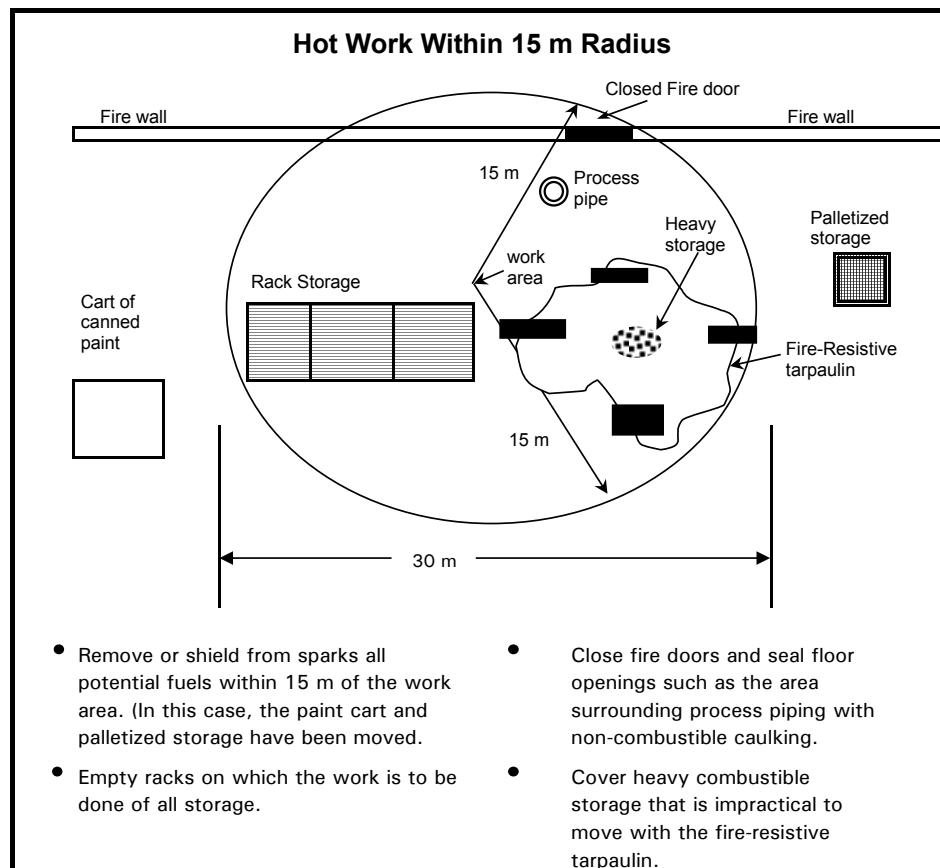


## Contractor Hot Work Checklist

NO.	YES	Prior to issuance of Contractor Hot Work Permit, the General Contractor (GC) must ensure that the following precautions are taken:	N/A
1		Fully charged and operable fire extinguisher(s) that are appropriate for the type of potential fire are available immediately at the work area. At minimum, ULC 4A40BC Type Extinguisher.	
2		Standpipe and fire hose available for Fire Department use only, if required.	
3		Fire blankets, welding screens, etc., as required are on site and in good condition.	
4		Personal Protective Equipment (PPE) for all workers is in good condition.	
5		Where heavy smoke may be generated, additional measures will be taken to prevent it from spreading, such as venting it to the outside or using a smoke "eating" machine. If heavy smoke cannot be avoided then the work will be performed when the building is not occupied.	
6		Cutting and welding equipment has been inspected to make sure bottles are secure. Cylinders have been supported or located in such a way that they cannot be knocked over.	
7		Hoses have been inspected for burns, cuts, worn places, abrasions and similar defects. NOTE: Taped repairs are unacceptable. Hose connections have been inspected to make sure they are secure and tight.	
8		Where welding, cutting, and/or open flame work is done near a wall, partition, ceiling, or roof of combustible construction, fire-retardant shields or guards have been provided to prevent ignition.	
9		The presence or development of possibly explosive mixtures of flammable gases or vapours and air has been checked and no issue found.	
10		Isolation of fire alarm detection zone, fire alarm system, or, sprinkler/sprinkler head system in the immediate area to prevent unnecessary actuation. NOTE: If it is determined by TTC that this is not possible or is impractical, the GC shall use alternate methods as agreed with the Senior Construction Inspector.	
11		The location where the work is to be performed has been assessed to ensure it will not be performed in an oxygen enriched atmosphere.	
12		Flammable (solids and other debris) or containers of flammable liquids/vapours removed or made inert.	
13		Work area has been inspected to ensure it is safe for welding, cutting, and/or open flame work operations, by being clear of combustibles or ensure the work is moved to a location free from combustibles. Where the work could not be moved, the combustibles have been moved to a safe distance or the combustibles have been properly shielded against ignition.	
14 a		Where combustible materials, such as paper clippings, wood shavings, or textile fibres, are on the floor, the floor has been swept clean for a radius of at least 15 metres.	
14 b		Combustible floors have been kept wet, covered with damp sand, or protected by non-combustible or fire-retardant shields. Where floors have been wet down, personnel operating arc welding, cutting, and/or open flame work equipment are being protected from possible electric shock. NOTE: Dust may affect smoke detectors in the area.	
15 a		All combustibles have been relocated at least 15 metres horizontally from the work site.	
15 b		Where relocation is impractical, combustibles have been protected with fire-retardant covers or otherwise shielded with metal or fire-retardant guards, tarpaulins or curtains. Edges of covers at the floor are tight to prevent sparks from going under them, including where several covers overlap when protecting a large pile.	
16		Openings or cracks in walls, floors, under locked doors, ducts or drains within 15 metres of the site have been tightly covered with fire-retardant or non-combustible material to prevent the passage of sparks to adjacent areas.	
17		Construction is non-combustible and without combustible covering or insulation.	
18		Where welding, cutting, and/or open flame work is to be done on a wall, partition, ceiling, or roof, precautions have been taken to prevent ignition and conduction of heat of combustibles on the other side or into another area by relocating combustibles.	
19		Welding, cutting, and/or open flame work will not be attempted on a partition, wall, ceiling, or roof that has a combustible covering or insulation, or on walls or partitions of combustible sandwich-type panel construction.	

## Contractor Hot Work Checklist

NO.	YES	Prior to issuance of Contractor Hot Work Permit, the General Contractor (GC) must ensure that the following precautions are taken:	N/A
20		Welding, cutting, and/or open flame work that is performed on pipes or other metal that is in contact with a combustible wall, partition, ceiling, roof, or other combustibles will not be undertaken if the work is close enough to cause ignition by conduction.	
21		Post notices or signage (e.g., caution, restrict entry) within work area and surrounding area, if required.	
22		FW supplied continuously during the hot work.	
23 a		FW supplied 1-hr after hot work is performed.	
23 b		FW supplied 3-hrs after hot work is performed for roofing projects, OR for work within 5-m radius of roofing surface when: - Any area where combustible materials used in building construction or contents are located within 5-m of persons using an open flame torch or other ignition sources, - Any area of the building exposed as a result of unprotected roof or wall openings located within 5-m of persons using an open flame torch or other ignition sources, and - Any area where combustibles on the underside of roofs or the opposite side of walls might be ignited as a result of person using an open flame torch or other ignition sources.	
24		No other duties to be performed by the FW Person.	
25		FW trained in use of fire extinguisher, sounding alarm, and emergency reporting.	
26		Additional FW required for adjoining areas outside of line of sight and for relief purposes.	
27		FW is responsible for the area affected by the Hot Work including identifying fire hazards.	



GC Representative Name

Signature

Company Name

Date

## Request for Construction Product Safety Data Sheet Evaluation

### **INSTRUCTIONS:**

- Obtain valid Safety Data Sheet (SDS) from the vendor.
- Complete this form for all new products or new applications **before purchase or use** and attach the product **SDS and supplier label**.
- Submit only one product per form.
- Forward this package to TTC Construction Office for review.

### **CONTRACT INFORMATION**

Contract # and Name:

Requested by:

Signature:

Request Date:

### **PRODUCT IDENTIFICATION**

1. Complete Product Name and Product Code(s) as shown on container label:

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2. Manufacturer's Name:

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### **PRODUCT USE**

1. How will this product be used?

**MAJOR TASK:** Describe the work activity, job titles, number of employees, operation, process or job to be done.

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**BASIC JOB STEPS:** Include how this product will be applied (e.g., sprayed, brushed, poured, welded, heated, etc.) Include a copy of the Manufacturer's technical data sheet and/or copy of existing plant work procedures if available.

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## Request for Construction Product Safety Data Sheet Evaluation

<p><b>2. How will this product be handled?</b></p> <p><input type="checkbox"/> Closed system</p> <p><input type="checkbox"/> Leaking closed system (e.g. odours, visible dust, spillage)</p> <p><input type="checkbox"/> Open system (e.g. parts washer)</p> <p><input type="checkbox"/> In-situ during routine equipment maintenance</p>	<p><b>8. Does the use of this product result in any of the following?</b></p> <p><input type="checkbox"/> Visible fumes or particles</p> <p><input type="checkbox"/> Deposits on people or surfaces</p> <p><input type="checkbox"/> Complaints of strong odors or discomfort</p> <p><input type="checkbox"/> Adverse health effect</p>
<p><b>3. How much of this product will be used <i>per day</i>?</b></p> <p><input type="checkbox"/> A few drops, a quick spray or a small dab</p> <p><input type="checkbox"/> Less than 1 liter/kg or 1 aerosol can</p> <p><input type="checkbox"/> Other, describe:</p>	<p><b>9. Is accidental eye contact possible while using this product? (e.g. splashing)</b></p> <p><input type="checkbox"/> YES <input type="checkbox"/> NO</p>
<p><b>4. How long will the product be on site and in use?</b></p> <p><input type="checkbox"/> &lt;1 Day <input type="checkbox"/> &lt; 1 Week</p> <p><input type="checkbox"/> &lt;1 Month <input type="checkbox"/> &lt; 1 Year</p> <p><input type="checkbox"/> &gt;1 Year</p>	<p><b>10. Is direct skin contact likely while using this product?</b></p> <p><input type="checkbox"/> YES <input type="checkbox"/> NO</p>
<p><b>5. How long will each exposure to this product be?</b></p> <p><input type="checkbox"/> &lt;5 minutes/day <input type="checkbox"/> &lt;30 minutes/day</p> <p><input type="checkbox"/> &lt;1 hour/day <input type="checkbox"/> &lt;4 hours/day</p> <p><input type="checkbox"/> &lt;8 hours/day</p>	<p><b>11. Is a <u>major</u> leak or spill likely given the physical state of the product and the quantities being used?</b></p> <p><input type="checkbox"/> YES <input type="checkbox"/> NO</p>
<p><b>6. Where <u>specifically</u> will this product be used?</b></p> <p><b>Is this area poorly ventilated or confined?</b></p> <p><input type="checkbox"/> YES <input type="checkbox"/> NO</p>	<p><b>12. How will the waste be disposed?</b></p> <p><input type="checkbox"/> TTC</p> <p><input type="checkbox"/> Contractor</p> <p><input type="checkbox"/> Other:</p>
<p><b>7. What type of ventilation will be used?</b></p> <p><input type="checkbox"/> General Plant</p> <p><input type="checkbox"/> Office Area</p> <p><input type="checkbox"/> Local Exhaust (e.g. welding fume extractor arms, fume hoods, air movers, etc.)</p> <p><input type="checkbox"/> Other, describe:</p>	<p><b>13. Is the waste considered to be hazardous waste?</b></p> <p><input type="checkbox"/> YES <input type="checkbox"/> NO</p> <p>If YES, contact the Occupational Hygiene and Environment Section to have waste/site registered.</p>
	<p><b>14. How is this product packaged (e.g. 45 gallon drum)?</b></p>

***Distribution: Occupational Hygiene and Environmental Section, Contract Files***

## Contract Safety Start-up Review

<b>Contractor:</b>		<b>Contract Name &amp; #:</b>	
<b>Date:</b>	<b>Time:</b>	<b>Reviewed by:</b>	


**Check Only One:** Satisfactory (S) | Non - Satisfactory (NS) | Not Applicable (N/A)

Inspection Item	S	NS	N/A	Observation
<b>1 Contractor Orientation and Training</b>				
Contractor's Site Specific Safety Orientation including hard-hat stickers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Supervisor's competency training	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Fall Prevention / Protection Training	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
WHMIS Worker Training	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Employer Specific OHS Awareness (O.Reg.297/13)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Fire Extinguisher Training	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Equipment Specific Training	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>2 Review of Key Contractual Safety Requirements (Master Specification 01 59 00)</b>				
Isolation of Emergency Sources Article, including Energy/System Isolation and Restoration Request Attachment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Utility Locates Article, including Contractor Service and Utility Locate Notification and Verification Attachment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Contractor's Work Area Separation Plan Submittals, including Contractor Work Area Separation Plan Guideline Attachment and Contractor Work Area Separation Plan Attachment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Hot Work Submittals, including Contractor Hot Work Permit Attachment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Electrical Rooms, Signal Rooms, Communication Rooms, Substations or Tie Breaker Rooms Submittals, including Access Request for Electrical Room, Substation and Tie Breaker Room Attachment, and Job Safety Analysis Safety Plan Development Reference Sheet Attachment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Contractor aware of the requirement for TTC Subway/SRT Rulebook, Surface Rulebook, etc. training	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>3 Health and Safety Postings (Contract Safety Notice Board)</b>				
Notice of Project	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Construction Employer Registration (Form 1000)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
OHS & Construction Regulations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
WSIB Form 82 (Accident & Injury Reporting)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
MOL Poster Health & Safety at Work Prevention starts here	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
ESA Poster	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Copy of Designate Substance Survey Report (DSSR)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Contractor's Occupational Health and Safety Policy and Program	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Contractor's Site Specific Safety Plan and Associated Procedures	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Contractor's Site Specific Safety Orientation Package	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Emergency Response and Evacuation Plan including associated procedures (e.g., Rescue Plans for WAH, PEWP, Confined Space, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Emergency Phone Numbers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Site Specific Traffic and Control Plan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Contractor Work Area Separation Plan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Name of JHSC / WHSR	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Material Safety Data Sheets (MSDS)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Ministry of Labour Orders	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

## Contract Safety Start-up Review

Inspection Item	S	NS	N/A	Observation
<b>4 Emergency Equipment</b>				
Qualified First Aider's Certificate (Current)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
First Aid Kit for size of work force including First Aid Manual	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
• Competent person in charge	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
• List of contents	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
• Injury Record Book	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
• Inspection Record	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Eye Wash Station/Bottle	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Fire Extinguisher	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
• Adequate numbers, type & size	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
• Charged & sealed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
• Inspection Card	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
• Mounted and Signs posted	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>5 Review of Site Conditions</b>				
Construction site separated from Public and TTC	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Construction site and hazard warning signage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Contractor Designated Meeting area and signage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Traffic Protection and Control measures established	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Equipment inspected prior to use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Manuals for machines over 10 hp	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Fall Prevention measures and controls for Working at Heights	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Hazardous Energy Controls i.e.: lock-out devices / tags / boxes available	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Fuel, Flammable & Compressed Gas storage and other hazardous materials	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Appropriate PPE being used for the task	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Spotter / Traffic Control Person/Signal Person/Back-up Person	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>6 Security</b>				
Property Permits issued and verified	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Notes:				
Safety Start-Up Review Attended By:				
<b>Contractor Acknowledgement</b>				
Construction Safety Officer has reviewed this report with the Contractor. Contractor acknowledges the findings in this report, agrees to address Non-Satisfactory items immediately, and post this form on the Contract Safety Notice Board.				
<b>Construction Safety Officer Name / Signature</b>	<b>Date</b>	<b>Contractor's Representative Name / Signature</b>	<b>Date</b>	
<b>Construction Site Manager Acknowledgement</b>				
<b>Construction Site Manager Name / Signature</b>				<b>Date</b>

Distribution: Senior Construction Inspector, Construction Clerk, Construction Engineer, Construction Site Manager, Deputy Construction Manager, Construction Manager, Senior Project Engineer, Project Manager, Senior Project Manager, Manager Safety & Security

 <b>STANDARD</b>	Reviewed				Correct	Approved	Issued
	A. SIU Manager-Standards				P. PETROVIC Director-Engineering Design	P. LAURIN Head of Engineering	Manager-Standards
	Status APPROVED				Date 26-SEP-2018	Rev. 1	
<b>SD015900.01</b>							





# Site Specific Crane Lift Plan Guideline

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The Contractor shall develop and implement a Site Specific Crane Lift Plan for the Contract.

The plan should include provisions to ensure cranes and other lifting devices are maintained in good condition and used in accordance with the operating manual and as required by the Regulations for Construction Projects.

This information serves as the basis for drafting procedures, assigning responsibilities, acquiring necessary equipment, and providing the training needed to manage jobsite level safety requirements.

When developing a Site Specific Crane Lift Plan, the contractor / employer should consider the following:

#	Item	Considerations
1	General Considerations	<ul style="list-style-type: none"><li>- Roadway closure considerations per Site Specific Traffic Protection , MTO Book 7 and Section 01 55 26 - Traffic</li><li>- Roles and Responsibilities of Supervisory and Worker personnel</li><li>- Temporary Work Zone Design, Set-up and Removal</li><li>- Supervisory and Traffic Control Personnel Training requirements for work in MTO Book 7 Temporary Conditions environment</li><li>- Traffic Control Plan communication to project parties</li><li>- Separation / cordoning off the area including provisions for a swing radius of Crane(s)</li></ul>
2	Site and Job Specific Safety Orientation	<ul style="list-style-type: none"><li>- Provisions for a pre-job briefing including all supervisors and workers involved in the lift</li><li>- Review all associated JHA's/JSA's</li></ul>
3	Supervisory Personnel	<ul style="list-style-type: none"><li>- Roles and responsibilities of Supervisory personnel in relation to a crane lift including on-site supervision</li><li>- Contact list of supervisory personnel including after-hours when applicable</li><li>- Supervisory Training requirements</li></ul>
4	Rigging Supervisor	<ul style="list-style-type: none"><li>- Roles and responsibilities of the contractor's supervisor responsible for planning and executing the rigging being used for the critical lift including Crane Operator tasks</li></ul>

# Site Specific Crane Lift Plan Guideline

5	Crane Operator	<ul style="list-style-type: none"> <li>- Operated by certified hoisting engineers if the cranes can hoist more than 7,260 kg</li> <li>- Cranes that hoist less than 7,260 kg must be operated by workers trained in the crane's safe operation</li> <li>- Proof of certification and training on-site</li> </ul>
6	Equipment & Machinery	<ul style="list-style-type: none"> <li>- Maintained in good condition and used as required by the Regulations for Construction Projects</li> <li>- A copy of any operating manuals and a maintenance log book must be kept with the crane</li> <li>- Inspected by a competent worker to determine if the cranes can handle the rated capacity and to identify any hazardous conditions</li> </ul>
7	Critical Lift Plan documentation	<ul style="list-style-type: none"> <li>- The Lift Plan should include: <ul style="list-style-type: none"> <li>- Current certification of the crane operator</li> <li>- Type of crane</li> <li>- Load test requirements</li> <li>- Type of rigging to be used including rated capacity</li> <li>- Most recent annual inspection records, which must include the name of the person conducting the inspection and qualifications</li> <li>- Conditions that may delay the lift</li> <li>- Overhead hazards power lines</li> <li>- Soil/ground conditions including considerations for subsurface vaults, duct-banks, storm water sewers, etc.</li> <li>- Communication Plan outlining hand signals and notification of work parties in the area</li> <li>- Load details</li> <li>- Use of taglines</li> <li>- Contingency plan including provisions for mechanical failure, incorrect load calculation resulting in exceeding 90% of crane capacity</li> <li>- Written calculations of the lift, including configuration of the rigging and load</li> </ul> </li> </ul>

# Site Specific Crane Lift Plan Guideline

		<ul style="list-style-type: none"> <li>- Safety Precautions necessary for all employees in the area, including personnel employed by Other Contractors as applicable,</li> <li>- Specific calculations for out of water lifts</li> <li>- Review of crane inspection and maintenance documentation to ensure that they are current</li> </ul>
8	Crane & Load Placement Diagram	- Inclusion of a Critical Lift Plan diagram for Crane and Load Placement
9	Rigging Configuration Diagram	- Inclusion of a Rigging Configuration diagram
10	Crane Inspections	<ul style="list-style-type: none"> <li>- Roles and Responsibilities</li> <li>- Records keeping</li> <li>- Inspection frequency</li> <li>- Inspection checklists</li> <li>- Reference to operating manuals and a maintenance log book to be kept on-site with the crane</li> </ul>
- NOTE:		
	Multiple Cranes on Site	- A Separate Lift Plan For each crane
	Changes on site	<ul style="list-style-type: none"> <li>- New Crane Lift must be developed</li> <li>- Any changes in the configuration of the crane, placement or rigging, lifting scheme, etc. or changes in any calculations from the originally submitted Crane Lift Plan</li> </ul>



## Contractor Request for Access to Public/Operating Area

Request No.:

(to be completed by SCI)

**NOTE: This request is to be completed by the Contractor when access is required in Public/Operating Area(s).**

<b>SECTION 1 - Request for Access (GC to complete) - Minimum 7 Days Notice -</b>			<b>Contract No.:</b>	
Site Location (address, intersection, etc.):	Start Date	End Date	Start Time	End Time
Name of Person requesting access:	Description of Work:			
Location of Work:				
Methods of Separation (e.g., demarcation devices, fences, pylons, guards, warning signs):				
Work Separation Plan updated / attached? <input type="checkbox"/> Yes <input type="checkbox"/> No <span style="float: right;">If 'no', do not authorize Access Request and advise Contractor to submit.</span>				
Will Utility Locates be performed? <input type="checkbox"/> Yes <input type="checkbox"/> N/A <span style="float: right;">If 'yes' - Contractor Service and Utility Locate Notification and Verification, form 74-02-001 required.</span>				
Access to Electrical Room, Substation or Tie Breaker Room required? <input type="checkbox"/> Yes <input type="checkbox"/> N/A <span style="float: right;">If 'yes', Access Request for Electrical Room, Substation or Tie Breaker Room, form ECF-0307-001 required.</span>				
Is Hot Work to be performed? <input type="checkbox"/> Yes <input type="checkbox"/> No <span style="float: right;">If 'yes', Contractor Hot Work Permit, form 74-05-002 required.</span>				
Is Energy Isolation Required? <input type="checkbox"/> Yes <input type="checkbox"/> No <span style="float: right;">If 'yes', Energy/System Isolation &amp; Restoration Request, form 74-01-001 required.</span>				
Requester Signature:		Office / Cell Phone No.:	Date:	
<b>SECTION 2 - Review of Access Request (SCI to complete)</b>				
Any operational activity within the location of work? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <span style="float: right;">If yes, further discussion with Operations is required.</span>				
Any other Contractors within the location of work? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <span style="float: right;">If yes further discussion with Constructor is required.</span>				
Contractor proposed appropriate methods of separation for the work? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <span style="float: right;">If No, further discussion with Operations is required.</span>				
Contractor provided updated Site Separation Plan for specified work? <input type="checkbox"/> Yes <input type="checkbox"/> No <span style="float: right;">If No, Site Separation Plan needs to be provided.</span>				
Applicable permits/request forms are attached? <input type="checkbox"/> Yes <input type="checkbox"/> No <span style="float: right;">If No, do not authorize Access Request.</span>				
Facility Manager notified in advance and indicated no concerns? <input type="checkbox"/> Yes <input type="checkbox"/> No <span style="float: right;">If No, discussion with Facility Manager is required.</span>				
<input type="checkbox"/> Construction Site Manager, Construction Safety Officer and Senior Project Engineer notified of this access request via email.				
Comments / notes:				
SCI Name:		Signature:		Date:
<b>SECTION 3 - Authorization (SCI to complete on the day access is required)</b>				
Facility Manager acknowledged no operational activity in the area.			<input type="checkbox"/> Yes	<input type="checkbox"/> No
No adjacent Contractor and/or operational activity present.			<input type="checkbox"/> Yes	<input type="checkbox"/> No
Contractor established appropriate separation methods.			<input type="checkbox"/> Yes	<input type="checkbox"/> No
Additional safety precautions applied, (e.g., signage, spotter etc.) list all:				
SCI Name:		Signature:		Date:
<b>SECTION 4 - Completion of Work &amp; Review of Work Area (Completed by SCI &amp; GC)</b>				
Review of Work Area upon completion of work by SCI & GC (Check all that apply)		Date:	Time: <input type="checkbox"/> AM <input type="checkbox"/> PM	
<input type="checkbox"/> All applicable permits have been closed		<input type="checkbox"/> Area is safe for operation		
<input type="checkbox"/> Separation barriers have been removed		<input type="checkbox"/> Locks/tags, separation equipment, tools and machinery removed		
<input type="checkbox"/> Facility Manager notified of completion of work				
SCI Name:		GC Representative Name:		
SCI Signature		GC Representative Signature:		

Distribution: Contractor, Requesting Department, Construction Site Manager, Construction Safety Officer, Senior Project Engineer, Contract File and others, as applicable



## Access Request to Contractor Work Area

Request No.: \_\_\_\_\_  
(to be completed by SCI)

**NOTE: This request is to be completed when access inside an ECE Contractor Work Area  
is required for purposes other than a site visit.**

<b>SECTION 1 - Request for Access (Requesting Department Representative to complete)</b>		Required Access Date: (Minimum 7 Days Notice)		
Site Location (address, intersection, etc.):	Start Date	End Date	Start Time	End Time
Department Name	Department Representative Name and Title:			
Reason for Access Request:				
Method of Separation (e.g., demarcation devices, fences, pylons, guards, warning signs etc.), as applicable:				
Department Representative Signature:		Office/Cell #:		
<b>SECTION 2 - Review of Access Request (Senior Construction Inspector (SCI) to complete)</b>			Contract No.:	
<input type="checkbox"/> Contractor notified in advance via email.				
<input type="checkbox"/> Contractor notified to schedule safety orientation prior to access.				
<input type="checkbox"/> Requesting Department proposed appropriate method of separation, as applicable. (If required, consult with CSO)				
<input type="checkbox"/> Construction Site Manager, Construction Safety Officer and Senior Project Engineer notified of this access request via email.				
Comments / notes:				
SCI Name:	Signature:		Date	
<b>SECTION 3 - Review and Authorization by Contractor (Constructor)</b>				
Contractor acknowledges no work activity within the access area.		<input type="checkbox"/> Yes	<input type="checkbox"/> No	If No, Contractor to provide alternate proposal.
Requesting department has proposed the appropriate separation, as applicable.		<input type="checkbox"/> Yes	<input type="checkbox"/> No	If No, Contractor to request a revision.
<input type="checkbox"/> Contractor will provide safety orientation.				
Additional safety precautions applied (e.g., signage, spotter etc.) describe below:				
Contractor Representative Name:		Contractor Representative Signature:		Date:
<b>SECTION 4 - Completion of Work in the Accessed Area (Completed by SCI &amp; Requesting Department Representative)</b>				
Review of access area by SCI & requesting Department Representative (Check all that apply)		Date:                      Time: <input type="checkbox"/> AM <input type="checkbox"/> PM		
<input type="checkbox"/> Separation barriers have been removed, as applicable		<input type="checkbox"/> Area is safe for operation		
<input type="checkbox"/> Contractor notified of completion of work and indicated no concerns		<input type="checkbox"/> Locks/tags, separation equipment, tools & machinery removed		
SCI Name:	Department Representative Name and Title:			
SCI Signature:	Department Representative Signature:			

Distribution: Contractor, Requesting Department, Construction Site Manager, Construction Safety Officer, Senior Project Engineer, Contract File and others, as applicable





**1 SPECIFIED PRODUCTS**

- 1.1 Work of this Contract is based on Products and systems specified by using any combination of the following methods:
  - 1.1.1 Prescriptive Specifications with catalogued Products.
  - 1.1.2 Performance Specifications with references to standards (for example, CGSB, CSA, ASTM, ULC, UL, WHI).
- 1.2 When only one (1) Product is specified, Products by other manufacturers may be acceptable by substitution, provided the requirements for substitutions specified in this Section are met, unless stated that no substitutions are permitted.
- 1.3 When a Product is specified along with a referenced standard, the specified Products will be acceptable on the condition that the Product complies with the referenced standard. Unless stated that no substitutions are permitted, Products by other manufacturers may be acceptable as a substitution on the condition that the Products comply with the specified referenced standard and meet the requirements for substitution specified in this Section.
- 1.4 When a Product is specified by reference to a standard only, any Product that meets the specified standard may be selected. Products meeting the minimum referenced standards will be accepted subject to TTC review that the Products are compatible with the Work.
- 1.5 When a Product is specified by prescriptive or performance Specification, any Product meeting the requirements of the Specification may be accepted subject to TTC review.

**2 SUBSTITUTIONS**

- 2.1 Requests for substitutions will not be accepted prior to Notification of Award.
- 2.2 Substitutions will be considered for TTC review provided that:
  - 2.2.1 Complete Product data is submitted in accordance with Sections 01 33 00 and 01 40 00.
  - 2.2.2 All data relating to changes in the Contract Schedule, if any, and relating to other Work have been submitted.
  - 2.2.3 The same warranty or greater is given for the substitution as for the original Product specified.
  - 2.2.4 All claims are waived for additional costs related to the substitution that may subsequently arise.
  - 2.2.5 Installation of the accepted substitution is coordinated with the Work and full responsibility is assumed when substitutions affect other work.
- 2.3 Substitutions to methods or processes described in the Specifications or Contract Drawings may be proposed for TTC review.
  - 2.3.1 Time spent by TTC in reviewing the substitution request is not to be the basis for a claim for extensions to the Milestones. Allow a minimum of twenty-eight (28) Days for TTC to review the substitution request following the receipt of the information required. Contractor will be solely responsible for delays arising as a result of the review by TTC of any request for substitution.

- 2.4 TTC may reject any request for substitution at any time in the process if, in the opinion of TTC, the proposed substitution may:
  - 2.4.1 Delay or adversely affect the Contract Schedule or disrupt the Work of the Contractor or Other Contractors.
  - 2.4.2 Require substantial revision to the Specifications and/or Contract Drawings.
  - 2.4.3 Not offer any benefit to TTC.
- 2.5 Do not substitute Products unless such substitutions have been reviewed and accepted for the Work by TTC.
- 2.6 Accepted substituted Products are subject to inspection by TTC and testing procedures as specified in Section 01 40 00, including submissions in accordance with Section 01 33 00. Install accepted substituted Products only after review and receipt of written acceptance from TTC on a TTC Construction Department Submittal Form.
- 2.7 When a Product is specified by reference to a standard or by prescriptive or performance Specification, upon request of TTC, obtain from the manufacturer, an independent testing laboratory report indicating that the Product meets or exceeds the specified requirements.

### **3 NUMBER OF ITEMS**

- 3.1 In cases where an item or a part of a Product or system is referred to in the singular number, it is intended that such reference apply to as many items or parts as are required to complete the Work.

### **4 QUALITY OF PRODUCTS**

- 4.1 Provide Products that are new and free from damage and defects, of the best quality, and compatible with Specifications for the purpose intended. If requested, furnish evidence as to type, source, and quality of Products provided.
- 4.2 Defective Products will be rejected regardless of the results of any previous reviews or inspections. Review or inspection does not relieve the Contractor from responsibility but is a precaution against oversight or error. Remove and replace defective Products at no cost to TTC, and be responsible for delays and expenses caused by rejection.
- 4.3 Remove rejected Product(s) within forty-eight (48) hours of receipt of instructions from TTC.
- 4.4 Should a dispute arise as to the quality or fitness of Products, the decision rests strictly with TTC based upon the requirements of Contract Documents.
- 4.5 Unless otherwise indicated in the Specifications, maintain uniformity of manufacture for any particular or like item throughout the Work.

### **5 TRADEMARKS AND LABELS**

- 5.1 Permanent labels, trademarks and nameplates on Products are not acceptable in locations visible to the public, except where required by authorities having jurisdiction or for operating instructions.

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**6 AVAILABILITY**

- 6.1 Notify TTC of foreseeable delays in the supply of Products, so that remedial action may be authorized in ample time to prevent delay in the performance of Work.
- 6.2 In the event of failure to notify TTC of delays at commencement of Work and should it subsequently appear that Work may be delayed for such reason, TTC reserves the right to direct the Contractor to take the following measures at no additional cost to TTC:
  - 6.2.1 Substitute more readily available Products of similar or better quality and character, or
  - 6.2.2 Temporarily install another Product until such time as the specified Product becomes available, at which time the temporarily installed Product shall be removed and the specified Product installed.

**7 PRODUCT DELIVERY AND HANDLING**

- 7.1 Be responsible for handling and delivery of Products. Do not engage TTC employees to assist in loading or unloading of Products. Be responsible for costs of delivery, loading, and offloading, and for transportation back to its origin for correction, if required, due to damage or defect.
- 7.2 Delivery of Products and removal of Products and debris through Public Areas of the operational Subway Station is restricted to the period between 10:00 p.m. and 5:00 a.m. and to Off-Peak Hours with the permission of TTC. Do not deliver Products or remove Products and debris during Peak Hours through Public Areas of the operational Subway Station. Do not use escalators or elevators for the delivery or removal of Products and debris. Use dollies, wagons, and carts with rubber wheels for movement of material.
- 7.3 Deliver extra stock materials required by the Contract to a TTC facility within the City of Toronto during regular hours. Before delivery, arrange for receiving at such facility. Be responsible for handling, delivery, loading, and offloading of such extra stock materials.
- 7.4 Store Products that are not in use in storage areas reserved by the Contractor for such purpose. Do not store on street, sidewalk, boulevard or elsewhere within public view except with TTC permission. Products that TTC may permit to be stored elsewhere than in the Contractor's storage areas to be neatly stacked or otherwise disposed and be so maintained.
- 7.5 Deliver packaged Products, in original unopened wrapping or containers, with manufacturer's seals and labels intact.
- 7.6 Label packaged Products to describe contents, quantity, and other information as specified.
- 7.7 Label fire-rated Products to indicate approval of ULC or WHI.
- 7.8 Hazardous materials information:
  - 7.8.1 In accordance with Section 01 59 00.

**8 STORAGE AND PROTECTION**

- 8.1 Be responsible for storage of Products as required by the Contract. Limited storage of Products is permitted on TTC property.

8.2 Store packaged or bundled Products in original and undamaged condition. Maintain manufacturer's seals and labels intact. Do not remove from packaging or bundling until required in the Work.

8.3 Store Products in order not to overload any part of the building, structure, falsework, formwork, or scaffolding.

## **9 MANUFACTURER'S RECOMMENDATIONS**

9.1 Unless otherwise indicated in the Specifications, install or erect Products in accordance with manufacturer's recommendations.

## **10 QUALITY OF WORK PERFORMED**

10.1 Ensure that Work performed is of a quality consistent with the Contract Documents and executed by Workers experienced and skilled in the respective duties for which they are employed. Immediately notify TTC if the required Work is such as to make it impractical to produce required results.

10.2 Do not employ a person who may be unfit, incompetent, careless, insubordinate, and unskilled in their required duties. TTC reserves the right to dismiss Workers from Site.

10.3 Decisions as to the quality or fitness of workmanship in cases of dispute rest solely with TTC, whose decision is final.

10.4 Coordination:

10.4.1 Ensure cooperation of Workers in laying out Work. Maintain efficient and continuous supervision.

10.4.2 Be responsible for coordination and placement of openings, sleeves, and accessories.

10.5 Concealment:

10.5.1 In finished areas, conceal pipes, ducts and wiring in floors, walls, and ceilings, except where indicated otherwise.

10.6 Compatibility of dissimilar materials:

10.6.1 Do not permit materials to come in contact with other materials whether in the presence of moisture or otherwise if conditions will result in corrosion, stain or discolouration, or deterioration of completed Work.

10.6.2 Provide compatible, durable separators where such contact is unavoidable. Apply isolation coating at 0.8 mm dry film thickness to prevent corrosive or electrolytic action between dissimilar materials such as aluminum to concrete, masonry, galvanized steel, and similar conditions.

**END OF SECTION**

**1 GENERAL**

- 1.1 The Contractor shall examine, protect, and restore, if damaged by the execution of the Work, all properties on or adjacent to the Work within the zone of influence as described in Toronto Municipal Code, or that may be affected by the Work, including all equipment and services within the properties. The Contractor shall identify, record, and catalogue existing conditions of these properties, prior to starting construction.

**2 EXAMINATION OF STRUCTURES**

- 2.1 The Contractor, TTC, and the Contractor's photographer shall jointly examine the finishes of TTC structures, including ceilings, walls and floors. A 'Condition Survey Photographic Report' shall be prepared by the Contractor. The report shall include a detailed photographic record and a written report. All photographs shall be numbered, dated, and labelled with the property name. The location from which the photograph was taken shall be identified. The report, when completed, shall be signed by both parties before distribution. The joint survey shall be conducted prior to the commencement of Work at Site.
- 2.2 The Contractor shall employ an experienced photographer to document existing conditions. In all cases, photography shall be good, clear, in focus, and comprehensive enough to adequately document the appearance of the existing property.
- 2.3 The Contractor, TTC, and the property owner shall jointly re-examine each of these properties after construction is completed to record condition differences.
- 2.4 The joint examination to specific properties does not relieve the Contractor of the responsibility to examine, protect, and restore of all property adjacent to the Work, or that which may be affected by the Work.

**3 EQUIPMENT AND SERVICES WITHIN THE PROPERTY**

- 3.1 Locate, protect, support, and maintain all equipment and services affected by the Work.
- 3.2 On completion, restore equipment, and services to their original condition, and relocate where necessary, to the satisfaction of TTC.

**4 RESTORATION**

- 4.1 Repair and restore parts of the property or structure, including equipment and services broken or damaged by operations performed under the Contract.

**END OF SECTION**



**1 DEFINITIONS**

- 1.1 **Cutting:** Removal of existing construction necessary to permit the installation or performance of other Work.
- 1.2 **Non-conforming:** Products, components, and assemblies that do not meet or exceed the minimum requirements established by the Contract Documents.
- 1.3 **Remedial Work:** Fitting and repair work required to restore surfaces and substrates to sound condition matching the appearance and performance characteristics of adjacent finishes and substrates after installation of other Work.

**2 GENERAL**

- 2.1 Perform Cutting and Remedial Work as required to make the parts of Work come together properly and to complete the Work.
- 2.2 Coordinate the Work to minimize Cutting and Remedial Work.
- 2.3 Have Cutting and Remedial Work performed by Workers with a minimum of three (3) years' experience performing similar work, and who have experience repairing the Products affected. Perform Cutting and Remedial Work in a manner that neither damages nor endangers the Work.
- 2.4 Remove, replace, patch and repair materials and surfaces cut or damaged during Cutting by methods and with materials that do not void existing warranties.
- 2.5 If steel reinforcement is accidentally cut, stop the associated Work immediately and notify TTC immediately and request a review by TTC. If directed by TTC, provide shoring at no cost to TTC.
- 2.6 If electrical cable or conduit, pipe, utilities or other embedded elements are accidentally cut, stop the associated Work immediately and notify TTC immediately and request a review by TTC. Proceed only as directed by TTC.

**3 SUBMITTALS**

- 3.1 Submit in accordance with Section 01 33 00.
- 3.2 Equipment relocation submittals:
  - 3.2.1 Where existing electrical equipment must be relocated, either permanently or temporarily, notify TTC and request approval in writing from TTC prior to commencing Work. Do not proceed until the written approvals have been provided.
    - 3.2.1.1 Provide TTC with details describing what equipment must be relocated, the reason for and duration of the relocation, and Drawings indicating existing location(s) and intended location(s). Submittals shall meet the requirements of Section 01 33 23.
  - 3.2.2 Where existing mechanical equipment must be relocated, either permanently or temporarily, notify TTC and request approval in writing from TTC prior to commencing Work. Do not proceed until the written approvals have been provided.
    - 3.2.2.1 Provide TTC with details describing what equipment must be relocated, the reason for and duration of the relocation, and Drawings indicating existing location(s) and intended location(s). Submittals shall meet the requirements of Section 01 33 23.

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- 3.3 Cutting steel reinforcement or other structural elements:
    - 3.3.1 Before Cutting steel reinforcement or other structural elements, notify TTC and request approval in writing from TTC prior to commencing Work. Do not proceed until the written approvals have been provided.
      - 3.3.1.1 Provide TTC with details describing what needs to be cut, the reason for the procedure, and Drawings indicating existing conditions. Submittals shall meet the requirements of Section 01 33 23.
  - 3.4 Cutting and Remedial Work Proposal:
    - 3.4.1 Submit a Cutting and Remedial Work Proposal at least fourteen (14) Business Days before the date Cutting and Remedial Work is to be performed.
    - 3.4.2 Submit a proposal describing procedures to TTC for review and approval in writing by TTC prior to Cutting and Remedial Work at structural elements, as well as for Cutting and Remedial Work that will be exposed to view in the completed Work. Include in the proposal the following items:
      - 3.4.2.1 Identification of Contract.
      - 3.4.2.2 Locations and descriptions of the Products, systems, components and assemblies affected.
      - 3.4.2.3 Reasons why Cutting and Remedial Work is necessary.
      - 3.4.2.4 Descriptions of the Cutting and Remedial Work and the Products to be used.
      - 3.4.2.5 Alternatives to Cutting if there are any.
      - 3.4.2.6 Summary of all scans.
      - 3.4.2.7 List utilities that Cutting and Remedial Work procedures will disturb or affect. List utilities that will be relocated, and those that will be temporarily out of service. Indicate how long service will be disrupted.
      - 3.4.2.8 The effect on Work performed by others under separate contract with TTC. Include arrangements made with Other Contractor(s) to ensure their responsibility for their work.
      - 3.4.2.9 Indicate Cutting and Remedial Work that will be performed.
    - 3.4.3 Acceptance: Obtain written acceptance of Cutting and Remedial Work Proposal before proceeding with Work. Review and acceptance of the Cutting and Remedial Work Proposal does not waive TTC right later to require removal and replacement of unsatisfactory work.
  - 3.5 As-Built Documents:
    - 3.5.1 Record Cutting and Remedial Work locations on As-Built Drawings, and submit in accordance with Section 01 78 39.
  - 3.6 Submit Safety Data Sheets for all Products intended for use during Remedial Work to TTC for review.
  - 4 EXAMINATION**
    - 4.1 Inspect Products, assemblies and systems affected by the Work of this Section. Uncover parts of the Work as may be necessary to ascertain conditions.



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**5 PREPARATION**

- 5.1 Utility locates: Refer to Section 01 59 00 for requirements concerning utility locates.
- 5.2 Obtain approvals from authorities having jurisdiction, Subcontractors, suppliers and Product manufacturers affected.
- 5.3 Avoid interference with use of adjoining areas or interruption of free, safe passage to adjoining areas.
- 5.4 Provide supports to assure structural integrity and safety of the Work.
- 5.5 Provide protection against adverse weather.
- 5.6 Provide temporary protection/covering of electrical and mechanical equipment prior to starting Work. Install temporary filters for ventilation system as required, and replace with new filters at completion of work.
- 5.7 Provide temporary lighting, heating, ventilation and other services as necessary for the safety of Workers and for the curing of materials.
- 5.8 Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to minimize interruption of services to occupied areas.
- 5.9 Before Cutting, scan proposed Work areas using Ground Penetrating Radar (GPR), pipe and cable locators, X-ray, or similar approved technology as necessary to find reinforcement, electrical cables and conduit, pipe, utilities, and other items that may be concealed. Include a summary of all scans in the Cutting and Remedial Work Proposal. Coordinate all scans with TTC.
- 5.9.1 Additional measures required to reduce the risk of unexpectedly encountering concealed and buried services:
  - 5.9.1.1 Have on hand and review all available design Drawings prior to Cutting;
  - 5.9.1.2 Have on hand and review all available As-Built Drawings prior to Cutting;
  - 5.9.1.3 Use the results of scans to confirm accuracy of available information, and to ensure reliability of the selected scanning method.
- 5.10 Erect hoarding and install other protection as required to restrict movement of dust and other debris, and reduce noise pollution; refer to Sections 01 50 00, 01 57 19 and 01 59 00 for requirements.

**6 PRODUCTS FOR REMEDIAL WORK**

- 6.1 Supply Products in accordance with Contract Documents.
- 6.2 Except if otherwise specified, Provide Products identical to existing Products. For exposed surfaces, use Products that visually match the existing adjacent surfaces. If identical Products are unavailable or cannot be used, use Products that will match the visual and functional performance of the existing Products when installed and cured.
- 6.2.1 Hazardous Products must be approved by TTC Occupational Hygiene and Environment Section prior to bringing them to, and using them on, TTC property.

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**7 PERFORMANCE**

- 7.1 Fit the various parts of the Work together and integrate them with other Products, components and assemblies.
- 7.2 Install Products in accordance with the requirements of the Contract Documents.
- 7.3 Make openings in non-structural elements for the accommodation and passage of mechanical and electrical Work. Have locations and sizes of openings in structural elements approved by TTC prior to Cutting.
- 7.4 Cut rigid materials with saws and core drills. Use of pneumatic and impact tools is not permitted.
- 7.5 Replace defective and Non-conforming Products, components, and assemblies.
- 7.6 Perform Cutting and Remedial Work by methods in order to avoid damage to other parts of the Work, and that will provide proper surfaces to receive Remedial Work and finishing.
- 7.7 Restore Work with new Products in accordance with the requirements of the Contract Documents.
- 7.8 Fit the various parts airtight to pipes, sleeves, ducts, conduit, and other penetrations through construction and assemblies with suitable allowances for deflection, expansion, and contraction.
- 7.9 Enclose pipes, ducts, conduit and wires passing through floors at areas where faucets occur (for example, Washrooms, Mechanical Rooms on suspended floors, Janitor Rooms) in metal sleeves that project 100 mm above the finished floor. Make sleeves air and watertight, with water and mould resistant fire-stopping.
- 7.10 Completely seal voids caused by the penetration of fire-rated walls, ceilings, and floors with firestopping materials, full thickness of the construction element, and meeting OBC requirements.
- 7.11 Refinish surfaces to match adjacent finishes. Refinish continuous surfaces to the nearest intersection. Refinish entire assembly units.

**END OF SECTION**

**1 GENERAL REQUIREMENTS**

- 1.1 Dispose of waste materials in accordance with Section 01 74 19.
- 1.2 Do not burn waste materials.
- 1.3 Do not bury debris or excess materials on TTC's property.
- 1.4 Do not deposit any construction waste in TTC waste disposal facilities.
- 1.5 Do not discharge volatile, harmful or dangerous materials into drainage systems.
- 1.6 Comply with Federal, Provincial and local regulations, by-laws and ordinances.
- 1.7 Make arrangements with, and obtain Permits from, authorities having jurisdiction for disposal of waste and debris.
- 1.8 Remove waste materials from Site and dispose of lawfully.

**2 QUALITY ASSURANCE**

- 2.1 Verify that cleaning agents and methods do not remove finishes and permanent protective coatings on surfaces being cleaned.
- 2.2 Cleaning products must be approved by TTC prior to use on Site.
- 2.3 Use cleaning products certified through one of the following environmental certification programs as applicable:
  - 2.3.1 EcoLogo® Certification;
  - 2.3.2 Green Seal® Certification;
  - 2.3.3 Enviroidesic™ Certification;
  - 2.3.4 Any other environmental certification authority.
- 2.4 Employ experienced Workers or professional cleaners for final cleaning. Clean each surface or unit to a clean and sanitary condition.
- 2.5 Comply with the manufacturer's written cleaning instructions.

**3 COORDINATION**

- 3.1 Coordinate repair or replacement of broken or damaged materials with original installer.

**4 CLEANING MATERIALS**

- 4.1 Cleaning materials must meet the following requirements:
  - 4.1.1 Quality assurance requirements specified in this Section.
  - 4.1.2 Use only compliant cleaning materials accepted by the manufacturer of the Product to be cleaned.
  - 4.1.3 Use compliant cleaning materials only on surfaces recommended by the cleaning material manufacturer.

## **5 CONTRACT CLEANLINESS**

- 5.1 Maintain the Work in a tidy condition, free from accumulation of waste material and debris.
- 5.2 Remove waste material and debris from the Site. Separate and dispose of waste materials in accordance with Section 01 74 19 and applicable legislation.
- 5.3 Clean interior areas prior to start of the finishes parts of the Work, maintain areas free of dust and other contaminants during finishing operations.
- 5.4 Remove excess sealant, mortar and paint droppings, splatters and staining.
- 5.5 If the recommended cleaning product and/or procedure does not result in a level of cleanliness acceptable to TTC, obtain recommendations regarding the remedial action required.
- 5.6 Dispose waste concrete and alkali washout materials on and off Site in designated facilities and locations as directed by TTC.
- 5.7 Remove concrete and alkali wash-offs on surfaces to prevent etching of glass and/or metal.
- 5.8 Remove waste material and debris from Site and deposit in waste container at end of each work day.
- 5.9 Store volatile waste in covered metal containers and remove from premises at end of each work day.
- 5.10 Provide adequate ventilation during use of volatile or noxious substances in accordance with manufacturer's recommendations and applicable regulatory standards. Use of building ventilation systems is not permitted for this purpose.
- 5.11 On a daily basis, remove dropped screws, metal filings and metallic clippings from floors and roof surfaces.
- 5.12 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.
- 5.13 Protect equipment from construction debris.

## **6 FINAL CLEANING**

- 6.1 Conduct cleaning and waste removal operations in accordance with local laws and ordinances, Federal, Provincial and local environmental and antipollution regulations.
- 6.2 Complete the following cleaning operations before requesting review of the Work for the application for the Certificate of Substantial Performance:
  - 6.2.1 Clean Site in areas disturbed by construction activities, including landscape development areas, and remove rubbish, waste material, litter and other foreign substances.
  - 6.2.2 Remove tools, Construction Equipment, machinery and surplus material from Site.
  - 6.2.3 Remove temporary protective materials and coatings.
  - 6.2.4 Clean interior hard surfaced finishes to a dirt free condition, free of stains, films, dust and foreign substances. Avoid disturbing the natural patina of exterior surfaces.

- 6.2.5 Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, maintenance holes, attics, interstitial spaces and similar spaces.
- 6.2.6 Vacuum clean concrete floors.
- 6.2.7 Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
- 6.2.8 Remove grease, dust, dirt, stains, labels, fingerprints, oxidization and other contaminants from interior and exterior surfaces.
- 6.2.9 Clean and polish transparent materials, including mirrors and glass in doors and windows:
  - 6.2.9.1 Remove glazing compounds and other noticeable vision obscuring materials.
  - 6.2.9.2 Remove grease, dust, dirt, stains, labels, fingerprints and other contaminants.
  - 6.2.9.3 Replace chipped or broken glass and other damaged transparent materials.
  - 6.2.9.4 Polish mirrors and glass, taking care not to scratch surfaces.
  - 6.2.9.5 Restore reflective surfaces to their original condition.
- 6.2.10 Remove labels that are not permanent.
- 6.2.11 Touch-up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
- 6.2.12 Remove paint from ULC, CSA, WHI and similar labels, including mechanical and electrical nameplates.
- 6.2.13 Remove grease, dust, dirt, stains, labels, fingerprints, oxidization and other contaminants from mechanical and electrical equipment and other equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
- 6.2.14 Replace parts subject to unusual operating conditions. Restore equipment, machinery or systems used as temporary facilities to "as new" condition, so that warranties may take effect at Substantial Performance.
- 6.2.15 Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure and other substances.
- 6.2.16 Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers and grills.
- 6.2.17 Clean ducts, blowers and coils.
- 6.2.18 Clean light fixtures and reflectors to function with full efficiency. Replace burned-out lamps, and those dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapour fixtures in accordance with requirements for new fixtures.
- 6.2.19 Run fixtures for a sufficient period of time to completely refresh all domestic hot, cold and tempered water piping.
- 6.2.20 Power wash all drains. After drains are power washed, clear all catch basins, sumps and pits of collected debris.
- 6.2.21 Clear all orifices and nozzles that have been obstructed.

- 6.2.22 Remove, inspect, clean and replace all strainer screens.
- 6.2.23 Ensure all equipment is clean and free from dust and debris. Refer to equipment specifications for additional cleaning requirements.
- 6.3 Upon completion of the Work, remove all plant, temporary buildings, surplus materials, rubbish and other equipment, tools and materials from the spaces and leave the Site in a neat, clean and safe condition acceptable to TTC.

**END OF SECTION**

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**1 SUMMARY**

- 1.1 Section includes labour, Products, equipment, and services necessary for demolition and construction Waste management of Hazardous Waste, Liquid Industrial Waste, and Non-hazardous Solid Waste in accordance with the Contract Documents.

**2 REFERENCES**

- 2.1 MOECP, Ministry of the Environment, Conservation, and Parks.
- 2.2 O. Regulation 102/94, Waste Audits and Waste Reduction Work Plans, under the Environmental Protection Act R.S.O. 1990.
- 2.3 O. Regulation 103/94, Industrial, Commercial and Institutional Source Separation Programs, Environmental Protection Act R.S.O. 1990.
- 2.4 R.R.O. 1990, Regulation 347, General - Waste Management, Environmental Protection Act R.S.O. 1990.
- 2.5 R.R.O. 1990, Regulation 362, Waste Management - PCB's, Environmental Protection Act R.S.O. 1990.

**3 DEFINITIONS**

- 3.1 Asbestos Waste: As defined by R.R.O. 1990, Regulation 347.
- 3.2 Environmental Compliance Approval: A MOECP issued permit, granted under Part V of the Environmental Protection Act, to use, operate, establish, alter, enlarge or extend a waste management system or a waste disposal site.
- 3.3 Generator: As defined by R.R.O. 1990, Regulation 347.
- 3.4 Hazardous Waste: As defined by R.R.O. 1990, Regulation 347.
- 3.5 Liquid Industrial Waste: As defined by R.R.O. 1990, Regulation 347.
- 3.6 Source Separation Program: A series of ongoing activities to separate reusable and recyclable Waste material into material categories from other types of Waste at point of generation.
- 3.7 Non-hazardous Solid Waste: As defined by R.R.O. 1990, Regulation 347.
- 3.8 Salvage: To reuse a construction material that would otherwise be Waste on a construction site other than the project Site.
- 3.9 Source Separation: The act of keeping different types of Waste materials separate beginning from the first time they become Waste.
- 3.10 Subject Waste: As defined by R.R.O. 1990, Regulation 347.
- 3.11 Waste: Includes Subject Waste and Non-hazardous Solid Waste.
- 3.12 Waste Audit: Detailed inventory of materials in building, involving quantifying by volume and weight amounts of materials and Waste generated during demolition, construction, and indicating disposal method, in accordance with MOECP requirements.
- 3.13 Waste Identification: Detailed inventory of materials in building, involving quantifying by volume/weight amounts of materials and Waste generated during demolition, construction and indicating disposal method, recycling, and landfill.

- 3.14 Waste Management Plan: A Contract-specific plan for the collection, transportation, and final disposition of Waste generated at Site. The purpose of the Plan is to reduce the amount of material being landfilled. The Waste Management Plan includes:
  - 3.14.1 Measuring and estimating the quantity and composition of Waste.
  - 3.14.2 Identifying reasons for Waste generation including operational factors.
  - 3.14.3 Addressing opportunities for reduction, reuse, salvaging or recycling of materials.
- 3.15 Waste Reduction Workplan: Written report which addresses opportunities for reduction, reuse or recycling of materials. Waste Reduction Workplan is based on information acquired from Waste Audit or Waste identification.
- 3.16 Waste Specialist: A specialist who is experienced with Waste management on construction projects, and is responsible to identify and quantify Waste, evaluate Waste management options, coordinate and track Waste management activities, and ensure full compliance with applicable Waste legislations.

#### **4 SUBMITTALS**

- 4.1 Submit in accordance with Section 01 33 00.
- 4.2 Submit the following:
  - 4.2.1 Waste Management Plan. Submit updated versions as they occur.
  - 4.2.2 Monthly Waste Tracking Record.

#### **5 WASTE MANAGEMENT REQUIREMENTS**

- 5.1 Preserve the environment and prevent pollution and environmental damages.
- 5.2 Comply with applicable regulations.
- 5.3 Waste related to this Contract is Contractor's property and responsibility.
- 5.4 Comply with Generator's role and responsibility as defined in R.R.O. 1990, Regulation 347, Section 29.1 to 29.5, Field Operations, if Waste will be taken to Contractor's facilities before shipping to a MOECP licensed Waste transfer facility or Waste disposal site.
- 5.5 Be responsible for costs, including disposal and Waste analysis.
- 5.6 Burning of Waste is not permitted.
- 5.7 Disposal of Subject Waste including, but not limited to, fuel, mineral spirits, oil, paint, and paint thinner into the ground, waterways, storm or sanitary sewers is prohibited.
- 5.8 Equipment maintenance activities, such as oil change, are prohibited on TTC properties.
- 5.9 Minimize Waste through proper and careful planning, scheduling, handling, workmanship, and Waste management practices such as reduce, reuse, repair, and recycle.
- 5.10 TTC conducts Site visit at proposed receivers as part of their review. Contractor to arrange visit within 10 Business Days of being requested. Site visit may include, but is not limited to, review of operation and relevant documentation to ensure proper management of Waste.
- 5.11 Develop, manage, and implement Waste Management Plan.



- 5.12 Review and update Waste Management Plan and Waste management practices periodically to ensure established programs are suitable for the Work being conducted.
- 5.13 Subject Waste:
  - 5.13.1 Collect, store, manage, transport, and dispose of Subject Waste in accordance with Contract Documents and applicable regulatory requirements.
- 5.14 Non-hazardous Solid Waste:
  - 5.14.1 Divert minimum 75% of Non-hazardous Solid Waste by weight from landfill and incineration.
  - 5.14.2 Prioritize actions and follow 3R's hierarchy. Reductions as first priority, followed by reuse, then recycle.
  - 5.14.3 Divert 100% of the following uncontaminated materials from landfill:
    - 5.14.3.1 Brick.
    - 5.14.3.2 Concrete.
    - 5.14.3.3 Paper.
    - 5.14.3.4 Corrugated Cardboard.
    - 5.14.3.5 Steel.
    - 5.14.3.6 Glass.
    - 5.14.3.7 Drywall (unpainted).
    - 5.14.3.8 Wood.
    - 5.14.3.9 Plastics: Sheet, film and containers.
    - 5.14.3.10 Polystyrene packaging.
    - 5.14.3.11 Wood.

## **6 WASTE MANAGEMENT PLAN**

- 6.1 Prepare a Waste Management Plan and update as needed.
- 6.2 Post up-to-date Waste Management Plan on Site for viewing by Site staff, TTC, and regulatory agency.
- 6.3 Waste Management Plan to include, but not be limited to, the following:
  - 6.3.1 Identify a Waste Specialist responsible for directing and managing all aspects of the waste management program.
  - 6.3.2 Determine if Subject Waste will be generated and complete Subject Waste Assessment Form (attachment 01 74 19.01).
  - 6.3.3 If Subject Waste is anticipated, provide the information and details specified in Article 7.
  - 6.3.4 Conduct Waste Identification and Waste Reduction Workplan of Non-hazardous Solid Waste prior to demolition and construction activities. Specify how Waste will be managed (reduce, reuse, recycle or landfill).
  - 6.3.5 Establish a Source Separation Program.
  - 6.3.6 Segregate Subject Waste from Non-hazardous Solid Waste.

**7 SUBJECT WASTE**

- 7.1 Ensure Waste management practices comply with requirements in accordance with this Section and applicable regulations.
- 7.2 Blending, mixing, drying, and diluting Subject Waste is not permitted.
- 7.3 Prior to starting Work, determine if Hazardous Waste or Liquid Industrial Waste will be generated as part of demolition or construction activities.
- 7.4 Complete a Subject Waste Assessment Form (attachment 01 74 19.01).
- 7.5 Where a Subject Waste cannot be managed under R.R.O. 1990, Regulation 247, Section 29.1 to 29.5 - Field Operations, and TTC Generator number is required, notify TTC minimum 15 Business Days prior to the planned shipment and provide the following:
- 7.5.1 Waste classification of the material.
- 7.5.2 Analytical results completed by an accredited lab if requested by TTC.
- 7.5.3 Proposed carrier(s) and its Environmental Compliance Approval.
- 7.5.4 Proposed receiver(s) and its Environmental Compliance Approval.
- 7.5.5 Please note that only during special circumstances will TTC permit the use of its Generator number.
- 7.6 If TTC Generator number is used, the associated waste manifests must be signed by a TTC employee who holds a valid Transportation of Dangerous Good certificate.
- 7.7 Remove Subject Waste from Site daily unless prior approval is granted by TTC.
- 7.8 Subject Waste must be stored:
- 7.8.1 In a secure location protected from vehicular collision and weather elements, and located an appropriate distance from drainage systems.
- 7.8.2 In a sealed container, which is in good condition with no visible signs of damage and that is compatible with the type of Subject Waste being stored.
- 7.8.3 With appropriate secondary containment (i.e., spill pallet, double-walled container, etc.).
- 7.8.4 In an appropriately labelled container identifying the type of waste and the waste class.
- 7.8.5 Only with substances that are compatible with each other.
- 7.9 The following Subject Waste is anticipated for the Contract:

Activities	Potential Subject Waste
Cleaning of sludge in sewer systems	Liquid Industry Waste resulting from system flush/camera scan

**8 WASTE IDENTIFICATION AND WASTE REDUCTION WORKPLAN**

- 8.1 Conduct a Waste Identification and prepare a Waste Reduction Workplan prior to commencing the Work.
- 8.2 The Waste Reduction Workplan includes, but is not limited to, information on the following (see example attachments):
- 8.2.1 Demolition and construction activities.

- 8.2.2 Materials generated from each activity and amount anticipated.
- 8.2.3 Management options (reuse, recycle, or landfill) and material management decisions.
- 8.2.4 Proposed Waste carrier(s) and Waste receiver(s) for each type of Waste.
- 8.3 For each anticipated Waste carrier and receiver, prepare a copy of:
  - 8.3.1 MOECP issued Environmental Compliance Approval.
- OR**
- 8.3.2 If the receiver is exempted from Part V of the Environmental Protection Act, a Letter of Commitment from the Waste receiver with the following information:
  - 8.3.2.1.1 Agreement to accept the material.
  - 8.3.2.1.2 Confirmation that the material will be recycled at their facility.
  - 8.3.2.1.3 Confirmation on the use that will be made of the material.
  - 8.3.2.1.4 Confirmation that the process of operation is ongoing at the time the material is being transported if the material is used for an ongoing process or operation.
  - 8.3.2.1.5 List of clauses in R.R.O. 1990, Regulation 347 and other applicable legislation that grants their exemption from Part V of the Environmental Protection Act R.S.O. 1990.

## **9 SOURCE SEPARATION PROGRAM**

- 9.1 Implement Source Separation Program for Waste generated to maximize Waste reduction initiatives.
- 9.2 Segregate and store Waste in dedicated and secured locations with proper signage.
- 9.3 Provide size-appropriate containers for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.
- 9.4 Place containers where collection of materials will not hinder TTC operations.
- 9.5 Prevent contamination of materials for recycle and Salvage and handle materials consistent with requirements for acceptance by designated facilities.
- 9.6 Take co-mingled materials to a processing facility for separation off Site.
- 9.7 Locate separated materials in areas that will minimize material damage.
- 9.8 Remove Waste from Site in a timely manner.

## **10 SPECIAL REQUIREMENTS**

- 10.1 Do not dispose of chemical containers, such as paint cans and aerosols cans into Non-hazardous Solid Waste collection containers located on TTC Site. These types of containers require special handling and the Contractor shall return these containers to their shop, for appropriate disposal.
- 10.2 Asbestos Waste is classified as Non-hazardous Solid Waste. It must be handled, stored, managed, transported and disposed of in accordance with R.R.O. 1990, Regulation 347, Section 17 Management of Asbestos Waste.
- 10.3 PCB waste must be handled, stored, managed, transported and disposed in accordance with R.R.O. 1990, O. Regulation 362.

**11 WASTE TRACKING RECORD**

11.1 Track Waste shipments leaving Site.

11.2 Prepare and maintain an up-to-date Waste Tracking Record (attachment 01 74 19.03) complete with weight tickets showing date, time, location, quantities, types of materials shipped, container identification, shipment identification, and destination.

**END OF SECTION**

**Toronto Transit Commission  
CONTRACT SH35-8**

**Attachment 01 74 19.01  
SUBJECT WASTE ASSESSMENT FORM**

---

Contract Number:

Contract Name:

Contractor:

Waste Specialist:

Date:

I certify that a pre-demolition and pre-construction Waste assessment has been conducted for this Contract. Subject Waste, as defined in R.R.O. 1990, Regulation 347:

- ☐ is not anticipated.
- ☐ is anticipated but will be managed in accordance with R.R.O. 1990, Regulation 347 and the requirements for exemption set out in Section 29.1 to 29.5, Field Operations. A TTC Waste Generator Number is not required.
- ☐ is anticipated and a TTC Waste Generator Number is required. The anticipated Waste classifications and Environmental Compliance Approval of the Waste carrier(s) and receiver(s) are enclosed.

Should unanticipated Subject Waste be generated during the Work and the use of a TTC Waste Generator number is required, associated Waste classification and the Environmental Compliance Approval of the Waste carrier(s) and receiver(s) will be submitted.

---

(Signature)

Name:

Title:



**Toronto Transit Commission**  
**CONTRACT SH35-8**
**Attachment 01 74 19.02**  
**WASTE REDUCTION WORKPLAN**

Contract Number:

Contract Title:

Contractor:

Waste Specialist Name and Signature:

Date:

[Construction] [Demolition] Activity	Anticipated Waste	Available Waste Management Options			Estimated Amount (tonnes)	Waste Management Decision	Waste Category	Collection at Contractor's Facilities?*	Proposed Carrier, Address and ECA #	Proposed Receiver, Address and ECA #
		Reuse	Recycle	Landfill						

\* Contractor confirms compliance with the R.R.O. 1990, Regulation 347, Section 29.1 to 29.5. Field Operations

**Toronto Transit Commission**  
**CONTRACT SH35-8**

**Attachment 01 74 19.02(a)**  
**WASTE REDUCTION WORKPLAN**

Contract Number:

Contract Title:

Contractor:

Waste Specialist Name and Signature:

Date:

Construction Activity	Anticipated Waste	Available Waste Management Options			Estimated Amount of Waste (tonnes)	Waste Management Decision	Waste Category	Collection at Contractor's Facilities?*	Proposed Carrier, Address and ECA #	Proposed Receiver, Address and ECA #
		Reuse	Recycle	Landfill						
Drywalling (unpainted)	Drywall scrap (Unpainted)	X	X	X	20 t	1. Reuse large pieces. 2. Recycle small pieces.	Wood recycling		Carrier A ECA #1234	Receiver A ECA #5678
Equipment packaging	Wood skids	X	X	X	20 t	1. Return for reuse by local supplier. 2. If supplier from overseas, sell to local companies for reuse. 3. Recycle broken skids	1 & 2: Not applicable 3: Wood recycling		Return to Supplier A	Return to Supplier A
	Cardboard		X	X	2 lb	Recycle	Comingle recycling	X	N/A	N/A
	Paper		X	X	2 lb	Recycle	Comingle recycling	X	N/A	N/A
	Plastic		X	X	2 lb	Recycle	Comingle recycling	X	N/A	N/A

\* Contractor confirms compliance with the R.R.O. 1990, Regulation 347, Section 29.1 to 29.5. Field Operations



**Toronto Transit Commission**  
**CONTRACT SH35-8**
**Attachment 01 74 19.02(b)**  
**WASTE REDUCTION WORKPLAN**

Demolition Activity	Anticipated Waste	Available Waste Management Options			Estimated Amount of Waste (tonnes)	Waste Management Decision	Waste Category	Collection at Contractor's Facilities?*	Proposed Carrier, Address and ECA #	Proposed Receiver, Address and ECA #
		Reuse	Recycle	Landfill						
Removal of drywall (painted)	Drywall (painted)			X	20 t	Landfill	Comingle landfill Waste		Carrier B ECA #1234	Receiver B ECA #5678
Removal of Wood / gypsum board (treated)	Wood (painted or treated)			X	30 t	Landfill	Comingle landfill Waste		Carrier C ECA #1234	Receiver C ECA #5678
Removal of electrical equipment and components	Electrical components	X	X	X	Small boxes	Recycle (obsolete equipment, cannot reuse)	Metal recycling	X	N/A	N/A
Removal of flooring	Title, carpet, wood, etc.			X	30 t	Landfill	Comingle landfill Waste		Carrier D ECA #1234	Receiver D ECA #5678
Removal of equipment (as whole)	Metal equipment	X	X	X	X	Return to TTC for reuse	Not applicable		N/A	N/A
Removal of pavement	Asphalt		X	X	50 t	Recycle	Asphalt and concrete comingle recycling		Carrier E ECA #1234	Receiver E ECA #5678
Removal of building structure	Concrete		X	X	100 t	Recycle	Asphalt and concrete comingle recycling		Carrier F ECA #1234	Receiver F ECA #5678
Removal of fibreglass Insulation	Insulation / sweat wrap		X	X	20 t	Landfill (recycling not available in Ontario)	Comingle landfill Waste		Carrier G ECA #1234	Receiver G ECA #5678

\* Contractor confirms compliance with the R.R.O. 1990, Regulation 347, Section 29.1 to 29.5. Field Operations



**Toronto Transit Commission**  
**CONTRACT SH35-8**

**Attachment 01 74 19.03**  
**WASTE TRACKING RECORD**

WASTE TRACKING RECORD (Monthly Detailed Tracking)						
Contract Name:				MM/YY:		
Contract Number:				Contractor:		
Waste Category	Way Bill #	Receiver	Date of Shipment	(A) Amount Reuse (tonnes)	(B) Amount Recycle (tonnes)	(C) Landfill (tonnes)
Total:						
I hereby certify that the information provided is complete and correct, and complies with the requirements of the Contract Documents.						
Signature:				Date:		
Total Waste Reduction % = [(A + B) / (A + B + C)] x 100:						

**Toronto Transit Commission**  
**CONTRACT SH35-8**

**Attachment 01 74 19.03**  
**WASTE TRACKING RECORD**

**WASTE TRACKING SUMMARY**

Contract Name:														
Contract Number:														
Contractor Name:														
Waste Category	Amount Reuse / Recycle	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
Total Reuse/Recycle														
Total Landfill														
% Diversion														

**1 SUBMITTALS**

- 1.1 Provide applicable documentation and information in Operation and Maintenance Manuals in accordance with Section 01 33 00 containing material suitable for TTC's operation and maintenance employees. Cover all Products and systems specified for inclusion in Operation and Maintenance Manuals.
- 1.2 Submit draft of Operation and Maintenance Manuals for TTC's review as per Milestone in Section 01 11 00. Make alterations and additions, as found to be necessary during commissioning and prepare final version of manual from corrected draft.
- 1.3 Submit final version of the Operation and Maintenance Manuals as per Milestone in Section 01 11 00.
- 1.4 Commissioning of system/equipment is not deemed complete until requisite number of copies of final version of manuals is submitted to TTC.
- 1.5 TTC is willing to sign non-disclosure documents, if necessary, in order to obtain appropriate level of detail in manuals.
- 1.6 If standard literature is incorporated into Operation and Maintenance Manuals, delete or suitably note any irrelevant information.
- 1.7 Manuals to have sufficient detail so TTC can totally maintain the Product, equipment or system.

**2 FORMAT**

- 2.1 Organize data in form of an instructional manual
- 2.2 Draft and final version in electronic format in accordance with attached template 01 78 23.01.
- 2.3 **Binders:** Commercial quality, 219 mm x 279 mm (8-1/2" x 11") maximum ring size.
- 2.4 When multiple binders are used, correlate data into related consistent groupings.
- 2.5 **Cover:** Identify each binder with typed or printed title "Operation and Maintenance Manual", list title of Contract, identify subject matter of contents.
- 2.6 **Text:** Manufacturer's printed data on 75 g/m<sup>2</sup> (20 pound) paper.
- 2.7 **Drawings:** Provide drawings with distinct uniform line thickness and legible lettering that will produce clear readable prints and also facilitate microfilming and reduced size reproduction. Provide with reinforced punched binder tab. Bind in with text; fold larger drawings, maximum size 254 mm x 432 mm (11" x 17") to size of text pages.
- 2.8 Arrange content by systems or process flow, under Section numbers and sequence of Table of Contents.
- 2.9 Provide tabbed fly leaf for each separate Product and system, with description of Product and major component parts of equipment.

### 3 CONTENTS

- 3.1 **Table of Contents:** Provide title of Contract, names, addresses, and telephone numbers of consultants and Contractor with name of responsible parties, schedule of Products and systems, indexed to content of volume.
- 3.2 **For each Product or system:** List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts and warranties. Warranty to include the following as a minimum:
  - 3.2.1 Description of warranty coverage.
  - 3.2.2 Date warranty starts.
  - 3.2.3 Date warranty expires.
  - 3.2.4 Contact name, address and phone number. The Contractor shall also be responsible for advising TTC of changes in contact information during the warranty period.
- 3.3 **Product data:** Mark each sheet to clearly identify specific Products and component parts, and data applicable to installation, delete inapplicable information.
- 3.4 **Drawings:** Supplement Product data to illustrate relations of component parts of equipment and systems, as required in the Specifications.
- 3.5 **Text:** As required to supplement Product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's printed instructions and as required in the Specifications.
- 3.6 **Test reports:** For each Product, equipment and system as required by the Specifications.
- 3.7 **Preventive maintenance:** Provide preventive maintenance program for equipment supplied.
- 3.8 Maintenance Equipment Log:
  - 3.8.1 Include electronic data file for equipment installed in the Contract. Information in log includes, but is not limited to:
    - 3.8.1.1 Name of system and/or subsystem.
    - 3.8.1.2 Model or part number.
    - 3.8.1.3 Serial number if provided.
    - 3.8.1.4 List of maintenance tasks to be performed.
    - 3.8.1.5 Scheduled frequency of each task.
    - 3.8.1.6 Indication of who will perform maintenance and their contact information.
    - 3.8.1.7 Location of equipment.
    - 3.8.1.8 Unit value.
    - 3.8.1.9 Purchase date.
    - 3.8.1.10 Warranty expiry date.
    - 3.8.1.11 Manufacturer, name and address.
    - 3.8.1.12 Supplier, name and address if different than above.

- 3.8.1.13 Supplier contact name and telephone number.
- 3.8.1.14 Copies of reviewed Product data and/or Shop Drawings.
- 3.8.1.15 Operation and Maintenance Manual reference/catalogue numbers.
- 3.9 **Commissioning report:** As described in Section 01 91 00.

**END OF SECTION**







# **SH35-8**

## **Sheppard Station Station Manager's Office and Zone Hub**

**[ARCHITECTURAL][MECHANICAL][ELECTRICAL]**

### **OPERATION & MAINTENANCE MANUAL**



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TAB A      TRADE CONTACT INFORMATION

TRADE	CONTACT INFORMATION
<b>Section No.:</b> [## ## ##]	<b>Name:</b> [Name of contact]
<b>Section Name:</b> [Name of section]	<b>Address:</b> [Address of contact]
<b>Subcontractor:</b> [Name of subcontractor]	<b>Tel:</b> [Telephone number]
	<b>Email:</b> [Email address]
<b>Section No.:</b> [## ## ##]	<b>Name:</b> [Name of contact]
<b>Section Name:</b> [Name of section]	<b>Address:</b> [Address of contact]
<b>Subcontractor:</b> [Name of subcontractor]	<b>Tel:</b> [Telephone number]
	<b>Email:</b> [Email address]
<b>Section No.:</b> [## ## ##]	<b>Name:</b> [Name of contact]
<b>Section Name:</b> [Name of section]	<b>Address:</b> [Address of contact]
<b>Subcontractor:</b> [Name of subcontractor]	<b>Tel:</b> [Telephone number]
	<b>Email:</b> [Email address]

**1 GENERAL**

- 1.1 Supply labour, Products, equipment, tools, services and supervision necessary to inspect and maintain all installed equipment, to ensure that equipment is kept in good working order, in accordance with manufacturer's recommendations and good practice.

**2 SUBMITTALS**

- 2.1 Maintenance Plan:
- 2.1.1 Submit Maintenance Plan for TTC's review, in accordance with Section 01 33 00. TTC to provide comments in accordance with Section 01 33 00. "Reviewed" or "Reviewed as Noted" Maintenance Plan to be included in the Operation and Maintenance Manuals.
- 2.1.2 Include list of required maintenance activities for all equipment supplied and installed as part of the Work, in accordance with the Operation and Maintenance Manuals and manufacturer's recommendations. Format of Maintenance Plan to be in accordance with Section 01 78 23 and information to be consistent with that provided in the Maintenance Equipment Log, as defined in Section 01 78 23.

**3 EXECUTION**

- 3.1 Contractor is responsible to maintain equipment as required by manufacturer before completion of Substantial Performance.
- 3.2 At Substantial Performance, provide certification that each piece of equipment was maintained as required by manufacturers, from time of installation to Substantial Performance.
- 3.3 Maintenance:
- 3.3.1 Perform maintenance tasks defined in "Reviewed" Maintenance Plan for all equipment supplied and installed as part of the Work until Contract Completion.
- 3.3.2 Provide all necessary repairs of malfunctions identified during scheduled or emergency inspections, including all labour and replacement parts.
- 3.3.3 Provide parts from same manufacturer as those replaced. Obtain authorization from TTC to replace equipment parts.
- 3.3.4 Any activity requiring system shut-down and access to interiors of electrical panels and equipment to be arranged with TTC.
- 3.3.5 Allow for replacement of lamps and ballasts for standard TTC lighting fixtures, labour and parts, for 5% of total number of lamps and ballasts installed under this Contract.
- 3.3.6 Provide current log of maintenance activities at each piece of equipment using Equipment Record Card. Equipment Record Cards are to be hard cardboard, installed securely either on, adjacent to, or inside equipment. Sample Equipment Record Card included as attachment C.

- 
- 3.3.7 Provide Equipment Maintenance Inspection Report: As per sample attachment A or Contractor's equivalent form, reviewed by TTC. Report to address tasks performed each month and to contain, as minimum, information shown on sample attachment. Provide Equipment Maintenance Inspection Report to TTC no later than the 15th day of each month. In addition to inspected equipment, report to also contain any obvious deficiencies in the following areas (as a minimum):
- 3.3.7.1 Over temperature in equipment areas.
  - 3.3.7.2 Under temperature in equipment areas.
  - 3.3.7.3 Lighting malfunctions/failures.
  - 3.3.7.4 Water leaks.
  - 3.3.7.5 Activated alarms or warnings.
  - 3.3.7.6 Deterioration of finishes.
  - 3.3.7.7 Graffiti and vandalism/breakage.
- 3.3.8 Provide written report to TTC within twenty-four (24) hours for deficiencies in operations found as part of regular inspection and maintenance activities. Report emergency situation to TTC immediately.
- 3.3.9 Equipment Maintenance Database: To be maintained for each piece of equipment in digital format (MS Excel) and made available to TTC upon request. At minimum, Equipment Maintenance Database to contain information shown on sample attachment B.
- 3.3.10 Within two (2) weeks of completion of maintenance period, submit Closeout Maintenance Report.

**END OF SECTION**

# EQUIPMENT MAINTENANCE INSPECTION REPORT

[illegible]





# EQUIPMENT MAINTENANCE DATABASE

Contract Title:			Contract No:			Page: ____ of ____		
ID No.		Description:				Location:		
Manufactured:		Model No:				Serial No:		
Date of Inspection MM/DD/YY	STATUS			Repair Description	Time to Repair	Final Status		Inspector's Name/Signature
	Operating	Idle	Under Service			OK	Under Service	

\*\*\* Update Equipment Data Base after each Scheduled or Emergency Inspection



# EQUIPMENT RECORD CARD

[illegible]

**\*\*\* Submit a copy of this (updated) record card with a completed Inspection Report**



**1 GENERAL**

- 1.1 Prepare, maintain, complete, and submit As-Built Drawings in accordance with the Contract Documents.
- 1.2 Retain on Site one (1) full set of As-Built Drawings.
- 1.3 Update as the Work progresses for weekly review.
- 1.4 Store in Site office in one (1) location, apart from documents used for construction.
- 1.5 File on racks for storage.
- 1.6 Maintain in clean, dry, and legible condition.
- 1.7 Identify each As-Built Drawing with "Contract As-Built Copy" stamp.
- 1.8 Make As-Built Drawings available to TTC at all times for reproduction.
- 1.9 Record accurately all deviations in the Work caused by, but not necessarily limited to, the following:
  - 1.9.1 Site conditions.
  - 1.9.2 Site instructions.
  - 1.9.3 Contract Changes.
  - 1.9.4 Correspondence.
  - 1.9.5 Addenda.
  - 1.9.6 Directions of jurisdictional authorities.
  - 1.9.7 Shop Drawing revisions.
  - 1.9.8 Record locations of subsurface and concealed physical conditions, such as buried utilities and services, structures, mechanical and electrical services, and embedded installations.
- 1.10 Where the Contract Documents allow options, show only option actually used. Delete options not used.
- 1.11 Accurately mark deviations from the Contract on one (1) full size set of Issued for Construction Drawings.
- 1.12 Where the Contract Drawings are not of sufficient size, scale or detail, the Contractor shall furnish its own Shop Drawings for incorporation of details and dimensions. Provide annotations on the As-Built Drawing set referencing applicable Shop Drawings.
- 1.13 Mark prints in red ink or red pencil in neat, legibly printed manner, and date.
- 1.14 Show deviations from the Contract Documents in detail. Identify actual locations to scale.
- 1.15 Mark As-Built Drawings as Deleted or Superseded to reflect their status.
- 1.16 Do not permanently conceal Work until the required As-Built information has been documented by the Contractor.

**2 SUBMISSION**

- 2.1 Duplicate in colour a second set of As-Built Drawings.
- 2.2 Stamp, sign, and date the As-Built Drawings.
- 2.3 Before application for Substantial Performance of the Work, submit As-Built Drawings in accordance with Section 01 33 00.
- 2.4 For Work agreed to be performed subsequent to Substantial Performance of the Work, separate As-Built submission is required.

**END OF SECTION**

**1 GENERAL**

- 1.1 Supply special tools and extra stock materials as specified in this Section.

**2 QUALITY**

**2.1 Special Tools:**

- 2.1.1 Include keys, tools, and special devices and materials required for operation and maintenance.

- 2.1.2 Supply special tools, undamaged, and non-defective.

**2.2 Extra Stock Materials:**

- 2.2.1 Supply extra stock materials, undamaged, non-defective, and of same quality and manufacturer as Products Provided in the Work.

- 2.2.2 Defective extra stock materials will be rejected and replaced at no cost to TTC.

**3 DELIVERY OF SPECIAL TOOLS**

- 3.1 Deliver and hand over special tools prior to commissioning.

- 3.1.1 Identify their associated function and equipment.

- 3.1.2 Use separate submittal form in accordance with Section 01 33 00, identifying the corresponding technical Section.

**4 DELIVERY OF EXTRA STOCK MATERIALS**

- 4.1 Deliver and hand over extra stock materials prior to Substantial Performance.

- 4.1.1 Use separate submittal form in accordance with Section 01 33 00, identifying the corresponding technical Section.

- 4.1.2 Deliver to locations as directed.

- 4.1.3 Store in a manner to prevent damage or deterioration.

- 4.1.4 Store in original and undamaged condition, packaged in original wrapping with manufacturer's seal and labels intact.

- 4.1.5 Store components subject to damage from weather in weatherproof enclosures.

- 4.1.6 Store paints and freezable materials in heated and ventilated room, as directed by TTC.

- 4.1.7 Extra stock materials to be whole pieces, and identified for material and location within the building.

**5 SPECIAL TOOLS AND EXTRA STOCK MATERIALS LIST**

Section and Title		Material and Quantity
08 71 00	Finish Hardware	<ul style="list-style-type: none"> <li>• Cleaning solution for stainless steel doors.</li> <li>• Two sets of wrenches for fire exit hardware.</li> </ul>
09 30 00	Tiling	<ul style="list-style-type: none"> <li>• Materials of 5% of gross area covered.</li> </ul>
09 91 00	Painting	<ul style="list-style-type: none"> <li>• Two draw downs and one 4 L can with complete Product code, formula, location purchased and date used, clearly marked for each paint Product, in each finish and colour of paint, used in the Work, for use in maintenance.</li> </ul>
21 13 00	Wet and Dry Pipe Sprinklers	<ul style="list-style-type: none"> <li>• In accordance with NFPA 13.</li> </ul>
22 42 00	Plumbing Fixtures and Specialties	<ul style="list-style-type: none"> <li>• Keys, tools, and special devices, with applicable location information tags.</li> <li>• Maintenance materials.</li> </ul>
23 33 00	Duct Accessories	<ul style="list-style-type: none"> <li>• Keys, tools, and special devices, with applicable location information tags.</li> <li>• Maintenance materials.</li> </ul>
26 24 16	Panelboard	<ul style="list-style-type: none"> <li>• Keys and tools, with applicable location information tags.</li> </ul>

**END OF SECTION**



**1 GENERAL**

- 1.1 Provide training for TTC personnel in operation and maintenance of Product(s) installed as indicated in the Contract Documents.
- 1.2 Do not conduct training until final Operation and Maintenance Manuals are reviewed and equipment has been completely installed and successfully commissioned.
- 1.3 Provide training topics in accordance with manufacturer's written recommendations.
- 1.4 Provide instructional materials and equipment to conduct training.
- 1.5 TTC reserves the right to use, reproduce and modify instructional materials (for example, manuals, lesson plans, and audio-visual aids) as TTC deems necessary for further instruction of TTC personnel.
- 1.6 Instructors shall be competent in the subject being taught.
- 1.7 For training sessions, persons per sessions to be trained, and number of hours per session refer to Article 7.
- 1.8 Training to be carried out at TTC facilities in Toronto.

**2 TRAINING PLAN**

- 2.1 Description of training process for Product(s) installed as part of this Contract, including:
  - 2.1.1 Description of planned training activities on individual Product basis.
  - 2.1.2 Description of training sessions.
  - 2.1.3 Training course material delivery schedule.
  - 2.1.4 Demonstration of on-the-job competence in type of Product being trained on.

**3 TRAINING COURSE MATERIAL**

- 3.1 Provide individual and written training course material for required Products in accordance with the Contract Documents.
- 3.2 Provide separation of curriculum as deemed necessary to facilitate detail of information, class size, and number of persons per group.
- 3.3 Provide each participant enrolled in training class with one (1) copy of the student manual.
- 3.4 Training course material to include:
  - 3.4.1 Overview of course material and content.
  - 3.4.2 List of prerequisites.
  - 3.4.3 Instructional techniques (lecture versus hands-on) and aids to be used.
  - 3.4.4 Facilities and equipment requirements for training.

3.4.5 **Student manual:**

- 3.4.5.1 Format of manuals shall be in accordance with Section 01 78 23 requirements.
- 3.4.5.2 Includes materials for student to interact in learning situation and consists of the following:
  - 3.4.5.2.1 Program overview and introduction.
  - 3.4.5.2.2 Statement of overall program goals.
  - 3.4.5.2.3 Learning objectives, stated in measurable terms specifically describing desired behaviours or knowledge gained.
  - 3.4.5.2.4 Fully developed prose treatment (not outline format) of content presentation.
  - 3.4.5.2.5 Illustrations, charts or graphics, as needed to enhance content presentation.
  - 3.4.5.2.6 Problems and questions related to lesson content, as appropriate.

3.4.6 **Audio-visual aids:**

- 3.4.6.1 Include audio-visual equipment, handouts, transparencies, slides, videos, simulators, and mock-ups.

3.4.7 **Supplemental materials:**

- 3.4.7.1 Include functional mock-up and representation for equipment requiring theoretical discussion. This may be in the form of animated schematic, model of equipment, actual device or interactive video training device. Mock-ups become the property of TTC.

3.4.8 **Instructor's qualifications:**

- 3.4.8.1 Include the following information:
  - 3.4.8.1.1 Position in organization.
  - 3.4.8.1.2 Length of time employed in organization.
  - 3.4.8.1.3 Relevant training experience.
  - 3.4.8.1.4 Education and reasons for selection of instructor.
  - 3.4.8.1.5 Demonstrated knowledge of the equipment being taught.

**4 TRAINING SCHEDULE**

- 4.1 Training schedule for Product(s) in accordance with the Contract Documents, including:
  - 4.1.1 Description of Product including Section reference.
  - 4.1.2 Type of training and description of personnel to be trained.
  - 4.1.3 Proposed date and time, course duration, and number of persons to be trained for each training session.
  - 4.1.4 Training location.
- 4.2 Course schedules and training sessions to take into consideration limited availability of TTC personnel due to their on-going operations and maintenance responsibilities.
- 4.3 To enable TTC personnel working on shifts to participate in courses, training shall take place at any time, including evenings and weekends. Time of each session to be at TTC's discretion.

- 4.4 Allow for minimum on-site or in-class training hours in accordance with Article 7.
- 4.5 Schedule separate training sessions on separate days.
- 4.6 It is unlikely that training sessions can be scheduled on consecutive days and may, in some cases, have to be scheduled weekly to account for the constrained availability of TTC personnel.

## **5 SUBMITTALS**

- 5.1 Submit for each Section in accordance with Section 01 33 00.
- 5.2 **Training Plan:**
  - 5.2.1 Submit training plan.
  - 5.2.2 Training plan must be submitted by Milestone date in Section 01 11 00.
- 5.3 **Training Course Material:**
  - 5.3.1 Submit draft training course material.
    - 5.3.1.1 Training course material must be submitted by Milestone date in Section 01 11 00 and available prior to commissioning of Products for which training is required, and prior to scheduling training.
    - 5.3.1.2 Contractor to make alterations and additions to training course material deemed necessary by TTC during commissioning.
  - 5.3.2 Submit final training course material, including TTC review comments and changes occurring during commissioning, seven (7) Days prior to first training session.
  - 5.3.3 Submit one (1) complete set of reviewed training course materials, typewritten or type-set originals or high quality copies so further copies can be made with no noticeable decrease in copy quality.
- 5.4 **Training Schedule:**
  - 5.4.1 Submit training schedule.
  - 5.4.2 Reviewed or Reviewed as Noted training schedule must be available twenty one (21) Days prior to first training session.
- 5.5 **Training Closeout Report:**
  - 5.5.1 Provide detailed listing of all completed training sessions, including date, start and end time, location, and a signed list of attendees for each session.

## **6 TRAINING**

- 6.1 Provide separate courses for operations training and maintenance training.
- 6.2 Utilize instructors from original equipment manufacturers where available.
- 6.3 For training specific requirements refer to Article 7.
- 6.4 **Operations Training Course:**
  - 6.4.1 Incorporate detailed review of Product operating manuals including, but not limited to:
    - 6.4.1.1 Product operating demonstrations.
    - 6.4.1.2 Troubleshooting procedures.

- 6.4.1.3 Start-up and set-up procedures.
- 6.4.1.4 Stage operating procedures and practices as they relate to specific equipment.
- 6.5 **Maintenance Training Course:**
  - 6.5.1 Incorporate detailed review of all aspects of equipment maintenance including, but not limited to:
    - 6.5.1.1 Detailed review of Product maintenance manuals.
    - 6.5.1.2 Documentation.
    - 6.5.1.3 Material descriptions.
  - 6.5.2 Include full understanding of the function and operation of components, and the following as applicable to equipment:
    - 6.5.2.1 Review of Drawings.
    - 6.5.2.2 Electrical schematics.
    - 6.5.2.3 Scheduled inspection and lubrication requirements.
    - 6.5.2.4 Adjustments and calibrations, and detailed troubleshooting.
    - 6.5.2.5 Component removal and installation.
  - 6.5.3 Include equipment operating instructions and demonstrations of the following three (3) levels of maintenance:
    - 6.5.3.1 Level 1: Repair defective components where appropriate.
    - 6.5.3.2 Level 2: Remove and replace defective components within units where appropriate.
    - 6.5.3.3 Level 3: Remove and replace units where appropriate.
  - 6.5.4 Maintenance training course to include operations training.
  - 6.5.5 Provide classroom and hands-on instruction.

## 7 TRAINING SESSIONS AND SPECIFIC REQUIREMENTS

### 7.1 Section 22 42 00 - Plumbing Fixtures and Specialties:

	TTC
No. of sessions	3
No. of persons per session	8
No. of hours per session (maximum)	7

### 7.2 Section 23 23 00 - Refrigerant Piping:

	TTC
No. of sessions	3
No. of persons per session	10
No. of hours per session (maximum)	7

7.3 **Section 27 51 23 - Passenger Assistant Intercom (PAI) System:**

	TTC
No. of sessions	6
No. of persons per session	10
No. of hours per session (maximum)	7

7.4 **Section 28 23 23 - Closed Circuit Television System (CCTV):**

	TTC
No. of sessions	5
No. of persons per session	10
No. of hours per session (maximum)	7
Specific requirements: 1. Use the reviewed Shop Drawings to indicate the Site specific placement and integration details.	

7.5 **Section 28 31 00 - Fire Alarm Systems:**

	TTC
No. of sessions	2
No. of persons per session	5
No. of hours per session (maximum)	7

**END OF SECTION**



**1 DEFINITIONS**

- 1.1 System: Group of interacting equipment or Subsystems forming a System.
- 1.2 Subsystem: Fabricated components, equipment, or smaller Systems forming part of a larger System.
- 1.3 Commissioning: A comprehensive and systematic process for verifying and documenting that the entire facility with its Systems, Subsystems, and equipment are installed, operational, and maintainable in accordance with Contract Documents.
- 1.4 The Commissioning process includes, but is not limited to, the following:
  - 1.4.1 Field Installation Verification (FIV): Process to verify and document that equipment and System installation is complete and in accordance with design intent, technical and maintenance requirements, applicable industry standards, and Contract Documents.
    - 1.4.1.1 FIV is conducted by the Contractor, with support of the Subcontractor and the associated factory authorized and trained personnel, and is a prerequisite to OPT.
    - 1.4.1.2 Testing, Adjusting, and Balancing (TAB) shall be coordinated with FIV.
    - 1.4.1.3 Verification of completeness of Operation and Maintenance (O&M) Manuals in accordance with Section 01 78 23 shall be coordinated with FIV.
    - 1.4.1.4 Upon successful completion of FIV of each System and Subsystem, Contractor shall submit copies of report with the Certificate of Readiness.
  - 1.4.2 Operational Performance Testing (OPT): Process to verify and document proper start-up and testing of components, equipment, Systems and Subsystems in accordance with Contract Documents, manufacturer's written instructions, and in compliance with applicable codes and standards.
    - 1.4.2.1 OPT is conducted by the Contractor, with support of the Subcontractor and the associated factory authorized and trained personnel, and is a prerequisite to FPT.
    - 1.4.2.2 TTC may elect to witness the OPT.
    - 1.4.2.3 Upon successful completion of OPT of each System and Subsystem, Contractor shall submit copies of report with the Certificate of Readiness.
  - 1.4.3 Functional Performance Testing (FPT): Process to verify and document that Systems and Subsystems are fully functional and properly integrated and interacting with other Systems and Subsystems in accordance with Contract Documents and reviewed Shop Drawings.
    - 1.4.3.1 FPT is conducted by the Contractor, with support of the Subcontractor and the associated factory authorized and trained personnel.
    - 1.4.3.2 TTC shall witness the FPT for final acceptance.
    - 1.4.3.3 Upon successful completion of FPT, the facility may be considered for occupancy and operation.
  - 1.4.4 Certificate of Readiness: TTC Standard Document attached at the end of this Section as the prerequisite for FPT. To be completed by the Contractor and submitted to TTC, with listed attachments, after:
    - 1.4.4.1 Successful FIV and OPT are completed.
    - 1.4.4.2 TAB reports are Reviewed or Reviewed as Noted.

1.4.4.3 Draft O&M Manuals are Reviewed or Reviewed as Noted.

## **2 SCOPE**

2.1 Commissioning of Systems and Subsystems in accordance with the requirements outlined in Contract Documents.

## **3 SUBMISSION ITEMS**

3.1 Commissioning Plan:

3.1.1 In accordance with this Section, submit description of overall Commissioning process of each System and/or Subsystem in accordance with Contract Documents and reviewed Shop Drawings, complete with the following documents:

3.1.1.1 Name of System/Subsystem.

3.1.1.2 List/Table/Chart/Schedule/Resource Allocation of Commissioning team members and their responsibilities.

3.1.1.3 Description of recommended testing and/or verification method, activities for FIV, OPT, and FPT.

3.1.1.4 Schedule, including test procedures submittals and proposed durations of planned activities for Pre-shipment or Factory Acceptance Inspection and Testing, FIV, OPT, and FPT.

3.2 Test Procedures - FIV, OPT, and FPT:

3.2.1 In accordance with each technical Section, provide detailed written test procedures required to perform FIV, OPT, and FPT through the use of simulated normal, alarm, and emergency conditions, as required, in order to confirm that each System and Subsystem, and interfaces between Systems, operate in accordance with Contract Documents.

3.2.2 Test procedure to describe individual test and steps comprising each test, particularly methods and processes to follow, and include the following items:

3.2.2.1 Setup and conditions for each test including descriptions of test equipment.

3.2.2.2 Step-by-step descriptions of each test including, but not limited to, inputs and user actions for each step, detailed review of control sequence, and set points.

3.2.2.3 Expected results for each test including pass/fail criteria. Provide detailed checklists with space for check-off fields.

3.2.2.4 Line for Contractor's signature and date to witness test successfully completed.

3.2.2.5 Estimated duration of each test.

3.2.2.6 List of proposed Contractor's and manufacturer's attendees and the responsibility of each party.



- 3.3 Certificate of Readiness:
  - 3.3.1 In accordance with each technical Section, provide the Certificate of Readiness form (01 91 00.01 attached) for each System and/or Subsystem including, but not limited to, the following information:
    - 3.3.1.1 Attach to each Certificate of Readiness form, relevant documentation for System and/or Subsystem scheduled to be tested including, but not limited to, the following:
      - 3.3.1.1.1 List of proposed attendees: List of Contractor's Commissioning team members, including Subcontractors and manufacturers associated with the Work being commissioned. Include the following information for each individual:
        - 3.3.1.1.1.1 Company name.
        - 3.3.1.1.1.2 Representative name.
        - 3.3.1.1.1.3 Phone number.
        - 3.3.1.1.1.4 Responsibilities.
      - 3.3.1.1.2 Pre-shipment or Factory Acceptance Testing documentation, where applicable.
      - 3.3.1.1.3 Field Quality Control Reports, where applicable.
      - 3.3.1.1.4 Copies of FIV and OPT reports.
      - 3.3.1.1.5 TAB reports, where applicable.
      - 3.3.1.1.6 FIV, OPT, and FPT procedures, as reviewed by TTC, where applicable.
      - 3.3.1.1.7 Inspection reports and certificates of authorities having jurisdiction, where applicable.
      - 3.3.1.1.8 Pre-start health and safety reports, where applicable.
      - 3.3.1.1.9 Confirmation that Reviewed as Noted Draft O&M Manuals are available on Site.
      - 3.3.1.1.10 List of deferred FPT, for testing requiring off-season conditions.
      - 3.3.1.1.11 Proof of test equipment calibration, where applicable.
    - 3.3.1.2 Sign and date the Certificate of Readiness form, confirming that by submitting the form and attachments, the Contractor certifies that equipment, Systems and Subsystems tested for FIV and OPT meet governing regulatory codes and standards, manufacturers' and Contract Document requirements, and are ready for FPT.
    - 3.3.1.3 Where Certificate of Readiness form is submitted for partially completed Systems and Subsystems, also attach the following information:
      - 3.3.1.3.1 Complete list of incomplete Work and associated deficiencies.
      - 3.3.1.3.2 Indicate uncompleted portion(s) of the Work and how they will be simulated so that OPT and FPT can be performed.
      - 3.3.1.3.3 Detailed description of each portion(s) of System and/or Subsystem proposed to be commissioned.
- 3.4 Test Reports - FIV, OPT, and FPT:
  - 3.4.1 In accordance with each technical Section, provide detailed reports within two (2) Business Days after completing testing for each System and/or Subsystem, where applicable, including, but not limited to, the following information:
    - 3.4.1.1 Contract name and number.
    - 3.4.1.2 Section name(s) and number(s).

- 3.4.1.3 Equipment/System description: Indicate related Systems and/or Subsystems proposed to be tested.
- 3.4.1.4 Location where the testing was performed.
- 3.4.1.5 Date when the testing was performed.
- 3.4.1.6 Weather conditions and average temperature when testing was performed.
- 3.4.1.7 Start and end times of testing.
- 3.4.1.8 Detailed listing of deficiencies identified during testing and corrective actions to be taken. Contractor to note if any deficiencies are disputed.
- 3.4.1.9 Attach signed attendee list.
- 3.4.1.10 Attach signed and completed test sheets.
- 3.5 Closeout Reports:
- 3.5.1 In accordance with each technical Section, provide detailed listing of deficiencies identified during testing and corrective actions completed.

## **4 PROCESS**

### **4.1 Commissioning Plan:**

- 4.1.1 Submit an overall proposed Commissioning plan to TTC for review in accordance with requirements listed in this Section and Section 01 33 00.
- 4.1.2 Reviewed or Reviewed as Noted Commissioning plan must be available by Milestone date in Section 01 11 00.

### **4.2 Test Procedures - FIV, OPT, and FPT:**

- 4.2.1 Submit FIV, OPT and FPT test procedures to TTC for review in accordance with this Section and Section 01 33 00.

### **4.3 Pre-Shipment or Factory Acceptance Inspection and Testing:**

- 4.3.1 Coordinate and schedule pre-shipment or factory acceptance inspection and testing for equipment, and each System and Subsystem as applicable, in accordance with technical Sections.
- 4.3.2 TTC may request third party to witness pre-shipment or factory acceptance inspection and testing. Unless otherwise accepted by TTC, schedule factory inspection and testing minimum sixty (60) Days in advance.
- 4.3.3 Coordinate schedule for completion of FIV, OPT, and FPT.
- 4.3.4 Obtain letters or test certificates from the System manufacturers, indicating that their technical representatives have inspected and tested respective Systems and/or Subsystems, and approved methods of installation and operation. Include completed test sheets provided in technical Sections, where applicable.

### **4.4 FIV:**

- 4.4.1 Coordinate completion of FIV inspections and submit to TTC for review in accordance with this Section and Section 01 33 00.
- 4.4.2 Include copies of Reviewed or Reviewed as Noted FIV reports with Certificate of Readiness.

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- 4.5 Include copies of inspection reports by authorities having jurisdiction with Certificate of Readiness.
- 4.6 Coordinate completion of inspections by authorities having jurisdiction and submit to TTC for review in accordance with this Section and Section 01 33 00.
- 4.7 **TAB:**
- 4.7.1 Coordinate completion of TAB and submit a TAB report to TTC for review in accordance with technical Sections and Section 01 33 00.
- 4.7.1.1 Make available copies of Reviewed or Reviewed as Noted TAB reports prior to submittal of the Certificate of Readiness.
- 4.8 **O&M Manuals:**
- 4.8.1 Coordinate preparation of O&M Manuals and submit to TTC for review in accordance with technical Sections and Sections 01 33 00 and 01 78 23.
- 4.8.2 Copies of Reviewed or Reviewed as Noted Draft O&M Manuals must be available prior to submittal of Certificate of Readiness.
- 4.9 **OPT and FPT:**
- 4.9.1 Unless otherwise accepted by TTC, schedule testing so no more than one (1) System is commissioned at a time.
- 4.9.2 Proposed schedule of OPT and FPT to be minimum fourteen (14) Days after notice is provided to TTC.
- 4.9.3 Schedule FPT minimum seven (7) Days after Certificate of Readiness has been returned Reviewed or Reviewed as Noted.
- 4.9.4 Make available equipment manufacturer's trained and certified representatives familiar with Systems being tested to demonstrate operation in its entirety, including control sequences. TTC reserves the right to request additional representation, at no cost to TTC. TTC reserves the right to request adhoc testing beyond the testing procedures, the need for which may become evident during testing.
- 4.9.5 Provide necessary tools and equipment to perform tests as required. Test equipment configured and calibrated to manufacturer's instruction and latest edition of applicable codes and standards.
- 4.9.6 Where more than one (1) discipline is responsible for Work regarding System being tested, Contractor's representatives from each discipline to be present. TTC reserves the right to request additional representation at no cost to TTC.
- 4.9.7 When TTC personnel arrive at Site and scheduled testing or re-testing cannot be performed as a result of deficiencies, Systems incomplete, unsuccessful test results or the Contractor's representatives not present or not familiar with operation or control sequences for purposes of the demonstration, testing will be cancelled at the discretion of TTC. Under such circumstances, the Contractor is to pay all costs incurred by TTC due to cancellation.
- 4.9.8 Resubmit Certificate of Readiness and re-schedule cancelled testing or re-testing at date acceptable to TTC.
- 4.9.9 The Contractor or TTC may cancel FIV, OPT, and FPT without penalty, provided a minimum of two (2) Business Day notice is given. Reschedule testing at a date acceptable to TTC.

- 4.9.10 After completion of FIV, OPT, and FPT of each System and Subsystem, submit testing report within two (2) Days, where applicable, in accordance with Section 01 33 00.
  - 4.9.11 Contractor to proceed immediately to correct deficiencies in the Work, which become evident during FIV, OPT, and FPT to the satisfaction of TTC, and update schedule in accordance with Section 01 32 16
  - 4.9.12 Resubmit Certificate of Readiness, reschedule and repeat FPT, as required by TTC, and at a date acceptable to TTC, at no additional cost to TTC.
  - 4.9.13 To ensure subsequent Work has not impacted previously successful testing, repeat of FPT may be required at discretion of TTC and shall be supported by the original equipment manufacturer's trained and certified representatives, as deemed necessary by TTC.
  - 4.9.14 Make adjustments and corrections to O&M Manuals, in accordance with Contract Documents as necessary during FPT, and submit final version in accordance with Section 01 78 23.
  - 4.10 **Deferred FPT:**
  - 4.10.1 If necessary, schedule and perform FPT requiring off-season conditions immediately when suitable weather conditions permit.
  - 4.10.2 Generally, the only Work that should be scheduled for deferred FPT are Systems and/or Subsystems that are temperature related such as HVAC Systems and Building Automation and Control Systems that cannot be properly tested for functional performance until TTC connections to remote locations are complete and all interfaced Systems and/or Subsystems have been successfully tested for functional performance.
- 5 SUCCESSFUL COMMISSIONING**
- 5.1 Successful completion of Commissioning is a prerequisite to the Work being declared ready for its intended purpose as defined in the Construction Act and the Certificate of Substantial Performance.
  - 5.2 Commissioning for each System and/or Subsystem considered successfully completed only after:
    - 5.2.1 FPT completed and FTP reports submitted to TTC.
    - 5.2.2 Deficiencies noted during FPT are corrected and final acceptance by TTC obtained.
    - 5.2.3 Final O&M Manuals are submitted in accordance with Section 01 78 23.
    - 5.2.4 Operational training is completed in accordance with Section 01 79 00.
    - 5.2.5 Maintenance training plans and manuals have been submitted and returned Reviewed or Reviewed as Noted in accordance with Sections 01 33 00, 01 78 25 and 01 79 00.

**END OF SECTION**

**CERTIFICATE OF READINESS****(For Functional Performance Testing)**

Contract Name:

Contract Number:

Equipment / System Description:

Equipment / System Readiness

☐ Fully Completed ☐ Partially Completed

Repeat of Unsuccessful Functional Performance Testing

☐ Yes ☐ No

Completion of Previously Partial Functional Performance Testing

☐ Yes ☐ No

Submittal Date of Submission to TTC:

Proposed Functional Performance Testing Date:

(Minimum 14 Days after C of R is submitted)

**PREREQUISITE DOCUMENTS:****ATTACHED**

1.	List of Proposed Attendees (Company name, phone number, and responsibilities for GC, Subcontractor, Manufacturers, etc.)	<input type="checkbox"/> Yes
2.	Pre-Shipment or Factory Acceptance Test Reports	<input type="checkbox"/> Yes <input type="checkbox"/> Not Applicable
3.	Field Quality Control Reports (Reviewed as Noted)	<input type="checkbox"/> Yes <input type="checkbox"/> Not Applicable
4.	Field Installation Verification Reports	<input type="checkbox"/> Yes
5.	Operational Performance Testing (Start-up and Testing) Reports	<input type="checkbox"/> Yes
6.	Testing and Balancing Reports	<input type="checkbox"/> Yes <input type="checkbox"/> Not Applicable
7.	Functional Performance Testing Procedures (Reviewed as Noted)	<input type="checkbox"/> Yes
8.	Jurisdictional Authority Inspection Reports	<input type="checkbox"/> Yes <input type="checkbox"/> Not Applicable
9.	Pre-Start Health and Safety Review Reports	<input type="checkbox"/> Yes <input type="checkbox"/> Not Applicable
10.	Draft Operational & Maintenance Manuals (Reviewed as Noted)	<input type="checkbox"/> Available <input type="checkbox"/> Not Applicable
11.	List of Deferred Functional Performance Tests	<input type="checkbox"/> Yes <input type="checkbox"/> Not Applicable

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CERTIFICATE OF READINESS	
(For Functional Performance Testing)	
12.	Test Equipment Calibration Information <input type="checkbox"/> Yes <input type="checkbox"/> Not Applicable
By submitting this requisition form and attachments, the Contractor certifies that equipment, Systems and Subsystems scheduled for Commissioning meet governing regulatory codes and standards, manufacturers' and Contract Documents requirements, and that Start-up and Testing has been performed successfully.	
Signed by:	
Signature:	
Date:	

1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment, and services necessary for Demolition and removals Work in accordance with the Contract Documents.

**1.2 REFERENCES**

1.2.1 CEAA, Canadian Environmental Assessment Act.

1.2.2 CEPA, Canadian Environmental Protection Act.

1.2.3 Chapter 591, Noise, City of Toronto Municipal Code.

1.2.4 Chapter 681, Sewers By-Law, City of Toronto Municipal Code.

1.2.5 CSA S350-M, Code of Practice for Safety in Demolition of Structures.

1.2.6 NFPA 241, Standard for Safeguarding Construction, Alteration, and Demolition Operations.

1.2.7 OBC, Ontario's 2012 Building Code Compendium.

1.2.8 OHSA & Ont. Reg, 213/91, Ontario Health and Safety Act.

1.2.9 OPSS.MUNI 928, Construction Specification for Structural Rehabilitation – Concrete Removal.

1.2.10 SOR/2005-32, CEPA, Off-Road Compression-Ignition Engine Emission Regulations.

1.2.11 SOR/2003-355, CEPA, Off-Road Small Spark-Ignition Engine Emission Regulations.

1.2.12 TDGA, Transportation of Dangerous Goods Act.

**1.3 DEFINITIONS**

1.3.1 Contaminated Materials: Refer to Section 01 57 19.

1.3.2 Demolition: Refer to Section 01 74 19.

1.3.3 Dispose: Refer to Section 01 74 19.

1.3.4 Hazardous Material: Refer to Section 01 57 19.

1.3.5 Recycling: Refer to Section 01 74 19.

1.3.6 Reuse: Refer to Section 01 74 19.

**1.4 SUBMITTALS**

1.4.1 Shop Drawings:

1.4.1.1 Submit indicating the following:

1.4.1.1.1 Drawings, diagrams, or details indicating stages of Demolition Work.

1.4.1.2 Have submissions signed and sealed by a Professional Engineer, licensed in the Province of Ontario.

1.4.2 Work Plan:

1.4.2.1 Plan to show equipment and methodology of Demolition to be used. Coordinate with Contract Baseline Schedule.

- 1.4.3 Contract Baseline Schedule:
  - 1.4.3.1 Plan indicating impact to Contract Baseline Schedule. Interruptions and delays to operations of subway and other TTC revenue operations are not permitted.
- 1.4.4 Reports:
  - 1.4.4.1 Waste Management Reports in accordance with Section 01 74 19.
  - 1.4.4.2 Condition Survey in accordance with Section 01 71 00.
  - 1.4.4.3 Inspection Reports.
  - 1.4.4.4 Closeout Reports.
  - 1.4.4.5 Environmental Controls and Method Plan in accordance with Section 01 57 19.
- 1.4.5 Safety and Fire Safety Procedures:
  - 1.4.5.1 Procedures before, during, and after Demolition Work used for protection of the public, TTC passengers, and property to be in accordance with CSA S350-M and Sections 01 50 00 and 01 57 19. In event of conflict, use the most stringent.
- 1.5 QUALITY ASSURANCE**
  - 1.5.1 Regulatory Requirements:**
    - 1.5.1.1 Ensure Demolition Work is performed in accordance with CEPA, CEAA, TDGA, and applicable Provincial and Municipal regulations.
  - 1.5.2 Professional Engineer:**
    - 1.5.2.1 Prepare Shop Drawings that include Demolition coordination procedures.
    - 1.5.2.2 Determine Demolition methods and phasing as necessary to meet the requirements of the Contract.
    - 1.5.2.3 Ensure removal of items do not impact on items to remain in a manner that causes damage or causes them to become unsafe.
    - 1.5.2.4 Prepare and submit a report to authorities having jurisdiction at completion of Demolition part of the Work.
  - 1.5.3 Demolition Contractor:**
    - 1.5.3.1 Demonstrate minimum 5 years of satisfactory experience in the demolition of entire buildings, parts of buildings, or in selective interior Demolition, similar to the type of Demolition Work required by this Contract.
  - 1.5.4 Start-Up Meeting:**
    - 1.5.4.1 Prior to commencement of the Demolition Work, hold start-up meeting at Site.
    - 1.5.4.2 Examine Site for locations where the Work of this Section will occur in order to determine conditions and extent of Work required, and any additional investigations needed prior to commencement of Demolition work.
    - 1.5.4.3 Verify items to be retained by TTC, and items to be removed.
    - 1.5.4.4 Determine means of access and egress together with nature and quantity of Demolition required.
  - 1.5.5 Meetings:**
    - 1.5.5.1 In accordance with Section 01 31 19.



## **1.6 PERMITS AND REGULATIONS**

- 1.6.1 Contractor will obtain a Permit for the Demolition parts of the Work in accordance with Section 01 11 00 and submit plans as required by OBC and authorities having jurisdiction.
- 1.6.2 Do not commence Demolition parts of the Work until Permit is received and posted.

## **1.7 CONDITION SURVEY**

- 1.7.1 Identify, record, and catalogue existing condition of the Site which may be affected by Demolition Work. Comply with requirements of Section 01 71 00. Perform additional Site investigation as may be required for the safety of performance of the Work.

## **1.8 ENVIRONMENTAL REQUIREMENTS**

- 1.8.1 Carry out Work in accordance with Section 01 57 19.
- 1.8.2 Ensure vibration and noise level generation during construction in accordance with City of Toronto By-Laws and Chapter 591 of the Municipal Code.
- 1.8.3 Fires and burning of waste or materials is not permitted on Site.
- 1.8.4 Do not bury waste materials.
- 1.8.5 Do not Dispose of waste or volatile materials including, but not limited to, mineral spirits, oil, petroleum based lubricants or toxic cleaning solutions into watercourses, storm or sanitary sewers.
- 1.8.6 Ensure proper disposal procedures are maintained throughout Contract.
- 1.8.7 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers, or onto adjacent properties.
- 1.8.8 Control disposal or runoff of water containing suspended materials or other harmful substances as directed by TTC.
- 1.8.9 Prevent extraneous materials from contaminating air beyond Work area by providing temporary enclosures during Demolition Work.

## **1.9 SITE CONDITIONS**

- 1.9.1 Carry out Work in accordance with requirements of Section 01 14 00.
- 1.9.2 Perform operations, machine and equipment movements, deliveries and removals at time(s) that will permit uninterrupted TTC operations in and around structures including parking, deliveries, and Site access and egress.
- 1.9.3 Hazardous Materials:
  - 1.9.3.1 If unexpected possible Hazardous or Contaminated Materials are encountered during Demolition, follow procedures stated in Section 01 57 19.

## **1.10 SAFETY**

- 1.10.1 Comply with requirements of CSA S350-M and Section 01 59 00.

## **1.11 SCHEDULING**

- 1.11.1 Meet the Contract Baseline Schedule without compromising specified mandatory minimum rates of waste diversion in accordance with Section 01 74 19.

2 Products

**2.1 MATERIALS AND EQUIPMENT**

2.1.1 Provide materials and equipment as required to perform the Work of this Section.

**2.2 TEMPORARY EQUIPMENT**

2.2.1 Leave equipment and machinery running only while in use, except where extreme temperatures prohibit shutting down.

2.2.2 Use water-efficient wetting equipment, trucks, and attachments for minimizing dust.

2.2.3 Use tools in manner allowing for salvage of materials in best condition possible.

2.2.4 Temporary equipment and machinery:

2.2.4.1 In accordance with SOR/2005-32.

2.2.4.2 In accordance with SOR/2003-355.

3 Execution

**3.1 PRODUCT REMOVAL AND REUSE**

3.1.1 Products requiring Demolition become Contractor's property. Remove Products from Site daily, unless such Products are otherwise specified or indicated on Contract Drawings to be Reused or handed over to TTC.

3.1.2 Stockpiling of rubble, debris, and surplus Products on Site is not permitted. Perform additional Site investigation as may be required for the safety of performance of the Work.

3.1.3 Items to be removed and stored for Reuse:

3.1.3.1 As indicated on Drawings.

3.1.4 Remove, handle, and transport Products indicated to be removed and stored for future use. Transport Products to storage area(s) designated by TTC. Perform Work to prevent damage to Products during removal and while in storage. Products damaged during removal will be inspected by TTC. TTC will determine extent of damage and accept or refuse Products.

3.1.5 Clean up rubble and debris resulting from Work promptly and Dispose at end of Day or place in waste disposal bins. Empty bins on a regular basis.

**3.2 EXAMINATION**

3.2.1 Identify, record, and catalogue existing conditions prior to starting Site Demolition Work.

**3.3 UNEXPECTED CONDITIONS**

3.3.1 If existing active services are unexpectedly encountered, are not indicated on Drawings, or otherwise made known and interfere with permanent facilities under construction, notify TTC in writing, requesting instructions on their disposition. Take immediate steps to ensure that services provided are not interrupted, and do not proceed with the Work until written instructions are received from TTC.

### **3.4 PROTECTION**

- 3.4.1 Provide hoarding in accordance with the requirements of Section 01 50 00, CSA S350-M and the authorities having jurisdiction.
- 3.4.2 Prevent movement of or damage to adjacent parts of existing structure to remain. Provide bracing and shoring as indicated on reviewed Shop Drawings.
- 3.4.3 Perform Demolition Work in sequence indicated on the reviewed Shop Drawings. Do not begin the Work of subsequent stage without completing the Work related to previous stage.
- 3.4.4 Accept full responsibility for damage or injury resulting from structural instabilities. Repair damage caused by Demolition to sound condition.
- 3.4.5 Support affected structures. If safety of structure is being demolished, adjacent structures or services appear endangered, take necessary action to support endangered item(s), then cease further operations and immediately notify TTC. Do not resume Demolition until reasons for safety concerns have been determined, corrected, and action taken to prevent further endangering.
- 3.4.6 If movement or settlement occurs, install additional bracing and shoring as necessary and make good any damage to acceptance of TTC.
- 3.4.7 Hang tarpaulins where debris and other materials are lowered. Build-in around openings with wood and plywood at locations used for removal of debris and materials.
- 3.4.8 Prevent debris from blocking surface drainage system, elevators, mechanical and electrical systems required to remain in operation.
- 3.4.9 Pay particular attention to prevention of fire and elimination of fire hazards which would endanger Work or adjacent structures and premises.
- 3.4.10 Dust and weather protection: Refer to Section 01 50 00.
- 3.4.10.1 Prior to Demolition Work in existing structures, temporarily enclose Work areas and access, by providing dustproof partitions in accordance with reviewed Shop Drawings.
- 3.4.10.2 Design partitions to prevent dust and dirt infiltration into adjoining areas, preventing ingress of water, and to resist loads due to wind or train pulses.
- 3.4.10.3 Adjust and relocate partitions as required for various operations of Work.
- 3.4.10.4 Upon completion of Work, remove and Dispose of partitions from Site.
- 3.4.11 Blasting is not permitted.

### **3.5 PREPARATION**

- 3.5.1 Give notice to Utility Authorities controlling services and appurtenances which will be affected by Demolition Work, and obtain approvals in writing prior to proceeding.
- 3.5.2 Disconnect and reroute electrical data, communication, and telephone service lines entering structures to be demolished. Remove abandoned lines as indicated on the Contract Drawings. Comply with requirements of Section 01 11 00.
- 3.5.3 Post warning signs on electrical lines and equipment required to remain energized.
- 3.5.4 Disassemble and remove mechanical equipment, ductwork and piping complete with supports and associated components.
- 3.5.5 Do not disrupt active or energized utilities designated to remain undisturbed.
- 3.5.6 Perform rodent and vermin control to comply with health regulations.

### 3.6 GENERAL

- 3.6.1 Perform Demolition with extreme care. Confine effects of Demolition to those parts of the Work which are to be removed.
- 3.6.2 Prevent inconvenience to persons outside the area.
- 3.6.3 Carry out Work in accordance to OHSA & Ont. Reg, 213/91.
- 3.6.4 Follow fire safety measures during Demolition in accordance with the requirements of NFPA 241.
- 3.6.5 Selectively demolish structure as indicated. Follow waste diversion requirements specified in Section 01 74 19.
- 3.6.6 Do not overload floor or wall with accumulations of material or debris or other loads.
- 3.6.7 Perform Work to minimize dust. Keep Work area wetted down with fog sprays to prevent dust and dirt from rising. Provide temporary water lines and connections that may be required. Upon completion, remove installed temporary water lines. Use covered chutes and water down.
- 3.6.8 Do not sell materials on Site.
- 3.6.9 Remove existing equipment, services, and obstacles where required for refinishing or make good existing surfaces, and replace as Work progresses.
- 3.6.10 At end of Day, leave Work area in safe condition with no part in danger of toppling or falling.
- 3.6.11 Drainage and sewer system protection:
  - 3.6.11.1 Ensure no dust, debris or slurry enters drainage and sewer system on Site.
  - 3.6.11.2 Remove and Dispose of debris and slurry promptly from Site.
  - 3.6.11.3 In accordance with Chapter 681, Sewers By-Law.

### 3.7 DEMOLITION

#### 3.7.1 Concrete:

- 3.7.1.1 Demolish concrete by methods which avoid impact loads on items which are not to be demolished.
- 3.7.1.2 Where only part(s) of concrete floor, wall, or other items to be demolished, use sawcuts to isolate areas to be demolished, except where existing reinforcing steel to be left in place. Prior to such isolating, install suitable support to prevent premature movement of area(s) being isolated and undesirable transfer of loads as cutting progresses. If necessary, remove area(s) to be demolished by successively isolating small sections.
- 3.7.1.3 Where reinforcing steel is to be left in place, use sawcuts from surface of concrete to reinforcing steel around perimeter(s) of area(s) to be demolished. Chip concrete without damaging reinforcing steel. If applicable, retouch damaged epoxy coating of existing reinforcing steel.
- 3.7.1.4 Equipment and procedures for partial depth removal of concrete shall be in accordance with OPSS.MUNI 928.

#### 3.7.2 Masonry:

- 3.7.2.1 Demolish block or brick walls in small sections of no more than 2 m<sup>2</sup>. Where only part(s) of a wall is to be demolished, install adequate support for adjacent part(s). Do not permit masonry to fall in mass from one level to another.

**3.7.3 Doors and Hardware:**

- 3.7.3.1 Where doors are scheduled to be removed unless indicated otherwise, removal to include, but not limited to the following:
  - 3.7.3.1.1 Remove door hardware in reusable condition, and hand over to TTC for TTC's use.
  - 3.7.3.1.2 Remove doors, and hand over to TTC or Contractor as indicated for reuse provided they are in reusable condition.
  - 3.7.3.1.3 Removal of door frames unless noted otherwise to remain.

**3.8 PATCHING AND REPAIRS**

- 3.8.1 Promptly repair damage to adjacent construction caused by selective Demolition Work.
- 3.8.2 Where repairs to existing surfaces are required patch surfaces to match existing.
- 3.8.3 Completely fill holes and depressions in remaining existing masonry wall with approved masonry patch material applied according to manufacturer's written instructions.
- 3.8.4 Restore exposed finishes and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.

**3.9 CLEANING AND RESTORATION**

- 3.9.1 Keep Site clean and organized throughout Demolition Work.
- 3.9.2 Upon completion of Demolition, remove debris, trim surfaces, and leave Work areas clean.

**END OF SECTION**



1 General

**1.1 SECTION INCLUDES**

1.1.1 Design, labour, Products, equipment, and services necessary for concrete formwork Work in accordance with the Contract Documents.

**1.2 REFERENCES**

1.2.1 ACI 347, Guide to Formwork for Concrete.

1.2.2 CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

1.2.3 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

1.2.4 CSA O86, Consolidation - Engineering Design in Wood.

1.2.5 CSA O121, Douglas Fir Plywood.

1.2.6 CSA-S269.1, Falsework and Formwork.

**1.3 DESIGN REQUIREMENTS**

1.3.1 Design concrete formwork components, and assemblies in accordance with CSA S269.1, to resist applicable loading and as follows:

1.3.1.1 Ensure finished concrete is within specified tolerances.

**1.4 SUBMITTALS**

**1.4.1 Shop Drawings:**

1.4.1.1 Submit manufacturer's details and specifications for proprietary materials used in formwork liners and coatings.

1.4.1.2 Submit Shop Drawings of formwork. Indicate information necessary to enable the Work to be accurately assembled to meet design requirements.

1.4.1.3 Prepare Shop Drawings in accordance with CSA-S269.1 and ACI 347 requirements.

1.4.1.4 Indicate sequence of erection and removal of formwork.

**1.4.2 Quality Assurance Submittals:**

1.4.2.1 Submit inspection reports in accordance with Article 1.5.

**1.5 QUALITY ASSURANCE**

1.5.1 Tolerances:

1.5.1.1 Construct forms to produce plumb, level, and true concrete.

1.5.1.1.1 Site placed concrete tolerances in accordance with CSA A23.1.

1.5.1.1.2 Variation permitted by TTC in one part of construction or in other parts of the Contract Documents not to be construed as permitting violation of more stringent requirements for any other part of construction, or in any other parts of the Specifications.

**1.6 DELIVERY, STORAGE AND HANDLING**

1.6.1 Store materials on Site to prevent damage. Protect from weather. Comply with CSA A23.1/A23.2.

2 Products

**2.1 MATERIALS**

2.1.1 Forms:

2.1.1.1 Plywood: In accordance with CSA O121, G1S Douglas Fir plywood, sheets as large as practical, minimum 19 mm thick, 7-ply, exterior grade, waterproof glue, and edges sealed with oil based sealer.

2.1.2 Formwork materials: Fit for intended purpose and meet CSA-S269.1 requirements. Where patented accessories, fabricated forms, shoring or scaffolding units are used, follow manufacturer's instructions for load carrying capacity and bracing.

2.1.3 Form ties: Removable or snap-off water penetration resistant ties, fixed or adjustable length, free of devices leaving holes in concrete larger than 25 mm in diameter, formed to break 25 mm from surface of concrete after form removal and having minimum working strength of 13 kN. Wire ties are not permitted.

2.1.4 Form release agent: Quick drying, sprayable, non-staining, non-toxic coating, compatible with paint and mortar, containing compounds that react with free lime present in concrete resulting in water insoluble soaps, preventing concrete from sticking to forms and compliant with CEPA, Canadian Volatile Organic Compounds (VOC) Concentration Limits for Architectural Coatings Regulations.

2.1.4.1 Formshield Pure by The Euclid Chemical Company.

2.1.4.2 Clean Strip Ultra J3 by Dayton Superior Corporation.

2.1.4.3 Duogard II – Water-Based Form Release Agent by W.R. Meadows of Canada Ltd.

2.1.4.4 Debond Form Coating by L&M Construction Chemicals, Inc.

2.1.5 Form tape: Reinforced, self-adhesive waterproof and pressure sensitive plastic form tape.

2.1.6 Chamfer strips: 25 mm x 25 mm triangular fillets milled from clear, straight grain pine, surfaced each side or extruded vinyl type, with or without nailing flange.

2.1.7 Form liners:

2.1.7.1 Plywood: In accordance with CSA O121, G1S, high density overlay, Douglas Fir T&G, square edge, minimum 6 mm thick, and G1S with resin bonded fibre coating for smooth finish, free of irregularities, dents, and surface defects.

2.1.7.2 Urethane elastomer: Medium-use elastomeric form liner designed for minimum of 40 reuses, maximum temperature limit of 60°C, thermal expansion approximately 8 times of plywood, high impact resistance, in pattern with manufacturer's compatible adhesive for positive attachment to formwork.



3 Execution

**3.1 GENERAL**

- 3.1.1 Construct and assemble formwork in accordance with CSA-S269.1, reviewed Shop Drawings, and to meet specified tolerances.
- 3.1.2 Because of tight clearances required between fixed and movable equipment used in structures, exercise particular care in erection of forms, setting, and holding in position during placing of concrete.
- 3.1.3 Remove and replace finished portions of structure varying outside acceptable tolerances from dimensions, elevation or position at no cost to TTC.
- 3.1.4 Incorporate continuous full size form panels for concrete surfaces exposed to public view in completed structure.
- 3.1.5 Construct forms rigidly, unyielding, tied, and supported so they do not shift or bulge under superimposed loads and weight and pressure of concrete.

**3.2 ERECTION**

- 3.2.1 Verify lines, levels, wall, and column centres before proceeding with Work.
- 3.2.2 Construct formwork to produce finished concrete conforming to shape, dimensions, and elevations specified and indicated in Contract Documents.
- 3.2.3 Obtain acceptance from TTC before framing openings not indicated on Contract Drawings or reviewed Shop Drawings.
- 3.2.4 Use form tape on inside of forms to ensure form joints are sufficiently smooth and tight to prevent leakage.
- 3.2.5 Use 25 mm chamfer strips on external corners of concrete and 25 mm fillets at interior corners of concrete members except at following locations:
  - 3.2.5.1 Where otherwise indicated on Contract Drawings.
- 3.2.6 Use full size form sheeting panels wherever possible. Ensure contact surfaces of formwork produce neat and symmetrical joint patterns either vertical or horizontal and, where possible, staggered to maintain structural continuity. Back vertical and horizontal joints solidly and fasten edges of abutting sheets to same stud. Take care to ensure adjacent form panels fit accurately, tight and flush. Use straight lumber.
- 3.2.7 Take particular care in forming corners and openings. Ensure formwork is tight and braced so no movement occurs.
- 3.2.8 Align form joints and make watertight. Keep form joints to minimum. Ensure no visible defects appear on exposed finished Work.
- 3.2.9 If internal ties are used, arrange them so when forms are removed, no metal is within 25 mm of any exposed surface.

**3.3 PREPARATION OF FORMS**

- 3.3.1 Clean formwork in accordance with CSA A23.1/A23.2 before placing concrete.
- 3.3.2 Provide suitable means to permit cleaning inside of form. Remove debris, sawdust, water and frozen matter prior to concrete placement.
- 3.3.3 Apply release agent by spray in accordance with manufacturer's recommendations. Ensure form surfaces receive uniform coating.

3.3.4 Notify TTC minimum 2 Days prior to placing concrete to allow for inspection of formwork.

### **3.4 JOINTS**

3.4.1 Contraction and construction joints:

3.4.1.1 Obtain acceptance from TTC to install joints in locations other than those indicated.

3.4.1.2 Comply with CSA A23.1/A23.2.

### **3.5 REMOVAL OF FORMS**

3.5.1 Do not disturb forms until concrete has hardened and developed sufficient strength to safely support its own weight and load on it.

3.5.2 Strip formwork in accordance with CSA A23.1/A23.2.

3.5.3 Leave formwork in place for the following minimum 7-Day periods of time after placing concrete:

3.5.3.1 Until concrete has reached 70% of its compressive strength and not before 7 Days.

3.5.4 Be responsible for safety of structure, both before and after removal of forms until concrete has reached its specified 28 Days compressive strength. Employ methods and sequences of removal of formwork to permit concrete to gradually take up stresses involved.

3.5.5 Take particular care when removing forms to ensure no damage occurs at corners, edges, and similar locations.

3.5.6 To help avoid colour variations in concrete, ensure length of time between concrete pouring and form removal is approximately the same for each portion of Work.

3.5.7 When forms are stripped, obtain permission from TTC before repairing voids, stone pockets, honeycombing, and other defects.

3.5.8 Reuse of formwork in concealed areas is subject to compliance with requirements of CSA A23.1/A23.2, CSA-S269.1, and review by TTC.

### **3.6 FIELD QUALITY CONTROL**

3.6.1 Prior to closing of forms and placement of concrete, notify TTC for field inspection review.

**END OF SECTION**

1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment and services necessary for concrete reinforcement Work in accordance with the Contract Documents.

**1.2 REFERENCES**

1.2.1 CAN/CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/ Methods of Test for Concrete.

1.2.2 CAN/CSA-G30.18-M, Carbon Steel Bars for Concrete Reinforcement.

1.2.3 CAN/CSA-A23.3, Design of Concrete Structures.

1.2.4 CSA W186-M, Welding of Reinforcing Bars in Reinforced Concrete Construction.

1.2.5 OPSS 905, Construction Specification for Steel Reinforcement for Concrete.

1.2.6 RSIC, Reinforcing Steel Institute of Canada, Manual of Standard Practice.

**1.3 SUBMITTALS**

**1.3.1 Shop Drawings:**

1.3.1.1 Submit Shop Drawings indicating:

1.3.1.1.1 Placing drawings, bar lists, quantities and bar bending details. Bar bending details to include details of standard bends. Indicate name of bent bar fabricator, name of bulk steel supplier and steel grade.

1.3.1.1.2 On placing drawings, indicate bar sizes, spacing, location and quantities of reinforcement, splines, splice lengths, coating designations, location of expansion, control and construction joints, with identifying code marks to permit correct placement. Indicate sequence of placing concrete. Indicate type, sizes, spacings and locations of chairs, spacers and hangers. Prepare reinforcing drawings in accordance with Reinforcing Steel Institute of Canada (RSIC) Manual of Standard Practice.

1.3.1.1.3 Design and detail lap lengths to CAN/CSA-A23.3. Supply Class B splices unless shown otherwise. Splices are to be staggered unless otherwise shown.

1.3.1.1.4 Substitution of different size bars may be permitted upon written acceptance of TTC.

**1.3.2 Quality Assurance Submittals:**

1.3.2.1 Submit certified copies of mill test reports for reinforcing steel and welded wire fabric, showing physical and chemical analysis, minimum 30 Days prior to commencing Work.

**1.4 DELIVERY, STORAGE, AND HANDLING**

1.4.1 Store reinforcing steel off the ground and kept free of mud, dirt, oil and any contaminants which may adversely affect performance of reinforcing steel. Comply with CAN/CSA-A23.1/A23.2.

2 Products

**2.1 MATERIALS**

- 2.1.1 **Reinforcing steel:** CAN/CSA-G30.18-M; Carbon-steel bars, deformed unless indicated otherwise, Grade 400R.
- 2.1.2 **Cold drawn annealed steel wire ties:** ASTM A82, minimum 1.6 mm diameter, with coating for use with uncoated and coated reinforcing steel.
- 2.1.3 **Chairs, bolsters, supports, spacers:** CAN/CSA-A23.1/A23.2 with sufficient strength to rigidly support weight of reinforcement and construction loads.

**2.2 FABRICATION**

- 2.2.1 Fabricate and bend reinforcing steel in accordance with CAN/CSA-A23.1/A23.2, RSIC Manual of Standard Practice and in accordance with reviewed placing drawings.
- 2.2.2 Obtain TTC acceptance for locations of reinforcement splices other than those shown on placing drawings.
- 2.2.3 Bend bars cold, heating of bars will not be permitted.
- 2.2.4 Verify elevations before cutting and bending reinforcing bars.
- 2.2.5 Ensure cutting and bending tolerances are sufficiently accurate to comply with placing tolerances shown.
- 2.2.6 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists. Clearly indicate mill run for which bars were fabricated.

3 Execution

**3.1 SPLICES AND LAPS**

- 3.1.1 Make splices in locations shown on Drawings. Lap lengths in accordance with CAN/CSA-A23.3 unless otherwise shown.

**3.2 PLACING**

- 3.2.1 Prior to installation of reinforcing steel, inspect installed Work of other trades and verify that Work is complete for installation of reinforcement.
- 3.2.2 Place reinforcing steel as shown on reviewed placing drawings and in accordance with CAN/CSA-A23.1/A23.2. Make bars as long as possible.
- 3.2.3 Tie bars at least at every fourth intersection minimum. Make maximum untied length 1000 mm.
- 3.2.4 Straighten kinks and bends.
- 3.2.5 Do not eliminate or displace reinforcement to accommodate hardware to be embedded in concrete.
- 3.2.6 Do not field bend bars partially embedded in concrete except as shown on Contract Drawings or as accepted by TTC.
- 3.2.7 Prior to placing concrete or closing wall and column forms, obtain TTC acceptance of reinforcing steel and position.

**3.3            CLEANING**

3.3.1           Ensure that reinforcing steel is free from loose mill scale, excessive rust, dirt, oil or paint.

**END OF SECTION**



1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment and services necessary for Cast-in-Place Concrete Work in accordance with the Contract Documents.

**1.2 REFERENCES**

1.2.1 ACI 308R, Guide to Curing Concrete.

1.2.2 ACI 309R, Guide for Consolidation of Concrete.

1.2.3 ASTM C260/C260M, Standard Specification for Air-Entraining Admixtures for Concrete.

1.2.4 ASTM C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

1.2.5 ASTM C494/C494M, Standard Specification for Chemical Admixtures for Concrete.

1.2.6 ASTM C881/C881M, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

1.2.7 CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

1.2.8 CSA G30.18, Carbon Steel Bars for Concrete Reinforcement.

**1.3 DEFINITIONS**

1.3.1 Cast-in-Place Concrete: Concrete elements less than 1.0 m thick.

**1.4 SUBMITTALS**

**1.4.1 Documentation and Certificate Submittals:**

1.4.1.1 Submit a current, valid Certificate of Ready Mixed Concrete Production Facilities as issued by RMCAO for plants supplying concrete to the Contract.

1.4.1.2 Submit certification that ready mix concrete manufacturer has current qualification for RMCAO Seal of Special Quality Concrete.

1.4.1.3 Submit credentials of testing laboratory proposed to be used on the Contract, including the Canadian Council of Independent Laboratories (CCIL) accreditation. Upon TTC approval, this laboratory becomes Contract designated laboratory.

**1.4.2 Quality Control Submittals:**

1.4.2.1 Submit 4 weeks prior to placement, Work Plan describing the material, equipment and procedures to be used for the following activities:

1.4.2.2 Concrete Curing Plan:

1.4.2.2.1 Submit 4 weeks prior to placement, Concrete Testing Program as part of Quality Control Plan for the Work of this Contract.

**1.4.3 Prequalification Submittals:**

- 1.4.3.1 Submit the Concrete Mix Design that will satisfy performance requirements for each type of concrete, as specified in Schedule A – Concrete Requirements, using Concrete Mix Design Submission Form (03 30 00.01) attached to this Section. List concrete tests that will be used to prequalify the mix. Do not proceed with prequalification testing until this submittal is reviewed.
- 1.4.3.2 Submit 4 weeks prior to placement prequalification test results for each Concrete Mix Design.
- 1.4.3.2.1 Changes in concrete mix constituents or their proportions require a new Mix Design submission. Minor modifications to the concrete mix design may be done without having to submit a new mix design, subject to TTC approval.
- 1.4.3.2.2 For Concrete Mix Design that has been used before and will be used without any alterations within 12 months, previous concrete test done by CCIL laboratory may be submitted in lieu of prequalification testing, upon TTC acceptance.
- 1.4.3.2.3 Do not place concrete before written TTC approval of the Mix Design is received.
- 1.4.3.3 Submit the material data 4 weeks prior to placement of concrete certifying that the following materials meet the specified requirements of this Contract:
  - 1.4.3.3.1 Cementitious materials.
  - 1.4.3.3.2 Supplementary cementing materials.
  - 1.4.3.3.3 Admixtures.
  - 1.4.3.3.4 Aggregates.
  - 1.4.3.3.4.1 Test fine and course aggregate to determine any potential for alkali-silicate or alkali-carbonated reactivity. If potentially reactive aggregates are considered for use, submit for each proposed Mix Design an evaluation of the potential for alkali-aggregate reaction and preventive measures to avoid deleterious expansion in concrete in accordance with CSA A23.1/A23.2.
  - 1.4.3.3.5 Water.
- 1.4.3.4 Submit the patching material specification four (4) weeks prior to placement. Use non-shrinking material that meets or exceeds the properties of the existing concrete.

**1.5 QUALITY ASSURANCE**

**1.5.1 Inspection and Testing:**

- 1.5.1.1 Inspection and testing for the Work of this Contract in accordance with CSA A23.1/A23.2 and to the Contract Documents.
- 1.5.1.2 Be responsible for inspection and testing for the Work of this Contract.
- 1.5.1.3 Quality Control activities undertaken by Contractor are subject to Quality Assurance auditing by TTC.
- 1.5.1.4 TTC may carry out inspection and testing of the Work for conformance to the Contract Documents at the construction Site, place of manufacture, storage, or any other Site designated by TTC. Cooperate and assist TTC during inspection and testing.
- 1.5.1.5 Inspection or testing by TTC will not augment or replace the Contractor's Quality Control nor relieve them from their contractual responsibility.



- 1.5.1.6 Remove defective materials and completed Work which fails inspection or testing and replace as directed by TTC.

**1.5.2 Defective Concrete:**

- 1.5.2.1 Hardened concrete state:

- 1.5.2.1.1 Concrete is considered defective when a cylinder test fails to meet the performance requirements for corresponding concrete type, as defined in Schedule A – Concrete Requirements of this Section.

- 1.5.2.1.2 In such case, conduct concrete core extraction and testing by a specialized third party inspection company at the direction of TTC.

- 1.5.2.1.3 Acceptance criteria for the tests from core specimens drilled from the structure in accordance with CSA A23.1/A23.2.

- 1.5.2.1.4 Immediately after coring, fill each core with approved patching material. Refer to Article 3.10.

- 1.5.2.1.5 Also, consider concrete defective if it is structurally unsound, honeycombed, or improperly finished, as determined by TTC.

- 1.5.2.2 Plastic concrete state:

- 1.5.2.2.1 Concrete considered defective when the measured slump, air content, placing temperature, or density of concrete fails to meet the performance requirements, as defined in the accepted Concrete Mix Design Submission Form.

- 1.5.2.2.1.1 In such cases, admixtures or water may be added by the concrete manufacturer in the presence of TTC only to increase the slump or air content, as noted in the Concrete Mix Design Submission Form. Run mixer for a minimum thirty additional revolutions to ensure homogeneity of the concrete and retest for both air content and slump. Admixtures to decrease air content are not allowed.

- 1.5.2.2.1.2 If the second failure occurs, concrete will be considered to have failed the requirements of the Specification and will be rejected.

- 1.5.2.3 TTC has the right to require replacement, strengthening or correction of impacted portions of a defective concrete structure to the acceptance of TTC.

- 1.5.2.4 Bear costs of rectifying defective concrete including inspections, design, coring, testing, strengthening, demolishing, and replacement. Bear investigation and evaluation costs even if further evaluation of design allows the unit to be classed as acceptable concrete.

**1.5.3 Records:**

- 1.5.3.1 Before unloading at Site, have the concrete manufacturer submit the delivery ticket (with each batch of concrete) with the following information printed, stamped or written:

- 1.5.3.1.1 Identification of batch plant.

- 1.5.3.1.2 Date and serial number of ticket.

- 1.5.3.1.3 Name of Contractor.

- 1.5.3.1.4 Contract Name and Contract number.

- 1.5.3.1.5 Concrete Mix Design Submission Form number, target slump and air content at end of chute.

- 1.5.3.1.6 Amount of concrete in cubic metres.

- 1.5.3.1.7 Truck number, cumulative total, and load number.
- 1.5.3.1.8 Time loaded or time of first mixing of cement and water/aggregate.
- 1.5.3.2 Include the following information, which is to be registered by the manufacturer on at least two copies of the delivery ticket, after discharge has been completed:
  - 1.5.3.2.1 Time that load arrived on Site.
  - 1.5.3.2.2 Time that discharge of load was started.
  - 1.5.3.2.3 Time that discharge of load was completed.
  - 1.5.3.2.4 Type and amount of admixtures/water, if added at Site, initialled by TTC.
- 1.5.3.3 Maintain accurate records of Cast-in-Place Concrete elements. Include in the records the following information:
  - 1.5.3.3.1 Date of placing concrete element.
  - 1.5.3.3.2 Location of concrete element.
  - 1.5.3.3.3 Specified strength of concrete.
  - 1.5.3.3.4 Air and form temperature when concrete was placed.
  - 1.5.3.3.5 Temperature of concrete when placed in the form.
  - 1.5.3.3.6 Test samples taken and results of test samples.
- 1.6 DELIVERY, STORAGE, AND HANDLING**
  - 1.6.1 Deliver and store materials on Site in accordance with CSA A23.1/A23.2.
  - 1.6.2 Concrete, Site-Mixed:**
    - 1.6.2.1 Site-mixed concrete is not permitted when:
      - 1.6.2.1.1 A structure contains more than a total of 50 m<sup>3</sup> of concrete.
      - 1.6.2.1.2 Specified compressive strength is higher than 25 MPa at 28 Days.
      - 1.6.2.1.3 Concrete is prestressed.
      - 1.6.2.1.4 Ready-mix concrete is specified.
    - 1.6.2.2 Transport concrete from mixer to point of delivery as rapidly as practicable. Conform to the requirements of Article 3.3, specified for methods and equipment.
  - 1.6.3 Concrete, Mixed Off-Site:**
    - 1.6.3.1 When the truck mixer or agitator is accepted for mixing or delivery of concrete, do not add admixtures or water to the batch after initial introduction of mixing. Admixtures or water to increase slump or air content may be added on Site only as noted on Concrete Mix Design Submission Form, and only by concrete manufacturer in the presence of TTC. For further details refer to Subparagraph 1.5.2.2 of this Section.
    - 1.6.3.2 Complete the discharge of concrete within 2 hours after introduction of mixing water to cement and aggregates.
- 1.7 AMBIENT CONDITIONS**
  - 1.7.1 Do not place concrete during rain or weather events that could damage the concrete.
  - 1.7.2 Protect newly placed concrete from rain or weather events in accordance with CSA A23.1/A23.2.

- 1.7.3 Cold weather protection:
  - 1.7.3.1 Maintain protection equipment, in readiness on Site.
  - 1.7.3.2 Use such equipment when the ambient temperature is at or below 5°C, or when, in the opinion of TTC, the temperature may fall below 5°C before concrete has cured.
  - 1.7.3.3 Do not place concrete upon or against a surface which is at a temperature lower than 5°C.
  - 1.7.3.4 Obtain TTC method of acceptance for maintaining minimum temperatures.
- 1.7.4 Hot weather protection:
  - 1.7.4.1 Protect concrete from direct sunlight when the ambient temperature is at or above 27°C.
  - 1.7.4.2 Prevent forms of getting too hot before concrete is placed. Apply accepted methods of cooling which will not affect concrete adversely.
- 1.7.5 Protection from drying: Refer to Article 3.5 of this Section.

## 2 Products

### 2.1 MATERIALS

#### 2.1.1 General:

- 2.1.1.1 Use admixtures for concrete in accordance with CSA A23.1/A23.2, unless otherwise acceptable to TTC.
- 2.1.1.2 Have the concrete manufacturer certify that materials and admixtures are compatible.
- 2.1.1.3 Use Products in accordance with the manufacturer's printed instructions unless otherwise acceptable to TTC.
- 2.1.1.4 Fresh concrete to be normal density concrete (2350 kg/m<sup>3</sup> ±100 kg/m<sup>3</sup>), unless otherwise noted in Schedule A – Concrete Requirements.

#### 2.1.2 Cement and Supplementary Cementing Materials:

- 2.1.2.1 Conforming to CAN/CSA A3001:
  - 2.1.2.1.1 For use in general concrete construction, when the special properties of other cement types are not required, use Portland cement Type GU or blended hydraulic cement Type GUb.
  - 2.1.2.1.2 When silica fume cement is included in the Concrete Mix Design, the substitution of silica fume not to exceed 8% by mass of Portland cement.
  - 2.1.2.1.3 When fly ash is included in the Concrete Mix Design, the substitution of fly ash not to exceed 25% by mass of Portland cement.
  - 2.1.2.1.4 When Ground Granulated Blast Furnace Slag (GGBFS) is included in the Concrete Mix Design, the substitution of GGBFS not to exceed 50% by mass of Portland cement, unless specifically accepted by TTC.
  - 2.1.2.1.5 For use in the concrete construction exposed to sulphates, use sulphate resistant cement in accordance with Table 3 of CSA A23.1.

#### 2.1.3 Coarse Aggregate:

- 2.1.3.1 In accordance with CSA A23.1/A23.2. Aggregate sources will be as listed on the MTO's Designated Source Materials (DSM) list.

- 2.1.3.2 Petrographic numbers for the following concretes are:
  - 2.1.3.2.1 Concrete pavement: 101 to maximum 125.
  - 2.1.3.2.2 Concrete structures and base: 101 to maximum 140.
  - 2.1.3.2.3 Gradation of coarse aggregate: In accordance with CSA A23.1, Table 11 Group 1.
- 2.1.4 Fine Aggregate:**
  - 2.1.4.1 In accordance with CSA A23.1/A23.2.
- 2.1.5 Water:**
  - 2.1.5.1 In accordance with CSA A23.1/A23.2.
- 2.1.6 Admixtures:**
  - 2.1.6.1 Manufacturers:
    - 2.1.6.1.1 The Euclid Chemical Company (Euclid Canada), a division RPM, Inc.
    - 2.1.6.1.2 Grace Construction Products.
    - 2.1.6.1.3 BASF – Admixture Systems.
    - 2.1.6.1.4 Sika Canada Inc.
  - 2.1.6.2 Add admixtures to concrete mix in accordance with manufacturer's written instructions.
    - 2.1.6.2.1 The use of calcium chloride is not permitted.
    - 2.1.6.2.2 Have the concrete manufacturer certify that admixtures are compatible.
  - 2.1.6.3 Air-entrainment admixtures in accordance with ASTM C260/C260M.
  - 2.1.6.4 Chemical admixtures: In accordance with CSA A23.1/A23.2 and ASTM C494/C494M.
    - 2.1.6.4.1 Water-reducing admixture: Type A.
    - 2.1.6.4.2 Retarding admixture: Type B.
    - 2.1.6.4.3 Accelerating admixture: Type C.
    - 2.1.6.4.4 Water-reducing and retarding admixtures: Type D.
    - 2.1.6.4.5 Water-reducing and accelerating admixture: Type E.
    - 2.1.6.4.6 Water-reducing high range admixture (super plasticizers): Type F.
    - 2.1.6.4.7 Water-reducing, high range and retarding admixtures (super plasticizers): Type G.
    - 2.1.6.4.8 Specific performance admixtures: Type S.
- 2.1.7 Curing and Sealing Compound:**
  - 2.1.7.1 Manufacturer's Products:
    - 2.1.7.1.1 Sika Florseal WB 25 by Sika Canada Inc.
    - 2.1.7.1.2 Kure-N-Seal 25 ES by BASF - Building Systems.
    - 2.1.7.1.3 CS-309-20 Clear Curing & Sealing Compound (VOC) by W.R. Meadows of Canada Ltd.
    - 2.1.7.1.4 Diamond Clear TB by The Euclid Chemical Company (Euclid Canada), a division of RPM, Inc.
    - 2.1.7.1.5 Cipadeck Cure & Seal by CPD Construction Products.

**2.1.8 Evaporation Reducer:**

2.1.8.1 Manufacturer: BASF - Building Systems.

**2.1.9 Epoxy Bonding Agent:**

2.1.9.1 In accordance with ASTM C881/C881M, Type V.

2.1.9.2 Manufacturer's Products:

2.1.9.2.1 Cipadite 25 Epoxcrete LV by CPD Construction Products.

2.1.9.2.2 Sikadur 32 Hi-Mod by Sika Canada Inc.

2.1.9.2.3 Euco #452 Epoxy System MV by The Euclid Chemical Company (Euclid Canada), a division of RPM, Inc.

**2.1.10 Latex Bonding Agent:**

2.1.10.1 In accordance with ASTM C1059/C1059M.

**2.1.11 Drilled Anchors:**

2.1.11.1 Manufacturer's Products:

2.1.11.1.1 HVA Adhesive System with HVU Capsules by Hilti Canada Corporation.

2.1.11.1.2 HIT-HY 200 Safe Set System by Hilti Canada Corporation (fast cure).

2.1.11.1.3 HIT - RE 500 V3 Epoxy Adhesive Anchoring System by Hilti Canada Corporation (slow cure).

2.1.11.1.4 FLO-ROK FR5MAX Injection Adhesive Anchor by UCAN Fastening Products.

2.1.11.1.5 Heavy Load Expansion Anchor (Part # LHL) by UCAN Fastening Products.

2.1.11.1.6 KWIK BOLT-TZ Expansion Anchor by Hilti Canada Corporation.

2.1.11.1.7 HSL-3 Expansion Anchor by Hilti Canada Corporation.

2.1.11.1.8 HDA Undercut Anchor by Hilti Canada Corporation.

**2.1.12 Bond Breakers:**

2.1.12.1 Manufacturer's Product: 810-07 Non-Fibered Asphalt Roof and Foundation Coating by Henry Company Canada Inc.

**2.1.13 Steel Dowels:**

2.1.13.1 In accordance with CSA G30.18, Grade 400.

**2.2 CONCRETE MIXES**

2.2.1 Produce concrete in accordance with Article Schedule A – Concrete Requirements of this Section.

2.2.2 Design concrete to avoid segregation and excessive bleeding.

2.2.3 Mix concrete and concrete proportions in accordance with CSA A23.1/A23.2.

2.2.4 Ensure Mix Design is adjusted suitably to prevent alkali aggregate reaction.

2.2.5 Indicate concrete manufacturer on the Concrete Mix Design Submission Form when combinations of cement and supplementary cementing materials meet or exceed the limits of High Volume Supplementary Cementing Materials (HVSCM) 1 or 2 as identified in CSA A23.1.

2.2.6 Class of exposure: In accordance with Schedule A - Concrete Requirements, for each concrete type.

2.2.7 Concrete temperature limits:

2.2.7.1 Temperature at placing: In accordance with CSA A23.1, Table 14.

2.2.7.2 Maximum curing temperature: 70°C.

### **2.3 DRY PACK**

2.3.1 Material: One part cement and three parts sand (fine aggregate) by volume. Add water to obtain a consistency that when a sample is squeezed, only enough water will come to the surface to moisten hand. Maximum water content will be 4.5 L to 23 kg of cement.

## **3 Execution**

### **3.1 GENERAL**

3.1.1 Supply, place and cure Cast-in-Place Concrete in accordance with CSA A23.1/A23.2 and this Section.

3.1.2 Prior to placement of concrete give TTC at least 2 Days' notice to permit a review of placement of formwork, reinforcing steel, waterstop, and associated items, embedded in concrete in accordance with reviewed Shop Drawings and Contract Documents.

3.1.2.1 At notification, give TTC the estimated time, location, and volume of concrete to be placed.

3.1.3 Prior to placing concrete, notify TTC to permit a review of the provisions for the protection of concrete during placing and curing in adverse weather.

3.1.4 Do not place concrete on surfaces which contain frost, water, or debris.

3.1.5 Ensure that reinforcement and associated items embedded in concrete are not disturbed during placement of concrete.

3.1.6 Install premoulded joint filler for full depth of concrete at abutting structures where indicated on Contract Drawings.

3.1.7 Ensure concrete cover over reinforcing steel in accordance with Contract Drawings.

3.1.8 Do not load new concrete until authorized by TTC.

3.1.9 Provide concrete for housekeeping pads for mechanical and electrical equipment in accordance with Sections 20 05 00 and 26 05 00.

3.1.10 Include required formwork and reinforcing.

### **3.2 INSERTS**

3.2.1 Tolerance for placing embedded items: In accordance with CSA A23.1/A23.2, unless otherwise indicated on Contract Documents.

3.2.2 Have respective trades verify location of items supplied by them.

3.2.3 Keep embedded items free of deleterious material.

3.2.4 Obtain TTC written approval for sleeves and openings greater than 100 mm x 100 mm that are not indicated on Contract Drawings.

3.2.5 Do not eliminate, cut, or displace reinforcement, to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from TTC before placing concrete.

- 3.2.6 Anchor bolts:
- 3.2.6.1 Before placing concrete, place anchor bolts in locations in accordance with reviewed Shop Drawings under supervision of the trade supplying anchor bolts and templates in accordance with the manufacturer's printed instructions and CSA A23.1/A23.2.
- 3.2.6.2 Allowable anchor bolt height tolerance within  $\pm 13$  mm maximum.
- 3.2.7 As concrete is being placed, ensure that items embedded in concrete are checked from time to time for position, alignment, and elevation.
- 3.2.8 Take special care to ensure dense, watertight concrete around items set in concrete.

### **3.3 PLACING OF CONCRETE**

- 3.3.1 Place concrete in accordance with CSA A23.1.
- 3.3.2 Ensure that placing equipment, if supported by falsework or formwork, does not impart harmful vibration to freshly placed concrete or cause deformation or misalignment of formwork.
- 3.3.3 At bearing walls, place concrete in one continuous operation to control joint below haunch on roof slab in accordance with Contract Drawings.
- 3.3.4 Place concrete in haunches and beams as part of roof when placement of concrete occurs unless otherwise indicated on Contract Drawings.
- 3.3.5 Slope concrete to levels in accordance with Contract Drawings.
- 3.3.6 Do not place concrete at such a rate as to endanger formwork or to prevent proper compaction.

### **3.4 CONCRETE CONSOLIDATION**

- 3.4.1 Consolidate concrete in accordance with CSA A23.1.
- 3.4.2 Work concrete into complete contact with forms and embedded items. Consolidate concrete adjacent to side forms and along entire length of forms to ensure a smooth surface finish after stripping of formwork.
- 3.4.3 Thoroughly vibrate concrete around waterstops, reinforcement, hardware anchors, and other embedded items, to ensure good bond.
- 3.4.3.1 Do not use vibrators to move concrete laterally.
- 3.4.3.2 Have vibrating equipment on hand and ready for use before placing is started.
- 3.4.3.3 Use internal vibrators where practicable, considering size and spacing of reinforcement.
- 3.4.4 Internal vibration can significantly affect entrained air void systems in concrete. Follow the detailed guidance for proper vibration as stated in ACI 309R.
- 3.4.5 Method of concrete consolidation to prevent damage to the temperature monitoring and recording systems, if installed.

### **3.5 PROTECTION AND CURING**

- 3.5.1 Protect and cure concrete in accordance with CSA A23.1 and submitted curing plan in accordance with Paragraph 1.4.2.
- 3.5.2 When surface moisture evaporation rate may exceed  $0.5 \text{ kg}/(\text{m}^2 \cdot \text{h})$ , take additional measures accepted by TTC to prevent rapid loss of moisture from surface of concrete. Refer to CSA A23.1.

- 3.5.3 Do not remove protection until the concrete has cooled to the temperature differential given in the CSA A23.1, Table 20, in order to avoid cracking of the concrete due to the sudden temperature change near the end of the curing period.
- 3.5.4 Removal of forms prior to the minimum curing period does not remove the Contractor's obligation to cure and protect the exposed concrete for the minimum time periods specified for curing and protection.
- 3.5.5 Curing types based on CSA A23.1, Table 19, as modified herein:
  - 3.5.5.1 Type 1 – Basic curing: Three Days at  $\geq 10^{\circ}\text{C}$  or for the time necessary to attain 40% of the specified strength.
  - 3.5.5.2 Type 2 - Additional curing: Seven Days total at  $\geq 10^{\circ}\text{C}$  and for the time necessary to attain 70% of the specified strength.
  - 3.5.5.3 Type 3 - Wet curing: Seven Days at  $\geq 10^{\circ}\text{C}$  and for the time necessary to attain 70% of the specified strength.
  - 3.5.5.4 Note: Silica fume concrete must be wet cured.
- 3.5.6 Wet curing of concrete:
  - 3.5.6.1 To prevent thermal shock and cracking, curing water should not be more than  $11^{\circ}\text{C}$  cooler than the concrete surface.
  - 3.5.6.2 When concrete has set, cover horizontal surfaces with at least one layer of wet burlap or other moisture-retaining covering. Strips must overlap at least 150 mm and must be held in place without marring the surface of concrete.
  - 3.5.6.3 Presoak burlap by immersing it in water for a minimum of 24 hours prior to placing and maintain in a continuously wet condition throughout the curing period by means of soaker hose. Intermittent drying is not permitted.
  - 3.5.6.4 Cover with polyethylene sheets not less than 0.1 mm (4 mls) thick, standard commercial grade, free of snags, tears or any other visible flaws to provide a tough pliable moisture barrier. Provide suitable weights to prevent blow-off or displacement of protective cover.
  - 3.5.6.5 Remove burlap after required curing time and allow to air dry until concrete has developed the specified design strengths.
  - 3.5.6.6 Fog misting may need to be applied from the time of finishing until concrete is set in order to prevent drying of the concrete surface.
  - 3.5.6.7 Water must not be allowed to drip, flow, or puddle on the concrete surface during fog misting, when placing the burlap, or at any time before the concrete has achieved final set.
- 3.5.7 Use of curing compounds and evaporation reducers:
  - 3.5.7.1 Except where concrete wet curing is required, use of curing compounds and evaporation reducers may be approved by TTC.
  - 3.5.7.2 Liquid-membrane forming compound for curing of concrete in accordance with ASTM C309.
  - 3.5.7.3 Apply curing compound/evaporation reducer after placing or finishing operations have been completed, in accordance with the compound manufacturer's printed instructions.
  - 3.5.7.4 Ensure compound application is uniform and continuous over entire area being cured.
  - 3.5.7.5 Where surfaces are to be exposed to sunlight, use compound with white pigment.



- 3.5.7.6 Do not use curing compounds on surfaces where a bond is required for additional concrete or where a bonded surface coating such as paint, tile, resilient flooring and similar materials are to be applied.
- 3.5.8 Have all materials and equipment needed for protection and curing on hand and ready for use prior to placement of concrete. Do not start placing concrete without written approval from TTC.

- 3.5.8.1 For additional information refer to ACI 308R.

### **3.6 CONSTRUCTION JOINTS**

- 3.6.1 Construct construction joints in accordance with CSA A23.1 and as indicated on Contract Drawings. Provide dowels in construction joints unless otherwise detailed.
- 3.6.2 Obtain acceptance of TTC to install construction joints in locations other than those indicated on Contract Drawings.

### **3.7 BONDING CONCRETE TO HARDENED CONCRETE**

- 3.7.1 Bond concrete in accordance with CSA A23.1/A23.2.
- 3.7.2 Roughen surface of set concrete and clean thoroughly to remove foreign matter and laitance.
- 3.7.3 Saturate roughened surfaces with water for 4 hours prior to concreting.
- 3.7.4 At horizontal construction joints, strike off horizontal joints and float finish from reinforcing steel to face of form.
  - 3.7.4.1 Slope concrete down slightly towards form.
  - 3.7.4.2 Ensure that leading edge of joint is straight and horizontal.
- 3.7.5 Carry out initial clean-up of lift surface by brushing with stiff wire brooms or by using an air-water jet with an intensity of 0.7 MPa before concrete has taken its final set, such that it removes any inert and porous material without disturbing coarse aggregate.
  - 3.7.5.1 Remove cuttings dislodged by brooming or jetting operation.
- 3.7.6 If initial clean-up is not effective or if concrete surface has become seriously contaminated, remove deleterious layer by wet aggregate blasting immediately before placing next lift.
- 3.7.7 Use 1.5 m<sup>3</sup> minimum of dried, sized sand passing the 5 mm sieve and retained on 1.25 mm sieve for cleaning each 100 m<sup>2</sup> of surface.
  - 3.7.7.1 After aggregate blasting, wash or blow loose particles from surface of joint.
- 3.7.8 Notify TTC to permit review of joint preparation before placing subsequent concrete.
- 3.7.9 Prior to placing fresh concrete, apply epoxy bonding agent or a neat cement wash consisting of one part latex bonding agent mixed with two parts cement, in accordance with manufacturer's printed instructions.

### **3.8 FINISHING**

- 3.8.1 Treat and finish exposed formed surfaces in accordance with CSA A23.1.
- 3.8.2 Grout tie holes in concrete flush to concrete surface. Grout with finishing cement mortar using same sand and cement as used in concrete.
- 3.8.3 Pack grout into place to fill tie hole and finish to match adjacent concrete surface.

3.8.4 Remove forms and strike off projections. Upon TTC inspection, fill honeycombing and repair defects in accordance with CSA A23.1/A23.2 and TTC instruction.

### **3.9 REPAIRING CRACKS IN CONCRETE**

3.9.1 After concrete has set for a minimum of 28 Days, and before a maximum of 125 Days, examine surfaces carefully for cracks.

3.9.2 Rout cracks larger than 0.3 mm at discretion of TTC.

3.9.3 Fill cracks with non-shrink grout.

3.9.4 Match surface to existing surfaces in quality, texture, colour, and elevation.

### **3.10 PATCHING**

3.10.1 Carry out patching as specified in CSA A23.1/A23.2.

3.10.2 Make good temporary openings left in concrete for pipes, conduits, ducts, shoring, and other Work during construction.

3.10.3 Reinforce with welded wire fabric, as required.

3.10.4 Mix, handle, and cure patching material according to manufacturer's instructions.

3.10.5 Immediately prior to patching clean, prepare, and remove free water from the surface.

3.10.6 Finish flush with the surface of the surrounding concrete and remove excess material.

### **3.11 SCHEDULE A - CONCRETE REQUIREMENTS**

Spec. Ref.	Concrete Type	Concrete Use	Class Of Exposure	Min Compressive Strength @ 28 Days	Air Content Category	Nominal Max Aggregate Size	Max Chloride Ion	Other Requirements
3.1	Structural and non-structural elements not exposed to chlorides, nor exposed to F/T	Concrete curb, concrete infill.	N	35 MPa	Not rated	20	-	-

### **3.12 CONCRETE MIX DESIGN SUBMISSION FORM (ATTACHED)**

3.12.1 Design concrete mix in accordance with the requirements of Schedule A – Concrete Requirements and Part 2 of this Section.

3.12.2 Each specific Contract application will require a separate Concrete Mix Design Submission Form. Each Submission Form will have a unique concrete Mix Design number.

3.12.3 Print Concrete Mix Design number on each delivery ticket. Concrete mixes not accepted by the designer will not be accepted on Site.

**END OF SECTION**

Contract Name and Contract Number				
Concrete Mix Design Number (same as on Delivery Ticket)				
Specific Contract Application (i.e., roof slab, basement walls, Gr. Fl. Columns, etc.)				
As Specified in Contract Documents	Concrete Reference in the Specification			
	Class of Exposure (CSA A23.1 Table 1)			
	Minimum Compression Strength @ Age (in Days)			
	Nominal Maximum Aggregate Size (mm) (based on cover & reinforcement spacing)			
	Maximum Chloride Ion Content by mass of cementing material (%)			
	Other Structural Requirements			
	Architectural Requirements: Color / Texture / Other			
Specified by Contractor and Concrete Producer	Air Content Category (1, 2 or Not Rated)			
	Method of Placement			
	Nominal Maximum Aggregate Size (mm) (same or smaller than in Specification)			
	Normal, HVSCM 1 or HVSCM 2 Concrete (CSA A23.1, Clause 8.7)			
	Maximum W/C Ratio (reduce for HVSCM1 exposed to F/T, see CSA A23.1, Table 2)			
	Hardened Concrete, if exposed to F/T (CSA A23.1, Clause 4.3.3.2):			
	1) Minimum air content (%)	1)		
	2) Maximum average void spacing (mm)	2)		
	Maximum Chloride Ion Penetrability (Class C-1 or A-1) (Coulombs @ Days)			
	Concrete Set: Delayed, Normal, Accelerated			
	Early Strength, if required: 75% fc' @ 24hours			
	Minimum and Maximum Placing Temperature (°C)			
	Plasticized Slump Range at End of Chute (mm ± mm)		±	
	Plasticized Slump Range at Point of Deposit (mm ± mm)		±	
	Plastic Concrete Air Content Range at End of Chute (% ± %)		±	
	Plastic Concrete Air Content Range at Point of Deposit (% ± %)		±	
	Quantity and type of admixture(s)/water that can be added on Site by concrete producer's representative ONLY			
Finish Type Number (see Specification)				
Curing Type (CSA A23.1, Table 2)				
Specified by Concrete Producer	Material Type	Name & Source	Material Type	Name & Source
	Cement		Air-Entraining Admixture	
	Water		Water Reduction Admixture	
	Coarse Aggregate		Plastisizers	
	Fine Aggregate		Corrosion Inhibitors	
	SCM - Slag, FA or Silica Fume		Other	

Note: Information marked with \*\*\* is to be shown on delivery ticket



1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment and services necessary for unit masonry Work in accordance with the Contract Documents.

**1.2 REFERENCES**

**1.2.1 Definitions:**

1.2.1.1 Control Joint: Groove which is formed, sawed, or tooled in concrete or masonry structure to regulate location and amount of cracking and separation resulting from dimensional change of different parts of structure, thereby avoiding development of high stresses.

**1.2.2 Reference Standards:**

- 1.2.2.1 ACI 530/530.1, Building Code Requirements and Specification for Masonry Structures and Companion Commentaries.
- 1.2.2.2 ASTM A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- 1.2.2.3 ASTM A240/A240M, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
- 1.2.2.4 ASTM A580/A580M, Standard Specification for Stainless Steel Wire.
- 1.2.2.5 ASTM A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- 1.2.2.6 ASTM C140, Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
- 1.2.2.7 ASTM C207, Standard Specification for Hydrated Lime for Masonry Purposes.
- 1.2.2.8 ASTM C494/C494M, Standard Specification for Chemical Admixtures for Concrete.
- 1.2.2.9 ASTM C881/C881M, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
- 1.2.2.10 ASTM C939, Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method).
- 1.2.2.11 ASTM C1107/C1107M, Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
- 1.2.2.12 CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
- 1.2.2.13 CAN/CSA-A165 Series, CSA Standards on Concrete Masonry Units (Consists of A165.1, A165.2 and A165.3).
- 1.2.2.14 CAN/CSA-A179, Mortar and Grout for Unit Masonry.
- 1.2.2.15 CSA A370, Connectors for Masonry.
- 1.2.2.16 CSA A371, Masonry Construction for Buildings.

- 1.2.2.17 CSA A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005, includes Update No. 1 and Update No. 2).
- 1.2.2.18 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- 1.2.2.19 CSA S304, Design of Masonry Structures.
- 1.2.2.20 NCMA TEK 10-2C, National Concrete Masonry Association, Control Joints For Concrete Masonry Walls – Empirical Method.

### **1.3 SUBMITTALS**

- 1.3.1 Submit in accordance with Section 01 33 00.

#### **1.3.2 Shop Drawings:**

- 1.3.2.1 Submit in accordance with Section 01 33 23 indicating:
  - 1.3.2.1.1 Cut sheets.
  - 1.3.2.1.2 Technical data.
  - 1.3.2.1.3 Manufacturer's recommendations.
  - 1.3.2.1.4 Indicate elevations, sections and details, dimensions, finishes, accessories, reinforcing, location of movement joints and relationship of new construction to existing adjacent structure.
  - 1.3.2.1.5 Verify field measurements.
  - 1.3.2.1.6 Indicate the following:
    - 1.3.2.1.6.1 Coursing patterns.
    - 1.3.2.1.6.2 Coursing elevations.
    - 1.3.2.1.6.3 Ties.
    - 1.3.2.1.6.4 Fasteners.
    - 1.3.2.1.6.5 Grouted cells.
    - 1.3.2.1.6.6 Size, type, location and spacing of reinforcement.
    - 1.3.2.1.6.7 Special detailing.
    - 1.3.2.1.6.8 Lintels.
    - 1.3.2.1.6.9 Locations of Control Joints.
    - 1.3.2.1.6.10 Control Joints details.
    - 1.3.2.1.6.11 Anchors.
    - 1.3.2.1.6.12 Adjacent existing construction.
- 1.3.2.2 Indicate elements of temporary bracing system required to assure stability of walls, lintels and other masonry Work during construction.
- 1.3.2.3 Submit Shop Drawings including, but not limited to, design calculations and connection details, stamped, signed and sealed by Professional Engineer, licensed in the Province of Ontario.

**1.3.3 Samples:**

- 1.3.3.1 Submit at least six of each type of block used indicating range of colour and texture, stacked with simulated joint samples.
- 1.3.3.2 Submit samples for anchors and ties.

**1.3.4 Quality Assurance Submittals:**

- 1.3.4.1 Submit masonry installer's qualifications including membership in good standing with Ontario Masonry Contractors Association (OMCA).
- 1.3.4.2 Submit independent testing laboratory credentials and certificate of Canadian Council of Independent Laboratories (CCIL) accreditation. Upon TTC approval, this laboratory becomes Contract designated laboratory.
- 1.3.4.3 Submit manufacturer's certificates stating that materials supplied are in accordance with this Section.
- 1.3.4.4 Submit Field Inspection Reports and Manufacture Plant Inspection Reports.

**1.3.5 Quality Control Submittals:**

- 1.3.5.1 Submit Work Plan which describes masonry Work material equipment and procedures that will be used on Contract.
- 1.3.5.2 Submit inspection pre-qualification, pre-construction and construction testing program for mortar grout and masonry wall assembly in accordance with CAN/CSA-A179.
- 1.3.5.3 Submit test results from Contract-designated testing laboratory.

**1.3.6 Closeout Submittals Package:**

- 1.3.6.1 Submit confirmation by Professional Engineer, licensed in the Province of Ontario, that manufacturing and installation of Masonry Work complies with the Contract Documents.

**1.4 QUALITY ASSURANCE**

**1.4.1 Regulatory requirements:**

- 1.4.1.1 In accordance with CSA S304.1 and CSA A370 for design requirements, and CSA A371 for construction requirements, except where more stringent requirements are indicated on Contract Drawings and specified in this Section.

- 1.4.1.1.1 Construction tolerances for masonry: In accordance with CSA A371.

- 1.4.2 Retain a Professional Engineer, licensed in the Province of Ontario, with experience in design, fabrication and erection of masonry Work of comparable complexity and scope, to perform the following services as part of the Work of this Section:

- 1.4.2.1 Design of structural members and connections.
  - 1.4.2.2 Stamp and sign Shop Drawings, design calculations and amendments.
  - 1.4.2.3 Review and report on manufacturer's and fabricator's quality control tests and reports for compliance with the Contract Documents.
  - 1.4.2.4 Conduct fabrication and erection inspections and prepare and submit written inspection reports verifying that the Work is in accordance with the Contract Documents and reviewed Shop Drawings.

- 1.4.3 Masonry Subcontractor's Qualification: Work shall be performed by masonry Subcontractor with minimum 5 years of experience in contracts of similar scope and complexity. Submit list of contracts, including name, address, and owner's contact information.
- 1.4.4 Pre-installation meeting:
  - 1.4.4.1 Conduct pre-installation meeting 14 Days prior to commencing Work of this Section. Contractor, TTC, masonry manufacturer, masonry installer, and parties who are directly affected by Work of this Section are to attend meeting.
  - 1.4.4.2 Verify Contract requirements, sequence of submittals, substrate conditions, manufacturer's installation recommendations, and manufacturer's warranty requirements.
  - 1.4.4.3 Within 72 hours after pre-installation meeting, prepare minutes of meeting, clearly indicating party required actions. Issue minutes to parties that attended pre-installation meeting.

## **1.5 DELIVERY, STORAGE, AND HANDLING**

- 1.5.1 Provide storage and handling in accordance with CSA A371.
- 1.5.2 Deliver and store masonry units on Site on wooden pallets. If not practical, stack masonry units carefully and neatly on high ground and on solid planks minimum 75 mm above grade.
- 1.5.3 If not used immediately after delivery, cover with non-staining tarpaulins or 6 mils thick polyethylene, adequately weighted or anchored down.
- 1.5.4 Lift skids with proper equipment and using sufficiently long slings or forks with protection to prevent damage to units/cubes, and lifted only by personnel experienced with equipment. Protect edges and corners of cubes.
- 1.5.5 Split twin packs into single cubes before loading onto scaffold.
- 1.5.6 Handle with care for smooth finished masonry units.
- 1.5.7 Deliver mortar materials in original, unbroken, and undamaged packages with manufacturer's name and brand.
- 1.5.8 Store bagged Products such as mortar and metal accessories in dry, waterproof area.
- 1.5.9 Store mortar materials to prevent deterioration or contamination by foreign materials.
- 1.5.10 Do not store units or equipment in areas which will obstruct access to Work.

## **1.6 SITE CONDITIONS**

- 1.6.1 In accordance with OHSA, erect scaffolding for execution of Work, maintain, and remove upon completion. Support scaffolding from unfinished surfaces.

## **2 Products**

### **2.1 UNIT MASONRY**

#### **2.1.1 General:**

- 2.1.1.1 Each type of unit masonry made by one manufacturer and uniform in colour, shade, and texture.



- 2.1.1.2 Include for special shapes and solid units as specified, and as detailed in accordance with Contract Drawings. Use manufacture special shapes at same time and with same batch as unit masonry. Unless specified otherwise, and provide the following:
- 2.1.1.2.1 Bull nosed or double bull nosed units for exposed and external corners. Only use bull nosed units with full and complete radius with no vertical ridge.
- 2.1.1.2.2 Concrete block lintels over openings in concrete block walls, except where steel lintels are specified in accordance with Contract Drawings.
- 2.1.1.2.3 Additional special shapes specified herein and in accordance with Contract Drawings.
- 2.1.1.3 Provide unit masonry with exposed surfaces free of cracks, chips, blemishes, and broken corners.

## **2.1.2 Concrete Block:**

- 2.1.2.1 General:
  - 2.1.2.1.1 Autoclave or bubble cure process, high pressure steam cured, modular, in accordance with CAN/CSA-A165.1.
- 2.1.2.2 Standard concrete blocks:
  - 2.1.2.2.1 Classification:
    - 2.1.2.2.1.1 SS/15/A/M: 75% solid and in accordance with Contract Drawings.
    - 2.1.2.2.1.2 H/15/A/M: For other block Work.
  - 2.1.2.2.2 Sizes: In accordance with Contract Drawings.
- 2.1.2.3 Fire-resistance-rated concrete blocks:
  - 2.1.2.3.1 1 hour fire-rated:
    - 2.1.2.3.1.1 SS/15/A/M: 75% solid and in accordance with Contract Drawings.
  - 2.1.2.3.2 Sizes: In accordance with Contract Drawings.

## **2.2 MORTAR AND GROUT**

### **2.2.1 Materials:**

- 2.2.1.1 In accordance with CAN/CSA-A179.

### **2.2.2 Water:**

- 2.2.2.1 Potable, clean, and free of ice, oil, acid alkali, organic matter, sediment or other harmful material in accordance with CAN/CSA-A179.

### **2.2.3 Aggregate:**

- 2.2.3.1 Aggregate for use in mortar: Sand, graded within limits specified in Table 1 of CAN/CSA-A179.
- 2.2.3.2 Aggregate for use in grout: Fine aggregate (sand) and course aggregate, graded within limits specified in Table 1 of CAN/CSA-A179.

### **2.2.4 Cementitious Materials:**

- 2.2.4.1 Portland cement: In accordance with CSA A3001. Use non-staining white cement where required to achieve colour selected by TTC.
- 2.2.4.2 Masonry and mortar cement: In accordance with CSA A3002.

2.2.4.3 Hydrated lime: In accordance with ASTM C207, Type S.

**2.2.5 Admixtures:**

2.2.5.1 Plasticizers, superplasticizers, and set-control admixtures: In accordance with ASTM C494/C494M.

2.2.5.2 Admixtures used in grout, not detrimental to grout or material or component in contact with grout.

**2.2.6 Mortar Types:**

2.2.6.1 In accordance with CAN/CSA-A179.

2.2.6.1.1 Type S:

2.2.6.1.1.1 Interior reinforced or non-reinforced walls.

2.2.6.1.2 Type N:

2.2.6.1.2.1 For interior walls that are non-load bearing.

2.2.6.1.3 Type O:

2.2.6.1.3.1 For repointing.

**2.2.7 Grout (for Filling Cells of Concrete Block):**

2.2.7.1 Unless indicated otherwise on Contract Drawings, select fine or coarse grout based on size of openings. Minimum grout space to use coarse grout is 50 mm.

2.2.7.2 Fluid grout to completely fill voids but not exhibiting excessive segregation or bleeding. When determining grout slump, consider:

2.2.7.2.1 Size to cell/opening to be grouted.

2.2.7.2.2 Initial rate of absorption of masonry unit.

2.2.7.2.3 Lift and pour height.

**2.2.8 Mortar and Grout Manufactured at the Site:**

2.2.8.1 Use only materials and mixing procedures that satisfy requirements of CAN/CSA-A179.

**2.2.9 Pre-Blended (Dry) Mortar and Grout Mixes:**

2.2.9.1 Bulk silo or bagged mortar/grout: No loose sand permitted on Site and hand mixing of bags and sand not permitted.

2.2.9.2 Manufacturer's Product(s):

2.2.9.2.1 Bétomix Plus by Daubois Inc.

2.2.9.2.2 Type N or Type S by Maxi-Mix.

2.2.9.2.3 Type N Mortar Mix by Quikrete Toronto Inc.

2.2.9.2.4 Type S Mason Mix by Quikrete Toronto Inc.

**2.2.10 Ready-Mix Mortar and Grout:**

2.2.10.1 Thoroughly mixed and delivered on Site with satisfactory degree of workability and without segregation of ingredients.

2.2.10.2 Batched at one of RMCAO plants and mixed and delivered in accordance with ready-mix concrete in CSA A23.1/A23.2.

**2.2.11 Acceptance Criteria:**

- 2.2.11.1 Basis of acceptance for mortar/grout manufactured on Site or mortar/grout manufactured in batching plant in accordance with CAN/CSA-A179, property specification.
- 2.2.11.2 Mortar manufactured on Site, mortar from pre-blended (dry) mix or ready-mix mortar in accordance with CAN/CSA-A179, Clause 7.2.2.
- 2.2.11.3 Grout manufactured on Site, grout from pre-blended (dry) mix or ready-mix grout meets requirements of CAN/CSA-A179, Clause 7.2.3.
- 2.2.11.4 Performance of masonry constructed with mortar and grout in accordance with CAN/CSA-A179, Clause 9.

**2.3 MASONRY CONNECTORS AND REINFORCEMENT**

- 2.3.1 Connectors (Anchors, Ties and Fasteners) and Horizontal Joint Reinforcement (Bars, Rods, Wire Fabric, Metal Embedded in Masonry) in accordance with CSA A370 and CSA A371.
- 2.3.2 Corrosion protection and material compatibility:
  - 2.3.2.1 Fabricated connector parts from stainless steel in accordance with CSA A370 Level 3 corrosion protection.
  - 2.3.2.2 Connector parts made from same material to reduce risk of galvanic corrosion.
  - 2.3.2.3 Structural integrity and maximum permitted displacement in accordance with CSA A370.
- 2.3.3 Connector load determination: In accordance with CSA S304.1.
- 2.3.4 Manufacturer(s):
  - 2.3.4.1 FERO Corporation.
  - 2.3.4.2 Blok-Lok, a Hohmann & Barnard Company.
- 2.3.5 Manufacturer's Product(s):
  - 2.3.5.1 Select Products that made by one manufacturer.
  - 2.3.5.2 Refer to table under Product column.

Masonry Connectors and Horizontal Joint Reinforcement Summary Table		
LOCATION	USE	PRODUCT
Single wythe walls	Joint reinforcement with adjustable ties	Ladder or truss type joint reinforcement and adjustable tie by Blok-Lok.
Bonding Intersecting Masonry Walls	Mesh wall ties	Blok-Lok MWT Mesh wall tie and tie bar.
Tying concrete block to concrete block	Masonry to masonry ties	Fero Block Shear attach with V-tie and Insulation Support.
		Blok-Lok BL 507S Shear anchors, attach with Flex-O-Lok tie and Wedge-Lok.

- 2.3.6 Description of Different Types Masonry Joint Reinforcement, and Ties:
- 2.3.6.1 Joint reinforcement: Ladder or truss type reinforcement. Material: Stainless steel, AISI Type 304 in accordance with ASTM A580/A580M. Minimum wire diameter: 9 gauge: Mesh size to be 38 mm to 50 mm narrower than wall partitions.
- 2.3.6.2 Double adjustable tie: Combine with above ladder or truss type reinforcement with welded bar. Tie to restrain movement of outer wythe.
- 2.3.6.3 Mesh wall tie: Size: 1.29 mm diameter wire x 12.7 mm square. Material: Stainless steel wire, AISI Type 304 in accordance with ASTM A580/A580M.
- 2.3.6.4 Tie bars: Material: Stainless steel, AISI Type 304; Size: 6.35 mm thick x 38 mm wide with 50 mm bends x length to suit condition.
- 2.3.7 Products selection by applications:
- 2.3.7.1 Masonry to masonry connector:
- 2.3.7.1.1 Length: Suit concrete block width and thickness of insulation.
- 2.3.7.1.2 Flat plate: Stainless steel in accordance with ASTM A240/A240M.
- 2.3.7.1.2.1 Thickness: Minimum 1.5 mm.
- 2.3.7.1.2.2 Length: Accommodate insulation thickness.
- 2.3.7.1.2.3 Vertical tie adjustment holes in exterior end of plate.
- 2.3.7.1.3 Tie: Stainless steel wire AISI Type 604 in accordance with ASTM A580/A580M. Length to provide placement of tie legs to centreline ( $\pm 13$  mm) of brick and concrete block veneer masonry of solid, semi-solid or cored units.
- 2.3.7.1.4 Fasteners: Provide minimum two stainless steel fasteners for each tie.
- 2.3.8 Loose Lintels and Lateral Support Angles:**
- 2.3.8.1 Structural steel angles, HHS beams, brackets, shim plates, wedges and anchor bolts: Supplied by Section 05 50 00 to this Section, installed as part of Work of this Section, and in accordance with CSA G40.20/G40.21, Grade 350W.
- 2.3.8.2 Corrosion protection: Hot-dip galvanized steel components after fabrication, in accordance with ASTM A123/A123M.
- 2.4 ACCESSORIES**
- 2.4.1 Epoxy Bonding Adhesive:**
- 2.4.1.1 Epoxy based agent in accordance with ASTM C881/C881M, Type V, tinted to indicate on visual inspection where applied.
- 2.4.2 Compressible Filler:**
- 2.4.2.1 Sound, draft and dust blocking joint filler, adhesive impregnated, polyurethane foam, rated for joint movement of -25%/+25% (total 50%).
- 2.4.2.2 Manufacturer's Product(s):
- 2.4.2.2.1 Illmod 600 by Tremco (Canada) Ltd., division of RPM Company.
- 2.4.2.2.2 Backerseal (greyflex) by Emseal Joint Systems Ltd., distributed by DRE Industries Inc.
- 2.4.3 Joint Filler and Sealant:**
- 2.4.3.1 Refer to Section 07 92 00.

**2.4.4 Firestopping and Smoke Seals:**

2.4.4.1 Refer to Section 07 84 00.

**2.4.5 Concrete Block Control Joint Material:**

2.4.5.1 Rubber Control Joint by Hohmann & Barnard Company.

2.4.5.2 RS Series Rubber Control Joint by Blok-Lok Limited.

**2.4.6 Block Filler:**

2.4.6.1 Dry pack grout: 1 part Portland cement, 1-1/2 parts sand, 2 parts 9 mm pea gravel with water to dampen mixture.

3 Execution

**3.1 EXAMINATION**

3.1.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to TTC. Commencement of Work means acceptance of existing conditions.

3.1.2 Verify items provided by other Sections are properly sized and located.

**3.2 INSTALLATION**

3.2.1 General:

3.2.1.1 Install masonry in locations in accordance with Contract Drawings.

3.2.1.2 Perform masonry Work in accordance with requirements of CSA A371 and as specified in this Section.

3.2.1.3 Provide masonry Work plumb, level, and true to line, with vertical joints in alignment and horizontal courses level, uniform and straight.

3.2.1.4 Provide temporary bracing of masonry Work during and after erection until permanent support installed.

3.2.1.5 Keep joint thickness tolerances, lateral and vertical alignment tolerances, level alignment tolerances and cross-sectional tolerances in accordance with CSA A371.

3.2.1.6 Keep tolerance in plane of 3.2 mm in 2438 mm.

3.2.1.7 Keep exposed faces free from stains, chips cracks, and deformed units.

3.2.1.8 Buttering corners of units, throwing mortar droppings into joints, or excessive furrowing of bed joints not permitted. Do not shift, tap or adjust masonry units after laying masonry units and mortar has taken initial set.

3.2.1.9 Where adjustments are necessary after mortar has started to set, remove mortar, clean masonry units, and replace with fresh mortar.

3.2.1.10 Cutting:

3.2.1.10.1 Minimize cutting masonry units. Use full size masonry units without cutting wherever possible. Do not substitute cut units where special shapes are available.

3.2.1.10.2 Cut masonry units straight with clean, even, sharp, and unchipped edges. Cut units as required, for pattern indicated on Contract Drawings, to fit adjoining Work neatly or for flush mounted electrical outlets, grilles, pipes, and conduit, leaving 3.2 mm maximum clearance.

- 3.2.1.10.3 No chipped, cracked and otherwise damaged masonry units permitted.
- 3.2.1.10.4 Perform cutting accurately to accommodate items passing through or embedded in masonry, to meet surface that masonry abuts, and to fit various conditions, such as flush mounted electrical outlets, grilles, pipes, and conduit.
- 3.2.1.10.5 Perform cutting of masonry units with power driven abrasive cutting disc or diamond cutting wheel leaving maximum 3.2 mm clearance.
- 3.2.1.10.6 Rub cuts smooth and even with carborundum or emery stone.
- 3.2.1.11 Mortar joints:
  - 3.2.1.11.1 When mortar is thumbprint hard, tool mortar joints concave and smooth, unless specified otherwise.
  - 3.2.1.11.2 Strike joints flush in non-exposed areas or in accordance with Contract Drawings.
  - 3.2.1.11.3 Use sufficient force to press mortar tight against masonry units on both sides of joints.
  - 3.2.1.11.4 Remove excess material or burrs left after jointing. Use trowel or rub with burlap bag.
  - 3.2.1.11.5 Use non-staining tools.
  - 3.2.1.11.6 Lay joints 10 mm thick unless otherwise indicated on Contract Drawings. Fill joints solidly with mortar, except where specifically designated to be left open.
  - 3.2.1.11.7 Exposed means visible in completed Work, unpainted and painted.
  - 3.2.1.11.8 Stagger joints in every course. Align joints plumb over each other in every other course. Unify thickness in vertical and horizontal joints.
  - 3.2.1.11.9 Rake out joints around metal frames in openings 19 mm deep to allow sealant application.
  - 3.2.1.11.10 Lay units in full bed of mortar with joints solid in every course.
  - 3.2.1.11.11 Do not butter corner units, throw mortar droppings into joints, or excessively furrow bed joints. Do not shift or tap units after mortar has taken initial set. If adjustment is necessary after mortar has started to set, remove and replace with fresh mortar.
- 3.2.1.12 Single wythe masonry wall construction:
  - 3.2.1.12.1 In accordance with requirements for water-resistant, single wythe masonry construction of authorities having jurisdiction.
- 3.2.1.13 Intersecting walls and partitions:
  - 3.2.1.13.1 Except where masonry bond is specified, terminate abutting walls and partitions flush against face of abutted walls. Tie intersections at every second course as follows:
    - 3.2.1.13.1.1 Non-load bearing walls: Install ties of masonry reinforcement T sections or strips of hardware cloth embedded in mortar.
    - 3.2.1.13.1.2 Fill vertical joint at intersection of abutted walls and partitions solid with mortar. If movement joint is located at intersection, rake out both sides to 9 mm depth.
- 3.3 CONCRETE BLOCK**
  - 3.3.1 Provide concrete masonry units sound and free of cracks and surface defects. Handle units carefully to avoid chipping and breaking.
  - 3.3.2 Where pipes and ducts penetrate masonry, point neatly and accurately around pipes and ducts.

- 3.3.3 Leave no cells open in exposed Work.
- 3.3.4 Block Work has masonry (joint) reinforcement.
- 3.3.5 Do not wet concrete masonry units before or during laying of masonry.
- 3.3.6 Locate corners accurately.
- 3.3.7 Concrete block lintels:
  - 3.3.7.1 Construct concrete block lintels above openings and other locations as specified, and as required to secure built-in anchor bolts and anchors in accordance with Contract Drawings.
  - 3.3.7.2 Build concrete block lintels ensuring that lintel jointing coincides with regular bond. Provide bearing of minimum 200 mm at each end.
  - 3.3.7.3 Install and secure in place reinforcements in accordance with Contract Drawings.
  - 3.3.7.4 Place and consolidate grout without disturbing reinforcements. Grout minimum two courses of concrete block units below underside of lintels.
  - 3.3.7.5 Allow lintels to reach full strength before removing temporary supports.
- 3.3.8 Chases and recesses:
  - 3.3.8.1 Form chases and recesses for conduit, pipes, and ducts as masonry Work progresses. Do not enclose conduit runs until complete and approved by independent inspection company engaged by Contractor and reviewed by TTC. Make chases and recesses plumb with inside joints struck flush and interiors free of obstructions and cleaned-up on completion.
- 3.3.9 Masonry against concrete:
  - 3.3.9.1 Where masonry is laid against concrete, fill joints with mortar as each course is laid.
- 3.4 FIRESTOPPING AND SMOKE SEALS**
  - 3.4.1 Firestopping and smoke seals around penetrations, at movement joints and deflection spaces in fire separations to be part of Work of Section 07 84 00. Provide assistance to firestopping trade.
- 3.5 CONNECTORS AND REINFORCEMENT**
  - 3.5.1 Install connector (anchors, ties, and fasteners) and horizontal joint reinforcement (bars, rods, and wire fabric) in accordance with CSA A370 and CSA A371.
  - 3.5.2 Reinforce masonry walls with continuous horizontal joint reinforcement in every second block course and as specified herein.
  - 3.5.3 Provide prefabricated L and T sections at corners and wall intersections respectively.
  - 3.5.4 Provide extra reinforcement or reinforcing ties at openings so that first and second courses above and below openings are reinforced. Extend extra reinforcement 610 mm beyond opening in each direction.
  - 3.5.5 Anchor new masonry to concrete elements and existing construction at maximum 400 mm o.c. vertically in accordance with OBC.
  - 3.5.6 Lap ends of adjoining strips of reinforcement 150 mm or more.

3.5.7 Cut, bend and lap reinforcing units in accordance with manufacturer's recommendations for continuity at returns, offsets, pipe enclosures, and other special conditions. Bending of masonry reinforcement or ties not permitted.

3.5.8 Connectors:

3.5.8.1 Vertical spacing: Maximum of 400 mm o.c.

3.5.8.2 Horizontal spacing: At every stud, and 600 mm o.c. maximum at concrete back-up.

3.5.8.3 Openings: Within 300 mm from edge.

### **3.6 GROUT**

3.6.1 Grout batched at Site: Grout mix designed in accordance with CAN/CSA-A179 and requirements specified in this Section.

3.6.2 Use of admixture for purpose of reducing water content in grout and adding flowability is permitted provided strength of grout is not reduced. Add admixture to mix in accordance with manufacturer's recommendations. Discard grout that has begun to set.

3.6.3 Grout batched off-site: When grout is prepared using pre-blended mixes or ready-mix, follow manufacturer's recommendations for:

3.6.3.1 Mixing time and procedure.

3.6.3.2 Time limits for useful life.

3.6.3.3 Re-tempering, if allowed.

### **3.7 GROUT PLACEMENT (GROUTING)**

3.7.1 Perform grouting in locations in accordance with Contract Drawings and:

3.7.1.1 In cells of masonry units containing reinforcement or anchorage.

3.7.1.2 In and around metal frames, or other built-in items, unless otherwise indicated.

3.7.2 Keep mortar droppings and projections out of grout space. Clean webs, wythes, and reinforcements of mortar droppings prior to placing grout.

3.7.3 Cure masonry to prevent blowouts of mortar joints from hydrostatic grout pressure or grout consolidation.

3.7.4 Low-lift grouting:

3.7.4.1 Wall: Built up to 1.5 m, vertical reinforcement inserted in cells from top, and grout is placed in one continuous pour to top of wall.

3.7.4.2 Grout: Consolidated, before building additional height of wall.

3.7.5 High-lift grouting:

3.7.5.1 When pour height is greater than 1.5 m:

3.7.5.1.1 Submit proposed sequence of Work, including masonry height, cleaning, reinforcement installation and inspection, closing of cleanout opening, and pour height.

3.7.5.2 Leave cleanout openings at bottom of every cell to facilitate removal of mortar debris and inspection. Remove mortar droppings from cells and seal cleanouts after inspection and prior to placing of grout.

3.7.6 Consolidation: In accordance with CSA A371.

3.7.7 Prior to commencement of grouting, TTC will review placement of reinforcing steel.



- 3.7.8 Stop pours 38 mm below top of course of masonry to form key at pour joints.
- 3.7.9 Grout beams over openings in one continuous operation. Cover tops of unfilled cell columns under horizontal masonry beams with mesh wall tie or use special units to confine grout to beam section.
- 3.8 MORTAR - GENERAL**
  - 3.8.1 Mortar batched at Site: Mix mortar in accordance with CAN/CSA-A179 and as specified in this Section.
  - 3.8.2 Mix mortar with maximum amount of water consistent with workability for maximum tensile bond strength within capacity of mortar.
  - 3.8.3 Do not use mortar which has begun to set. Use mortar within 1.5 hours if air temperature is 25°C or higher, and 2.5 hours if air temperature is lower than 25°C, after initial mixing. Re-temper mortar within these periods only as required to restore workability. Discard mortar not used within these time limits or has begun to set. If necessary, mortar may be re-tempered within this time limit by replacing only water lost due to evaporation and by thoroughly re-mixing.
  - 3.8.4 Mortar batched off-site: When mortar is prepared using pre-blended mixes or ready-mix, follow manufacturer's recommendations for:
    - 3.8.4.1 Mixing time and procedure.
    - 3.8.4.2 Time limits for useful life.
    - 3.8.4.3 Re-tempering, if allowed.
    - 3.8.4.4 Discard mortar not used within its useful life or begin to set.
- 3.9 BUILT-IN ITEMS**
  - 3.9.1 Coordinate, locate, set-in-place, and bond into masonry as masonry Work progresses, items provided by other Sections including, but not limited to, the following:
    - 3.9.1.1 Metal doors, frames, and screens, anchors, bolts, straps, hangers, sleeves, inserts, loose steel lintels, and electrical switches, conduits and other anchorage or attachments as specified.
    - 3.9.1.2 Install built-in items in secure, neat, rigid, true, and plumb manner.
  - 3.9.2 Build wall openings, slot, and recesses required for ducts, grilles, pipes and other items.
  - 3.9.3 Prevent displacement of built-in items during construction. Check plumb, location, and alignment frequently as Work progresses.
  - 3.9.4 Brace door jambs to maintain plumbness. Set anchors between metal frames and masonry and fill voids between metal frames and masonry walls with insulation.
  - 3.9.5 Coordinate with other Sections to avoid cutting and patching.
- 3.10 STEEL LINTELS AND LATERAL SUPPORT SYSTEMS**
  - 3.10.1 Steel lintels supplied by Section 05 50 00 to this Section; install as part of Work of this Section.
  - 3.10.2 Steel lintels:
    - 3.10.2.1 Install steel lintels in accordance with Contract Drawings and as specified herein.
    - 3.10.2.2 Centre lintels above opening and provide minimum bearing 100 mm at each end.

- 3.10.2.3 Grout minimum two courses of concrete block units below underside of lintels.
- 3.10.2.4 Keep lintels supported until masonry above has reached required strength, as indicated in Contract Drawings.
- 3.10.3 Lateral support system:
  - 3.10.3.1 Install lateral support and anchorage in accordance with CSA S304.1 and as specified herein.
  - 3.10.3.2 Unless otherwise indicated on Contract Drawings, install lateral support angles at 1200 mm o.c. along top of concrete block walls. Secure lateral support anchors to building structure along wall. Perform necessary drilling of concrete and steel.
  - 3.10.3.3 Where junction of wall and structure are visible in completed building lay sash block so grooves engage in legs of metal anchors so anchorage is concealed.
  - 3.10.3.4 Where junction of wall and structure are concealed, lay top course to engage lateral support angles.

### **3.11 MASONRY PARTITIONS**

- 3.11.1 Non-load bearing:
  - 3.11.1.1 Carry partitions up through ceiling to structure above, unless indicated or specified otherwise.
  - 3.11.1.2 Terminate partitions within 25 mm of building structure above.
  - 3.11.1.3 Where partitions occur directly under and parallel to structural framing carry these partitions up to 19 mm of bottom of structural framing.
  - 3.11.1.4 Where walls and partitions are pierced by structural members, ducts, or pipes, fill voids with mortar to within 19 mm of members and flush with wall finishes.
  - 3.11.1.5 Fill spaces between partition and structure, structural framing, ducts and pipes with insulation and seal with compressible filler.

### **3.12 CONTROL JOINTS**

- 3.12.1 Control Joints:
  - 3.12.1.1 Provide joints design in accordance with NCMA TEK 10-2C, Figure 3 and in accordance with Contract Drawings.
    - 3.12.1.1.1 Joints permit free longitudinal movement, and allow transfer of lateral shear load by providing shear key.
  - 3.12.1.2 Provide vertical through-wall Control Joints at maximum 6 m o.c. (except as otherwise indicated or specified) in accordance with Contract Drawings and at the following locations:
    - 3.12.1.2.1 Door and screen openings.
    - 3.12.1.2.2 Junction between load-bearing to non-load bearing walls.
    - 3.12.1.2.3 Continuous walls having no openings, intersections or columns.
    - 3.12.1.2.4 High-stress concentrations and at points of weakness, for example at abrupt changes in work height, and at wall thickness changes such as at chases and at pilasters.
  - 3.12.1.3 Space Control Joints maximum 3.658 m from corners.
  - 3.12.1.4 Provide Control Joints within wall construction in locations in accordance with Contract Drawings.

- 3.12.1.5 Keep Control Joints free of debris.

### **3.13 REPAIR AND POINTING**

- 3.13.1 Remove and replace masonry units which are loose, chipped, broken, cracked, marked, stained, discoloured or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install with fresh mortar, and point to eliminate evidence of replacement.
- 3.13.2 During tooling of joints, enlarge cracks, holes or other defects. Point and completely fill with mortar.
- 3.13.3 Point joints including corners, openings, and adjacent Work for neat, uniform appearance, properly prepared for application of sealant where required.
- 3.13.4 Repoint defective joints as follows:
- 3.13.4.1 Cut back joints 12.7 mm to prevent damaging units. Remove dust and loose materials by brushing or by water jet.
- 3.13.4.2 If water jet is used, allow excess water to drain before repointing.
- 3.13.4.3 Repoint with same mix as original.
- 3.13.4.4 Pack mortar tightly in thin layers and tool joints or strike flush as required.

### **3.14 PROTECTION**

- 3.14.1 General: Protect masonry in accordance with CSA A371 and as specified in this Section.
- 3.14.2 Wall covering:
- 3.14.2.1 Completely cover partially completed wall when Work is not in progress.
- 3.14.2.2 Extend protective cover down both sides minimum 610 mm and secure in place.
- 3.14.2.3 Cover masonry Work below screens until screens and sills are installed.

### **3.15 MASONRY CLEANING**

- 3.15.1 Clean masonry in accordance with manufacturer's recommendations.
- 3.15.2 Clean exposed masonry surfaces, removing excess mortar as Work progresses. Dry brush installed masonry at end of each day's Work.
- 3.15.3 Remove mortar with wood paddles and scrapers before wetting. Saturate masonry with clean water and flush off loose mortar and dirt. Clean masonry using water, scrubbing brushes, and wood paddles only.
- 3.15.4 On completion of masonry Work, after mortar is thoroughly set and cured, and defective joints tuckered and pointed, clean masonry thoroughly.
- 3.15.5 Remove efflorescence in accordance with unit masonry manufacturer's recommendations, subject to TTC review, and acceptance of materials and methods by TTC.
- 3.15.6 Do not perform cleaning with metal brush or muriatic acid.

### **3.16 FIELD QUALITY CONTROL**

- 3.16.1 Perform compressive strength tests for the following:

- 3.16.1.1 Masonry units: Test and specimens number in accordance with CAN/CSA-A165 Series and ASTM C140.
- 3.16.1.2 Mortar for block: Tests in accordance with CAN/CSA-A179.
- 3.16.1.3 Grout: Tests in accordance with CAN/CSA-A179.
- 3.16.2 Perform additional field testing as required, in accordance with approved Quality Control Plan, and submit field test results from independent inspection company engaged by the Contractor to TTC for review.
- 3.16.3 TTC has the right to reject Work that does not meet requirements of this Section, and to require repair or replacement as necessary to rectify Work.
- 3.17 SITE CLEAN-UP**
- 3.17.1 Upon completion of Work of this Section, remove debris, equipment and excess material from Site.

**END OF SECTION**

1 General

**1.1 SECTION INCLUDES**

- 1.1.1 Design, labour, Products, equipment and services necessary for the structural steel Work in accordance with the Contract Documents.

**1.2 REFERENCES**

- 1.2.1 ASTM A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- 1.2.2 ASTM A307, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.
- 1.2.3 ASTM A325M, Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric).
- 1.2.4 ASTM A563M, Standard Specification for Carbon and Alloy Steel Nuts (Metric).
- 1.2.5 ASTM C1107/C1107M, Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
- 1.2.6 ASTM F436, Standard Specification for Hardened Steel Washers.
- 1.2.7 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- 1.2.8 CSA S16, Design of Steel Structures.
- 1.2.9 CISC, Handbook of Steel Construction.
- 1.2.10 CISC/CPMA 2-75, A Quick-drying Primer for Use on Structural Steel.
- 1.2.11 CSA S136 PACKAGE, North American Specification for the Design of Cold-Formed Steel Structural Members and S136.1, Commentary on North American Specification for the Design of Cold-Formed Steel Structural Members.
- 1.2.12 CSA W47.1, Certification of Companies for Fusion Welding of Steel.
- 1.2.13 CSA W55.3, Certification of Companies for Resistance Welding of Steel and Aluminum.
- 1.2.14 CSA W59, Welded Steel Construction (Metal Arc Welding).
- 1.2.15 CWB, Canadian Welding Bureau.
- 1.2.16 SSPC-SP6/NACE No. 3, The Society for Protective Coatings, Commercial Blast Cleaning.
- 1.2.17 SSPC-SP10/NACE No. 2, The Society for Protective Coatings, Near-White Blast Cleaning.

### 1.3 DESIGN REQUIREMENTS

- 1.3.1 Design details and connections in accordance with requirements of CSA S16 and CSA S136 to resist forces, moments, shears indicated or implied and handling, transportation and erection loads and as indicated on the Contract Drawings.
  - 1.3.1.1 Include in design for connections between columns, beams, girders, trusses and braces, and between such members as spandrel angles and beams, hangers, stiffeners and their supporting members.
  - 1.3.1.2 Standard connections such as connections for shear only:
    - 1.3.1.2.1 Select shear connections from the CISC, Handbook of Steel Construction.
    - 1.3.1.2.2 If forces are not indicated, select or design connections to support reaction from maximum uniformly distributed load that can be safely supported by beam in bending, if no point loads act on beam, assuming fully supported compression flange.
  - 1.3.1.3 Non-standard connections: Designed and stamped by a Professional Engineer, licensed in the Province of Ontario.
- 1.3.2 Structural design to accommodate active loads including live, dead, lateral, wind, seismic, handling, transportation and erection loads.
- 1.3.3 Design Connections:
  - 1.3.3.1 To safely withstand the combined effects of shear, moment and torque at applicable design stresses.
  - 1.3.3.2 Not to interfere with architectural clearance lines or finishes.
  - 1.3.3.3 Of base plate and cap plate bearing on column to column section by welding or grinding column to bear.
  - 1.3.3.4 Taking into account any eccentricity.
  - 1.3.3.5 With direct fastening to flanges of spandrel beams to restrain twisting.
  - 1.3.3.6 Single angle and fish-plate type connections are not permitted except for secondary, lightly loaded elements.
  - 1.3.3.7 Make single angle connections of wrapped type.

### 1.4 SUBMITTALS

- 1.4.1 Submit in accordance with Section 01 33 00.
- 1.4.2 Shop Drawings:
  - 1.4.2.1 Submit Shop Drawings in accordance with Section 01 33 23.
    - 1.4.2.1.1 Include shop and field splices, cuts, copes, camber, connection details, holes, reinforcements, bearing plates, welds, anchors, identification marks, surface preparation and finishes.
    - 1.4.2.1.2 Indicate welds in accordance with CSA W59 welding symbols standard.
  - 1.4.2.2 Submit sketches and design calculations for structural members and connections with the corresponding Shop Drawings.

**1.4.3 Erection Drawings:**

- 1.4.3.1 Submit erection drawings in accordance with Section 01 33 23.
- 1.4.3.1.1 Indicate details and information necessary for assembly and erection purposes such as description of methods, member identification, sequence of erection, type of equipment used in erection and temporary bracings.
- 1.4.3.1.2 Reproduction of the Contract Drawings for use as erection drawings is not permitted. Do not use Contract CADD files.

**1.4.4 Test Reports:**

- 1.4.4.1 Four (4) weeks minimum, prior to structural steel fabrication, submit 2 copies of mill test reports by steel manufacturer indicating chemical and physical properties of steel to be used in the Work and confirming that tests completed are in accordance with CSA G40.20/G40.21.

**1.4.5 Certifications:**

- 1.4.5.1 Submit certifications for welding companies under Division 1 or 2.1 in accordance with CSA W47.1 for fusion welding of steel structures, and CSA W55.3 for resistance welding of structural components.
- 1.4.5.2 Submit confirmation by the Professional Engineer that fabrication and erection complies with the Contract Documents.

**1.4.6 Inspection Reports:**

- 1.4.6.1 Submit field reports of shop and field inspections.

**1.5 QUALITY ASSURANCE**

- 1.5.1 Retain a Professional Engineer, licensed in the Province of Ontario, with experience in design, fabrication and erection of structural steel Work of comparable complexity and scope, to perform the following services as part of the Work of this Section:
  - 1.5.1.1 Design of structural members and connections.
  - 1.5.1.2 Stamp and sign Shop Drawings and erection drawings, design calculations and amendments.
  - 1.5.1.3 Review and report on manufacturer's and fabricator's quality control tests and reports for compliance with the Contract Documents.
  - 1.5.1.4 Conduct fabrication and erection inspections and prepare and submit written inspection reports verifying that the Work is in accordance with the Contract Documents and reviewed Shop Drawings and erection drawings.

**1.6 DELIVERY, STORAGE AND HANDLING**

- 1.6.1 Exercise care in handling primer finished materials.
- 1.6.2 Do not handle steel until primer paint has cured sufficiently to handle without damage to same. Use nylon slings for handling and a combination of wood or polystyrene blocking between units in stockpile and in transit.
- 1.6.3 Schedule and sequence the Work so a minimum of handling occurs prior to erection.

2 Products

**2.1 MATERIALS**

- 2.1.1 Rolled structural steel shapes and flat hot-rolled steel Products: In accordance with CSA G40.20/G40.21, Grade 300W.
- 2.1.2 Hollow structural sections (HSS): In accordance with CSA G40.20/G40.21, Grade 350W, Class H.
- 2.1.3 Beam connections, columns, base plates, beams, purlins, girts and sag rods: In accordance with CSA G40.20/G40.21.
- 2.1.4 Surface preparation: Remove moisture, oil, grease, dirt, excessive rust, loose mill scale and clean in accordance with SSPC-SP6/NACE No. 3.
- 2.1.5 Shop paint primer (prime painted steel): In accordance with CISC/CPMA 2-75.
- 2.1.6 Hot-dip galvanizing: In accordance with ASTM A123/A123M; minimum zinc coating of 600 g/m<sup>2</sup>.
- 2.1.7 Welding materials: In accordance with CSA W59 and certified by the CWB.
- 2.1.8 Anchor bolts: In accordance with ASTM A307, Grade C, with hexagon heads and nuts, lengths shown with a minimum of 13 mm projecting beyond the nut. Nuts: In accordance with ASTM A563M.
- 2.1.9 High strength bolts: In accordance with ASTM A325M, Type 1, heavy hexagon high strength bolts, of standard size, of lengths required for thickness of members joined and for type of connection.
  - 2.1.9.1 Lock washers, lock nuts, burr thread to prevent bolts from working loose.
  - 2.1.9.2 In accordance with ASTM A563M; hexagon semi-finished nuts.
  - 2.1.9.3 In accordance with ASTM F436; flat, smooth hardened washers, quenched and tempered.
- 2.1.10 Shear studs: In accordance with CSA W59, Appendix H.
- 2.1.11 Field touch-up primer (prime painted steel): In accordance with CISC/CPMA 2-75.

**2.2 FABRICATION**

- 2.2.1 Fabricate structural steel in accordance with CSA S16 and CISC, Handbook of Steel Construction fabrication tolerances except as indicated otherwise.
- 2.2.2 Splicing of members is not permitted except as indicated on the Contract Drawings or as accepted by TTC.
- 2.2.3 Clean, prepare surfaces and shop prime structural steel in accordance with CSA S16.
- 2.2.4 Prime interior structural steel in shop except if galvanized finish is indicated. Galvanize exterior and tunnel structural steel unless indicated otherwise.
- 2.2.5 Do not paint surfaces which will be embedded in concrete.
- 2.2.6 Continuously weld structural steel members where indicated.
- 2.2.7 Grind shop fabrication welds smooth.
- 2.2.8 Fabricate structural steel members true and without twists or open joints.



- 2.2.9 Weld in accordance with CSA W59.
- 2.2.10 Fabricate properly sized holes to accommodate other parts of the Work including holes required for attachment; locate holes to prevent appreciable reduction of structural member strength. Reinforce openings as necessary to maintain strength of structural members.
- 2.2.11 Fabricate HSS members with sufficient holes to prevent the accumulation of water.
- 2.3 STRUCTURAL GROUT**
- 2.3.1 Premixed, flowable, non-shrink grout without aggregate fillers: In accordance with ASTM C1107/C1107M, Masterflow 713 by Master Builders Technologies Ltd.; Sika Grout 212 by Sika Canada Inc.
- 3 Execution
- 3.1 EXAMINATION**
- 3.1.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to TTC. Commencement of Work means acceptance of existing conditions.
- 3.1.2 Obtain written approval from TTC prior to field cutting or altering of structural members.
- 3.2 MARKING**
- 3.2.1 Mark materials in accordance with CSA G40.20/G40.21.
- 3.2.2 Match marking: Mark bearing assemblies and splices in shop for fit and match.
- 3.3 STRUCTURAL STEEL ERECTION**
- 3.3.1 Supply and coordinate the location and placement of anchor bolts and base plates.
- 3.3.2 Erect structural steel in accordance with reviewed Shop Drawings and erection drawings and tolerances of CSA S16 and CISC, Handbook of Steel Construction tolerances except restrict the maximum variation in elevation to 6 mm.
- 3.3.3 Splicing of members is not permitted except as indicated on the Contract Drawings or as accepted by TTC.
- 3.3.4 Set steel accurately to lines and elevations indicated. Set column bases and shim to proper elevations. Install structural grouting in accordance with details and the manufacturer's recommendations.
- 3.3.5 Assemble structural steel members true, plumb and level, free of twists and open joints.
- 3.3.6 Make high strength bolted connections in accordance with CSA S16.
- 3.3.7 Weld in accordance with CSA W59.

**3.4 FIELD TOUCH-UP PAINTING**

- 3.4.1 Upon completion of erection, mechanically brush clean bolts, rivets, welds and burned or scratched surfaces.
- 3.4.2 Touch-up damaged surfaces and surfaces without shop coat with field touch-up primer or touch-up primer for galvanized steel as applicable.

**END OF SECTION**

1 General

**1.1 SECTION INCLUDES**

1.1.1 Design, labour, Products, equipment, and services necessary for the metal fabrications Work in accordance with the Contract Documents.

**1.2 REFERENCES**

- 1.2.1 ASTM A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- 1.2.2 ASTM A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- 1.2.3 ASTM A307, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength.
- 1.2.4 ASTM A325, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
- 1.2.5 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- 1.2.6 ASTM A563, Standard Specification for Carbon and Alloy Steel Nuts.
- 1.2.7 ASTM B633, Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
- 1.2.8 CAN/CGSB 1.146, Cold Curing, Gloss Epoxy Coating.
- 1.2.9 CAN/CSA W117.2, Safety in Welding, Cutting, and Allied Processes.
- 1.2.10 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.
- 1.2.11 CISC/CPMA 1-73a, A Quick-drying One-coat Paint for Use on Structural Steel.
- 1.2.12 CSA A23.3, Design of Concrete Structures.
- 1.2.13 CSA S304.1, Design of Masonry Structures.
- 1.2.14 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- 1.2.15 CSA S16, Design of Steel Structures and CISC, Handbook of Steel Construction.
- 1.2.16 CSA S136 PACKAGE, Consists of CAN/CSA-S136 - North American Specification for the Design of Cold-Formed Steel Structural Members and S136.1, Commentary on North American Specification for the Design of Cold-Formed Steel Structural Members.
- 1.2.17 CSA W47.1, Certification of Companies for Fusion Welding of Steel.
- 1.2.18 CSA W48, Filler Metals and Allied Materials for Metal Arc Welding.
- 1.2.19 CSA W55.3, Certification of Companies for Resistance Welding of Steel and Aluminum.
- 1.2.20 CSA W59, Welded Steel Construction (Metal Arc Welding).
- 1.2.21 OBC, Ontario Building Code.
- 1.2.22 Ontario Ministry of Labour Engineering Data Sheet 2-04.
- 1.2.23 SSPC-Paint 20, Zinc-Rich Coating (Type I - Inorganic and Type II - Inorganic).

- 1.2.24 SSPC-PS Guide 12.00, Guide to Zinc-Rich Systems.
- 1.2.25 SSPC-PS Guide 12.01, One-Coat Zinc-Rich Painting System.
- 1.2.26 SSPC-PS Guide 22.00, Guide for Selecting One-Coat Preconstruction or Prefabrication Painting Systems.
- 1.2.27 SSPC-SP 1, Solvent Cleaning.
- 1.2.28 SSPC-SP 2, Hand Tool Cleaning.
- 1.2.29 SSPC-SP 3, Power Tool Cleaning.
- 1.2.30 SSPC-SP 6/NACE No. 3, Commercial Blast Cleaning.
- 1.2.31 SSPC-SP 11, Power Tool Cleaning to Bare Metal.

### **1.3 DESIGN REQUIREMENTS**

- 1.3.1 Where size of metal fabrication elements is not indicated on Contract Drawings, design metal fabrications to resist dead, live, wind, lateral and seismic loads in accordance with TTC Design Manual. Where applicable, additional design requirements for specific metal fabrication are indicated in Part 2.
- 1.3.2 Where connection details are not indicated on Contract Drawings, design fasteners and connections to concrete, masonry and structural steel elements in accordance with CSA A23.3, CSA S304.1, CSA S16 and CSA S136.

### **1.4 SUBMITTALS**

- 1.4.1 Submit in accordance with Section 01 33 00.
  - 1.4.1.1 **Shop Drawings:**
    - 1.4.1.1.1 Submit Shop Drawings for fabrication and erection in accordance with Section 01 33 23 indicating:
      - 1.4.1.1.1.1 Layouts, plans, elevations, and connections to the supports necessary for installation.
      - 1.4.1.1.1.2 Materials, profiles types and sizes, core thicknesses, finishes, joints, number and type of anchors, supports, reinforcement details, and accessories.
      - 1.4.1.1.1.3 Loads at each connection point to the structural element.
    - 1.4.1.1.2 Ensure Shop Drawings are uniform in size and based on field measurements.
  - 1.4.1.2 **Documentation:**
    - 1.4.1.2.1 Submit certifications for welding companies in accordance with CSA W47.1 for fusion welding of steel structures, and CSA W55.3 for resistance welding of structural components.
    - 1.4.1.2.2 Submit letter of certification by Canadian Welding Bureau (CWB) that companies are currently in good standing.
    - 1.4.1.2.3 Submit manufacturer mill test report.
- 1.4.2 **Quality Assurance Submittal:**
  - 1.4.2.1 Submit shop field reports and field inspections.

**1.4.3 Closeout Submittal:**

- 1.4.3.1 Submit confirmation by the Professional Engineer that fabrication and erection complies with the Contract Documents.

**1.5 QUALITY ASSURANCE**

- 1.5.1 Retain a Professional Engineer, licensed in the Province of Ontario, with experience in design, fabrication and erection of metal fabrication Work of comparable complexity and scope, to perform the following services as part of the Work of this Section:
- 1.5.1.1 Design of metal fabrications and connections.
- 1.5.1.2 Stamp and sign Shop Drawings, design calculations and amendments.
- 1.5.1.3 Review and report on manufacturer's and fabricator's quality control tests and reports for compliance with Contract Documents.
- 1.5.1.4 Conduct fabrication and erection inspections, prepare and submit written inspection reports verifying that Work is in accordance with Contract Documents and reviewed Shop Drawings and erection Drawings.
- 1.5.2 Manufacturer mill test report:
- 1.5.2.1 Submit 4 weeks prior to metal fabrication, two copies of mill test reports by manufacturer indicating chemical and physical properties of metal fabrication used in Work.

**1.6 DELIVERY, STORAGE AND HANDLING**

- 1.6.1 Exercise care in handling primer finished materials.
- 1.6.2 Do not handle steel until primer paint has cured sufficiently to handle without damage to same. Use nylon slings for handling and a combination of wood or polystyrene blocking between units in stockpile and in transit.
- 1.6.3 Prior to erection, schedule and sequence the Work to limit handling occurs.

**2 Products**

**2.1 MATERIALS**

- 2.1.1 Structural shapes, plates, and similar items: In accordance with CSA G40.20/G40.21, Grade 300W.
- 2.1.2 Hollow Structural Sections (HSS): In accordance with CSA G40.20/G40.21, Grade 350W, Class H.
- 2.1.3 Welding materials: In accordance with CSA W48 and CSA W59.
- 2.1.4 Steel pipe: In accordance with ASTM A53/A53M.
- 2.1.5 Stainless steel sheet and plate: In accordance with ASTM A240/A240M, Type 304; finished to XL blend S, brushed for exposed to view surfaces.
- 2.1.6 Primer paint: In accordance with CISC/CPMA 1-73a.
- 2.1.7 Shop primer for steel: As recommended by manufacturer.
- 2.1.8 Field touch-up primer: In accordance with Section 09 91 00, Painting and Finishing Schedule – INT-MISC.
- 2.1.9 Cold curing, gloss epoxy coating: In accordance with CAN/CGSB 1.146.

## 2.2 COMPONENTS

### 2.2.1 Electrical duct and mechanical pipe sleeves:

2.2.1.1 Galvanized pipe, sized for free passage of conduit.

2.2.1.2 Supply pipe sleeves to respective section for building in. Install when passing through walls, floors and ceilings.

2.2.1.3 Size sleeves to clear insulated surfaces, pipes and conduits with 13 mm minimum, unless noted otherwise.

2.2.1.4 Terminate sleeves flush with surfaces of walls and ceiling and extend 38 mm above floors, unless noted otherwise.

2.2.1.5 Seal and make waterproof and watertight sleeves of type suitable for application after installation of conduit or conductors.

### 2.2.1.6 Firestopping and smoke seals material:

2.2.1.6.1 Firestopping and smoke seals are specified under the Work of Section 07 84 00. Provide assistance to firestopping trade.

2.2.1.6.2 Pack void between sleeve and pipe, conduit, or other penetrations. In accordance with ULC requirement and maintain fire-resistance rating of the penetrated surface assembly.

2.2.1.7 Construct of steel pipe with annular fins continuously welded at midpoint in accordance with table below, unless noted otherwise, galvanized after fabrication:

Sleeve Diameter	Pipe Schedule	Annular Thickness	Fin Width
Up to 150 mm	40	6 mm	56 mm
200 to 300 mm	20	10 mm	88 mm
350 mm and up	10	10 mm	121 mm

## 2.3 ACCESSORIES

### 2.3.1 Fasteners:

2.3.1.1 Include bolts, nuts, washers, lock washers, anchor bolts, machine screws and machine bolts in accordance with ASTM A307, A325.

2.3.1.2 Supply fasteners in lengths as required to suit material being joined.

2.3.1.2.1 Bolt length: Flush with the nut when installed.

2.3.1.3 Use lock washer, lock nuts or double nuts for fastener assembly.

### 2.3.1.4 Hot-dip galvanized fasteners:

2.3.1.4.1 In accordance with ASTM A153/A153M.

2.3.1.4.2 Use for area exposed to weather or corrosive environment (for example, high humidity, chlorides or both).

2.3.1.4.3 Treat fastener threaded components (for example, bolt and nut) with the same process as a fastener assembly.

2.3.1.5 Use unfinished fasteners for areas that are not exposed to weather or corrosive environment.

- 2.3.1.6 Use stainless steel fasteners for joining stainless steel components, in accordance with ASTM F593.
- 2.3.1.7 Design fastener assembly to avoid galvanic corrosion when different metal type in contact.
- 2.3.2 Drilled anchors:
  - 2.3.2.1 Manufacturer's Products:
    - 2.3.2.1.1 HVA Adhesive System with HVU Capsules by Hilti Canada Corporation.
    - 2.3.2.1.2 HIT-HY 200 Safe Set System by Hilti Canada Corporation (fast cure).
    - 2.3.2.1.3 HIT - RE 500 Epoxy Adhesive Anchoring System by Hilti Canada Corporation (slow cure).
    - 2.3.2.1.4 HILTI HIT – HY 70 Masonry Adhesive Anchoring system.
    - 2.3.2.1.5 FLO-ROK FR5MAX Injection Adhesive Anchor by UCAN Fastening Products.
    - 2.3.2.1.6 Heavy Load Expansion Anchor (Part # LHL) by UCAN Fastening Products.
    - 2.3.2.1.7 KWIK BOLT-TZ Expansion Anchor by Hilti Canada Corporation.
    - 2.3.2.1.8 HSL-3 Expansion Anchor by Hilti Canada Corporation.
    - 2.3.2.1.9 HDA Undercut Anchor by Hilti Canada Corporation.

## **2.4 FABRICATION**

- 2.4.1 Verify dimensions of existing Work before commencing fabrications and report any discrepancies to TTC.
- 2.4.2 Fit and assemble Work in shop where possible. Execute Work in accordance with details and reviewed Shop Drawings.
- 2.4.3 Where shop fabrication is not possible, make trial assembly in shop.
- 2.4.4 Use self-tapping shake-proof screws on items requiring assembly by screws or in accordance with Contract Drawings.
- 2.4.5 Use screws for interior metal Work.
- 2.4.6 Use welded connections for exterior metal Work.
- 2.4.7 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.
- 2.4.8 Execute shop welding to requirements specified.
- 2.4.9 Carefully make and fit details. Take special care with exposed finished Work to produce a neat and correct appearance for TTC review.
- 2.4.10 Assemble members without twists or open joints.
- 2.4.11 Prior to fabrication, determine the correct size holes for connecting Work with other trades. Where possible, indicate holes on Shop Drawings.
- 2.4.12 Place holes not to cause appreciable reduction in strength of member.

## **2.5 WELDING**

- 2.5.1 Perform by electric arc process.
- 2.5.2 Execute welding to avoid damage or distortion to Work and in accordance with the following standards:
  - 2.5.2.1 CSA W48 for electrodes. If rods are used, only coated rods are allowed.
  - 2.5.2.2 CSA W59 for design of connections and workmanship.
  - 2.5.2.3 CAN/CSA W117.2 for safety.
- 2.5.3 Thoroughly clean welded joints and expose steel for a sufficient distance to perform welding operations.
- 2.5.4 Smooth finish welds.
- 2.5.5 Supply continuous and ground welds where exposed to view and paint finish.
- 2.5.6 Test welds for conformance and remove Work not meeting specified standards and replace to meet TTC review.

## **2.6 SHOP PAINTING**

- 2.6.1 Clean steel in accordance with SSPC-SP 6/NACE No. 3 to remove mill scale, oil, grease, weld flux and splatter.
- 2.6.2 Mask edges to be field welded.
- 2.6.3 Shop prime steel with one coat of primer paint to dry film thickness of 70 µm (0.07 mm), except items to be galvanized or concrete encased.

## **2.7 ZINC COATINGS**

### **2.7.1 Surface Preparation:**

- 2.7.1.1 Clean steel in accordance with SSPC-SP 3.
- 2.7.1.2 Clean steel for zinc-rich painting in accordance with SSPC-SP 10/NACE No. 2 or SSPC-SP 11.

### **2.7.2 Hot-Dip Galvanizing:**

- 2.7.2.1 In accordance with ASTM A123/A123M and ASTM A153/A153M.
- 2.7.2.2 For rolled, pressed and forged steel shapes, plates, bars and strips:
  - 2.7.2.2.1 Minimum mass of zinc coating for steel thickness 1 mm - 6 mm and greater: In accordance with ASTM A123/A123M.
- 2.7.2.3 Iron and steel hardware:
  - 2.7.2.3.1 Minimum mass of zinc coating for bolt, nuts, washer and fasteners, in accordance with ASTM A153/A153M.
- 2.7.2.4 After fabrication, hot-dip galvanized specific miscellaneous steel items in accordance with Contract Drawings. Plug relief vents air tight.
- 2.7.2.5 After galvanizing, remove plugs, ream holes to proper size and re-tap threads.
  - 2.7.2.5.1 Straighten shapes and assemblies true to line and plane after galvanizing.
  - 2.7.2.5.2 Repair damaged galvanized surfaces with zinc-rich primer in accordance with manufacturer's recommendation.



**2.7.3 Zinc-Rich Painting:**

- 2.7.3.1 Use for items when hot-dip galvanize is not applicable.
- 2.7.3.2 In accordance with SSPC-PS Guide 12.00, 22.00 and SSPC-PS Paint 20 and SSPC-PS 12.01.
- 2.7.3.3 Coating thickness: 15.24 - 127 µm (0.6 - 5.0 mil).
- 2.7.3.4 Apply using spray roller or brush.

**2.7.4 Zinc Plating by Electrolytic Process:**

- 2.7.4.1 Fasteners and hardware items:
  - 2.7.4.1.1 Coating thickness: 5.08 – 25.4 µm (0.2 - 1.0 mil) in accordance with ASTM B633.

**2.8 FABRICATED ITEMS**

**2.8.1 Steel Lintels and Lateral Bracing for Masonry Walls:**

- 2.8.1.1 Fabricate, supply, and deliver steel lintels and lateral supports to Section 04 20 00 for installation.
- 2.8.1.2 Lintel width: as indicated on Contract Documents.

**2.8.2 Inserts, Hangers and Supports:**

- 2.8.2.1 Make inserts drilled type.
- 2.8.2.2 Before openings are cut through structure, obtain TTC written acceptance for procedures, locations and reinforcements required.
- 2.8.2.3 Do not weld hangers to structural steel members or burn holes in structural steel.
- 2.8.2.4 Do not suspend items from steel decking.

**2.8.3 Mechanical Equipment Supports:**

- 2.8.3.1 Design supplementary steel structures to support mechanical equipment at locations and elevations in accordance with Contract Drawings.
- 2.8.3.2 Obtain dimensions and weights of equipment from reviewed mechanical Shop Drawings and Product data.
- 2.8.3.3 Arrange in accordance with Contract Drawing details where indicated, and with manufacturer's recommendations.
- 2.8.3.4 Submit Shop Drawings of support for each type and size of equipment, designed, reviewed and sealed by a Professional Engineer. Information should include:
  - 2.8.3.4.1 Equipment loads and connections.
  - 2.8.3.4.2 Connect details to building structure.
  - 2.8.3.4.3 Locations of equipment.
  - 2.8.3.4.4 Loads at each connection point to building structure.
- 2.8.3.5 Refer to Sections for particular requirements. Mechanical equipment requiring structural steel supports include, but are not limited to:
  - 2.8.3.5.1 Air handling units.
  - 2.8.3.5.2 Condenser units.

2.8.3.5.3 Fans.

2.8.3.5.4 Piping and ductwork.

**2.8.4 Counter Glazing Support Frame:**

2.8.4.1 Design and fabricate cantilevered steel frame to size and detail in accordance with reviewed Shop Drawings.

2.8.4.2 Coordinate Work of this Section with Sections 06 20 00 and 08 81 00.

2.8.4.3 Bottom rail:

2.8.4.3.1 Weld bar post to continuous stainless steel anchor plate.

2.8.4.4 Provide steel channel frame to support top of glass.

2.8.4.4.1 Provide structural support frame at head of units as required.

**2.8.5 Column/Wall Corner Guard:**

2.8.5.1 Continuous stainless steel plate (1.6 mm thick), fabricated to profiles indicated on Drawings, secured to column/wall with 3 mm thick x 50 mm stainless steel bent plate clip anchored at 450 mm c/c.

3 Execution

**3.1 EXAMINATION**

3.1.1 Examine previously installed Work, upon which this Section depends, verify dimensions and condition of existing Work, and coordinate repairs, alterations and rectification if necessary. Commencement of Work of this Section is deemed to signify acceptance of existing prior conditions.

3.1.2 Obtain TTC written approval prior to field cutting or altering of structural members.

**3.2 ERECTION**

3.2.1 Fit joints and intersecting members accurately.

3.2.2 Make Work in true planes with adequate fastenings.

3.2.3 Build and erect Work plumb, true, square, straight, level and accurate to sizes detailed, free from distortion or defects detrimental to appearance or performance.

3.2.4 Perform drilling of concrete and steel as required to fasten Work of this Section.

**3.3 ANCHORS AND FASTENING**

3.3.1 Provide all anchor bolts and drilled anchors, or other means of anchorage required for building into floors, walls and ceilings, where necessary to secure metal and wood to concrete, masonry or steel Work, other than anchorages specified under other Sections.

3.3.2 Set anchors in locations and spaced in accordance with Contract Drawings.

3.3.3 Properly secure anchor bolts and provide adequate reinforcing to ensure safe rigid installation for Work.

3.3.4 Use self-drilling expansion-type concrete anchors for attaching to masonry and concrete.

3.3.5 Fasten all components and items securely.

- 3.3.6 Use weld studs of size not larger than 10 mm for attaching miscellaneous materials and equipment to building steel. When weight of item requires larger fasteners, use clips or brackets and secure by welding or through bolting.
- 3.3.7 Use steel beam clamps of 2-bolt design to transmit load to beam web. Do not use C and I clamps.
- 3.4 FIELD PAINTING**
  - 3.4.1 Paint bolt heads, washers, nuts, field welds and previously unpainted items.
  - 3.4.2 Repair primer paint damaged during delivery and installation with colour match touch-up primer.

**END OF SECTION**



1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment, and services necessary for rough carpentry Work in accordance with Contract Documents.

**1.2 REFERENCES**

- 1.2.1 ASTM A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- 1.2.2 ASTM A325, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
- 1.2.3 ASTM D2898, Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing.
- 1.2.4 ASTM F1667, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.
- 1.2.5 CAN/CGSB 51.32-M, Sheathing, Membrane, Breather Type.
- 1.2.6 CAN/CSA O80 Series, Wood Preservation.
- 1.2.7 CAN/ULC-S102, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- 1.2.8 CSA O121, Douglas Fir Plywood.
- 1.2.9 CSA O141, Softwood Lumber.
- 1.2.10 National Lumber Grades Authority (NLGA), Standard Grading Rules for Canadian Lumber.

**1.3 QUALITY ASSURANCE**

- 1.3.1 Lumber identification: Grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- 1.3.2 Plywood identification: Grade mark in accordance with applicable CSA standards.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- 1.4.1 Protect materials from excessive moisture and weather during transit, storage, and erection.
- 1.4.2 At Site storage:
  - 1.4.2.1 Wrap material with moisture resistant covers.
  - 1.4.2.2 Store in dry, ventilated indoor area, and off the ground.

2 Products

**2.1 MATERIALS**

- 2.1.1 Lumber:
  - 2.1.1.1 Softwood, G4S, moisture content 19% or less at time of installation, in accordance with the following:
    - 2.1.1.1.1 CSA O141 and NLGA Standard Grading Rules for Canadian Lumber.

- 2.1.1.1.2 Board quality, dimension sizes, and post and timber sizes: Standard or better.
- 2.1.1.2 Lumber quality:
  - 2.1.1.2.1 Carefully select individual pieces with no knots and defects which can interfere with bolt placement, nailing, and connections.
- 2.1.1.3 Lumber defects:
  - 2.1.1.3.1 Discard wood with defects not suited to serve the intended function.
  - 2.1.1.3.2 Reject lumber with excessive warps, twists, bows, crooks, mildew, fungus, mould, improper cutting, and fitting.
- 2.1.2 Furring, blocking, nailing strips, grounds, bucks, and backing:
  - 2.1.2.1 G2S, kiln dried with moisture content 19% or less at time of installation, free from sap, shakes, splits, knots, and in accordance with the following:
    - 2.1.2.1.1 CSA O141 and NLGA, Standard Grading Rules for Canadian Lumber.
  - 2.1.2.1.2 Board quality: Construction or better.
  - 2.1.2.1.3 Dimension sizes: Construction light framing or better.
  - 2.1.2.1.4 Post and timber sizes: Construction or better.
- 2.1.3 Plywood:
  - 2.1.3.1 In accordance with CSA O121, G1S standard construction, exterior grade, laminated with waterproof adhesive.
- 2.1.4 Nails, spikes, and staples:
  - 2.1.4.1 In accordance with ASTM F1667: Spiral type.
- 2.1.5 Bolts:
  - 2.1.5.1 In accordance with ASTM A325, 12.7 mm dia. minimum, with nuts and washers unless noted otherwise.
- 2.1.6 Proprietary fasteners:
  - 2.1.6.1 Toggle bolts, expansion shields, lag bolts, screws, and inorganic fibre plugs as recommended by the manufacturer.
- 2.1.7 Wood screws:
  - 2.1.7.1 Countersunk head, full thread type.
- 2.1.8 Hot-dip galvanizing:
  - 2.1.8.1 In accordance with ASTM A153/A153M, Class A.
  - 2.1.8.2 Electroplated galvanized fastener is not permitted.

**3 Execution**

**3.1 INSTALLATION**

- 3.1.1 Fit and install wood furring, strapping, grounds, and blocking.
- 3.1.2 Adequately size, correctly place, and conceal members for finishes, fitments, and for Work under other Sections. Anchor wood members securely in place.

- 3.1.3 Install rough bucks, nailing strips, and linings to rough openings as required for backing for frames and other Work.
- 3.1.4 Bolt wood blocking or nailing strips to steel framing.
- 3.1.5 Align and plumb faces of furring and blocking to tolerance of 1:600.

### **3.2 FASTENERS**

- 3.2.1 Frame, anchor, fasten, tie, and brace members for required strength and rigidity.
- 3.2.2 Use hot-dipped galvanized fasteners for exterior Work, Work below grade, and for pressure treated lumber.
- 3.2.3 Countersink bolts and bolt heads as required for clearance of other Work.
- 3.2.4 Size fasteners to penetrate base member by half of fastener length minimum. Minimize splitting of wood members by staggering nails in direction of grain.
- 3.2.5 For plywood use spiral, annular, or resin coated nails and staples.

### **3.3 MISCELLANEOUS CARPENTRY WORK**

- 3.3.1 Provide rough carpentry indicated on Contract Drawings and as required to complete the Work.
- 3.3.2 Cooperate with other trades in installing items supplied by other Sections. Cut openings in woodwork when required, and make good disturbed surfaces.

**END OF SECTION**





1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment, and services necessary for finish carpentry Work in accordance with the Contract Documents.

**1.2 REFERENCES**

1.2.1 ANSI A208.2, Medium Density Fiberboard (MDF) for Interior Applications.

1.2.2 ANSI/ASME B18.6.1, Wood Screws (Inch Series).

1.2.3 ASTM A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

1.2.4 ASTM A240/A240M, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

1.2.5 ASTM C1378, Standard Test Method for Determination of Resistance to Staining.

1.2.6 ASTM C501, Standard Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser.

1.2.7 ASTM D1037, Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials.

1.2.8 ASTM D3023, Standard Practice for Determination of Resistance of Factory-Applied Coatings on Wood Products to Stains and Reagents.

1.2.9 CSA O151, Canadian Softwood Plywood.

1.2.10 NAAWS, North American Architectural Woodwork Standards – 3.1, 2017, including all errata and supplements.

**1.3 DEFINITIONS**

1.3.1 Exposed Interior Surfaces:

1.3.1.1 Interior surfaces exposed to view in open casework or behind transparent doors.

1.3.2 Semi-Exposed Surfaces:

1.3.2.1 Interior surfaces exposed to view when doors or drawers are opened.

1.3.3 Concealed Surfaces:

1.3.3.1 Exterior or interior surfaces covered or not normally exposed to view.

**1.4 SUBMITTALS**

1.4.1 Submit in accordance with Section 01 33 00.

**1.4.2 Shop Drawings:**

1.4.2.1 Submit in accordance with Section 01 33 23 indicating:

1.4.2.1.1 Performance criteria, compliance with appropriate reference standards, characteristics, limitations, and troubleshooting protocol.

1.4.2.1.2 Product transportation, storage, handling, and installation requirements.

- 1.4.2.1.3 Materials, thicknesses, sizes, finishes, hardware, wood species, profiles, connection attachments, shop jointing, field jointing, reinforcing, anchorage, fastener types and sizes, special installation conditions, mechanical and electrical service routes, cutout locations, and sizes. Include erection Drawings, plans, elevations, sections, and details as applicable.

**1.4.3 Samples:**

- 1.4.3.1 Submit samples of the following:

- 1.4.3.1.1 Each colour, pattern, and texture of decorative laminate, in manufacturer's standard tag size.

**1.5 QUALITY ASSURANCE**

- 1.5.1 Execute Work of this Section by member of AWMAC with 5 years' experience in finish carpentry Work of comparable complexity and scope.
- 1.5.2 Fabricate finish carpentry Work in accordance with NAAWS standards, Premium Grade materials, and installation.
- 1.5.3 Perform Work in accordance with NAAWS standards, First-Class Workmanship.
- 1.5.4 Perform metal Work of this Section by firm possessing modern architectural metal fabricating equipment and capable of cutting, fitting, bending, and installing stainless steel finishes, and capable of producing required quality Shop Drawings.
- 1.5.5 Remove and replace finish carpentry Work not meeting NAAWS standards requirements.

**1.6 DELIVERY, STORAGE, AND HANDLING**

- 1.6.1 Deliver, store, and handle finish carpentry in accordance with AWMAC Quality Standards.
- 1.6.2 Control temperature and humidity in accordance with AWMAC recommendations, before, during, and after finish carpentry delivery, and during storage and installation.
- 1.6.3 Provide suitable protective covering material for decorative laminate items. Take special precautions at corners.
- 1.6.4 Set up suitable area before millwork is delivered to Site. Avoid damage by excessive changes in moisture content.

**2 Products**

**2.1 MATERIALS**

**2.1.1 Lumber:**

- 2.1.1.1 For concealed framing:
- 2.1.1.1.1 In accordance with NAAWS standards, Custom Grade, S4S, eastern spruce, balsam fir, or jack pine, average moisture content 7% +/-2% at installation.

**2.1.2 Softwood Plywood:**

- 2.1.2.1 In accordance with CSA O151, 19 mm unless indicated otherwise, G2S.

**2.1.3 Medium Density Fibreboard (MDF):**

- 2.1.3.1 In accordance with ASTM D1037 and ANSI A208.2, Premium Grade for interior use.
- 2.1.3.2 Density: Minimum 700 kg/m<sup>3</sup>.
- 2.1.3.3 Formaldehyde emissions: Maximum 0.30 ppm per 0.424 m<sup>2</sup>/m<sup>3</sup> of room volume.
- 2.1.3.4 Fire-retardant treated for Class A with flame spread rating 0 to 25.

**2.1.4 Stainless Steel Sheet:**

- 2.1.4.1 In accordance with ASTM A240/A240M, Type 304 alloy.
- 2.1.4.2 Thickness: Minimum 1.6 mm.

**2.1.5 Draw Bolts and Splines:**

- 2.1.5.1 Type: In accordance with fabricator's recommendations.

**2.1.6 Nails and Staples:**

- 2.1.6.1 Size and type to suit application.
- 2.1.6.2 Galvanized in accordance with ASTM A153/A153M for exterior Work, interior humid areas, and for treated lumber.

**2.1.7 Bolts, Nuts, Washers, Blind Fasteners, Lags, and Screws:**

- 2.1.7.1 Size and type to suit application and nature of components joined.
- 2.1.7.2 Stapling not permitted.

**2.1.8 Wood Screws:**

- 2.1.8.1 In accordance with ANSI/ASME B18.6.1 stainless steel.
- 2.1.8.2 Type and size to suit application.

**2.1.9 Adhesive:**

- 2.1.9.1 In accordance with manufacturer's recommendations.

**2.1.10 Bituminous Mastic:**

- 2.1.10.1 Selected by millwork fabricator.

**2.2 COUNTERTOP**

**2.2.1 General:**

- 2.2.1.1 In accordance with NAAWS standards, Premium Grade, and as detailed on Contract Drawings.
- 2.2.1.2 Lumber and sheet Products used: In accordance with NAAWS standards.
- 2.2.1.3 Surface:
  - 2.2.1.3.1 Chemical resistance in accordance with ANSI/NEMA LD 3 and stain resistance in accordance with ASTM D3023, and ASTM C1378.
  - 2.2.1.3.2 Abrasion resistance in accordance with ASTM C501.
- 2.2.1.4 Concealed edgeband:
  - 2.2.1.4.1 Maximum 1.6 mm (1/16"), show on face and edge of plywood and particleboard.

**2.3 FABRICATION - METAL WORK**

- 2.3.1 Fabricate stainless steel Work in accordance with Section 05 50 00 requirements and as specified herein.

- 2.3.2 Maintain continuous, unbroken profiles during joining, and assembly process.
- 2.3.3 Construct finished Work free from distortion and defects detrimental to appearance and performance.
- 2.3.4 Smooth finished surfaces Work.
- 2.3.5 Conceal countersink exposed fastenings, where indicated on reviewed Shop Drawings.
- 2.3.6 Fabricate stainless steel brake formed countertop, front, sides, bases over plywood core, and additional miscellaneous Work, including stainless steel clad panels, to details shown.

**3 Execution**

**3.1 EXAMINATION**

- 3.1.1 Verify condition and dimensions of previously installed Work upon which this Section depends.
- 3.1.2 Report defects to TTC.
- 3.1.3 Commencement of Work means acceptance of existing conditions.

**3.2 INSTALLATION**

**3.2.1 General:**

- 3.2.1.1 Install Work in accordance with NAAWS standards and tolerances for architectural woodwork.
- 3.2.1.2 Set and secure finished carpentry in place, rigid, plumb, square, and level.
  - 3.2.1.2.1 Use appropriate devices in accordance with manufacturer's recommendations.
  - 3.2.1.2.2 Scribe and cut as required.
  - 3.2.1.2.3 Fit to abutting walls and surfaces.
  - 3.2.1.2.4 Fit into recesses and accommodate piping, columns, fixtures, outlets, other projecting, intersecting, and penetrating objects.
  - 3.2.1.2.5 Form joints to conceal shrinkage.
- 3.2.2 Trim and scribe moulds to conceal voids at walls, partitions, and ceilings, leaving maximum 1 mm gap.
- 3.2.3 Coordinate cutouts for plumbing fixtures, inserts, appliances, outlet boxes, and other fixtures, in finish carpentry. Round internal corners of cutouts and seal exposed cores.

**3.3 CLEAN-UP**

- 3.3.1 Upon completion of installation:
  - 3.3.1.1 Clean installed items of pencil and ink marks and broom clean area.
  - 3.3.1.2 Remove adhesives, sealants, and stains in accordance with manufacturer's recommendations.

**3.4 PROTECTION**

- 3.4.1 Protect surfaces from damage until Contract completion.

**END OF SECTION**

1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment and services necessary for firestopping and smoke seals  
Work in accordance with the Contract Documents.

**1.2 REFERENCES**

1.2.1 CAN/ULC S115, Fire Tests of Fire Stop Systems.

1.2.2 NFPA 130, Standard for Fixed Guideway Transit and Passenger Rail Systems.

1.2.3 OBC, Ontario Building Code.

**1.3 DESIGN DESCRIPTION**

1.3.1 Provide fire tested firestopping and smoke seal systems in locations including, but not limited to, the following:

1.3.1.1 Penetrations through fire-resistance-rated floor and roof assemblies requiring protected openings including both empty openings and openings that contain penetrations.

1.3.1.2 Penetrations through fire-resistance-rated wall assemblies including both empty openings and openings that contain penetrations.

1.3.1.3 Membrane penetrations in fire-resistance-rated wall assemblies where items penetrate one side of the barrier.

1.3.1.4 Joints in fire-resistance-rated assemblies to allow independent movement.

1.3.1.5 Joints through penetrations and membrane penetrations in smoke barriers and smoke partitions.

**1.4 SUBMITTALS**

1.4.1 Product Data, and Shop Drawings Package:

1.4.1.1 **Product Data:**

1.4.1.1.1 Submit manufacturer's Product data for all Products listed in this Section indicating:

1.4.1.1.1.1 Performance criteria, compliance with appropriate reference standards, characteristics, and limitations.

1.4.1.1.1.2 Product transportation, storage, handling, and installation requirements.

1.4.1.1.1.3 Submit firestopping manufacturer's Product data for materials and prefabricated devices including manufacturer's printed installation instructions.

1.4.1.2 **Shop Drawings:**

1.4.1.2.1 Submit Shop Drawings indicating:

1.4.1.2.1.1 Fire rated systems for each typical application.

1.4.1.2.1.2 Location of each proposed fire rated system.

1.4.1.2.1.3 Method of reinforcement anchorage, fastening and installation. Construction details should accurately reflect actual job conditions.

1.4.2 Quality Assurance Submittals Package:

1.4.2.1 **Manufacturer:** Submit qualifications of technical representative.

1.4.2.2 **Applicators:** Submit training letter(s) from the firestopping system manufacturer prior to firestopping installation.

1.4.2.3 **Certification:** Submit engineering judgments approved by authorities having jurisdiction prior to installation.

1.4.3 Closeout Submittals Package:

1.4.3.1 Submit a letter of certification to TTC certifying that all firestopping has been installed in accordance with approved ULC, C-UL or UL fire test standard for each type of penetration.

## 1.5 QUALITY ASSURANCE

1.5.1 Qualifications:

1.5.1.1 **Manufacturer's qualifications:** Products specified in this Section shall be supplied by a single manufacturer with a minimum of 10 years' experience.

1.5.1.2 **Applicator's qualifications:** Perform Work of this Section by manufacturer-approved workers with minimum 3 years' experience in similar Work.

1.5.2 Quality Control:

1.5.2.1 The manufacturer's technical representative shall be on Site during initial installation of the firestopping systems to verify proper Product selection and installation procedures.

1.5.2.2 Product selection and installation is in accordance with OBC, UL, ULC, C-UL listings and CAN/ULC S115 fire test standard to achieve the required fire protection rating.

1.5.2.3 Submit the manufacturer's engineering judgment identification number(s) and Shop Drawing details when no ULC, C-UL or UL system is available for an application. Engineering judgment drawings must follow the requirements set forth by the International Firestop Council.

## 1.6 DELIVERY, STORAGE AND HANDLING

1.6.1 Deliver materials undamaged in manufacturer's clearly labelled, unopened containers, identified with brand, type and ULC, C-UL or UL label where applicable.

1.6.2 Store materials under cover and protect from weather and damage in accordance with manufacturer's requirements, including temperature restrictions.

1.6.3 Comply with recommended procedures, precautions or remedies described in Safety Data Sheet (SDS) as applicable.

1.6.4 Do not use damaged or expired materials.

## 1.7 SITE CONDITIONS

1.7.1 In accordance with manufacturer's requirements and maintain a minimum temperature of 5°C for a minimum period of 24 h before application, during application and until application is fully cured.

2 Products

## 2.1 MANUFACTURERS

2.1.1 Manufacturers of rated systems, include:

2.1.1.1 AD Fire Protection Systems.

2.1.1.2 3M Canada Inc.

2.1.1.3 Tremco Canada.

2.1.1.4 Hilti Canada.

## **2.2 SYSTEMS**

2.2.1 Manufacturers shall comply with through-penetration firestopping systems and joint systems listed in the ULC Fire Resistance Directory – Volume III, or UL Products Certified for Canada (C-UL).

2.2.2 Manufacturers shall have fire protection specialists on their staff capable of providing technical support at Site, such as Contractor certification and firestopping systems selection.

2.2.3 Provide firestopping composed of components that are compatible with each other, the substrates forming openings and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.

2.2.4 Firestopping and smoke seals: Provide ULC, C-UL or UL listed Products and systems in accordance with CAN/ULC S115, suitable to actual application and installation conditions.

2.2.5 Comply with the requirements of NFPA 130 and OBC Article 3.9.1.1.

2.2.6 Do not use Products containing asbestos.

## **2.3 MATERIALS**

2.3.1 Firestopping system ratings: Comply with applicable OBC requirements for locations and hourly ratings of F, FH, or FTH designations.

2.3.2 Damming, back-up, supports and anchorage: Supply Products as required in accordance with the manufacturer's fire rated systems and to the acceptance of authorities having jurisdiction.

2.3.3 Primer: As recommended by the firestopping manufacturer.

2.3.4 Impaling clips: The manufacturer's standard Product, galvanized steel.

2.3.5 Water (if applicable): Potable, clean and free from injurious amounts of deleterious substances.

3 Execution

## **3.1 EXAMINATION**

3.1.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to TTC. Commencement of Work means acceptance of existing conditions.

3.1.2 Verify that substrates and surfaces to receive firestopping and smoke seals are clean, dry and frost free.

## **3.2 FIRESTOPPING AND SMOKE SEAL LOCATIONS AND RATINGS**

3.2.1 Supply and install ULC, C-UL, UL firestopping systems rated to match fire design rating of the assemblies into which they are installed.

**3.2.1.1 ULC FH Rating:**

3.2.1.1.1 Gaps at intersections of fire-resistance rated masonry and gypsum board partitions.

3.2.1.1.2 Control and sway joints in fire-resistance rated walls and partitions such as masonry and gypsum board.

3.2.1.1.3 Gaps at top of fire-resistance rated partitions such as masonry and gypsum board partitions.

**3.2.1.2 ULC FTH Rating:**

3.2.1.2.1 Penetrations through fire-resistance rated walls and partitions including mechanical and electrical services, and openings and sleeves for future use.

3.2.1.2.2 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.

**3.3 PREPARATION**

3.3.1 Prepare, modify and adjust void sizes, proportions and conditions to conform to fire rated assembly requirements such as assembly opening size and dimensional restrictions.

3.3.2 Mask adjacent surfaces to avoid spillage and over-coating of adjacent surfaces. Remove stains from adjacent surfaces.

**3.4 INSTALLATION**

3.4.1 Install firestopping and smoke seal systems in accordance with manufacturer's instructions and fire rated assembly to establish continuity and integrity of fire separations.

3.4.2 Install primers as recommended by firestopping Product manufacturers.

3.4.3 Install temporary forming, damming, back-up as required. Remove after materials have achieved initial cure and will resist displacement.

3.4.4 Use resilient, elastomeric firestopping systems in the following locations:

3.4.4.1 Openings and sleeves for future use.

3.4.4.2 Penetration systems subject to vibration or thermal movement.

3.4.5 Trowel and tool exposed firestopping Product surfaces to uniform, smooth finish.

3.4.6 Repair damaged firestopped surfaces to acceptance by TTC.

3.4.7 Install firestopping filler in horizontal joints with 2 impaling clips per 1200 mm length, maximum.

3.4.8 Identify each firestopping penetration assembly with permanent label listing the following:

3.4.8.1 Assembly and rating in hours.

3.4.8.2 Date of installation.

3.4.8.3 Installing company's name and telephone number.

**3.5 FIELD QUALITY CONTROL**

3.5.1 Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.

3.5.2 Notify the manufacturer's representative prior to concealing or enclosing firestopping materials and service penetration assemblies and arrange for the manufacturer's review.

3.5.3 Keep areas of work accessible until inspected by authorities having jurisdiction.



- 3.5.4 Perform patching and repairing of firestopping caused by cutting or penetrating of existing firestopping systems already installed by others.
- 3.5.5 Install a warning card that is clearly visible adjacent to all large and medium openings that may be re-penetrated. This card shall contain the following information:
  - 3.5.5.1 Warning that the opening has been firestopping protected.
  - 3.5.5.2 Indicate the firestopping system used (ULC, C-UL or UL).
  - 3.5.5.3 FH rating or FTH rating.
  - 3.5.5.4 Firestopping Product(s) used.
  - 3.5.5.5 Person to contact and phone number in case of modification or new penetration of firestopping system.
- 3.6 CLEAN-UP**
  - 3.6.1 Remove excess materials and debris and clean adjacent surfaces immediately after application.

**END OF SECTION**



1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment, and services necessary for sealants Work in accordance with Contract Documents.

**1.2 REFERENCES**

1.2.1 ASTM C510, Standard Test Method for Staining and Color Change of Single-or Multicomponent Joint Sealants.

1.2.2 ASTM C920, Standard Specification for Elastomeric Joint Sealants.

1.2.3 ASTM C1021, Standard Practice for Laboratories Engaged in Testing of Building Sealants.

1.2.4 ASTM C1193, Standard Guide for Use of Joint Sealants.

1.2.5 ASTM C1248, Standard Test Method for Staining of Porous Substrate by Joint Sealants.

1.2.6 ASTM C1330, Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants.

**1.3 SUBMITTALS**

1.3.1 Submit in accordance with Section 01 33 00.

**1.3.2 Product Data:**

1.3.2.1 Submit manufacturer's Product data describing sealant type, composition, recommendations or directions for surface preparation, material preparation, and material installation.

**1.3.3 Quality Assurance Submittals:**

1.3.3.1 Submit pre-installation meeting reports.

1.3.3.2 Submit field quality control inspection and test report results.

**1.4 QUALITY ASSURANCE**

1.4.1 Applicator qualifications:

1.4.1.1 Execute Work by applicators trained and approved by the manufacturer and having 5 years proven experience.

1.4.2 Independent inspection and testing agency:

1.4.2.1 Qualification: In accordance with ASTM C1021.

1.4.2.2 Conduct field inspection and testing of sealant with the manufacturer's representative for a minimum of 5% of joints, including mixing of materials, joint preparation, priming, joint profile and thickness, application, adhesion, cohesion, and tooling.

1.4.2.3 Prepare and submit inspection and test report results after each inspection. Include confirmation by the manufacturer that installation has been satisfactorily completed.

- 1.4.3 Manufacturer's representative:
  - 1.4.3.1 Review Site conditions, joint design, and installer's qualifications. Report unsatisfactory conditions to TTC.
  - 1.4.3.2 Check container labels, inspect preparation of substrate materials and review installation procedures 48 hours in advance of installation, and randomly test installed Work.
- 1.4.4 Pre-installation meetings:
  - 1.4.4.1 Conduct meetings 7 Days in advance of sealant installation.
  - 1.4.4.2 Include TTC, sealant manufacturer's representative, independent inspection and testing agency engaged by Contractor, and parties who are directly affected by the Work of this Section.
  - 1.4.4.3 Verify Contract requirements, substrate conditions, joint conditions and profile, weather conditions, and the manufacturer's installation instructions.
  - 1.4.4.4 Within 72 hours following the pre-installation meeting, prepare a pre-installation meeting report and issue to all parties in attendance.
    - 1.4.4.4.1 Clearly indicate the recommendations made during the pre-installation meeting, the required actions, and by whom.

## **1.5 DELIVERY, STORAGE, AND HANDLING**

- 1.5.1 Deliver materials to the Site in their original, unopened containers, with Product labels intact.
  - 1.5.1.1 Product labels: Identify the manufacturer's name, brand name, date of manufacture, grade, and type, application directions, and expiry date or shelf life.
- 1.5.2 Store flammable materials in safe containers to eliminate fire hazards.
- 1.5.3 Store materials in accordance with manufacturer's recommendations.
- 1.5.4 Maintain materials to prevent deterioration or contamination by foreign materials.
- 1.5.5 Keep materials dry and free from snow, ice and frost.

## **1.6 SITE CONDITIONS**

- 1.6.1 Do not proceed with installation of joint sealants when:
  - 1.6.1.1 Ambient air temperatures are less than 5°C.
  - 1.6.1.2 Joint substrates and recesses are wet or damp.
  - 1.6.1.3 Where contaminants which may interfere with adhesion have not been removed from joint substrates.
  - 1.6.1.4 Site conditions do not meet manufacturer's recommendations.

2 Products

**2.1 MATERIALS - SEALANTS**

**2.1.1 Type A:**

2.1.1.1 Single component, non-sag, non-paintable, silicone joint sealant, in accordance with ASTM C920, Type S, Grade NS, minimum Class 25, and non-staining when tested in accordance with ASTM C510 or ASTM C1248.

2.1.1.2 Colour:

2.1.1.2.1 To match adjacent substrate.

2.1.1.3 Manufacturer's Products:

2.1.1.3.1 Dow Corning Contractors Weatherproofing Sealant (CWS) by Dow Corning Corp.

2.1.1.3.2 Tremsil 400 by Tremco (Canada) Ltd., division of RPM Company.

2.1.1.3.3 Sikasil-N plus by Sika Canada Inc.

2.1.1.3.4 GE SWS by Momentive Performance Materials.

2.1.1.3.5 Pecora PCS by Pecora Corporation.

**2.1.2 Type C:**

2.1.2.1 Anti-microbial (mildew-resistant), non-paintable, silicone joint sealant, in accordance with ASTM C920, Type S, Grade NS, minimum Class 25, and non-staining when tested in accordance with ASTM C510 or ASTM C1248.

2.1.2.2 Colour:

2.1.2.2.1 Clear/translucent.

2.1.2.3 Manufacturer's Products:

2.1.2.3.1 Dow Corning 786 Silicone Sealant by Dow Corning Corp.

2.1.2.3.2 Tremsil 200 Silicone Sealant (with Fungicide) by Tremco (Canada) Ltd., division of RPM Company.

2.1.2.3.3 Sikasil-GP by Sika Canada Inc.

2.1.2.3.4 GE SCS1700 Sanitary by Momentive Performance Materials.

2.1.2.3.5 898NST by Pecora Corporation.

**2.1.3 Type F:**

2.1.3.1 Low dirt pick-up, silicone joint sealant, in accordance with ASTM C920, Type S, Grade NS, minimum Class 50, and non-staining when tested in accordance with ASTM C510 or ASTM C1248.

2.1.3.2 Colour:

2.1.3.2.1 To match adjacent substrate.

2.1.3.3 Manufacturer's Products:

2.1.3.3.1 Dow Corning 756 SMS Building Sealant by Dow Corning Corp.

2.1.3.3.2 Spectrem 3 by Tremco (Canada) Ltd., division of RPM Company.

2.1.3.3.3 SikaSil WS-295 by Sika Canada Inc.

2.1.3.3.4 GE SCS9000 Silpruf NB by Momentive Performance Materials.

2.1.3.3.5 Pecora 864NST by Pecora Corporation.

**2.1.4 Firestopping and Smoke Seals:**

2.1.4.1 Refer to Section 07 84 00.

**2.2 ACCESSORIES**

2.2.1 Primers:

2.2.1.1 Type recommended by sealant manufacturer for substrate, to promote adhesion and to prevent staining of adjacent surfaces for conditions encountered.

2.2.2 Joint backing:

2.2.2.1 Extruded, round, solid section, skinned surface, closed cell, soft polyethylene foam gasket stock, compatible with primer and sealant materials.

2.2.2.2 30% to 50% oversized.

2.2.2.3 Shore A hardness of 20, tensile strength 140 kPa to 200 kPa, in accordance with ASTM C1330.

2.2.2.4 Bond breaker type surface.

2.2.3 Bond breaker tape:

2.2.3.1 Polyethylene tape or other plastic tape recommended by sealant manufacturer to prevent sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint.

2.2.3.2 Provide self-adhesive, pressure sensitive tape where applicable.

2.2.3.3 Do not use material impregnated with oil, bitumen, non-curing polymer or similar deleterious material.

2.2.4 Cleaning agents:

2.2.4.1 Recommended by sealant manufacturer.

2.2.4.2 Free of oily residues or other substances capable of staining or harming joint substrates and adjacent surfaces.

2.2.5 Masking tape:

2.2.5.1 Non-staining, non-absorbent material compatible with joint sealants and surfaces adjacent to joints.

**3 Execution**

**3.1 EXAMINATION**

3.1.1 Verify substrate conditions and dimensions of previously installed Work upon which this Section depends.

3.1.2 Report defects to TTC. Commencement of Work means acceptance of existing conditions.

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**3.2 PREPARATION**

- 3.2.1 Ensure joint sealants, primers, joint backing, bond breaker and cleaning agents are compatible with one another and with joint substrates.
- 3.2.2 Prior to the commencement of sealant application, arrange for sealant manufacturer's representative to perform a site adhesion test on each substrate type to which each sealant will be applied.
- 3.2.3 Ensure surface preparation and primer recommendation is compatible with each substrate type.
- 3.2.4 Ensure masonry substrates have cured a minimum of 28 Days prior to proceeding with sealant Work.
- 3.2.5 Clean joints to receive sealants in accordance with the manufacturer's recommendations and as specified in this Section.
- 3.2.6 Remove foreign matter from joint substrates that could interfere with adhesion of joint sealant, including surface dirt, dust, old joint sealants, oil, grease, water, mortar, loose material, and other substances detrimental to sealant's performance.
- 3.2.7 Remove paints, except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer.
- 3.2.8 Remove lacquer or other protective coatings from metal surfaces, without damaging metal finish, using oil-free solvents.
- 3.2.9 Remove rust, mill scale, and coatings from ferrous metals.
- 3.2.10 Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants.
  - 3.2.10.1 Remove loose particles remaining after porous joint cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
  - 3.2.10.2 Porous joint substrates include, but are not limited to, the following:
    - 3.2.10.2.1 Unit masonry.
    - 3.2.10.2.2 Unglazed surfaces of ceramic tile.
- 3.2.11 Clean nonporous joint substrate surfaces with cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
  - 3.2.11.1 Wire brush, grinding, or sand blasting methods may be used on ferrous metals.
  - 3.2.11.2 Non-porous joint substrates include, but are not limited to, the following:
    - 3.2.11.2.1 Metal.
    - 3.2.11.2.2 Glazed surfaces of ceramic tile.
- 3.2.12 Joint priming:
  - 3.2.12.1 Prime joint substrates and apply primer in accordance with sealant manufacturer's recommendations.
  - 3.2.12.2 Confine primers to areas of joint-sealant bond.
  - 3.2.12.3 Spillage or migration to adjoining surfaces is not permitted.

3.2.13 Masking tape:

3.2.13.1 Prior to performing Work, use masking tape or other means to protect adjacent exposed surfaces from damage including, but not limited to, smearing and staining.

3.2.13.2 Remove protection immediately upon completion and clean adjacent, exposed surfaces of any compound deposited upon such surfaces.

**3.3 INSTALLATION**

3.3.1 Perform Work in accordance with manufacturer's recommendations for Products and applications indicated, unless more stringent requirements apply.

3.3.2 Use Products without additives or adulteration. Use one manufacturer's Product for each location in accordance with Article 3.7.

3.3.3 Perform Work in accordance with ASTM C1193.

3.3.4 Joint backing:

3.3.4.1 Install joint backing to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

3.3.4.1.1 Depth of recess: Maintain 2:1 joint width to depth ratio, up to a maximum of 13 mm, and not less than 6 mm at centre of joint.

3.3.4.1.2 Where recess is less than specified depth, cut back surface of recess to specified depth.

3.3.4.2 Do not leave gaps between ends of joint backings.

3.3.4.3 Do not stretch, twist, puncture, or tear joint backings.

3.3.4.4 Remove absorbent joint backings that have become wet before sealant application, and replace with dry materials.

3.3.4.5 Support joint backing on horizontal surfaces against vertical movement which might result from pedestrian or vehicular traffic loads.

3.3.5 Install bond breaker tape between sealant and back of joints where joint backing is not used.

3.3.6 Apply sealant immediately after adjoining Work is in condition to receive sealant Work and as follows:

3.3.6.1 Apply sealant in a continuous bead using gun with correctly sized nozzle. Use sufficient pressure to completely fill joint recess.

3.3.6.2 Ensure sealant has full, direct uniform contact with, and adhesion to, side surfaces of recess. Superficial pointing with skin bead is not acceptable.

3.3.7 Tooling:

3.3.7.1 Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified to form smooth, uniform sealant bead, free from ridges, wrinkles, sags, air pockets, embedded impurities, dirt, stains, or other defects.

3.3.7.2 At recesses in angular surfaces, finish sealant with flat profile, flush with face of material at each side.



- 3.3.7.3 At recesses in flush surfaces, finish sealant with concave face and flush with face of material at each side.
- 3.3.8 Immediately remove excess sealant and droppings.
- 3.3.9 Ensure sealant bead is uniform in colour.
- 3.3.10 Cure in accordance with the sealant manufacturer's recommendations. Do not cover up sealants until proper curing has taken place.
- 3.3.11 Remove defective sealant and reapply.

### **3.4 FIELD QUALITY CONTROL**

- 3.4.1 Retain an independent inspection and testing agency to conduct field inspection and testing of sealant.
- 3.4.2 Prepare and submit inspection reports to TTC.

### **3.5 CLEANING**

- 3.5.1 Clean surfaces adjacent to joints. Immediately remove sealant smears or other soiling resulting from application of sealants.
- 3.5.2 Remove masking tape and other residue.
- 3.5.3 Do not mar or damage finishes on materials adjacent to joints. Repair or replace marred or damaged materials.

### **3.6 PROTECTION**

- 3.6.1 Protect joint sealants:
  - 3.6.1.1 During and after curing period from contact with contaminating substrates.
  - 3.6.1.2 From damages by construction operations or other causes.
- 3.6.2 If damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated sealants immediately.

### 3.7 SEALANT LOCATIONS SCHEDULE

Sealant Locations Schedule	
<b>Type A</b>	Above grade level, vertical applications
	<ul style="list-style-type: none"><li>- General perimeter caulking (doors and frames, thresholds).</li><li>- Vertical control, lap joints application.</li><li>- Painted metals.</li><li>- Interior partition head to structure above.</li><li>- Interior metal frames joints.</li><li>- Locations not indicated on Contract Drawings and required sealant for Work.</li></ul>
<b>Type C</b>	Above grade level, horizontal and vertical applications
	<ul style="list-style-type: none"><li>- Tiled areas' horizontal and vertical control joints.</li><li>- At corners of tiled walls.</li></ul>
<b>Type F</b>	Above grade level, horizontal and vertical applications
	<ul style="list-style-type: none"><li>- Required non-staining to building materials.</li><li>- Masonry, where non-staining to building materials is required.</li></ul>

**END OF SECTION**

1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment and services necessary for the stainless steel frames Work in accordance with the Contract Documents.

**1.2 REFERENCES**

1.2.1 ANSI/BHMA A156.16, Auxiliary Hardware.

1.2.2 ASTM A167, Specification for Stainless and Heat Resisting Chromium-Nickel Steel Plate, Heat and Strip.

1.2.3 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated Galvanized or Zinc Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.2.4 ASTM A924/A924M, Specification for General Requirements for Steel Sheet, Metallic Coated by the Hot-Dip Process.

1.2.5 AWS D1.6., Structural Welding Code – Stainless Steel.

1.2.6 CAN4-S104-M, Standard Method for Fire Test of Door Assemblies.

1.2.7 CAN4-S105-M, Standard Specification for Fire Door Frames, Meeting the Performance Required by CAN4-S104M.

1.2.8 CSA W47.1, Certification of Companies for Fusion Welding of Steel Structures.

1.2.9 NFPA 80, Fire Doors and Windows.

**1.3 SUBMITTALS**

1.3.1 Submit in accordance with Section 01 33 00.

**1.3.2 Product Data and Shop Drawings Package:**

**1.3.2.1 Product Data:**

1.3.2.1.1 Submit manufacturer's Product data for all Products listed in this Section indicating:  
1.3.2.1.2 Frame construction.

**1.3.2.2 Shop Drawings:**

1.3.2.2.1 Submit Shop Drawings in accordance with Section 01 33 23, indicating:

1.3.2.2.1.1 Thickness and type of steel and finish.

1.3.2.2.1.2 Location of anchorages, joining, welding, sleeving, exposed fasteners, openings and arrangement for hardware.

1.3.2.2.2 Submit schedule indicate frames to be fire rated.

**1.4 QUALITY ASSURANCE**

1.4.1 Perform Work in accordance with requirements of the Canadian Steel Door and Frame Manufacturers Association.

1.4.2 Label and list fire rated frames by an organization accredited by the Standards Council of Canada in conformance with CAN4-S104-M and CAN4-S105-M for ratings or indicated. Fire labels must be factory applied by manufacturer.

1.4.3 Field application of fire labels is not permitted.

2 Products

**2.1 MANUFACTURERS**

2.1.1 M.J. Daley Manufacturing Co. Ltd.

2.1.2 S.W Fleming Ltd.

2.1.3 Ambico Ltd.

2.1.4 Trillium Steel Doors Ltd.

**2.2 FRAMES**

**2.2.1 Materials:**

2.2.1.1 **Stainless steel:** Tensioned levelled steel to ASTM A167, Type 304, XL blend S, brushed finish.

2.2.1.2 **Minimum frame base stainless steel thickness:** 2.0 mm.

**2.2.1.3 Frame anchors:**

2.2.1.3.1 Frames in masonry: 1.6 mm minimum, adjustable T-strap jamb anchors.

2.2.1.3.2 Labelled frames: Brass plate, riveted to door and door frame, in accordance with ULC requirements.

2.2.1.4 **Floor anchors:** 3.5 mm minimum adjustable floor clip angles with 2 holes for anchorage to floor.

**2.3 FABRICATION**

**2.3.1 General:**

2.3.1.1 Fabricate frames in accordance with reviewed Shop Drawings.

2.3.1.2 Welding: Continuous unless specified otherwise. Execute welding by a firm fully acceptable to the American Welding Society to requirements of AWS D1.6.

2.3.1.3 Form profiles accurately to details shown on Contract Drawings.

2.3.1.4 Ream and remove burrs from drilled and punched holes.

2.3.1.5 Grind welded corners and joints to a flat plane and fill with metallic filler and sand to a uniform smooth finish. Grind and polish stainless steel to match adjacent finish.

**2.3.2 Frames:**

2.3.2.1 Fabricate frames of welded construction. Cut mitres and joints accurately and weld continuously on inside of frame profile. Make direction of stainless steel grain vertical on frame faces.

2.3.2.2 Construct large frame sections with provision for on Site assembly to suit Site conditions.

2.3.2.3 Blank, reinforce, drill and tap frames for mortised, templated hardware. Protect mortised cut-outs with guard boxes.

2.3.2.4 Reinforce frames where required for surface mounted hardware.

2.3.2.5 Install 2 channel or angle spreaders per frame, to ensure correct frame alignment. Install stiffener plates or spreaders between frame trim where required, to prevent bending of trim and to maintain alignment when setting in place.

**2.3.3 Anchorage:**

- 2.3.3.1 Anchor units to floor and wall construction. Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb, minimum number of anchors for each jamb:
  - 2.3.3.1.1 Frames up to 2285 mm: 3 anchors
- 2.3.3.2 Where frames are to be set in masonry, supply adjustable anchors to trade installing frame.
- 2.3.3.3 Fabricate frames for installation in gypsum board partitions with steel anchors of suitable design, minimum number of anchors for each jamb:
  - 2.3.3.3.1 Frames up to 2285 mm height: 4 anchors

3 Execution

**3.1 EXAMINATION**

- 3.1.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to TTC. Commencement of Work means acceptance of existing conditions.

**3.2 STAINLESS STEEL FRAME INSTALLATION**

- 3.2.1 Install stainless steel frames plumb, square, level, secure, and at correct elevation.
- 3.2.2 Secure anchorages and connections to adjacent construction. Brace frames rigidly in position while building-in. Remove temporary steel shipping jamb spreaders. Install wood spreaders at third points of frame rebate height to maintain frame width. Supply and install vertical support at centre of head for openings over 1200 mm in width. Remove wood spreaders after frames have been built-in.
- 3.2.3 Allow for structural deflection and prevent structural loads from being transmitted to stainless steel frames.

**3.3 FIRE RATED FRAMES**

- 3.3.1 Install fire rated frames in accordance with requirements of NFPA 80.

**3.4 DOOR HARDWARE**

- 3.4.1 Install door hardware supplied by Section 08 71 00.
- 3.4.2 Install door hardware in accordance with hardware templates and manufacturers' written instructions.
- 3.4.3 Adjust fixed and operable hardware for correct clearances and function.

**3.5 ADJUSTING AND CLEANING**

- 3.5.1 Clean frames after installation.

**END OF SECTION**



1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment and services necessary for the wood flush doors Work in accordance with the Contract Documents.

**1.2 ABBREVIATIONS**

1.2.1 **EHDPC:** Extra heavy-duty particleboard core.

1.2.2 **FD:** Fire resistant core.

1.2.3 **HPDL:** High pressure decorative laminate.

**1.3 REFERENCES**

1.3.1 ANSI/NEMA LD3, High-Pressure Decorative Laminates (HPDL).

1.3.2 ANSI/NEMA LD3.1, Performance, Application, Fabrication and Installation of High Pressure Decorative Laminates.

1.3.3 ANSI/WDMA I.S. 1A, Industry Standard for Architectural Wood Flush Doors.

1.3.4 ASTM E90, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

1.3.5 AWMAC, Architectural Woodwork Manufacturer's Association of Canada, Quality Standards for Architectural Woodwork.

1.3.6 CAN/ULC-S104, Standard Method for Fire Tests of Door Assemblies.

1.3.7 CAN4-S105M, Fire Door Frames Meeting the Performance Required by CAN/ULC-S104.

1.3.8 CEPA, Canadian Environmental Protection Act, Volatile Organic Compound (VOC) Concentration Limits for Architectural Coating Regulations.

1.3.9 ITS/Warnock-Hersey Mark for Fire Door Test Certificate.

1.3.10 NFPA 80, Standard for Fire Doors and Other Opening Protectives.

1.3.11 NFPA 252, Standard Methods of Fire Tests of Door Assemblies.

1.3.12 SCC, Standards Council of Canada.

**1.4 SUBMITTALS**

1.4.1 Submit in accordance with Section 01 33 00.

**1.4.2 Product Data, Shop Drawings and Documentation Package:**

**1.4.2.1 Product Data:**

1.4.2.1.1 Submit copies of manufacturer's Product data indicating:

1.4.2.1.1.1 Manufacturer's storage and handling recommendations.

1.4.2.1.1.2 Hanging preparation and installation instructions for each type of door.

1.4.2.2 **Shop Drawings:**

1.4.2.2.1 Submit Shop Drawings in accordance with Section 01 33 23 indicating:

1.4.2.2.1.1 Core materials, construction, factory finishes, blocking for hardware, undercut requirements, and other pertinent data.

1.4.2.2.1.2 Elevations indicating size, thickness and type, swing and fire rating label.

1.4.2.2.1.3 Cross reference each door to the Door Schedule.

1.4.2.3 **Documentation:**

1.4.2.3.1 Submit certification that fire-rated doors have been tested in accordance with CAN/ULC-S104, NFPA 252 and as indicated in the Door Schedule on Contract Drawings.

**1.4.3 Warranty:**

1.4.3.1 Submit extended warranty in accordance with Article 1.7.

**1.5 QUALITY ASSURANCE**

1.5.1 Perform Work in accordance with requirements of AWMAC and ANSI/WDMA I.S. 1A.

1.5.2 Provide fire-rated doors in accordance with NFPA 80 when tested in accordance with CAN/ULC-S104 and NFPA 252.

1.5.3 Label and list fire-rated doors by an organization accredited by the Standards Council of Canada (SCC) in accordance with CAN/ULC-S104, CAN4-S105M and ITS/Warnock-Hersey for ratings specified or indicated.

**1.6 DELIVERY, STORAGE AND HANDLING**

1.6.1 Do not deliver any Products to Site until building is completely enclosed.

1.6.2 Ensure Products will not be damaged by exposure to excessive moisture.

1.6.3 Deliver, store and handle wood doors in accordance with the AWMAC Quality Standards amended as follows:

1.6.3.1 Deliver doors in factory applied plastic bags or heavy-duty paper protective cartons. Mark packaging with sufficient identification to ensure proper door location.

1.6.3.2 Handle wood doors carefully to prevent damage. Lift or carry; do not drag. Replace damaged doors.

1.6.3.3 Store doors flat on a dry, level surface minimum 100 mm off floor in closed-in building with operational HVAC system. Maintain relative humidity between 25% to 55%. Keep away from sunlight.

1.6.3.4 Remove doors from Site which have scratches or other blemishes which cannot be removed by sanding and replace with new.

**1.7 EXTENDED WARRANTY**

1.7.1 Submit a written warranty for wood flush doors in accordance with the General Conditions, except that the warranty period is extended to 3 years against defects and deficiencies. Defects shall include, but not be limited to, buckling, opening of seams, warping in excess of 6 mm, delamination of face veneer, telegraphing of core construction or any excessive colour fading. Upon written notification by TTC, promptly repair and/or replace such doors.



2 Products

**2.1 MANUFACTURES**

2.1.1 Baillargeon Doors Inc.

2.1.2 Marshfield Door Systems Inc.

2.1.3 Lambton Doors.

**2.2 MATERIALS**

**2.2.1 Wood Flush Doors:**

2.2.1.1 In accordance with AWMAC or ANSI/WDMA I.S. 1A.

2.2.1.2 Performance duty level: Extra heavy-duty.

2.2.1.3 Grade: Custom grade.

**2.2.2 Fire-Rated Doors:**

2.2.2.1 In accordance with ULC, UL or WHI.

2.2.2.2 Core for 45 minutes fire-rated doors: Mineral core with additional hardware blocking in accordance with AWMAC or ANSI/WDMA I.S. 1A, quality standard and manufacturer's requirements.

2.2.2.3 Stiles and rails for fire-rated doors: Manufacturer's standard in accordance with the manufacturer's labelling agency.

2.2.3 **Construction:** Five ply.

2.2.4 Edge Type C.

**2.2.5 Facing:**

2.2.5.1 **Plastic laminate facing:** In accordance with ANSI/NEMA LD3, 1.6 mm thick, heavy wear resistance, Grade GP, Type HD, suede finish, colour and pattern as selected by TTC.

2.2.5.1.1 Plastic laminate from one of the following manufacturers:

2.2.5.1.1.1 Arborite.

2.2.5.1.1.2 Formica Inc.

2.2.5.1.1.3 Nevamar Company LLC.

2.2.5.1.1.4 Wilsonart Canada.

2.2.6 **Crossband:** Minimum thickness 1.6 mm.

2.2.7 **Adhesive:** Water resistant, Type II, contact adhesive that does not contain added urea formaldehyde resins and complies with the maximum level of VOC permitted in accordance with CEPA, VOC Concentration Limits for Architectural Coating Regulations.

2.2.8 **Wood door sealer:** Type as recommended by the wood door manufacturer and complies with the maximum level of VOC permitted in accordance with CEPA, VOC Concentration Limits for Architectural Coating Regulations.

**2.3 FABRICATION**

2.3.1 Fabricate doors to the following dimensions except as indicated otherwise on Contract Drawings: 965 mm x 2150 mm x 44 mm.

- 2.3.2 Fabricate wood doors square, true and free from distortion or core ghost lines.
- 2.3.3 Provide blocking as required for surface mounted hardware to prevent the need for through-bolting.
- 2.3.4 Factory drill pilot holes for hinges.
- 2.3.5 Cut and Bevel Stile Edges:**
  - 2.3.5.1 Lock side: 3 mm in 50 mm.
  - 2.3.5.2 Hinge side: 1.5 mm in 50 mm.
- 2.3.6 Abrade back face of plastic laminate to improve adhesive bond and apply plastic laminate on both faces of doors. Bond materials under pressure to smooth surface free from distortion, waves, ridges or core ghost lines. Bevel plastic laminate edges 20°.
- 2.3.7 Radius inside corners of plastic laminate facing at cutouts to prevent cracking.

## **2.4 FIRE-RATED DOORS**

- 2.4.1 Fabricate and label fire-rated wood doors with hourly rating in accordance with Door Schedule.
- 2.4.2 In accordance with all applicable labelling agencies requirements and the construction standard of the manufacturer.

## **3 Execution**

### **3.1 EXAMINATION**

- 3.1.1 Examine existing conditions upon which Work of this Section depends. Report to TTC in writing on defects or discrepancies. Commencement of Work means acceptance of existing conditions.

### **3.2 INSTALLATION**

- 3.2.1 Install doors plumb, rigid, square, clear of floor finishes and with correct rebate opening for door installation.
- 3.2.2 In accordance with AWMAC or ANSI/WDMA I.S. 1A quality standard for wood door installation.

### **3.3 FIRE-RATED DOORS**

- 3.3.1 Install fire-rated doors in accordance with NFPA 80.

### **3.4 DOOR HARDWARE**

- 3.4.1 Install door hardware supplied by Section 08 71 00.
- 3.4.2 Install door hardware in accordance with hardware templates and manufacturer's instructions.
- 3.4.3 Adjust fixed and operable hardware for correct clearances and function.

### **3.5 ADJUSTING AND CLEANING**

- 3.5.1 Replace the following wood doors:
  - 3.5.1.1 Warped more than 3 mm, measured at any point on door relative to perfectly flat surface.
  - 3.5.1.2 Core telegraphing visible at 1500 mm distance under final Site lighting conditions.

3.5.2 Adjust doors for smooth and balanced door movement.

**3.6 SCHEDULE**

3.6.1 In accordance with Door Schedule on Contract Drawings.

**END OF SECTION**



1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment, and services necessary for finish hardware Work in accordance with Contract Documents.

**1.2 REFERENCES**

1.2.1 ANSI/BHMA A156.18, Materials and Finishes.

1.2.2 NFPA 80, Fire Doors and Windows.

**1.3 HARDWARE GROUP REQUIREMENTS**

1.3.1 Refer to attachment 08 71 00.01 for hardware requirements for quantity and type of hardware for each hardware group.

**1.4 SUBMITTALS**

1.4.1 Submit in accordance with Sections 01 33 00 and 01 33 23.

**1.4.2 Shop Drawings:**

1.4.2.1 Submit the following:

1.4.2.1.1 Manufacturer's Product name and catalogue number, type of finish, quantities required.

1.4.2.1.2 Photographs and Drawings showing elevations, plans, and critical dimensions.

1.4.2.1.3 Compliance with reference standards, and fire ratings.

1.4.2.1.4 Features, functions, and technical data.

1.4.2.1.5 Locations and mounting heights of each type of hardware.

1.4.2.1.6 Transportation and installation requirements.

1.4.2.1.7 Supply door templates and required information to door and frame manufacturer to enable accurate sizes, locations of cut-outs, and reinforcement for hardware.

1.4.2.1.8 Submit templates and installation instructions to required trade to arrange for provisions for accurate setting and fitting of hardware.

1.4.2.1.9 Submit Door Hardware Schedule. Indicate Product, type, manufacturer, model number, base material, function, size, and finish information.

**1.4.3 Quality Assurance Submittal:**

1.4.3.1 Submit ULC or WH-ETL certification for hardware in fire separation and exit doors prior to Product delivery.

**1.4.4 Closeout Submittals:**

1.4.4.1 Submit the following for incorporation into Operation and Maintenance Manuals in accordance with Section 01 78 23:

1.4.4.1.1 Inspection reports.

1.4.4.1.2 Maintenance, adjustment, and repair instructions.

1.4.4.1.3 Warranty information.

## **1.5 QUALITY ASSURANCE**

- 1.5.1 Door hardware manufacturers:
  - 1.5.1.1 Companies registered with BHMA.
- 1.5.2 For hardware in fire separation and exit doors:
  - 1.5.2.1 ULC or WH-ETL certification.
- 1.5.3 Inspection report:
  - 1.5.3.1 Retain hardware consultant to prepare report. Hardware consultant to inspect completed installation, and verify hardware supplied and installed in accordance with manufacturer's recommendations.
- 1.5.4 Maintenance, adjustment, and repair instructions:
  - 1.5.4.1 Correct care of hardware, including information on lubrication of locksets, adjustments, and repairs of door closers, and general maintenance.

## **1.6 DELIVERY, STORAGE AND HANDLING**

- 1.6.1 Package hardware on set by set basis with complete set of screws, bolts, and fastenings necessary for complete installation.
- 1.6.2 Label packages legibly, indicating manufacturer's name, hardware name and model number, function, size, metal (type, thickness and finish) opening direction, (if applicable) and scheduled installation location. Cross reference to hardware groups.
- 1.6.3 Include packing slip complete with list of parts, name of manufacturer, and installation door number.
- 1.6.4 Protect prefinished surfaces with wrapping and strippable coating as required to prevent scratches, nicks, and blemishes.
- 1.6.5 Replace defective or damaged hardware with new.
- 1.6.6 Deliver hardware to Site in original factory packaging in accordance with Section 01 62 00.
- 1.6.7 Store hardware indoors, in secure dry, clean, well-ventilated area, and in accordance with manufacturer's recommendations.

## **1.7 SPECIAL TOOLS AND EXTRA STOCK MATERIALS**

- 1.7.1 Supply in accordance with Section 01 78 43:
  - 1.7.1.1 Cleaning solution for stainless steel frames.
  - 1.7.1.2 Two (2) sets of wrenches for fire exit hardware.

## **2 Products**

### **2.1 GENERAL**

- 2.1.1 Ensure each hardware item of same type, design, and manufacturer.
- 2.1.2 Ensure selected hardware functions are correct and in accordance with Contract requirements and authorities having jurisdiction.
- 2.1.3 Verify each door handing corresponds to direction of door opening indicated on the Contract Drawings.

- 2.1.4 Verify cylindrical lockset compatible with TTC key in lever (KIL) Medeco KIL 20 200, request information from TTC.
- 2.1.5 Inform TTC of discrepancies in the Contract Documents regarding quality, quantity, operation or function of hardware selected.
- 2.1.6 Fire rated hardware:
- 2.1.6.1 Selected and installed in accordance with applicable codes and regulations, NFPA 80, and to approval of authorities having jurisdiction.
- 2.1.6.2 ULC labelled.
- 2.1.7 Locksets and latch sets on fire rated doors: Minimum 19 mm throw.
- 2.2 HARDWARE MANUFACTURE GROUP**
- 2.2.1 Select hardware entirely from one of manufacturers indicated in Article 2.3. Avoid mixing Products from different manufacturers unless otherwise indicated.

**2.3 MATERIALS**

- 2.3.1 Hardware types and manufacturers:

Hardware Types	Manufacturer's Parts and Products			Finish
	DORMA + KABA GROUP	ALLEGION GROUP	ASSA ABLOY GROUP	
Standard weight butt hinge	PBB CB51 - 4 1/2" x 4" x NRP	IVES 3CB1 - 4 1/2" x 4" x NRP	McKinney TA314 - 4 1/2" x 4" x NRP	630
Deadbolt	Dorma - D800 Series	Schlage - B600 Series	Sargent - 480 Series	626
Cylindrical storeroom lockset	Dorma C800 SERIES ("LR Lever) Prepare with 20200V1(S) core	Schlage ND SERIES (Rhodes Lever with Vandguard Feature) Prepare with 2020073(S) core	Arrow QL SERIES with 20200H1(S) core	626
Surface door closer (with metal cover)	Dorma - 8900 Series	LCN - 4041XP Series	Sargent - 351 Series	689
Manufacturer	CBH	ALLEGION GROUP	ASSA ABLOY GROUP	
Kickplate	CBH 903 x SIZE x 3M TAPE	Standard Metal K10A - SIZE x 3M Tape	Rockwood K1050 x SIZE x SA	630
Floor stop	CBH -CBH 110 or 100	IVES - FS13 or FS17	Rockwood - 438 or 439	626
Wall stop	CBH - CBH 140	IVES - WS406CVX	Rockwood - 406	626

Manufacturer	K.N. CROWDER MFG. INC.	PEMKO	NATIONAL GUARD PRODUCTS	
Weatherstripping	W-14	312_R	134NA	AL
Door Sweep	W-13S	315_N	200NSS	AL
Threshold	CT-9	170A	424	AL

## 2.4 FASTENINGS

- 2.4.1 Provide fastening devices required for satisfactory installation and operation of hardware.
- 2.4.2 Attach items to masonry or concrete with expandable shields, lag screws, bolts or other fastening devices as required.
- 2.4.3 Fasteners to be stainless steel, with Phillips or Robertson heads, unless indicated otherwise in hardware schedule. Exposed fastenings to match existing hardware.

## 2.5 FINISHES

- 2.5.1 Metal finishes: Free from defects, clean, unstained, and of uniform colour for each type of finish required.
- 2.5.2 Finishes and categories: In accordance with ANSI/BHMA A156.18.

626	Satin chromium plated over nickel; base material brass/bronze; Category "A" brushed chrome.
628	Satin aluminum, clear anodized; base material aluminum; Category "A".
630	Satin stainless steel, base material STS 300 Series; Category "A".
689	Aluminum painted; base material any; Category "E" silver sprayed.

## 2.6 KEYING

- 2.6.1 During construction, supply temporary cylinders keyed alike, and compatible with locks.
- 2.6.2 Supply cylinders with cam/tail pieces suitable for specified lock function. Supply compression rings, trim collars, and blocking rings to suit.

## 3 Execution

## 3.1 EXAMINATION

- 3.1.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects and discrepancies to TTC.
- 3.1.2 Replace and pay for defective hardware, including incorrectly selected hardware, remedial, and installation costs.
- 3.1.3 Commencement of Work means acceptance of existing Site conditions.



**3.2 INSTALLATION**

- 3.2.1 Install hardware in accordance with manufacturer's installation instructions and applicable codes and regulations.
- 3.2.2 Mount hardware measured from finished floor to centre of hardware, unless indicated otherwise:
  - 3.2.2.1 Top hinge: 250 mm from head of door to top of hinge.
  - 3.2.2.2 Bottom hinge: 265 mm from finished floor to bottom of hinge.
  - 3.2.2.3 Intermediate hinge: Centred between top and bottom hinge.
  - 3.2.2.4 Locksets, latchsets: 1000 mm.

**3.3 FIELD QUALITY CONTROL**

- 3.3.1 Adjust door hardware for smooth operation, and weather-tightness.
- 3.3.2 Ensure hardware supplied is correctly installed and correct for Work as constructed.

**END OF SECTION**



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ABBREVIATIONS.....	1
CATEGORY M. OFFICE BUILDING .....	1
Group 1214 Office Single Door .....	1
Group 1218 Storage Room Single Door .....	1



## ABBREVIATIONS

ADA	-	Americans with Disabilities Act
c/w	-	Complete with
MFG	-	Manufacturer
NRP	-	Non-Removable Hinge Pins

## CATEGORY M. OFFICE BUILDING

### Group 1214 Office Single Door

3	Standard Weight Concealed Ball Bearing Hinge – NRP – Stainless Steel	1 ½ Pair
1	Cylindrical Storeroom Lockset	Keyed alike for Construction
1	Deadbolt	Keyed alike for Construction
1	Surface Closer with Metal Cover	
1	Kickplate – 254 mm (10") x 38.1 mm (1 ½") Less Door Width — 3M Tape	
1	Floor Stop or Wall Stop (Wall Stop preferred if wall is block or concrete)	

### Group 1218 Storage Room Single Door

3	Standard Weight Concealed Ball Bearing Hinge – NRP – Stainless Steel	1 ½ Pair
1	Cylindrical Storeroom Lockset	Keyed alike for Construction
1	Surface Closer with Metal Cover	
1	Kickplate – 254 mm (10") x 38.1 mm (1 ½") Less Door Width — 3M Tape	
1	Floor Stop or Wall Stop (Wall Stop preferred if wall is block or concrete)	
1	Weatherstrip - Aluminum with Neoprene on jambs	
1	Weatherstrip - Adhesive Silicone Strip Across Header	
1	Door Sweep – Aluminum with Neoprene	
1	Threshold – Aluminum, Barrier Free Approved, Width To Suit	

END OF INDEX



1 General

**1.1 SECTION INCLUDES**

1.1.1 Design, labour, Products, equipment and services necessary for glass and glazing Work in accordance with the Contract Documents.

**1.2 REFERENCES**

1.2.1 ASTM C794, Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants.

1.2.2 ASTM D1187/D1187M, Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.

1.2.3 ASTM F738M, Standard Specification for Stainless Steel Metric Bolts, Screws, and Studs.

1.2.4 CSA S16, Design of Steel Structures.

1.2.5 CSA S136 PACKAGE, North American Specification for the Design of Cold Formed Steel Structural Members, and S136.1-12, Commentary on North American Specification for the Design of Cold-Formed Steel Structural Members.

1.2.6 GANA, Glass Association of North America, Glazing Manual.

1.2.7 IGMAC, Insulating Glass Manufacturer's Association of Canada.

1.2.8 LSGA, Laminators Safety Glass Association, Standards Manual.

1.2.9 OBC, Ontario's Building Code.

1.2.10 ULC, Underwriters Laboratories of Canada.

**1.3 DESIGN REQUIREMENTS**

1.3.1 Conform to OBC design requirements and design glass in accordance with CAN/CGSB 12.20-M. Perform stress analysis. Design units to accommodate live, dead, lateral, wind, seismic, handling, transportation and erection loads. In case of discrepancies, the most stringent requirements to govern.

1.3.2 **Framing and connection details:** Design framing and connections, where not indicated on Contract Drawings, in accordance with CSA S16 and CSA S136.1.

1.3.3 **Framing-system glass bite:** Coordinate with other Sections and size glass units as required to ensure that the minimum glass bite on all 4 sides is 15 mm for all glazing Types.

1.3.4 **Industry standards:** Design, fabricate and install the Work in accordance with the guidelines and recommendations of the following industry manuals. In case of discrepancies, the most stringent requirements govern:

1.3.4.1 GANA, Glazing Manual.

1.3.4.2 GANA, Sealant Manual.

1.3.4.3 GANA, Laminated Glazing Reference Manual.

1.3.4.4 GANA, Engineering Standards Manual.

1.3.4.5 LSGA, Standards Manual.

- 1.3.5 Deflection: Size glass thickness to limit glass deflection to 1/200 with full recovery of glazing materials.

#### **1.4 SUBMITTALS**

- 1.4.1 Submit samples in accordance with Section 01 33 00.

##### **1.4.2 Product Data, Shop Drawings and Documentation Package:**

###### **1.4.2.1 Product Data:**

- 1.4.2.1.1 Submit manufacturer's printed Product literature, specifications and data sheets. Clearly indicate on each submission to which glazing type and assembly the submission pertains.

###### **1.4.2.2 Shop Drawings:**

- 1.4.2.2.1 Submit engineered fabrication and erection Shop Drawings in accordance with Section 01 33 23 and the quality assurance requirements of this Section indicating the following:

- 1.4.2.2.1.1 Design, fabrication and installation details.

- 1.4.2.2.1.2 Stress analysis report.

- 1.4.2.2.1.3 Design calculations.

###### **1.4.2.3 Documentation:**

- 1.4.2.3.1 Submit manufacturer's certification compatibility of glass and glazing materials.

- 1.4.2.3.2 Submit a letter from the manufacturer of the insulated glass units (IG) confirming that they are currently certified by IGMAC for the manufacture of the Products to be provided for this Contract.

- 1.4.2.3.3 Submit IGMAC Certification Number(s) for Products provided for this Contract.

##### **1.4.3 Samples:**

- 1.4.3.1 Submit sample of each glazing type.

##### **1.4.4 Quality Assurance Submittals:**

- 1.4.4.1 Provide test results in accordance with ASTM C1087 and ASTM C794 showing compatibility of applied sealants with accessories used in butt-joint glazing systems and also determine strength, ability of cured sealant to maintain a bond to substrate under severe conditions and characteristics of peel properties of a cured-in-place elastomeric joint sealants for use in butt-joint glazing. Provide a statement and test data confirming sealant used in design indicated to accommodate design load requirements without failure.

- 1.4.4.2 Provide plant verification testing and analysis of glass and performance values for each type of insulating glass unit.

- 1.4.4.3 Provide shop inspection and testing for glass.

- 1.4.4.4 Testing to confirm values and performance levels for low-e coating, spacer, primary and secondary sealants, thermal performance and condensation resistance.



## **1.5 QUALITY ASSURANCE**

- 1.5.1 Retain Professional Engineer, licensed in the Province of Ontario, with experience in glazing Work of comparable complexity and scope, to perform the following services as part of the Work of this Section:
  - 1.5.1.1 Design glass and glazing Work.
  - 1.5.1.2 Review, stamp and sign fabrication and erection Shop Drawings.
  - 1.5.1.3 Conduct shop and on-Site inspections and prepare and submit inspection reports.

## **1.6 SITE CONDITIONS**

- 1.6.1 Coordinate the Work of this Section with the installation of framing to ensure a continuous, uninterrupted sequence and to prevent the undue exposure of unprotected frames to the weather or contamination.
- 1.6.2 Do not install any glazing until all nearby welding is completed.

## **1.7 ENVIRONMENTAL REQUIREMENTS**

- 1.7.1 Install glazing when ambient temperature is 10°C minimum.
- 1.7.2 Maintain ventilated environment for 24 hours after installation.
- 1.7.3 Maintain minimum ambient temperature before, during and 24 hours after installation of glazing materials.

## **2 Products**

### **2.1 MANUFACTURERS**

- 2.1.1 AFGD Glass Inc.
- 2.1.2 AGC Glass Company.
- 2.1.3 General Electric Company.
- 2.1.4 Guardian Industries Corp.
- 2.1.5 Laird Plastics.
- 2.1.6 Nippon Electric Glass Company Ltd.
- 2.1.7 Oldcastle Glass Inc.
- 2.1.8 Pilkington Glass of Canada Ltd.
- 2.1.9 PPG Canada Inc.
- 2.1.10 Prelco Inc.
- 2.1.11 Saint-Gobain Vetrotech.
- 2.1.12 Visteon Corporation

## **2.2 MATERIALS - GLASS**

### **2.2.1 General:**

- 2.2.1.1 Glass shall be glazing quality, clear float glass or low iron, thickness 6 mm unless otherwise specified.
- 2.2.1.2 Glass thicknesses shall be to the minimum indicated or of greater thickness to ensure compliance with the design requirements of this Section and reviewed Shop Drawings.
- 2.2.1.3 Provide the glazing types specified in this Section.

### **2.2.2 Clear Glass:**

- 2.2.2.1 In accordance with CAN/CGSB 12.3-M.
- 2.2.2.2 6 mm thickness.
- 2.2.2.3 Clear float glass.
- 2.2.2.4 Ultra-clear.
- 2.2.2.5 Visible light transmittance of 91%.
- 2.2.2.6 Shading coefficient of 1.05.

### **2.2.3 Tempered Glass:**

- 2.2.3.1 In accordance with CAN/CGSB 12.1-M, Type 2, Class B, Category II, minimum thickness 6 mm.
- 2.2.3.2 Clear float glass.
- 2.2.3.3 Perform tempering using horizontal tong-free method. If roller lines are acceptable to TTC, install in horizontal direction.

### **2.2.4 Laminated Tempered Glass Units (GL-1):**

- 2.2.4.1 In accordance with CAN/CGSB 12.1-M, Type 1, Class B; Category II.
- 2.2.4.2 Exterior-facing pane: 6 mm thick, clear tempered glass.
- 2.2.4.3 1.5 mm thick, polyvinyl butryal (PVB) clear bonding interlayer.
- 2.2.4.4 Interior-facing pane: Clear tempered glass, 6 mm thick.

## **2.3 MATERIALS - ACCESSORIES**

- 2.3.1 **Glazing and rebate primers, sealants, sealers and cleaners:** Compatible with each other. Type as recommended by glass manufacturer.
- 2.3.2 **Glazing gasket for interior locations except fire rated units:** Neoprene or EPDM.
- 2.3.3 **Glazing tape (glass units in interior location):** Polyshim II by Tremco Ltd.; Preformed and preshimmed tape with paper release. Size as recommended by manufacturer.
- 2.3.4 **Spacer shims:** Neoprene, 60-70 Shore A Durometer hardness, 75 mm long x 6 mm wide x 6 mm high minimum, size designed for glass size and weight of glass unit, self-adhesive on face.
- 2.3.5 **Setting blocks:** Neoprene or EPDM, 80-90 Shore A Durometer hardness, 100 mm long x 6 mm high x rebate width minimum, size designed for glass size and weight of glass unit.

- 2.3.6      **Glazing sealant:** Type as recommended by glazing manufacturer. Butt joint sealant one part structural silicone conforming to ASTM C1184. Dow Corning 795 by Dow Corning Corporation or GE SCS2000 SilPruf by GE Silicones.
- 2.3.7      **Heel bead:** Dow Corning 795 by Dow Corning Corporation or GE SCS2000 SilPruf by GE Silicones.
- 2.3.8      **Glass presence markers:** Easily removable, non-residue depositing.
- 2.3.9      Isolation Coating: Bituminous Paint:**
- 2.3.9.1      Brush or spray grade, non-fibrated, asbestos free, liquid asphalt type emulsion in accordance with ASTM D1187/D1187M, Type I or II.
- 2.3.9.1.1      Karnak 100 AF Non-Fibered Emulsion Dampproofing by Karnak Corporation.
- 2.3.9.1.2      Sealastic by W.R. Meadows of Canada, Ltd.
- 2.3.9.1.3      No. 810-07 Non-Fibered Asphalt Coating by Henry Company Canada Inc.
- 2.3.10      **Screws, bolts and fasteners:** In accordance with ASTM F738M; Type 304 stainless steel.
- 2.4      FABRICATION – GENERAL**
- 2.4.1      Verify glazing dimensions on Site.
- 2.4.2      Cut all glass to field measurement with proper clearances. Cut to produce clean, straight edges with no chips, cracks or flaws.
- 2.4.3      Make any cut-outs, openings or holes in accordance with the engineered Shop Drawings. Grind exposed edges smooth and round off corners.
- 2.4.4      Clearly label each glass lite with maker's name, weight, quality and glass type. Do not remove labels until after Work reviewed by TTC.
- 2.4.5      Fabricate glazing maximum 3 mm smaller than rebate size in either dimension; allow for edge spacers, shims and setting blocks as necessary.
- 2.4.6      Do not cut, seam, rip nor abrade tempered and laminated glass after fabrication.
- 2.5      FABRICATION – LAMINATED GLASS UNITS**
- 2.5.1      Conform to the following standards and industry guidelines as they apply to the Work.
- 2.5.2      The autoclave heat and pressure bonding process shall be modified as required to suit bonding various substrates and combinations of substrates, as follows:
- 2.5.2.1      Fully tempered glass.
- 2.5.2.2      Polyvinyl butryal bonding interlayers.
- 3      Execution
- 3.1      EXAMINATION**
- 3.1.1      Verify conditions and dimensions of previously installed Work upon which Work of this Section depends. Report defects to TTC. Commencement of Work means acceptance of existing conditions.

### **3.2 INSTALLATION**

- 3.2.1 Refer to the Contract Drawings and schedules for glazing requirements and locations.
- 3.2.2 Install glazing to the Work unless specified to be carried out under other Sections. Work of this Section includes all glazing not specified under other Sections.
- 3.2.3 Apply primer to contact surfaces prior to glazing.
- 3.2.4 Use setting blocks at 1/4 points and spacers to centre glass unit in frame.
- 3.2.5 Perform work in accordance with GANA, Glazing Manual, IGMAC and Laminators Safety Glass Association - Standards Manual for glazing installation methods.
- 3.2.6 Size glass to code requirements and verify openings for glazing correctly sized and within tolerance and install glazing in accordance with manufacturer's written instructions.
- 3.2.7 Install glazing with full contact and adhesion at perimeter.
- 3.2.8 Maintain edge clearance recommended by glass manufacturer.
- 3.2.9 Install glass presence markers in 2 cross stripes extending from diagonal corners. Maintain markers until final clean-up.
- 3.2.10 Remove, dispose of and replace broken, cut and abraded glass.
- 3.2.11 Miscellaneous interior glass including without limitations screens.
- 3.2.12 Unless otherwise required, glaze interior glass using glazing gasket glazing tape.
- 3.2.13 Install 2 sided frameless structural butt joint glass assemblies where indicated in Contract Document using specified glazing with slightly wet grinded kerf and polished butt-joint edges for aesthetics.
- 3.2.14 Ensure precise levelling of sill member achieved and provision made at head to accommodate deflection of structure.
- 3.2.15 For glazing at head and sill use wet, dry, or wet/dry glazing systems. Position glazing so vertical edges spaced slightly apart and seal with clear, colourless or coloured silicone sealant.

### **3.3 CLEANING**

- 3.3.1 Immediately remove sealant and compound droppings from finished surfaces. Periodically clean installed glass during construction to avoid permanent etching and staining.
- 3.3.2 Remove labels, protective material and glass presence markers from prefinished surfaces. Avoid storing materials adjacent to glass. Protect glass from other trades. At completion of Work, replace any damaged or broken glass provided under this Section with similar glass.

### **3.4 CLEAN-UP**

- 3.4.1 Upon completion of the Work of this Section, remove debris, equipment and excess materials from Site.

**END OF SECTION**

1 General

**1.1 SECTION INCLUDES**

1.1.1 Design, labour, Products, equipment and services necessary for gypsum and cement board Work in accordance with the Contract Documents.

**1.2 REFERENCES**

1.2.1 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.2.2 ASTM C475/C475M, Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

1.2.3 ASTM C553, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Application.

1.2.4 ASTM C645, Standard Specification for Nonstructural Steel Framing Members.

1.2.5 ASTM C754, Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

1.2.6 ASTM C840, Standard Specification for Application and Finishing of Gypsum Board.

1.2.7 ASTM C1002, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

1.2.8 ASTM C1396/C1396M, Standard Specification for Gypsum Board.

1.2.9 CAN/ULC S702, Standard for Thermal Insulation Mineral Fibre for Buildings.

1.2.10 OESC, Ontario Electrical Safety Code.

1.2.11 OBC, Ontario's Building Code.

**1.3 QUALITY ASSURANCE**

**1.3.1 Qualifications:**

1.3.1.1 Execute the Work of this Section by skilled, qualified and experienced Workers trained in the installation of the Work of this Section.

**1.4 SITE CONDITIONS**

1.4.1 Do not begin Work of this Section until:

1.4.1.1 Wet Work including concrete, masonry, plaster, stucco and terrazzo finishes are complete.

1.4.1.2 Mechanical and electrical Work above the ceiling is complete.

1.4.1.3 Substrate and ambient temperature for gypsum board:

1.4.1.3.1 Prior to installation: Maintain between 10°C to 20°C for 48 hours.

1.4.1.3.2 During installation: Maintain between 10°C to 20°C.

1.4.1.3.3 After Installation: Maintain between 10°C to 20°C for 48 hours after completion with joint treatment.

1.4.1.4 Relative humidity is below 80%.

1.4.1.5 Ventilation is adequate to remove excess moisture.

1.4.2 If Site conditions do not meet the requirements described above, install temporary protection and facilities.

2 Products

## 2.1 MATERIALS

### 2.1.1 Steel Framing System:

#### 2.1.1.1 Manufacturers:

2.1.1.1.1 Bailey Metal Products Limited.

2.1.1.1.2 CGC Inc.

2.1.1.2 **Galvanized steel sheet:** In accordance with ASTM A653/A653M, Z275; cold rolled, galvanized steel sheet:

2.1.1.2.1 Steel studs and track runners: In accordance with ASTM C645; formed from galvanized steel sheet, 0.84 mm thick, galvanized steel studs and runners, 32 mm wide x 89 mm depth as indicated on Contract Drawings.

2.1.1.2.2 Furring channels: In accordance with ASTM C645; formed from galvanized steel sheet cold rolled, width 64 mm, depth 13 mm.

#### 2.1.1.3 Accessories:

2.1.1.3.1 Screw fasteners: In accordance with ASTM C1002 Type S; corrosion resistant.

### 2.1.2 Boards and Accessories:

#### 2.1.2.1 Manufacturers:

2.1.2.1.1 CertainTeed Gypsum Inc.

2.1.2.1.2 CGC Inc.

2.1.2.1.3 Georgia Pacific Canada.

2.1.2.1.4 Unifix Inc.

2.1.2.2 **Cement board:** In accordance with ASTM C1396/C1396M.

2.1.2.2.1 Durock Cement Board by CGC Inc.

2.1.2.2.2 Permabase by Unifix Inc distributed by CertainTeed Gypsum Inc.

2.1.2.3 **Screw fasteners for cement board:** Corrosion resistant; types as recommended by cement board manufacturer.

2.1.2.4 **Cement board joint filler:** Type as recommended by cement board manufacturer.

2.1.2.5 **Acoustical insulation:** In accordance with CAN/ULC S702, Type 1 or ASTM C553:

2.1.2.5.1 QuietZone by Owens Corning Inc.

2.1.2.5.2 AFB by Roxul Inc.

2.1.2.5.3 Thickness: As indicated on Contract Drawings.

2.1.2.6 **Acoustical sealant:** In accordance with CAN/CGSB 19.21-M.

2.1.2.7 **Corner bead and casing bead:** Formed from 0.6 mm thick minimum, galvanized steel sheet.

- 2.1.2.8            **Control joint strip:** Roll formed from galvanized steel sheet, with a tape protected recess, 6 mm wide x 11 mm deep.

3                   Execution

### 3.1                   **EXAMINATION**

- 3.1.1            Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to TTC. Commencement of Work means acceptance of existing conditions.

### 3.2                   **STEEL STUDS AND FURRING**

- 3.2.1            Install steel stud partitions to underside of structure above unless indicated otherwise.
- 3.2.2            Install track runners on top of concrete curb, on top of steel support and beam, and at underside of structure; align track runners accurately and secure to steel support and structure at 600 mm o.c. maximum.
- 3.2.3            Install double top track runner assembly to prevent the transmission of structural loads to steel studs.
- 3.2.4            Install steel studs vertically at 400 mm and not more than 50 mm from abutting walls, at openings and at each side of corners. Install studs securely to track runners.
- 3.2.5            Schedule and coordinate steel framing installation with mechanical and electrical services installation.
- 3.2.6            Install steel studs and furring for cement board in accordance with the cement board manufacturer's recommendations.

### 3.3                   **ACOUSTICAL INSULATION**

- 3.3.1            Install acoustic insulation into partitions as indicated and in accordance with the manufacturer's instructions. Fill stud cavities to full height of partitions and carefully cut and fit acoustic insulation around services and protrusions.

### 3.4                   **ACOUSTICAL SEALANT**

- 3.4.1            Install acoustical sealant in accordance with the manufacturer's instructions and Contract Drawings.
- 3.4.2            Install acoustical sealant to acoustically insulated partitions.
- 3.4.3            Install acoustical sealant under floor runner track, at partition perimeter both sides and at openings, cut-outs, and penetrations, concealed from view in the final installation.

### 3.5                   **CEMENT BOARD**

- 3.5.1            Fabricate and pre-cut cement board to required sizes and with necessary cut-outs.
- 3.5.2            Install cement board with edges centred on steel framing and joints staggered in adjacent rows. Fit ends and edges closely but do not force together.
- 3.5.3            Install cement board fasteners at 150 mm o.c. with perimeter fasteners between 10 mm to 16 mm from ends and edges.

- 3.5.4 Install cement board joint filler in accordance with the cement board manufacturer's directions to produce watertight, filled joints without voids, cracks and excess joint filler.

**END OF SECTION**



1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment, and services necessary for tiling Work in accordance with the Contract Documents.

**1.2 REFERENCES**

1.2.1 ANSI A108/A118/A136.1, American National Standard Specification for the Installation of Ceramic Tile. This publication is a compilation of voluntary standards for the installation of ceramic tile. American National Standard Specifications A108.01, .02, .1A, .1B, .1C, .4, .5, .6, .8, .9, .10, .11, .12, .13, .14, .15, .16 and .17 define installation of ceramic tile. A118.1, .3, .4, .5, .6, .7, .8, .9, .10, .11, .12, .13, .15 and A136 define test methods and physical properties for ceramic tile installation materials.

1.2.2 ANSI A137.1, American National Standards Specifications for Ceramic Tile.

1.2.3 ASTM C144, Standard Specification for Aggregate for Masonry Mortar.

1.2.4 ASTM C373, Standard Test Method for Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products, Ceramic Tiles, and Glass Tiles.

1.2.5 ASTM C920, Standard Specification for Elastomeric Joint Sealants.

1.2.6 CSA A3000, Cementitious Materials Compendium.

1.2.7 DCOF, Dynamic Coefficient of Friction.

1.2.8 ISO 13006, Ceramic Tiles -- Definitions, Classification, Characteristics and Marking.

1.2.9 ISO 13007, Ceramic Tiles -- Grouts and Adhesives.

1.2.10 TTMAC, Terrazzo, Tile and Marble Association of Canada, Specification Guide 09 30 00 Tile Installation Manual.

1.2.11 TTMAC, Terrazzo, Tile and Marble Association of Canada, Hard Surface Maintenance Guide.

**1.3 SUBMITTALS**

1.3.1 Submit in accordance with Section 01 33 00.

**1.3.2 Product Data, Shop Drawings, and Documents Package:**

**1.3.2.1 Product Data:**

1.3.2.1.1 Submit manufacturer's Product data including:

1.3.2.1.1.1 Cut sheets.

1.3.2.1.1.2 Technical data.

1.3.2.1.1.3 Manufacturer's installation and instruction guidelines.

1.3.2.1.1.4 Design data and test report.

1.3.2.1.1.5 Requirements for transportation, storage, and handling of Products and materials.

**1.3.2.2 Shop Drawings:**

1.3.2.2.1 Submit Shop Drawings in accordance with Section 01 33 23 indicating:

1.3.2.2.1.1 Tile layout, patterns, colour arrangement, and control joint locations.

1.3.2.2.1.2 Perimeter conditions, junctions with dissimilar materials.

1.3.2.2.1.3 Setting details.

1.3.2.3 **Documentation:**

1.3.2.3.1 Submit installer's proof of membership in good standing with TTMAC.

1.3.2.3.2 Submit certification for each type of floor tile that dynamic coefficient of friction (DCOF) is minimum 0.42 tested in accordance with ANSI A137.1.

**1.3.3 Samples:**

1.3.3.1 Submit duplicate sample panels of each type, class, finish, colour, texture, size, and pattern of tile.

## **1.4 SITE CONDITIONS**

1.4.1 Do not install Work of this Section outside of the following environmental ranges without TTC and Product manufacturer's written acceptance:

1.4.1.1 Ambient air and surface temperature: 12°C to 38°C.

1.4.1.2 Install epoxy mortar and grout between 18°C and 35°C in accordance with manufacturer's recommendations.

1.4.1.3 Curing time: Maintain temperature range for 48 hours before, during, and after installation.

1.4.1.4 Install temporary protection and facilities to maintain Product manufacturer's specified environmental requirements for 7 Days before, during, and 7 Days after installation.

1.4.1.5 Ventilation: Provide and maintain adequate ventilation or supplemental equipment where Work of this Section may generate volatile gases or where there is risk of raising relative humidity levels that could damage building finishes and assemblies.

## **1.5 MAINTENANCE MATERIALS**

1.5.1 Submit maintenance materials to TTC, 5% of gross area covered.

1.5.2 Allow proportionately for each pattern and type of tile specified and part of same Production run as installed Products.

1.5.3 Store maintenance Products as directed by TTC.

1.5.3.1 Store packaged or bundled Products in original and undamaged condition.

1.5.3.2 Retain original manufacturer's seals and labels intact. Do not remove from packaging or bundling until required for repairs or maintenance.

1.5.3.3 Provide estimated storage area requirements.

2 Products

## **2.1 PERFORMANCE REQUIREMENTS**

2.1.1 Slip resistance: Provide materials having minimum DCOF 0.42 dry/wet in accordance with ANSI A137.1, when tested to BOT 3000 Digital Tribometer.

2.1.2 Floor level tolerances: Provide materials to attain floor level tolerances required by this Section. Calculate quantity of materials based on difference between specified tolerance and initial tolerance in accordance with Section 03 30 00. Make measurements in same manner as used in Section 03 30 00.

## **2.2 FLOOR TILES**

### **2.2.1 Ceramic Tile (CT 2) and (CT-2A):**

- 2.2.1.1 In accordance with ANSI A137.1.
- 2.2.1.1.1 Surface hardness: MOHS minimum 7.
- 2.2.1.1.2 Dimensional variation:
  - 2.2.1.1.2.1 Length or width:  $\pm 0.6\%$ .
  - 2.2.1.1.2.2 Edge straightness:  $\pm 0.6\%$ .
  - 2.2.1.1.2.3 Evenness:  $\pm 0.5\%$ .
  - 2.2.1.1.2.4 Thickness:  $\pm 5.0\%$ .
- 2.2.1.1.3 Dimensions: as per Drawings.
- 2.2.1.1.4 Cove base (CT2A): 300 mm x 200 mm high, bevelled top edge, colour to match tile.
- 2.2.1.1.5 Finish: Glazed.
- 2.2.1.1.6 Accessories: Available accessory trim pieces as required to complete installation.
- 2.2.1.1.7 Mortar: Epoxy adhesive.
- 2.2.1.1.8 Grout: Sanded.
- 2.2.1.1.9 Grout joint width: 6 mm.
- 2.2.1.1.10 Colour: to be selected by Consultant.
- 2.2.1.1.11 Edges: Square.
- 2.2.1.1.12 Tile and manufacturer:
  - 2.2.1.1.12.1 To be selected distributed by Olympia Tile International Inc or OSI Hard Surfaces.

## **2.3 WALL TILES**

### **2.3.1 Ceramic Tile (CT-1A):**

- 2.3.1.1 In accordance with ANSI A137.1.
- 2.3.1.1.1 Dimensional variation:
  - 2.3.1.1.1.1 Length or width:  $\pm 0.6\%$ .
  - 2.3.1.1.1.2 Edge straightness:  $\pm 0.6\%$ .
  - 2.3.1.1.1.3 Evenness:  $\pm 0.5\%$ .
  - 2.3.1.1.1.4 Thickness:  $\pm 5.0\%$ .
- 2.3.1.1.2 Dimensions: 300 mm x 300 mm.
- 2.3.1.1.3 Tile colour: to be selected by Consultant.
- 2.3.1.1.4 Finish: Glazed, anti-graffiti.
- 2.3.1.1.5 Mortar: Thinset mortar.
- 2.3.1.1.6 Grout: Sanded.
- 2.3.1.1.7 Grout joint width: 3 mm.
- 2.3.1.1.8 Grout colour: to match tile.
- 2.3.1.1.9 Accessories: Available accessory trim pieces as required to complete installation.

- 2.3.1.1.10 Tile and manufacturer:
- 2.3.1.1.10.1 To be selected distributed by Olympia Tile International Inc or OSI Hard Surfaces.

**2.3.2 Ceramic Tile (CT-1B):**

- 2.3.2.1 In accordance with ANSI A137.1.
- 2.3.2.1.1 Dimensional variation:
  - 2.3.2.1.1.1 Length or width:  $\pm 0.6\%$ .
  - 2.3.2.1.1.2 Edge straightness:  $\pm 0.6\%$ .
  - 2.3.2.1.1.3 Evenness:  $\pm 0.5\%$ .
  - 2.3.2.1.1.4 Thickness:  $\pm 5.0\%$ .
- 2.3.2.1.2 Dimensions: 300 mm x 300 mm.
- 2.3.2.1.3 Tile colour: to be selected by Consultant.
- 2.3.2.1.4 Finish: Glazed, anti-graffiti.
- 2.3.2.1.5 Mortar: Thinset mortar.
- 2.3.2.1.6 Grout: Sanded.
- 2.3.2.1.7 Grout joint width: 3 mm.
- 2.3.2.1.8 Grout colour: to match tile.
- 2.3.2.1.9 Accessories: Available accessory trim pieces as required to complete installation.
- 2.3.2.1.10 Tile and manufacturer:
- 2.3.2.1.10.1 To be selected distributed by Olympia Tile International Inc or OSI Hard Surfaces.

**2.3.3 Ceramic Tile (CT-1C):**

- 2.3.3.1 In accordance with ANSI A137.1.
- 2.3.3.1.1 Dimensional variation:
  - 2.3.3.1.1.1 Length or width:  $\pm 0.6\%$ .
  - 2.3.3.1.1.2 Edge straightness:  $\pm 0.6\%$ .
  - 2.3.3.1.1.3 Evenness:  $\pm 0.5\%$ .
  - 2.3.3.1.1.4 Thickness:  $\pm 5.0\%$ .
- 2.3.3.1.2 Dimensions: 300 mm x 300 mm.
- 2.3.3.1.3 Tile colour: to be selected by Consultant.
- 2.3.3.1.4 Finish: Glazed, anti-graffiti.
- 2.3.3.1.5 Mortar: Thinset mortar.
- 2.3.3.1.6 Grout: Sanded.
- 2.3.3.1.7 Grout joint width: 3 mm.
- 2.3.3.1.8 Grout colour: to match tile.
- 2.3.3.1.9 Accessories: Available accessory trim pieces as required to complete installation.
- 2.3.3.1.10 Tile and manufacturer:
- 2.3.3.1.10.1 To be selected distributed by Olympia Tile International Inc or OSI Hard Surfaces.

## **2.4 SETTING MATERIALS**

### **2.4.1 Mortar Systems:**

#### **2.4.1.1 Epoxy Adhesive:**

2.4.1.1.1 In accordance with ANSI A118.3 and ISO 13007 R2, chemical resistant, 100% solids epoxy with high temperature resistance, and meeting the following minimum physical requirements:

2.4.1.1.1.1 Compressive strength: >34.4 MPa.

2.4.1.1.1.2 Shear bond strength: >8.6 MPa.

2.4.1.1.1.3 Thermal shock resistance: >4.1 MPa.

2.4.1.1.1.4 Tensile strength: >9.6 MPa.

2.4.1.1.1.5 Shrinkage: 0-0.1%.

2.4.1.1.1.6 Total VOC content: <0.05 mg/m<sup>3</sup>.

2.4.1.1.1.7 ISO 13007: R2.

2.4.1.1.1.8 Manufacturer's Product(s):

2.4.1.1.1.8.1 Latapoxy 300 by Laticrete International Inc.

2.4.1.1.1.8.2 Kerapoxy by Mapei Inc.

2.4.1.1.1.8.3 TA-440 AccuColor EFX by TEC Inc.

2.4.1.1.1.8.4 100 Flex Epoxy Grout by Flextile Ltd.

#### **2.4.1.2 Latex or Polymer Modified, Thinset Mortar:**

2.4.1.2.1 Location: Dry and moderate traffic interiors tile size 300 mm x 300 mm or less.

2.4.1.2.2 In accordance with ANSI A118.4, ANSI A118.11, and ISO 13007 C2ES1P2.

2.4.1.2.3 Manufacturer's Product(s):

2.4.1.2.3.1 #52 Versatile by Flextile Ltd.

2.4.1.2.3.2 Ultraflex 3 by Mapei Inc.

2.4.1.2.3.3 TA-392 (Gray)/TA-393 (White) SuperFlex Mortar by TEC Inc.

2.4.1.2.3.4 4-XLT Medium/Thin-set Mortar by Laticrete International Inc.

## **2.5 CRACK SUPPRESSION MEMBRANE**

2.5.1 Crack suppression membrane: Thin, cold applied, single-component liquid, and load bearing.

2.5.2 Reinforcing fabric: Non-woven and rot-proof, specifically intended for crack suppression.

2.5.3 Materials: Non-toxic, non-flammable, and non-hazardous during storage, mixing, application, and when cured.

2.5.4 Physical requirements in accordance with the following:

2.5.4.1 Elongation @ break (in accordance with ASTM D751): 20 - 30%.

2.5.4.2 System crack resistance (in accordance with ANSI A118.12): Pass (High).

2.5.4.3 Seven Day tensile strength (in accordance with ANSI A118.10): 1.8 MPa – 2.0 MPa.

- 2.5.4.4 Seven Day shear bond strength (in accordance with ANSI A118.10):  
1.4 MPa - 1.9 MPa.
- 2.5.4.5 Twenty-eight Day shear bond strength (in accordance with ANSI A118.4):  
>1.48 MPa - 2.4 MPa.
- 2.5.4.6 Service rating (in accordance with ASTM C627): Extra heavy.
- 2.5.4.7 Total VOC content: <0.05 mg/m³.
- 2.5.4.8 Manufacturer's Product(s):
  - 2.5.4.8.1 Hydroban by Laticrete International Inc.
  - 2.5.4.8.2 1000 Flexilastic Crack Isolation by Flextile Ltd.
  - 2.5.4.8.3 Mapeguard 2 by Mapei Inc.
  - 2.5.4.8.4 TA-324 Triple Flex - Waterproofing Crack Isolation Membrane by TEC Inc.

## **2.6 GROUTS AND SEALANTS**

### **2.6.1 Grout, Sanded (Floors and Bases):**

- 2.6.1.1 Joint width: 5 mm to 10 mm in accordance with ANSI A118.7.
- 2.6.1.2 Manufacturer's Product(s):
  - 2.6.1.2.1 600 Polymer Modified Sanded Floor Grout by Flextile Ltd.
  - 2.6.1.2.2 Sanded Ker-200 Dry-Polymer Modified Floor Grout by Mapei Inc.
  - 2.6.1.2.3 TA-650 AccuColor Premium Sanded Grout with TA-869 Acrylic Grout Additive by TEC Inc.
  - 2.6.1.2.4 Permacolor Grout 2500 Series by Laticrete International Inc.

### **2.6.2 Cement Grout, Sanded (Walls):**

- 2.6.2.1 Joint width: Over 3 mm in accordance with ANSI A118.6 and ISO 13007 CG2W.
- 2.6.2.2 Manufacturer's Product(s):
  - 2.6.2.2.1 Keracolor S by Mapei Inc.
  - 2.6.2.2.2 TEC TA 650, Accucolor Premium Sanded Grout with TA 869 Acrylic Grout Additive by TEC Inc.
  - 2.6.2.2.3 Permacolor Grout 2500 Series by Laticrete International Inc.
  - 2.6.2.2.4 Flextile 600 by Flextile Ltd.

### **2.6.3 Grout Colour:**

- 2.6.3.1 To match tiles from manufacturer's full colour range.

### **2.6.4 Sealants:**

- 2.6.4.1 Joint Backing: Refer to Section 07 92 00.

## **2.7 CEMENT LEVELLING BED**

- 2.7.1 Mix:
  - 2.7.1.1 One part Portland cement.
  - 2.7.1.2 Four parts sand.

- 2.7.1.3 One part water (including polymer additive), adjusted for water volume depending on moisture content of sand.
- 2.7.1.4 Include polymer additive where required by the TTMAC detail.
- 2.7.1.5 Manufacturer's Product(s):
  - 2.7.1.5.1 4 to 1 mix by Mapei Inc.
  - 2.7.1.5.2 Flextile 44 by Flextile Ltd.
  - 2.7.1.5.3 Laticrete levelling bed: 3701 Fortified Mortar Bed by Laticrete International Inc. mixed with water only and in accordance with manufacturer's instructions.

## **2.8 PENETRATING SEALER**

- 2.8.1 Clear, water based, non-visible after application.
  - 2.8.1.1 Manufacturer's Product(s):
    - 2.8.1.1.1 511H<sub>2</sub>O Plus by Miracle Sealants Company.
    - 2.8.1.1.2 Ultracare Penetrating Plus by Mapei Inc.

## **2.9 ACCESSORIES:**

- 2.9.1 Divider strips for floor and base: Refer to Section 09 66 13.

- 3 Execution

## **3.1 EXAMINATION**

- 3.1.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to TTC.
- 3.1.2 Commencement of Work means acceptance of existing conditions.

## **3.2 SURFACE PREPARATION**

- 3.2.1 Shot blast existing concrete surface floors.
- 3.2.2 Clean and dry surfaces thoroughly.
- 3.2.3 Neutralize trace of strong acids or alkali from substrate.
- 3.2.4 On masonry walls and concrete wall curbs where tiles and bases are required, apply levelling coat prior to application of thinset mortar.
- 3.2.5 Concrete slabs where existing flooring finishes are demolished and where new tile Work is required, apply levelling coat as required to ensure level substrate prior to mortar application.
- 3.2.6 Carefully plan layout of tile Work to provide symmetrical pattern and so that no tile is less than half full size. Minimize cutting.
- 3.2.7 Thoroughly clean back of tiles immediately prior to installation.

## **3.3 CRACK ISOLATION MEMBRANE**

- 3.3.1 Over cracks, in concrete floor slab install layer of crack suppression membrane in accordance with manufacturer's recommendation.

### **3.4 LEVELLING BED**

- 3.4.1 Install levelling bed on uneven substrate surfaces, level, and plumb substrates in accordance with following tolerances:
  - 3.4.1.1 Vertical surfaces: Maximum 3 mm in 2.4 m.
  - 3.4.1.2 Horizontal surfaces: 6 mm in 3 m from finished levels of surface, or better. On platform level, slope 2% with crown at centre line of double sided platform.
- 3.4.2 Clean structural substrate control joints and blow-clean with compressed air. Grout fill control joints flush to slab with levelling bed.

### **3.5 INSTALLATION**

- 3.5.1 Lay out tile Work in accordance with reviewed Shop Drawings.
- 3.5.2 Lay out Work to produce symmetrical pattern with minimum amount of cutting. Ensure cut tile at room perimeter minimum 1/2 of full size.
- 3.5.3 Do not start Work until Work of other trades, which goes through or is in space behind tile or tile backing walls, has been completed.
- 3.5.4 Install tiles in accordance with manufacturer's recommendation and TTMAC, Tile Installation Manual. If conflict occurs, manufacturer's installation recommendations govern over TTMAC Tile Installation Manual.
- 3.5.5 Mix and install mortar bed, adhesive and grout components in accordance with manufacturer's recommended proportions and methods, to achieve maximum bond strength.
- 3.5.6 Apply mortar bed and tile Work to non-frozen, frost-free surface.
- 3.5.7 Place as large area as can be covered with tile before mortar or adhesive has reached its initial set in one operation. When more mortar or adhesive has been spread than can be properly covered within setting period, cut back unfinished portion to clean, bevelled edge and remove.
- 3.5.8 If necessary, back butter tiles to ensure minimum 95% coverage between tile, setting material, and substrate. Twist and slide tiles into position.
- 3.5.9 Lay out individual tiles to straight edge at regular intervals. Install tiles to pattern layouts as indicated.
- 3.5.10 Set tiles in place and rap or beat with beating block as necessary to ensure proper bond and to level surface of tile.
- 3.5.11 At locations where tiles of different thickness are required on same elevation, provide thicker setting bed for thinner tiles to ensure tiles faces are installed flush.
- 3.5.12 Align tile for uniform joints and allow to set until firm.
- 3.5.13 Adjust joints between tiles to be uniform, plumb, straight, even, and true with adjacent tiles flush. Align grout joints in both directions unless indicated otherwise.
- 3.5.14 Align floor, base, and wall tile grout joints where tile lengths are same.
- 3.5.15 Install tile accessory fittings for complete and fully coordinated tile assembly.
- 3.5.16 Install wall tile full height of wall unless indicated otherwise.
- 3.5.17 Make necessary adjustments and drill, cut, and fit to suit adjacent Work of other trades.



- 3.5.18 Cut and fit tile units around corners, fixtures, drains, and other built-in objects to maintain uniform joint appearance. Make cut edges smooth, even, and free from chipping. Chipped and broken edges and edges resulting from splitting not permitted. Cut units to suit required dimensions, installation, and Site conditions.
- 3.5.19 Extend tile behind fitments and other wall mounted units.
- 3.5.20 Form intersections, corners, returns, and bases accurately.
- 3.5.21 Make joints watertight without voids, cracks, excess mortar or grout.
- 3.5.22 Make internal angles square, external angles bullnosed. Use bullnose edged tiles for bullnose effect.
- 3.5.23 Use bullnose edged tiles where edges of tiles at terminations are left exposed.
- 3.5.24 Clean excess mortar from surface of tile with wet cloth or sponge while mortar fresh.
- 3.5.25 Allow minimum 4 hours after installation of tiles with fastset mortar to cure before grouting.
- 3.5.26 Allow minimum 36 hours after installation of tiles with regular (not fastset) mortar before grouting.
- 3.5.27 Apply grout in accordance with grout manufacturer's recommendation to produce watertight, filled joints without voids, cracks, and excess grout. Thoroughly compact and tool floor grout.
- 3.5.28 Except for control joints and around projections through tile Work, fill joints solid with grout. Fill bevelled and cushion edge tiles joints to depth of bevel and cushion. Fill square edged tile joints flush with surface of tiles.
- 3.5.29 Remove excess grout by wiping diagonally across joints with damp, clean sponge. Change water with clean water often.
- 3.5.30 Thoroughly clean installed tile surfaces after installation and grouting has cured, and immediately prior to applying sealer.
- 3.5.31 Ensure completed Work is free from broken, damaged, and other faulty tiles.
- 3.5.32 Ensure top surface of installed tiles are flush with each adjacent tile and that entire surface of installed tiles are plumb, level and even throughout.
- 3.5.33 If existing tiles, those to remain, are damaged during demolition and removal Work, provide new tiles to match existing tiles. Prepare substrate and install new tiles as specified for new Work of this Section.
- 3.5.34 Provide adequate protection of completed tiled surfaces to prevent damage by other trades until final completion of the Work.
- 3.5.35 Protect exposed edges of floor tile with same thickness as tile until adjoining floor finish installed.

### **3.6 CONTROL JOINTS**

- 3.6.1 Continue control, construction and cold joints in structural substrate up through tile finish, and align with mortar joints where possible. Review joint locations on Site with TTC.
- 3.6.2 Install joint widths to match grout joint widths except where minimum width is indicated.
- 3.6.3 Follow control joint width for interior areas in accordance with TTMAC recommendations.

3.6.4 Install control joints in the following typical locations:

3.6.4.1 Aligned over structural beams.

3.6.4.2 At restraining perimeters such as walls and columns.

3.6.4.3 In accordance with reviewed Shop Drawings.

3.6.5 Seal control joints in accordance with Section 07 92 00.

### **3.7 JOINT BACKING AND TILE SEALANT**

3.7.1 Provide caulking required for tile Work in accordance with sealant manufacturer's recommendation.

3.7.2 Install joint backing under sealant as necessary.

3.7.3 Caulk around piping, fittings, and other items extending through tiled surfaces.

3.7.4 Seal internal tile to tile junctions. Tool to smooth, flush surface, free from air bubbles, and contamination.

### **3.8 FIELD QUALITY CONTROL**

3.8.1 Field testing: Conduct slip resistance testing in accordance with ANSI A137.1.

3.8.2 Prepare inspection report to TTC.

### **3.9 CLEANING**

3.9.1 Clean and polish floor and wall tile after grout has cured in accordance with TTMAC recommendations in Hard Surface Maintenance Guide. Do not use acid for cleaning.

3.9.2 Repoint joints after cleaning as required to eliminate imperfections, repeat cleaning as required. Avoid scratching tile surfaces.

### **3.10 PROTECTION**

3.10.1 Prevent traffic over tiled areas and protect tiled assemblies from weather, freezing, and water immersion for minimum 48 hours after final installation.

3.10.2 Prevent direct impact, vibration, and heavy hammering on adjacent and opposite walls for minimum 24 hours after final installation.

**END OF SECTION**

1 General

**1.1 SECTION INCLUDES**

1.1.1 Design, labour, Products, equipment and services necessary for acoustical ceilings Work in accordance with the Contract Documents.

**1.2 REFERENCES**

1.2.1 ASTM A653/A653M, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.2.2 ASTM C423, Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

1.2.3 ASTM C635, Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

1.2.4 ASTM C636, Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.

1.2.5 ASTM C645, Specification for Non-Load Bearing (Axial) Steel Studs, Runners (Tracks), and Rigid Furring Channels for Screw Application of Gypsum Board.

1.2.6 CAN/CGSB-92.1-M, Sound Absorptive Prefabricated Acoustical Units.

**1.3 DESIGN REQUIREMENTS**

1.3.1 Design acoustical ceiling suspension system in accordance with ASTM C636 and manufacturer's printed directions.

1.3.2 Design suspended ceiling system for adequate support of electrical fixtures as required by current bulletin of Electrical Inspection Department of Ontario Hydro.

1.3.2.1 Design hanger anchor and entire suspension system static loading not to exceed 25% of their ultimate capacity including lighting fixture dead loads.

1.3.2.2 Design suspension system to support weight of mechanical and electrical items such as air handling boots and lighting fixtures, and with adequate support to allow rotation/relocation of light fixtures.

1.3.3 Design ceiling system to withstand positive and negative wind loads, uplift of piston effect of up to 1.25 kPa, and train wind load of 44 m/s.

1.3.4 Design subframing as necessary to accommodate, to avoid conflicts and interferences where ducts or other equipment prevent regular spacing of hangers.

**1.4 SUBMITTALS**

1.4.1 Submit in accordance with Section 01 33 00.

1.4.2 Product Data, and Shop Drawings Package:

1.4.2.1 Product Data:

1.4.2.1.1 Submit manufacturer's Product data for all Products listed in this Section indicating:

1.4.2.1.1.1 Suspension system and acoustic tiles.

1.4.2.2 Shop Drawings:

1.4.2.2.1 Submit Shop Drawings in accordance with Section 01 33 23, indicating:

1.4.2.2.1.1 Suspension system layout including hangers.

- 1.4.2.2.1.2 Conditions at abutting, intersecting, and penetrating construction.
- 1.4.2.2.1.3 Dimensioned locations of lighting fixtures, diffusers, sprinkler heads and other items piercing ceiling plane.

**1.4.3 Quality Assurance Submittals:**

- 1.4.3.1 Submit test results for suspension anchor inserts; include data on design loading per anchor and tensile strength of hangers.

**1.5 SITE CONDITIONS**

**1.5.1 Do not install the Work of this Section until:**

- 1.5.1.1 Wet Work including concrete, masonry, plaster, stucco, and terrazzo finishes complete.
- 1.5.1.2 Mechanical and electrical Work above ceiling complete.
- 1.5.1.3 Relative humidity below 80%.
- 1.5.1.4 Ventilation adequate to remove excess moisture.

**1.5.2 Install temporary protection and facilities to maintain Product manufacturer's, and above Specification, environmental requirements 24 hr before, during, and after installation.**

**2 Products**

**2.1 MATERIALS**

**2.1.1 Suspension system: ASTM C635.**

- 2.1.1.1 B-E Safe-T-Lock by Bailey Metal Products Limited.

- 2.1.1.2 Donn DX Fast-Loc by CGC Inc.

- 2.1.1.3 Prelude by Armstrong World Industries Canada Ltd.

**2.1.2 Galvanized steel sheet: ASTM A653/A653M, G90; cold rolled, galvanized steel sheet.**

**2.1.3 Main carrying channels: ASTM C645; channels formed from galvanized steel sheet, 38 mm x 19 mm cold rolled.**

**2.1.4 Subframing: ASTM C645; channels formed from galvanized steel sheet, dimensions and spans as required.**

**2.1.5 Hangers: 2.6 mm minimum diameter, galvanized steel wire.**

**2.1.6 Tie wire: 1.6 mm minimum diameter, soft annealed galvanized steel wire.**

**2.1.7 Wall mouldings and accessories: Including but not limited to, corner caps, edge mouldings, panel hold over clip, metal closures, and trim. Finish and colour: same as main tees.**

**2.1.8 Exposed main, cross tees, and relocatable cross tees: 25 mm exposed face x 38 mm high steel, bulb tee design double steel web, rectangular single spans without exceeding deflection of 1/360 of span. Splices integral and reversible; cross tee interlocking into main tee.**

- 2.1.8.1 Colour and finish: Baycoat 5000 Series baked on enamel finish, special white.

**2.1.9 Acoustic tile (ACT1): CAN/CGSB-92.1-M.**

- 2.1.9.1 Georgian Minaboard by Armstrong World Industries Canada Ltd.; Donn DX by CGC Interiors Div of CGC Inc.

- 2.1.9.2 Pattern: random fissured.
- 2.1.9.3 Flame spread rating: 25 or less.
- 2.1.9.4 Smoke developed: 15 or less.
- 2.1.9.5 Noise reduction coefficient (NRC) designation (ASTM C423): 0.50 - 0.60.
- 2.1.9.6 Edge type: Square.
- 2.1.9.7 Colour: white.
- 2.1.9.8 Size:
  - 2.1.9.8.1 600 mm x 1200 mm x 16 mm thick.
- 2.1.10 Wall mouldings: Match acoustical ceiling suspension system.

### 3 Execution

#### 3.1 SUSPENSION SYSTEM

- 3.1.1 Coordinate locations and openings of mechanical and electrical services support, and penetration through acoustical ceilings. Coordinate field conditions, clearances, measurements, and mechanical and electrical services testing and commissioning, above acoustical ceilings.
- 3.1.2 Install hanger wires plumb and securely anchored to building structural framing, independent of walls, pipes, ducts, and metal deck; install additional framing and hangers to bridge interference items.
- 3.1.3 Install acoustical ceiling systems in accordance with manufacturer's written instructions, reviewed Shop Drawings, and ASTM C636, listed in order of precedence.
- 3.1.4 Install hanger wires at 1200 mm maximum centres along carrying channels, not less than 25 mm, and not more than 150 mm from channel ends.
- 3.1.5 Install additional hangers at lighting fixture and air distribution ductwork locations. Do not attach hanger wires to mechanical or electrical equipment. Do not support mechanical and electrical fixtures and fitting on ceiling without ceiling manufacturer's written acceptance.
- 3.1.6 Install acoustical ceiling suspension system to tolerance of 1:1200 of span and 0.4 mm maximum between adjacent metal members. Tolerances not cumulative. Refer to Electrical Contract Drawings for fixture layout.
- 3.1.7 Do not bend or twist hangers as means of levelling. Form double loops tightly and lock to prevent vertical movement or rotation within loop.
- 3.1.8 Install edge moulding at intersection of ceiling and vertical surfaces.
- 3.1.9 Centre acoustical ceiling suspension systems on room axis; install equal border pieces. Install hangers onto ends of main tee runners at not more than 150 mm from ends of runners, adjacent and perpendicular to walls.
- 3.1.10 Support suspension system independently of walls, columns, ducts, pipes and conduits.
- 3.1.11 Install main runners in maximum available lengths. Layout joints in suspension members to avoid perimeters of recessed fixtures. Lock grid members to form rigid assembly. Install additional tee, suspension system framing around recessed fixtures, diffusers, grilles and other items for complete assembly.

**3.2 ACOUSTIC TILES**

- 3.2.1 Carefully cut and trim acoustic tiles to accommodate Work of Divisions 21, 23, 26, and 28.
- 3.2.2 Fit acoustic tiles carefully into place. Remove and replace acoustic tiles with broken edges, or damaged, marked, discoloured, soiled, or stained faces.

**3.3 FIELD QUALITY CONTROL**

- 3.3.1 Arrange, pay for, and execute Site load tests at location selected by TTC, on anchor inserts by independent, certified testing company. Perform 10 random anchor tests at commencement of Work. Pay for additional tests, required if pull out strength not acceptable as requested by TTC.

**END OF SECTION**

1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment, and services necessary for Portland cement terrazzo Work in accordance with the Contract Documents.

1.1.2 The Work of this Section is indicated on Contract Drawings as TT1.

**1.2 REFERENCES**

1.2.1 ASTM B135M, Standard Specification for Seamless Brass Tube.

1.2.2 ASTM D56, Standard Test Method for Flash Point by Tag Closed Cup Tester.

1.2.3 CAN/CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.

1.2.4 CAN/CSA-A3000, Cementitious Materials Compendium.

1.2.5 TTMAC 09 66 00 Terrazzo Specification Guide, Terrazzo Tile and Marble Association of Canada.

**1.3 SUBMITTALS**

1.3.1 Submit in accordance with Section 01 33 00.

**1.3.2 Shop Drawings:**

1.3.2.1 Submit in accordance with Section 01 33 23 indicating:

1.3.2.1.1 Proposed mix of topping to match existing terrazzo.

1.3.2.1.2 Product data for crack joint filler and water-based terrazzo sealer.

**1.3.3 Samples:**

1.3.3.1 Submit the following samples:

1.3.3.1.1 250 mm x 250 mm x 25 mm thick samples of each colour terrazzo, labeled with cement colour and percentage of each aggregate. Include documentation to confirm that samples match existing.

1.3.3.1.2 250 mm long samples of each divider strip, screed, and weeping tube.

**1.3.4 Closeout Submittals:**

1.3.4.1 Submit copies of the TTMAC Maintenance Guide for incorporation into the Operation and Maintenance Manuals in accordance with Section 01 78 23.

**1.4 QUALITY ASSURANCE**

1.4.1 Qualifications:

1.4.1.1 Perform Work of this Section by a company that is in good standing with TTMAC and has a minimum of 5 years proven experience on installations of similar complexity and scope.

**1.5 SITE CONDITIONS**

1.5.1 Maintain air temperature and structural base temperature at terrazzo installation area above 12°C for 24 hours before, during and 24 hours after installation.

1.5.2 Provide daily field reports to verify that these site conditions have been maintained.

2 Products

**2.1 MATERIALS**

- 2.1.1 Cement: In accordance with CAN/CSA-A3000, Type GU.
- 2.1.2 Pigments: Non-fading mineral pigments in selected colours to match existing.
- 2.1.3 Sand: In accordance with CAN/CSA A23.1/A23.2.
- 2.1.4 Water: In accordance with CAN/CSA A23.1/A23.2.
- 2.1.5 Latex additive: Keralastic by Mapei Inc., or Full Bond Additive TA867 by TEC Inc.
- 2.1.6 Marble chips: Uniform, sound and abrasion resistant.
  - 2.1.6.1 Grade chips in accordance with TTMAC standards, free from flats and flakey particles.
  - 2.1.6.2 Size and colours of chips to match existing adjoining terrazzo and to TTC selection.
- 2.1.7 Slip-resistant aggregate: White aluminum oxide (AL203) 36 grit.
- 2.1.8 Divider strips (base): 3.2 mm thick zinc alloy 150 mm high with 100 mm horizontal leg, 30 mm radius cove, to Detail No. 416B of Terrazzo Specification Guide.
- 2.1.9 Base screed: 9 mm high x 19 mm wide x 1.2 mm thick zinc alloy to Detail No. 416B of Terrazzo Specification Guide.
- 2.1.10 Curing compound: In accordance with CAN/CSA A23.1/A23.2, non-staining.
  - 2.1.10.1 Moisture retention: Maximum 0.015 grams.
- 2.1.11 Terrazzo sealer: UL-listed, colourless, slip and stain-resistant penetrating sealer with pH factor between 7 and 8 that does not affect colour or physical properties of terrazzo surface. Flash point, in accordance with ASTM D56: 27°C, minimum.

**2.2 MIXES**

- 2.2.1 Underbed Mix: 1 part cement, 4 parts sand by volume, water to produce mortar of stiff consistency.
- 2.2.2 Neat grout mix:
  - 2.2.2.1 Type 1 (prior to underbed mix): Water to saturation, grey cement broadcast, latex additive to slurry consistency for broom installation.
  - 2.2.2.2 Type 2 (after terrazzo topping matrix): Water to saturation, cement broadcast (colour to match matrix), latex additive to slurry consistency for steel trowel installation.
- 2.2.3 Terrazzo topping matrix:
  - 2.2.3.1 TT1: TTMAC Plate to match existing.

3 Execution

**3.1 EXAMINATION**

- 3.1.1 Verify conditions and dimensions of previously installed Work upon which this Section depends.
- 3.1.2 Report defects to TTC.
- 3.1.3 Commencement of Work means acceptance of existing conditions.



### **3.2 REMOVAL OF EXISTING TERRAZZO**

- 3.2.1 Remove existing terrazzo where indicated. Use equipment with self-contained dust and debris collector. Remove material to base slab.
- 3.2.2 Use equipment and removal methods that do not damage existing flooring or other finishes and elements that are to remain. Do not damage or vibrate divider strips indicated to remain.
- 3.2.3 Comply with the requirements of Section 02 41 23.

### **3.3 PREPARATION**

- 3.3.1 Comply with recommendations and guidelines of the TTMAC 09 66 00 Terrazzo Specification Guide and requirements of this Section. In case of conflict, more stringent requirements govern.
- 3.3.2 Refer to Contract Drawings for locations and details.
- 3.3.3 Schedule completion of surfacing Work of this Section before installation of adjacent wall finishes.
- 3.3.4 Coordinate installation of Work that passes through, beneath or behind terrazzo.
- 3.3.5 Protect and block-off drain inlets situated level with, or lower than, highest point of terrazzo Work, until after final cleaning.
- 3.3.6 Vacuum clean substrate surfaces and remove bond-inhibiting substances.

### **3.4 INSTALLATION – GENERAL**

- 3.4.1 Install Products in layout as indicated on reviewed Shop Drawings.
- 3.4.2 Unless otherwise indicated or specified, install Portland cement terrazzo systems in accordance with recommendations of TTMAC 09 66 00 Terrazzo Specification Guide, Specification and Details.

### **3.5 NEAT GROUT TYPE 1, UNDERBED, DIVIDER STRIPS, AND TRIM**

- 3.5.1 Saturate base slab with water over 24 hours and remove excess water prior to installation.
- 3.5.2 Apply neat grout Type 1 mix and broom thoroughly over underbed floor and base substrates with stiff broom for continuous, void-free contact.
- 3.5.3 Immediately install underbed mix to 13 mm at bases, before neat grout attains its set. Allow 16 mm recess to finished floor grade to accommodate terrazzo topping matrix.
- 3.5.4 Before underbed has achieved initial set, install divider strips in the following typical locations:
  - 3.5.4.1 Aligned over control, construction, and cold joints in base slab.
  - 3.5.4.2 At restraining perimeters such as walls.
  - 3.5.4.3 As indicated on reviewed Shop Drawings.
- 3.5.5 Install floor divider strips with 90° intersections, tight-butt joints, and flush with finished floor elevation.
- 3.5.6 Install base dividers and screeds. Set base dividing strips to align with floor divider strips at 1800 mm o.c. maximum.
- 3.5.7 Wet-cure underbed for 24 hours.

### **3.6 TERRAZZO TOPPING MATRIX**

- 3.6.1 Saturate underbed with water and remove excess moisture.
- 3.6.2 Apply neat grout Type 1 mix and broom thoroughly over underbed with stiff broom for continuous, void-free contact.
- 3.6.3 Install blended terrazzo topping matrix to 16 mm depth.
- 3.6.4 Prior to rolling, broadcast slip-resistant aggregate in two passes at right angle to each other at rate of 1 kg per 1 m<sup>2</sup>.
- 3.6.5 Prevent uneven distribution of aggregate by removing superfluous water in terrazzo topping matrix with minimum 100 kg weight rollers. Add additional marble aggregate as required to obtain compact mass.
- 3.6.6 Steel trowel terrazzo topping matrix to flat and even surface, flush with top of divider strips.

### **3.7 BASES**

- 3.7.1 Install terrazzo topping matrix wall bases where indicated.
- 3.7.2 Form coves at floor bases and recessed corners, to radii indicated on Contract Drawings.

### **3.8 CURING**

- 3.8.1 After terrazzo topping matrix has set, saturate surface with water and apply curing compound to retain surface moisture, for curing period minimum 3 Days. Adjust curing period to suit Site conditions such as ventilation, relative humidity, and temperature.

### **3.9 SURFACING AND NEAT GROUT TYPE 2**

- 3.9.1 After minimum 3 Day curing period, wet grind terrazzo topping matrix surface in the following two steps, remove slurry and wash terrazzo clean, between steps:
  - 3.9.1.1 Step 1: #24 or #36 (as necessary) grit abrasive stone, with silica sand, in multiple passes, to final level and profile.
  - 3.9.1.2 Step 2: #80 grit abrasive stone, in one pass, omit silica sand, to remove rough scratches.
- 3.9.2 Wash terrazzo thoroughly with clean water, steel trowel neat grout Type 2 over entire surface to fill voids and pinholes. After grout has cured, apply curing compound. Allow terrazzo and neat grout to cure for another 72 hours before finish polishing.
- 3.9.3 Allow neat grout Type 2 to remain on terrazzo surface until after other trades are completed, (minimum 48 hours), before finishing.

### **3.10 FINISHING AND CLEANING**

- 3.10.1 Wet grind terrazzo surface with #80 grit abrasive stone to smooth finish, free from ridges, scratches, machine marks, and other blemishes, to match existing and to acceptance of TTC. Remove slurry immediately from Site and wash clean, do not wash slurry into drains.
- 3.10.2 Clean terrazzo surfaces as follows:
  - 3.10.2.1 Remove soil with push broom and remove fine dust with heavy-duty vacuum cleaner.
  - 3.10.2.2 Apply neutral cleaning solution in accordance with manufacturer's instructions, allow to loosen soil, machine clean with fibre scrubbing brush or pad. Do not use steel wool.

3.10.2.3 Remove soiled cleaning solution with wet vacuum and rinse with warm water. Rinse second time with warm water and remove with wet vacuum.

3.10.2.4 Allow floor to dry completely, minimum 4 hours.

### **3.11 SEALING**

3.11.1 As soon as possible after final cleaning, apply three coats of terrazzo sealer in accordance with manufacturer's recommendations, including surface preparation and installation methods.

**END OF SECTION**



1 General

**1.1 SECTION INCLUDES**

- 1.1.1 Labour, Products, equipment and services necessary for painting Work in accordance with the Contract Documents.
- 1.1.2 Work of this Section includes, but is not limited to, the following:
  - 1.1.2.1 Surface preparation of substrates as required for acceptance of painting including cleaning, small crack repair, patching, caulking and making good surfaces and areas to the limits defined in this Section.
  - 1.1.2.2 Specific pretreatments noted in this Section or specified in the MPI, Architectural Painting Specification Manual, shall follow the manufacturer's recommendation for specified Products. In the event of discrepancies, follow TTC instructions.
  - 1.1.2.3 Paint exposed-to-view mechanical (heating, ventilating, and plumbing) services and equipment (including ducts and sprinkler piping) and electrical Work unless prefinished.
  - 1.1.2.4 Repainting of existing surfaces and finishes when adjacent to new painting Work where applicable, including surface preparation, prime and finish coats in accordance with MPI repainting requirements and the manufacturer's printed instructions.
  - 1.1.2.5 If volatile/flammable materials are used, follow manufacture's safety instructions.
  - 1.1.2.6 Include all touch-ups and field painting necessary to complete the Work.

**1.2 REFERENCES**

- 1.2.1 ASTM D3359, Standard Test Methods for Measuring Adhesion by Tape Test.
- 1.2.2 ASTM D6237, Standard Guide for Painting Inspectors (Concrete and Masonry Substrates).
- 1.2.3 CEPA, Volatile Organic Compound (VOC) Concentration Limits for Architectural Coatings Regulations.
- 1.2.4 EPA, as amended by O. Reg. 347. Therefore this should just be listed as O.Reg. 347, General – Waste Management.
- 1.2.5 CAN/ULC-S102, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- 1.2.6 CAN/ULC-S102.2, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.

**1.3 SUBMITTALS**

- 1.3.1 Submit in accordance with Section 01 33 00.

**1.3.2 Shop Drawings:**

- 1.3.2.1 Submit manufacturer's Product data for all Products listed in this Section indicating:
  - 1.3.2.1.1 Performance criteria, compliance with appropriate reference standards, characteristics and limitations.
  - 1.3.2.1.2 Product transportation, storage, handling, and installation requirements.
  - 1.3.2.1.3 Application procedures used to obtain finishes.

1.3.2.1.4 Listing of the manufacturer's Product types, Product codes, and Product names, number of coats, dry film thicknesses (dft) and VOC concentration. Submit listing a minimum of 8 weeks before materials are required.

1.3.2.1.5 Manufacturer's Safety Data Sheets (SDS).

**1.3.3 Samples:**

1.3.3.1 Submit 300 mm x 150 mm draw-downs of each colour a minimum of 30 Days before paint is required, as follows:

1.3.3.1.1 Samples on same type of materials as that on which the coating is to be applied, where possible.

1.3.3.1.2 Identify each sample with Contract number and title, colour reference, gloss/sheen level rating, date and name of applicator.

**1.3.4 Quality Assurance Submittals:**

1.3.4.1 Submit certified documentation to confirm each Painter has a minimum of 5 years' experience on contracts of similar complexity and scope.

1.3.4.2 Submit certified documentation to confirm each Worker has a Certificate of Qualification in accordance with TQAA - ACA.

1.3.4.3 Submit certified documentation that Foreperson has 10 years' experience on contracts of similar complexity and scope.

1.3.4.4 Submit certification that Work has been completed in accordance with manufacturer's printed instructions, including preparation and application.

1.3.4.5 Submit the electronic moisture meter manufacturer's specifications including tolerances.

1.3.4.6 Submit record of latest meter calibration to meet manufacturer's recommendations.

**1.3.5 Closeout Submittals Package:**

1.3.5.1 Submit the following for incorporation into the Operation and Maintenance Manuals in accordance with Section 01 78 23:

1.3.5.1.1 Itemized list, complete with the manufacturer's name, paint type and colour for all colours used.

**1.4 QUALITY ASSURANCE**

1.4.1 Comply with the requirements of the MPI Manuals, except where more stringent requirements are specified in this Section.

1.4.2 Qualifications:

1.4.2.1 Painting Subcontractor: Minimum of 5 years' proven satisfactory painting experience of Contracts of similar size and nature.

1.4.2.2 Applicator: Certificate of qualification executing Work and be under the full time supervision of a qualified representative of the Contractor.

1.4.2.3 Supervision:

1.4.2.3.1 Have Work supervised by a full-time qualified foreperson that has a minimum of 10 years' experience on contracts of similar complexity and scope. It is the responsibility of the Foreperson to ensure all equipment used on Site is operated by experienced personnel.

- 1.4.2.3.2 Supervisor shall be thoroughly conversant with the requirements of the Specification, schedules, Drawings and MPI, Architectural Painting Specification Manual, as well as the applicable VOC regulations.

## **1.5 DELIVERY, STORAGE, AND HANDLING**

- 1.5.1 Deliver materials to the Site and store in sealed, original, labelled containers bearing the manufacturer's name, brand name, type of paint or coating, and colour designation, materials content, as well as mixing and reducing, and application requirements.
- 1.5.2 Provide safe, lockable, well ventilated fireproof storage lockers to store paint, thinner, solvents, and other volatile, corrosive, hazardous, flammable, and explosive materials. Take all necessary precautions and post adequate warnings as required.
- 1.5.2.1 Maintain storage enclosures at a minimum of 10°C and maximum of 30°C ambient temperatures and in accordance with the Product manufacturer's recommendations.
- 1.5.3 Post hazard warning signage in areas of storage and mixing. Install and maintain sufficient CO<sub>2</sub> fire extinguishers of a minimum 9 kg capacity, accessible in each of the storage and mixing areas.
- 1.5.4 Protect storage and mixing area floors and walls from paint drips, splatters and spills with sheets, clean plywood or metal pans where mixing is being carried out.
- 1.5.4.1 Store oily rags, drop cloths, waste products, empty containers, and materials subject to spontaneous combustion in ULC and CSA approved sealed containers in accordance with governing fire and safety regulations, and remove from Site on a daily basis.
- 1.5.5 Leave storage areas clean and free from evidence of occupancy upon completion of Work.

## **1.6 WASTE MANAGEMENT AND DISPOSAL**

- 1.6.1 Treat paints, wood preservatives, stains, and finishes, which cannot be reused, as hazardous waste and dispose of in accordance with hazardous waste regulations under the EPA and applicable Federal, Provincial, and Municipal government regulations, Section 01 74 19, and Part 3 of this Section.
- 1.6.2 Close and tightly seal partly used cans of materials including used sealant and adhesive tubes, containers, cleansers, thinners, solvents and excess paint, and store at ambient temperature, protected in well ventilated fire-safe area or area designated for hazardous waste. Provide for delivery to recycling or collection facility.
- 1.6.3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal or appropriate cleaning and laundering.
- 1.6.4 Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.
- 1.6.5 Ensure that empty paint cans are dry prior to disposal or recycling.
- 1.6.6 Do not dispose of paints or solvents by pouring on the ground, into the sink, or drain which include maintenance hole, floor drain, grate, catch basin, sanitary and storm sewer.
- 1.6.7 Retain cleaning water for water-based materials, then filter out and properly dispose of sediments. In no case shall equipment be cleaned using free draining water.
- 1.6.8 Set aside and protect surplus and uncontaminated finish materials not required by TTC. Deliver to recycling or collection facility for reuse or remanufacturing.

**1.7 SITE REQUIREMENTS AND ENVIRONMENTAL CONDITIONS**

- 1.7.1 All Work areas to be clean, dry, properly cured, and properly prepared before painting commences.
- 1.7.2 Do not perform painting Work:
  - 1.7.2.1 When the ambient air and substrate temperatures are below a minimum of 10°C.
  - 1.7.2.2 When the relative humidity is above 85% or the dew point is less than 3°C variance between the air/surface temperatures.
  - 1.7.2.3 Unless a minimum lighting level of 323 lux (30 foot candles) is provided on surfaces to be painted.
  - 1.7.2.4 Where dust is generated by construction activities so that airborne particles will not affect the quality of the finished surfaces.
- 1.7.3 Unless environmental conditions are within MPI and paint manufacturer's recommendations, Provide suitable protective weatherproof covering or enclosure, and sufficient heating facilities to maintain minimum ambient air and substrate temperatures, for 24 hours before, during, and after paint application.
- 1.7.4 Schedule painting of surfaces exposed to direct intense sunlight during early morning or ambient temperatures or provide suitable weatherproof covering.
- 1.7.5 Ventilation to remove odours, evaporating solvents, vapours and fumes, and moisture.
- 1.7.6 Protection:
  - 1.7.6.1 Provide sufficient, clean drop cloths and protective coverings for full protection including, but not limited to, the following:
    - 1.7.6.1.1 Floors.
    - 1.7.6.1.2 Furnishings.
    - 1.7.6.1.3 Light fixtures, fire and smoke detectors.
    - 1.7.6.1.4 Sprinkler heads.
    - 1.7.6.1.5 Prefinished diffusers and registers.
    - 1.7.6.1.6 Prefinished equipment.
    - 1.7.6.1.7 Fire rating labels and equipment specification plates.
  - 1.7.6.2 Protect mechanical, electrical and special equipment, and other components of the building which do not require painting from paint spotting and other soiling during the painting process.
  - 1.7.6.3 Mask adjoining Work adjacent to Work being painted or carefully cut in without overlaps.
- 1.7.7 Cleaning:
  - 1.7.7.1 Clean surfaces in preparation for application of painting.
  - 1.7.7.2 Clean surfaces soiled by spillage of paint and paint spatters.
  - 1.7.7.3 Be responsible for cleaning operations that cause damage to the surface until the Contract is complete. Repair or replace damaged Work without cost to TTC. Surfaces shall be cleaned and repainted to the satisfaction of TTC.
  - 1.7.7.4 Leave areas clean and free from evidence of occupancy upon completion of Work.



- 1.7.8 Testing:
- 1.7.8.1 Prior to painting Work:
- 1.7.8.1.1 Test concrete, masonry, and plaster surfaces for alkalinity.
- 1.7.8.1.2 Test that moisture content of substrates does not exceed the following maximums:
- 1.7.8.1.2.1 12% for concrete and masonry (clay and concrete brick/block).
- 1.7.8.2 Carry out test for dry film thickness (dft) over entire surface to be painted, as required.

## **1.8 SCHEDULING**

- 1.8.1 Allow curing of concrete for 28 Days at 24°C before painting, unless the manufacturer's Products are designed for application prior to curing for 28 Days.
- 1.8.2 Indicate in writing, constraints that may affect the scheduling of particular Work activities caused by external factors.
- 1.8.3 To prevent disruptions, coordinate and cooperate with Other Contractors and TTC in performing Work required to complete the Contract.
- 1.8.4 In occupied facilities, schedule Work to prevent disruption of occupants in and around the building and ensure painted surfaces will have dried so that occupants are not affected.
- 1.8.5 Perform painting after facility working hours in accordance with Contract Schedule.
- 1.8.6 Obtain written authorization from TTC for changes in the Work schedule.

## **1.9 EXTRA STOCK MATERIALS:**

- 1.9.1 Provide labelled, packaged maintenance materials in accordance with Section 01 78 43.
- 1.9.2 Maintenance materials shall be from the same production run (batch mix) as paint used on the Contract.
- 1.9.3 Containers shall be new, unopened cans, properly labelled and identified with the manufacturer's name, type of paint, colour and colour number. Store where directed in accordance with this Section's requirements.

## **2 Products**

### **2.1 MATERIALS**

- 2.1.1 Primers and paint:
- 2.1.1.1 Coatings, varnishes, stains, lacquers, and putty or plastic wood-fillers: Use only Products listed in the MPI Approved Products List, exterior and interior systems as manufacturer's premium grade and quality Products.
- 2.1.2 Acceptable manufacturers:
- 2.1.2.1 Benjamin Moore & Co. Limited.
- 2.1.2.2 Devoe Coatings brand by PPG Architectural Coatings Canada Inc.
- 2.1.2.3 Dulux Paints, a division of PPG Architectural Coatings Canada Inc.
- 2.1.2.4 Flame Control Coatings, Inc.
- 2.1.2.5 Glidden brand by Dulux Paints, a division of PPG Architectural Coatings Canada.
- 2.1.2.6 ITW Polymers Coatings North America.

- 2.1.2.7 PPG Architectural Coatings Canada Inc.
- 2.1.2.8 PPG Canada, Inc., PPG Protective and Marine Coatings Division.
- 2.1.2.9 Procoat.
- 2.1.2.10 RPM International Inc.
- 2.1.2.11 The Sherwin-Williams Company.
- 2.1.3 Other materials such as cleansers, detergents and coating additives to be the highest quality Products and compatible with the paint materials being used in accordance with manufacturer's recommendations.
- 2.1.4 Materials to be lead and mercury free and comply with CEPA, Volatile Organic Compound (VOC) Concentration Limits for Architectural Coatings Regulations.
- 2.1.5 Materials to have good flowing and brushing properties, and dry or cure free of blemishes, sags, and air entrapment. Paint to have uniform dispersion of pigment in a homogeneous mixture. Refer to Article 3.5, Field Quality Control, for standard of acceptance requirements.

## **2.2 EQUIPMENT**

- 2.2.1 Applicators to be of premium quality, clean, and suitable for the type of Product and application, in accordance with MPI and Product manufacturer's recommendations.
- 2.2.2 Spray painting equipment: Suited to the type and consistency of paint or coating being applied, of ample capacity, and kept clean and in good working order at all times.

## **2.3 MIXING AND TINTING**

- 2.3.1 Unless otherwise specified in this Section, paint shall be ready-mixed and pretinted to match finish.
- 2.3.2 Mix paste, powder or catalyzed paint mixes in accordance with manufacturer's recommendations.
- 2.3.3 If required, thin paint for spraying in accordance with paint manufacturer's recommendations. If directions are not on the container, obtain instructions in writing from manufacturer and provide a copy to TTC.
  - 2.3.3.1 Do not use kerosene or any organic solvents to thin paints.

## **2.4 COLOUR SCHEDULE**

- 2.4.1 TTC will select paint colours at a later date.
- 2.4.2 Colour Schedule: TTC will refine choice of colours and gloss/sheen rating when compiling a Colour Schedule for the Contract. Allow for colour selection beyond the paint manufacturer's standard colour range including light and dark tones.
  - 2.4.2.1 Conform to paint gloss/sheen level rating requirements, listed in MPI, Architectural Painting Specification Manual and Paragraph 2.5.2.
- 2.4.3 TTC shall have complete freedom in choice of colours in compiling the Colour Schedule and will not necessarily select colours from the standard colour charts of the manufacturer's Products reviewed for use.
- 2.4.4 TTC shall have the right to make changes in colour tone of finishes prior to final coat to obtain desired results without additional cost to TTC.

## **2.5 PAINTING AND FINISHING SCHEDULE**

2.5.1 Perform Work in accordance with MPI premium grade finish requirements and this Section.

2.5.2 MPI Gloss/Sheen Level Rating:

G1	Matte finish – flat
G2	Velvet
G3	Eggshell finish
G4	Satin
G5	Semi-gloss finish
G6	Gloss
G7	High-gloss finish

Painting and Finishing Schedule				
INTERIOR SUBSTRATES	Application	Manufacturer	Coating System	Gloss/Sheen Rating
INT 4.2: Concrete Masonry Units (concrete block)	General	The Sherwin-Williams Company	1st coat: Preprite Block Filler Interior/Exterior Latex 2nd and 3rd coats: Pro Industrial Acrylic	G5
INT 5.3: Galvanized Metal (not chromate passivated - zinc coated steel)	High contact/high traffic areas (pipes, etc.)	The Sherwin-Williams Company	1st coat: Pro Industrial Pro-Cryl Universal Primer 2nd and 3rd coats: Hi-Solids Polyurethane 100	G7
		Benjamin Moore & Co. Limited	1st coat: Insl-X Stix Waterborne Bonding Primer SXA-110 2nd and 3rd coats: Insl-X Corotech V540 Waterborne Urethane	
INT 5.5: Copper (Pipes)	General	The Sherwin-Williams Company	1st coat: DTM Wash Primer 2nd and 3rd coats: Pro Industrial Acrylic	G7
INT 10.1: Canvas and Cotton Coverings (pipes and duct coverings, etc.)	General	The Sherwin-Williams Company	1 <sup>st</sup> and 2 <sup>nd</sup> coats: Pro Industrial Acrylic	G7

3 Execution

### **3.1 EXAMINATION**

3.1.1 Verify condition of previously installed Work upon which this Section depends. Report defects to TTC. Commencement of Work means acceptance of existing conditions.

### **3.2 PREPARATION**

#### **3.2.1 General:**

3.2.1.1 Clean substrate surfaces free from dust, grease, soiling or extraneous matter which are detrimental to finish.

3.2.1.2 Patch, repair, and smooth minor substrate defects and deficiencies, such as machine, tool, and sand paper marks, shallow gouges, marks and nibs.

3.2.1.3 Refer to MPI, Architectural Painters Specification Manual, for surface preparation requirements of substrates not listed here.

3.2.2 Where finish hardware, electrical coverplates, light fixtures, grilles, gratings, louvres, access panels, convector covers, enclosures, and other escutcheons and appurtenances have been installed, remove, store, and re-install to accommodate painting. Do not clean hardware with solvent that will damage or remove permanent lacquer finishes.

**3.2.3 Alkali Content Tests and Neutralization:**

3.2.3.1 Test for pH level using litmus paper on dampened substrate.

3.2.3.2 Neutralize surfaces over 8.5 pH with 4% solution of zinc sulphate for solvent based systems and tetrapotassium pyrophosphate for latex based systems, to below 8.0 pH, and allow to dry.

3.2.3.3 Brush off any residual zinc sulphate crystals.

3.2.3.4 Coordinate paint system primer/sealer to be alkali-resistant.

**3.2.4 Substrate Moisture Tests:**

3.2.4.1 Test for moisture content over entire surface to be painted, minimum one test/2 m<sup>2</sup> in field areas and one test/600 mm along inside corners including at ceiling to wall juncture.

3.2.4.2 If any test registers above 10%, allow entire substrate surfaces, within the plane, to dry further before paint system application. Install temporary drying fans, if necessary.

3.2.4.3 Retest employing same criteria as above.

**3.2.5 Mildew Removal:**

3.2.5.1 Scrub with solution of trisodiumphosphate and sodium hypochlorite (Javex) bleach, rinse with water and allow to dry completely.

**3.2.6 Cementitious and Masonry (Block):**

3.2.6.1 Allow curing for 28 Days before painting.

3.2.6.2 Coordinate repair of protrusion-chipping grinding and honeycomb filling with responsible trades.

3.2.6.3 Remove dirt, loose mortar, scale, powder, efflorescence and other foreign matter.

3.2.6.4 Remove form oil and grease with trisodiumphosphate, rinse and allow to dry thoroughly.

3.2.6.5 Prepare surfaces in accordance with SSPC-SP 13/NACE No. 6.

3.2.6.6 Remove rust stains with solution of sodium metasilicate after thorough wetting; allow to dry thoroughly.

**3.2.7 Aluminum (Mill Finish):**

3.2.7.1 Wash with xylene solvent, apply etching primer, then paint immediately.

**3.2.8 Copper (Mill Finish):**

3.2.8.1 Wash with xylene solvent, apply vinyl etch primer, then paint immediately.

**3.2.9 Galvanized Steel Sheet:**

3.2.9.1 Z275 (heavy coating): In accordance with SSPC-SP 7/NACE No. 4.

3.2.9.2 ZF075 (light zinc coating or satin coating): Remove contamination, wash with xylene solvent.

3.2.9.3 Touch-up damaged galvanized areas with organic zinc-rich primer.

**3.2.10 Galvanized Iron and Steel:**

- 3.2.10.1 Prepare galvanized and ungalvanized metal surfaces in accordance with SSPC-SP 1.
- 3.2.10.2 Unpassivated, unweathered and weathered: Remove oil, grease, dirt, oxide and other foreign materials in accordance with SSPC-SP 1, subject to paint manufacturer's recommendations for paint application.
- 3.2.10.3 Manufacturer pretreated (including passivated): In accordance with SSPC-SP 7/NACE No. 4.
- 3.2.10.4 Touch-up damaged galvanized areas with organic zinc-rich primer.

**3.2.11 Factory Primed Surfaces:**

- 3.2.11.1 Touch-up damaged areas.
- 3.2.11.2 Clean as required for top coat.

**3.2.12 Coordinate with Other Trades to Prevent:**

- 3.2.12.1 Damage and inadvertent activation of fire and smoke detectors.
- 3.2.12.2 Odour and dust distribution by permanent HVAC systems including fouling of ducts and filters.

**3.3 MIXING PAINT**

- 3.3.1 Field-mix Products in accordance with manufacturer's recommendations.
- 3.3.2 Do not use kerosene or any other organic solvents to thin water-based paint.

**3.4 APPLICATION**

- 3.4.1 Apply painting systems in accordance with the MPI, Architectural Painters Specification Manual. Apply each Product in accordance with manufacturer's recommended dry film thickness (dft).
- 3.4.2 Painting systems listed are the minimum acceptable level of quality. Apply additional coats if necessary to obtain substrate hiding acceptable to TTC.
- 3.4.3 Tint prime and intermediate coats lighter than final topcoats for identification of each succeeding coat and to facilitate inspections. Include only manufacturer's recommended reducing and tinting accessories. Do not add adulterants.
- 3.4.4 Sand lightly between coats to achieve a suitable bonding surface for subsequent coats.
- 3.4.5 Apply paint uniformly in thickness, colour, texture and gloss, as determined by TTC under adequate illumination and viewed at a distance of 1500 mm. Apply finishes free of defects in materials and application which, in the opinion of TTC, affect appearance and performance. Defects include, but are not limited to:
  - 3.4.5.1 Improper cleaning and preparation of surfaces.
  - 3.4.5.2 Entrapped dust, dirt, rust.
  - 3.4.5.3 Alligatoring, blisters, peeling.
  - 3.4.5.4 Scratches, blemishes.
  - 3.4.5.5 Uneven coverage, misses, drips, runs and poor cutting in.
- 3.4.6 Do not apply coatings on substrates, which are not sufficiently dry. Unless indicated otherwise, allow each painting system coat to cure until dry and hard before the following coats are applied.

3.4.7 Repaint entire areas of damaged or incompletely covered surfaces, to the nearest inside or outside corner. Patching will not be permitted.

**3.4.8 Miscellaneous Painting Requirements:**

3.4.8.1 Paint all surfaces of projecting ledges above and below sight lines to match adjacent surfaces, unless otherwise specified.

3.4.8.2 Two (2) wall colours per room.

**3.4.9 Mechanical, Electrical, and Other Painting Coordination:**

3.4.9.1 Paint mechanical services in accordance with Divisions 20, 21, 22, 23 and as indicated herein.

3.4.9.2 Coordinate painting of pipes, ducts and coverings with the Work of Divisions 22 and 23 to precede pipe colour banding, flow arrows, and other pipe identification labelling installation.

3.4.9.3 Paint exposed conduit, pipes, hangers, ductwork, grilles, gratings, louvres, access panels, fire hose cabinets, registers, convector and radiator covers, enclosures and other mechanical and electrical equipment including services concealed inside cupboard and cabinet work. Apply colour and sheen to match adjacent surfaces, except as noted otherwise.

3.4.9.4 Paint portions of surfaces such as duct interiors, piping, ductwork, hangers, insulation, walls and similar items, visible through grilles, louvres, convector covers, etc., matte black in colour.

3.4.9.5 Remove the following to accommodate painting, carefully store, clean, then reinstall on completion of each area and when dry:

3.4.9.5.1 Switch and receptacle plates.

3.4.9.5.2 Fittings and fastenings.

3.4.9.5.3 Grilles, gratings, louvres and access panels.

3.4.9.6 Mechanical equipment:

3.4.9.6.1 Prime and paint the following mechanical equipment and services in their entirety:

3.4.9.6.1.1 Exposed sanitary, storm and vent piping.

3.4.9.6.1.2 Other equipment and services identified in Contract Documents.

3.4.9.6.2 Refer to Section 20 05 53 for colours for mechanical services. Where colours not identified, obtain colour from TTC.

**3.5 FIELD QUALITY CONTROL**

3.5.1 Dry film thickness tests:

3.5.1.1 Test for dft over entire surface to be painted, minimum one test/2 m<sup>2</sup> in field areas and one test/600 mm along inside corners including at ceiling to wall junction.

3.5.1.2 If any test registers below specified thickness, reapply paint to entire surface to nearest inside and outside corners.

3.5.1.3 If test registers more than 50% above specified thickness:

3.5.1.3.1 Consult with paint manufacturer.

3.5.1.3.2 Determine if problem exists.

3.5.1.3.3 Offer solutions to TTC and repair as directed.

3.5.1.4 Retest employing same criteria after repair.

### **3.6 CLEANING**

3.6.1 Clean and reinstall all items that were removed before undertaking painting operations.

3.6.2 Remove spilled, splashed, and splattered paint promptly as Work proceeds and on completion of Work. Clean surfaces soiled by paint spillage and paint splatters. Repair or replace damaged Work as directed by TTC.

3.6.3 Protect surfaces from paint droppings and dust to meet the approval of TTC. Avoid scuffing newly applied paint.

3.6.4 Restore areas used for storage, cleaning, mixing, and handling of paint to clean condition as approved by TTC.

### **3.7 PROTECTION**

3.7.1 Post WET PAINT signs during drying and restrict or prevent traffic where necessary.

3.7.2 Following inspection and acceptance by TTC of each room, post sign reading:  
PAINTING COMPLETE - NO ADMITTANCE WITHOUT CONTRACTOR'S  
PERMISSION.

**END OF SECTION**





1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment and services necessary for locker Work in accordance with the Contract Documents.

**1.2 REFERENCES**

1.2.1 ASTM A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.

1.2.2 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.2.3 CAN/CGSB-93.1, Sheet, Aluminum Alloy, Prefinished, Residential.

1.2.4 CGSB 1.88, Gloss Alkyd Enamel, Air Drying and Baking.

1.2.5 CAN/CGSB-1.213, Etch Primer (Pretreatment Coating or Tie Coat) for Steel and Aluminum.

1.2.6 CSA W47.1, Certification of Companies for Fusion Welding of Steel Structures.

1.2.7 CSA W47.2, Certification of Companies for Fusion Welding of Aluminum.

1.2.8 CSA W55.3, Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings

1.2.9 CSA W59, Welded Steel Construction (Metal Arc Welding).

**1.3 QUALITY ASSURANCE**

1.3.1 Welding by fabricator fully approved by the Canadian Welding Bureau to CSA W47.1, CSA W55.3 and CSA W47.2 as may be applicable.

**1.4 SUBMITTALS**

1.4.1 Submit in accordance with Section 01 33 00.

**1.4.2 Product Data, and Shop Drawings Package:**

**1.4.2.1 Product data:**

1.4.2.1.1 Submit manufacturer's Product data for all Products listed in this Section indicating:

1.4.2.1.1.1 Product transportation, storage, handling and installation requirements.

**1.4.2.2 Shop Drawings:**

1.4.2.2.1 Submit Shop Drawings in accordance with Section 01 33 23, indicating:

1.4.2.2.1.1 Elevations, sections and detail dimensions, gauges, finishes and relationship to adjacent construction.

1.4.2.2.1.2 Type and class of locker, fabricating and assembly methods, assembled banks of lockers, tops, rods, hooks, shelves bases, trim, numbering, filler panels where applicable, end/back panels, doors, handles locking method, and ventilation method.

1.4.2.2.1.3 Dimensions job checked where work is installed against finished surfaces.

2 Products

**2.1 MANUFACTURERS**

2.1.1 Hadrian Manufacturing Inc.

**2.2 MATERIALS**

2.2.1 **Sheet Steel:** ASTM A653/A653M, ZF 075, wiped coat.

2.2.2 **Aluminum sheet:** mill finish plain, embossed, patterned, utility sheet.

2.2.3 **Aluminum extrusions:** Aluminum Association alloy AA6063-T5.

2.2.4 **Steel:** New, medium grade steel.

2.2.5 **Stainless steel:** ASTM A167, Type 302 alloy with a No. 4 finish.

2.2.6 **Welding materials:** CSA W59.

2.2.7 **Interior primer:** CISC/CPMA Standard 2-75a.

2.2.8 **Zinc rich primer:** Minimum 97% pure electrolytic zinc in dry film coating.

2.2.9 **Primer for baked-on enamel finishes on steel:** CGSB 1.81 Type II.

2.2.10 **Baked-on enamel finishes on steel:** CGSB 1.88 Type II.

2.2.11 **Nails and fasteners:** same material as fabricated items.

2.2.12 **Gaskets:** Vinyl.

2.2.13 **Primer:** CAN/CGSB-1.213 for aluminum surfaces.

2.2.14 Prefinish steel sheet with factory applied polyvinylidene fluoride Class F1S or F2S colour selected from manufacturer's standard range

2.2.15 Prefinish aluminum sheet with factory applied coating to CAN/CGSB-93.1 Type 1 or 2, Class F1S or F2S colour selected from manufacturer's standard range.

**2.3 FABRICATION**

2.3.1 **Lockers:** Type 1-two tier full-height locker, Class 2 - A bank of lockers, freestanding.

2.3.1.1 **Size:** 300 mm wide x 450 mm deep x 1830 high.

2.3.1.2 **Assembly:** Welded construction.

2.3.1.3 **Top:** Sloped.

2.3.1.4 **Doors:** One-piece double-wall envelope construction, cold rolled stretcher levelled sheet steel 20 msg thick outer panel and 24 msg thick inner panel spot welded together on 4 sides. Doors set flush to frames with continuous hinge.

2.3.1.5 **Door Frames:** Cold rolled minimum 16 msg thick sheet steel formed to a channel shape and horizontal members welded to vertical member.

2.3.1.6 **Door handle:** Recessed handle aluminum, approved colour anodized.

2.3.1.7 **Body:** Comprised of sides, back, top and bottom 24 msg thick cold rolled steel with formed edges, or 26 msg if sides are provided with stiffening ribs and back is flanged. Provide positive drain in bottom.

2.3.1.8 **Shelve:** 24 msg thick cold rolled steel with channel formed front, one per locker.

**2.3.2 Accessories:**

- 2.3.2.1 **Heavy-Duty Hooks:** three (3) wrought steel rod coat hooks attached as approved.
- 2.3.2.2 **Ventilation:** Provide proven, unobstructed free-flow ventilation at top and bottom of lockers.
- 2.3.2.3 **Locking Device:** Keyed cylinder lock, master keyed. Supply two change keys for each locker and six master keys.
- 2.3.2.4 **Base:** manufacturer's standard 89 mm high galvaneal steel box base with 44 mm recess from locker front.

3 Execution

**3.1 INSTALLATION**

- 3.1.1 Install lockers to sizes and to profiles shown on the Contract Drawings from materials and thicknesses (gauges) specified herein.
- 3.1.2 Assemble and install lockers in accordance with manufacturer's written instructions.
- 3.1.3 Install locker numbers and locking devices specified.

**END OF SECTION**



1 General

**1.1 SECTION INCLUDES**

1.1.1 This Section covers general requirements for supply, installation, and testing of mechanical systems and equipment as indicated in Contract Documents.

1.1.2 Refer to requirements of Division 01.

**1.2 GENERAL REQUIREMENTS**

1.2.1 Comply with local authorities having jurisdiction.

1.2.2 Supply and install warning signs, nameplates and glass covered diagrams as required by inspection authority.

1.2.3 Submit required documentation and Shop Drawings to authorities having jurisdiction in order to obtain approval for the Work. Copies of Contract Documents may be used for this purpose. Contractor to prepare additional information, details, etc. authorities require.

1.2.4 Where materials require special inspection and approval of CSA or local authorities, obtain such approval for particular installation.

**1.3 SUBMITTALS**

1.3.1 Submit the following in accordance with Section 01 33 00:

1.3.1.1 Product data.

1.3.1.2 Shop Drawings and in accordance with Section 01 33 23.

1.3.1.3 Samples.

1.3.1.4 Test reports and in accordance with Section 23 05 93.

1.3.1.5 Test certificates and in accordance with authorities having jurisdiction.

1.3.1.6 Commissioning package and in accordance with Section 01 91 00.

1.3.1.7 Commissioning closeout package and in accordance with Section 01 91 00.

1.3.1.8 Training plan and in accordance with Section 01 79 00.

1.3.1.9 Operation and Maintenance Manuals and in accordance with Section 01 78 23.

1.3.1.10 As-Built Drawings and in accordance with Section 01 78 39.

**1.4 SUBSTITUTIONS AND ALTERNATIVE PRODUCTS**

1.4.1 Where a specified Product is substituted or an alternative Product is proposed, submit Product data for both the specified Product and the alternative Product.

1.4.2 Alternative and substitute submittals will be returned without review unless accompanied by the specified Product submittal literature.

1.4.3 Refer to Section 01 62 00 item 2 for general requirements.

**1.5 DELIVERY, STORAGE, AND HANDLING**

1.5.1 Equipment shall not be delivered to Site until it is ready to be installed.

1.5.2 Whether located on Site or not, protect all equipment from dust, dirt and the elements.

**1.6 TRAINING**

- 1.6.1 Provide training in accordance with Section 01 79 00, and as indicated within mechanical Sections.

## **1.7 DIMENSIONS**

- 1.7.1 Verify dimensions by reference to Product data sheets, Shop Drawings and field measurement where applicable.
- 1.7.2 Include for necessary changes or additions to routing of piping, ductwork, and other services, to accommodate structural, electrical and architectural conditions.

## **1.8 COORDINATION**

- 1.8.1 Co-ordinate installation of mechanical equipment with equipment of other trades. Notify other trades in advance of openings, anchors, hangers or other provisions necessary for installation.
- 1.8.2 Co-ordinate installation of all new and existing mechanical services to avoid interferences. Co-ordinate installation of mechanical equipment with equipment of other trades.
- 1.8.3 Identify embedded, concealed or recessed equipment before construction start. In spaces above ceilings, co-ordinate installation with other trades.
- 1.8.4 Notify other trades concerned of openings, anchors, hangers or other provisions necessary for installation of mechanical Works installed or provided in structure, walls, floors, etc., or may affect other Work.
- 1.8.5 Read Contract Drawings in conjunction with manufacturer's Installation Instructions.
- 1.8.6 Install mechanical items in time to avoid cutting or patching of Work.
- 1.8.7 Include for reconstruction of Work required due to lack of timely submissions before commencing Work. Remove, relocate or replace Work to TTC acceptance.
- 1.8.8 Where conflicts or Site conditions require appreciable deviation from the Work as specified or indicated, notify TTC before proceeding.

## **1.9 SPARE PARTS**

- 1.9.1 Provide spare part list including component parts availability, names and addresses of spare part suppliers, and list of specialized tools necessary for maintenance.
- 1.9.2 Furnish spare parts in accordance with mechanical Sections. In addition, provide the following:
  - 1.9.2.1 One filter cartridge or set of filter media for each filter or filter bank in addition to one final operating set, including all HVAC equipment.
  - 1.9.2.2 As indicated in the Specifications.
- 1.9.3 Submit manufacturer's recommended spare parts lists for all mechanical equipment for purposes of ordering selected spare parts. Submit copies in accordance with Section 01 33 00, each copy to be contained in a binder with individual Sections separated by tabs.

2 Products

**2.1 APPROVALS AND QUALITY**

- 2.1.1 Provide new materials and new Products only. Equipment to bear approval stamp of CSA, or approval label of other authority having jurisdiction for particular application and location used.
- 2.1.2 Provide units of same manufacture where two or more units of same class or type of equipment required.

**2.2 SLEEVES**

- 2.2.1 Provide sleeves in accordance with Section 05 50 00.
- 2.2.1.1 **Vertical:** Extend 50 mm above and below the slab.
- 2.2.1.2 **Horizontal:** Flush to width of wall.
- 2.2.2 Waterproof sleeves packed and sealed as follows:
  - 2.2.2.1 Seals modular mechanical type consisting of interlocking synthetic rubber links shaped to continuously fill annular space around outside of pipe. Links loosely assembled with bolts to form continuous rubber belt around pipe, with pressure plate under each bolt head and nut.
  - 2.2.2.2 Determine inside diameter of each individual wall opening or sleeve as applicable before fabricating seals.
  - 2.2.2.3 After seal correctly positioned, tighten seal bolts to expand rubber links and provide watertight seal to manufacturer's recommendations.
  - 2.2.2.4 Manufacturers:
    - 2.2.2.4.1 Link-Sea' by Thunderline Link-Seal.
    - 2.2.2.4.2 Metraseal by The Metraflex Company.

**2.3 EQUIPMENT SUPPORTS**

- 2.3.1 **Equipment supports supplied by equipment manufacturer:** specified elsewhere in Divisions 20, 21, 22 and 23.
- 2.3.2 **Equipment supports not supplied by equipment manufacturer:** fabricate from structural grade steel meeting requirements of Section 05 50 00. Submit Shop Drawings sealed by a Professional Engineer, licensed in the Province of Ontario, indicated all loads and connection details.
- 2.3.3 Co-ordinate all dimensional information for equipment supports with reviewed Shop Drawings. No equipment frames shall be assembled prior to confirmation with reviewed Shop Drawings.
- 2.3.4 Place floor-mounted equipment on existing housekeeping pads. Equipment includes, but is not limited to:
  - 2.3.4.1 Hot water tanks.
  - 2.3.4.2 Pipe and duct risers from underground.

## **2.4 PREPARATION FOR FIRESTOPPING**

- 2.4.1 Firestopping material and installation within annular space between pipes, ducts, insulation and adjacent fire separation: specified in Section 07 84 00.
- 2.4.2 Uninsulated unheated pipes not subject to movement: no special preparation.
- 2.4.3 Uninsulated heated pipes subject to movement: wrap with non-combustible smooth material to permit pipe to move without damaging firestopping material.
- 2.4.4 Insulated pipes and ducts: ensure integrity of insulation and vapour barrier at fire separation.

## **2.5 ESCUTCHEONS**

- 2.5.1 **Application:** On pipes passing through walls, partitions, floors and ceilings in finished areas.
- 2.5.2 Chrome or nickel plated brass or Type 302 stainless steel, one piece type with set screws.
- 2.5.3 Outside diameter to cover opening or sleeve.
- 2.5.4 Inside diameter to fit around finished pipe.

## **2.6 FINISHES**

- 2.6.1 Clean and touch up surfaces of shop painted Products scratched or marred during shipment or installation, to match original paint.
- 2.6.2 Clean, prime and paint exposed hangers, racks, and fasteners to prevent rust in accordance with Section 09 91 00.

## **2.7 ACCESS DOORS**

- 2.7.1 Prime coat painted steel (unless otherwise specified) flush access doors, each complete with a minimum #16 gauge frame, minimum #18 gauge door panel, heavy-duty rust-resistant concealed hinges, a positive locking screwdriver lock, and mounting and finishing features to suit the particular construction in which it is to be installed.
- 2.7.2 Access door sizes are to suit the concealed work for which they are supplied, and wherever possible they are to be of a standard size for all applications, but in any case they are to be minimum 300 mm x 300 mm for hand entry and 600 mm x 600 mm for body entry.
- 2.7.3 Access doors in fire rated construction are to be ULC listed and labelled and of a rating to maintain the fire separation integrity.
- 2.7.4 Where access doors are located in surfaces where special finishes are required, they are to be of a recessed door type capable of accepting the finish in which they are to be installed so as to maintain the final building surface appearance throughout, and constructed of stainless steel with a #4 finish.

## **3 Execution**

### **3.1 FASTENINGS**

- 3.1.1 Provide fastenings in accordance with Section 05 50 00.
- 3.1.2 Provide anchor bolts, sleeves and fasteners of same finish as adjacent materials, unless stainless steel or other material specified.



- 3.1.3 Space anchors within their load limit or shear capacity and ensure they provide positive permanent anchorage. Organic material plugs unacceptable.
- 3.1.4 Establish anchor locations by means of templates or by utilizing pre-drilled steelwork as template.
- 3.1.5 Install anchors in accordance with manufacturer's instructions.

### **3.2 NOISE AND VIBRATION**

- 3.2.1 If equipment operates with excessive noise or vibration due to improper installation, balancing or support, eliminate noise or vibration to TTC acceptance, in accordance with Section 20 05 48.
- 3.2.2 Make connections to noise producing and vibrating equipment with flexible conduit and connectors.
- 3.2.3 Install vibration isolators where indicated. Isolate equipment from structure with spring or rubber isolators when suspended and appropriate sandwich pads when floor mounted.
- 3.2.4 Perform dynamic balancing of equipment exceeding 2 mm/s.

### **3.3 IDENTIFICATION OF EQUIPMENT**

- 3.3.1 Identify mechanical equipment and systems in accordance with Section 20 05 53 and as indicated on Contract Drawings.
- 3.3.2 Identification of equipment not specifically listed in Section 20 05 53 to meet standards set by Section 20 05 53. Directions supplied by TTC at later date.

### **3.4 CONSUMABLES**

- 3.4.1 Provide consumables for duration of the Contract.
- 3.4.2 Provide list including component parts availability, names and addresses of suppliers, recommended manufacturer schedules for consumables.

### **3.5 TRIAL USE**

- 3.5.1 Temporary or trial usage by TTC of any device, machinery, apparatus, equipment or other Work supplied under this Section before final completion and written acceptance by TTC, is not evidence of acceptance by TTC.
- 3.5.2 TTC has the privilege of such temporary and trial usage as soon as the Contractor claims Work completed in accordance with Contract Documents, for such reasonable length of time as TTC deems sufficient for making complete and thorough test. No claim allowed for damage to or breaking of any parts of such Work used, when caused by defective materials or improper workmanship.

### **3.6 FIELD QUALITY CONTROL**

- 3.6.1 Test equipment and systems provided under this Division for electrical and mechanical defects in accordance with Standards and recommendations of manufacturers, and corrections and adjustments made prior to requesting inspection by TTC.

### **3.7 COMMISSIONING**

- 3.7.1 Perform commissioning in accordance with this Section and Sections 01 91 00 and 23 05 93.
- 3.7.2 General:
  - 3.7.2.1 Performance test the equipment to verify electrical and mechanical operation is in accordance with Standards and recommendations of manufacturers.

- 3.7.2.2 Provide factory authorized and trained personnel to perform commissioning and start-up testing, including checkout, adjustments, balancing and calibration of components and systems, as required.
- 3.7.2.3 Provide these services, as required, to ensure installation is in proper working order and to ensure TTC's staff is conversant with all aspects of its care and operation.
- 3.7.2.4 Check, adjust, calibrate and balance components, as applicable, including controls, ducting, piping and field wiring. Provide these services for such period and for as many visits as necessary to achieve complete working order in subject work.
- 3.7.2.5 Commissioning Closeout Reports to include Sequence of Operations and piping and wiring schematics.
- 3.7.2.6 Inspections by jurisdictional authorities shall include all appropriate local and provincial authorities, such as:
  - 3.7.2.6.1 Building Inspection's Department, in accordance with Ontario Building Code.
  - 3.7.2.6.2 Fire Services Inspection's Department.
  - 3.7.2.6.3 Ministry of Labour, Regulation for Industrial Establishments.
  - 3.7.2.6.4 Technical Standards and Safety Authority (TSSA).

### **3.8 PRE-START HEALTH AND SAFETY REVIEW REPORTS**

- 3.8.1 For pre-start health and safety review requirements, refer to Section 01 11 00 and technical Sections.

### **3.9 CLEANING**

- 3.9.1 Final cleaning in accordance with Section 01 74 11.
- 3.9.2 At completion of Work, carry out complete and thorough clean up on surfaces of equipment, and on interior of panels.
- 3.9.3 Where equipment shows corrosion, or damage to finish, touch-up surfaces to TTC acceptance.
- 3.9.4 Leave polished, painted or plated Work bright and clean. Replace filters in air and piping systems.
- 3.9.5 Repair, adjust and lubricate mechanisms and leave in operational condition.
- 3.9.6 Clean or replace, to TTC's satisfaction, all equipment components that become plugged or inoperable as result of debris entering mechanical systems.
- 3.9.7 Replace all equipment filters with new at Substantial Performance.

### **3.10 MECHANICAL INTERFERENCES**

- 3.10.1 Based upon the information presented on the Contract Drawings, manufacturer's installation instructions and Shop Drawing submittals, co-ordinate the final location of mechanical equipment with other disciplines.
- 3.10.2 Review Drawings and submittals as they become available, and identify potential interference problems to TTC before construction of same commences.
- 3.10.3 Adjust equipment location where required to allow clearances and access for routine maintenance.

- 3.10.4 Prior to commencing installation prepare and submit Drawings of equipment and systems, requiring tight co-ordination among trades, and where deviations from Contract Drawings must be made to resolve interference with other systems, building structure, or to maintain access for routine maintenance.

**3.11 SUPPLY OF ACCESS DOORS**

- 3.11.1 Supply access doors to give access to all mechanical Work which may need maintenance or repair but which is concealed in inaccessible construction, except as otherwise specified herein or on the Drawings.
- 3.11.2 Locate access doors as inconspicuously as possible in walls and partitions and arrange mechanical Work such that it is clearly within view and accessible for inspection and servicing.
- 3.11.3 Group piping and ductwork to ensure the minimum number of access doors is required. Access doors will be installed by the trades responsible for the particular type of construction in which the doors are required.

**3.12 MAINTENANCE**

- 3.12.1 Maintain all equipment and systems installed until Substantial Performance, in accordance with Section 01 78 25.
- 3.12.2 Carry out regular scheduled maintenance of equipment and systems following Substantial Performance until Contract Completion, in accordance with Section 01 78 25.

**END OF SECTION**



1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment and services necessary for pressure gauge and thermometer Work in accordance with the Contract Documents.

**1.2 REFERENCES**

1.2.1 ANSI/ASME B40.1, Gauges-Pressure, Indicating Dial Type-Elastic Element.

1.2.2 CAN/CGSB-14.4, Thermometers, Liquid-in-Glass, Self Indicating, Commercial/Industrial Type.

1.2.3 CAN/CGSB-14.5, Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.

**1.3 SUBMITTALS**

1.3.1 Submit in accordance with Section 01 33 00.

**1.3.2 Product Data:**

1.3.2.1 Submit manufacturer's Product data indicating performance criteria, compliance with appropriate reference standards, characteristics, and limitations, for the following items:

1.3.2.1.1 Thermometers.

1.3.2.1.2 Pressure gauges.

1.3.2.1.3 Stop cocks.

1.3.2.1.4 Syphons.

1.3.2.1.5 Wells.

**1.3.3 Closeout Submittals Package:**

1.3.3.1 Submit the following for incorporation into Operation and Maintenance Manuals in accordance with Section 01 78 23:

1.3.3.1.1 Identification: Manufacturing name, type, year, serial number, number of units, capacity, and identification of related systems.

1.3.3.1.2 Functional description detailing operation and control of components.

1.3.3.1.3 Performance criteria and maintenance data.

1.3.3.1.4 Operating instructions and precautions.

1.3.3.1.5 Safety precautions.

1.3.3.1.6 Maintenance and troubleshooting guidelines/protocol, and recommended equipment for analysis and repair.

2 Products

**2.1 GENERAL**

2.1.1 **Ranges:** Full range to be twice design operating point.

## **2.2 THERMOMETERS**

- 2.2.1 Round, 125 mm diameter, adjustable (90°) angle bimetal dial type thermometers, in accordance with referenced standards.
- 2.2.2 Accurate to within 1% of full scale.
- 2.2.3 Hermetically sealed stainless steel case with stainless steel ring.
- 2.2.4 Dampened bimetal coil, calibration adjustment screw.
- 2.2.5 White aluminum dual scale dial with black and blue markings and black aluminum pointer.
- 2.2.6 Double strength glass window.
- 2.2.7 12 mm NPT connection with 6.4 mm diameter stainless steel stem, and a suitable thermowell.

### **2.2.8 Manufacturers:**

- 2.2.8.1 H.O. Trerice B85600 Series.
- 2.2.8.2 Weiss Model 5VBM25.
- 2.2.8.3 Ashcroft #50E160E-040-0/250.

## **2.3 THERMOMETER WELLS**

- 2.3.1 Copper pipe: copper or bronze.
- 2.3.2 Steel pipe: brass or stainless steel.

## **2.4 PRESSURE GAUGES**

- 2.4.1 Adjustable glycerine filled, 100 mm or 115 mm diameter, in accordance with referenced standards.
- 2.4.2 Accurate to within 1% of scale range.
- 2.4.3 Type 304 stainless steel case with relief valve and polished stainless steel bayonet.
- 2.4.4 Stainless steel rotary movement with stainless steel bushings and socket.
- 2.4.5 Clear acrylic window.
- 2.4.6 Dual scale white dial and black pointer.

### **2.4.6.1 Manufacturers:**

- 2.4.6.1.1 H.O. Trerice Co. No. 700 Series.
- 2.4.6.1.2 Weiss Instruments Model LF4S-2.
- 2.4.6.1.3 Ashcroft #35-1009 SWL-26.

### **2.4.7 Options:**

- 2.4.7.1 Snubber (brass) for pulsating operation.
- 2.4.7.2 Bronze ball valve.

3 Execution

**3.1 GENERAL**

3.1.1 Install so easily read from floor or platform. If not possible, install remote reading units.

3.1.2 Install between equipment and first fitting or valve.

**3.2 THERMOMETERS**

3.2.1 Install in wells in all piping. Provide heat conductive material inside well.

3.2.2 Install in locations as indicated and on inlet and outlet of:

3.2.2.1 DHW tanks.

3.2.2.2 Wherever else shown or specified.

3.2.3 Install wells as indicated only for balancing purposes.

3.2.4 Use extensions where thermometers installed through insulation.

**3.3 PRESSURE GAUGES**

3.3.1 Install in the following locations:

3.3.1.1 Suction and discharge of pumps (except sump pumps).

3.3.1.2 Upstream and downstream of PRVs.

3.3.1.3 In other locations as indicated.

3.3.2 Install gauge cocks for balancing purposes, elsewhere as indicated.

3.3.3 Use extensions where pressure gauges installed through insulation.

**END OF SECTION**





1 General

**1.1 SECTION INCLUDES**

1.1.1 Design, labour, Products, equipment and services for mechanical hangers and supports  
Work in accordance with the Contract Documents.

**1.2 REFERENCES**

1.2.1 ANSI/ASME B31.1/B31.3, Power and Process Piping Package.

1.2.2 ASTM A123/A123M, Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.

1.2.3 ASTM A125, Standard Specification for Steel Springs, Helical, Heat-Treated.

1.2.4 ASTM A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

1.2.5 ASTM A307, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod, 60,000 PSI Tensile Strength.

1.2.6 ASTM A563, Standard Specification for Carbon and Alloy Steel Nuts.

1.2.7 CAN/CSA-G164-M, Hot Dip Galvanizing of Irregularly Shaped Articles.

1.2.8 ANSI/MSS SP-58, Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

1.2.9 OBC, Ontario's Building Code Part 7.

1.2.10 Ontario Regulation 815/84, O. Reg. 815/84.

1.2.11 ULC, Underwriters Laboratories of Canada.

**1.3 DESIGN REQUIREMENTS**

1.3.1 Construct pipe hanger and support in accordance with manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.

1.3.2 Base maximum load ratings on allowable stresses prescribed by ANSI/ASME B31.1/B31.3 or ANSI/MSS SP-58.

1.3.3 Supports and guides not to transmit excessive quantities of heat to building structure.

1.3.4 Design hangers and supports to support systems under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.

1.3.5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with ANSI/MSS SP-58.

**1.4 SUBMITTALS**

1.4.1 Submit in accordance with Section 01 33 00.

**1.4.2 Product data and Shop Drawings Package:**

**1.4.2.1 Product Data:**

1.4.2.1.1 Submit manufacturer's Product data listed in this Section indicating:

1.4.2.1.1.1 Performance criteria, compliance with appropriate reference standards, characteristics, limitations, and troubleshooting protocol.

- 1.4.2.1.2 Indicate on manufacturer's catalogue literature:
- 1.4.2.1.2.1 Upper attachment.
- 1.4.2.1.2.2 Middle attachment.
- 1.4.2.1.2.3 Pipe attachment.
- 1.4.2.1.2.4 Riser clamps.
- 1.4.2.1.2.5 Shields and saddles.
- 1.4.2.1.2.6 Strut system and accessories.
- 1.4.2.2 **Shop Drawings:**
- 1.4.2.2.1 Submit Shop Drawings for custom fabricated supports and related Products in accordance with Section 01 33 23 indicating:
  - 1.4.2.2.1.1 Fabrication of custom supports and supplemental steel.
  - 1.4.2.2.1.2 Locations where each type of support will be applied.
  - 1.4.2.2.1.3 Estimate of load transmitted to building structure at each connection.
- 1.4.2.2.2 Submit coordination of all supplied hanger and support bolt hole locations and other Product dimensions with structural steel elements and incorporate details in structural steel Shop Drawings.
- 1.4.3 **Quality Assurance Submittals Package:**
- 1.4.3.1 Submit shop inspection and test reports.
- 1.4.3.2 Submit manufacturer's field reports.
- 1.4.4 **Commissioning Package:**
- 1.4.4.1 Submit the following in accordance with Section 01 91 00:
  - 1.4.4.1.1 Commissioning Plan.
  - 1.4.4.1.2 Commissioning Procedures.
  - 1.4.4.1.3 Certificate of Readiness.
- 1.4.5 **Commissioning Closeout Package:**
- 1.4.5.1 Submit the following in accordance with Section 01 91 00:
  - 1.4.5.1.1 Deficiency Report.
  - 1.4.5.1.2 Commissioning Closeout Report.
- 2 Products
- 2.1 **MANUFACTURERS**
- 2.1.1 Anvil.
- 2.1.2 Taylor.
- 2.2 **GENERAL**
- 2.2.1 Fabricate hangers and supports to ANSI/ASME B31.1/B31.3 and ANSI/MSS SP-58.
- 2.2.2 Support from top of structural members. Where structural bearing does not exist or inserts not in suitable locations, provide supplementary structural steel members to approval of TTC.

2.2.3 Where carbon steel pipe, ferrous hangers and supports, or structural steel elements come in contact with bare copper piping, protect pipe by providing neoprene gasket material to isolate the pipe.

2.2.4 Oversize pipe supports to accommodate outside diameter of thermal insulation and jacket and to avoid penetrating the vapour retarder.

### **2.3 UPPER ATTACHMENT**

#### **2.3.1 Concrete:**

2.3.1.1 Inserts for cast-in-place concrete: Galvanized steel wedge in accordance with ANSI/MSS SP-58, Type 18, ULC listed for pipe, nominal pipe size 19 mm through nominal pipe size 200 mm inclusive.

2.3.1.2 Carbon steel clevis plate for surface mount with malleable iron socket (weldless eye nut) to ANSI/MSS SP-58, Type 17, and expansion case and bolt. Each plate shall be supplied with 4 expansion cases and 4 bolts.

### **2.4 MIDDLE ATTACHMENT**

2.4.1 Carbon steel threaded rod, galvanized finish.

### **2.5 PIPE ATTACHMENT**

2.5.1 Hot and cold piping, steel or cast iron; hot piping, steel, with less than 25 mm horizontal movement; hot piping, steel, with more than 300 mm middle attachment (rod) length: galvanized adjustable clevis in accordance with ANSI/MSS SP-58, Type 1, ULC listed.

2.5.2 Cold copper piping; hot copper piping with less than 25 mm horizontal movement; hot copper piping with more than 300 mm middle attachment (rod) length: Adjustable clevis in accordance with ANSI/MSS SP-58, Type 1, copper plated.

2.5.3 Non-insulated, stationary pipe line: Carbon steel, galvanized pipe ring, tapped in accordance with NFPA standards and ANSI/MSS SP-58, Type 10.

### **2.6 RISER CLAMPS**

2.6.1 Steel or cast iron pipe: Galvanized carbon steel in accordance with ANSI/MSS SP-58, Type 8, ULC listed.

2.6.2 Copper pipe: Carbon steel copper plated in accordance with ANSI/MSS SP-58, Type 8.

### **2.7 OFFSET PIPE CLAMPS**

2.7.1 Steel or cast iron pipe: Galvanized carbon steel, ULC listed.

2.7.1.1 Material: Anvil fig. 103; Taylor fig. 87.

### **2.8 SHIELDS**

2.8.1 Protection shield of galvanized carbon steel sheet, minimum 1.6 mm thickness, with high density insulation for full length of shield with uninterrupted vapour barrier and jacket, in accordance with ANSI/MSS SP-58, Type 40.

3 Execution

**3.1 GENERAL**

- 3.1.1 Perform Work in accordance with OBC Part 7, O. Reg. 815/84, ANSI/ASME B31.1/B31.3, and NFPA-13.
- 3.1.2 Install in strict accordance with reviewed Shop Drawings, Contract Drawings details and manufacturer's written instructions.
- 3.1.3 Maintain uninterrupted continuity and integrity of thermal insulation vapour retarder jacket and finishes.
- 3.1.3.1 Hangers, supports to be outside outer jackets.
- 3.1.4 Site conditions: Where deviations and adjustments are necessary, obtain approval from TTC before proceeding.

**3.2 HANGER AND SUPPORT SPACING**

- 3.2.1 Spacing and middle attachment (rod) diameter as specified in applicable codes, indicated on Contract Drawing or as indicated in table below, whichever is more stringent:

Nominal Pipe Size	Rod Diameter	Maximum Spacing Steel	Maximum Spacing Copper
Up to 31 mm	10 mm	2.1 m	1.8 m
38 mm	10 mm	2.7 m	2.4 m
50 mm	10 mm	3.0 m	2.4 m
63 mm	12 mm	3.4 m	2.7 m
75 mm	12 mm	3.6 m	3.0 m
88 mm	12 mm	3.9 m	3.3 m
100 mm	16 mm	4.2 m	3.6 m
125 mm	16 mm	4.8 m	
150 mm	22 mm	5.1 m	
200 mm	22 mm	5.7 m	
250 mm	22 mm	6.6 m	
300 mm	22 mm	6.9 m	

- 3.2.2 Install hanger or support within 300 mm of each change in direction.
- 3.2.3 Install a hanger or support at each mechanical joint fitting.

**3.3 HANGER AND SUPPORT INSTALLATION**

- 3.3.1 Offset hanger so rod vertical in operating position.
- 3.3.2 Adjust hangers/supports to equalize load.

**3.4 COMMISSIONING**

- 3.4.1 Perform commissioning in accordance with Sections 01 91 00 and 20 05 00.
- 3.4.2 Verify operational performance in general conformance with the following outline:

- 3.4.2.1 Pipe Vibration and Movement:
- 3.4.2.1.1 Within acceptable limits.

**END OF SECTION**



- 1 General
  - 1.1 SECTION INCLUDES**
    - 1.1.1 Labour, Products, equipment and services necessary for mechanical vibration control Work in accordance with the Contract Documents.
  - 1.2 SUBMITTALS**
    - 1.2.1 Submit in accordance with Section 01 33 00.
    - 1.2.2 Product Data and Shop Drawings Package:**
      - 1.2.2.1 Product Data:**
        - 1.2.2.1.1 Submit manufacturer's Product data for all Products listed in this Section indicating:
          - 1.2.2.1.1.1 Performance criteria, compliance with appropriate reference standards, characteristics, limitations, and troubleshooting protocol.
          - 1.2.2.1.1.2 Product transportation, storage, handling, and installation requirements.
      - 1.2.2.2 Shop Drawings:**
        - 1.2.2.2.1 Submit Shop Drawings in accordance with Section 01 33 23 indicating:
          - 1.2.2.2.1.1 Elevations, sections, details and operating components, dimensions, gauges, finishes and relationship of operating components to adjacent construction.
          - 1.2.2.2.1.2 Provide separate Shop Drawings for each isolated system Shop Drawings complete with performance and Product data.
    - 1.2.3 Quality Assurance Package:**
      - 1.2.3.1 Submit field testing reports.
      - 1.2.3.2 Submit certification following manufacturer's site visit.
- 2 Products
  - 2.1 GENERAL**
    - 2.1.1 Size and shape of bases type and performance of vibration isolation as indicated.
  - 2.2 ELASTOMERIC MOUNTS**
    - 2.2.1 **Type M1** - colour coded; neoprene in shear; maximum durometer of 60; threaded insert and two bolt-down holes; ribbed top and bottom surfaces.
    - 2.2.2 Manufacturers:
      - 2.2.2.1 Korfund.
      - 2.2.2.2 Mason.
      - 2.2.2.3 Vibro Acoustics.
      - 2.2.2.4 Kinetics-Vibron.

## 2.3 SPRINGS

- 2.3.1 Design stable springs so ratio of lateral to axial stiffness minimum 1.2 times ratio of static deflection to working height. Select for 50% travel beyond rated load. Units complete with levelling devices.
- 2.3.2 Ratio of height when loaded to diameter of spring 0.8 to 1.0.
- 2.3.3 Colour code springs.

## 2.4 HANGERS

- 2.4.1 Colour coded springs, rust resistant, painted box type hangers. Arrange to permit hanger box or rod to move through 30° arc without metal to metal contact.
- 2.4.2 **Type H1** - neoprene - in-shear, molded with rod isolation bushing passing through hanger box.
- 2.4.3 **Type H2** - stable spring, elastomeric washer, cup with molded isolation bushing passing through hanger box.
- 2.4.4 **Type H3** - stable spring, elastomeric element, cup with molded isolation bushing passing through hanger box.
- 2.4.5 **Type H4** - stable spring, elastomeric element with precompression washer and nut with deflection indicator.
- 2.4.6 **Manufacturers:**
  - 2.4.6.1 Korfund.
  - 2.4.6.2 Mason.
  - 2.4.6.3 Vibro Acoustics.
  - 2.4.6.4 Kinetics-Vibron.

## 3 Execution

### 3.1 INSTALLATION

- 3.1.1 Install vibration isolation equipment in accordance with manufacturer's instructions and adjust mountings to level equipment.
- 3.1.2 Piping, ducting and electrical connections to isolated equipment not to reduce system flexibility and piping, conduit and ducting passage through walls and floors not to transmit vibrations.
- 3.1.3 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm minimum static deflection as follows:
  - 3.1.3.1 Up to NPS 4: first 3 points of support. NPS 5 to NPS 8: first 4 points of support. NPS 10 and Over: first 6 points of support.
  - 3.1.3.2 First point of support static deflection of twice deflection of isolated equipment, minimum 50 mm.
- 3.1.4 Where isolation bolted to floor use vibration isolation rubber washers.
- 3.1.5 Block and shim level bases so ductwork and piping connections made to rigid system at operating level, before making isolator adjustment. No physical contact between isolated equipment and building structure.

### 3.2 SITE VISIT



- 3.2.1 Manufacturer to visit Site and provide written certification installation is in accordance with manufacturer's instructions and submit report to TTC.
- 3.2.2 Provide TTC with notice 24 h in advance of visit.
- 3.2.3 Make adjustments and corrections in accordance with written report.

**END OF SECTION**



1 General

**1.1 SECTION INCLUDES**

1.1.1 Design, labour, Products, equipment and services necessary for mechanical identification Work in accordance with the Contract Documents.

**1.2 REFERENCES**

1.2.1 CAN/CGSB-1.60, Interior Alkyd Gloss Enamel.

1.2.2 CAN/CGSB-24.3, Identification of Piping Systems.

1.2.3 CPPI - Colour Symbol System to Mark Equipment for Product Identification.

1.2.4 NFPA 13, Installation of Sprinkler Systems.

1.2.5 NFPA 170, Fire Safety Symbols.

1.2.6 Ontario Fire Code – Part 4 Flammable and Combustible Liquids.

1.2.7 WHMIS – Workplace Hazardous Materials Information System made under Occupational Health and Safety Act.

**1.3 SUBMITTALS**

1.3.1 Submit in accordance with Section 01 33 00.

**1.3.2 Product Data and Shop Drawings Package:**

**1.3.2.1 Product Data:**

1.3.2.1.1 Submit manufacturer's Product data for all Products listed in this Section indicating:

1.3.2.1.1.1 Sizes, colours, material, identification legend, identification systems, and fasteners.

1.3.2.1.1.2 Performance criteria, compliance with appropriate reference standards, characteristics, limitations, and troubleshooting protocol.

**1.3.2.2 Shop Drawings:**

1.3.2.2.1 Submit Shop Drawings in accordance with Section 01 33 23 indicating:

1.3.2.2.1.1 Equipment schedule indicating equipment location (including room number), service, identifier, nameplate type, nameplate colour, and method of fastening.

**1.3.3 Samples:**

1.3.3.1 Submit samples of each identification Product.

**1.3.4 Closeout Submittals Package:**

1.3.4.1 Submit the following for incorporation into Operation and Maintenance Manuals in accordance with Section 01 78 23:

1.3.4.1.1 Equipment schedule indicating equipment location (including room number), service, identifier, nameplate type, nameplate colour, nameplate location, and method of fastening.

1.3.4.1.2 Manufacturer's installation instructions for the following items:

1.3.4.1.2.1 Equipment nameplates.

1.3.4.1.2.2 Pipe markers.

2 Products

**2.1 MANUFACTURER'S NAMEPLATES**

**2.1.1 General:**

2.1.1.1 Use numbering system on Shop and As-Built Drawings and throughout course of Work.

2.1.1.2 Mechanical identification in English.

2.1.1.3 Obtain exact wording from TTC if wording of mechanical identification not specified.

2.1.1.4 Locate nameplates for easy reading.

2.1.1.5 Type 304 stainless steel, minimum 0.64 mm thick with machine engraved upper case black filled lettering.

2.1.1.6 Mount manufacturer's nameplate on each piece of equipment, mechanically fastened using stainless steel rivets or screws.

2.1.1.7 Fabricate nameplates to withstand wear or deterioration of lettering in located environment.

**2.1.1.8 Indicate:**

2.1.1.8.1 Size.

2.1.1.8.2 Equipment model.

2.1.1.8.3 Manufacturer's name.

2.1.1.8.4 Serial number.

2.1.1.8.5 TTC mechanical equipment identifying label.

2.1.1.8.6 Equipment Tag Number.

2.1.1.8.7 Performance Data.

2.1.1.8.8 Electrical data: including voltage, cycle, phase, power, motor size.

2.1.1.8.9 Service Information.

2.1.1.8.10 Date of Manufacturer.

2.1.1.9 Install approval label/registration plates (i.e. CSA, ULC or Ontario Hydro Special Approval) as required by authority having jurisdiction.

**2.2 EQUIPMENT NAMEPLATES**

**2.2.1 General:**

2.2.1.1 Nameplate text layout consists of one or more separate lines of text as follows:

2.2.1.1.1 Area served as shown on equipment schedules on Contract Drawings.

2.2.1.1.2 Equipment description as indicated in the Equipment Nameplate Schedule.

2.2.1.1.3 Identify mechanical equipment tag number as XX - YYYY - #, where:

2.2.1.1.3.1 Geographical Division XX: .

2.2.1.1.3.2 Tag Identifier wording YYYY: as indicated in Equipment Nameplate Schedule.

2.2.1.1.3.3 Number #: sequential and as identified on Contract Drawings.

2.2.1.2 **Mounting Location:** as indicated in Equipment Nameplate Schedule.

2.2.1.3 **Product Type:** select to suit application as indicated in equipment nameplate schedule.

2.2.1.3.1 **Product Type E-1:**

2.2.1.3.1.1 Rectangular, lamacoid plastic plate 3 mm thick, semi-flexible, non-aging, 3 layer, laminated phenolic material, with machine engraved 7 mm uppercase lettering, chamfered edges, and two 4.5 mm minimum holes located at each side of long dimension.

2.2.1.3.1.2 Minimum height 40 mm and length to suit required text and mounting screws.

2.2.1.3.1.3 Nameplate text layout to consist of the following information:

2.2.1.3.1.3.1 **Line 1:** Area Served.

2.2.1.3.1.3.2 **Line 2:** Equipment Description.

2.2.1.3.1.3.3 **Line 3:** Equipment Tag Number.

2.2.1.3.1.4 **Manufacturers:**

2.2.1.3.1.4.1 Seton.

2.2.1.3.1.4.2 Brady.

2.2.1.3.1.4.3 Smillie McAdams Summerlin.

2.2.1.3.2 **Product Type E-3:**

2.2.1.3.2.1 Circular, 50 mm diameter, minimum 0.64 mm thick, Type 304 stainless steel, with machine engraved 6 mm uppercase black filled lettering, and one 4.5 mm minimum hole located at top. Lettering in single line.

2.2.1.3.2.2 Nameplate text layout to consist of the following information:

2.2.1.3.2.2.1 **Line 1:** Equipment Tag Number.

2.2.1.3.2.3 **Manufacturers:**

2.2.1.3.2.3.1 Seton.

2.2.1.3.2.3.2 Brady.

2.2.1.3.2.3.3 Smillie McAdams Summerlin.

2.2.1.4 **Equipment Nameplate Schedule:**

2.2.1.4.1 **Service: Plumbing and Drainage Equipment**

Description	Tag Identifier Wording	Mounting Location	Product Type
Trap Primer Distribution Header	TP	On equipment panel	E-1
Hot Water Tank	HWT	On equipment panel	E-1
T&P Relief Valve	T&P RV	On fixture body	E-3

2.2.1.4.2 **Service: Fire Protection Equipment**

Description	Tag Identifier Wording	Mounting Location	Product Type
Fire Extinguisher (Inside)	FE	On equipment panel	E-1

2.2.1.4.3      **Service: HVAC Equipment**

Description	Tag Identifier Wording	Mounting Location	Product Type
Air Conditioning Unit	ACU	On equipment	E-1
Condenser Unit	ACC	On equipment	E-1

**2.3      PIPING IDENTIFICATION**

**2.3.1      General:**

- 2.3.1.1      **Pipe:** paint all piping to base colour indicated in Pipe Identification Schedule in accordance with Section 09 91 00 and in accordance with authority having jurisdiction.
- 2.3.1.2      Apply pipe identification markers to CAN/CGSB-24.3 after pipe painting complete.
- 2.3.1.3      Obtain exact wording from TTC if wording of mechanical identification is not specified.

**2.3.2      Pipe Markers:**

- 2.3.2.1      Requirements common to all Pipe Markers:

- 2.3.2.1.1      Selection to suit indoor or outdoor application as indicated.

2.3.2.1.2      **Marker Band:**

- 2.3.2.1.2.1      Colour: as indicated in table.

- 2.3.2.1.2.2      Minimum length:

- 2.3.2.1.2.2.1      Up to 50 mm outside diameter: 200 mm long band.

- 2.3.2.1.2.2.2      65 mm to 150 mm outside diameter: 300 mm long band.

- 2.3.2.1.2.2.3      Over 200 mm outside diameter: 600 mm long band.

- 2.3.2.1.2.2.4      Band length suitable to accommodate required text, arrows and pictograms as indicated.

2.3.2.1.3      **Text:**

- 2.3.2.1.3.1      Colour: As indicated in Schedule.

- 2.3.2.1.3.2      Identifier Wording: as indicated in table, block capital lettering and direction of flow arrows on single line, size lettering to CAN/CGSB-24.3.

2.3.2.1.4      **Identifier Arrow:**

- 2.3.2.1.4.1      Size arrows to match size and colour of lettering.

- 2.3.2.1.4.2      Use double headed arrows where flow reversible.

2.3.2.2      **Product Type P-2:**

2.3.2.2.1      **Snap-on Pipe Marker (Indoor):**

- 2.3.2.2.1.1      Mechanically applied, coiled wrap-around, 360° visibility, acrylic faced vinyl, resistant to fading, moisture dirt and temperatures between -40°C and 82°C.

2.3.2.2.1.2      **Manufacturers:**

- 2.3.2.2.1.2.1 Seton – Setmark Snap-on Markers, special order as required where identifier wording varies from manufacturer's standards and for outside diameters 150 mm and larger.
- 2.3.2.2.1.2.2 Brady – Snap-on Pipe Markers, special order as required where identifier wording varies from manufacturer's standards and for outside diameters 150 mm and larger.
- 2.3.2.2.1.2.3 Smillie McAdams Summerlin – Coil-Mark, special order as required where identifier wording varies from manufacturer's standards and for outside diameters 150 mm and larger.

### 2.3.3 Pipe Identification Schedule

#### 2.3.3.1 Service: Plumbing and Drainage Piping

Description	Tag Identifier Wording	Pipe	Marker		
		Base Colour	Product Type	Band Colour	Text Colour
Domestic Cold Water	DCW	Blue PPG 3062	P-2	Green	White
Domestic Hot Water	DHW-Hot	Pink PPG 2154	P-2	Yellow	Black
Sanitary Drain	SAN	White	P-2	Green	White
Sanitary Vent	SAN-Vent	White	P-2	Green	White

## 2.4 DUCTWORK IDENTIFICATION

### 2.4.1 Ducts:

- 2.4.1.1 **Uninsulated:** prepare surface and paint in accordance with Section 09 91 00 to base colour indicated in Schedule.
- 2.4.1.2 **Insulated:** prepare surface and paint in accordance with Section 09 91 00 to base colour indicated in Schedule.
- 2.4.2 Apply identification markers to CAN/CGSB-24.3 after duct painting complete.

### 2.4.3 Product Type:

- 2.4.3.1 Product Type D-1:
- 2.4.3.1.1 Painted Marker: Identify as follows:
- 2.4.3.1.1.1 Identifier Band: Locate at regular intervals to colour indicated in table.
- 2.4.3.1.1.2 Identifier wording: stencil 50 mm high block capital lettering, wording to colour as indicated in table.
- 2.4.3.1.1.3 Identifier arrow: paint 150 mm long direction of flow arrows to colour as identified in table.

### 2.4.4 Ductwork Identification Schedule:

Description	Tag Identifier Wording	Duct	Marker
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		Base Colour	Band Colour	Text Colour
Make-Up Air Supply	Supply Air - MUA	Royal Blue PPG 54-310	Blue	White
Exhaust Air	Exhaust Air	Royal Blue PPG 54-310	Blue	White
HVAC Supply	Supply Air - HVAC	Royal Blue PPG 54-310	Blue	White
HVAC Return	Return Air - HVAC	Royal Blue PPG 54-310	Blue	White
Condenser Air In	Condenser Air In	Royal Blue PPG 54-310	Blue	White
Condenser Air Out	Condenser Air Out	Royal Blue PPG 54-310	Blue	White

### 3 Execution

#### 3.1 PREPARATION

##### 3.1.1 General:

3.1.1.1 Verify substrate surfaces solid, free from surface water, frozen matter, dust, oil, grease, scaling or laitance, projections and other foreign matter detrimental to performance.

3.1.1.2 Remove deleterious material from substrate and clean to manufacturer's instructions.

##### 3.1.2 Manufacturer's Nameplates:

3.1.2.1 Do not insulate or paint over nameplates.

##### 3.1.3 Mechanical Equipment Nameplates:

3.1.3.1 Locate nameplates in conspicuous location to facilitate easy reading from floor and to properly identify equipment.

3.1.3.2 Install stand-off for nameplates on hot surfaces and insulated surfaces.

3.1.3.3 Equipment: secure nameplates to equipment substrate with minimum of two self-tapping stainless steel screws.

3.1.3.4 Valves: secure circular and square nameplates to valves with stainless steel jack chain, trade size #16, and S hooks. Ensure chain and nameplate do not impede operation of valve.

##### 3.1.4 System Design Nameplates:

3.1.4.1 Provide system nameplates as scheduled in Part 2.

3.1.4.2 Location: in accordance with Part 2 to facilitate easy reading from floor and to properly identify equipment.

##### 3.1.5 Pipework Identification:

3.1.5.1 Paint finished surfaces of all pipe work, including metal surfaces for non-insulated pipe and insulation coating for insulated pipe.

3.1.5.2 Do not paint aluminum cladding.



- 3.1.5.3 Install pipe markers in accordance with manufacturer's written instructions, as indicated.
- 3.1.5.4 Locate pipe markers in strict accordance with the following:
  - 3.1.5.4.1 On long straight runs in open areas, and Equipment Rooms one identification marker minimum clearly visible from any one viewpoint in area and at 20 m maximum intervals.
  - 3.1.5.4.2 Adjacent to changes in direction.
  - 3.1.5.4.3 Once minimum in small rooms through which piping passes.
  - 3.1.5.4.4 On both sides of visual obstruction and where run difficult to follow.
  - 3.1.5.4.5 On both sides of separation such as walls, floors and partitions.
  - 3.1.5.4.6 Where piping concealed in pipe chase, or other confined space, at entry and leaving points and adjacent to each access opening.
  - 3.1.5.4.7 At beginning and end points of each run and at each piece of equipment in run.
  - 3.1.5.4.8 At point immediately upstream of all valves. Where not possible, place identification as close to valve as possible, preferably on upstream side.
  - 3.1.5.4.9 Legend easily and accurately readable from usual operating areas and readily accessible points.
  - 3.1.5.4.10 Plane of lettering approximately at right angles to most convenient line of sight with consideration for operating positions, lighting conditions, reduced visibility of colour or lettering caused by dust and dirt and risk of physical damage.
- 3.1.6 Ductwork Identification:**
  - 3.1.6.1 Paint finished surfaces of all ductwork; metal surface for non-insulated ductwork and insulation coating for insulated ductwork.
  - 3.1.6.2 Do not paint non-insulated stainless steel or aluminum clad duct.
  - 3.1.6.3 Location duct markers in strict accordance with the following:
    - 3.1.6.3.1 On long straight runs in open areas, and Equipment Rooms one identification lettering minimum clearly visible from any one viewpoint in space and at 20 m maximum intervals.
    - 3.1.6.3.2 Adjacent to changes in direction.
    - 3.1.6.3.3 At least once in each small room through which ductwork passes.
    - 3.1.6.3.4 On both sides of visual obstruction or where run difficult to follow.
    - 3.1.6.3.5 On both sides of separation such as walls, floors and partitions.
    - 3.1.6.3.6 Where ductwork concealed in duct chase, or other confined space, at entry and leaving points and adjacent to each access opening.
    - 3.1.6.3.7 At beginning and end points of run and at each equipment in run.
    - 3.1.6.3.8 At point immediately upstream of major manually operated or automatically controlled dampers. Where not possible, place identification as close to damper as possible, preferably on upstream side.
    - 3.1.6.3.9 Lettering easily and accurately readable from usual operating areas and readily accessible points.

- 3.1.6.3.10 Plane of lettering approximately at right angles to most convenient line of sight with consideration for operating positions, lighting conditions, reduced visibility of colour or lettering caused by dust and dirt and risk of physical damage.
- 3.1.6.3.11 Beside each access door.
- 3.1.6.3.12 Stencil over final finish only.

**END OF SECTION**

1 General

**1.1 SECTION INCLUDES**

- 1.1.1 Design, labour, Products, equipment and services necessary for wet and dry pipe sprinklers Work in accordance with the Contract Documents.
- 1.1.2 Comply with latest requirements of NFPA 13, local codes and authorities having jurisdiction.
- 1.1.3 Products in accordance with current ASTM and ASME standards, ULC listed and approved for fire services.

**1.2 TTC SUPPLIED PRODUCTS**

- 1.2.1 At the request of the sprinkler designer, TTC is to supply within 14 Days CADD drawings of facility indicating wall layouts, ceiling plans, HVAC duct layout and typical elevations.
- 1.2.2 All Contract Drawings in Bentley Systems MicroStation drawing format.
- 1.2.3 Sprinkler system designer is responsible for converting to other CADD formats.

**1.3 REFERENCES**

- 1.3.1 ASME, American Society of Mechanical Engineers.
- 1.3.2 ASME B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
- 1.3.3 ASME B16.3, Malleable Iron Threaded Fittings: Classes 150 and 300.
- 1.3.4 ASME B16.4, Gray Iron Threaded Fittings: Classes 125 and 250.
- 1.3.5 ASME B16.5, Piping Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.
- 1.3.6 ASME B16.9, Factory-Made Wrought Buttwelding Fittings.
- 1.3.7 ASME B16.21, Nonmetallic Flat Gaskets for Pipe Flanges.
- 1.3.8 ANSI, American National Standards Institute.
- 1.3.9 ANSI/AWWA C104/A21.4, American National Standard for Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water.
- 1.3.10 AWWA C105/A21.5, Standard for Polyethylene Encasement for Ductile-Iron Pipe System.
- 1.3.11 ANSI/AWWA C110/A21.10, American National Standard for Ductile-Iron and Gray-Iron Fittings.
- 1.3.12 ANSI/AWWA C111/A21.11, American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- 1.3.13 ANSI/MSS SP-58, Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application and Installation.
- 1.3.14 ASTM, American Society for Testing and Materials.
- 1.3.15 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- 1.3.16 ASTM A105/A105M, Standard Specification for Carbon Steel Forgings for Piping Applications.

- 1.3.17 ASTM A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- 1.3.18 ASTM A795/A795M, Standard Specification for Black and Hot-Dipped, Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.
- 1.3.19 AWWA, American Water Works Association.
- 1.3.20 CSA B242, Groove- and Shoulder-Type Mechanical Pipe Couplings.
- 1.3.21 ISO 9001, International Organization of Standardization, Quality Management Systems – Requirements.
- 1.3.22 NFPA, National Fire Protection Association.
- 1.3.23 NFPA 13, Standard for the Installation of Sprinkler Systems.
- 1.3.24 OBC, Ontario's Building Code.
- 1.3.25 OFC, Ontario Fire Code.
- 1.3.26 ULC, Underwriters Laboratories of Canada.

#### **1.4 DESIGN REQUIREMENTS**

- 1.4.1 Accompanying Contract Drawings indicate areas protected by sprinklers and generally installed systems, but do not completely identify all heads and piping required to give necessary protection to the approval of authorities having jurisdiction. Prepare and submit to TTC, minimum 1:100 scale Shop Drawings approved by local Fire and Building Departments indicating actual systems installed.
- 1.4.2 Coordinate Shop Drawings with trades concerned, and show sleeves, openings, passage of piping through building structure, type and location of heads and similar information. Piping not to pass through ducts nor interfere with service spaces for equipment, ducts, other piping, lights, electrical devices, controls or operating devices.
- 1.4.3 Design to accommodate structural design of building, location and space of mechanical and electrical equipment.
- 1.4.4 Coordinate furniture and equipment layout where indicated on Contract Drawings with final locations of low-point drain lines and inspector test risers along wall.
- 1.4.5 Design and install fire protection (sprinkler) systems in accordance with OBC, OFC, NFPA standards, and Contract Document requirements.
- 1.4.6 Referenced codes and standards represent minimum requirements. Do not reduce requirements of materials, equipment and design criteria standards established by Contract Documents by applying minimum code requirements.
- 1.4.7 Do not proceed with installation and modifications until all review comments made by the authorities having jurisdiction, and TTC have been incorporated to the satisfaction of the originator and TTC (including TTC Fire Prevention).
- 1.4.8 Design system using following parameters:
  - 1.4.8.1 Hazard: To suit occupancy as indicated.
  - 1.4.8.2 Pipe size and layout:
    - 1.4.8.2.1 Hydraulic design.
    - 1.4.8.2.2 Sprinkler head layout: In accordance with NFPA 13 and as directed by authorities having jurisdiction.

- 1.4.8.3 Water supply:
- 1.4.8.3.1 Base design on NFPA 13 and independent water flow test conducted by this Contractor.
- 1.4.8.3.2 Maximum system pressure requirement 48,265 kPa less than available water supply pressure at required flow rate, to account for future fluctuation in water supply pressure.
- 1.4.8.4 Zoning: System zoning as indicated.
- 1.4.9 Design and install sprinkler system to provide full fire protection coverage for indicated area. Include for additional branches and sprinkler heads, as required due to any obstructions, in accordance with NFPA 13. In addition to where indicated on Contract Drawings include additional test/drain/low point connections as required.

## **1.5 SUBMITTALS**

- 1.5.1 Submit in accordance with Section 01 33 00.

### **1.5.2 Shop Drawing(s):**

- 1.5.2.1 Submit in accordance with Section 01 33 23 and NFPA 13 indicating:
  - 1.5.2.1.1 Performance criteria, compliance with appropriate reference standards, characteristics, limitations, and troubleshooting protocol.
  - 1.5.2.1.2 Design data, water test report, water supply information, hydraulic calculations and working plans including, but not limited to, sprinkler valve room equipment layout, sprinkler system layout and other detailed information in full accordance with NFPA 13.

### **1.5.3 Sample(s):**

- 1.5.3.1 Submit samples of each type of sprinkler head to be installed.

### **1.5.4 Commissioning Submittal(s):**

- 1.5.4.1 In accordance with Section 01 91 00:
  - 1.5.4.1.1 Submit Test Procedures.
  - 1.5.4.1.2 Submit Certificate of Readiness.
  - 1.5.4.1.3 Submit Test Reports.
  - 1.5.4.1.4 Submit Closeout Report.
  - 1.5.4.1.5 Submit Contractor's material and test certificate for sprinkler system in accordance with NFPA 13.
  - 1.5.4.1.6 Submit monthly inspection and test reports.

### **1.5.5 Closeout Submittal(s):**

- 1.5.5.1 Submit the following for incorporation into Operation and Maintenance Manuals in accordance with Section 01 78 23:
  - 1.5.5.1.1 Identification: Manufacturing name, type, year, serial number, number of units, capacity, and identification of related systems.
  - 1.5.5.1.2 Functional description detailing operation and control of components.
  - 1.5.5.1.3 Performance criteria and maintenance data.
  - 1.5.5.1.4 Operating instructions and precautions.

- 1.5.5.1.5 Safety precautions.
- 1.5.5.1.6 Maintenance and troubleshooting guidelines/protocol and recommended equipment for analysis and repair.
- 1.5.5.1.7 Tests conducted and submitted to authorities having jurisdiction.
- 1.5.5.1.8 Contractor's material and test certificate for sprinkler system.
- 1.5.5.1.9 Prepare and submit Building Permit, signed and stamped by Contractor's Design Engineer, clearly stating that the Work has been completed in general conformance with the design drawings of the Contractor's engineer.
- 1.5.5.1.10 Special tools and extra stock materials list in accordance with Article 1.9.
- 1.5.5.1.11 Spare parts list in accordance with Section 20 05 00.
- 1.5.5.1.12 Copy of full set of reviewed Shop Drawings and, if applicable, Marked-up Shop Drawings.
- 1.5.5.1.13 Warranty information.
- 1.5.5.2 Submit CADD files of As-Built Drawings in Microstation V8 format. Sprinkler consultant responsible for converting files in formats other than Microstation V8 back to Microstation V8 format.
- 1.5.5.3 Submit building closeout letter.

## **1.6 QUALITY ASSURANCE**

- 1.6.1 Quality assurance requirements:
  - 1.6.1.1 Fabricator's qualifications:
    - 1.6.1.1.1 All personnel licensed and qualified for fire protection Work.
    - 1.6.1.1.2 Qualifications to include:
      - 1.6.1.1.2.1 Company to have established ISO 9001 quality plan.
      - 1.6.1.1.2.2 Minimum 20 years in fire protection business.
      - 1.6.1.1.2.3 One hundred or more employees on staff.
      - 1.6.1.1.2.4 Membership in Canadian Automatic Sprinkler Association.
      - 1.6.1.1.2.5 Membership in NFPA.
      - 1.6.1.1.2.6 Installers to be members of Sprinkler Fitters of Ontario.
  - 1.6.1.2 Designer's qualifications:
    - 1.6.1.2.1 Professional Engineer, licensed in the Province of Ontario, to perform the following Work of this Section:
      - 1.6.1.2.1.1 Design and sizing calculations.
      - 1.6.1.2.1.2 Review, stamp, and sign Shop Drawings, design calculations, water flow tests and reports.
      - 1.6.1.2.1.3 Certify system as indicated on Shop Drawings is in accordance with NFPA 13.
      - 1.6.1.2.1.4 Conduct shop and on-site inspections, prepare and submit monthly written inspection reports verifying this part of Work is in accordance with Contract Documents and reviewed Shop Drawings. Perform inspections minimum once per month.

- 1.6.1.2.1.5 Monitor and report on supplier's and fabricator's quality control tests and reports for compliance with Contract Documents.
- 1.6.1.2.1.6 Prepare and submit inspection reports and building closeout letter for fire protection systems.
- 1.6.2 Regulatory requirements:
  - 1.6.2.1 Prior to installation of sprinkler system, submit documents to authorities having jurisdiction and obtain their approval.
  - 1.6.2.2 Make submissions to authorities having jurisdiction well in advance so as not to delay installation.
  - 1.6.2.3 Submissions to include:
    - 1.6.2.3.1 Plans containing information outlined in NFPA 13, Chapter 23, "Plans and Calculations".
    - 1.6.2.3.2 Water supply information.
    - 1.6.2.3.3 Complete set of hydraulic calculations.
  - 1.6.2.4 Shop Drawings and hydraulic calculations to have stamp of Professional Engineer, licensed in the Province of Ontario, certifying system as indicated is in accordance with OBC and NFPA 13.

## **1.7 DELIVERY, STORAGE AND HANDLING**

- 1.7.1 Acceptance at Site:
  - 1.7.1.1 Reject dirty or rusty piping.
- 1.7.2 Storage and protection:
  - 1.7.2.1 Keep piping dry and free of construction dirt and debris.
  - 1.7.2.2 Keep pipe ends capped until ready to install.

## **1.8 TRAINING**

- 1.8.1 Provide training plan, training course material, training schedule, and training in accordance with Section 01 79 00.

## **1.9 SPECIAL TOOLS AND EXTRA STOCK MATERIALS**

- 1.9.1 Provide special tools and spare sprinklers in accordance with Section 01 78 43.

## **2 Products**

### **2.1 MANUFACTURERS**

- 2.1.1 Viking Fire Protection Inc.
- 2.1.2 Reliable Automatic Sprinkler Co., Inc.
- 2.1.3 Anvil Fire Protection.
- 2.1.4 Venus Fire Protection (ASTRA brand).

### **2.2 GENERAL**

- 2.2.1 All material and equipment specified approved for sprinkler service as recommended by NFPA 13 and listed by ULC.

**2.3 MATERIALS - ABOVEGROUND**

**2.3.1 Piping, fitting and joints - galvanized:**

**2.3.1.1 Application:**

**2.3.1.1.1 Dry sprinkler systems.**

**2.3.1.2 Piping:**

**2.3.1.2.1 Ferrous, hot-dip galvanized, seamless steel pipe for fire protection use, in accordance with ASTM A795/A795M and NFPA 13.**

**2.3.1.2.2 Ferrous, hot-dip galvanized, seamless steel pipe in accordance with ASTM A53/A53M, Grade B and NFPA 13.**

**2.3.1.2.3 Size: In accordance with schedule on Contract Drawings.**

**2.3.1.2.4 Wall thickness: Minimum of Sch. 40 and in accordance with schedule on Contract Drawings.**

**2.3.1.3 Fittings and joints:**

**2.3.1.3.1 Minimum working pressure: 1206 kPa.**

**2.3.1.3.2 Cast iron:**

**2.3.1.3.2.1 Threaded fittings: Class 125 in accordance with ASME B16.4.**

**2.3.1.3.2.2 Flanged Fittings:**

**2.3.1.3.2.2.1 Class 125 in accordance with ASME B16.1.**

**2.3.1.3.2.2.2 Gasket: In accordance with ASME B16.21, full face.**

**2.3.1.3.2.2.3 Bolts: In accordance with ASTM A307, Grade B, carbon steel hex-head bolts with heavy series hex nuts.**

**2.3.1.3.3 Malleable iron:**

**2.3.1.3.3.1 Threaded fittings: Class 150, in accordance with ASME B16.3.**

**2.3.1.3.3.2 Buttweld: Wrought steel in accordance with ASME B16.9 and ASTM A234/A234M, galvanized after fabrication.**

**2.3.1.3.3.3 Flanged fittings:**

**2.3.1.3.3.3.1 Class 150 slip-on or welded neck type in accordance with ASME B16.5 and ASTM A105/A105M, galvanized after fabrication.**

**2.3.1.3.3.3.2 Gasket: In accordance with ASME B16.21, full face.**

**2.3.1.3.3.3.3 Bolts: In accordance with ASTM A307, Grade B, carbon steel hex-head bolts with heavy series hex nuts.**

**2.3.1.3.3.4 Grooved system:**

**2.3.1.3.3.4.1 Galvanized groove and shoulder couplings and fittings allowed where approved by the underwriters and authorities having jurisdiction.**

**2.3.1.3.3.4.2 In accordance with ASTM A47/A47M, with ends suitable for use with mechanical joint couplings in accordance with CSA B242.**

**2.3.1.3.3.4.3 Track-head bolts and hex.**

**2.3.1.3.3.4.4 Nuts: In accordance with ASTM A183.**



- 2.3.1.3.3.4.5 Gaskets: EPDM material (oil-free air), ambient temperature range, flush-seal arrangement, in accordance with ASTM D2000 and recommended by manufacturer for sprinkler system.
- 2.3.1.4 Finish:
  - 2.3.1.4.1 All materials, including pipe and fittings, hot-dip galvanized.
  - 2.3.1.4.2 Where welding performed, hot-dip galvanize after fabrication.
  - 2.3.1.4.3 After galvanization, all materials prepared, primed and painted by qualified trades in accordance with Sections 09 91 00 and 20 05 53.
- 2.3.2 Hangers and supports:
  - 2.3.2.1 Hanger and support in accordance with NFPA 13 and ANSI/MSS SP-58.
  - 2.3.2.2 ULC listed for fire protection service.
  - 2.3.2.3 Hanger rods, bolts, nuts and washers: Hot-dip galvanized.
  - 2.3.2.4 Carbon steel continuous threaded rod: Galvanized finish; Fig. 146 by Anvil (Grinnell).
  - 2.3.2.5 Adjustable clevis hangers: Galvanized carbon steel, ULC approved; Fig. 260 by Anvil (Grinnell).
  - 2.3.2.6 Adjustable swivel ring: Galvanized carbon steel, ULC approved; Fig. 69 by Anvil (Grinnell).
  - 2.3.2.7 Pipe clamps: Galvanized carbon steel, ULC approved; Fig. 261 by Anvil (Grinnell).
  - 2.3.2.8 U-bolt: Galvanized carbon steel, Fig. 137 by Anvil (Grinnell).
  - 2.3.2.9 Refer to Section 20 05 29 for additional requirements.
- 2.3.3 Pipe sleeves: 2 mm galvanized steel sized to suit pipe.
- 2.3.4 Caulking: Refer to Section 07 84 00.

## **2.4 EQUIPMENT**

- 2.4.1 Sprinkler heads:
  - 2.4.1.1 Type A: Upright bronze.
  - 2.4.1.2 Type B: Pendant chrome link and lever type.
  - 2.4.1.3 Type C: Pendant chrome glass bulb type.
  - 2.4.1.4 Type D: Recessed polished, chrome, bulb, fusible link type with ring and cup.
  - 2.4.1.5 Type E: Flush polished, chrome link and lever type.

## **3 Execution**

### **3.1 EXAMINATION**

- 3.1.1 Examine Contract Drawings to determine location of structural, mechanical and electrical elements.
- 3.1.2 Adjust location of sprinkler system component to avoid interference with above. Coordinate with affected trades.

### **3.2 PREPARATION**

- 3.2.1 Prepare Shop Drawings of sprinkler system in accordance with applicable codes.
- 3.2.2 Contract Drawing layouts shown for coordination only and may not indicate all components in accordance with applicable codes. Adjust design accordingly.
- 3.2.3 Do not reduce requirements of Contract Documents by application of less stringent code requirements.
- 3.2.4 Submit Sections 21 12 00 and 21 13 00 Shop Drawings for review at the same time.

### **3.3 INSTALLATION**

#### **3.3.1 General:**

- 3.3.1.1 Install, inspect and test in accordance with NFPA 13, reviewed Shop Drawings and Contract Drawing details.
- 3.3.1.2 Flushing to be witnessed by TTC, TTC Fire Prevention and authorities having jurisdiction. Inform TTC a minimum of 7 Days prior to scheduled tests.
- 3.3.1.3 Do not recess, paint, insulate or conceal any Work including piping and accessory equipment before it has been inspected and approved.
- 3.3.1.4 Install all system components in accordance with manufacturer's printed instructions.
- 3.3.1.5 Certificate: Provide pressure test certificate for each pipe system upon completion of Contract.
- 3.3.1.6 Install pipe supports in accordance with NFPA 13.

#### **3.3.2 Material – aboveground:**

- 3.3.2.1 Install pipe sleeves for pipes passing through interior walls, slabs or foundation walls. Caulk space between pipes and sleeves with specified caulk. Trim putty flush with face on each side.
- 3.3.2.2 Pitch piping in direction to avoid air pockets and low points in accordance with NFPA 13.

#### **3.3.3 Equipment:**

- 3.3.3.1 Install, inspect and test to acceptance of TTC, TTC fire prevention and in accordance with NFPA 13.

### **3.4 FIELD QUALITY CONTROL**

- 3.4.1 Consulting design engineer to inspect progress of Work, provide monthly reports to TTC and copy the authorities having jurisdiction.
- 3.4.2 Upon acceptance of system, provide letter to the authorities having jurisdiction that sprinkler system is installed in accordance with Shop Drawings and applicable codes.

### **3.5 FLUSHING OF PIPING**

- 3.5.1 Flush in accordance with NFPA 13.
- 3.5.2 Flush in presence of TTC.
- 3.5.3 Flushing performed prior to completion.

**3.6 PAINTING**

- 3.6.1 Prepare, prime and paint all pipes and fittings by qualified trades in accordance with Sections 09 91 00 and 20 05 53.
- 3.6.2 Do not paint sprinkler heads. Replace heads fouled by paint.

**3.7 COMMISSIONING**

- 3.7.1 Perform commissioning in accordance with Sections 01 91 00 and 20 05 00.
- 3.7.2 Verify operational performance in general conformance with the following outlines:
  - 3.7.2.1 Operating Performance Verifications:
    - 3.7.2.1.1 Flushing.

**3.8 PROTECTION**

- 3.8.1 Locate overhead sprinkler piping at minimum required height above floor to provide sufficient clearance needed in that specific area. Coordinate with TTC.
- 3.8.2 Protect sprinkler heads from overspray if ceiling is electro-statically spray painted, or similar spray method is applied. Replace heads fouled by paint.

**3.9 MAINTENANCE**

- 3.9.1 Maintain all equipment and systems installed until Substantial Performance, in accordance with Section 01 78 25.
- 3.9.2 Carry out regular scheduled maintenance of equipment and systems following Substantial Performance until Contract Completion, in accordance with Section 01 78 25.

**END OF SECTION**



1 General

**1.1 SECTION INCLUDES**

1.1.1 Design, labour, Products, equipment and services necessary for portable fire extinguishers Work in accordance with the Contract Documents.

**1.2 REFERENCES**

1.2.1 ANSI/NFPA 10, Standard for Portable Fire Extinguishers.

1.2.2 OFC, Ontario Fire Code Division B, Part 6.

1.2.3 CAN/ULC-S508, Standard for the Rating and Fire Testing of Fire Extinguishers

**1.3 DESIGN REQUIREMENTS**

1.3.1 Prepare Drawings indicating locations and types of extinguishers in accordance with requirements of OFC and ANSI/NFPA 10.

1.3.2 Determine number of fire extinguishers in accordance with code requirements.

**1.4 SUBMITTALS**

1.4.1 Submit in accordance with Section 01 33 00.

**1.4.2 Shop Drawings:**

1.4.2.1 Submit in accordance with Section 01 33 23 including:

1.4.2.1.1 Fire Extinguishers and Cabinets Product data sheets.

1.4.2.1.2 Plans indicating locations, identification tag, and types of extinguishers and cabinets.

1.4.2.1.3 Mounting details.

**1.4.3 Quality Assurance Submittals:**

1.4.3.1 Submit written inspection report.

**1.4.4 Closeout Submittals Package:**

1.4.4.1 Submit the following for incorporation into Operation and Maintenance Manuals in accordance with Section 01 78 23:

1.4.4.1.1 Identification: Manufacturer's name, type, year, serial number, number of units, capacity, and identification of related systems.

1.4.4.1.2 Functional description detailing operation.

1.4.4.1.3 Performance criteria and maintenance data.

1.4.4.1.4 Bilingual operating instructions and precautions.

1.4.4.1.5 Safety precautions.

1.4.4.1.6 Component parts availability, including names and addresses of spare part suppliers.

1.4.4.1.7 Items submitted to TTC: Keys, tools, special devices, and maintenance materials.

1.4.4.1.8 Copy of full set of reviewed Shop Drawings with Marked-up Shop Drawings as applicable.

## **1.5 QUALITY ASSURANCE**

1.5.1 Retain Professional Engineer, licensed in the Province of Ontario, with experience in fire extinguisher layout and products' selection Work of comparable complexity and scope, to perform the following services as part of Work of this Section:

1.5.1.1 Design fire extinguisher layout and select products.

1.5.1.2 Review, stamp, and sign Shop Drawings.

1.5.1.3 Conduct on-site inspections and prepare and submit written inspection reports to verify Work is in accordance with Contract Documents and reviewed Shop Drawings.

## **1.6 DELIVERY, STORAGE AND HANDLING**

### **1.6.1 Storage and protection:**

1.6.1.1 Protect stored equipment from freezing, water, dirt and debris.

1.6.1.2 Contractor shall provide own fire extinguishers during construction period.

2 Products

## **2.1 FIRE EXTINGUISHERS**

### **2.1.1 Multi-Purpose Dry Chemical Extinguishers – Tag: FE – 1:**

2.1.1.1 Stored pressure rechargeable type with wall bracket, hose and nozzle. 4.5 kg, ULC listed for A, B and C class protection with a minimum rating of 6A:80B.C.

2.1.1.2 Manufacturers:

2.1.1.2.1 Model # A456X, by Amerex Corporation.

2.1.1.2.2 Model #ABC-100WWD, by National Fire Equipment Ltd.

2.1.1.2.3 Model #D-ABC10, by Herbert Williams Fire Equipment Ltd.

## **2.2 BACKING BOARD FOR FIRE EXTINGUISHERS**

2.2.1 19 mm thick exterior grade plywood, good one side.

2.2.2 100 mm wider and 200 mm taller than fire extinguisher.

2.2.3 Top and bottom semi-circular.

2.2.4 Finish: Primed and painted gloss white fire retardant paint in accordance with Section 09 91 00.

2.2.5 Mount identification tag (FE-XX) at top of board in accordance with Section 20 05 53.

3 Execution

## **3.1 EXAMINATION**

3.1.1 Verify conditions and dimensions of previously installed Work upon which Work of this Section depends. Report defects to TTC. Commencement of Work means acceptance of existing conditions.

3.1.2 Contract Drawings indicate preferred locations of fire extinguishers, but may not indicate all locations needed to meet applicable codes.

- 3.1.3 Numbers of fire extinguishers indicated on Contract Drawings are minimum required and shall not be reduced by application of code requirements.

## **3.2 INSTALLATION**

### **3.2.1 Fire Extinguishers:**

- 3.2.1.1 Provide extinguishers where shown on reviewed Shop Drawings.
- 3.2.1.2 Conform to Ontario Fire Code Part 6 of Division B and the authorities having jurisdiction for maximum travel distance between extinguishers.
- 3.2.1.3 Mount interior fire extinguishers that are not accessible to the general public on backing boards with brackets. Fasten backing boards securely to wall.
- 3.2.1.4 Identify extinguishers in accordance with ANSI/NFPA10 and CAN/ULC-S508 and Section 20 05 53.
- 3.2.1.5 Attach bilingual tag or label to extinguishers, indicating month and year of installation. Provide space for service dates.
- 3.2.1.6 Install fire extinguishers after wall finishing Work is complete.
- 3.2.1.7 Locate extinguishers at strike side if extinguishers are adjacent to doors.
- 3.2.1.8 Mount fire extinguishers weighing 18 kg or more at not more than 1067 mm, measured from finished floor elevation to top of fire extinguisher.
- 3.2.1.9 Mount fire extinguishers weighing less than 18 kg at not more than 1219 mm, measured from finished floor elevation to top of fire extinguisher.
- 3.2.1.10 Minimum 102 mm from bottom of fire extinguisher to finished floor.

## **3.3 CLEANING**

- 3.3.1 Leave extinguishers new, clean, and free of construction dirt and debris.
- 3.3.2 Replace extinguishers used during construction with new units.

## **3.4 MAINTENANCE**

- 3.4.1 Maintain equipment and systems installed until Substantial Performance, in accordance with Section 01 78 25.
- 3.4.2 Carry out regular scheduled maintenance of equipment and systems following Substantial Performance until Contract Completion, in accordance with Section 01 78 25.

**END OF SECTION**





1 General

**1.1 SECTION INCLUDES**

1.1.1 Design, labour, Products, equipment, tools, supervision, and services necessary for thermal insulation of piping in accordance with the Contract Documents.

1.1.2 Insulate and jacket piping, valves, fittings and equipment for piping systems where indicated in piping insulation schedule in Part 3.

**1.2 RELATED SECTIONS**

1.2.1 Section 07 92 00 - Sealants.

1.2.2 Section 09 91 00 – Painting.

1.2.3 Section 20 05 53 – Mechanical Identification.

**1.3 REFERENCES**

1.3.1 ASHRAE Standard 90.1, Energy Efficient Design of New Buildings.

1.3.2 ASTM B209M, Specification for Aluminum and Aluminum Alloy Sheet and Plate.

1.3.3 ASTM C177, Standard Test Method for Steady State Heat Flux Measurement and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

1.3.4 ASTM C335, Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.

1.3.5 ASTM C449M, Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.

1.3.6 ASTM C552, Standard Specification for Cellular Glass Thermal Insulation.

1.3.7 ASTM C921, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

1.3.8 ASTM C1136, Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.

1.3.9 ASTM D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.

1.3.10 ASTM C533, Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.

1.3.11 ASTM C534, Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

1.3.12 ASTM C547, Standard Specification for Mineral Fiber Pipe Insulation.

1.3.13 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

1.3.14 CAN/CGSB 51.53M, Jacketing, Polyvinyl, Chloride Sheet, for Insulating Pipes, Vessels and Round Ducts.

1.3.15 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.

1.3.16 International Association of Heat and Frost Insulators and Asbestos Workers.

1.3.17 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.

## 1.4 DEFINITIONS

1.4.1 For purposes of this Section:

1.4.1.1 Concealed: insulated mechanical services in suspended ceilings and chases and furred-in spaces.

1.4.1.2 Exposed: not Concealed as defined herein.

1.4.1.3 Runout: Exposed piping connections to fixtures and equipment, 2000 mm in length or less.

## 1.4.2 TIAC insulation codes:

1.4.2.1 Insulation: 1501 – H, 1501 – C.

1.4.2.2 CPF: Code Piping Finish.

## 1.5 SUBMITTALS

1.5.1 Submit in accordance with Section 01 33 00.

## 1.5.2 Product Data, Shop Drawings and Documentation Package:

### 1.5.2.1 Product Data:

1.5.2.1.1 Submit manufacturer's Product data for all Products listed in this Section indicating:

1.5.2.1.1.1 Performance criteria, compliance with appropriate reference standards, characteristics, and limitations.

1.5.2.1.1.2 Product storage, handling, and installation requirements, including detailed installation instructions with respect to:

1.5.2.1.1.2.1 Various pipe, fittings, valves and jointing components.

1.5.2.1.1.2.2 Provisions for expansion.

1.5.2.1.1.2.3 Jacketing.

1.5.2.1.1.2.4 Vapour retarders, adhesives, coatings and fastening systems.

1.5.2.1.1.2.5 Pipe hangers and supports.

### 1.5.2.2 Shop Drawings:

1.5.2.2.1 Submit Shop Drawings for custom fabricated Products in accordance with Section 01 33 23 indicating:

1.5.2.2.1.1 Manufacturer's catalogue literature related to installation, fabrication and jointing recommendations.

1.5.2.2.1.2 Elevations, sections and details of Products and application methods, dimensions, gauges, finishes and relationship to equipment and to adjacent construction.

### 1.5.2.3 Documentation:

1.5.2.3.1 **Trades:** Submit copy of the following membership certificates:

1.5.2.3.1.1 Master Insulator's Association of Ontario or TIAC.

1.5.2.3.1.2 International Association of Heat and Frost Insulators and Asbestos Workers.

1.5.2.3.2 **Tradespersons:** Submit copy of the International Association of Heat and Frost Insulators and Asbestos Workers membership certificate.

## 1.5.3 Closeout Submittals Package:

- 1.5.3.1 Submit the following for incorporation into Operation and Maintenance Manuals in accordance with Section 01 78 23:
  - 1.5.3.1.1 Identification: Manufacturing name, type, year, serial number, number of units, capacity, and identification of related systems.
  - 1.5.3.1.2 Performance criteria and maintenance data.
  - 1.5.3.1.3 Operating instructions and precautions.
  - 1.5.3.1.4 Safety precautions.
  - 1.5.3.1.5 Manufacturer's instructions for installation, delivery and storage for the following items:
    - 1.5.3.1.5.1 Insulation.
    - 1.5.3.1.5.2 Jacketing.
- 1.5.3.2 Submit manufacturer's field inspection reports.

## **1.6 QUALITY ASSURANCE**

- 1.6.1 Insulation trade to be specialist in performing Work of this Section and have minimum 3 years successful experience in this size and type of project, qualified to standards and member of Master Insulator's Association of Ontario or TIAC, and International Association of Heat and Frost Insulators and Asbestos Workers.
- 1.6.2 Tradesperson to be member of International Association of Heat and Frost Insulators and Asbestos Workers.

## **1.7 DELIVERY, STORAGE AND HANDLING**

- 1.7.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- 1.7.2 Protect from weather, construction traffic.
- 1.7.3 Protect against damage from any source.
- 1.7.4 Store at temperatures and conditions required by manufacturer.

## **2 Products**

### **2.1 PIPING INSULATION**

#### **2.1.1 Insulation:**

- 2.1.1.1 **Mineral fibre** as specified herein includes glass fibre, rock wool, or mineral wool.
  - 2.1.1.1.1 Thermal conductivity ("k" factor) not to exceed 0.033 W/mC at 24°C mean temperature when tested to ASTM C 335.
  - 2.1.1.1.2 Rigid moulded mineral fibre with factory applied vapour retarder jacket with self-adhering longitudinal lap.
    - 2.1.1.1.2.1 Mineral fibre: to ASTM C547.
    - 2.1.1.1.2.2 Jacket to CGSB 51-GP-52Ma.
    - 2.1.1.1.2.3 Maximum "k" factor: to ASTM C547.
  - 2.1.1.1.3 Fire and Smoke Rating: To CAN/ULC-S102:
    - 2.1.1.1.3.1 Maximum flame spread rating: 25.

- 2.1.1.1.3.2 Maximum smoke developed rating: 50.
- 2.1.1.1.4 Securement: Self-adhesive tape, aluminum foil, 75 mm wide, butt joints.
- 2.1.1.1.5 **Manufacturers:**
  - 2.1.1.1.5.1 Johns Manville Insulation Inc.
  - 2.1.1.1.5.2 Manson Insulation.
  - 2.1.1.1.5.3 Owens-Corning.
  - 2.1.1.1.5.4 Knauf Fibre Glass.
- 2.1.1.2 **Elastometric, closed cell:**
  - 2.1.1.2.1 Expanded, closed cell foam, black unslit tubing.
  - 2.1.1.2.2 Thermal conductivity (k factor) not to exceed 0.039 W/mC at 24°C mean temperature when tested to ASTM C177.
  - 2.1.1.2.3 Elastomeric contact adhesive:
    - 2.1.1.2.3.1 Compatible with insulation for joining surfaces.
    - 2.1.1.2.3.2 Product: Armaflex 520.
    - 2.1.1.2.4 Product: Armaflex by Armacell.
- 2.1.1.3 **Cellular glass:**
  - 2.1.1.3.1 Closed glass cell, high compressive strength.
  - 2.1.1.3.2 Suitable for buried application.
  - 2.1.1.3.3 Thermal conductivity (k factor) not to exceed 0.045 W/mC at 24°C mean temperature when tested to ASTM C177.
  - 2.1.1.3.4 Meets ASTM C552.
  - 2.1.1.3.5 Securement: Stainless steel bands, 19 mm wide, 0.5 mm thick, 300 mm o.c.
  - 2.1.1.3.6 Product: Foamglas by Pittsburg-Corning.
- 2.1.2 **Jacket:**
  - 2.1.2.1 **Polyvinyl Chloride (PVC) Fittings:**
    - 2.1.2.1.1 One-piece moulded type to CAN/CGSB 51.53, preformed shapes as required.
    - 2.1.2.1.2 Minimum service temperatures: -20°C.
    - 2.1.2.1.3 Maximum service temperature: 65°C.
    - 2.1.2.1.4 Moisture vapour transmission: 0.02 perm.
    - 2.1.2.1.5 Thickness: 0.5 mm.
    - 2.1.2.1.6 Fastenings:
      - 2.1.2.1.6.1 Use solvent weld adhesive compatible with insulation to seal laps and joints or,
      - 2.1.2.1.6.2 Pressure sensitive vinyl tape, 50 mm wide.
    - 2.1.2.1.7 Not permitted on straight pipe runs.
  - 2.1.2.2 **Canvas:**
    - 2.1.2.2.1 220 g/m<sup>2</sup> (6 oz/sq yd) cotton, plain weave.

- 2.1.2.2.2 Lagging adhesive:
  - 2.1.2.2.2.1 Fire retardant lagging adhesive to ASTM C921 compatible with insulation.
  - 2.1.2.2.2.2 Products:
    - 2.1.2.2.2.2.1 Bakor 120-19.
    - 2.1.2.2.2.2.2 Childers CP-52.
- 2.1.2.3 **Aluminum:**
  - 2.1.2.3.1 To ASTM B209.
  - 2.1.2.3.2 Thickness: 0.50 mm sheet.
  - 2.1.2.3.3 Finish: Stucco embossed with factory attached protective liner (moisture barrier) on interior surface.
  - 2.1.2.3.4 Joining: Longitudinal Z-lock type and circumferential slip joints with 50 mm butt end laps.
  - 2.1.2.3.5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner on interior surface.
  - 2.1.2.3.6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.
  - 2.1.2.3.7 Butt Straps: Aluminum with foam strips with peel off tape on both outside edges of inside of strap.
  - 2.1.2.3.8 Material: Childers lock on jacketing system.

### 3 Execution

#### 3.1 PRE-INSTALLATION REQUIREMENT

- 3.1.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.
- 3.1.2 Surfaces clean, dry and free from foreign material.
- 3.1.3 Heat tracing installed, tested and verified.

#### 3.2 INSTALLATION

- 3.2.1 Install to TIAC National Standards.
- 3.2.2 Apply materials to manufacturer's instructions and this Specification.
- 3.2.3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
- 3.2.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
  - 3.2.4.1 Hangers, supports outside outer jacket.
- 3.2.5 Supports, Hangers: Size insulation shields to suit outside diameter of insulation and jacket.

#### 3.3 REMOVABLE, PREFABRICATED, INSULATION AND ENCLOSURES

- 3.3.1 Application: At expansion joints, valves, primary flow measuring elements, flanges and unions at equipment.

3.3.2 Design: To permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.

3.3.3 Insulation:

3.3.3.1 Insulation, fastenings and finishes: same as system.

3.3.3.2 Jacket: Aluminum, PVC.

### **3.4 PIPING INSULATION APPLICATION SCHEDULES**

3.4.1 Schedule below indicates piping to be insulated, except where noted.

3.4.2 Includes pipes, valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.

3.4.3 TIAC Code: To appropriate piping code, 1501-H, 1501-C.

3.4.4 Thickness of insulation as listed in the following table.

3.4.5 Piping not to be insulated:

3.4.5.1 Runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Temp °C	TIAC Code	Pipe sizes (NPS) and insulation thickness (mm)					
			Run out	to 1	1¼ to 2	2½ to 4	5 to 6	8 & over
DHW and DHWR+TW	60	1501-H	25	25	25	38	38	38
DCW	10	1501-C	25	25	25	25	25	25
SAN* **	10	1501-C	25	25	25	25	25	25
DSP *	10	1501-C	25	25	25	25	25	
RHG	44	1501-H	25	25	25	-	-	-
RL	4	1501-C	25	25	25	-	-	-

\* Insulate heat traced portion only, as indicated on Drawings.

\*\* Insulate SAN in ceiling space only.

### **3.5 JACKET APPLICATION**

3.5.1 Jacket Application: Apply to pipe, valves and fittings as follows:

3.5.1.1 Exposed indoors:

3.5.1.1.1 Up to 1.8 m above finished floor: Aluminum jacket.

3.5.1.1.2 Over 1.8 m above finished floor: Canvas jacket with PVC fittings.

3.5.1.2 Exposed in Mechanical Rooms: Canvas jacket with PVC fittings.

3.5.1.3 Concealed, indoors: Vapour barrier only.

3.5.1.4 Use vapour retarder jacket compatible with insulation.

3.5.2 Finish attachments: SS bands, at 300 mm o.c. Seals: Wing.

3.5.3 Installation: To appropriate TIAC code CPF/1, CPF/3 or as specified.

3.5.4 Painting: Paint all exposed insulated pipe in accordance with Sections 09 91 00 and 20 05 53. Painting shall be performed by qualified trades.

### **3.6 VALVES**

3.6.1 Finish jacket neat and clean to valve stem.

3.6.2 Where insulation and jacket interferes with valve operation, provide valve stem extension to suit.

**3.7 FIELD QUALITY CONTROL**

3.7.1 Manufacturer/supplier to provide field inspections to verify installation in conformance with manufacturer's recommendations, instructions and specified requirements.

**END OF SECTION**





1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment and services necessary for domestic water piping Work in accordance with the Contract Documents.

**1.2 REFERENCES**

1.2.1 ASME B16.15, Cast Copper Alloy Threaded Fittings: Classes 125 and 250.

1.2.2 ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.

1.2.3 ASME B16.22, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

1.2.4 ANSI/AWWA B300, Hypochlorites.

1.2.5 ASME B16.24, Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500.

1.2.6 ASME B16.42, Ductile-Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300.

1.2.7 ASTM B32, Standard Specification for Solder Metal.

1.2.8 ASTM A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

1.2.9 ASTM B75, Standard Specification for Seamless Copper Tube.

1.2.10 ASTM B88, Standard Specification for Seamless Copper Water Tube.

1.2.11 ASTM B584, Standard Specification for Copper Alloy Sand Castings for General Applications.

1.2.12 MSS SP-80, Bronze Gate, Globe, Angle and Check Valves.

1.2.13 MSS SP-110, Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.2.14 MSS SP-139, Copper Alloy Gate, Globe, Angle, and Check Valves for Low Pressure/Low Temperature Plumbing Applications.

1.2.15 NSF/ANSI Standard 61, Drinking Water System Components - Health Effects.

1.2.16 NSF/ANSI 372, Drinking Water Systems Components - Lead Content.

1.2.17 OBC, Ontario's Building Code.

1.2.18 Ontario Plumbing Code.

1.2.19 Ontario Regulation 169, Ontario Drinking Water Quality Standards.

**1.3 SUBMITTALS**

1.3.1 Submit in accordance with Section 01 33 00.

**1.3.2 Product Data Package:**

1.3.2.1 Submit manufacturer's Product data for all Products listed in this Section indicating:

1.3.2.1.1 Performance criteria, compliance with appropriate reference standards, characteristics, and limitations.

**1.3.3 Quality Assurance Submittal Package:**

- 1.3.3.1 Submit preliminary inspection test and reports as required by authorities having jurisdiction.

**1.3.4 Commissioning Package:**

- 1.3.4.1 Submit the following in accordance with Section 01 91 00:

- 1.3.4.1.1 Commissioning Procedures.

- 1.3.4.1.2 Certificate of Readiness.

**1.3.5 Commissioning Closeout Package:**

- 1.3.5.1 Submit the following in accordance with Section 01 91 00:

- 1.3.5.1.1 Deficiency Report.

- 1.3.5.1.2 Commissioning Closeout Report.

**1.3.6 Closeout Submittals Package:**

- 1.3.6.1 Submit the following for incorporation into Operation and Maintenance Manuals in accordance with Section 01 78 23:

- 1.3.6.1.1 Safety precautions.

- 1.3.6.1.2 Component parts availability including names and addresses of spare part suppliers.

- 1.3.6.1.3 Final pressure test report in accordance with Sections 20 05 00 and 23 05 93.

- 1.3.6.1.4 Commissioning reports.

- 1.3.6.1.5 Copy of the valve identification chart as requested on Paragraph 3.5.5.

- 1.3.6.2 Submit As-Built Documents in accordance with Section 01 78 39.

**1.4 QUALITY ASSURANCE**

**1.4.1 Installer's Qualifications:**

- 1.4.1.1 Trade qualification: Plumber's Certificate of Qualification administered by the Ontario Ministry of Training, Colleges and Universities.

**1.5 DELIVERY, STORAGE, AND HANDLING**

- 1.5.1 Storage and protection: Keep piping clean and dry, and ends capped until installation.

- 2 Products

**2.1 LEAD FREE REQUIREMENTS**

- 2.1.1 The wetted surface of all elements of systems whose components are in contact with potable water is to contain less than 0.25% of lead by weighted average, as outlined in NSF/ANSI 372 and as certified by an independent recognized testing facility.

**2.2 ABOVE GROUND PIPING, FITTINGS AND JOINTS**

- 2.2.1 Application:

- 2.2.1.1 Domestic cold water (DCW).

- 2.2.2 NPS ½ (12 mm) to NPS 12 (300 mm) domestic water piping in systems with operating pressure below 1380 kPa (200 psi):
  - 2.2.2.1 Pipe:
    - 2.2.2.1.1 Hard (drawn) seamless copper tube, Type L in accordance with ASTM B88.
  - 2.2.2.2 Fittings:
    - 2.2.2.2.1 Cast copper, solder type in accordance with ASME B16.18.
    - 2.2.2.2.2 Wrought copper and copper alloy, solder type, in accordance with ASME B16.22.
    - 2.2.2.2.3 Cast bronze threaded fittings, Class 125 and 250, in accordance with ASME B16.15.
    - 2.2.2.2.4 Bronze pipe flanges and flanged fittings, Class 150 and 300, in accordance with ASME B16.24; hex head bolts, nuts, and washers in accordance with ASTM A307, heavy series.
  - 2.2.2.3 Joints:
    - 2.2.2.3.1 Soldered: 95% tin, 5% antimony or "Silvabrite 100" solder in accordance with ASTM B32.
    - 2.2.2.3.2 Screwed: Teflon tape.
    - 2.2.2.3.3 Grooved: Couplings to be with angle bolt pads to provide a rigid joint.
      - 2.2.2.3.3.1 Victaulic 606 - copper pipe standard coupling complete with EPDM flush seal gasket.
      - 2.2.2.3.3.2 Victaulic 607 – copper pipe coupling ready for direct stab installation without field disassembly, complete with grade EHP gasket.
- 2.2.3 Application: NPS ½ (12 mm) exposed trap primer lines:
  - 2.2.3.1 Pipe: Soft copper coil seamless copper tube, Type L in accordance with ASTM B88.
  - 2.2.3.2 Fittings: Cast bronze threaded fittings, Class 125 and 250, in accordance with ASME B16.15.
  - 2.2.3.3 Joints: Screwed: Teflon tape.
- 2.3 VALVES**
  - 2.3.1 Ball Valves:**
    - 2.3.1.1 Application:
      - 2.3.1.1.1 Domestic cold water (DCW).
    - 2.3.1.2 **NPS 2 (50 mm) and Smaller, Soldered:**
      - 2.3.1.2.1 Bronze body, full port with solder ends, forged brass cap, and Class 600 WOG MSS SP-110.
      - 2.3.1.2.2 Stainless steel ball and stainless steel blowout-proof stem with extension to suit thickness of insulation.
      - 2.3.1.2.3 RPTFE packing, bearing and seat.
      - 2.3.1.2.4 Zinc plated lever nut and handle.
      - 2.3.1.2.5 Manufacturers:
        - 2.3.1.2.5.1 NIBCO S-585-66-LF.

2.3.1.2.5.2 Apollo Valves 77C-240 Series.

2.3.1.2.5.3 Milwaukee Valve Co. UPBA150/150S.

2.3.1.2.5.4 Kitz 869AM-LL.

**2.3.1.3 NPS 2 (50 mm) and Smaller, Screwed:**

2.3.1.3.1 Bronze or brass body, full port with NPT threaded ends, forged brass cap, and Class 600 WOG MSS SP-110.

2.3.1.3.2 Stainless steel ball and stainless steel blowout-proof stem with extension to suit thickness of insulation.

2.3.1.3.3 Reinforced poly tetrafluoroethylene (RPTFE) packing, bearing and seat.

2.3.1.3.4 Zinc plated lever nut and handle.

2.3.1.3.5 Manufacturers:

2.3.1.3.5.1 NIBCO T-585-66-LF.

2.3.1.3.5.2 Apollo 77FLF-140 Series.

2.3.1.3.5.3 Milwaukee Valve Co. UPBA100/100S.

2.3.1.3.5.4 Kitz 868AM-LL.

**2.3.1.4 Drain Valves:**

2.3.1.4.1 Bronze or brass C49300 material body, full port with NPT threaded ends, forged brass cap, and Class 600 WOG.

2.3.1.4.2 Chrome-plated ball and blowout-proof stem.

2.3.1.4.3 RPTFE packing, bearing and seat.

2.3.1.4.4 Zinc plated lever nut and lockable handle.

2.3.1.4.5 Hose end connection with cap and chain.

2.3.1.4.6 Manufacturers:

2.3.1.4.6.1 Toyo Fig 5046-LF.

2.3.1.4.6.2 Apollo 70LF-100HC.

2.3.1.4.6.3 Watts Industries #B6000-CC.

2.3.1.4.6.4 Kitz 868C.

**2.4 CHLORINE DISINFECTANT**

2.4.1.1 Chlorine: In accordance with ANSI/AWWA B300 and AWWA C651.

**3 Execution**

**3.1 GENERAL**

3.1.1 Perform Work in accordance with Part 7 of OBC and authorities having jurisdiction.

**3.2 PREPARATION**

3.2.1 Clean pipes, fittings and valves of debris and water before installation. Carefully inspect materials for defects before installing. Remove defective materials from Site.

### **3.3 PIPE INSTALLATION - GENERAL**

- 3.3.1 Install in accordance with Ontario Plumbing Code and authorities having jurisdiction.
- 3.3.2 Cut square, ream and clean tubing and tube ends, clean recesses of fittings and assemble without binding.
- 3.3.3 Connect to equipment in accordance with manufacturer's instructions and drawing schedule unless otherwise indicated.
- 3.3.4 Slope piping so that it can be completely drained.
- 3.3.5 Provide proper dielectric separation between copper and ferrous pipe or equipment.
- 3.3.6 Install trap primer lines to requirements of trap priming system.
- 3.3.7 Insulate and jacket piping in accordance with Section 22 07 19.

### **3.4 ABOVEGROUND PIPE INSTALLATION**

- 3.4.1 Install tubing close to building structure to minimize furring, conserve headroom and space. Group exposed piping and run parallel to walls.
- 3.4.2 Install cold water service piping below and away from all hot piping to maintain temperature of cold water as low as possible.
- 3.4.3 Paint and identify piping in accordance with Section 20 05 53.
- 3.4.4 Support piping in accordance with Section 20 05 29. Where possible, neatly route piping of the section with other service piping.

### **3.5 VALVES**

- 3.5.1 Isolate each piece of equipment, with shut-off valves, ball type.
- 3.5.2 Sweat valves with solder ends to copper pipe with low temperature (215.5°C) solder in accordance with valve manufacturer's recommendations.
- 3.5.3 Provide a drain valve at the bottom of potable water risers, on strainers (where equipped), at all piping low points and where indicated on Contract Drawings. Pipe to nearby drain.
- 3.5.4 Locate valves in accessible positions as follows:
  - 3.5.4.1 Within hand reach 2 m from floor (most acceptable).
  - 3.5.4.2 Within hand reach of 3 m ladder (limited acceptance is based on Site operation conditions with little or no obstructions at high levels).
- 3.5.5 Valve Identification Chart:
  - 3.5.5.1 Provide valve number, location, diameter, make and model, and designated system (e.g. DHW, DCW, etc.).
  - 3.5.5.2 Install in the Valve Room or at a location advised by TTC.

### **3.6 UNIONS**

- 3.6.1 Install unions at all connections to fixtures and specialties (where existing connections/couplings do not allow) for fast and convenient disconnection of pipes for maintenance.

### **3.7 DISINFECTION AND TESTING**

- 3.7.1 Flush out and disinfect potable water piping, after pressure testing is complete.
- 3.7.2 Disinfection of potable water piping shall be conducted after preliminary flushing has been completed and under the supervision of a Professional Engineer, authorized by Professional Engineers Ontario to perform the Work.
- 3.7.3 During disinfection process, all valves, faucets, hose outlets and service connections in the section treated shall be operated in order to disinfect the appurtenances.
- 3.7.4 Final flushing of piping shall be done until all foreign materials have been removed and the flushed water is clear. Provide connections and pumps as required. Open and close valves, faucets, hose outlets and service connections to ensure thorough flushing.
- 3.7.5 Take water sample from a source which reflects the water quality of the entire system, such as hose bibb or faucet, and is remotely located from the incoming water. Do not take water sample from a filtered source, such as drinking fountain.
- 3.7.6 Water sampling, transportation of the water sample to the laboratory and analytical testing of the water sample have to be conducted by an accredited laboratory which is licensed by the Ontario Ministry of the Environment (MOE) for the provision of drinking-water testing services.
- 3.7.7 Test in accordance with the requirements listed in Ontario Regulation 169, Ontario Drinking Water Quality standards.
- 3.7.8 Submit to the City of Toronto a report setting out the results of the testing. Report to be stamped, signed and sealed by the Professional Engineer.
- 3.7.9 Potable water piping may be placed in service upon receiving notification from City of Toronto.
- 3.7.10 Failed tests: Repeat flushing and disinfection.
- 3.7.11 All disinfection, laboratory testing, report preparation and verification shall be done at the expense of TTC and in accordance with governing standards.

### **3.8 COMMISSIONING**

- 3.8.1 Perform commissioning in accordance with Sections 01 91 00 and 20 05 00.
- 3.8.2 Verify operational performance in general conformance with the following outline:
  - 3.8.2.1 Adequate water supply pressure to all fixtures, including, but not limited to:
    - 3.8.2.1.1 Trap Primer.
    - 3.8.2.2 Tracer wire and junction box:
      - 3.8.2.2.1 Continuity.

### **3.9 CLEANING**

- 3.9.1 Clean exposed metal surfaces to facilitate painting.

### **3.10 PAINTING**

- 3.10.1 Paint exposed piping in accordance with Sections 09 91 00 and 20 05 53 by qualified trades.

**3.11 MAINTENANCE**

- 3.11.1 Maintain all equipment and systems installed until Substantial Performance, in accordance with Section 01 78 25.
- 3.11.2 Once system is started-up, maintain space heat and heat tracing to protect piping from freezing.

**END OF SECTION**





1 General

**1.1 SECTION INCLUDES**

1.1.1 Design, labour, Products, equipment, and services necessary for sanitary and storm drainage and vent piping Work in accordance with the Contract Documents.

**1.2 REFERENCES**

1.2.1 ANSI/ASME B16.1, Cast Iron Pipe Flanges and Flanged Fittings.

1.2.2 ASME B16.29, Wrought Copper and Copper Alloy Solder Joint Drainage Fittings.

1.2.3 ASTM B88, Standard Specification for Seamless Copper Water Tube.

1.2.4 ASTM B306, Standard Specification for Copper Drainage Tube (DWV).

1.2.5 ASTM C564, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

1.2.6 CAN/CSA B70, Cast Iron Soil Pipe, Fittings, and Means of Joining.

1.2.7 MSS-SP-25, Standard Marking System for Valves, Fittings, Flanges and Unions.

**1.3 DESIGN REQUIREMENTS**

1.3.1 Venting systems: In accordance with OBC.

**1.4 SUBMITTALS**

1.4.1 Submit in accordance with Section 01 33 00.

**1.4.2 Shop Drawings:**

1.4.2.1 Catalogue data sheets clearly indicating selected Product, compliance with appropriate reference standards, characteristics, and limitations.

**1.4.3 Closeout Submittals Package:**

1.4.3.1 Submit the following for incorporation into Operation and Maintenance Manuals in accordance with Section 01 78 23:

1.4.3.1.1 Identification: Manufacturer's name, type, year, serial number, number of units, capacity and identification of related systems.

1.4.3.1.2 Performance criteria and maintenance data.

1.4.3.1.3 Safety precautions.

1.4.3.1.4 Component parts availability, including names and addresses of spare part suppliers.

1.4.3.1.5 Commissioning report.

1.4.3.2 Submit As-Built Drawings in accordance with Section 01 78 39.

1.4.3.3 Submit written inspection and test reports.

**1.5 QUALITY ASSURANCE**

1.5.1 Installer's qualifications:

1.5.1.1 Trades: Plumber Certification of Qualification administered by the Ontario Ministry of Training, Colleges and Universities.

2 Products

## **2.1 PIPING, FITTINGS, AND JOINTS - ABOVEGROUND**

### **2.1.1 Aboveground Gravity Drain and Vent:**

- 2.1.1.1 NPS 65 mm and smaller:
  - 2.1.1.1.1 Copper pipe type DWV hard temper in accordance with ASTM B306.
  - 2.1.1.1.2 Fittings: Wrought copper, solder joint, in accordance with ASME B16.29.
  - 2.1.1.1.3 Solder material: Lead free solder (tin-antimony or tin-silver).
- 2.1.1.2 NPS 75 mm and larger:
  - 2.1.1.2.1 Piping and fittings: Grey cast iron Class 4000, in accordance with CAN/CSA B70, plain ends.
  - 2.1.1.2.2 Joints: Heavy-duty, mechanical joint couplings:
    - 2.1.1.2.2.1 Gaskets and sealing rings: Neoprene rubber in accordance with ASTM C564. For oily waste use Nitrile or Viton gasket material.
    - 2.1.1.2.2.2 Shield: Corrugated, 0.4 mm thickness stainless steel Type 304.
    - 2.1.1.2.2.3 Clamping bands: Stainless steel, worm-gear drive, clamping bands:
      - 2.1.1.2.2.3.1 NPS 100 mm and smaller: Four bands.
      - 2.1.1.2.2.3.2 NPS 150 mm and larger: Six bands.
    - 2.1.1.2.2.4 Manufacturers:
      - 2.1.1.2.2.4.1 Husky, Model SD 4000.
      - 2.1.1.2.2.4.2 Fernco, Heavy-Duty Series.
      - 2.1.1.2.2.4.3 Mission Rubber Company, Heavy Weight Couplings.

## **3 Execution**

### **3.1 GENERAL**

- 3.1.1 Perform Work in accordance with OBC, Part 7 and authorities having jurisdiction.

### **3.2 PREPARATION**

- 3.2.1 Carefully inspect materials for defects. Clean pipes, fittings, and valves of debris and water before installation. Remove defective materials from Site.

### **3.3 PIPE INSTALLATION - GENERAL**

- 3.3.1 Remove burrs and cuttings from piping before assembly.
- 3.3.2 Lay and join pipe in accordance with manufacturer's instructions.
- 3.3.3 Handle pipe in accordance with manufacturer's instructions and approved methods.
- 3.3.4 Do not exceed maximum joint deflection recommended by pipe manufacturer.
- 3.3.5 Cut pipes for special inserts, fittings or closure pieces in neat manner and as recommended by pipe manufacturer, without damaging pipe or its coating, and leaving smooth end at right angles to axis of pipe.
- 3.3.6 Where connecting to dissimilar pipe materials or pipe dimensions, provide adaptor couplings approved by pipe manufacturer for application.

3.3.7 Connect to fixtures and equipment with pipe sizes and fittings in accordance with manufacturer's instructions unless otherwise indicated. Refer to Contract Drawings for plumbing fixture connection schedule and schematics.

3.3.8 Install cleanouts at changes in direction greater than 45 degrees and at 15 m spacing.

### **3.4 PIPE INSTALLATION - ABOVEGROUND**

3.4.1 Torque coupling connection in accordance with manufacturer's instructions.

3.4.2 Install above ground piping parallel and close to walls and ceilings to conserve headroom and space. Slope above ground piping to 2% grade unless otherwise indicated on Contract Drawings.

3.4.3 Support above ground piping in accordance with Section 20 05 29 and applicable codes. In addition, support above ground piping within 300 mm of each joint and change in direction.

3.4.4 Identify above ground piping in accordance with Section 20 05 53.

3.4.5 Heat trace above ground gravity drainage including drain traps in all unheated areas, in accordance with Electrical Drawings.

3.4.6 Insulate and jacket above ground piping in accordance with Section 22 07 19.

3.4.7 For mechanically joined pipe which requires maintenance removal, such as condensate P traps, install pipe union fitting to facilitate removal.

### **3.5 VENTING**

3.5.1 Contract Drawings do not completely indicate all venting requirements. Venting may be omitted for drawing clarity.

3.5.2 Provide complete venting of drainage systems in accordance with OBC, whether indicated on Contract Drawings or not.

3.5.3 Terminate vents in accordance with OBC requirements.

### **3.6 PIPE SERVICE SPACES**

3.6.1 Arrange gravity and vent piping to permit unrestricted passage within service space.

3.6.2 Clear passage shall be 900 mm wide by 2000 mm high above floor.

3.6.3 Do not locate pipework where it will be stepped on or over for access.

3.6.4 Coordinate pipe routing with domestic hot and cold water systems.

### **3.7 JOIST AND CEILING SPACES**

3.7.1 Adjust routing of piping in joist and ceiling spaces to avoid conflicts with ductwork and other services.

3.7.2 Where adjustments are required, review with TTC before proceeding.

3.7.3 Record changes on As-Built Drawings.

### **3.8 POWER WASHING AND VIDEOTAPING OF EXISTING DRAINAGE SYSTEM**

3.8.1 Coordinate scheduling of power washing and videotaping of existing drainage system. Refer to Section 01 50 00.

3.8.2 Complete power washing and videotaping prior to commencing construction activities.

3.8.3 Complete power washing and videotaping after completing the construction activities.

3.8.4 Protect existing drain openings from entry of construction debris after power washing has been completed.

**3.9 POWER WASHING AND VIDEOTAPING OF NEW DRAINAGE SYSTEM**

3.9.1 Coordinate scheduling of power washing and videotaping of new drainage system. Refer to Section 01 50 00.

**3.10 DRIP PANS**

3.10.1 Drip pan drain: Minimum NPS 40 mm pipe size or as indicated on Contract Drawings.

3.10.2 Route drip pan drain to nearest floor drain or a visible air gapped drain connection.

3.10.3 Refer to Section 20 05 00 for additional requirements.

**3.11 FIELD QUALITY CONTROL**

3.11.1 Field testing: Conduct inspection and testing in accordance with Sections 20 05 00 and 23 05 93.

3.11.2 Perform ball test of drainage piping in accordance with OBC, and in the presence of Plumbing Inspector and TTC.

3.11.3 If ball test fails, investigate and correct blockage or deficiency. If necessary, re-excavate and re-lay pipe at no extra cost to TTC. Repeat Work of Paragraph 3.11.2 above.

3.11.4 Perform water test in accordance with OBC requirements.

3.11.5 Perform final test in accordance with OBC requirements.

3.11.6 Arrange for TTC to witness tests.

3.11.7 Notify TTC minimum 21 Days prior to testing.

3.11.8 Prepare written inspection reports to TTC.

3.11.9 Verify operational performance in conformance with the test requirements outlined in this Section.

3.11.10 Prepare test report in general conformance, but not limited to, items listed in the following outline:

3.11.10.1 Drainage piping and fittings:

3.11.10.1.1 Videotape.

3.11.10.1.2 Pressure test.

3.11.10.1.3 Ball test.

3.11.10.1.4 Other.

**3.12 PAINTING**

3.12.1 Clean exposed metal surfaces to facilitate painting.

3.12.2 Paint above ground piping, including hangers and fittings not covered by insulation. Work performed by qualified trades in accordance with Sections 09 91 00 and 20 05 53.

**3.13 PROTECTION**

3.13.1 Cap risers to prevent entry of debris.

3.13.2 Provide additional marking and flagging as required to prevent construction traffic from colliding with or running over risers.

3.13.3 Protect drain openings from entry of construction debris.

**3.14 MAINTENANCE**

3.14.1 Maintain equipment and systems installed until Substantial Performance, in accordance with Section 01 78 25.

3.14.2 Once system is started up, maintain space heat and heat tracing to protect piping from freezing.

3.14.3 Until facility is in full operation, operate fixtures and trap primers on a weekly basis as required to maintain trap seals.

**END OF SECTION**



1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment and services necessary for plumbing fixtures and specialties Work in accordance with the Contract Documents.

**1.2 REFERENCES**

1.2.1 CAN/CSA-B45 Series, Plumbing Fixtures (Consists of B45.0, B45.1, B45.2, B45.3, B45.4, B45.5, B45.6, B45.7, B45.8 and B45.9).

1.2.2 CAN/CSA-B70, Cast Iron Soil Pipe, Fittings, and Means of Joining.

1.2.3 CSA-B79, Commercial and Residential Drains and Cleanouts.

1.2.4 CSA-B125.3, Plumbing Fittings.

1.2.5 NSF/ANSI 372, Drinking Water Systems Components - Lead Content.

1.2.6 OBC, Ontario Building Code.

1.2.7 UL 94, Standard for Safety of Flammability of Plastic Materials for Parts in Devices and Appliances Testing.

**1.3 SUBMITTALS**

1.3.1 Submit in accordance with Section 01 33 00.

**1.3.2 Product Data and Shop Drawings Package:**

**1.3.2.1 Product Data:**

1.3.2.1.1 Submit manufacturer's Product data for all Products listed in this Section except Products submitted as Shop Drawings indicating:

1.3.2.1.1.1 Performance criteria, compliance with appropriate reference standards, characteristics, limitations, and troubleshooting protocol.

1.3.2.1.1.2 Coordination with architectural Contract Drawings for location of floor drains.

**1.3.3 Commissioning Package:**

1.3.3.1 Submit the following in accordance with Section 01 91 00:

1.3.3.1.1 Commissioning Plan.

1.3.3.1.2 Commissioning Procedures.

1.3.3.1.3 Certificate of Readiness.

**1.3.4 Commissioning Closeout Package:**

1.3.4.1 Submit the following in accordance with Section 01 91 00:

1.3.4.1.1 Deficiency Report.

1.3.4.1.2 Commissioning Closeout Report.

**1.3.5 Training Plan:**

1.3.5.1 Submit Training Course Material and Training Schedule in accordance with Section 01 79 00.

**1.3.6 Closeout Submittals Package:**

- 1.3.6.1 Submit the following for each Product for incorporation into Operation and Maintenance Manuals in accordance with Section 01 78 23:
  - 1.3.6.1.1 Identification: Manufacturing name, type, year, serial number, number of units, capacity, and identification of related systems.
  - 1.3.6.1.2 Functional description detailing operation and control of components.
  - 1.3.6.1.3 Performance criteria and maintenance data.
  - 1.3.6.1.4 Operating instructions and precautions.
  - 1.3.6.1.5 Safety precautions.
  - 1.3.6.1.6 Component parts availability including names and addresses of spare part suppliers.
  - 1.3.6.1.7 Maintenance and troubleshooting guidelines/protocol, and recommended equipment for analysis and repair.
  - 1.3.6.1.8 List of items submitted to TTC: Keys, tools, special devices, maintenance materials.
- 1.3.6.2 Submit As-Built Drawings in accordance with Section 01 78 39.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- 1.4.1 Handle and store materials and Products to prevent damage to materials, Products, and structure.
- 1.4.2 Deliver materials in their original wrapping or containers with manufacturer's labels and seals intact and store in a dry area under cover, on raised platforms.
- 1.4.3 Ship metal members in rigid crates to avoid damage. Bent or deformed material rejected.
- 1.4.4 Suitably protect metal members against damage.

**1.5 TRAINING**

- 1.5.1 Provide training in accordance with Section 01 79 00.
- 1.5.2 Operation training:
  - 1.5.2.1 Allow for minimum of 1 hour per group of on-site time, to train in all aspects of equipment and system(s) operation(s).
  - 1.5.2.2 Maximum duration of each training session: 1 hour.
  - 1.5.2.3 Operation training of related systems may be combined, at discretion of TTC, provided all Contract requirements satisfied.
- 1.5.3 Maintenance training:
  - 1.5.3.1 Plant Maintenance – Plumbers:
    - 1.5.3.1.1 Allow for minimum of 1 hour per group of on-site time, to train in all aspects of equipment and system(s) operation(s).
    - 1.5.3.1.2 Schedule separate training sessions for 3 groups of maximum 7 persons per group, on separate days.
    - 1.5.3.1.3 Maximum duration of each training session: 2 hours.



2 Products

**2.1 LEAD FREE REQUIREMENTS**

2.1.1 The wetted surface of all elements of systems whose components are contacted by potable water is to contain less than 0.25% of lead by weighted average, as outlined in NSF/ANSI 372 and as certified by an independent recognized testing facility.

**2.2 PLUMBING FIXTURES AND FITTINGS**

**2.2.1 General:**

2.2.1.1 Manufacture plumbing fixtures in accordance with CAN/CSA-B45 Series.

2.2.1.2 Manufacture plumbing fittings in accordance with CSA-B125.3.

**2.3 CLEANOUTS**

2.3.1 Floor access:

2.3.1.1 Round cast iron hot-dip galvanized body and frame with adjustable secured nickel bronze top cast box with anchor lugs seal plug with neoprene gasket.

2.3.1.1.1 Zurn Model ZXN1612-G-SP.

2.3.1.1.2 J.R. Smith Model #4021S-G.

2.3.1.1.3 Watts Model CO-200-RX-34G-13.

2.3.1.1.4 Mifab.

2.3.1.2 Cover for concrete floors: Heavy-duty cast iron top with gasket.

2.3.1.2.1 Zurn Model ZX-1612-G-SP.

2.3.1.2.2 J.R. Smith Model #4022S-G.

2.3.1.2.3 Watts Model CO-200-RX-4-34G-13.

2.3.1.2.4 Mifab.

2.3.1.3 Cover for terrazzo finish: Polished nickel bronze with recessed cover for filling with terrazzo.

2.3.1.3.1 Zurn Model ZN-1400\_Z-G.

2.3.1.3.2 J.R. Smith Model #4180S-G.

2.3.1.3.3 Watts Model CO-200-US-34G-13.

2.3.1.3.4 Mifab.

2.3.1.4 Cover for tile and linoleum floors: Polished nickel bronze with recessed cover for linoleum or tile infill.

2.3.1.4.1 Zurn Model ZN-1602-G-SP-X.

2.3.1.4.2 J.R. Smith Model #4140S-G.

2.3.1.4.3 Watts Model CO-200-T-34G-13.

2.3.1.4.4 Mifab.

- 2.3.2 Plug:
  - 2.3.2.1 Cast iron male with brass screws and threaded brass or bronze plug. Sealing caulked lead seat or neoprene gasket.
    - 2.3.2.1.1 Zurn Model Z-1616-SP.
    - 2.3.2.1.2 J.R. Smith Model #4283S-G.
    - 2.3.2.1.3 Watts Model CO-270.
    - 2.3.2.1.4 Mifab.
- 2.3.3 Line cleanout:
  - 2.3.3.1 Stainless steel 180 mm x 180 mm cover with flush head vandal proof securing screws, bevelled edge frame complete with anchoring lugs.
    - 2.3.3.1.1 Zurn Model ZN1443-BP-VP.
    - 2.3.3.1.2 J.R. Smith Model #4435C-NB-05.
    - 2.3.3.1.3 Watts Model CO-450-RD.
    - 2.3.3.1.4 Mifab.

## **2.4 FLOOR DRAINS**

- 2.4.1 Indicated as 'FD-B': Floor drains in tiled areas to be galvanized cast iron body, flashing clamp with seepage openings and heavy-duty adjustable 127 mm x 127 mm (5 in. x 5 in.) square nickel bronze strainer, secured with stainless steel screws, 100 mm (4 in.) throat on strainer, sediment bucket. Drain to be complete with trap primer connection.
  - 2.4.1.1 Zurn Model ZN-415S-G-HD-P-Y.
  - 2.4.1.2 J.R. Smith Model 2005YB-B-P050-G-NB.
  - 2.4.1.3 Watts Model FD-100-C-L5-1-5-13.
  - 2.4.1.4 Mifab Model F1000C-S-5-7-13.

## **3 Execution**

### **3.1 INSTALLATION**

#### **3.1.1 Plumbing Fixtures and Fittings:**

- 3.1.1.1 Provide all required plumbing fixtures and fittings.
- 3.1.1.2 Install in accordance with OBC and authorities having jurisdiction.
- 3.1.1.3 Install in accordance with manufacturer's instructions and as specified.
- 3.1.1.4 Connect fixtures and fittings with piping sized in accordance with Contract Drawing schedule. Feed fixtures on outside walls from floor; feed other fixtures from wall.
- 3.1.1.5 Confirm the exact location of all plumbing fixtures and trim prior to roughing-in.
- 3.1.1.6 When an installation is complete, check and test the operation of each fixture and fitting. Adjust or repair as required.

**3.1.2 Floor Drains:**

- 3.1.2.1 Provide floor drains where indicated on Contract Drawings.
- 3.1.2.2 Equip each drain with a trap.
- 3.1.2.3 Confirm the exact location of drains prior to roughing in.
- 3.1.2.4 Temporarily cover floor drains during construction procedures. Remove covers during final cleanup Work and when requested, demonstrate free and clear operation of each drain. Replace any damaged grates and refinish any areas of the drain where the cast iron finish has been damaged or removed, including rusted areas.

**3.1.3 Cleanouts:**

- 3.1.3.1 In addition to those required by OBC, and as indicated on Contract Drawings, install where indicated.
- 3.1.3.2 Bring cleanouts to finished floor unless serviceable from below floor.
- 3.1.3.3 Where cleanout terminations occur in finished areas, confirm locations prior to rough-in and arrange piping to suit.
- 3.1.3.4 Terminate above in line cleanouts, a sufficient distance from walls, to allow cleanout to be removed for maintenance.

**3.1.4 Trap Priming:**

- 3.1.4.1 Trap seal primer piping:
  - 3.1.4.1.1 Refer to Section 22 11 16.
  - 3.1.4.1.2 Ensure trap primer piping secured to floor drain primer tapplings and not terminated through tapping in throat of drain.

**3.2 COMMISSIONING**

- 3.2.1 Perform commissioning in accordance with Sections 01 91 00 and 20 05 00.
- 3.2.2 Verify operational performance in general conformance with the following outline:
  - 3.2.2.1 Floor drains:
    - 3.2.2.1.1 Verify proper operation of trap primer and flushing features.
    - 3.2.2.1.2 Verify security and removability of strainers.
  - 3.2.2.2 Cleanouts:
    - 3.2.2.2.1 Verify covers gastight, secure, and easily removable.
    - 3.2.2.2.2 Verify cleanout rods can probe as far as next cleanout.

**3.3 MAINTENANCE**

- 3.3.1 Maintain all equipment and systems installed until Substantial Performance, in accordance with Section 01 78 25.
- 3.3.2 Carry out regular scheduled maintenance of equipment and systems following Substantial Performance until Contract Completion, in accordance with Section 01 78 25.

**END OF SECTION**



- 1 General
- 1.1 SECTION INCLUDES**
  - 1.1.1 Labour, Products, equipment and services necessary for testing, adjusting and balancing (TAB) of mechanical systems Work in accordance with the Contract Documents.
- 1.2 DEFINITIONS**
  - 1.2.1 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this Section.
- 1.3 QUALITY ASSURANCE**
  - 1.3.1 Submit names of personnel proposed to perform TAB to TTC within 90 Days of Notification of Award for approval.
  - 1.3.2 Provide documentation confirming qualifications, successful experience.
- 1.4 PURPOSE OF TAB**
  - 1.4.1 Test to verify correct and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads.
  - 1.4.2 Adjust and regulate equipment and systems to meet performance requirements and to achieve interaction with other related systems under normal and emergency loads and operating conditions.
  - 1.4.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.
- 1.5 EXCEPTIONS**
  - 1.5.1 TAB of systems and equipment regulated by codes, standards to acceptance of authority having jurisdiction.
- 1.6 CO-ORDINATION**
  - 1.6.1 Schedule time required for TAB (including repairs, re-testing) into Contract Schedule to ensure completion before Substantial Performance of Work.
  - 1.6.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.
- 1.7 PRE-TAB REVIEW**
  - 1.7.1 Review Contract Documents before Contract construction start, confirm in writing to TTC adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.
  - 1.7.2 Review specified standards and report to TTC in writing proposed procedures which vary from standard.
  - 1.7.3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

**1.8 START-UP**

- 1.8.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.
- 1.8.2 Follow special start-up procedures specified in other Sections of Division 23.

**1.9 OPERATION OF SYSTEMS DURING TAB**

- 1.9.1 Operate systems for length of time required for TAB and as required by TTC for verification of TAB reports.

**1.10 START OF TAB**

- 1.10.1 Notify TTC 7 Days prior to start of TAB.
- 1.10.2 Start TAB only when building essentially completed, including:
  - 1.10.2.1 Installation of ceilings, doors, windows, other construction affecting TAB.
  - 1.10.2.2 Application of weatherstripping, sealing, caulking.
  - 1.10.2.3 Pressure, leakage, other tests specified in other Sections of Division 23.
  - 1.10.2.4 Provisions for TAB installed and operational.
  - 1.10.2.5 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:
    - 1.10.2.5.1 Correct thermal overload protection in place for electrical equipment.
    - 1.10.2.5.2 **Air systems:**
      - 1.10.2.5.2.1 Filters in place, clean.
      - 1.10.2.5.2.2 Duct systems clean.
      - 1.10.2.5.2.3 Ducts, air shafts, ceiling plenums airtight to within specified tolerances.
      - 1.10.2.5.2.4 Correct fan rotation.
      - 1.10.2.5.2.5 Fire, volume control dampers installed and open.
      - 1.10.2.5.2.6 Coil fins combed, clean.
      - 1.10.2.5.2.7 Access doors, installed, closed.
      - 1.10.2.5.2.8 Outlets installed, volume control dampers open.

**1.11 APPLICATION TOLERANCES**

**1.11.1 Do TAB to following tolerances of design values:**

- 1.11.1.1 HVAC air systems: +5%, -5%.

**1.12 ACCURACY TOLERANCES**

- 1.12.1 Measured values accurate to within  $\pm 2\%$  of actual values.

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**1.13 INSTRUMENTS**

- 1.13.1 Prior to TAB, submit to TTC list of instruments used together with serial numbers.
- 1.13.2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.
- 1.13.3 Calibrate within 3 months of TAB. Provide certificate of calibration to TTC.

**1.14 SUBMITTALS**

- 1.14.1 Submit in accordance with Section 01 33 00.
- 1.14.2 Submit, prior to commencement of TAB:
  - 1.14.2.1 Proposed methodology and procedures for performing TAB if different from referenced standard.

**1.14.3 PRELIMINARY TAB REPORT**

- 1.14.3.1 Submit for checking and approval of TTC, prior to submission of formal TAB report, sample of rough TAB sheets. Include:
  - 1.14.3.1.1 Details of instruments used.
  - 1.14.3.1.2 Details of TAB procedures employed.
  - 1.14.3.1.3 Calculations procedures.
  - 1.14.3.1.4 Summaries.

**1.14.4 TAB REPORT**

- 1.14.4.1 Format in accordance with SMACNA HVAC Systems Testing, Adjusting and Balancing guidelines.
- 1.14.4.2 Show all results in SI units and include:
  - 1.14.4.2.1 Contract As-Built Drawings.
  - 1.14.4.2.2 System schematics.
- 1.14.4.3 Submit 6 copies of TAB Report to TTC for verification and approval, in English in D-ring binders with index tabs.

**1.15 VERIFICATION**

- 1.15.1 Reported results subject to verification by TTC.
- 1.15.2 Provide personnel and instrumentation to verify up to 30% of reported results.
- 1.15.3 Number and location of verified results at discretion of TTC.
- 1.15.4 Bear costs to repeat TAB as required to acceptance of TTC.

**1.16 SETTINGS**

- 1.16.1 After TAB completed to acceptance of TTC, replace drive guards, close access doors, lock devices in set positions, ensure sensors at required settings.
- 1.16.2 Permanently mark settings to allow restoration at any time during life of facility. Markings do not eradicate or cover.

**1.17 COMPLETION OF TAB**

1.17.1 TAB considered complete only when final TAB Report received and accepted by TTC.

**1.18 AIR SYSTEMS**

1.18.1 **Standard:** TAB to most stringent TAB standards of AABC, NEBB, SMACNA and ASHRAE.

1.18.2 Do TAB of air handling systems, components and controls specified under Division 23:

1.18.2.1 Supply, return, make-up air and exhaust air systems.

1.18.3 **Qualifications:** Personnel performing TAB current member in good standing of AABC or NEBB.

1.18.4 **Quality assurance:** Perform TAB under direction of supervisor qualified to standards of AABC or NEBB.

1.18.5 Measurements to include, but not limited to, the following as appropriate for systems, equipment, components, controls: Air velocity, static pressure, flow rate, pressure drop (or loss), duct cross-sectional area.

1.18.6 Locations of equipment measurements to include, but not limited to, the following as appropriate:

1.18.6.1 Inlet and outlet of each damper, other equipment causing changes in conditions.

1.18.6.2 At each controller, controlled device.

1.18.7 Locations of systems measurements to include, but not limited to, the following as appropriate: Each main duct, main branch, sub-branch, run-out (or grille, register or diffuser).

2 Products

**Not used.**

3 Execution

**Not used.**

**END OF SECTION**



1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment, tools, supervision, and services necessary for thermal insulation for ductwork in accordance with the Contract Documents.

**1.2 REFERENCES**

1.2.1 ASHRAE Standard 90.1, American Society of Heating, Refrigeration and Air Conditioning Engineers.

1.2.2 ASTM B209M, Specification for Aluminum and Aluminum Alloy Sheet and Plate.

1.2.3 ASTM C177, Standard Test Method for Steady State Heat Flux Measurement and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

1.2.4 ASTM C449M, Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.

1.2.5 ASTM C518, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

1.2.6 ASTM C612, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

1.2.7 ASTM C916, Standard Specification for Adhesives for Duct Thermal Insulation.

1.2.8 ASTM C921, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

1.2.9 ASTM C1071, Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).

1.2.10 ASTM C1136, Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.

1.2.11 ASTM C1290, Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.

1.2.12 ASTM C1338, Test Method for Determining Fungi Resistance of Insulation Material and Faces.

1.2.13 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.

1.2.14 International Association of Heat and Frost Insulators and Asbestos Workers.

1.2.15 NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems.

1.2.16 NFPA 90B, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

1.2.17 The Master Insulators' Association of Ontario.

1.2.18 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.

### **1.3 DEFINITIONS**

1.3.1 For purposes of this Section:

1.3.1.1 Concealed - mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.

1.3.1.2 Exposed - not Concealed as defined herein.

1.3.2 TIAC Codes:

1.3.2.1 CER: Rigid Insulation.

1.3.2.2 CEF: Flexible Insulation.

1.3.2.3 CRD: Code Round Finish.

1.3.2.4 CRF: Code Rectangular Finish.

### **1.4 SUBMITTALS**

1.4.1 Submit in accordance with Section 01 33 00.

#### **1.4.2 Shop Drawings:**

1.4.2.1 Submit manufacturer's Product data for all Products listed in this Section indicating:

1.4.2.1.1 Performance criteria, compliance with appropriate reference standards, characteristics, and limitations.

1.4.2.1.2 Certification that VOC content of adhesives and tapes meets the minimum requirements of ASTM C916, NFPA 90A, and NFPA 90B.

1.4.2.1.3 Product storage, handling, and installation requirements, including detailed installation instructions with respect to:

1.4.2.1.3.1 Jacketing.

1.4.2.1.3.2 Vapour retarders, adhesives, coatings and fastening systems.

1.4.2.2 Submit Shop Drawings in accordance with Section 01 33 00 indicating:

1.4.2.2.1 Manufacturer's catalogue literature related to installation, fabrication and jointing recommendations.

1.4.2.2.2 Elevations, sections and details of Products and application methods, dimensions, gauges, finishes and relationship to equipment and to adjacent construction.

#### **1.4.2.3 Quality Assurance Submittals:**

1.4.2.3.1 Submit copy of the following membership certificates:

1.4.2.3.1.1 Mechanical Subcontractor: The Master Insulators' Association of Ontario or TIAC.

1.4.2.3.1.2 Installers: International Association of Heat and Frost Insulators and Asbestos Workers.

## **1.5 QUALITY ASSURANCE**

- 1.5.1 Installation trade to be specialist in performing Work of this Section and have minimum 3 years' successful experience in this size and type of contract, qualified to standards and member of Master Insulator's Association of Ontario or TIAC, and International Association of Heat and Frost Insulators and Asbestos Workers.
- 1.5.2 Tradesperson to be member of International Association of Heat and Frost Insulators and Asbestos Workers.

## **1.6 DELIVERY, STORAGE AND HANDLING**

- 1.6.1 Deliver materials to Site in original factory packaging, labelled with manufacturer's name, address.
- 1.6.2 Protect from weather, construction traffic.
- 1.6.3 Protect against damage from any source.
- 1.6.4 Store at temperatures and conditions required by manufacturer.

## **2 Products**

### **2.1 DUCT INSULATION**

#### **2.1.1 Fire and Smoke Rating:**

- 2.1.1.1 In accordance with CAN/ULC-S102:
  - 2.1.1.1.1 Maximum flame spread rating: 25.
  - 2.1.1.1.2 Maximum smoke developed rating: 50.

#### **2.1.2 Mineral fibre as specified herein includes:**

- 2.1.2.1 Glass fibre, rock wool or mineral wool.

#### **2.1.3 Mineral fibre blanket with vapour barrier:**

- 2.1.3.1 Application: Insulation system for round or oval ducting, suitable for temperature range of -4°C up to 121°C.
- 2.1.3.2 Material: In accordance with ASTM C1290 Type III, mineral fibre blanket; in accordance with ASTM C1136 vapour barrier jacket and facing material.
- 2.1.3.3 Maximum thermal conductivity, (k factor) not to exceed 0.033 W/mC at 24°C mean temperature when tested in accordance with ASTM C177.
- 2.1.3.4 **Manufacturers:**
  - 2.1.3.4.1 CertainTeed - Saint Gobain.
  - 2.1.3.4.2 Johns Manville Insulation Inc.
  - 2.1.3.4.3 Knauf Insulation.
  - 2.1.3.4.4 Manson Insulation Products Ltd. Manufactured by Knauf Insulation.
  - 2.1.3.4.5 Owens-Corning Canada.

**2.1.4 Mineral fibre rigid board with vapour barrier:**

- 2.1.4.1 **Application:** Insulation system for rectangular ducting, suitable for temperature range of -4°C up to 65°C.
- 2.1.4.2 **Material:** In accordance with ASTM C612 mineral fibre board; in accordance with ASTM C1136 vapour barrier, jacket and facing material.
- 2.1.4.3 Maximum thermal conductivity, (k factor) not to exceed 0.033 W/mC at 24°C mean temperature when tested in accordance with ASTM C177.
- 2.1.4.4 **Manufacturers:**
  - 2.1.4.4.1 CertainTeed - Saint Gobain.
  - 2.1.4.4.2 Johns Manville Insulation Inc.
  - 2.1.4.4.3 Knauf Insulation.
  - 2.1.4.4.4 Manson Insulation Products Ltd. Manufactured by Knauf Insulation.
  - 2.1.4.4.5 Owens-Corning Canada.

**2.2 INSULATION SECUREMENT**

- 2.2.1 Tape: Self-adhesive, 75 mm wide, aluminum foil.
- 2.2.2 Contact adhesive: Quick setting, non-flammable fire retardant adhesive to adhere fibrous glass Type 1 in accordance with ASTM C916. VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24). Produced under the classification follow-up service of UL and meets NFPA 90A and 90B 25/50 requirements.
- 2.2.3 Lap seal adhesive: Quick setting adhesive for joints and lap sealing of vapour retarder. Flame spread 10, smoke development 0.
- 2.2.4 Cuphead weld pins: Minimum 2.7 mm diameter (12 ga), with 38 mm diameter head for installation through insulation.
  - 2.2.4.1 Weld pins: Ducts over 635 mm wide, use on bottom of duct.
  - 2.2.4.2 Length to suit thickness of insulation.

**2.3 JACKETS**

**2.3.1 Canvas:**

- 2.3.1.1 Type II (flexible for vapour retardance, or physical support, or combination thereof; 220 g/m<sup>2</sup> cotton, plain weave.
- 2.3.1.2 Lagging adhesive:
  - 2.3.1.2.1 Fire retardant lagging adhesive in accordance with ASTM C916, compatible with insulation system.

**2.3.2 Aluminum:**

- 2.3.2.1 In accordance with ASTM B209.
- 2.3.2.2 Thickness: 0.50 mm sheet.
- 2.3.2.3 Finish: Stucco embossed with factory attached protective liner (moisture barrier) on interior surface.

- 2.3.2.4 Joining: Longitudinal 2-lock type and circumferential slip joints with 50 mm butt end laps.
- 2.3.2.5 Fittings: 0.5 mm thick die shaped fitting covers with factory attached protective liner on interior surface.
- 2.3.2.6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.
- 2.3.2.7 Butt Straps: Aluminum with foam strips with peel off tape on both outside edges of inside of strap.

**2.3.3 PVC:**

- 2.3.3.1 Not Permitted.

**3 Execution**

**3.1 PRE- INSTALLATION REQUIREMENT**

- 3.1.1 Required tests completed and reviewed by TTC.
- 3.1.2 Surfaces clean, dry and free from foreign material.

**3.2 INSTALLATION**

- 3.2.1 Install in accordance with TIAC National Standards.
- 3.2.2 Use stand-offs for duct mounted accessories. Insulation on removable accessories fabricated so readily removable without damage to insulation.
- 3.2.3 Use two layers with staggered joints when required nominal thickness exceeds 75 mm.
- 3.2.4 Vapour barrier and insulation complete over full length of duct or surface, without penetration for hangers, standing duct seams and without interruption at sleeves.
- 3.2.5 Supports, hangers in accordance with Section 20 05 29.
- 3.2.6 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.
- 3.2.7 Install insulation with smooth and even surfaces.
- 3.2.8 Apply insulation materials, accessories and finishes in accordance with manufacturer's recommendations.
- 3.2.9 Apply 1.0 mm thick metal corners to rectangular ductwork within 4 m of floor level.
- 3.2.10 Mechanical fasteners: Use insulating cement, as required and weld pins at maximum 200 mm centres, but minimum 2 rows per side.

### 3.3 INSULATION APPLICATION

#### 3.3.1 Insulate all ductwork as follows:

DUCTWORK DESCRIPTION	INSULATION TYPE	VAPOUR RETARDER	THICKNESS (MM)
Rectangular cold and dual temperature supply air ducts	Board or Semi-Rigid	Yes	38
Round cold and dual temperature supply air ducts	Blanket or Semi-Rigid	Yes	38
Supply, return and exhaust ducts exposed in space being served	Blanket, Board or Semi-Rigid	Yes	None

### 3.4 JACKET APPLICATION

#### 3.4.1 Jacket application: Apply to insulated ductwork as follows:

##### 3.4.1.1 Exposed indoors:

3.4.1.1.1 Up to 1.8 m above finished floor: Aluminum jacket.

3.4.1.1.2 Over 1.8 m above finished floor: Canvas jacket.

3.4.1.2 Concealed, indoors: Canvas jacket.

3.4.1.3 Use vapour retarder jacket compatible with insulation.

3.4.2 Finish attachments: SS bands, at 300 mm oc. Seals: Wing.

#### 3.4.3 Coating:

3.4.3.1 Provide fire retardant coating on canvas jackets.

3.4.3.2 Coat canvas covering exposed to finished spaces, with diluted coat of lagging adhesive, as recommended by insulation manufacturer for priming purposes.

3.4.4 Installation: To appropriate TIAC code CRF/1 through CPF/4, CRD/1 through CRD/5 or as specified.

#### 3.4.5 Painting:

3.4.5.1 Paint all exposed insulated ductwork in accordance with Sections 09 91 00 and 20 05 53.

3.4.5.2 Painting by qualified trades.

**END OF SECTION**

1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment and services necessary for refrigerant piping Work in accordance with the Contract Documents.

**1.2 REFERENCES**

- 1.2.1 ANSI/ASHRAE Standard 34, Designation and Safety Classification of Refrigerants.
- 1.2.2 ANSI/ASME B16.24, Cast Copper Pipe Flanges and Flanged Fittings.
- 1.2.3 ANSI/ASME B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes.
- 1.2.4 ANSI/ASME B16.50, Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings.
- 1.2.5 ANSI/ASME B31.5, Refrigeration Piping.
- 1.2.6 ANSI/AWS A5.8, Standard Specification for Filler Metals for Brazing and Braze Welding.
- 1.2.7 ANSI/AWS B2.2, Standard for Brazing Procedure and Performance Qualification.
- 1.2.8 ANSI/AWS C3.4, Specification for Torch Brazing.
- 1.2.9 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- 1.2.10 ASTM B280, Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
- 1.2.11 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.
- 1.2.12 CSA B52, Mechanical Refrigeration Code.
- 1.2.13 EPS 1/RA/1, Code of Practice for the Reduction of CFC's (Environment Canada).
- 1.2.14 Technical Standards and Safety Authority (TSSA).

**1.3 DEFINITIONS**

- 1.3.1 Brazed Joint: A gas-tight joint formed by joining metal parts with alloys that melt at temperatures above 427°C.
- 1.3.2 Soldered Joint: A gas-tight joint formed by joining metal parts with alloys that melt at temperatures not exceeding 427°C and above 204°C.

**1.4 SUBMITTALS**

1.4.1 Submit in accordance with Section 01 33 00.

**1.4.2 Product Data Package:**

- 1.4.2.1 Submit manufacturer's Product data for all Products listed in this Section indicating:
  - 1.4.2.1.1 Performance criteria, compliance with appropriate reference standards, characteristics, limitations, and troubleshooting protocol.

**1.4.3 Quality Assurance Submittals Package:**

- 1.4.3.1 Submit Ozone Depletion Cards.
- 1.4.3.2 Submit brazing certification.

- 1.4.3.3 Submit Certificate of Qualification (Trade Card).
- 1.4.3.4 Submit TSSA Certificate of Authorization (systems greater than 5 tons capacity).
- 1.4.3.5 Submit all forms listed in the TSSA Package (systems greater than 5 tons capacity).

**1.4.4 Training Plan:**

- 1.4.4.1 Submit Training Course Material and Training Schedule in accordance with Section 01 79 00.

**1.4.5 Closeout Submittals Package:**

- 1.4.5.1 Submit the following for incorporation into Operation and Maintenance Manuals in accordance with Section 01 78 23:
  - 1.4.5.1.1 Identification: Manufacturing name, type, year, serial number, number of units, capacity, and identification of related systems.
  - 1.4.5.1.2 Functional description detailing operation and control of components.
  - 1.4.5.1.3 Operating instructions and precautions.
  - 1.4.5.1.4 Safety precautions.
  - 1.4.5.1.5 Field measurements and final inspection and test reports.
- 1.4.5.2 Submit As-Built Drawings in accordance with Section 01 78 39.

**1.5 QUALITY ASSURANCE**

**1.5.1 Installer's Qualifications:**

- 1.5.1.1 **Brazing:**
  - 1.5.1.1.1 Brazing procedures and brazer performance in accordance with either Section IX of the ASME Boiler and Pressure Vessel Code, or ANSI/AWS B2.2.
  - 1.5.1.1.2 Brazing processes for copper and copper alloy pipe and tube according to ANSI/AWS C3.4.
  - 1.5.1.1.3 Brazing certification, as described above, administered by TSSA.
- 1.5.1.2 **Ozone Depleting Substances:**
  - 1.5.1.2.1 Valid Ozone Depletion Prevention Card, administered by Ministry of the Environment.
- 1.5.1.3 **Trade Qualifications:**
  - 1.5.1.3.1 Valid Certificate of Qualification (Refrigeration and Air Conditioning Mechanic), administered by Ontario Ministry of Training, Colleges and Universities.

**1.5.2 Manufacturer's Qualifications:**

- 1.5.2.1 TSSA Certificate of Authorization.
- 1.5.2.2 Quality control plan on file with the TSSA.

**1.5.3 Inspections:**

- 1.5.3.1 Schedule and pay for regular general inspections with authority having jurisdiction at regular intervals throughout construction period including, but not limited to, the following:
  - 1.5.3.1.1 Pre-construction material inspection.
  - 1.5.3.1.2 Demonstration of brazing procedures.



- 1.5.3.1.3 General installation inspections.
- 1.5.3.1.4 Other inspections as requested by authority having jurisdiction.
- 1.5.3.1.5 Final pressure tests.

## **1.6 APPROVALS**

- 1.6.1 The Contractor shall register Contract Drawings and Specifications, where required under Boilers and Pressure Vessels Act, with TSSA.
- 1.6.2 Fees for registration and review shall be paid by the Contractor.

## **1.7 DELIVERY, STORAGE AND HANDLING**

- 1.7.1 Acceptance at Site: Piping sealed, clean and dry, nitrogen charge intact.
- 1.7.2 Storage and protection: Maintain piping clean and dry, ends capped.

## **1.8 TRAINING**

- 1.8.1 Provide training in accordance with Section 01 79 00.

### **1.8.2 Maintenance Training:**

- 1.8.2.1 Plant Maintenance – Plumbers:
  - 1.8.2.1.1 Allow for minimum of 8 h of total on-site time to train in all aspects of equipment and system(s) operation(s), repair and maintenance, per group to be trained.
  - 1.8.2.1.2 Schedule separate training sessions for 3 groups of maximum 7 persons per group, on separate days.
  - 1.8.2.1.3 Maximum duration of each training session: 8 h.
  - 1.8.2.1.4 Maintenance training of related systems may be combined, at discretion of TTC, provided all Contract requirements satisfied.

## **2 Products**

### **2.1 REFRIGERANTS – NEW SYSTEMS**

- 2.1.1 Use refrigerants approved by Environment Canada and conforming to intent of Montreal Protocol and amendments.
- 2.1.2 Refrigerant: R410A only, in accordance with ANSI/ASHRAE Standard 34.

### **2.2 PIPING AND TUBING**

#### **2.2.1 Outside diameter 16 mm (5/8") and smaller:**

- 2.2.1.1 Application:
  - 2.2.1.1.1 Liquid lines.
  - 2.2.1.1.2 Small split air conditioning systems (2 tons or less).
- 2.2.1.2 Annealed copper: In accordance with ASTM B280.
- 2.2.1.3 Wall thickness: In accordance with CSA B52 and ANSI/ASME B31.5.
- 2.2.1.4 Fully annealed temper, bright and thoroughly dried. Dehydrated and nitrogen purged, sealed ends.

**2.2.2 All Sizes:**

- 2.2.2.1 Application:
  - 2.2.2.1.1 Suction lines.
  - 2.2.2.1.2 Hot gas lines.
  - 2.2.2.1.3 Split systems larger than 2 tons.
- 2.2.2.2 Hard-drawn copper: In accordance with ASTM B280 type ACR. Seamless for sizes up to 3-1/8" OD.
- 2.2.2.3 Wall thickness: In accordance with CSA B52 and ANSI/ASME B31.5.
- 2.2.2.4 Deoxidized, dehydrated and sealed with reusable plugs.

**2.3 FITTINGS AND JOINTS**

**2.3.1 Service:**

- 2.3.1.1 Design pressure 2070 kPa and temperature 121°C.

**2.3.2 Brazed:**

- 2.3.2.1 Fittings: Wrought copper in accordance with ANSI/ASME B16.50.
- 2.3.2.2 Joints: Brazed in accordance with ANSI/AWS C3.4. Soldered joints not permitted.
- 2.3.2.3 Brazing Material:
  - 2.3.2.3.1 Filler metals in accordance with ANSI/AWS A5.8, BCuP series, Type 5.
  - 2.3.2.3.2 5% Phosphorus, 15% Silver, balance Copper.
- 2.3.2.4 Flux: Not required.

**2.3.3 Flared:**

- 2.3.3.1 Threaded fittings: Cast bronze, in accordance with ANSI/ASME 16.26, Class 125 and 250, for refrigeration.

**2.3.4 Flanged:**

- 2.3.4.1 Bronze pipe flange and flanged fittings: In accordance with ANSI/ASME B16.24, Class 150 and Class 300.
- 2.3.4.2 Bolts, nuts and washers: In accordance with ASTM A307, heavy series.
- 2.3.4.3 Gaskets: Suitable for service.

**2.4 VALVES**

- 2.4.1 22 mm and under: Class 500, 3.5 MPa, globe or angle non-directional type, diaphragm, packless type, with forged brass body and bonnet, moistureproof seal for below freezing applications, brazed connections.
- 2.4.2 Over 22 mm: Class 375, 2.5 MPa, globe or angle type, diaphragm, packless type, back-seating, cap seal, with cast bronze body and bonnet, moistureproof seal for below freezing applications, brazed connections.

## **2.5 ACCESSORIES**

### **2.5.1 Pipe Sleeves:**

2.5.1.1 Hard copper or galvanized steel, sized to provide 6 mm clearance around between sleeve and uninsulated pipe or between sleeve and insulation. Refer to Section 20 05 00.

2.5.2 **Sight glass:** In liquid line.

3 Execution

## **3.1 GENERAL**

3.1.1 Install in accordance with CSA B52, EPS 1/RA/1 and ANSI/ASME B31.5.

3.1.2 Install piping in accordance with respective equipment manufacturer's installation instructions and requirements.

3.1.3 Connect to equipment with isolating valves. Use brazed joints and connections wherever possible.

3.1.4 Use flanged and flared connections only where necessary. Locate in accessible unconcealed areas.

3.1.5 Provide space for servicing, disassembly and removal of equipment and components to manufacturer's written instructions.

3.1.6 Protect openings in piping against entry of foreign material.

3.1.7 Unless indicated otherwise on Drawings, size refrigeration lines to industry practice, with maximum pressure drop corresponding to 1.1°C (2°F) for total equivalent length of each line.

## **3.2 BRAZING PROCEDURES**

3.2.1 Braze in accordance with ANSI/AWS C3.4 with qualified Workers.

3.2.2 Bleed inert gas into pipe during brazing.

3.2.3 Remove valve internal parts, solenoid valve coils, sight glass.

3.2.4 Do not apply heat near expansion valve and bulb.

## **3.3 INSPECTIONS**

3.3.1 Leave joints in piping systems uncovered until tests completed and system inspected and approved by TTC.

3.3.2 Provide access, such as but not including scissor lift and trained operator, for inspection of installed Work. Provide fall awareness training and safety harnesses to all personnel required to inspect the Work.

3.3.3 The following apply to systems greater than 5 tons capacity:

3.3.3.1 TTC and authority having jurisdiction shall inspect new piping prior to pressure tests for compliance with registered Drawings and Specifications.

3.3.3.2 Pay all costs for inspections performed by jurisdictional authority.

3.3.3.3 Co-ordinate installation and testing activities with inspection requirements of TSSA.

### **3.4 PIPING INSTALLATION**

#### **3.4.1 General:**

- 3.4.1.1 Install piping in accordance with recommendations of respective equipment supplier and to the requirements of authorities having jurisdiction.
- 3.4.1.2 Soft annealed copper tubing: Bend without crimping or constriction.
- 3.4.1.3 Hard drawn copper tubing: Do not bend. Minimize use of fittings.
- 3.4.1.4 Insulate and jacket, in accordance with Section 22 07 19:
  - 3.4.1.4.1 Suction lines.
  - 3.4.1.4.2 Piping where condensation may occur.
  - 3.4.1.4.3 Liquid lines located outdoors or in areas above room temperature.
- 3.4.1.5 Support piping in accordance with Section 20 05 29 and applicable codes.
- 3.4.1.6 Identify piping in accordance with Section 20 05 53.

#### **3.4.2 Hot Gas Lines:**

- 3.4.2.1 Pitch at least 1:240 down in direction of flow to prevent oil return to compressor during operation.
- 3.4.2.2 Provide trap at base of risers over 2400 mm high and at each 7600 mm.
- 3.4.2.3 Provide inverted deep trap at top of each riser.
- 3.4.2.4 Provide double risers for compressors having capacity modulation.
  - 3.4.2.4.1 Large riser: Install traps as specified above.
  - 3.4.2.4.2 Small riser: Size for 5.1 m/s at minimum load. Connect upstream of traps on large riser.
- 3.4.3 **Suction lines:** Refer to hot gas lines, as applicable.

### **3.5 PRESSURE AND LEAK TESTING**

- 3.5.1 Close valves on factory charged equipment and other equipment not designed for test pressures.
- 3.5.2 Leak test in accordance with CSA B52 before evacuation at 1.2 times maximum high side operating pressure for high side, and 1.2 times maximum low side operating pressure for low side.
- 3.5.3 Test Procedure: Build pressure up to 35 kPa with refrigerant gas on high and low sides. Supplement with nitrogen to required test pressure. Test for leaks with electronic or halide detector. Repair leaks and repeat tests.
- 3.5.4 For systems greater than 5 tons capacity, pressure test in accordance with TSSA requirements. Permit TSSA to witness tests and provide necessary notification. Submit completed test reports to the TSSA and TTC.
- 3.5.5 Use only approved pressure test procedures. Any pressure test procedure found unsafe, in opinion of TTC or TSSA inspector, will be cancelled and rescheduled at the Contractor's expense.

### **3.6 DEHYDRATION AND CHARGING**

- 3.6.1 Close service valves on factory charged equipment.
- 3.6.2 Ambient temperatures 13°C minimum for minimum of 12 h before and during dehydration.
- 3.6.3 Use copper lines of largest practical size to reduce evacuation time.
- 3.6.4 Use 2-stage vacuum pump with gas ballast on second stage capable of pulling 5 Pa absolute and filled with dehydrated oil.
- 3.6.5 Measure system pressure with vacuum gauge. Take readings with valve between vacuum pump and system closed.
- 3.6.6 Triple evacuate system components containing gases other than correct refrigerant or having lost holding charge as follows:
  - 3.6.6.1 Twice to 14 Pa absolute and hold for 4 h.
  - 3.6.6.2 Break vacuum with refrigerant to 14 kPa.
  - 3.6.6.3 Final to 5 Pa absolute and hold for at least 12 h.
  - 3.6.6.4 Isolate pump from system, record vacuum and time readings until stabilization of vacuum.
  - 3.6.6.5 Submit results to TTC.
- 3.6.7 Charging:
  - 3.6.7.1 Charge system through filter-drier and charging valve on high side. Low side charging not permitted.
  - 3.6.7.2 With compressors off, charge only amount necessary for correct operation of system. If system pressures equalize before system fully charged, close charging valve and start up. With unit operating, add remainder of charge to system.
  - 3.6.7.3 Re-purge charging line if refrigerant container changed during charging process.
- 3.6.8 Checks:
  - 3.6.8.1 Make checks and measurements in accordance with manufacturer's operation and maintenance instructions.
  - 3.6.8.2 Record and submit measurements to TTC.

### **3.7 CERTIFICATES**

- 3.7.1 Complete and submit TSSA form "Piping Systems Installation and Test Data Report".

**END OF SECTION**



1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment, tools, supervision and services necessary for duct Work in accordance with the Contract Documents.

**1.2 REFERENCES**

- 1.2.1 ASTM A480/A480M, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
- 1.2.2 ASTM A635/A635M, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot Rolled, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability.
- 1.2.3 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- 1.2.4 CAN/ULC-S110, Standard Methods of Test for Air Ducts.
- 1.2.5 NFPA 90A, Installation of Air Conditioning and Ventilating Systems.
- 1.2.6 SMACNA/HVAC, Duct Construction Standards-Metal and Flexible.

**1.3 SUBMITTALS**

1.3.1 Submit in accordance with Section 01 33 00.

**1.3.2 Product Data and Shop Drawings Package:**

**1.3.2.1 Product Data:**

- 1.3.2.1.1 Submit manufacturer's Product data for all Products listed in this Section indicating:
  - 1.3.2.1.1.1 Performance criteria, compliance with appropriate reference standards, characteristics, limitations, and troubleshooting protocol.
  - 1.3.2.1.1.2 Product transportation, storage, handling, and installation requirements.
  - 1.3.2.1.1.3 Performance data to AMCA 500.

**1.3.2.2 Shop Drawings:**

- 1.3.2.2.1 Submit Shop Drawings in accordance with Section 01 33 23 indicating:
  - 1.3.2.2.1.1 Adjacent construction, elevations, sections and details of components, dimensions, gauges, finishes and relationship of components to adjacent construction.
  - 1.3.2.2.1.2 Fabrication details for ductwork, fittings, accessories and supports.

**1.3.3 Quality Assurance Submittals Package:**

1.3.3.1 Submit field inspection and duct leakage test reports in 5 Business Days.

**1.3.4 Closeout Submittals Package:**

- 1.3.4.1 Submit the following for incorporation into Operation and Maintenance Manuals in accordance with Section 01 78 23:
  - 1.3.4.1.1 Functional description detailing operation and control of components.
  - 1.3.4.1.2 Consumables.

- 1.3.4.1.3 List of items submitted to TTC: Keys, tools, special devices, maintenance materials.
- 1.3.4.1.4 Final tests and reports.
- 1.3.4.1.5 Manufacturer's installation instructions for following:
  - 1.3.4.1.5.1 Duct joints.
  - 1.3.4.1.5.2 Duct sealant.
- 1.3.4.2 Submit As-Built Drawings in accordance with Section 01 78 39.

## 1.4 QUALITY ASSURANCE

### 1.4.1 Quality assurance requirements:

- 1.4.1.1 **Manufacturer's/Installer's qualifications:** All sheet metal workers to be members of the Sheet Metal Workers International Association and hold Certificate of Qualification or registered as apprentice sheet metal worker.
- 1.4.1.2 **Designer's qualifications:**
  - 1.4.1.2.1 Licensed in the Province of Ontario.
  - 1.4.1.2.2 Design ductwork to SMACNA/HVAC standards.
  - 1.4.1.2.3 Review and sign fabrication and erection Shop Drawings and design calculations.
  - 1.4.1.2.4 Conduct shop and site inspections, prepare and submit inspection reports verifying this part of Work is in accordance with Contract Documents and reviewed Shop Drawings. Perform inspections once per month minimum.
  - 1.4.1.2.5 Monitor and report on supplier's and fabricator's quality control tests and reports for compliance with Contract Documents.

## 2 Products

### 2.1 DUCTWORK, FITTINGS AND OTHER CONSTRUCTION

#### 2.1.1 General - Ductwork, fittings and other construction, rectangular and round as indicated on Contract Drawings.

- 2.1.1.1 **Pressure Class:** Designed and constructed to +/- 500 Pa (2 in. w.g.) SMACNA/HVAC Duct Pressure Class.
- 2.1.1.2 **Seal Classification:** SMACNA/HVAC Seal Class C; all transverse joints for +/- 500 Pa (2 in. w.g.) SMACNA/HVAC Duct Pressure Class.
- 2.1.1.3 **Sealant:**
  - 2.1.1.3.1 Flexible water based, non-flammable adhesive sealant designed for use in all pressure duct systems.
  - 2.1.1.3.2 UL 723 listed, meets NFPA requirements for Class 1 ductwork and conforms to ASTM E84.
  - 2.1.1.3.3 To CAN/ULC-S102 maximum flame spread rating 0, maximum smoke development rating 0.
  - 2.1.1.3.4 Ultraviolet light resistant, prevents water air and moisture entry into duct system.



- 2.1.1.3.5 Products:
- 2.1.1.3.5.1 Ductmate PROseal.
- 2.1.1.3.5.2 Duro Dyne DWN.
- 2.1.2 Type 1 – Galvanized ductwork, fittings and other construction, rectangular and round as indicated on Contract Drawings.**
- 2.1.2.1 **Material:**
- 2.1.2.1.1 Galvanized: Galvanized sheet steel, G-60 to ASTM A653/A653M.
- 2.1.2.1.2 Lock forming quality.
- 2.1.2.2 **Gauge:**
- 2.1.2.2.1 Select gauge according to duct dimensions and compliant with intermediate reinforcement, reinforcement spacing and specified joints for specified duct pressure class construction.
- 2.1.2.3 **Seams:**
- 2.1.2.3.1 Rectangular: Use only Pittsburgh Lock Seam for all longitudinal duct seams.
- 2.1.2.3.2 Round: Use only spiral seam type wound ductwork.
- 2.1.2.4 **Joints:**
- 2.1.2.4.1 **Rectangular:**
- 2.1.2.4.1.1 All transverse joints air tight rectangular duct connector system, slide-on flanged metal connectors with snap on metal cleats and flange gasket.
- 2.1.2.4.1.2 Joint material type to match ductwork. To be used on ductwork of material gauges 14 to 26.
- 2.1.2.4.1.3 Tested to minimum equivalent of SMACNA/HVAC Class F transverse joint and greater as required for specified duct pressure class construction. Select system model according to manufacturer's selection table(s) to suit duct material, gauge, size, pressure class and reinforcement.
- 2.1.2.4.1.4 Manufacturer: Ductmate Canada Ltd.
- 2.1.2.4.1.4.1 Ductmate Model D25, Alloy Type GA:
- 2.1.2.4.1.4.1.1 Galvanized steel construction, angle 24 gauge roll formed.
- 2.1.2.4.1.4.1.2 Use with galvanized steel ductwork gauge 20 to 26.
- 2.1.2.4.1.4.1.3 Equivalent to SMACNA/HVAC Class F transverse joint.
- 2.1.2.4.1.4.2 Ductmate Model D35, Alloy Type GA:
- 2.1.2.4.1.4.2.1 Galvanized steel construction, angle 20 gauge roll formed.
- 2.1.2.4.1.4.2.2 Use with galvanized steel ductwork gauge 16 to 26.
- 2.1.2.4.1.4.2.3 Equivalent to SMACNA/HVAC Class J transverse joint.
- 2.1.2.4.1.4.3 Ductmate Model D45, Alloy Type GA:
- 2.1.2.4.1.4.3.1 Galvanized steel construction, angle 18 gauge roll formed.
- 2.1.2.4.1.4.3.2 Use with galvanized steel ductwork gauge 14 to 22.
- 2.1.2.4.1.4.3.3 Equivalent to SMACNA/HVAC Class K transverse joint.

- 2.1.2.4.2 **Round:**
- 2.1.2.4.2.1 All transverse joints air tight, round duct connector system.
- 2.1.2.4.2.2 Tested in accordance with SMACNA/HVAC testing procedures to exceed requirements for specified duct pressure class construction.
- 2.1.2.4.2.3 Galvanized steel construction, roll formed inner flange rings and tightening closure ring.
- 2.1.2.4.2.3.1 Up to 850 mm diameter: inner flanges 22 ga, closure ring 20 ga.
- 2.1.2.4.2.3.2 900 mm diameter and larger: inner flanges 20 ga, closure ring 18 ga.
- 2.1.2.4.2.4 Neoprene gasket.
- 2.1.2.4.2.5 Joint material type to match ductwork. Use with galvanized steel ductwork gauge 16 to 26.
- 2.1.2.4.2.6 Manufacturer: Ductmate Canada Ltd.
- 2.1.2.4.2.6.1 Spiralmate-L – Large Profile round duct connector. 203 mm to 1826 mm hot-dipped galvanized steel.
- 2.1.2.5 **Reinforcement:** Select SMACNA/HVAC standard intermediate reinforcement according to duct dimensions and compliant with specified joints and selected sheet metal gauge for specified duct pressure class construction.
- 2.1.2.6 **Fittings:**
- 2.1.2.6.1 Fabrication: to SMACNA/HVAC.
- 2.1.2.6.2 **Radiused elbows:**
- 2.1.2.6.2.1 Rectangular: Centreline radius: 1.5 times width of duct, where not possible, provide short radius with double thickness turning vanes.
- 2.1.2.6.2.2 Round: Smooth radius or five pieces.
- 2.1.2.6.3 **Mitred elbows, rectangular:**
- 2.1.2.6.3.1 To 400 mm: with single thickness turning vanes.
- 2.1.2.6.3.2 Over 400 mm: with double thickness turning vanes.
- 2.1.2.6.4 **Branches:**
- 2.1.2.6.4.1 Rectangular main and branch: with 45° entry on branch.
- 2.1.2.6.4.2 Round main and branch: enter main duct at 45° with conical connection.
- 2.1.2.6.4.3 As indicated on Drawings.
- 2.1.2.6.5 **Transitions:**
- 2.1.2.6.5.1 Diverging: 20° maximum included angle.
- 2.1.2.6.5.2 Converging: 30° maximum included angle.
- 2.1.2.6.6 **Offsets:** Short radiused elbows or as indicated.
- 2.1.2.6.7 **Obstruction deflectors:** maintain full cross-sectional area. Maximum included angles: As for transitions.
- 2.1.2.7 **Application:**
- 2.1.2.7.1 Finished office type spaces typically concealed within ceiling spaces including:

- 2.1.2.7.1.1 Office Area.
- 2.1.2.7.1.2 Storage Room.

## **2.2 ACCESSORIES**

- 2.2.1 Hangers and supports:
  - 2.2.1.1 Configuration: ASHRAE and SMACNA/HVAC requirements and as shown on the Contract Drawings.
  - 2.2.1.2 Hangers and supports: By means of trapeze angle and rods and metal straps.
  - 2.2.1.3 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct. Maximum size duct supported by strap hanger: 500 mm.
  - 2.2.1.4 Angles for trapeze hangers and metal straps galvanized steel.
  - 2.2.1.5 Rods for suspending straps and angles galvanized steel with locking nuts and washers. Angle and rod sizes to following table:

WIDTH (MM)	ANGLE SIZE (MM)	ROD SIZE (MM DIA)
up to 750	25x25x3	6
751 to 1050	40x40x3	6
1051 to 1500	40x40x3	10
1501 to 2100	50x50x3	10
2101 to 2400	50x50x5	10
2401 and over	50x50x6	10

- 2.2.1.6 In accordance with Section 20 05 29.
- 2.2.2 Miscellaneous metal for duct supports, sealing collars, sealing angles, etc. galvanized and in accordance with Section 05 50 00 unless otherwise indicated.

## **3 Execution**

### **3.1 EXAMINATION**

- 3.1.1 Verify condition and dimensions of previously installed Work this Section depends upon. Report defects to TTC. Commencement of Work means acceptance of existing conditions.

### **3.2 GENERAL**

- 3.2.1 Perform Work to ASHRAE and SMACNA/HVAC references and NFPA 90A.
- 3.2.2 Do not break continuity of insulation vapour barrier with hangers and supports.
- 3.2.3 Install proprietary manufactured flanged duct joint to manufacturer's instructions.
- 3.2.4 Provide mechanical identification in accordance with Section 20 05 53 after completion of testing and duct insulation.
- 3.2.5 Provide painting in accordance with Section 09 91 00.
- 3.2.6 Fabricate and install duct supports and sealing angles/collars for external ductwork as shown on the Contract Drawings and in accordance with Section 05 50 00.

### **3.3 HANGERS**

- 3.3.1 Strap hangers: install to SMACNA/HVAC.
- 3.3.2 Angle hangers: with locking nuts and washers.
- 3.3.3 Hanger spacing: to ASHRAE and SMACNA/HVAC as follows:

DUCT SIZE (MM)	SPACING (MM)
to 1500	3000
1501 and over	2500

### **3.4 SEALING AND TAPING**

- 3.4.1 Apply sealant to joint to manufacturer's instructions.
- 3.4.2 Recoat with minimum of one coat of sealant to manufacturer's instructions.

### **3.5 FIELD QUALITY CONTROL**

- 3.5.1 Perform testing and balancing to the requirements of Section 23 05 93.
- 3.5.2 Arrange testing witnessed by TTC.
- 3.5.3 Submit test reports for review by TTC.

**END OF SECTION**

1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment, tools, supervision and services necessary for duct accessories Work in accordance with the Contract Documents.

**1.2 REFERENCES**

1.2.1 AAMA, American Architectural Manufacturers Association, Aluminum Association Designation System for Aluminum Finishes.

1.2.2 ASHRAE, Handbooks.

1.2.3 NFPA 90A, Installation of Air Conditioning and Ventilating Systems.

1.2.4 SMACNA/HVAC, Duct Construction Standards Metal and Flexible.

**1.3 SUBMITTALS**

1.3.1 Submit in accordance with Section 01 33 00.

**1.3.2 Product Data and Shop Drawings Package:**

**1.3.2.1 Product Data:**

1.3.2.1.1 Submit manufacturer's Product data for all Products listed in this Section indicating:

1.3.2.1.1.1 Performance criteria, compliance with appropriate reference standards, characteristics, limitations, and troubleshooting protocol.

1.3.2.1.1.2 Product transportation, storage, handling, and installation requirements.

**1.3.2.2 Shop Drawings:**

1.3.2.2.1 Submit Shop Drawings in accordance with Section 01 33 23 indicating:

1.3.2.2.1.1 Adjacent construction, elevations, sections and details of components, dimensions, gauges, finishes and relationship of components to adjacent construction.

1.3.2.2.1.2 Fabrication details for accessories.

**1.3.3 Closeout Submittals Package:**

1.3.3.1 Submit the following for incorporation into Operation and Maintenance Manuals in accordance with Section 01 78 23:

1.3.3.1.1 Functional description detailing operation and control of components.

1.3.3.1.2 Consumables.

1.3.3.1.3 List of items submitted to TTC: Keys, tools, special devices, maintenance materials.

1.3.3.2 Submit As-Built Drawings in accordance with Section 01 78 39.

**1.4 DESIGN/PERFORMANCE REQUIREMENTS**

1.4.1 Manufacture and install in accordance with SMACNA/HVAC Duct Construction Standards.

2 Products

**2.1 MATERIALS**

**2.1.1 Access doors:**

- 2.1.1.1 Flat oval, double flange type construction with pre-punched holes on inner flange for surface mounting.
- 2.1.1.2 Double skin, lift-off doors, one piece, sealed, 25 mm thick insulation.
- 2.1.1.3 Die-formed 0.7 mm (24 ga) galvanized steel frame and door.
- 2.1.1.4 Seal edge of access door with neoprene or rubber gasket for positive seal, low leakage.
- 2.1.1.5 Fit access doors with zinc plated camlocks or sash locks and include safety chain.
- 2.1.1.6 Size access doors according to equipment installed in ductwork and maintenance requirements or as indicated.

**2.1.2 Instrument test ports:**

- 2.1.2.1 1.6 mm thick steel zinc plated after manufacturing.
- 2.1.2.1.1 Camlock handles with neoprene expansion plug and handle chain.
- 2.1.2.1.2 28 mm minimum inside diameter. Length to suit insulation thickness.
- 2.1.2.1.3 Neoprene mounting gasket.
- 2.1.2.1.4 Product: Duro-Dyne IP1 or IP2.

**2.1.3 Flexible connections:**

- 2.1.3.1 Fabric:
  - 2.1.3.1.1 Silicone rubber coated glass fabric, minimum 0.58 kg/m<sup>2</sup>, factory fabricated with metal to fabric to metal connections.
  - 2.1.3.1.2 Tensile Strength: 890 x 1112 N.
  - 2.1.3.1.3 Temperature Range: -60°C to 260°C.
  - 2.1.3.1.4 Class 1 material to ULC S110.
  - 2.1.3.1.5 Length of flexible connections fabric 150 mm.
- 2.1.3.2 Metal: 76 mm, 0.66 mm (24 ga) galvanized steel.
- 2.1.3.3 Product: Duro Dyne; Super Metal-Fab with Thermafab Fabric.

**2.1.4 Turning vanes:**

- 2.1.4.1 Factory or shop fabricated double thickness with trailing edge, to recommendations of SMACNA and as indicated.
- 2.1.4.2 Vane rail:
  - 2.1.4.2.1 Precision stamped, 24 ga galvanized steel, uniform vane spacing. Fabricated of stainless steel where required. Refer to Contract Drawings and Section 23 31 14.

3 Execution

**3.1 EXAMINATION**

3.1.1 Verify condition and dimensions of previously installed Work this Section depends upon. Report defects to TTC. Commencement of Work means acceptance of existing conditions.

**3.2 GENERAL**

3.2.1 Perform Work to ASHRAE and SMACNA/HVAC references and NFPA 90A.

3.2.2 Do not break continuity of insulation vapour barrier with duct accessories.

3.2.3 Provide mechanical identification in accordance with Section 20 05 53 after completion of testing and duct insulation.

**3.3 FLEXIBLE CONNECTIONS**

3.3.1 Install flexible connectors in locations indicated on the Contract Drawings.

3.3.2 Provide flexible connections at inlets and outlets connections to exhaust fans, and inlet and outlet connections to air conditioning units.

3.3.3 Maintain 50 mm distance between metal parts when equipment operates. Align metal parts on each side of flexible material. Make flexible connectors taut to prevent necking caused by excess slack.

**3.4 ACCESS DOORS IN DUCTWORK**

3.4.1 Install access doors in accordance with manufacturer's instructions in the following locations:

3.4.1.1 At fire and smoke dampers.

3.4.1.2 At control and operating dampers.

3.4.1.3 At equipment requiring maintenance.

3.4.1.4 At duct mounted instrumentation or control devices.

3.4.1.5 And other locations where shown on Contract Drawings.

**3.5 INSTRUMENT TEST PORTS**

3.5.1 Install instrument test ports to recommendations of SMACNA/HVAC and in accordance with manufacturer's instructions.

3.5.2 For traverse readings, locate as follows:

3.5.2.1 At ducted inlets and outlets of air handling units.

3.5.2.2 At inlets and outlets of fan systems.

3.5.2.3 At main and sub-main ducts.

- 3.5.3 Turning vanes:
- 3.5.3.1 Install to recommendations of SMACNA/HVAC and as indicated.

**END OF SECTION**



1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment, tools, and services necessary for dampers work in accordance with the Contract Documents.

**1.2 REFERENCES**

1.2.1 ANSI/AMCA Standard 500-D, Laboratory Methods of Testing Dampers for Rating.

1.2.2 ASHRAE, American Society of Heating, Refrigeration and Air-Conditioning Engineers.

1.2.3 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.2.4 CAN/ULC-S112-M, Standard Methods of Fire Test of Fire-Damper Assemblies

1.2.5 NFPA 90A, Installation of Air Conditioning and Ventilating Systems.

1.2.6 SMACNA/HVAC, Duct Construction Standards - Metal and Flexible.

1.2.7 ULC, Underwriters' Laboratories of Canada.

1.2.8 ULC-S505, Fusible Links for Fire Protection Service.

**1.3 SUBMITTALS**

1.3.1 Submit in accordance with Section 01 33 00.

**1.3.2 Product Data and Shop Drawings Package:**

**1.3.2.1 Product Data:**

1.3.2.1.1 Submit manufacturer's Product data for all Products listed in this Section indicating:

1.3.2.1.1.1 Performance criteria, compliance with appropriate reference standards, characteristics, limitations, and troubleshooting protocol.

**1.3.2.2 Shop Drawings:**

1.3.2.2.1 Submit Shop Drawings in accordance with Section 01 33 23 indicating:

1.3.2.2.1.1 Adjacent construction, elevations, sections and details of components, dimensions, gauges, finishes and relationship of components to adjacent construction.

1.3.2.2.1.2 Fabrication details for accessories.

**1.3.3 Commissioning Package:**

1.3.3.1 Submit the following in accordance with Section 01 91 00:

1.3.3.1.1 Commissioning Plan.

1.3.3.1.2 Commissioning Procedures.

1.3.3.1.3 Certificate of Readiness.

**1.3.4 Commissioning Closeout Package:**

1.3.4.1 Submit the following in accordance with Section 01 91 00:

1.3.4.1.1 Deficiency Report.

1.3.4.1.2 Commissioning Closeout Report.

**1.3.5 Training Plan:**

- 1.3.5.1 Submit Training Course Material and Training Schedule in accordance with Section 01 79 00.

**1.3.6 Closeout Submittals Package:**

- 1.3.6.1 Submit the following for incorporation into Operation and Maintenance Manuals in accordance with Section 01 78 23:
- 1.3.6.1.1 Functional description detailing operation and control of components.
  - 1.3.6.1.2 Component parts availability including names and addresses of spare part suppliers.
  - 1.3.6.1.3 Performance criteria and maintenance data.
  - 1.3.6.1.4 Consumables.
  - 1.3.6.1.5 Lubrication schedule indicating lubrication points and type of lubricant recommended.
  - 1.3.6.1.6 Maintenance and troubleshooting guidelines.
  - 1.3.6.1.7 List of items submitted to TTC: Keys, tools, special devices, maintenance materials.
  - 1.3.6.1.8 Provide manufacturer's recommended spare parts list in accordance with Section 20 05 00.
- 1.3.6.2 Submit As-Built Drawings in accordance with Section 01 78 39.

2 Products

**2.1 MANUAL BALANCING DAMPERS**

**2.1.1 General:**

- 2.1.1.1 Dampers constructed in accordance SMACNA requirements and as specified herein.
- 2.1.1.2 Select damper size to suit ductwork. Confirm size and configuration of ductwork from field survey.
- 2.1.1.3 Minimum damper construction suitable for system operation pressure of 625 Pa.

**2.1.2 Application:**

- 2.1.2.1 All ductwork where indicated for both low pressure (500 Pa) and high pressure (1000 Pa) systems. Refer to Section 23 31 14 for ductwork Specification.
- 2.1.2.2 Rectangular and round ductwork as indicated on Contract Drawings and recommended by ASHRAE and as required to perform TAB.
- 2.1.2.3 For round ductwork, use dampers equipped with manufactured round transition collars.

**2.1.3 Frame:**

- 2.1.3.1 125 mm deep, minimum 1.6 mm (16 gauge) galvanized steel hat channel with die-formed corner gussets.

**2.1.4 Blades:**

- 2.1.4.1 150 mm wide on 140 mm centers, minimum 1.6 mm (16 gauge) galvanized steel Triple-V design.
- 2.1.4.2 Opposed blade action.

**2.1.5 Drive Shaft, Axles and Linkage:**

- 2.1.5.1 Shaft: 150 mm long, minimum 13 mm diameter fixed drive shaft on each damper section.
- 2.1.5.2 Axles: minimum 13 mm diameter plated steel bolted to blades.
- 2.1.5.3 Linkage: plated steel, concealed type totally enclosed within frame and out of airstream.

**2.1.6 Bearing/Bushing:**

- 2.1.6.1 "Oilite" bronze bushing, self-lubricating type.

**2.1.7 Hand locking quadrant:**

- 2.1.7.1 1.6 mm (16 gauge) galvanized steel, plated steel hardware.

**2.1.8 Product:**

- 2.1.8.1 Nailor Industries Inc., Model 1820 / 1022.

**2.2 SINGLE BLADE BALANCING DAMPER**

**2.2.1 Application:**

- 2.2.1.1 Low pressure (500 Pa) ductwork systems only. Maximum height/diameter = 300 mm (12"). Refer to Section 23 31 14 for ductwork Specification.
- 2.2.1.2 Runouts to registers and diffusers as indicated on Contract Drawings and as required to perform TAB.
- 2.2.1.3 Damper minimum construction in accordance with SMACNA requirements and as specified herein.
- 2.2.1.4 Select damper size to suit ductwork. Confirm size and configuration of ductwork from field survey.

**2.2.2 Frame:**

- 2.2.2.1 Rectangular: minimum 1.3 mm (18 gauge) galvanized steel, 75 mm deep.
- 2.2.2.2 Round: minimum 1.6 mm (16 gauge) galvanized steel.

**2.2.3 Blade:**

- 2.2.3.1 Rectangular: minimum 1.0 mm (20 gauge) galvanized steel.
- 2.2.3.2 Round: minimum 1.6 mm (16 gauge) galvanized steel.

- 2.2.4 **Shaft and Axles:** minimum 13 mm diameter plated steel double bolted to blades, 150 mm extension beyond frame.

- 2.2.5 **Bearing/Bushing:** "Oilite" bronze bushing, self-lubricating type.

- 2.2.6 **Hand locking quadrant:** 1.6 mm (16 gauge) galvanized steel, plated steel hardware.

- 2.2.7 **Product:** Nailor Industries Inc., Model 1090 / 1870.

**2.3 SPLITTER DAMPER**

- 2.3.1 Dampers mounted in ducts with manufactured end bearings with rigid design splitter rod assembly and external adjustment.
- 2.3.2 Blade: airfoil design, constructed of same material as duct with double thickness one gauge heavier than duct.
- 2.3.3 Damper hardware manufacturer: Duro Dyne.

## 2.4 BACKDRAFT DAMPER

### 2.4.1 Application:

2.4.1.1 All ductwork where indicated for both low pressure (500 Pa) and high pressure (1000 Pa) systems. Refer to Section 23 31 14 for ductwork Specification.

2.4.1.2 Horizontal installation for upward airflows, mounting frame type to suit construction.

2.4.1.3 Counter balancing for assist open.

2.4.2 **Frame:** 63 mm deep, extruded aluminum minimum 1.5 mm in thickness.

2.4.3 **Blades:** extruded aluminum profiles minimum 1.5 mm in thickness.

2.4.4 Blade seals:

2.4.5 Extruded silicone blade seals.

2.4.6 Seals secured in integral slot within aluminum extrusions.

2.4.7 **Linkage:** hard alloy aluminum crankarms fastened to zinc plated steel pivot rods and doubly secured within channel running along top of blade.

2.4.8 **Bearing:** self-lubricating "Celcon" bearing rotating on zinc plated 13 mm steel pivot points.

2.4.9 **Leakage:** 101 L/s per m<sup>2</sup> at 250 Pa in accordance with ANSI/AMCA Standard 500-D.

2.4.10 Manufacturers:

2.4.10.1 TAMCO, Series 7000.

2.4.10.2 Nailor Industries Inc., Model 1300.

## 2.5 FIRE DAMPER (DYNAMIC)

### 2.5.1 Application:

2.5.1.1 All ductwork for both horizontal and vertical installations where indicated for both low pressure (500 Pa) and high pressure (1000 Pa) systems. Refer to Section 23 31 14 for ductwork Specification.

2.5.1.2 Provide and install dynamic fire dampers as indicated on Contract Drawings, in ducts penetrating fire separations and as required by applicable Codes. Dynamic fire dampers to fully close under fan operation conditions.

2.5.1.3 Fire link actuated curtain type, 1 ½ hour fire resistance rating, Type B: places curtain blade pack out of air stream for higher free area.

2.5.1.4 For round ductwork, use dampers equipped with round transition collars (Type C).

2.5.1.5 Horizontal mount dampers equipped with stainless steel closure springs and galvanized curtain blade locking ramps.

2.5.1.6 Coordinate access door size at each duct mounted fire damper to allow inspection, cycling, or testing and replacement of fusible link.

2.5.2 **Frame:** 107 mm deep, minimum 0.7 mm (24 gauge) roll-formed galvanized steel. Self-locking corner construction.

2.5.3 **Blades:** curtain type interlocking blades, minimum 0.7 mm (24 gauge) roll formed galvanized steel.

2.5.4 **Enclosures:** minimum 0.7 mm (22 gauge) galvanized steel.

- 
- 2.5.5      **Fusible link:** ULC listed, melts at 74°C.
- 2.5.6      Perimeter retaining angles and integral sleeve sized and selected to suit installation provided as required.
- 2.5.7      Manufacturers:
- 2.5.7.1      Nailor Industries Inc., Model D-0120 Type B or Model D-0130 Type C.
- 2.5.7.2      Ruskin, Model DIBD2 Type B or Model DIBD2 Type C.
- 3          Execution
- 3.1          EXAMINATION**
- 3.1.1      Verify condition and dimensions of previously installed work this Section depends upon. Report discrepancies to TTC. Commencement of Work means acceptance of existing conditions.
- 3.2          GENERAL**
- 3.2.1      Perform Work in accordance with ASHRAE and SMACNA references and NFPA 90A.
- 3.2.2      Provide mechanical identification in accordance with Section 20 05 53 after completion of testing and duct insulation.
- 3.3          DAMPERS**
- 3.3.1      Install dampers in locations shown or indicated in Contract Documents, in accordance with reviewed Shop Drawings and manufacturer's installation instructions.
- 3.3.2      Install all dampers to prevent rattling and vibration.
- 3.3.3      Locate actuators to permit easy access and service.
- 3.3.4      Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.
- 3.4          FIRE DAMPERS**
- 3.4.1      Install fire dampers in locations shown on Contract Drawings, in ducts penetrating fire separations, in accordance with NFPA 90A, Ontario Building Code reviewed Shop Drawings and manufacturer's installation instructions.
- 3.4.2      Maintain integrity of fire separation.
- 3.4.3      After completion and prior to concealment, obtain approvals of complete installation from authority having jurisdiction.
- 3.4.4      Install access door adjacent to damper. Refer to Section 23 33 00.
- 3.4.5      Coordinate with installer of firestopping.
- 3.4.6      Seal multiple damper modules with silicon sealant.
- 3.5          COMMISSIONING**
- 3.5.1      Perform commissioning in accordance with Sections 01 91 00 and 20 05 00.
- 3.5.2      Verify operational performance in general conformance with the following outlines:
- 3.5.2.1      **Operational Performance Outline:**

- 3.5.2.1.1 Blade clearance.
- 3.5.2.1.2 Rotation.
- 3.5.2.1.3 Locking quadrant handle (where applicable).
- 3.5.2.1.4 Actuator (where applicable).
- 3.5.2.1.5 Manual override of actuator (where applicable).
- 3.5.2.1.6 Fail safe (where applicable).
- 3.5.2.1.7 Reset (where applicable).
- 3.5.2.2 **Functional Performance Outline:**
- 3.5.2.2.1 Vibration.
- 3.5.2.2.2 Actuators respond to inputs to open or close (where applicable).
- 3.5.2.2.3 Reset (where applicable).

**END OF SECTION**

1 General

**1.1 SECTION INCLUDES**

1.1.1 Design, labour, Products, equipment and services necessary for the installation of flexible ductwork in accordance with the Contract Documents.

**1.2 REFERENCES**

1.2.1 CAN/ULC-S110, Standard Methods of Test for Air Ducts.

1.2.2 NFPA 90A, Installation of Air Conditioning and Ventilating Systems.

1.2.3 NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.

1.2.4 SMACNA/HVAC Duct Construction Standards - Metal and Flexible.

1.2.5 UL 181, Factory Made Air Ducts and Connectors.

**1.3 DESIGN/PERFORMANCE REQUIREMENTS**

1.3.1 Factory fabricated to CAN/ULC-S110.

1.3.2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.

1.3.3 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

**1.4 SUBMITTALS**

**1.4.1 Product Data:**

1.4.1.1 Submit manufacturer's Product data for all Products listed in this Section in accordance with Section 01 33 00, indicating:

1.4.1.1.1 Thermal properties.

1.4.1.1.2 Friction loss.

1.4.1.1.3 Acoustical loss.

1.4.1.1.4 Leakage.

1.4.1.1.5 Fire rating.

**1.4.2 Closeout Submittals Package:**

1.4.2.1 Submit the following for incorporation into Operation and Maintenance Manuals in accordance with Section 01 78 23:

1.4.2.1.1 Identification: Manufacturing name, type, year, serial number, number of units, capacity, and identification of related systems.

1.4.2.1.2 Performance criteria and maintenance data.

1.4.2.1.3 Manufacturer's installation instructions for each different type of flexible duct.

1.4.2.2 Submit As-Built Drawings in accordance with Section 01 78 39.

## 1.5 CERTIFICATION OF RATINGS

1.5.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

## 2 Products

### 2.1 FLEXIBLE DUCTWORK

2.1.1 **Type 1:** Metallic – insulated, spiral wound flexible aluminum, triple lock mechanical joint, airtight, leakproof with factory applied, 25 mm thick flexible glass fibre thermal insulation with polyethylene vapour barrier.

2.1.1.1 Application: Where indicated on Contract Drawings.

2.1.1.2 Performance:

2.1.1.2.1 Factory tested to 2.5 kPa without leakage.

2.1.1.2.2 Maximum relative pressure drop coefficient: 3.

2.1.1.2.3 Self-supporting and bend radius of 1.5x diameter.

2.1.1.2.4 **Temperature range:** -40°C to 120°C.

2.1.1.2.5 **Pressure range:** -250 Pa to 3000 Pa.

2.1.1.3 Manufacturer: Flexmaster, Model: Type T/L-VT.

2.1.2 **Type 2:** Metallic acoustic insulated, spiral wound, triple lock mechanical joint, flexible perforated aluminum with factory applied 25 mm thick flexible glass fibre thermal insulation and sleeved by polyethylene vapour barrier.

2.1.2.1 Performance:

2.1.2.1.1 Factory tested to 2.5 kPa without leakage.

2.1.2.1.2 Maximum relative pressure drop coefficient: 3.

2.1.2.1.3 Self-supporting and bend radius of 1.5x diameter.

2.1.2.1.4 **Temperature range:** -40°C to 120°C.

2.1.2.1.5 **Pressure range:** -250 Pa to 3000 Pa.

2.1.2.2 Application: Where indicated on Contract Drawings and where required to achieve noise attenuation.

2.1.2.3 Acoustical performance: Minimum attenuation (dB/m) to the following table:

Duct Dia:	Frequency (Hz)				
	125	250	500	1000	2000
100	0.6	3	12	27	
150	1.2	3	12	22	27
200	2.0	5	12	19	20
300	2.4	5	12	16	15

2.1.2.4 Manufacturer: Flexmaster, Model: Type T/L-A.



3 Execution

**3.1 EXAMINATION**

- 3.1.1 Determine individual lengths on site following installation of ductwork and grilles and diffusers.

**3.2 DUCT INSTALLATION**

- 3.2.1 Install in accordance with: CAN/ULC-S110, NFPA 90A and SMACNA/HVAC.
- 3.2.2 Maximum length of flexible duct: 3 m.
- 3.2.3 Support flexible duct in accordance with SMACNA and not less than every 1.5 m.
- 3.2.4 Install in accordance with manufacturer's instructions and recommendations.

**3.3 FIELD QUALITY CONTROL**

- 3.3.1 Adjust accurate lengths to suit without excessive length or bends.

**3.4 PROTECTION**

- 3.4.1 Protect from damage at all times. Replace if vapour barrier is torn or pierced.

**END OF SECTION**



1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment and services necessary for acoustic duct lining Work in accordance with the Contract Documents.

**1.2 REFERENCES**

1.2.1 ANSI/NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems.

1.2.2 ANSI/NFPA 90B, Standard for the Installation of Warm Air Heating and Air Conditioning Systems.

1.2.3 CAN/ULC-S102, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.2.4 ASTM C552, Standard Specification for Cellular Glass Thermal Insulation.

1.2.5 ASTM C553, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

1.2.6 ANSI/SMACNA 006, HVAC Duct Construction Standards - Metal and Flexible.

1.2.7 International Association of Heat and Frost Insulators and Asbestos Workers.

1.2.8 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.

**1.3 DEFINITIONS**

1.3.1 For purposes of this Section:

1.3.1.1 Concealed: mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.

1.3.1.2 Exposed: not Concealed as defined herein.

1.3.2 TIAC Codes:

1.3.2.1 CER: Rigid Insulation.

1.3.2.2 CEF: Flexible Insulation.

1.3.2.3 CRD: Code Round Finish.

1.3.2.4 CRF: Code Rectangular Finish.

**1.4 SUBMITTALS**

1.4.1 Submit in accordance with Section 01 33 00.

**1.4.2 Product Data and Documentation Package:**

**1.4.2.1 Product Data:**

1.4.2.1.1 Submit manufacturer's Product data for all Products listed in this Section indicating:

1.4.2.1.1.1 Performance criteria, compliance with appropriate reference standards, characteristics, and limitations.

1.4.2.1.1.2 Product storage, handling, and installation requirements, including detailed installation instructions with respect to:

1.4.2.1.1.2.1 Jacketing.

1.4.2.1.1.2.2 Vapour retarders, adhesives, coatings and fastening systems.

1.4.2.2 **Documentation:**

1.4.2.2.1 **Trades:** Submit copy of the following membership certificates:

1.4.2.2.1.1 Master Insulator's Association of Ontario or TIAC.

1.4.2.2.1.2 International Association of Heat and Frost Insulators and Asbestos Workers.

1.4.2.2.2 **Tradespersons:** Submit copy of the International Association of Heat and Frost Insulators and Asbestos Workers membership certificate.

**1.4.3 Closeout Submittals Package:**

1.4.3.1 Submit the following for incorporation into Operation and Maintenance Manuals in accordance with Section 01 78 23:

1.4.3.1.1 Identification: Manufacturing name, type, year, serial number, number of units, capacity, and identification of related systems.

1.4.3.1.2 Manufacturer's Instructions:

1.4.3.1.2.1 Installation instructions in accordance with Section 01 33 00 including procedures and installation standards to achieve.

**1.5 QUALITY ASSURANCE**

1.5.1 Installation trade to be specialist in performing work of this Section and have minimum 3 years successful experience in this size and type of project, qualified to standards and member of Master Insulator's Association of Ontario or TIAC, and International Association of Heat and Frost Insulators and Asbestos Workers.

1.5.2 Tradespersons to be member of International Association of Heat and Frost Insulators and Asbestos Workers.

**1.6 DELIVERY, STORAGE AND HANDLING**

1.6.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

1.6.2 Protect from weather, construction traffic.

1.6.3 Protect against damage from any source.

1.6.4 Store at temperatures and conditions required by manufacturer.

2 Products

**2.1 DUCT LINER**

**2.1.1 General:**

2.1.1.1 Fibrous glass duct liner: air stream side faced with mat facing.

2.1.1.2 Flame spread rating maximum 25. Smoke development rating maximum 50 when tested to CAN/ULC-S102.

**2.1.2 Rigid:**

- 2.1.2.1 Use on flat surfaces.
- 2.1.2.2 25 mm thick, to CGSB 51-GP-10 or ASTM C552, fibrous glass rigid board duct liner.
- 2.1.2.3 Density: 36 kg/m<sup>3</sup> minimum.
- 2.1.2.4 Thermal resistance minimum 0.76 m<sup>2</sup>. C/W for 25 mm thickness when tested to ASTM C177, at 24°C mean temperature.

**2.1.3 Flexible:**

- 2.1.3.1 Use on round or oval surfaces.
  - 2.1.3.2 25 mm thick, to CGSB-51-GP-11 or ASTM C553, fibrous glass blanket duct liner.
  - 2.1.3.3 Density: 24 kg/m<sup>3</sup> minimum.
  - 2.1.3.4 Thermal resistance minimum 0.74 m<sup>2</sup>. C/W for 25 mm thickness when tested to ASTM C177, at 24°C mean temperature.
- 2.1.4 **Standard of Acceptance:** Knauf Duct Liner EM (flexible) or Rigid Plenum Liner (rigid), and Johns Manville "Permacote Linacoustic".

**2.2 ADHESIVE**

- 2.2.1 TO ANSI/NFPA 90A and ANSI/NFPA 90B.
- 2.2.2 Flame spread rating maximum 25. Smoke development rating maximum 50. Temperature range -29°C to +93°C.

**2.3 FASTENERS**

- 2.3.1 Weld pins 2.0 mm diameter, length to suit thickness of insulation. Metal retaining clips, 32 mm square.
- 2.3.2 Material: Duro Dyne PN Series with NC or PC-1 series clips.

**2.4 JOINT TAPE**

- 2.4.1 Polyvinyl treated open weave fibreglass membrane 50 mm wide.
- 2.4.2 Material: Duro Dyne FT2.

**2.5 SEALER**

- 2.5.1 To ANSI/NFPA 90A and ANSI/NFPA 90B.
- 2.5.2 Flame spread rating maximum 25. Smoke development rating maximum 50. Temperature range minus 68°C to plus 93°C.

3 Execution

**3.1 GENERAL**

3.1.1 Provide acoustic duct lining wherever shown, scheduled or specified on the Drawings. Do work in accordance with recommendations of SMACNA duct liner standards as indicated in SMACNA HVAC Duct Construction Standards, Metal and Flexible, except as specified otherwise, and for all installations, regardless of velocity, at leading and trailing edges of duct liner sections, provide galvanized steel nosing channel in accordance with Detail "A" of Fig. 2-19, Flexible Duct Liner Installation, found in the SMACNA manual referred to above.

3.1.2 Line inside of ducts where indicated.

3.1.3 Duct dimensions, as indicated, are clear inside duct lining.

**3.2 DUCT LINER**

3.2.1 Install in accordance with manufacturer's recommendations, and as follows:

3.2.1.1 Fasten to interior sheet metal surface with 100% coverage of adhesive.

3.2.1.2 In addition to adhesive, install weld pins with clips minimum 2 rows per surface and maximum 425 mm on centres. Cut off excess weld pin.

**3.3 JOINTS**

3.3.1 Seal butt joints, exposed edges, weld pin and clip penetrations and damaged areas of liner with joint tape and sealer. Install joint tape in accordance with manufacturer's recommendations, and as follows:

3.3.1.1 Bed tape in sealer.

3.3.1.2 Apply 2 coats of sealer over tape.

3.3.2 Replace badly damaged areas of liner at discretion of TTC.

**END OF SECTION**

1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment and services necessary for grille, register, and diffuser Work in accordance with the Contract Documents.

**1.2 REFERENCES**

1.2.1 ASHRAE, Handbooks.

1.2.2 ASHRAE Standard 70, Method of Testing for Rating the Performance of Air Outlets and Inlets.

1.2.3 CSA, Canadian Standards Association.

1.2.4 ETL, Intertek ETL Semko, Product Testing and Certification.

1.2.5 OBC, Ontario Building Code, Part 6.

1.2.6 ULC, Underwriter's Laboratory of Canada.

**1.3 SUBMITTALS**

1.3.1 Submit in accordance with Section 01 33 00.

**1.3.2 Product Data:**

1.3.2.1 Submit manufacturer's Product data for all Products listed in this Section indicating:

1.3.2.1.1 Performance criteria, compliance with appropriate reference standards, characteristics, limitations, and troubleshooting protocol.

1.3.2.1.2 Capacity.

1.3.2.1.3 Throw and terminal velocity.

1.3.2.1.4 Noise criteria.

1.3.2.1.5 Pressure drop.

1.3.2.1.6 Neck velocity.

1.3.2.1.7 Dimensions.

1.3.2.1.8 Specified options.

**1.3.3 Closeout Submittals Package:**

1.3.3.1 Submit the following for incorporation into Operation and Maintenance Manuals in accordance with Section 01 78 23:

1.3.3.1.1 Identification: Manufacturing name, type, year, serial number, number of units, capacity and identification of related systems.

1.3.3.1.2 Functional description detailing operation of components.

1.3.3.1.3 Performance criteria and maintenance data.

1.3.3.1.4 Operating instructions and precautions.

1.3.3.1.5 Component parts availability including names and addresses of spare part suppliers.

- 1.3.3.1.6 List of items submitted to TTC:
- 1.3.3.1.6.1 Keys for volume control adjustment.
- 1.3.3.1.6.2 Keys for airflow pattern adjustment.
- 1.3.3.1.7 Manufacturer's installation instructions for the following items:
  - 1.3.3.1.7.1 Grilles.
  - 1.3.3.1.7.2 Registers.
  - 1.3.3.1.7.3 Diffusers.

## **1.4 CERTIFICATION OF RATINGS**

- 1.4.1 Catalogued or published ratings obtained from tests carried out by manufacturer from independent testing agency signifying adherence to codes and standards.

## **2 Products**

### **2.1 GENERAL**

- 2.1.1 To meet size, capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated in manufacturer's Product data for the design performance criteria specified.

#### **2.1.2 Frames:**

- 2.1.2.1 Full perimeter gaskets.
- 2.1.2.2 To suit mounting application and in accordance with Contract Drawings.
- 2.1.2.3 Oversized grilles, registers and diffusers to be suitably reinforced and provided with mullions to provide rigidity without compromising performance or operation.

#### **2.1.3 Finish:**

- 2.1.3.1 Aluminum Products:
  - 2.1.3.1.1 Powder coat paint finish, 50-75 micron (2.0 – 3.0 mils).
  - 2.1.3.1.2 Refer to Drawing schedule for finish application.
- 2.1.3.2 Durable, corrosion and wear resistant.

#### **2.1.4 Concealed manual volume control damper operators.**

#### **2.1.5 Colour:**

- 2.1.5.1 As specified or as shown on Contract Drawings.

#### **2.1.6 Manufacturers:**

- 2.1.6.1 E.H. Price.
- 2.1.6.2 Nailor.
- 2.1.6.3 Titus.
- 2.1.6.4 Tuttle & Bailey.

#### **2.1.7 Model:**

- 2.1.7.1 In accordance with Model Series indicated on the Contract Drawing Schedule and including the options specified herein.



## **2.2 RETURN AND EXHAUST GRILLES AND REGISTERS**

**2.2.1 Type B:** Egg crate register (ceiling mount, ducted).

2.2.1.1 High capacity, high free area, low sound and pressure drops.

2.2.1.2 13 x 13 x 13 aluminum grid core.

2.2.1.3 Extruded aluminum construction.

2.2.1.4 32 mm border for flat surface/duct mount applications.

2.2.1.5 Grille mounted aluminum opposed blade damper with concealed operator.

2.2.1.6 Model Series, dimensions and finish in accordance with Contract Drawings.

**2.2.2 Type C:** Fixed louvered face register (wall mount, ducted).

2.2.2.1 Aluminum construction.

2.2.2.2 Roll formed fixed blades, 45° deflection at 19 mm spacing.

2.2.2.3 Blades parallel to long dimension.

2.2.2.4 32 mm border, flat surface mount, reinforced welded mitred corners.

2.2.2.5 Grille mounted steel opposed blade damper with concealed operator.

2.2.2.6 Model Series, dimensions and finish in accordance with Contract Drawings.

## **2.3 DIFFUSERS**

**2.3.1 Type A:** Square cone, adjustable diffuser.

2.3.1.1 Four cones, one piece die formed cones, aluminum construction.

2.3.1.2 360° radial air pattern, adjustable from full horizontal to full vertical from face operated tabs.

2.3.1.3 32 mm border for flat surface mount and border for lay-in ceiling applications.

2.3.1.4 Neck mounted radial opposed blade damper with concealed operator.

2.3.1.5 Model Series, neck size, dimensions and finish in accordance with Contract Drawings.

**3 Execution**

## **3.1 INSTALLATION**

3.1.1 In accordance with manufacturer's recommendations.

3.1.2 Bolt grilles, registers and diffusers in place in all areas except finished office areas.

3.1.3 Coordinate installation with Architectural finishes and details.

3.1.4 Coordinate installation with fire dampers where grilles, registers and diffusers are installed in fire-rated assembly.

3.1.5 Set all adjustable blades at 45° and all balancing dampers in full open position in preparation of TAB.

- 3.1.6 Coordinate manufacture and delivery of custom fabrications, finishes and oversized Product requirements to meet construction schedules in accordance with Contract Drawings and Specifications.

**END OF SECTION**

1 General

**1.1 SECTION INCLUDES**

- 1.1.1 Labour, Products, equipment and services necessary for electrical general requirements Work in accordance with the Contract Documents.
- 1.1.2 Refer to requirements of Division 01. This Section does not delegate functions or Work to any specific trade. This Section covers general requirements for supply and installation of electrical equipment specified in Divisions 26, 27 and 28, and detailed on Contract Drawings.
- 1.1.3 In general, the following summarizes Electrical Scope of Work and General Requirements. Details of Contract requirements in accordance with Contract Documents.
- 1.1.3.1 Electrical distribution equipment including devices and cables in accordance with Contract Documents.
- 1.1.3.2 New Voice, Data and SCADA connections in accordance with Contract Documents.
- 1.1.3.3 Normal Lighting - Interior: Provide new lighting system complete with new lighting panels, fixtures, conduit, poles, wiring and controls in accordance with Contract Documents.
- 1.1.3.4 Exit/Emergency Lighting: Provide new exit and emergency lighting, conduit wiring and controls throughout, in accordance with Contract Documents.
- 1.1.3.5 P.A. System: Provide new P.A. system, conduit and wiring in accordance with Contract Documents.
- 1.1.3.6 Receptacles: Provide new receptacles and associated conduits and wiring in accordance with Contract Documents.
- 1.1.3.7 Panelboards: Provide new panelboards for receptacles, power distribution and lighting in accordance with Contract Documents.
- 1.1.3.8 New Equipment Power: Provide Power connection, HVAC system, in accordance with Contract Documents.
- 1.1.3.9 Control and Monitoring Power System: Provide conduit, wiring to HVAC equipment, pumps, mechanical equipment and other miscellaneous systems in accordance with the Contract Documents.
- 1.1.3.10 Building Automation Control System: Provide conduit, wiring to HVAC equipment, pumps, lighting inverter, gas detection, and other miscellaneous systems in accordance with Contract Documents.
- 1.1.3.11 Fire Alarm System: Provide new FA Devices in accordance with Contract Documents.
- 1.1.3.12 Confirm exact location and characteristics of new electrical systems on Site and adjust to Site requirements. Advise TTC of any discrepancies. Test, commission standalone and interfaced systems to ensure proper operation and correct deficiencies.
- 1.1.3.13 Demolition: Removed and relocated existing panelboards, lighting, receptacles, CCTV, etc., in accordance with the Contract Documents. Staging of Work shall be in accordance with the Architectural Construction Staging Drawings.

- 1.1.3.14 Coordinate with TTC for demolition and construction Work to avoid disruption of transit operation.
- 1.1.3.15 Updating and expansion of CCTV system: Provide new CCTV cameras and equipment to cover new system layout in accordance with the Contract Drawings.
- 1.1.3.16 Trace, verify and record existing circuits to existing electrical equipment and provide typed revised panelboard schedules.
- 1.1.3.17 Any equipment not indicated on Contract Drawings shall remain unless noted otherwise. Remove and reinstall any electrical equipment, conduit, wire, light fixtures, required to be moved because of interference due to installation of new equipment. Coordinate with other trades.
- 1.1.3.18 Confirm exact locations of new and existing electrical systems on Site. Advise TTC of any discrepancies.
- 1.1.3.19 Electrical Work on existing and new equipment that requires power connection or disconnection from existing panelboards, switchboard or communication equipment shall be done by TTC forces. It is the Contractor's responsibility to coordinate with TTC to schedule TTC work.
- 1.1.3.20 All existing services that pass through area deemed for renovations are to be maintained and/or relocated to suit Scope of Work and staging requirements.
- 1.1.3.21 Cut, patch and make good all holes made due to electrical system installation in accordance with Section 01 73 29.
- 1.1.3.22 Provide temporary lighting where required in accordance with Section 01 50 00.
- 1.1.3.23 Reviewed single line diagram (863 mm x 562 mm), printed on non-fading and non-acid paper and mounted in non-combustible frame, protected by tempered glass to be fitted on wall in Electrical Room.
- 1.1.3.24 Prior and during construction, coordinate with other Divisions to avoid interference of equipment and services. Ensure no services are affected by demolition Work. If services are affected by demolition Work, notify TTC immediately.
- 1.1.3.25 Verify functioning of complete fire alarm system upon completion of the Work to be witnessed by TTC. Provide verification certificate to TTC.
- 1.1.3.26 Complete inspection, start-up, testing and commissioning of installed equipment in accordance with manufacturer's recommendations and Contract Documents.
- 1.1.3.27 Furnish inspection and start-up report to TTC for review prior to scheduling commissioning.
- 1.1.3.28 Correct and complete all construction deficiencies before scheduling commissioning.
- 1.1.3.29 Provide services of manufacturer's technical representative for commissioning at no additional cost to TTC.

## **1.2 REFERENCES**

- 1.2.1 ASME A17.1/CSA B44, Safety Code for Elevators and Escalators.
- 1.2.2 CAN/CGSB 1.181, Ready-Mixed Organic Zinc-Rich Coating.
- 1.2.3 CSA, Canadian Standards Association.
- 1.2.4 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standards for Electrical Installation.

- 1.2.5 CSA C22.2 No. 94, Special Purpose Enclosures.
- 1.2.6 CSA Z462, Workplace Electrical Safety.
- 1.2.7 EEMAC, Electrical and Electronic Manufacturers Association of Canada.
- 1.2.8 ESA, Electrical Safety Authority.
- 1.2.9 IEC, International Electro-Technical Commission.
- 1.2.10 IEEE, Institute of Electrical & Electronics Engineers.
- 1.2.11 IEEE 1584, Guide for Performing Arc Flash Hazard Calculations.
- 1.2.12 NEMA, National Electrical Manufacturers Association.
- 1.2.13 OBC, Ontario Building Code.
- 1.2.14 OESC, Ontario Electrical Safety Code.
- 1.2.15 SSPC-SP1, Solvent Cleaning.
- 1.2.16 SSPC-SP3, Power Tool Cleaning.
- 1.3 SUBMITTALS**
- 1.3.1 Submit in accordance with Section 01 33 00.
- 1.3.2 Shop Drawings:**
- 1.3.2.1 Submit in accordance with Section 01 33 23 indicating:
  - 1.3.2.1.1 Performance criteria, compliance with appropriate reference standards, characteristics, limitations, and troubleshooting protocol.
  - 1.3.2.1.2 Product transportation, storage, handling, and installation requirements
  - 1.3.2.1.3 Technical data, Product data, supplemented by bulletins, component illustrations, detailed views, technical descriptions of items, and parts lists.
  - 1.3.2.1.4 Materials or equipment actually being supplied. Thicknesses, finishes.
  - 1.3.2.1.5 Details of construction, accurate dimensions. Mounting and installation details.
  - 1.3.2.1.6 Capacity, operating characteristics and performance.
  - 1.3.2.1.7 Identifying number of specific equipment.
  - 1.3.2.1.8 Non-catalogue items, prepared specifically for this Contract.
  - 1.3.2.1.9 Supplementary data, with database explaining theory of operation.
  - 1.3.2.1.10 Total weight.
  - 1.3.2.1.11 Shipping sections.
  - 1.3.2.1.12 Bill of material.
  - 1.3.2.1.13 Connections, calculations, test results and loads.
  - 1.3.2.1.14 Termination and interconnection lists.
  - 1.3.2.1.15 Nameplate drawings.
  - 1.3.2.1.16 Interconnection lists, schematic diagrams with cross-referenced components lists and sequence of operations.
  - 1.3.2.1.17 Equipment and components performance curves.

- 1.3.2.1.18 Names and addresses of local suppliers and service representatives.
- 1.3.2.1.19 Identification table complete with details of conduit size, wire or cable size, junction boxes, pull boxes and feeder panels/breaker identification. Refer to Section 26 05 53, Annexure-1/2/3 Tables, complete as part of Shop Drawing submission.
- 1.3.2.2 **Single Line and Riser Diagrams Drawings:**
- 1.3.2.2.1 Submit reviewed single line diagrams of electrical distribution systems mounted in metal frames located in AC Switchgear Room and substation AC and DC Switchgear Rooms as required. Reviewed single line diagram shall include complete facility distribution system starting with incoming service of Local Utility Authority, downstream distribution system complete with symbol, legend, over current-protective devices, revenue metering, TTC metering, interlocking and transfer schemes.
- 1.3.2.2.2 Submit fire alarm riser and shut-down diagram within central alarm and control facility cabinet, including plan and zoning diagram of building, mounted in metal pouch in cabinet.
- 1.3.2.2.3 Submit single line diagrams in easily readable size, printed on non-fading and non-acidic paper and mounted in non-combustible frames, protected by tempered glass to be fitted on wall in Electrical Rooms. Confirm mounting location with TTC.
- 1.3.2.2.4 Provide description of applicable interlocking and transfer schemes reviewed by TTC.
- 1.3.2.3 **Composite Construction Drawing:**
- 1.3.2.3.1 Prepare dimensioned drawings, utilizing latest Shop Drawings and include, but not limited to, details pertaining to clearances, access, sleeves, electrical connections, locations and elevations of pipes, ducts, and conduits.
- 1.3.3 **Samples:**
- 1.3.3.1 Submit samples requirement in accordance with the technical Section.
- 1.3.4 **Quality Assurance Submittal Package:**
- 1.3.4.1 Submit test report for each test performed. Tests shall be signed by testing engineer and where witnessed by TTC. Submit 4 copies of each report, including:
  - 1.3.4.1.1 Records of tests performed, methods of calculation, date and time of test, ambient conditions, names of testing company, test engineer and witnesses, if required.
- 1.3.4.2 Submit final test report certifying, electrical installation ready and fit for service.
- 1.3.5 **Commissioning Package:**
- 1.3.5.1 Submit the following in accordance with Section 01 91 00:
  - 1.3.5.1.1 Commissioning Plan.
  - 1.3.5.1.2 Commissioning Procedures.
  - 1.3.5.1.3 Certificate of Readiness.
- 1.3.6 **Commissioning Closeout:**
- 1.3.6.1 Submit the following in accordance with Section 01 91 00:
  - 1.3.6.1.1 Deficiency Report.
  - 1.3.6.1.2 Commissioning Closeout Report.

**1.3.7 Closeout Submittals Package:**

- 1.3.7.1 Submit the following for incorporation into Operation and Maintenance Manuals in accordance with Section 01 78 23:
- 1.3.7.1.1 Complete set of reviewed Shop Drawings of equipment.
  - 1.3.7.1.2 Shop Drawings of equipment supplied by TTC.
  - 1.3.7.1.3 Complete bills of materials and spare parts showing manufacturer's names, addresses, local replacement sources and telephone numbers.
  - 1.3.7.1.4 Stock list of recommended spare parts and quantity of each item.
  - 1.3.7.1.5 Manufacturer's warranties.
  - 1.3.7.1.6 Manufacturer's certified reports.
  - 1.3.7.1.7 Installation instructions.
  - 1.3.7.1.8 Appropriate servicing, troubleshooting and preventative maintenance schedule and instructions for equipment and systems. Equipment and components performance curves.
  - 1.3.7.1.9 Field testing and commissioning reports.
  - 1.3.7.1.10 Factory test reports.
  - 1.3.7.1.11 Person hours/year to perform certain functions adequately.
  - 1.3.7.1.12 If requested by TTC, supplementary data with database explaining theory of operation.
  - 1.3.7.1.13 Details of design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of portion or feature of installation.
  - 1.3.7.1.14 Final ESA and/or local Hydro Certificates.

**1.3.7.2 As-Built Drawings:**

- 1.3.7.2.1 Submit As-Built Drawings in accordance with Section 01 78 39 indicating:
- 1.3.7.2.1.1 Accurately maintained, dimensioned record of cable, conduit, bus duct and equipment locations in shafts, Mechanical Rooms, Electrical Rooms, Switchgear Rooms, ceiling spaces and other critical locations to avoid conflict with other trades. Show deviations and changes in Work from Contract Drawings.
  - 1.3.7.2.1.2 Actual locations of conduits and ducts, piping, maintenance holes, and similar items located below or outside of structure.
  - 1.3.7.2.1.3 Dimensions with respect to structural column lines or walls and elevations with respect to finished floor levels or grades, referenced to centre line of conduit, duct, or raceway for the following: Conduits in inaccessible locations.
  - 1.3.7.2.1.4 On each Drawing in lower right hand corner in letters minimum 13 mm high as follows: AS-BUILT: THIS DRAWING HAS BEEN REVISED TO SHOW ELECTRICAL SYSTEMS AS INSTALLED followed by signature of Contractor and date.

## **1.4 QUALITY ASSURANCE**

- 1.4.1 Submit required documentation to authorities having jurisdiction to obtain approvals.
- 1.4.2 Coordination:
  - 1.4.2.1 Notify TTC before working in existing areas. Existing equipment or device worked on or removed disconnected from power supply.
  - 1.4.2.2 Coordinate installation of electrical equipment with equipment of other trades. Notify other trades in advance of openings, anchors, hangers or other provisions necessary for electrical installation.
  - 1.4.2.3 Embedded, concealed or recessed equipment identified before construction. In spaces above ceilings, coordinate installation with other trades.
  - 1.4.2.4 During construction, protect equipment from elements and damage by other construction activities in area.
  - 1.4.2.5 Notify other trades concerned of openings, anchors, hangers or other provisions necessary for installation of electrical Work for installation in structure, walls, floors and similar locations or may affect other Work.
  - 1.4.2.6 Install electrical items in time to avoid cutting or patching of Work.
  - 1.4.2.7 Where conflicts or Site conditions require deviation from Work as specified or indicated, notify TTC and provide required documentation for acceptance by TTC before proceeding.
  - 1.4.2.8 Include for reconstruction of Work required due to lack of timely submissions before commencing Work. Remove, relocate or replace Work to the acceptance of TTC.
- 1.4.3 Protect finished and unfinished Work or Work of other trades until completed Work has been accepted.
- 1.4.4 Regulatory requirements:
  - 1.4.4.1 Comply with authorities having jurisdiction. Include for changes or alterations required by authorities having jurisdiction.
  - 1.4.4.2 Submit required documentation and Shop Drawings to authorities having jurisdiction in order to obtain approval for the Work.
  - 1.4.4.3 Prepare additional information, details and similar items authorities require.
  - 1.4.4.4 Provide warning signs, labels, nameplates and glass covered diagrams as required by inspection authority.
  - 1.4.4.5 Where materials require special inspection and approval of CSA or local authorities, obtain such approval for particular installation.
  - 1.4.4.6 Do not reduce standards established by Contract Documents by applying lower standards in codes.
  - 1.4.4.7 Obtain and pay for Permits required and arrange and pay for inspection and testing.



## **1.5 DESIGN FOR EASE OF MAINTENANCE**

- 1.5.1 The equipment shall be designed and constructed so that adjustment, replacement, repairs or regular upkeep can be easily carried out by maintenance personnel with minimum additional training and with tools normally available. The design shall incorporate, where possible, the concept of modular removal and replacement of malfunctioning components.
- 1.5.2 The design of the equipment shall provide maximum accessibility to all equipment and components to facilitate preventative maintenance checks, services and repair actions. Test points and test procedures, with values and tolerance range, shall be provided to facilitate diagnosis of malfunctioning components and for check-out after repair/replacement.
- 1.5.3 Precautions shall be taken to protect operation and maintenance personnel from moving parts, high voltages, toxic or corrosive material, excessive heat or any other hazards which might be presented while maintaining and operating the equipment. Wherever possible and where required by law, design features which exclude such hazards shall be incorporated. Where this is not possible, mitigation of such hazards by procedures is acceptable provided adequate warnings and notices are provided both in the procedures and at the equipment.

## **1.6 SITE CONDITIONS**

- 1.6.1 Protect, support and maintain existing active services as required for execution of Work without disturbing these services.
- 1.6.2 Circuit designations on existing panelboards may not agree with field installation. Trace and verify such circuits, as required.
- 1.6.3 Do not disrupt existing lighting, power or communications systems.
- 1.6.4 If temporary connections are required to maintain services during construction period, provide necessary material, equipment and labour to electrical safety codes and standards.
- 1.6.5 Notify and obtain written permission from TTC before working on/or accessing any existing panel or electrical equipment.
  - 1.6.5.1 All new and existing electrical equipment shall be connected to or disconnected from existing distribution system (e.g. switchgear, switchboards, panelboards, control panels, etc.) by TTC forces and coordinated by TTC.
- 1.6.6 Electrical safety:
  - 1.6.6.1 Protect personnel during construction from physical danger from exposed energized equipment such as panelboard mains and outlet wiring. Shield and mark live parts LIVE – 600/230 VOLTS AC.
  - 1.6.6.2 Arrange for installation of temporary doors, barriers and similar items, for rooms containing electrical equipment. Keep doors locked except when under direct supervision.
  - 1.6.6.3 Use minimum 1½ hour fire rated temporary doors and barriers for rooms containing electrical equipment.

2 Products

**2.1 MATERIALS**

- 2.1.1 Plywood: In accordance with requirements of Section 06 10 00.
- 2.1.2 Primer: In accordance with requirements of Section 09 91 00.
- 2.1.3 Primer for galvanized surfaces: In accordance with requirements of Section 09 91 00.
- 2.1.4 Paint: In accordance with requirements of Section 09 91 00.
- 2.1.5 Fish wire: Yellow waterproof polypropylene rope minimum 6 mm diameter.
- 2.1.6 Sleeves: In accordance with requirements of Section 05 50 00 or suitable sized PVC sleeves to suit the Site application.

**2.2 FABRICATION**

- 2.2.1 If CSA certified equipment unavailable, obtain special approval for equipment from CSA and/or ESA.
- 2.2.2 Provide equipment suitable for its intended use within range of temperature -40°C to +40°C and humidity values experienced in Toronto.
- 2.2.3 Equipment installed in electrically noisy environment, caused by AC and DC traction power equipment. Operation of potential detectors not adversely affected.
- 2.2.4 Factory assemble control panels and other components except for shipping splits.
- 2.2.5 Fabricate steel supports, plates and hardware as required. Hot-dip galvanize prefabricated supports such as channels, brackets, hangers, slotted angles. Do not field weld, but bolt or clamp. Touch-up cut sections with cold galvanizing zinc coating.
- 2.2.6 Do not manufacture or install electrical equipment or systems until Shop Drawing review and acceptance by TTC and/or authorities having jurisdiction.

**2.3 FINISHES**

- 2.3.1 Prepare and clean surfaces of electrical Products requiring painting in accordance with SSPC-SP3 for rust and SSPC-SP1 for oil, grease, dirt and other contaminates.
- 2.3.2 Apply one coat of primer.
- 2.3.3 Paint all electrical equipment in accordance with EEMAC standard.
- 2.3.4 Apply paint in accordance with manufacturer's instructions regarding application methods, coating thicknesses, equipment, temperature and humidity conditions.
  - 2.3.4.1 Provide verification of finish standards that the finish system complies with EEMAC and industry test standards. Provide specific verification that 1000 hour (min) salt spray and humidity tests have been met.
- 2.3.5 Clean and touch-up surfaces scratched or marred during shipment and installation, to match original paint finish.
- 2.3.6 Clean, prime and paint exposed hangers, racks and fasteners to prevent rust in accordance with Section 09 91 00.
- 2.3.7 Provide touch-up paint.

3 Execution

**3.1 EXAMINATION**

- 3.1.1 Verify condition and dimensions of previously installed Work this Section depends upon. Report defects to TTC. Commencement of Work means acceptance of existing conditions.
- 3.1.2 Verify equipment access and coordinate with equipment supplier to ensure equipment can physically transport to installation location.
- 3.1.3 Quantities or lengths indicated in Contract Documents are approximate and do not gauge or limit Work. No adjustment to Contract Price allowed to complete Work.
- 3.1.4 Include for changes or additions to routing of conduits, raceways, ductbanks and similar items, to accommodate structural, mechanical and architectural conditions.

**3.2 EXISTING EQUIPMENT**

- 3.2.1 Electrical equipment requiring temporary or permanent relocation or power due to construction is the Contractor's responsibility.
  - 3.2.1.1 All new and existing electrical equipment shall be connected to or disconnected from existing distribution system (e.g. switchgear, switchboards, panelboards, control panels, etc.) by TTC forces.
- 3.2.2 Include and provide additional items and accessories or connections obviously required to provide complete working system for relocated equipment, but omitted from Specifications or not shown on Contract Drawings.
- 3.2.3 Assume existing conduits in Work area contain live circuits.
- 3.2.4 Trace conduits and circuits feeding existing equipment in Work area obstructing and interfering with Contract Work. Maintain circuits live, if required and in use.
- 3.2.5 Contractor shall coordinate any Work related to electrical equipment requiring temporary or permanent relocation or power due to construction with TTC.
- 3.2.6 Unless "only" suffixes "supply, install and connect" or variation of those words, it means "supply, install and connect".

**3.3 INSTALLATION**

- 3.3.1 Coordinate installation of electrical equipment with equipment of other trades. Notify other trades in advance of openings, anchors, hangers or other provisions necessary for electrical installation.
- 3.3.2 Identify embedded, concealed or recessed equipment before construction. In spaces above ceilings, coordinate electrical installation with other trades, such as ductwork and piping.
- 3.3.3 Install wiring and connections to equipment supplied by other trades, such as wiring and interlocks of equipment and control devices specified in other Divisions.
- 3.3.4 Protect electrical equipment from elements and damage by other construction activities in area.
- 3.3.5 Perform electrical Work in accordance with OBC, OESA, and CSA. Perform changes or alterations required by authorized inspectors of authorities having jurisdiction such as Local Hydro or ESA.

- 3.3.6 After completion of part of Work, notify TTC to make final inspection. Make tests of such portions and promptly make any changes necessary, to acceptance by TTC. Place Work in service at such time and in such order as TTC may direct.
- 3.3.7 Do not reduce requirements of standards established by Contract Documents by applying Codes referred to in this Division.
- 3.3.8 Unless otherwise specified, Contract Documents intended to cover ancillary items necessary for Work of Divisions 26, 27 and 28. Provide ancillary omitted items essential for complete and operational installation.
- 3.3.9 TTC to make final connections to existing operational electrical panels and equipment. Identify and install suitable lengths of wire and cable for this purpose.
- 3.3.10 Assemble, install, connect and adjust for complete operation of electrical equipment.
- 3.3.11 Install electrical equipment in locations shown on Contract Drawings. Such locations subject to change to suit conditions as Work progresses. Before installing equipment, obtain instructions from TTC for exact locations, make such changes without extra cost to TTC.
- 3.3.12 Existing and new conduits, outlets, or other electrical equipment shown on Contract Drawings not necessarily exact locations or quantities. Make allowances for additional Work of removing or installing additional conduits, outlets, as required, to accommodate Work.
- 3.3.13 No change to Contract Price allowed for relocation of equipment incorrectly installed because of failure to check and coordinate details, Contract Drawings and interferences, prior to installation.
- 3.3.14 Use flexible conduits to connect devices, mounted on removable panels and of sufficient length to permit panel removal without dislodging connected device.

### **3.4 HEATING, VENTILATION AND PLUMBING EQUIPMENT**

- 3.4.1 Provide necessary material and make connections to the following plumbing, heating and ventilation equipment.
  - 3.4.1.1 **Hot Water Tanks:** Connect to thermostats mounted on tanks.
  - 3.4.1.2 **Pipe Tracing Heating:** Install transformers and thermostat. Connect transformers, thermostat and heating cable.
  - 3.4.1.3 **Ventilation fans other than above:** Install starters and speed regulators. Inter-connect starters, speed regulators and fan motors.

### **3.5 NEUTRAL CONDUCTOR AND PHASING**

- 3.5.1 Install individual grounded neutral conductor for one-pole, two-pole or three-pole branch breakers of balanced, 3-phase 4-wire circuits unless noted otherwise. Current carrying capacity of neutral conductors shall be equal or greater than the phase conductor to suit load conditions.
- 3.5.2 Balance single phase loads to minimize unbalance of 3-phase supply.

### **3.6 NOISE AND VIBRATION**

- 3.6.1 If equipment operates with excessive noise or vibration due to incorrect installation or support, eliminate noise or vibration to acceptance by TTC.
- 3.6.2 Make connections to noise producing and vibrating equipment with flexible conduit.

- 3.6.3 Install vibration isolators where indicated. Isolate transformers from structure with spring or rubber isolators when suspended and appropriate sandwich pads when floor mounted. Isolate diesel generator sets from structure with vibration isolators.

### **3.7 LOCATION OF OUTLETS**

- 3.7.1 Location of outlets subject to change, if information given prior to installation.
- 3.7.2 Relocate outlets up to 3000 mm from original location at no extra cost or credit.
- 3.7.3 Relocations over 3000 mm reviewed and negotiated on individual basis.
- 3.7.4 Make relocations required as result of insufficient coordination, at no cost to TTC. Relocations subject to acceptance by TTC.

### **3.8 MOUNTING HEIGHTS**

- 3.8.1 Mounting heights of equipment: From finished floor to centreline of equipment unless specified or indicated otherwise.
- 3.8.2 If mounting height of equipment not indicated, verify before proceeding with installation.
- 3.8.3 Install electrical equipment at following heights above finished floors, unless indicated otherwise:
- 3.8.3.1 **Local switches:** 1,200 mm.
- 3.8.3.2 **Wall receptacles:** Vertical orientation, generally 400 mm; 1,000 mm in Electrical, LAN, and Mechanical Rooms; 850 mm in office areas.
- 3.8.3.3 **Telephone outlets:** 850 mm.
- 3.8.3.4 **Data outlets:** 850 mm.
- 3.8.3.5 **Fire alarm stations and handsets:** 1,050 to 1150 mm.
- 3.8.3.6 **Wall mounted speakers:** 300 mm to top below finished ceiling.
- 3.8.3.7 Locate receptacles above kitchen counter backsplash to underside of kitchen cabinet. Verify site condition before installation.

### **3.9 CONDUIT AND CABLE INSTALLATION**

- 3.9.1 Assume existing conduits in Work area contain live circuits. Coordinate any Work on existing equipment with TTC.
- 3.9.2 Relocate temporary or permanent electrical equipment and conduits as required.

### **3.10 LOAD BALANCING**

- 3.10.1 Measure phase current to panelboards with normal loads operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record current readings. Submit recorded data to TTC for review.
- 3.10.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment. Measure phase voltages to reflect utility voltage fluctuations and set accordingly.

**3.11 CARE, OPERATION AND START-UP**

- 3.11.1 Instruct TTC's staff in operation, care and maintenance of installation at times arranged by TTC and detailed in other Sections at no extra cost to TTC.
- 3.11.2 Provide services of Contractor's staff to supervise startup of installation, check, adjust, balance and calibrate components at no extra cost to TTC.
- 3.11.3 Provide these services for such period and for as many visits as necessary to put installation in working order and to ensure TTC's staff conversant with all aspects of its care and operation at no extra cost to TTC.

**3.12 TRIAL USE**

- 3.12.1 Temporary or trial usage by TTC of any device, machinery, apparatus, equipment or other work supplied under this Section before final completion and written acceptance by TTC and ESA, is not evidence of acceptance by TTC.
- 3.12.2 TTC reserves use of such temporary and trial usage as soon as Contractor claims Work completed in accordance with Contract Drawings and Specifications, for reasonable length of time as TTC deems sufficient for making complete and thorough test. No claim for damage accepted from Contractor for injury to or breaking of parts used, whether caused by defective materials or improper workmanship.

**3.13 VOLTAGE RATINGS**

- 3.13.1 Operating voltages: in accordance with CSA standards and or OESC.
- 3.13.2 Motors, electric heating, control and distribution devices and equipment: Operating satisfactorily at 60 Hz within normal operating limits established by CSA standards. Design equipment to operate in extreme operating conditions established in standards, without damage to equipment.

**3.14 FIELD QUALITY CONTROL AND COMMISSIONING**

- 3.14.1 Perform commissioning in accordance with Sections 01 91 00 and 26 08 00.
- 3.14.2 General:
  - 3.14.2.1 Performance test the equipment to verify electrical and mechanical operation is in accordance with Standards and recommendations of manufacturers.
  - 3.14.2.2 Provide factory authorized and trained personnel to perform commissioning and start-up testing, including checkout, adjustments, balancing and calibration of components and systems, as required.
  - 3.14.2.3 Provide these services as required to ensure installation is in proper working order and to ensure the TTC's staff conversant with all aspects of its care and operation at no extra cost to TTC.
  - 3.14.2.4 Test conduits and ducts installed but required left empty for clean bore.
  - 3.14.2.5 Cap empty conduits and provide pullstring.
  - 3.14.2.6 Inspections by jurisdictional authorities shall include all appropriate local and provincial authorities, such as:
    - 3.14.2.6.1 Building Inspection's Department, in accordance with OBC.
    - 3.14.2.6.2 Toronto Hydro, Local Utility Authority.
    - 3.14.2.6.3 Fire Services Inspection's Department.

- 3.14.2.6.4 Ministry of Labour, Regulation for Industrial Establishments.
- 3.14.2.6.5 Electrical Safety Authority.
- 3.14.3 Tests:
  - 3.14.3.1 Perform tests on each of the following systems:
    - 3.14.3.1.1 Water supply pumps and controls.
    - 3.14.3.1.2 Sanitary waste pumps and controls.
    - 3.14.3.1.3 High voltage and or low voltage electrical distribution and control system.
    - 3.14.3.1.4 Storm drainage system.
    - 3.14.3.1.5 Equipment factory tests (refer to appropriate Sections).
    - 3.14.3.1.6 Heating, Ventilating and Air Conditioning Systems, (HVAC).
    - 3.14.3.1.7 Fire protection and Alarm systems.
    - 3.14.3.1.8 Miscellaneous mechanical systems.
    - 3.14.3.1.9 Emergency lighting and UPS system.
    - 3.14.3.1.10 PA, data, intercom system, CCTV and PAI.
  - 3.14.3.2 Test wiring systems with switchgear, switchboards, panelboards, fuseholders, switches and overcurrent devices in place and connected, as the following:
    - 3.14.3.2.1 **Dielectric test on 120/208 V equipment and wiring:** Apply 500 V AC, 60 Hz for three minutes between phase conductors and between each phase conductor and ground. Ensure test voltages for 600 V equipment and cables are as recommended by manufacturers of equipment and cable.
    - 3.14.3.2.2 **Insulation resistance test:** After completion of Dielectric test, measure insulation resistance by means of approved resistance measuring instrument. Minimum value of insulation resistance between connected system and ground: Minimum values prescribed under Insulation Resistance in accordance with OESC, ESA or manufacturer's recommendations.
    - 3.14.3.2.3 Remove and replace shorted, grounded and defective conductors.
  - 3.14.3.3 With lighting system completely connected and lamped, make the following tests:
    - 3.14.3.3.1 **Control and switching:** Test circuits for correct operation of devices, switches and controls.
    - 3.14.3.3.2 **Polarity test:** Test sockets for correct polarity.
    - 3.14.3.3.3 **Voltage test:** Make voltage test at last outlet, one on each circuit, with circuit fully loaded. If excessive drop in potential, locate cause and correct condition. Replace defective parts, materials, conductors, insulation or splices.
    - 3.14.3.3.4 **Phase balance:** Measure load on each phase at each distribution panelboard and at main switchboard. Report results to TTC. Make necessary rearrangement of phase connections to balance load on each phase. Make rearrangement as instructed by TTC and restrict to exchanging connections at panelboards or at main switchboard. After making changes, submit to TTC drawings or marked prints showing modified connections.

- 3.14.3.4 **Supply voltage:** Measure and report to TTC line voltage of each phase at load terminals of main breakers. Make test with majority of electrical equipment in use.
- 3.14.3.4.1 **Motor loadings:** Measure and report to TTC line currents of each phase of each motor under load. Upon indication of unbalance or overload, thoroughly examine electrical connections and rectify any defective parts or wiring. If electrical connections correct, report overloads and phase unbalances to TTC.
- 3.14.3.4.2 **General operation:** Energize and put into operation each electrical circuit and item. Make necessary repairs, alterations, replacements, tests and adjustments required for complete and acceptable operating electrical system.
- 3.14.3.5 Make tests in presence of TTC. Perform General-Operation testing at time of acceptance of Work. Refer to Sections 01 91 00 and 26 08 00 for specific start-up testing and commissioning of equipment or systems.

### 3.15 CLEANING

- 3.15.1 Perform final cleaning in accordance with Section 01 74 11.
- 3.15.2 Where equipment shows corrosion, or damage to finish of panels, panelboards fixtures or devices, touch-up surfaces to the acceptance of TTC.
- 3.15.3 Polish plated work and glass. Replace burned out lamps.
- 3.15.4 Repair, adjust and lubricate mechanisms and leave in operating condition.

### 3.16 TRAINING

- 3.16.1 Provide training and documentation in accordance with Section 01 79 00 and as indicated within electrical Sections.

### 3.17 MAINTENANCE

- 3.17.1 Maintain all equipment and systems installed until Substantial Performance, in accordance with Section 01 78 25.
- 3.17.2 Carry out regular scheduled maintenance of equipment and systems following Substantial Performance until Contract Completion, in accordance with Section 01 78 25.

**END OF SECTION**



1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment and services necessary for wires and cables 0 - 1000 V  
Work in accordance with the Contract Documents.

**1.2 REFERENCES**

1.2.1 ASTM B3, Standard Specification for Soft or Annealed Copper Wire.

1.2.2 ASTM B8, Standard Specification for Concentric-Lay-Stranded Copper Conductors,  
Hard, Medium-Hard, or Soft.

1.2.3 ASTM D1047, Standard Specification for Poly (Vinyl Chloride) Jacket for Wire and  
Cable.

1.2.4 CSA, Canadian Standards Association.

1.2.5 CSA C22.2 No. 0.3, Test Methods for Electrical Wires and Cables.

1.2.6 CSA C22.2 No. 38, Thermoset Insulated Wires and Cables.

1.2.7 CSA C22.2 No. 49, Flexible Cords and Cables.

1.2.8 CSA C22.2 No. 75, Thermoplastic-Insulated Wires and Cables.

1.2.9 CSA C22.2 No. 124, Mineral-Insulated Cable.

1.2.10 OESC, Ontario Electrical Safety Code.

1.2.11 NFPA 130, National Fire Protection Association Standard for Fixed Guideway Transit  
and Passenger Rail System.

1.2.12 UL, Underwriters' Laboratories.

**1.3 SUBMITTALS**

1.3.1 Submit in accordance with Section 01 33 00.

**1.3.2 Product Data and Shop Drawings Package:**

**1.3.2.1 Product Data:**

1.3.2.1.1 Submit manufacturer's Product data indicating:

1.3.2.1.1.1 Technical data, supplemented by bulletins, component illustrations, detailed  
views, technical descriptions of items, and parts lists.

1.3.2.1.1.2 Performance criteria, compliance with appropriate reference standards,  
characteristics, limitations, and troubleshooting protocol.

1.3.2.1.1.3 Product transportation, storage, handling, and installation requirements.

**1.3.2.2 Shop Drawings:**

1.3.2.2.1 Submit Shop Drawings in accordance with Section 01 33 23 indicating:

1.3.2.2.1.1 All cables used on Contract.

1.3.2.2.1.2 All cable terminations used on Contract.

1.3.2.2.1.3 All cable supports used on Contract.

**1.3.3 Quality Assurance Submittals Package:**

1.3.3.1 If requested by TTC, or if necessary to meet Site condition requirements, submit alternate cable routing information for review prior to proceeding with the Work.

1.3.3.2 Submit manufacturer's minimum 10 years documented experience.

**1.3.4 Commissioning Package:**

1.3.4.1 Submit the following in accordance with Section 01 91 00:

1.3.4.1.1 Commissioning Plan.

1.3.4.1.2 Commissioning Procedures.

1.3.4.1.3 Certificate of Readiness.

1.3.4.2 Submit completed test sheets specified in Section 26 08 00 to the Certificate of Readiness.

1.3.5 Submit certification from cable manufacturer that installation is in accordance with their requirements.

**1.3.6 Commissioning Closeout Package:**

1.3.6.1 Submit the following in accordance with Section 01 91 00:

1.3.6.1.1 Deficiency Report.

1.3.6.1.2 Commissioning Closeout Report.

**1.4 QUALIFICATIONS**

1.4.1 Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum 10 years documented experience.

**1.5 REGULATORY REQUIREMENTS**

1.5.1 Furnish Products listed and classified by CSA and UL, as suitable for application.

**1.6 SITE CONDITIONS**

1.6.1 Verify field measurements and conditions as required by the Contract Documents.

1.6.2 Cable routing on Contract Drawings is approximate unless fully dimensioned. Route cable as required to suit Site conditions and as reviewed by TTC.

1.6.3 Where cable routing is not shown and destination only is indicated, determine exact routing and lengths required to suit Site conditions and as reviewed by TTC.

**1.7 COORDINATION**

1.7.1 Coordinate Work specified in this Section with work provided under other electrical work and work of other trades.

1.7.2 Determine required separation between cable and other work.

1.7.3 Determine cable routing to avoid interference with other work.

1.7.4 Provide core drilling where required prior to commencing Work.

1.7.5 Coordinate alternate cable routing with TTC prior to proceeding with the Work.

2 Products

**2.1 MANUFACTURERS**

2.1.1 Electro Cables.

2.1.2 General Cables.

2.1.3 Prysmian.

2.1.4 Nexans.

**2.2 BUILDING WIRES**

2.2.1 **Low voltage wires and cables:** Minimum 600 V insulation.

2.2.2 **Conductors:** Stranded copper. Minimum size No.12 AWG, stranded wire in sizes up to and including No. 8 AWG: Nylon jacketed and thermoplastic insulated T90, and TWU90 unless noted otherwise in the Contract Documents.

2.2.3 **Copper conductors:** Minimum size #6 and larger, with 600 V insulation (for 208 V feeder) and 1000 V insulation (for 600 V feeder) of chemically cross-linked thermosetting polyethylene material rated RW90, and RWU90 as indicated on Contract Drawings.

2.2.4 All wires/cables free of all splices between terminations. If physical constraints of installation prevent this, details of splicing subject to TTC's approval.

2.2.5 Colour coding as follows:

2.2.5.1 **120/208 V & 347/600 V Circuits:**

2.2.5.1.1 **Conductor, 1 Phase:** Black and white.

2.2.5.1.2 **Conductor, 1 Phase:** Red, black and white.

2.2.5.1.3 **Conductor, 3 Phase:** Red, black and blue.

2.2.5.1.4 **Conductor, 3 Phase:** Red, black, blue and white.

2.2.5.2 **Ground:** Green.

**2.3 MINERAL - INSULATED (MI) CABLES**

2.3.1 **Conductors:** Solid bare soft-annealed copper, size as indicated on Contract Drawings.

2.3.2 **Insulation:** Compressed powdered magnesium oxide to form compact homogeneous mass throughout entire length of cable. Insulation voltage rating of 600 V.

2.3.3 **Sheath:** Seamless soft-drawn copper.

2.3.4 **Outer jacket:** Low smoke zero halogen with polyolefin applied over sheath.

2.3.5 **Cable:** FT4, 2 hours, in accordance with NFPA 130 and ANSI/UL-2196 or CAN/ULC-S139.

2.3.6 **Connectors:** Brass type approved by manufacturer.

2.3.7 **Termination kits:** Approved by manufacturer.

2.3.8 **Mounting channels, supports, and fasteners:** Stainless steel in accordance with Section 26 05 29.

## 2.4 METAL - CLAD (MC) CABLES (600 V)

- 2.4.1 Conductors: Annealed copper in accordance with ASTM B8.
- 2.4.2 Insulation: Low smoke zero halogen (LSZH) ceramifiable silicone.
- 2.4.3 Armour: Continuously welded and corrugated copper.
- 2.4.4 Outer Jacket: Flame resistant low smoke zero halogen.
- 2.4.5 Cable: Vitalink RC90, single or multi-conductor, rated for 600 V, 90°C, sunlight-resistant, 2-hour fire resistive in accordance with NFPA 130 and ANSI/UL-2196 or CAN/ULC-S139.
- 2.4.6 Connector: Brass, watertight, and CSA approved for copper metal clad cables.
- 2.4.7 Splices are not permitted unless pre-approved by TTC.
- 2.4.8 Mounting channels, supports, and fasteners: Stainless steel in accordance with Section 26 05 29.

## 2.5 CONTROL WIRE AND CABLE

- 2.5.1 Control Cable:
  - 2.5.1.1 RW90 thermosetting XLPE insulated, minimum 600 V insulation.
  - 2.5.1.2 Conductors to be soft annealed copper, minimum conductor size 2.5 mm<sup>2</sup> (No. 14 AWG), stranded, tinned unless otherwise indicated on the Contract Drawings.
- 2.5.2 Multi-conductor cables for installation in conduit, or cable tray to substation equipment.
  - 2.5.2.1 **Conductors:**
    - 2.5.2.1.1 Soft, untinned copper having physical characteristics in accordance with ASTM B3.
    - 2.5.2.1.2 8.38 mm<sup>2</sup> (No. 8 AWG), 5.26 mm<sup>2</sup> (No. 10 AWG) and 3.31 mm<sup>2</sup> (No. 12 AWG) conductors stranded with 7 concentric strands per conductor, conforming to CSA C22.2 No. 75.
  - 2.5.2.2 **Insulation:**
    - 2.5.2.2.1 Wires and cables with minimum 600 V insulation.
    - 2.5.2.2.2 Moisture resistant type "TW" thermoplastic compound with composition, physical and electrical properties, in accordance with CSA C22.2 No. 75. Insulation thickness for single conductor #8 to be 2 mm and for multi-conductor cables to conform to Table-10.
    - 2.5.2.2.3 **Wires No. 6 gauge and larger:** RW90 or RWU90 thermosetting XLPE insulated unless noted otherwise.
  - 2.5.2.3 **Colour Identification:**
    - 2.5.2.3.1 Individual conductors of multi-conductor cable identified by solid coloured insulant, in clockwise sequence as follows:

Conductor	Cable
1	Black
2	Red
3	Green
4	Yellow
5	Brown

Conductor	Cable
6	Orange
7	White

- 2.5.2.4 **Assembly of multi-conductor cable:** Length of lay of cabled conductors per Table 28 of CSA C22.2 No. 38. Interstices between conductors filled with non-hygroscopic material, where necessary. Conductor assembly taped together with one layer of mylar tape, lapped minimum 6 mm.
- 2.5.2.5 **Multi-conductor cable sheath:** Taped conductor assembly with continuously extruded thermoplastic jacket applied, to meet requirements for polyvinylchloride jacket as specified in ASTM D1047, except minimum elongation 150%. Sheath thickness 2 mm average, with minimum thickness at any point 80% of average.
- 2.5.2.6 **Tests:** Dielectric strength and insulation resistance tests performed on finished cable, and conform to CSA C22.2 No. 75. Conductor resistance tested and at 20°C not to exceed:
- 2.5.2.6.1 0.654 ohms per 305 m for #8 conductors.
- 2.5.2.6.2 1.62 ohms per 305 m for #12 conductors.
- 2.5.2.6.3 4.18 ohms per 305 m for #16 conductors.
- 2.5.2.7 **Marker:** Multi-conductor cables provided with identifying marker consisting of coloured threads incorporated in cable assembly or printed on surface of thermoplastic sheath.
- 3 Execution
- 3.1 EXAMINATION**
- 3.1.1 Verify cable end factory temporary seals have remained intact, insulation has not been exposed to air and no moisture has entered cable insulation.
- 3.1.2 Verify completion of Work by other trades likely to damage cable.
- 3.2 STORAGE**
- 3.2.1 Cables shipped from manufacturer with ends temporarily sealed against moisture ingress.
- 3.2.2 When cables cut in field, seal exposed end using standard sealing compound and PVC tape in accordance with cable manufacturer's recommendation.
- 3.2.3 Store cable in clean dry location.
- 3.3 HANDLING**
- 3.3.1 Uncoil cable by rolling or rotating supply reel (available from manufacturer) to ease handling and prevent possible snarling and kinking. Do not pull from coil periphery or centre.
- 3.3.2 Take precautions necessary to prevent damage to cable from contact with sharp objects, including pulling over foreign objects or sheaves.

### 3.4 WIRING METHODS

- 3.4.1 Use wiring methods indicated on the Contract Drawings, manufacturer's instructions, and as specified herein.

### 3.5 INSTALLATION OF WIRES AND CABLES (NON-MI CABLES)

- 3.5.1 Pull in all wires in any one conduit at same time directly from reels or coil carefully to avoid damage to conductors or insulation. In accordance with cable manufacturer's recommendations.
- 3.5.2 No joints in any conductors between any boxes or outlets. Neutral conductors unbroken throughout their length. Feeders continuous without splices throughout their entire length unless TTC's approval given to allow splices.
- 3.5.3 Use proper crimping tool on pressure applied specific connectors at conductor joints.
- 3.5.4 Properly designate wire and cable circuits at distribution panelboards and switchboards by specified fibre tag.
- 3.5.5 Use terminal lugs on conductors No.10 AWG or larger where they are terminated for connection to switchboard or other equipment. Apply lugs with proper tools.
- 3.5.6 Carefully unroll cable from reels and coil and run cable as complete from one outlet or junction box to next.
- 3.5.7 Seal space between cables and sleeves or wall or floor opening, with UL listed firestop putty, sealant, compound or pillow, after wires and cables have been installed. Refer to Section 07 84 00 for Products, locations, rating and installation.
- 3.5.8 If necessary to splice cable, make splice in junction box of adequate size. Keep number of splices in any run of cable to absolute minimum consistent with available coil length and with installation conditions. If in opinion of TTC excessive number of splices have been made in cable, remove cable and replace with proper number of splices.
- 3.5.9 Support cables on clips at maximum spacing of 1 m. Make bends in cable with proper tools (available from manufacturer), to following minimum radii measured inside bend.

SHEATH DIAMETER (OD)	MINIMUM BENDING RADIUS
Above 19 mm and including 38 mm	12 x Sheath diameter
Above 38 mm	15 x Sheath diameter

- 3.5.10 Straighten cable runs to form neat and uniform appearance. Route cables, where possible, parallel to or at right angles to walls, ceilings and floors. Where this is not possible seek permission from TTC.
- 3.5.11 Carry out stripping, straightening, bending, supporting and termination in conformity with this Section and installation instructions of cable manufacturer. Consult TTC regarding any discrepancy.
- 3.5.12 Carry conductors of branch circuits or feeders in same multi-conductor cable, unless otherwise noted or reviewed by TTC.
- 3.5.13 **Connectors:** Wing nut type as manufactured by Thomas & Betts.
- 3.5.14 **Terminal lugs:** Solderless pressure-applied type lugs. Lugs to have conductivity not less than wire or cable to which they are attached.
- 3.5.15 **Duct seal:** Duct Seal Weatherproof Compound by Appleton Electric Products.

- 3.5.16 **Soldering lugs:** As recommended by cable manufacturer.
- 3.5.17 Identify at both ends utilizing permanent markers in accordance with Section 26 05 53.
- 3.5.18 Install wiring as follows:
  - 3.5.18.1 In conduit systems in accordance with Section 26 05 34.
  - 3.5.18.2 In cable troughs in accordance with the OESC.
  - 3.5.18.3 In surface and lighting fixture raceways in accordance with the OESC.
  - 3.5.18.4 In wireways and auxiliary gutters in accordance with the OESC.
  - 3.5.18.5 Identify at both ends utilizing permanent markers in accordance with Section 26 05 53.
- 3.5.19 For LSZH jacketed cables pulled in conduit provide lubricant in accordance with cable manufacturer's recommendation.
- 3.5.20 Where wire size has been increased to compensate voltage drop, make reductions to wire size only at terminal lugs. In accordance with OESC, wire size shall not be reduced below rated circuit ampacity.
- 3.6 INSTALLATION OF MINERAL - INSULATED CABLES**
  - 3.6.1 Run cable concealed, securely supported by hangers.
  - 3.6.2 Support 2 h fire rated cables at 1 m intervals.
  - 3.6.3 Make cable terminations by using factory-made kits.
  - 3.6.4 At cable terminations use thermoplastic sleeving over bare conductors.
  - 3.6.5 Do not splice cables.
- 3.7 INSTALLATION OF MC CABLES (600 V)**
  - 3.7.1 Metal clad copper-sheathed cable shall be supported by cable straps that do not damage the cable sheathing and are approved by manufacturer.
  - 3.7.2 Cable supports shall not exceed 2 metres intervals.
  - 3.7.3 Cable bent radius shall not be smaller than indicated by the cable manufacturer and in accordance with OESC.
  - 3.7.4 Make splices in 2-hour fire resistive block splice box supplied by MC Cable Manufacturer and in accordance with manufacturer's instructions. Block splice box to be listed to ANSI/UL-2196 or CAN/ULC-S139 for fire exposure, 2-hour rated, and designated for use with Vitalink MC Cable and kit components.
  - 3.7.5 Use only stainless steel mounting channels, supports, and fasteners in accordance with Section 26 05 29.
- 3.8 INSTALLATION OF CONTROL CABLES**
  - 3.8.1 Install control cables in conduit.
  - 3.8.2 Ground control cable shield.

### **3.9 FIELD QUALITY CONTROL AND COMMISSIONING**

- 3.9.1 Perform commissioning in accordance with Sections 01 91 00, 26 05 00 and 26 08 00.
- 3.9.2 Inspect cable for physical damage and proper connection.
- 3.9.3 Verify continuity of each conductor.
- 3.9.4 Provide certification from cable manufacturer that installation is in accordance with their requirements.
- 3.9.5 Test all conductors for continuity, short circuits and grounds. Ensure resistance to ground not less than 50 megohms.
- 3.9.6 Pre-acceptance Tests:
  - 3.9.6.1 After installing cable but before splicing and terminating perform insulation resistance test with 1000 V (500 V for MI) megger on each conductor.
  - 3.9.6.2 Check insulation resistance after each splice and/or termination to ensure cable system ready for acceptance testing.
- 3.9.7 Acceptance Tests:
  - 3.9.7.1 Test insulation resistance, conductor resistance and capacitance to ensure cable in accordance with Specifications.
  - 3.9.7.2 Verify wiring interconnections by ringing out to ensure interconnections are in accordance with Contract Drawings.
  - 3.9.7.3 During testing ensure terminations and accessory equipment are disconnected.
  - 3.9.7.4 During testing ground shields, ground wires and conductors not under test.
- 3.9.8 Test results shown on the test sheets specified in Section 26 08 00 shall show the location at which each test was made and the circuit tested, and the result of each test.
- 3.9.9 Remove and replace entire length of cable if cable fails to meet any of test criteria.

**END OF SECTION**



- 1 General
- 1.1 SECTION INCLUDES**
  - 1.1.1 Labour, Products, equipment, testing and services necessary for grounding and bonding Work in accordance with the Contract Documents.
- 1.2 REFERENCES**
  - 1.2.1 CSA C22.1, Canadian Electrical Code.
  - 1.2.2 CSA C22.2 No. 31, Switchgear Assemblies.
  - 1.2.3 OESC, The Ontario Electrical Safety Code.
- 1.3 SUBMITTALS**
  - 1.3.1 Submit in accordance with Section 01 33 00.
  - 1.3.2 Shop Drawings:**
    - 1.3.2.1 Submit in accordance with Section 01 33 23 indicating:
      - 1.3.2.1.1 Technical data, supplemented by bulletins, component illustrations, detailed views, technical description of items and parts list.
  - 1.3.3 Quality Assurance Submittals:**
    - 1.3.3.1 Submit test results of ground continuity and resistance for the review of TTC.
  - 1.3.4 Commissioning Package:**
    - 1.3.4.1 Submit the following in accordance with Section 01 91 00:
      - 1.3.4.1.1 Commissioning Procedures.
      - 1.3.4.1.2 Certificate of Readiness.
  - 1.3.5 Commissioning Closeout:**
    - 1.3.5.1 Submit in accordance with Section 01 91 00.
    - 1.3.5.2 Submit Deficiency Report.
    - 1.3.5.3 Submit Commissioning Closeout Report.
  - 1.3.6 Closeout Submittals Package:**
    - 1.3.6.1 Submit the following for incorporation into Operation and Maintenance Manuals in accordance with Section 01 78 23:
      - 1.3.6.1.1 Operation and maintenance data.
      - 1.3.6.1.2 Recommended periodic inspection and maintenance procedures.
      - 1.3.6.1.3 Copy of full set of reviewed Shop Drawings with Marked-up Shop Drawings as applicable.
      - 1.3.6.1.4 Copy of warranty information.
  - 1.3.7 Pre-Start Health and Safety:**
    - 1.3.7.1 Submit Pre-Start Health and Safety Review Report in accordance with this Section.

## **1.4 QUALITY ASSURANCE**

1.4.1 Submit written test report in accordance with Section 26 08 00.

2 Products

## **2.1 MANUFACTURERS**

2.1.1 Thomas & Betts.

2.1.2 Burndy.

2.1.3 Dossert.

2.1.4 Hubbell.

2.1.5 Erico.

## **2.2 MATERIALS**

2.2.1 Ground conductors: Bare, stranded, soft-drawn copper 120 mm<sup>2</sup> (No. 4/0 AWG) for buried loops and interconnections of major equipment e.g. power transformers, switchboard and minimum 35 mm<sup>2</sup> (No. 2 AWG) for above ground runs to other distribution equipment unless indicated otherwise.

2.2.2 Grounding conductors: Green insulated up to size #1 AWG or bare conductors for larger sizes unless indicated otherwise on the Contract Drawings.

2.2.3 Bonding connections: Copper compression barrel terminals, rated for minimum 600 V at 90°C and CSA certified when applied with tool and die combination. One or two-hole terminals bolted to ground bus as indicated on Contract Drawings.

2.2.4 Grounding and bonding conductors: In accordance with the OESC, Table 16/Table 51 or as specified in the Contract Documents.

## **2.3 ELECTRICAL SAFETY GROUNDING**

2.3.1 Supply means for permanent and effective electrical grounding of exposed non-current-carrying metal parts, assemblies housing electrical current carrying components, as required by the OESC and Contract Drawings.

2.3.2 Additional grounding requirements in accordance with CSA C22.2. No. 31 and Occupational Health and Safety Act and Regulations for Construction Projects.

2.3.3 All electrical distribution and control equipment doors to have flexible ground bonding braid to extend ground from equipment ground bus bar and not rely on hinge.

2.3.4 Provisions for grounding to consist of grounding bus.

2.3.5 Supply grounding bus with compression type connectors suitable for connection of external copper grounding conductors of at least No. 4/0 AWG in size.

3 Execution

## **3.1 INSTALLATION**

3.1.1 Provide grounding conductors, bonding and tap connections for complete grounding system in accordance with Contract Drawings.

3.1.2 Bond metallic conduits, boxes and non-current-carrying metal parts of equipment together to form continuous grounded system.

- 3.1.3 Install grounding conductors without damage, do not dislodge or displace during construction Work. Install conductors with enough slack to prevent breaking stresses.
- 3.1.4 Install separate ground conductor in all conduits sized to OESC unless noted otherwise.
- 3.1.5 Provide additional grounding in accordance with the OESC and the requirements of authorities having jurisdiction.

**3.2 FIELD QUALITY CONTROL AND COMMISSIONING**

- 3.2.1 Perform commissioning in accordance with Sections 01 91 00, 26 05 00 and 26 08 00.
- 3.2.2 Conduct ground continuity and resistance tests using 62% or “fall of potential” method. Submit ground continuity and resistance test results to TTC for review. Perform tests in accordance with Section 26 08 00 prior to energizing electrical systems.

**END OF SECTION**



1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment and services necessary for hangers and supports Work in accordance with the Contract Documents.

**1.2 REFERENCES**

1.2.1 ASTM A123/A123M, Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron & Steel Products.

1.2.2 ASTM A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

1.2.3 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

1.2.4 ASTM A1008/A1008M, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.

1.2.5 ASTM B633, Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

1.2.6 ASTM B766, Specification for Electrodeposited Coatings of Cadmium.

1.2.7 CSA, Canadian Standards Association.

1.2.8 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standards for Electrical Installations.

1.2.9 OESC, Ontario Electrical Safety Code.

1.2.10 ULC, Underwriters Laboratories of Canada.

**1.3 SUBMITTALS**

1.3.1 Submit in accordance with Section 01 33 00.

**1.3.2 Product Data Package:**

1.3.2.1 Submit manufacturer's Product data in accordance with Section 01 33 00 indicating:

1.3.2.1.1 Technical data, supplemented by bulletins, component illustrations, detailed views, technical descriptions of items, and parts lists.

1.3.2.1.2 Performance criteria, compliance with appropriate reference standards, characteristics, limitations, and troubleshooting protocol.

1.3.2.1.3 Product transportation, storage, handling, and installation requirements.

2 Products

**2.1 MANUFACTURERS**

2.1.1 Unistrut Corporation.

2.1.2 Hilti Corp.

2.1.3 Copper (B-Line) Inc.

2.1.4 Thomas & Betts.

## 2.2 MATERIALS

- 2.2.1 Anchor bodies, nuts, washers and expansion elements to be manufactured from AISI 304 and AISI 316 stainless steel.
- 2.2.2 Drop-in anchors in accordance with AISI 303 requirements for stainless steel.
- 2.2.3 Threaded rod shall be carbon steel, zinc electroplated in accordance with ASTM B633, SC 1, Type I. Threads to be Class 2A fit, Class 2B thread.
- 2.2.4 Mounting channel shall be carbon steel hot-dipped galvanized in accordance with ASTM A123/A123M for channels and ASTM A153/A153M for angles, connectors, bases and fasteners.
- 2.2.5 Cable tray, fittings and accessories in accordance with CSA C22.2 No. 126.1. Hot-dip galvanized in accordance with ASTM A1008/A1008M, SS Grade 33, Type 2, in accordance with ASTM A123/A123M providing a minimum thickness of 457 g/m<sup>2</sup>.
- 2.2.6 Fastening devices in various types of structures:
  - 2.2.6.1 Fastening devices shall be sized by the Contractor for specific loading applications and installed in accordance with manufacturer's recommendations.
    - 2.2.6.1.1 **Precast Concrete Panel:**
      - 2.2.6.1.1.1 Medium to light duty applications: Sleeve anchor, stainless steel, HLC by Hilti Corp.
      - 2.2.6.1.1.2 Heavy-duty applications: Heavy-duty expansion anchor, stainless steel, HSL-3 by Hilti Corp.
    - 2.2.6.1.2 **Concrete Structure:**
      - 2.2.6.1.2.1 Seismic application: Expansion anchor, stainless steel, Kwik Bolt TZ by Hilti Corp.
      - 2.2.6.1.2.2 Non-Seismic applications: Expansion anchor, stainless steel, Kwik Bolt-3 by Hilti Corp.
    - 2.2.6.1.3 **Concrete Block Wall:**
      - 2.2.6.1.3.1 Medium to light duty applications: Sleeve anchor, stainless steel, HLC by Hilti Corp.
    - 2.2.6.1.4 **Concrete Anchoring:**
      - 2.2.6.1.4.1 Drop in anchor, expansion type, stainless steel, internally threaded and flush mounted, HDI or HDI-L by Hilti Corp.
    - 2.2.6.1.5 Threaded rod, carbon steel, zinc electroplated, threaded rod by Hilti Corp.
    - 2.2.6.1.6 **Hollow wall anchoring:** Sleeve anchor, stainless steel, HLC by Hilti Corp.
    - 2.2.6.1.7 **Steel beams and columns:** Beam clamps, malleable and iron electro-galvanized, BC-EG by Hilti Corp.
  - 2.2.7 Mounting Channels:
    - 2.2.7.1 Mounting channel size, gauge and profile to be determined by the Contractor for specific application and installed in accordance with manufacturer's recommendations.
    - 2.2.7.2 C-profile channel, with serrated edges for extra hold, shall be hot-dipped galvanized steel, Strut by Hilti Corp.
    - 2.2.7.3 Fastening equipment for mounting channel: Bolts, washers, nuts, saddle nuts, brackets, angle brackets, splice plates, clamps and bases shall be manufactured from hot-dipped galvanized steel.

- 2.2.7.4 Conduit/cable support clamps shall be hot-dipped galvanized.
- 2.2.8 Cable Trays:
- 2.2.8.1 Cable tray shall be ladder type, consisting of straight sections, fittings and accessories. Cable tray must be listed by CSA/ULC as equipment grounding (or bonding) conductor.
- 2.2.8.2 Cable tray, siderails and rungs shall be hot-dip galvanized steel with minimum thickness of 457 g/m<sup>2</sup>.
- 2.2.8.3 Ladder tray shall incorporate 2 siderails connected by lateral rungs. Rungs shall be 25.4 mm centres for attachment of cable ties, and perpendicular to the centre of the siderails.
- 2.2.8.4 Cable tray shall meet specified CSA load ratings with safety factor of 1.5. The cable tray shall support a 90 kg concentrated load of midspan over and above stated cable load.
- 2.2.8.5 Size cable tray for contained cables to occupy 60% maximum of cross-sectional area; size cable tray to contain cables without projecting above top of tray. Minimal cable tray sizes indicated on Contract Drawings shall not be reduced without TTC's permission.
- 2.2.8.6 Supply special sections such as horizontal elbows, vertical risers, reducers, horizontal and vertical tees, and similar items as required to complete installation. Supply covers for vertical sections. Support cables in vertical sections with cushion clamps. Supply grommetted cut-outs for cable entry into 208 V switchboard. Supply covers as indicated on Contract Drawings.
- 2.2.8.7 Bond/ground cable tray in accordance with Section 26 05 26.
- 2.2.9 **Wire harness:** Supply strapping for control wire and cable installation within equipment.
- 2.2.10 **Touch up paint:** Inorganic zinc rich primer, recommended by manufacturer.
- 2.3 FABRICATION**
- 2.3.1 Fabricate mounting channels for cable trough in U-shape; hot dip galvanized after fabrication to ASTM A123/A123M.
- 3 Execution
- 3.1 INSTALLATION**
- 3.1.1 **Precast concrete panel:** Obtain approval from TTC before drilling precast concrete panels.
- 3.1.2 Install mounting channels for support of conduits, cables, troughs, trays, lighting fixtures, boxes, cabinets and other electrical devices and equipment.
- 3.1.3 Fasten mounting channels at maximum 100 mm from each end and install clamps for mounting conduits and cables on channels.
- 3.1.4 Secure equipment to concrete structure with expansion anchors or drop-in anchors.
- 3.1.5 Secure equipment to hollow masonry walls with sleeve anchors.
- 3.1.6 **Steel beams and columns:** Drill through steel and bolt as accepted by TTC.

- 3.1.7 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Before installation, ensure ceiling adequately supported to carry weight of equipment specified.
- 3.1.8 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- 3.1.9 **Cable trays:** Install in accordance with manufacturer's written instructions.
- 3.1.10 **Wire harness:** Install in accordance with manufacturer's instructions. Install wire harness to support wires and cables correctly.
- 3.1.11 Fasten exposed conduit or cables to structures or support system using straps, as follows:
  - 3.1.11.1 One-hole steel straps to secure surface conduits and cables smaller than 50 mm dia.
  - 3.1.11.2 Two-hole steel straps for conduits and cables 50 mm and larger in diameter.
  - 3.1.11.3 Beam clamps to secure conduit to exposed steel work.
- 3.1.12 Suspended Support Systems:
  - 3.1.12.1 Support individual cable or conduit runs with minimum 6 mm dia threaded rods and spring clips.
  - 3.1.12.2 Support 2 or more cables or conduits on channels supported by minimum 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.
- 3.1.13 For surface mounting of 2 or more conduits, use channels at maximum 1500 mm o.c. spacing.
- 3.1.14 Install metal brackets, frames, hangers, clamps and other supports where indicated or as required to support conduit and cable runs.
- 3.1.15 Install woven stainless steel wires or nylon cable grips, one per cable, in conjunction with clamps/straps to support cables within cable tray risers.
- 3.1.16 Install threaded rods and brackets for raceway risers where there is no wall support.
- 3.1.17 Do not use wire lashing or perforated straps to support or secure raceways or cables.
- 3.1.18 Do not use hangers, supports or cable trays to support equipment of other trades, except when permitted by TTC.
- 3.1.19 Do not use supports of other trades to hang conduits or cable support, except when permitted by the respective trades and accepted by TTC.
- 3.1.20 Install fastenings and supports as required for each type of equipment, cables and conduits, and in accordance with manufacturer's recommendations.
- 3.1.21 Touch up abrasions, cuts and welds of galvanized material with touch up paint and remove sharp edges.

**END OF SECTION**



1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment and services necessary for splitter boxes, junction boxes, pullboxes and cabinets Work in accordance with the Contract Documents.

**1.2 REFERENCES**

1.2.1 ANSI/ASA 61, Gray Powder Coating.

1.2.2 CSA C22.2 No. 0, General Requirements – Canadian Electrical Code, Part II.

1.2.3 CSA C22.2 No. 0.4, Bonding of Electrical Equipment.

1.2.4 CSA C22.2 No. 26, Wireways, Auxiliary, Gutters and Associated Fittings.

1.2.5 CSA C22.2 No. 40, Cutout, Junction and Pullboxes.

1.2.6 CSA C22.2 No. 85-M, Rigid PVC Boxes and Fittings.

1.2.7 CSA C22.2 No. 94-M, Special Purpose Enclosures.

1.2.8 NEMA, National Electrical Manufacturers Association.

1.2.9 OESC, The Ontario Electrical Safety Code.

**1.3 SUBMITTALS**

1.3.1 Submit in accordance with Section 01 33 00.

**1.3.2 Shop Drawings:**

1.3.2.1 Submit in accordance with Section 01 33 23 indicating:

1.3.2.1.1 Technical data supplemented by bulletins, component illustrations, detailed views, technical descriptions of items and parts lists.

1.3.2.1.2 Performance criteria, compliance with appropriate reference standards, characteristics, limitations, and troubleshooting protocol.

1.3.2.1.3 Product transportation, storage, handling, and installation requirements.

1.3.2.1.4 Mounting details, methods and dimensions.

1.3.2.1.5 Enclosure type and size.

1.3.2.1.6 Internal layout of identified components.

1.3.2.1.7 Front panel layout of identified components.

1.3.2.1.8 Electrical wiring diagram with internal and external connections.

1.3.2.1.9 Bill of material listing all components.

1.3.2.1.10 Electrical schematic with description of operations, complete with terminal numbers and field connections.

2 Products

**2.1 MANUFACTURERS**

2.1.1 Hammond.

2.1.2 Hubbell.

2.1.3 Appleton.

2.1.4 Eurobex.

2.1.5 Thomas & Betts.

**2.2 MANUFACTURED EQUIPMENT**

**2.2.1 Junction boxes and pullboxes, CSA certified, to be used with the following, unless indicated otherwise:**

**2.2.1.1 Rigid Galvanized Steel Threaded Conduit and TECK Cable:**

2.2.1.1.1 Enclosures shall be fabricated from minimum 1.9 mm thick galvanized sheet steel, powder coated in accordance with ANSI/ASA 61, grey epoxy textured powder electrostatically applied inside and out and suitable for surface or flush mounting. Enclosure shall be complete with screw on cover, a neoprene gasket for a water-tight seal and a 1.9 mm thick inner plate. Enclosures shall be minimum size of 150 mm x 150 mm x 100 mm. Type NEMA-1 or NEMA-3R, as indicated on Contract Drawings.

2.2.1.1.2 Round junction boxes shall be fabricated from malleable iron, high tensile strength and ductility, high corrosion resistance and high impact and shock resistant. Junction boxes shall be suitable for exposed or concealed installations, cast ferrous alloy cover, neoprene gasket, 4 tapped holes, 2 external mounting tabs, 4 tapped conduit entries for rigid galvanized steel threaded conduit and 2 close-up plugs (hub size as required). Type NEMA-4 or stainless steel NEMA-4X, as indicated on Contract Drawings.

**2.2.1.2 Mineral Insulated Cable:**

2.2.1.2.1 Round junction boxes or square junction boxes shall be fabricated from malleable iron, high tensile strength and ductility, high corrosion resistance and high impact and shock resistant. Junction box shall be suitable for exposed or concealed installations, cast ferrous alloy cover, neoprene gasket, 4 tapped holes and external mounting tabs. Type NEMA-4.

**2.2.1.3 Liquid-tight Flexible Conduit:**

2.2.1.3.1 Enclosures shall be fabricated from minimum 1.9 mm thick sheet steel, powder coated in accordance with ANSI/ASA 61, grey epoxy textured powder electrostatically applied inside and out and suitable for surface or flush mounting. Enclosure shall be complete with screw on cover, a neoprene gasket for a water-tight seal and a 1.9 mm thick inner plate. Enclosures shall be minimum size of 150 mm x 150 mm x 100 mm. Type NEMA-4 or stainless steel NEMA-4X, as indicated on Contract Drawings.

2.2.1.3.2 Round junction boxes shall be fabricated from malleable iron, high tensile strength and ductility, high corrosion resistance and high impact and shock resistant. Junction box shall be suitable for exposed or concealed installations, cast ferrous alloy cover, neoprene gasket, 4 tapped holes, 2 external mounting tabs, 4 tapped conduit entries for rigid galvanized steel threaded conduit and 2 close-up plugs (hub size as required). Type NEMA.

**2.2.2 Fasteners:**

2.2.2.1 For fastener, refer to Section 26 05 29.

**2.2.3 Device Boxes:**

2.2.3.1 Provide device boxes in accordance with Section 26 27 26.

3 Execution

**3.1 INSTALLATION**

3.1.1 Install junction boxes, pullboxes as required to suit Site conditions.

3.1.2 Before proceeding with installation, ensure junction/pull boxes, conduits and other electrical equipment clear mechanical, architectural and other installations.

3.1.3 Install junction and pullboxes in accordance with the OESC.

3.1.4 Set boxes and fittings square with adjacent ceiling, floor, wall or beam line and support independently of conduits entering same. Keep unused knockouts flush and tight. Unused nailing or other holes in boxes not permitted.

3.1.5 Locate boxes to be freely accessible. Locate boxes above suspended ceilings within reach of openings for ceiling recessed fixtures. Install access panels where boxes inaccessible.

3.1.6 Install pullboxes in every conduit run exceeding 30 m between termination points. Space pullboxes 30 m maximum apart. Use maximum (4 quarter bends) 4 right angle bends, or equivalent, in conduit run between pullboxes.

3.1.7 TTC reserves right to alter location of any electrical installation by 1.5 m, without increase to Contract Price, prior to outlet installation.

3.1.8 Install correct identification for boxes in accordance with Section 26 05 53.

3.1.9 Install junction boxes recessed in Office, Zone Hub, Storage Room.

**END OF SECTION**



1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment and services necessary for conduits Work in accordance with the Contract Documents.

**1.2 REFERENCES**

1.2.1 ASTM A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

1.2.2 ASTM E136, Standard Test Method for Behaviour of Materials in a Vertical Tube Furnace 750°C.

1.2.3 CAN/CGSB 1.181, Ready-Mixed Organic Zinc-Rich Coating.

1.2.4 CE12-1000, PVC Coated Rigid Metal Conduit.

1.2.5 CEC 12-1200 thru 12-1220, Rigid RTRC (Fiberglass) Conduit.

1.2.6 CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit.

1.2.7 CSA C22.2 No. 45, Rigid Metal Conduit.

1.2.8 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.

1.2.9 CSA C22.2 No. 83, Electrical Metallic Tubing.

1.2.10 CSA C22.2 No. 85, Rigid PVC Boxes and Fittings.

1.2.11 NFPA 130, Standard for Fixed Guideway Transit and Passenger Rail Systems.

1.2.12 OBC, Ontario's Building Code.

1.2.13 OESC, Ontario Electrical Safety Code.

1.2.14 UL 2196, 2 Hour Fire Test for Fire Resistive Cables (RTRC- Phenolic).

**1.3 SUBMITTALS**

1.3.1 Submit in accordance with Section 01 33 00.

**1.3.2 Product Data and Shop Drawings Package.**

**1.3.2.1 Product Data:**

1.3.2.1.1 Submit manufacturer's Product data for all Products listed in this Section indicating:

1.3.2.1.1.1 Technical data, supplemented by bulletins, component illustrations, detailed views, technical descriptions of items and parts lists.

1.3.2.1.1.2 Performance criteria, compliance with appropriate reference standards, characteristics, limitations, and troubleshooting protocol.

1.3.2.1.1.3 Product transportation, storage, handling, and installation requirements. Indicate application conditions and limitations of use of Product as stipulated by product testing agency specified under regulatory requirements.

1.3.2.1.1.4 Submit RTRC conduit manufacturer test reports and technical documentation which demonstrate the conduit-cable assembly and horizontal/vertical support system has been tested to UL 2196 and ASTM E136 in accordance with NFPA 130 for fire resistive applications.

**1.3.2.2 Shop Drawings:**

1.3.2.2.1 Submit Shop Drawings in accordance with Section 01 33 23 indicating:

1.3.2.2.1.1 All conduits used on Contract.

1.3.2.2.1.2 All conduits terminations used on Contract.

1.3.2.2.1.3 All conduits supports used on Contract.

**1.3.3 Quality Assurance Package:**

1.3.3.1 Submit written report results in accordance with Section 26 08 00.

**1.3.4 Commissioning Package:**

1.3.4.1 Submit the following in accordance with Section 01 91 00:

1.3.4.2 Commissioning Plan.

1.3.4.3 Commissioning Procedures.

1.3.4.4 Certificate of Readiness.

**1.3.5 Commissioning Closeout Package:**

1.3.5.1 Submit Deficiency Report.

1.3.5.2 Submit Commissioning Closeout Report.

**1.4 RESTRICTION**

1.4.1 Do not use PVC piping inside or within 1 m of subway station structures.

2 Products

**2.1 MANUFACTURERS**

2.1.1 Metallic conduit: Columbia MBF/Allied Tubing or Wheatland Tube.

2.1.2 Anchors and fasteners: In accordance with Section 26 05 29.

2.1.3 PVC coated RGS conduit: Ocal by Thomas & Betts or Perma-Cote by Robroy Industries.

**2.2 MATERIALS**

**2.2.1 Rigid Galvanized Steel (RGS) Conduit:**

2.2.1.1 Material: Hot-dip galvanized steel tubing. Metallic rigid conduit other than hot-dip galvanized rigid steel is unacceptable.

2.2.1.2 Restrictions: In accordance with OESC, Rule 12-1000, rigid and flexible metal conduit.

2.2.1.3 Applications: Indoor, outdoor, wet and dry locations, elevator/escalator shafts, concealed or exposed to all atmospheric conditions. Permitted in hazardous locations in accordance with OESC, Section-18, hazardous locations and as indicated on Contract Drawings or as instructed by TTC.

2.2.1.4 Fittings: Use threaded hubs (bullet hubs) for connections to threadless junction boxes, enclosures and equipment. Threaded hubs shall be of rugged steel/malleable iron construction, electro-zinc plated, complete with nylon insulated throat. Couplings shall be threaded of rugged steel/malleable iron construction and electro-zinc plated and shall allow conduit coupling without rotating either pipe. Straps shall be steel/malleable iron construction with hot-dipped galvanized finish. Expansion/contraction fitting shall be telescopic sleeve type with bonding jumper and made of steel/malleable iron construction with hot-dipped galvanized finish. Conduit bodies shall be steel/malleable iron with zinc electroplate finish.

2.2.1.5 Conduit shall be threaded at both ends.

**2.2.2 Flexible Metal Conduit:**

2.2.2.1 Material: Flexible steel armour.

2.2.2.2 Restrictions: Not permitted in hazardous classified locations, embedded in concrete or aggregate, in wet locations, exposed to oil or gasoline. It shall not be subject to physical damage and limited to less than 1 m in Public Areas. It shall be limited to maximum 600 V and in accordance with OESC, Rule 12-1000, rigid and flexible metal conduit.

2.2.2.3 Applications: Exposed or concealed work, limited to maximum 1 m unless noted otherwise and shall be approved by TTC.

2.2.2.4 Fittings: Rugged steel/malleable iron construction, electro-zinc plated, nylon insulated throat complete with bushing and locknut.

**2.2.3 Liquid-Tight Flexible Conduit:**

2.2.3.1 Material: Corrosion resistant galvanized steel flexible inner core extruded with flexible durable PVC jacket. PVC jacket shall be resistant to sunlight, oils, acids and vapours while providing protection from moisture.

2.2.3.2 Restrictions: Not permitted in hazardous classified locations, embedded in concrete, aggregate or cinder fill. It shall be limited to maximum 600 V and in accordance with OESC, Rule 12-1300, liquid-tight flexible metal conduit.

2.2.3.3 Applications: Indoor, outdoor, concealed, wet and dry locations.

2.2.3.4 Fittings: Compression metallic convolution type suitable for liquid-tight conduit where exposed to moisture, made from steel/malleable iron and electro-zinc plated and chromate coated for corrosion protection, complete with body, gland, locknut, ground cone, sealing gasket and insulator.

**3 Execution**

**3.1 PREPARATION**

3.1.1 Carefully clean conduits before and after installation. Clean burrs from ends and free inside surface from imperfections likely to damage wires or cables.

3.1.2 Immediately before wires or cables pulled into any conduit run, snake with steel band with tube cleaner equipped with spherical mandrel, diameter minimum 85% of nominal inside diameter of conduit. Remove and replace conduits not passing mandrel.

### **3.2 INSTALLATION - GENERAL**

- 3.2.1 Minimum conduit size 21 mm unless indicated otherwise. No reduction in sizes shall be permitted without the acceptance of TTC.
- 3.2.2 Prior to installation of conduit, check installation does not hinder or obstruct equipment or space allocated to other Products.
- 3.2.3 Protect conduits from entrance of water or other foreign matter, by adequate and complete plugging overnight or when Work temporarily suspended. Plug ends of conduits with plastic plugs to ensure plugged or capped ends form watertight seal.
- 3.2.4 Install surface mounted conduit parallel to, or at right angles to, structure lines, walls, ceilings or floors. Form bends, off-sets and supply necessary fittings for installation of conduits.
- 3.2.5 Install conduits to allow conductors drawn-in without excessive strain or damage.
- 3.2.6 Install fish wire in conduits to facilitate wire/cable pulling and additional fish wire left in place to facilitate pulling additional wires and cables.
- 3.2.7 Exposed conduits shall be metallic.
- 3.2.8 Use bends or off-sets only where necessary. Make bends and offsets in field with correct tools to avoid flattening of conduit. Split, deformed or damaged conduits not permitted.
- 3.2.9 Install specified expansion or deflection fittings where conduits cross expansion/contraction or deflection joints.
- 3.2.10 Replace broken conduits which may be caused inadvertently by construction activities.
- 3.2.11 Install rigid hot-dipped galvanized steel conduits in subway station, unless indicated otherwise. To be used for all electrical power circuits unless noted otherwise.
- 3.2.12 Where rigid conduit enters pullboxes, junction boxes, panelboards and cabinets, install iron hub fittings.
- 3.2.13 Fasten conduits with anchors spaced maximum 1500 mm apart. Fasten clamps to concrete or masonry with specified anchors.
- 3.2.14 Install hot-dipped galvanized steel supports necessary to mount conduit fittings, conduit and boxes in locations where no mounting surface available.
- 3.2.15 Identify conduits at both ends, by means of permanent stainless steel tags in accordance with Section 26 05 53.
- 3.2.16 Install all conduits to meet OBC, OESC and NFPA 130 requirements.
- 3.2.17 Flexible metal conduit shall not be used for connecting to panelboards or switchboards unless approved by TTC.
- 3.2.18 All conduit penetrations through floor slabs are to be installed to prevent water flow between floors, by means of cast-in-place galvanized sleeves, built-up concrete pad, or sealed galvanized metal water dams. Seal conduit penetrations to prevent smoke or water passage.
- 3.2.19 Conduits are to be concealed in areas accessible to public, unless indicated otherwise.
- 3.2.20 Conduits are not allowed to pass through wayfinding sign boxes, light fixtures or enclosures and shall not create any obstruction for maintenance.

### **3.3 INSTALLATION - METALLIC CONDUITS**



3.3.1 Fasten conduits by specified clamps spaced maximum 1.5 m apart. Fasten clamps to concrete or masonry with specified anchors.

3.3.2 Apply Red Glyptal compound to threads of rigid galvanized metal conduit and fittings. Touch-up scratches and wrench marks with touch-up paint as work progresses.

3.3.3 Install metallic conduit unless indicated otherwise.

### **3.4 BENDING RADIUS - METALLIC AND NON-METALLIC CONDUITS**

3.4.1 Make bends in conduit of the following minimum radii:

Size of Conduit	Minimum Radius of Bend
21 mm & 27 mm	300 mm
41 mm	450 mm
53 mm	600 mm
103 mm	900 mm

### **3.5 EXISTING CONDUIT**

3.5.1 Assume existing conduits in Work area contain live circuits. Coordinate with TTC for power isolation to live circuits.

3.5.2 Conduits located in Work area that obstruct and interfere with Work, shall be traced to source and rerouted. Coordinate with TTC for conduit rerouting and temporary connections to existing equipment. Existing equipment shall be maintained and remain operable during duration of Work.

3.5.3 Relocate temporary or permanent electrical equipment and conduits in accordance with the OESC requirements. Location of relocated equipment shall be approved by TTC.

### **3.6 FIRESTOPPING AND SMOKE SEALS**

3.6.1 Maintain the integrity of all floors and fire separations by installing firestopping and smoke seals for all electrical services passing through floors or fire separations.

3.6.2 Install firestopping and smoke seals in fire separations for the following services:

3.6.2.1 Feeders serving emergency distribution equipment, lighting panels and emergency motor starters.

3.6.2.2 Fire alarm system, feeders containing wiring for more than one floor between control and annunciator panels and between data gathering panels on risers.

3.6.2.3 Conduits which are part of the subway ventilation system.

3.6.2.4 Feeders to central alarm and control facilities.

3.6.2.5 Where indicated on Contract Drawings.

3.6.2.6 Feeders to HVAC systems.

**END OF SECTION**



1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment and services necessary for electrical identification of electrical equipment and systems in accordance with the Contract Documents.

**1.2 REFERENCES**

1.2.1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standards for Electrical Installation.

**1.3 ELECTRICAL IDENTIFICATION PROCEDURES**

1.3.1 Develop principal equipment numbers from equipment flow sheets with numbers increasing in direction of flow.

1.3.2 Use numbering system throughout course of Work including on Shop and As-Built Drawings.

1.3.3 Make electrical identification in English.

1.3.4 Where wording of electrical identification not specified on Contract Drawings, obtain exact wording from TTC.

1.3.5 Manufacturer's Nameplate:

1.3.5.1 Mount manufacturer's nameplate on each piece of equipment, mechanically fastened with raised letters. Fabricate nameplates to withstand wear or deterioration of lettering in located environment.

1.3.5.2 Indicate size, equipment model, manufacturer's name, serial number, voltage, cycle, phase and power of motor.

1.3.5.3 Identify electrical equipment with following labels:

1.3.5.3.1 TTC electrical equipment identifying label.

1.3.5.3.2 Approval label (CSA, ULC or ESA approval).

1.3.6 System identification:

1.3.6.1 **Conduit:** List conduits other than lighting and receptacle circuits on conduit schedule and identify as 00 - TV - 001 where:

1.3.6.1.1 00 - Geographical Division.

1.3.6.1.2 TV - Function.

1.3.6.1.3 001 - Sequential Number.

1.3.6.2 Identify function of conduit as follows:

TB	Tunnel Barrier
TV	Closed Circuit Television (CCTV)
TP	Traction Power (DC)
ET	Emergency Trip
PT	Public Pay Telephone
PX	TTC Telephone (Pax)
PI	Passenger Info (Signage)
PA	Public Address
FA	Fire Alarm/Detection

VS	Ventilation System
EL	Emergency Lighting
SE	Security System
TI	Train Destination (Signage)
AI	Passenger Assistance Intercoms
RS	Radio System
SI	Signal System
CB	Communications Backbone
FC	Fare Collection System
MF	Multi-function (i.e., annunciation, control and miscellaneous Instrumentation circuits, routed in one conduit)
EC	Empty Conduit
BT	Bell Telephone (Main Feeder to Switchboard)
HV	High Voltage (Main Feeders).
GR	Grounding

1.3.6.3 **Pullboxes and junction boxes:** List pullboxes and junction boxes other than those for lighting and receptacle circuits on electrical box schedule and identified as 00 - A - 001 where:

1.3.6.3.1 00 - Geographical Division.

1.3.6.3.2 A - Function.

1.3.6.3.3 001 - Sequential Number.

1.3.6.4 Identify function of each pullbox and junction box as follows:

A	Public Address
V	Voice Communication (PA system)
F	Fire Alarm/Detection
P	Power (AC or DC)
T	Closed Circuit Television (CCTV)
E	Emergency Alarm Station (EAS)
W	Pullbox used in safety walkway or station platform where more than one function converge (such as V,P,E and similar items)
S	Signalling/Train Control
G	Fibre Optic
Z	Empty Box
C	Control
Q	Security
B	Telephone
I	Intercom
D	Dynamic Information Display

1.3.6.5 **Cable tray identification:** Identify cable trays as 00 - H - 001 where:

1.3.6.5.1 00 - Geographical Division.

1.3.6.5.2 H - Function.

1.3.6.5.3 001 - Sequential Number.

1.3.6.6 Identify function of each cable tray as follows:

H	High Voltage 27.6 kV Power
M	Medium Voltage 5 kV, 15 kV Power
L	Low Voltage AC Power (600 V and less)

D	Low Voltage DC Power (129 V and less)
T	600 V DC Traction Power
G	Fibre Optic
S	Low Voltage Signal
C	Control

1.3.7 Cable system identification:

1.3.7.1 Identify cable whose origin and destination are within confines of same geographical division as 00 - ARB1 / RT1 - P 01 where:

1.3.7.1.1 00 - Geographical Division.

1.3.7.1.2 ARB1 - Equipment Identifier with sequential number for cable's origin.

1.3.7.1.3 RT1 - Equipment Identifier with sequential number for cable's destination.

1.3.7.1.4 P - Cable Category.

1.3.7.1.5 01 - Sequential Number.

1.3.7.2 Identify cable whose origin is in one geographical division and destination in another geographical division as 00 - RTU1 / 00 - CACF - J 01 where:

1.3.7.2.1 00 - Geographical division number for cable's origin.

1.3.7.2.2 RTU1 - Equipment Identifier with sequential number for cable's origin.

1.3.7.2.3 00 - Geographical Division number for cable's destination.

1.3.7.2.4 CACF - Equipment Identifier with sequential number for cable's destination.

1.3.7.2.5 J - Cable Category.

1.3.7.2.6 01 - Sequential number.

1.3.7.3 Identify cable category as follows:

P	Power (AC)
C	Control
J	Data/Instrumentation, Annunciation
S	Low Voltage Signal (CCTV, Radio, LAN, Security)
G	Fibre Optic
D	Power (DC)
E	Ground

1.3.8 Electrical equipment identification:

1.3.8.1 Identify electrical equipment as 00 - EAS - 1 where:

1.3.8.1.1 00 - Geographical Division.

1.3.8.1.2 EAS - Equipment identifier.

1.3.8.1.3 1 - Sequential number.

1.3.8.2 Identify equipment identifier as follows:

IDENTIFIER	EQUIPMENT DESCRIPTION
ACB	Air Circuit Breaker
ABT	AC Tie Breaker
AN	Antennae
ARP	Agent Release Panel

AT	Auxiliary Transformer
ATS	Automatic Transfer Switch
BAP	Burglar Alarm Panel
BL	Blue Light
BT	Public Telephone (Bell)
CACF	Central Alarm Control Facility
CC	Control Cabinet
CM	Control Module (Fire Alarm/Detection)
CP	Control Panel
CR	Auxiliary Control Relay
CTC	Cable Termination Cabinet
DBC	DC Breakers Control Panel
DBT	DC Tie Breaker
DICC	Dynamic Information Control Cabinet
DIDU	Dynamic Information Display Unit
DP-X	Distribution Panelboard (Review Contract Drawings for panel designation X e.g. 'A')
DRB	DC Rectifier Breaker
DS	Disconnect Switch
DSW	DC Switchgear
EAS	Emergency Alarm Station
ECC	Escalator Control Cabinet
ECP	Escalator Control Panel
ELCP	Escalator Lubricator Control Panel
EOIS	Electrically Operated Isolating Switch
ETS	Emergency Trip Switch
FAA	Fire Alarm Audible Device
FACP	Fire Alarm Control Panel
FAP	Fire Alarm Panel
FAS	Fire Alarm Visual Device
FB	Fire Alarm Bell
FDP	Fan Diagnostic Panel
FFH	Fire Fighter's Handset
FIM	Fault Isolator Module (Fire Alarm/Detection)
FNAGS	Floating Negative Automatic Grounding Switch
FOCC	Fibre Optic Control Cabinet
FOPP	Fibre Optic Patch Panel
FOSP	Fibre Optic Splice Box
FQ	Frequency Switch
FS	Flow Switch
GD	Guard Departure Light
GR	Grounding
HS	Humidity Switch
HD	Heat Detector (Fire Alarm/Detection)
HTR	Heater/Heating Element Input
IC	Intercom Outlet
ICBC	Intercom Collector's Booth Console
IMCC	Intercom Main Control Cabinet
J	Junction Box
LA	Lightning Arrester
LCL	Local Control Console for Crossover Switching
LCP	Elevator Control Panel
LI	Lighting Inverter
LS	Level Switch

MCC	Motor Control Centre
MM	Monitor Module (Fire Alarm/Detection)
MP	Manual Pull Station
MS	Minisub (600 V-208 V/120 V Transformer c/w Panelboard)
MST	Motor Starter
MTS	Manual Transfer Switch
MVS	Motion/Vibration Switch
OS	Occupancy Switch
P	Pull Box
PAX	TTC Telephone
PB	Pushbutton Station
PC	Photocell
PCP	Pump Control Panel
PMU	PA Microphone Unit
PNU	PA Ambient Noise Sensor Unit
PS	Pressure Switch/Sensor
PST	Passenger Station Transformer
PSU	PA Speaker Unit
RAN	Remote Annunciator (Fire Alarm/Detector)
RLA	Radio Line Amplifier
RT	Rectifier Transformer
RTD	Resistance Temperature Detector
RTU	Remote Terminal Unit
SB	208 V Switchboard
SC	Collector's Booth Security Cabinet
SD	Smoke Detector
SMS	SCADA Master Station
SR	Silicone Rectifier
SVCP	Subway Ventilation Control Panel
SW	27.6 kV, 13.8 kV, 4.16 kV and 600 V Switchgear
TB	Terminal Block
TBCP	Tunnel Barrier Control Panel
TJ	Telephone Jack
TP	Test Point (Test Block)
TS	Temperature Switch/Thermostat
TVC	CCTV Camera
TVBC	CCTV Collector's Booth Console
TVCC	CCTV Control Cabinet
TXC	TTC Telephone Cabinet
UPS	Uninterruptible Power Supply
VA	Volume Attenuator
VCP	Ventilation Control Panel
VS	Vibration Switch
ZS	Limit Switch

1.3.9

Identify internal geographic location as follows:

ER	-	Electrical Room
CR	-	Control Room
LANR	-	LAN Room
MCCR	-	Motor Control Centre Room
MR	-	Machine Room
VR	-	Valve Room
PR	-	Pump Room

JR	-	Janitor Room
CCH	-	Cable Chamber
SCH	-	Subchamber
EE	-	Elevator
EEC	-	Elevator Cab
CLBT	-	Collector Booth
ELOB	-	Elevator Lobby
ESH	-	Elevator Shaft

#### **1.4 SCHEMATIC DEVICE/WIRING IDENTIFICATION**

1.4.1 Identification on schematics in accordance with Figure 26 05 53, Device/Wiring Identification at end of this Section.

#### **1.5 SUBMITTALS**

1.5.1 Submit in accordance with Section 01 33 00.

##### **1.5.2 Product Data and Shop Drawings Package:**

###### **1.5.2.1 Product Data:**

1.5.2.1.1 Submit manufacturer's Product data indicating:

1.5.2.1.1.1 Technical data, supplemented by bulletins, component illustrations, detailed views, technical descriptions of items, and parts lists.

1.5.2.1.1.2 Performance criteria, compliance with appropriate reference standards, characteristics, limitations, and troubleshooting protocol.

1.5.2.1.1.3 Product transportation, storage, handling, and installation requirements.

1.5.2.1.1.4 Sizes, colours, identification systems and fasteners.

1.5.2.1.1.5 Equipment schedule indicating equipment location (including room number), service, identifier, nameplate type and nameplate colour.

###### **1.5.2.2 Shop Drawings:**

1.5.2.2.1 Submit Shop Drawings in accordance with Section 01 33 23 indicating:

1.5.2.2.1.1 Fasteners, colour of background, dimensions, thicknesses, finishes and colour of identification letters per application.

1.5.2.2.1.2 Composite identification label and fastener detail.

1.5.2.2.1.3 Nameplate Drawings.

1.5.2.2.1.4 Identification table, complete with details of conduit size, wire or cable size, junction boxes, pullboxes and feeder panels/breaker identification. Refer to Section 26 05 53, Annexure-1-2-3 tables, complete as part of Shop Drawing submission.



2 Products

**2.1 MATERIALS**

**2.1.1 Nameplates:**

2.1.1.1 **Type 1 (Stations and above ground structures):** Square or rectangular, lamacoid plastic plate 3 mm thick, semi-flexible, non-aging, 3 layer, laminated phenolic material, with machine engraved uppercase lettering, chamfered edges and two 4.5 mm minimum holes located at top and bottom, manufactured by Brady, Revere-Seton, and Seton.

**2.1.2 Conduit tags:**

2.1.2.1 Circular, minimum 0.64 mm thick, stainless steel tags. Size to suit electrical identifier, with identification markings machine engraved uppercase and black filled. Lettering minimum 6 mm high. Tags to come with stainless steel wire and clamps. Conduit tags for exposed conduit to have one 4.5 mm minimum top hole and conduit tags for embedded conduit to have two 4.5 mm minimum holes top and bottom, manufactured by Brady, Revere-Seton, and Seton.

**2.1.3 Wire markers:**

2.1.3.1 White slip-on markers made of PVC with black imprint manufactured by:

2.1.3.1.1 Shure-Code SM Sleeve Markers by Thomas & Betts.

2.1.3.1.2 Z-Type Markers by Wieland.

**2.1.4 Permanent plastic tape:**

2.1.4.1 0.18 mm thick vinyl plastic electrical colour coding tape; Scotch 35 by 3M Inc.

**2.1.5 Paint:**

2.1.5.1 In accordance with Section 09 91 00.

3 Execution

**3.1 EXAMINATION**

3.1.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to TTC. Commencement of Work means acceptance of existing conditions.

**3.2 INSTALLATION**

**3.2.1 Install electrical identification in accordance with manufacturer's written instructions.**

**3.2.2 Cable Trays:**

3.2.2.1 Identify each cable tray in accordance with cable tray schedule:

3.2.2.1.1 Characters painted on side walls using stencils.

3.2.2.1.2 Black characters 75 mm high.

3.2.2.1.3 Paint cable tray identification in accordance with Section 09 91 00.

3.2.2.1.4 Space cable tray identification maximum of 10 m along cable tray runs and minimum of once in every room in visible location.

3.2.2.2 Identify cable trays carrying voltages above 600 volts in addition to above as follows:

3.2.2.2.1 Red background and white characters 75 mm high reading DANGER - HIGH VOLTAGE spaced at maximum of 3 m intervals and at least one in every room or area and on both sides of tray where applicable.

### 3.2.3 Conduit:

3.2.3.1 Colour code conduits and metallic sheathed cables with permanent plastic tape or paint strip at points where conduit or cable enters wall, ceiling, or floor and at 15 m intervals.

3.2.3.2 Number conduits within 150 mm of box, device or equipment from which it originates.

3.2.3.3 Identify exposed conduit with conduit tags.

3.2.3.4 Arrange numbering on conduit tags to prevent numbers being obscured by adjacent conduit.

3.2.3.5 Identify each end of conduit from 150 mm from where it enters panel, box or equipment with conduit tags.

3.2.3.6 **Colours:** Prime 25 mm wide; auxiliary 19 mm:

	PRIME	AUXILIARY
DC Voltage System	Red	Black
AC Systems:		
Up to 250 V	Yellow	
251 to 600 V	Light Blue	
601 to 5000 V	Green	
5001 to 13800 V	Orange	
13801 to 27600 V	Brown	
Telephone	Purple	
Other systems in Section 26 50 00	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other systems in Divisions 27 and 28	Red	Yellow

### 3.2.4 Wire:

3.2.4.1 Identify power wiring with wire markers, on both ends of phase conductors of feeders and branch circuit wiring to CSA C22.1.

3.2.4.2 Identify control wiring with wire markers, numbered in accordance with wiring interconnection lists, schematic diagrams and schedules where applicable.

3.2.4.3 Use colour coded wires in communication cables, matched throughout systems.

3.2.4.4 Identify individual wires with wire markers applied at both ends of wire.

3.2.4.5 Circuiting designation to include panel designation, circuit number and wiring at devices, including terminal blocks and junction points.

3.2.4.6 Provide wire identification system consistent with schematics.

3.2.4.7 Place identification labels within 10 mm of terminating point in visible location. Maintain phase sequence and colour coding throughout Work.

### 3.2.5 Cable:

- 3.2.5.1 Identify cables with wire markers applied at both ends of cable.
- 3.2.5.2 Place identification of cables where cables:
  - 3.2.5.2.1 Pass through walls, floors or ceiling.
  - 3.2.5.2.2 Pass through pullboxes or maintenance holes.
  - 3.2.5.2.3 Exit/enter from raceway systems such as tray work and conduits.
- 3.2.5.3 Colour of cable outer jacket: Black.
- 3.2.6 Paint pullboxes, junction boxes and electrical panels (containing modules) associated with fire alarm/detection system ANSI safety red in accordance with Section 09 91 00.

### 3.2.7 Electrical Equipment:

- 3.2.7.1 Place identifying label on each cell or cubicle of electrical equipment, comprised of several cells or cubicles such as switchgear and motor control centres.
- 3.2.7.2 Visible manufacturer's trademarks, nameplates or names not permitted in areas accessible to public.
- 3.2.7.3 Provide high voltage equipment with warning signs, suitably engraved as required to meet requirements of Inspection Authority.
- 3.2.7.4 Where wording not specified on Contract Drawings, obtain exact wording from TTC.
- 3.2.7.5 Identify pull boxes, terminal cabinets and junction boxes enclosing cables or connections with nameplates indicating voltage, box number and circuit number.
- 3.2.7.6 Provided junction boxes, relay panels and miscellaneous equipment energized from two or more sources with warning nameplate prominently displayed, noting number and location of sources and their voltage.
- 3.2.7.7 Supply and install identification nameplates on equipment such as circuit breakers, safety switches, panelboards and pushbutton stations.
- 3.2.7.8 Mount typewritten circuit directory with clear plastic cover, on inside of each panelboard door, indicating breaker or switch circuit number, rating, load description and load data and panel number.
- 3.2.7.9 **Nameplates:**
  - 3.2.7.9.1 Secure nameplates to equipment and substrates with minimum of two self-tapping stainless steel screws.
  - 3.2.7.9.2 Make nameplates 250 mm x 175 mm minimum unless otherwise specified as follows:

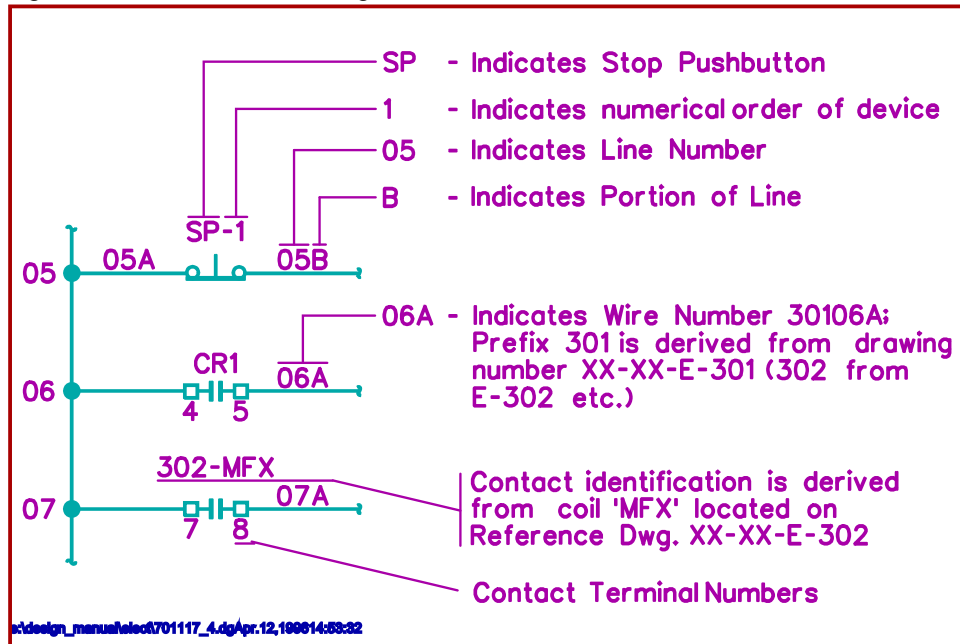
NAMEPLATE SIZES (mm)			
Size 1	10 x 50	1 line	4.75 high letters
Size 2	10 x 75	1 line	6 high letters
Size 3	10 x 75	2 lines	4.75 high letters
Size 4	20 x 100	1 line	6 high letters
Size 5	20 x 100	2 lines	4.75 high letters
Size 6	25 x 100	1 line	13 high letters
Size 7	25 x 100	2 lines	6 high letters
Size 8	50 x 200	3 lines	13 high letters

- 3.2.7.9.3 Make nameplates on equipment served from emergency power/UPS with white letters on red background.
- 3.2.7.9.4 Nameplate for breaker in 208/120 V switchboard serving fire alarm/detection system of white letters on red background.
- 3.2.7.9.5 **Equipment and component nameplates:** white letters on black background.
- 3.2.7.9.6 **Warning and emergency power source equipment nameplates:** White letters on red background.
- 3.2.7.9.7 **Wording on nameplates:** Acceptable to TTC prior to manufacture.
- 3.2.7.9.8 Securely fasten nameplates to equipment with self-tapping stainless steel screws.
- 3.2.7.10 Ensure manufacturer's nameplates and authority approval (CSA, ULC) labels visible and legible after equipment installed.

### **3.3 WARNING IDENTIFICATION**


- 3.3.1 Install warning identification with suitable background colour and lettering as required by provincial and local Hydro authority and other inspection authorities. Obtain necessary details from governing authorities. Install warning identification in accordance with applicable code requirements on electrical equipment, access doors to equipment and in following locations.
  - 3.3.1.1 Inside cabinets or panels where more than one power source.
  - 3.3.1.2 Electrical Rooms.
- 3.3.2 Use porcelain enamel signs, minimum size 175 mm x 250 mm except where specified otherwise.
- 3.3.3 Mark junction boxes, relay panels and miscellaneous equipment energized from two or more sources, with warning nameplate prominently displayed, noting number and location of sources and voltage.

Figure 26 05 53, Device/Wiring Identification



END OF SECTION



CABLE TAG NO.	No. OF CABLES	No. OF COND.	COND. SIZE	CABLE FUNCTION	RACEWAY TAG *	CABLE ORIGIN	CABLE DESTINATION	DRAWING REFERENCE	GENERAL NOTES							
									<div><div><div></div><div>C.O.</div></div><div><div></div><div>/</div><div>/</div></div><div><div></div><div>C.O.</div></div><div><div></div><div>/</div><div>/</div></div><div><div></div><div>C.O.</div></div><div><div></div><div>/</div><div>/</div></div><div><div></div><div>C.O.</div></div><div><div></div><div>/</div><div>/</div></div></div> <div>REVISIONS</div> <div><div>DRAWN .....</div><div>/</div><div>/</div></div> <div><div>CHECKED.....</div><div>/</div><div>/</div></div> <div><div>CORRECT.....</div><div>/</div><div>/</div></div>							
							DWG. NO.					CONTRACT No.				
							TITLE					<div> TORONTO TRANSIT COMMISSION</div>				
							Electrical : WIRE OR CABLE SCHEDULE									
							SCALE					STATUS		DWG. No.	REV. No.	SHEET
							N.T.S.					DATE				





[illegible]



[illegible]



1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment and services necessary electrical testing Work in accordance with the Contract Documents.

1.1.2 Complete test sheets forming part of this Section and Section 23 05 93.

**1.2 REFERENCES**

1.2.1 ANSI/NEMA-ST-20, Dry Type Transformers for General Applications.

1.2.2 CAN/CSA C22.2 No. 29-M, Panelboards and Enclosed Panelboards.

1.2.3 CAN/CSA C22.2 No. 31, Switchgear Assemblies.

1.2.4 CAN/CSA C22.2 No. 47-M, Air-Cooled Transformers (Dry Type).

1.2.5 CAN/ULC S537, Standard for the Verification of Fire Alarm System.

1.2.6 CSA C9, Dry Type Transformers.

1.2.7 OESC, Ontario Electrical Safety Code.

**1.3 GENERAL**

1.3.1 Testing methods and test results to CSA, the Ontario Electrical Safety Code, authorities having jurisdiction and manufacturer's recommendations.

1.3.2 Perform testing with systems completely connected, both loaded and unloaded.

**1.4 ELECTRICAL DISTRIBUTION SYSTEM**

**1.4.1 Control and switching:**

1.4.1.1 Test circuits for correct operation of devices, switches and controls.

**1.4.2 Polarity tests:**

1.4.2.1 Test circuits for correct operation of devices and polarity sequence.

**1.4.3 Voltage tests:**

1.4.3.1 Perform voltage test at last outlet of each circuit. Maximum drop in potential permitted 3% on 120 V and 208 V branch circuits; 3% on 208 V feeder circuits; and 3% on 600 V feeder circuits.

**1.4.4 Phase balance:**

1.4.4.1 Measure load on each phase at each switchboard, splitter, distribution panelboard and report results in writing to TTC. Re-arrange phase connections as necessary to balance load on each phase as instructed by TTC. Re-arrangement restricted to exchanging of connections at distribution points. After changes, submit to TTC As-Built Drawings in accordance with Section 01 78 39, indicating modified connections.

**1.4.5 Supply voltage:**

1.4.5.1 Measure line voltage of each phase at load terminals of main breakers and report results in writing to TTC. Perform supply voltage test to electrical equipment in use.

**1.4.6 Conductors:**

1.4.6.1 **Dielectric test on 120/208 V equipment and wiring:** Apply 500 V DC for one minute between phase conductors and between each phase conductor and ground. Test voltages for 600 V equipment and cables as recommended by manufacturers of equipment and cable.

1.4.6.2 **Insulation resistance test:** After dielectric test complete, measure insulation resistance by approved resistance measuring instrument. Insulation resistance between connected system and ground: minimum values prescribed under Insulation Resistance in the Ontario Electrical Safety Code.

1.4.6.3 Remove and replace shorted, grounded or defective conductors.

**1.4.7 General operations:**

1.4.7.1 Energize and put into operation electrical circuits and items. Make repairs, alterations, replacements, tests and adjustments necessary for complete and acceptable operating electrical system.

**1.4.8 Distribution panels:**

1.4.8.1 Verify and record information for each distribution panel as to:

1.4.8.1.1 Manufacturer.

1.4.8.1.2 Amp rating.

1.4.8.1.3 Voltage.

1.4.8.1.4 Phasing.

1.4.8.1.5 Correct operation of each breaker.

1.4.8.1.6 Labelling.

**1.4.9 Lighting and receptacle circuits:**

1.4.9.1 Verify and record the following information for each lighting and receptacle circuit:

1.4.9.1.1 Phasing and polarity.

1.4.9.1.2 Insulation resistance to ground.

1.4.9.1.3 Secure connections.

**1.5 GROUNDING**

1.5.1 Verify resistance and continuity of driven electrodes, connections, grounding conductors, main bonding conductors and supplementary bonding conductors.

**1.6 CONTROL AND COMMUNICATIONS WIRES AND CABLES**

1.6.1 Check each cable and wire for continuity, short circuits and grounds. Ensure resistance to ground of circuits 50 megohms minimum.

1.6.2 Tests:

1.6.2.1 After installing cable but before splicing and terminating, perform insulation resistance test with megger on each conductor.

1.6.2.2 Check insulation resistance after each splice and/or termination.

1.6.2.3 Test continuity of wires, conductor resistance and capacitance.

- 1.6.2.4 Verify wiring interconnections by ringout.
- 1.6.2.5 During testing ensure terminations and accessory equipment disconnected.
- 1.6.2.6 During testing ground shields, ground wires and conductors not under test.
- 1.6.2.7 Restore termination connections, grounds, shields, ground wires and conductors after testing.
- 1.6.3 Provide TTC with written list of test results showing location each test made, circuit tested and result of each test. Provide assurance that the existing conditions were restored.
- 1.6.4 Remove and replace entire length of cable if cable fails to meet test criteria.
- 1.7 CONTROL PANELS AND CABINETS**
- 1.7.1 Verify system installations, connections and controls complete and Product in operable condition.
- 1.7.2 Prepare and insert additional data in Operation and Maintenance Manuals when need for additional data becomes apparent during instructions.
- 1.8 FIRE ALARM SYSTEM**
- 1.8.1 Perform tests to CAN/ULC S537 and as specified.
- 1.8.2 Fire alarm system:
  - 1.8.2.1 Test each device and alarm circuit to ensure fire detectors and fire protection supervisory devices transmit alarm to fire alarm panel and actuate alarm and ancillary devices.
  - 1.8.2.2 Check new remote annunciator panel to ensure zones shown correctly.
  - 1.8.2.3 Simulate open, ground and short circuit faults on alarm and signalling circuits to ensure proper operation of trouble signals.
- 1.9 TEST REPORTS**
- 1.9.1 Inspection and test program formed by implementation of attached test sheets intended to supplement and not replace, manufacturer's recommended testing and inspection and Local Regulations and their testing requirements. Record tests on test sheets included.
- 1.9.2 Schedules include information generally accepted as Of Value to TTC which becomes responsible for completed works. Maintain this principle by issuing test sheets to TTC for inclusion of their additional data requirements. Typically contents of test reports used for maintenance records.
- 1.9.3 Validity of inspection and test program dependent on information contained on test sheets being accurate. If in doubt do not make entry.
- 1.10 COMPLETION OF TEST SHEETS**
- 1.10.1 Incorporate any modifications to test sheets arising from TTC review of test program.
- 1.10.2 Sign test sheets indicating contents accurate. TTC to review sheets to confirm test sheet as accurate record.
  - 1.10.2.1 Carry out procedure promptly.
  - 1.10.2.2 Review by TTC does not mean transfer of responsibility. Responsibility for Work remains with Contractor until Contract Completion.

2 Products

**Not used.**

3 Execution

### **3.1 FIELD QUALITY CONTROL AND COMMISSIONING**

3.1.1 Perform Commissioning in accordance with Sections 01 91 00 and 26 05 00.

3.1.2 Perform start-up and testing on systems and demonstrate how they conform to Specification documents. Under the supervision of TTC, make adjustments and fine tune systems.

3.1.3 Contractor can use test sheets attached to this Section to complete start-up and testing of electrical system or perform start-up and testing of electrical system in accordance with equipment manufacturer's recommendation.

### **3.2 ELECTRICAL DIAGRAMS**

3.2.1 Electrical distribution system: locate reviewed single line diagram in AC Switchboard Room. Refer to Section 26 05 00 for drawing size, type and mounting. Location of installation subject to TTC approval.

3.2.2 Drawings photograph of diagram(s) measuring 915 mm x 760 mm for each drawing. Non-fading photographic process.

### **3.3 TEST SHEETS**

3.3.1 Complete the following Test Sheets as part of start-up, testing and commissioning of installed electrical system to achieve Substantial Performance and final acceptance:

3.3.1.1 Test Sheet No. E-01 - Moulded Case Circuit Breakers

3.3.1.2 Test Sheet No. E-03 - Power and Lighting Panelboards

3.3.1.3 Test Sheet No. E-06 - Switchboard Circuit Breaker

3.3.1.4 Test Sheet No. E-12 - Interior/Exterior Lighting, Switches and Receptacles

3.3.1.5 Test Sheet No. E-13 - Acceptance Sheet

3.3.1.6 Test Sheet No. E-14 - Cables and Conductors

3.3.1.7 Test Sheet No. E-15 - Grounding

3.3.1.8 Test Sheet No. E-16 - Public Address - Speaker Assembly and Loop Wiring

3.3.1.9 Test Sheet No. E-18 - Public Address - Termination Enclosure

3.3.1.10 Test Sheet No. E-20 - CCTV - Camera - Enclosure and Coaxial Cable

3.3.1.11 Test Sheet No. E-21 - CCTV Systems - Termination Enclosure

3.3.1.12 Fire Alarm System – per Appendix C of CAN/ULC-S537

3.3.2 Document manufacturer's recommended installation checks and performance testing requirements in remarks column of associated test sheets and associated test reports.

**END OF SECTION**



### MOULDED CASE CIRCUIT BREAKERS

Location: \_\_\_\_\_ Manufacturer: \_\_\_\_\_  
 Breaker I.D.: \_\_\_\_\_ Telephone No.: (    ) \_\_\_\_\_  
 Breaker Fed From: \_\_\_\_\_ Purchase Order No.: \_\_\_\_\_  
 Model No.: \_\_\_\_\_ Job No.: \_\_\_\_\_  
 Serial No.: \_\_\_\_\_  
 Breaker Description: \_\_\_\_\_  
 Breaker Frame, Amps: \_\_\_\_\_  
 Phase/Poles: \_\_\_\_\_  
 Non-auto: \_\_\_\_\_  
 Trip Setting, Amps: \_\_\_\_\_  
 Interruption Rating: \_\_\_\_\_  
 Voltage: \_\_\_\_\_

Installation Checks	Yes	No	Comments
Nameplate Complete	<input type="checkbox"/>	<input type="checkbox"/>	
Identification Label	<input type="checkbox"/>	<input type="checkbox"/>	
On/Off Labels	<input type="checkbox"/>	<input type="checkbox"/>	
Warning Signs	<input type="checkbox"/>	<input type="checkbox"/>	
Terminals And Cable Connections	<input type="checkbox"/>	<input type="checkbox"/>	
Breaker Bolts Torqued To MRT*	<input type="checkbox"/>	<input type="checkbox"/>	
Breaker Cable Lugs Tightened	<input type="checkbox"/>	<input type="checkbox"/>	
Busbar Connection	<input type="checkbox"/>	<input type="checkbox"/>	
Lubrication (if required)	<input type="checkbox"/>	<input type="checkbox"/>	
Solid-State Trip Unit	<input type="checkbox"/>	<input type="checkbox"/>	
Breaker Lockoff Facility	<input type="checkbox"/>	<input type="checkbox"/>	
Condition Of Assembly	<input type="checkbox"/>	<input type="checkbox"/>	
Cleanliness	<input type="checkbox"/>	<input type="checkbox"/>	
Cleanliness	<input type="checkbox"/>	<input type="checkbox"/>	
Cover Installed	<input type="checkbox"/>	<input type="checkbox"/>	
Door Interlock	<input type="checkbox"/>	<input type="checkbox"/>	
Handle Interlock	<input type="checkbox"/>	<input type="checkbox"/>	
Operation Mechanic	<input type="checkbox"/>	<input type="checkbox"/>	
Clearance Around Switch	<input type="checkbox"/>	<input type="checkbox"/>	

\* MRT = Manufacturer recommended torque

#### Remarks:

Inspected by: (print) \_\_\_\_\_  
 Name, Company, and Address \_\_\_\_\_  
  
 Witnessed by: \_\_\_\_\_  
 Witnessed by: \_\_\_\_\_  
 Date: \_\_\_\_\_ y/ \_\_\_\_\_ m/ \_\_\_\_\_ d

Operational Checks		Yes	No	Comments
Common Trip Handle (2-pole CB)		<input type="checkbox"/>	<input type="checkbox"/>	
Push-to-Trip Button		<input type="checkbox"/>	<input type="checkbox"/>	
Operating Handle		<input type="checkbox"/>	<input type="checkbox"/>	
Proper Latching and Closing		<input type="checkbox"/>	<input type="checkbox"/>	
Quickmake-Quickbreak Toggle Mechanism		<input type="checkbox"/>	<input type="checkbox"/>	
<b>Specified Tests and Measured Data</b>				
Insulation Megger Test:		Phase A-B = _____		Phase C-A = _____
(MΩ)		Phase B-C = _____		Phase ABC-Grd = _____
Contact Resistance (ductor) Test:		Phase A = _____		
(μΩ)		Phase B = _____		
		Phase C = _____		
<b>Note:</b> <i>Equipment to be isolated from all sources of power.</i>				
<b>Remarks:</b>				
<b>Equipment Data</b>				
<b>Item</b>	<b>Specified</b>	<b>Shop Drawings</b>	<b>Installed</b>	
Manufacturer				
Type				
Voltage				
A				
Phase				
Poles				
Neutral				
Unfused				
Fuse Type and Size				
Interrupting A				
EEMAC Enclosure Type				
Door Interlock				
Conduit and Wire Size				
<b>Remarks:</b>				
Inspected by: (print) _____				
Name, Company, and Address _____				
Witnessed by: _____				
Witnessed by: _____				
Date: _____ y/ _____ m/ _____ d				

<b>POWER AND LIGHTING PANELBOARDS</b>			
Panelboard ID Location Manufacturers: Serial No.: Description: Fed From: Conduit and Feeder Size: Voltage/Phase/Wires: Mounting: Mains:	Manufacturer: Telephone No.: (    ) Purchase Order No.: Job No.:		
Installation Checks	Yes	No	Comments
Identification Label	<input type="checkbox"/>	<input type="checkbox"/>	
Filler Pieces in Place	<input type="checkbox"/>	<input type="checkbox"/>	
Cable/Conductors Identified	<input type="checkbox"/>	<input type="checkbox"/>	
Bus Cable Lugs Torqued to MRT	<input type="checkbox"/>	<input type="checkbox"/>	
Bus Bolts Torqued to MRT	<input type="checkbox"/>	<input type="checkbox"/>	
Breaker Bolts Torqued to MRT	<input type="checkbox"/>	<input type="checkbox"/>	
Mounting	<input type="checkbox"/>	<input type="checkbox"/>	
Hinged Door/Front Cover	<input type="checkbox"/>	<input type="checkbox"/>	
Key Lock	<input type="checkbox"/>	<input type="checkbox"/>	
Drip Hood	<input type="checkbox"/>	<input type="checkbox"/>	
Grounding of Equipment	<input type="checkbox"/>	<input type="checkbox"/>	
Isolated Ground Bus	<input type="checkbox"/>	<input type="checkbox"/>	
Clean Equipment	<input type="checkbox"/>	<input type="checkbox"/>	
Breaker Designation and Identification	<input type="checkbox"/>	<input type="checkbox"/>	
Spare Breaker Installed	<input type="checkbox"/>	<input type="checkbox"/>	
Typewritten Panel Directory in Panel	<input type="checkbox"/>	<input type="checkbox"/>	
Spare Conduit Stubbed Up to Ceiling	<input type="checkbox"/>	<input type="checkbox"/>	

Installation Review			
Item	Yes	No	Comments
Nameplate Complete	<input type="checkbox"/>	<input type="checkbox"/>	
Wiring Circuits Identified	<input type="checkbox"/>	<input type="checkbox"/>	
Cable Phasing Colour-coded	<input type="checkbox"/>	<input type="checkbox"/>	
Clearance Around Equipment	<input type="checkbox"/>	<input type="checkbox"/>	
Confirmation of Circuit Directory	<input type="checkbox"/>	<input type="checkbox"/>	
Check for Signs of Overheating	<input type="checkbox"/>	<input type="checkbox"/>	
Check Breakers for Mechanical Operation	<input type="checkbox"/>	<input type="checkbox"/>	
Check Main Breaker for Lockoff Facility	<input type="checkbox"/>	<input type="checkbox"/>	
Sprinkler Drip Hood	<input type="checkbox"/>	<input type="checkbox"/>	
Warning Signs	<input type="checkbox"/>	<input type="checkbox"/>	
Operational Checks	Yes	No	Comments
Branch Circuit Breaker Operation	<input type="checkbox"/>	<input type="checkbox"/>	
GFCI Operation	<input type="checkbox"/>	<input type="checkbox"/>	
Specified Tests and Measured Data			
Feeder Insulation Test:		Phase A-B = _____	Phase A-Grd = _____
(MΩ)		Phase B-C = _____	Phase B-Grd = _____
		Phase C-A = _____	Phase C-Grd = _____
Voltage Test:	Phase V:	AN = _____	BN = _____ CN = _____
	Line V:	AB = _____	BC = _____ CA = _____
Load Test:	Line Currents:	I <sub>B</sub> = _____	I <sub>A</sub> = _____ I <sub>C</sub> = _____
Voltage: _____	Bus A: _____		
<b>Note:</b> <i>Equipment to be isolated from all sources of power.</i>			
<b>Remarks:</b>			

Test Results			
Item		Results	Comments
Load:	Current Phase A Current Phase B Current Phase C		
Voltage:	Phase-Phase and Neutral Voltage A-B Voltage B-C Voltage C-A Voltage A-N Voltage B-N Voltage C-N		
Equipment Data		Specified	Shop Drawings
Bus, A			
Bus bracing, kA			
Copper or Aluminum Bus			
Floor-Mounted			
EEMAC Enclosure Type			
Contactor Size			
Main Breaker Type and Size			
Main Breaker Lockoff Facility			
Feeder Conduit and Wire Size			
Branch Breaker (list type, size and interrupting capacity)			
Metering (A, V, kW)			
Ground Wire Size			
Feeder Conduit Size			
CT Ratio			
PT Ratio			
<b>Remarks:</b>			

Branch Breaker List			
Designation	Type and Frame	Short-Circuit Rating	Trip, A

Inspected by: (print) \_\_\_\_\_  
Name, Company, and Address

Witnessed by: \_\_\_\_\_

Witnessed by: \_\_\_\_\_

Date: \_\_\_\_\_ y/ \_\_\_\_\_ m/ \_\_\_\_\_ d

<b>SWITCHBOARD CIRCUIT BREAKER</b>			
Location: Breaker ID: Fed From: Breaker Manufacturers: Serial No.: Breaker Description: Poles/Voltage: Frame/Rated A: Closed V: Trip V: Types of Overloads: Fuses: Rated Interrupting Time: Interrupted Ratings: Rated Max kV: BIL:	Manufacturer: Telephone No.: (    ) Purchase Order No.: Job. No.:		
Installation Checks	Yes	No	Comments
Nameplate	<input type="checkbox"/>	<input type="checkbox"/>	
Identification Label	<input type="checkbox"/>	<input type="checkbox"/>	
Mounting: Drawout or Fixed	<input type="checkbox"/>	<input type="checkbox"/>	
Arc Chutes and Arc Extinguishers	<input type="checkbox"/>	<input type="checkbox"/>	
Terminals and Bus Connections	<input type="checkbox"/>	<input type="checkbox"/>	
Breaker Bolts Torqued to MRT	<input type="checkbox"/>	<input type="checkbox"/>	
Racking Devices, Rollers, Shutter	<input type="checkbox"/>	<input type="checkbox"/>	
Cell Barrier	<input type="checkbox"/>	<input type="checkbox"/>	
Solid-State Trip Unit	<input type="checkbox"/>	<input type="checkbox"/>	
Lubrication (if required)	<input type="checkbox"/>	<input type="checkbox"/>	
Dead Front Cover	<input type="checkbox"/>	<input type="checkbox"/>	
Breaker Lockoff Facility	<input type="checkbox"/>	<input type="checkbox"/>	
Clearance in Front	<input type="checkbox"/>	<input type="checkbox"/>	
Condition of Assembly	<input type="checkbox"/>	<input type="checkbox"/>	
Cleanliness	<input type="checkbox"/>	<input type="checkbox"/>	
Operational Checks	Yes	No	Comments
Push-to-Open Button	<input type="checkbox"/>	<input type="checkbox"/>	
Push-to-Close Button	<input type="checkbox"/>	<input type="checkbox"/>	
Electrical or Mechanical Operation	<input type="checkbox"/>	<input type="checkbox"/>	
Proper Latching and Closing	<input type="checkbox"/>	<input type="checkbox"/>	
Drawout Racking Mechanism	<input type="checkbox"/>	<input type="checkbox"/>	

Specified Tests and Measured Data			
Insulation (Megger) Test: (MΩ)	Phase A-B = _____	Phase C-A = _____	
	Phase B-C = _____	Phase ABC-Grd = _____	
Contact Resistance (ducor) Test: (μΩ)	Phase A = _____		
	Phase B = _____		
	Phase C = _____		
<b>Note:</b> <i>Equipment to be isolated from all sources of power.</i> <b>Remarks:</b>			
Installation Review			
Item	Yes	No	Comments
General Condition of Assembly	<input type="checkbox"/>	<input type="checkbox"/>	
Condition of Main Contact and Arcing Contacts	<input type="checkbox"/>	<input type="checkbox"/>	
Evidence of Corrosion	<input type="checkbox"/>	<input type="checkbox"/>	
Control CCT Contacts, Aux Contacts, and Cell Interlocks	<input type="checkbox"/>	<input type="checkbox"/>	
Breaker Stab Condition	<input type="checkbox"/>	<input type="checkbox"/>	
Insulators, Phase Barriers, and Arc Chutes – Condition	<input type="checkbox"/>	<input type="checkbox"/>	
Springs, Linkage, Alignment of Operating Mechanism	<input type="checkbox"/>	<input type="checkbox"/>	
Racking Device, Rollers, Shutters, Ramps, Lifting Device	<input type="checkbox"/>	<input type="checkbox"/>	
Fixing Bolts, Terminations and Connections Checked	<input type="checkbox"/>	<input type="checkbox"/>	
Electrical Operation	<input type="checkbox"/>	<input type="checkbox"/>	
Mechanical Operation	<input type="checkbox"/>	<input type="checkbox"/>	
Instrument Transformers (CT/PT) and Metering	<input type="checkbox"/>	<input type="checkbox"/>	
Operations Counter	<input type="checkbox"/>	<input type="checkbox"/>	
Clean Contacts and Lubricate Mechanism	<input type="checkbox"/>	<input type="checkbox"/>	
All Tools Removed, Doors, Covers Replaced	<input type="checkbox"/>	<input type="checkbox"/>	



Test Results				
Item		As Found	As Left	Comments
Contact Resistance:	Phase A			
( $\mu\Omega$ )	Phase B			
	Phase C			
Insulation Test:	A-B			
( $M\Omega$ ) (phase-phase and grid)	B-C			
	C-A			
	ABC-Grd			
<b>Note:</b> <i>Equipment to be isolated from all sources of power.</i>				
<b>Remarks:</b>				

Calibration Function Test					
Instantaneous Element Test:	Pickup Set:				
Current Inject Test	Trip Time:	s			
Short-time Element Test:	Pickup Set:	Delay Set:			
Current Inject Test	Trip Time:	s			
Long-time Element Test:	Pickup Set:	Delay Set:			
Current Inject Test	Trip Time:	Yes	<input type="checkbox"/>	No	<input type="checkbox"/> Delay
	Phase A:	Yes	<input type="checkbox"/>	No	<input type="checkbox"/> s
	Phase B:	Yes	<input type="checkbox"/>	No	<input type="checkbox"/> s
	Phase C:	Yes	<input type="checkbox"/>	No	<input type="checkbox"/> s
Ground Fault Element Test:	Pickup Set:	Delay Set:			
	Trip Time	s			
	Sensor (CT) Checks:	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
	Sensor Cat. No.:				
	Sensor (CT) Tap Available:				
	Sensor Tap in Use:				
	Sensor (CT) Tap Used in Test:				
Inspected by: (print) _____					
Name, Company, and Address					
Witnessed by: _____					
Witnessed by: _____					
Date: _____ y/ _____ m/ _____ d					



INTERIOR/EXTERIOR LIGHTING, SWITCHES AND RECEPTACLES																		
Room No.	Room Name	Switches				Lighting				Receptacles							Comments	
		Type*	Mounting	Coverplate	Operation	Quantity	Luminaire Type	Luminaire Installed	Mounting	Operation	Quantity	Type*	Normal/Emergency	Panel Directory	Location	Mounting		Coverplate

**Note:** \*Types of switches: L = Low Voltage, N = Line Voltage, D = Dimmer, MS = Master Switch, P = Pilot light

**Note:** \*Receptacle Types: D = Duplex, F = Fourplex, GFCI = Ground Fault Circuit Interrupter, I = Isolated Ground

**Remarks:**

Inspected by: (print) \_\_\_\_\_

Name, Company, and Address \_\_\_\_\_

Witnessed by: \_\_\_\_\_

Witnessed by: \_\_\_\_\_

Date: \_\_\_\_\_ y/ \_\_\_\_\_ m/ \_\_\_\_\_ d

Lighting Standards, Receptacles & Switch Stations Post Mounted (Outdoor)																				
Pole Number & Circuit Number	Receptacle No. & Circuit Number	Switch Station No. & Circuit Number	Drawing Number	Voltage	Lighting Standard							Receptacle			Switch / P.B. Station				Comments	
					Type	HID Type, Number & Watts	Fuse Size (Amps)	Control: Photocell (P), Contactor (C)	Grounding	Pole Handhole Cover Installed	Operation	Size (Amps), D-Duplex, S-Single	Ground Fault Type	Operation	Identification	Equipment Controlled	Circuit No. or Control Circuit (C)	Operation		

**Note:**

**Note:** \*Receptacle Types: D = Duplex, F = Fourplex, GFCI = Ground Fault Circuit Interrupter, I = Isolated Ground

**Remarks:**

Inspected by: (print) \_\_\_\_\_  
Name, Company, and Address \_\_\_\_\_

Witnessed by: \_\_\_\_\_  
Witnessed by: \_\_\_\_\_

Date: \_\_\_\_\_ y/ \_\_\_\_\_ m/ \_\_\_\_\_ d

### Acceptance Equipment or System Release for Operation by Commission

Location: \_\_\_\_\_

The following: \_\_\_\_\_

(a) Deficiencies (see attached list, if any).

(b) Other.

The operation of this equipment does not relieve the Contractor of any contractual responsibilities.

Name: \_\_\_\_\_ } on behalf of the Contractor  
 Title: \_\_\_\_\_ }  
 Date: \_\_\_\_\_ }

Recommended for acceptance by:

Name: \_\_\_\_\_ } on behalf of the Engineer  
Title: \_\_\_\_\_  
Date: \_\_\_\_\_

Accepted by:

Name: \_\_\_\_\_ } on behalf of the Commission  
Title: \_\_\_\_\_  
Date: \_\_\_\_\_

Distribution:     Original to Owner  
                      1<sup>st</sup> copy to Contractor  
                      2<sup>nd</sup> copy to Engineer  
                      3<sup>rd</sup> copy to Commission

Attached: \_\_\_\_\_ test reports

<b>CABLES AND CONDUCTORS</b>												
<b>Insulation Resistance (IR) for Cables and Wires, 600 Volt and Less</b>												
Item	Feeder Identification No. and Description	Insulation Resistance Readings in Mega Ohms										Remarks
		Phase to Ground							Phase to Phase			
		A	B	C	Red	Black	Blue	A-B	B-C	C-A	G-W	
1.												
2.												
3.												
4.												
5.												
6.												
7.												
8.												
9.												
10.												
11.												
12.												
13.												
14.												
15.												

Testing Instrument Make: \_\_\_\_\_ Serial Number: \_\_\_\_\_

Calibration Certificate Date: \_\_\_\_\_ Issued By: \_\_\_\_\_

Megger, Testing Voltage: \_\_\_\_\_ Volts

(at testing time) Ambient Temperature: \_\_\_\_\_ C degrees, Relative Humidity: \_\_\_\_\_%

Inspected by: (print) \_\_\_\_\_

Name, Company, and Address \_\_\_\_\_

Witnessed by: \_\_\_\_\_

Witnessed by: \_\_\_\_\_

Date: \_\_\_\_\_ y/ \_\_\_\_\_ m/ \_\_\_\_\_ d





GROUNDING							
Grounding For: Power/Lighting/Clean Ground				(Delete Non-Applicable Items)			
Test Details							
Reference		Electrodes No. & Type & Length	Resistance To Earth	Cu Tape/Cable Size	Continuity Resistance	Check Connections to Layout Drawings	
Dwg. No.	Location					Yes	No

**Remarks:**

**Note:** Attach sketches illustrating ground rod and grounding wires layout and reference numbers.

Continuity Testing Instrument: Make: \_\_\_\_\_ Serial Number: \_\_\_\_\_  
 Calibration Certificate Date: \_\_\_\_\_ Issued by: \_\_\_\_\_

Grounding Testing Instrument: Make: \_\_\_\_\_ Serial Number: \_\_\_\_\_  
 Calibration Certificate Date: \_\_\_\_\_ Issued by: \_\_\_\_\_

(at testing time) Ambient Temperature: \_\_\_\_\_ C degrees, Relative Humidity: \_\_\_\_\_%

Inspected by: (print) \_\_\_\_\_  
 Name, Company, and Address \_\_\_\_\_

Witnessed by: \_\_\_\_\_  
 Witnessed by: \_\_\_\_\_  
 Date: \_\_\_\_\_ y/ \_\_\_\_\_ m/ \_\_\_\_\_ d



PUBLIC ADDRESS SPEAKER ASSEMBLY AND LOOP WIRING			
Zone Location:		Manufacturer:	
Circuit Location:		Telephone No.: (    )	
Model No.:		Project No.:	
		Shop Drawing No.:	
Serial No.:		Maintenance Manual No.:	
Description	Installation Verification		Comments
	Yes	No	
Speaker Assemblies:			
- Speaker ID No's	<input type="checkbox"/>	<input type="checkbox"/>	
- Pullbox ID No's	<input type="checkbox"/>	<input type="checkbox"/>	
- Conduit ID No's	<input type="checkbox"/>	<input type="checkbox"/>	
- Condition of Enclosures	<input type="checkbox"/>	<input type="checkbox"/>	
- Tap Setting (1W, 2W)	<input type="checkbox"/>	<input type="checkbox"/>	
- Condition of Faceplate – Touch-up Required	<input type="checkbox"/>	<input type="checkbox"/>	
- Mounting (S, R, H)*	<input type="checkbox"/>	<input type="checkbox"/>	
- Frequency Response Test	<input type="checkbox"/>	<input type="checkbox"/>	
Wiring:			
- Wiring ID	<input type="checkbox"/>	<input type="checkbox"/>	
- Size	AWG		
- Length	m		
- Circuit Continuity (end to end)	<input type="checkbox"/>	<input type="checkbox"/>	
- DC Resistance	Ω		
- Resistance to Ground	MΩ		
* S = Surface, R = Recessed, H = Hanger			
<b>Remarks:</b>			
Inspected by: (print) _____ Name, Company, and Address _____  Witnessed by: _____ Witnessed by: _____ Date: _____ y/ _____ m/ _____ d			



<b>PUBLIC ADDRESS TERMINATION ENCLOSURE</b>			
Location:		Manufacturer:	
Model No.:		Telephone No.: (    )	
		Project No.:	
		Shop Drawing No.:	
		Maintenance Manual No.:	
Description	Installation Verification		Comments
	Yes	No	
ID No's	<input type="checkbox"/>	<input type="checkbox"/>	
Conduit ID No's	<input type="checkbox"/>	<input type="checkbox"/>	
Condition of Enclosures	<input type="checkbox"/>	<input type="checkbox"/>	
Mounting (S, R, H)*	<input type="checkbox"/>	<input type="checkbox"/>	
Conduit Entry Top or Bottom	<input type="checkbox"/>	<input type="checkbox"/>	
Spare Conduit to Tray	<input type="checkbox"/>	<input type="checkbox"/>	
Terminal Strip:			
- Type of Connector	<input type="checkbox"/>	<input type="checkbox"/>	
- All Wiring Secured	<input type="checkbox"/>	<input type="checkbox"/>	
Shop Drawing:			
- Interconnection Diagrams Inside Terminal Cabinet	<input type="checkbox"/>	<input type="checkbox"/>	
* S = Surface, R = Recessed, H = Hanger			
<b>Remarks:</b>			
Inspected by: (print) _____			
Name, Company, and Address _____			
Witnessed by: _____			
Witnessed by: _____			
Date: _____ y/ _____ m/ _____ d			



CCTV - CAMERA ENCLOSURE AND COAXIAL CABLE			
Location:		Manufacturer:	
		Telephone No.: (    )	
Model No.:		Project No.:	
		Shop Drawing No.:	
Serial No.:		Maintenance Manual No.:	
Description	Installation Verification		Comments
	Yes	No	
Camera Enclosure:			
- Camera ID No's	<input type="checkbox"/>	<input type="checkbox"/>	
- Pullbox ID No's	<input type="checkbox"/>	<input type="checkbox"/>	
- Conduit ID No's	<input type="checkbox"/>	<input type="checkbox"/>	
- Condition of Enclosures	<input type="checkbox"/>	<input type="checkbox"/>	
- Mounting (S, R, H)*	<input type="checkbox"/>	<input type="checkbox"/>	
- Heater (type and wattage)	<input type="checkbox"/>	<input type="checkbox"/>	
Wiring:			
- Wiring Type – RG-59U/RG-11U	<input type="checkbox"/>	<input type="checkbox"/>	
- Connector Type			
- Circuit Continuity (end to end)	<input type="checkbox"/>	<input type="checkbox"/>	
- Resistance to Ground	MΩ		
* S = Surface, R = Recessed, H = Hanger			
<b>Remarks:</b>			
Inspected by: (print) _____			
Name, Company, and Address _____			
Witnessed by: _____			
Witnessed by: _____			
Date: _____ y/ _____ m/ _____ d			





CCTV SYSTEMS TERMINATION ENCLOSURE			
Location:		Manufacturer:	
Model No.:		Telephone No.: (    )	
		Project No.:	
		Shop Drawing No.:	
		Maintenance Manual No.:	
Description	Installation Verification		Comments
	Yes	No	
ID No's	<input type="checkbox"/>	<input type="checkbox"/>	
Conduit ID No's	<input type="checkbox"/>	<input type="checkbox"/>	
Condition of Enclosures	<input type="checkbox"/>	<input type="checkbox"/>	
Mounting (S, R, H)*	<input type="checkbox"/>	<input type="checkbox"/>	
Conduit Entry Top or Bottom	<input type="checkbox"/>	<input type="checkbox"/>	
Spare Conduit to Tray	<input type="checkbox"/>	<input type="checkbox"/>	
Terminal Strip:			
- Type of Connector	<input type="checkbox"/>	<input type="checkbox"/>	
- All Wiring Secured	<input type="checkbox"/>	<input type="checkbox"/>	
Shop Drawings:			
- Interconnection Diagrams Inside Terminal Cabinet	<input type="checkbox"/>	<input type="checkbox"/>	
* S = Surface, R = Recessed, H = Hanger			
Remarks:			
Inspected by: (print) _____			
Name, Company, and Address			
Witnessed by: _____			
Witnessed by: _____			
Date: _____ y/ _____ m/ _____ d			



1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment and services necessary for panelboard Work in accordance with the Contract Documents.

**1.2 REFERENCES**

1.2.1 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

1.2.2 CSA C22.2 No. 29, Panelboards and Enclosed Panelboards.

1.2.3 CAN/CGSB-1.81-M, Air Drying and Baking Alkyd Primer for Vehicles and Equipment.

1.2.4 CAN/CGSB-1.104-M, Semigloss Alkyd Air Drying and Baking Enamel.

1.2.5 CSA C22.2 No. 0.4, Bonding of Electrical Equipment.

1.2.6 CSA C22.2 No. 5, Moulded Case Circuit Breakers, Molded – Case Switches and Circuit-Breaker Enclosures.

1.2.7 CSA C 22.2 No. 94-M, Special Purpose Enclosures.

1.2.8 OESC, Ontario Electrical Safety Code.

**1.3 SUBMITTALS**

1.3.1 Submit in accordance with Section 01 33 00.

**1.3.2 Product Data and Shop Drawings Package:**

**1.3.2.1 Product Data:**

1.3.2.1.1 Submit manufacturer's Product data indicating:

1.3.2.1.1.1 Technical data, supplemented by bulletins, component illustration, detailed views, technical descriptions of items, and parts lists.

1.3.2.1.1.2 Performance criteria, compliance with appropriate reference standards, characteristics, limitations, and troubleshooting protocol.

1.3.2.1.1.3 Product transportation, storage, handling, and installation requirements.

**1.3.2.2 Shop Drawings:**

1.3.2.2.1 Submit Shop Drawings in accordance with Section 01 33 23 indicating:

1.3.2.2.1.1 Elevations, sections and details of components, dimensions, gauges, finishes and relationship to adjacent construction.

1.3.2.2.1.2 Schematic, complete panel circuit schedule in accordance with Contract Documents.

**1.3.3 Commissioning Package:**

1.3.3.1 Submit the following in accordance with Section 01 91 00:

1.3.3.1.1 Commissioning Plan.

1.3.3.1.2 Commissioning Procedures.

1.3.3.1.3 Certificate of Readiness.

1.3.3.2 Attach completed test sheets specified in Section 26 08 00 to the Certificate of Readiness.

**1.3.4 Commissioning Closeout Package:**

1.3.4.1 Submit the following in accordance with Section 01 91 00:

1.3.4.1.1 Deficiency Report.

1.3.4.1.2 Commissioning Closeout Report.

**1.3.5 Closeout Submittals Package:**

1.3.5.1 Submit the following for incorporation into the Operation and Maintenance Manuals in accordance with Section 01 78 23:

1.3.5.1.1 Identification: Manufacturer's name, type, year, serial number, number of units, capacity, and identification of related systems.

1.3.5.1.2 Functional description detailing operation and control of components.

1.3.5.1.3 Performance criteria and maintenance data.

1.3.5.1.4 Safety precautions.

1.3.5.1.5 Operating instructions and precautions.

1.3.5.1.6 Component parts availability including names and addresses of spare parts suppliers.

1.3.5.1.7 Maintenance and troubleshooting guidelines/protocol and recommended equipment for analysis and repair.

1.3.5.1.8 Final tests and commissioning reports.

1.3.5.1.9 Torque measurements.

1.3.5.2 Submit the following maintenance materials in accordance with Section 01 78 43:

1.3.5.2.1 Spare Parts:

1.3.5.2.1.1 Keys and tools.

**2 Products**

**2.1 MANUFACTURERS**

2.1.1 Schneider Electric.

2.1.2 Cutler-Hammer.

2.1.3 Siemens Canada.

**2.2 MATERIALS**

2.2.1 Steel sheet: ASTM A653, Z275 coating designation; galvanized steel sheet.

2.2.2 Stainless steel sheet: ASTM A240, type 304.

2.2.3 Expanding type metallic anchors: Cinch two unit threaded anchorages.

2.2.4 Bolts: 10 mm diameter to suit anchors.

**2.3 PANELBOARD**

2.3.1 Panelboards: To CSA C22.2 No. 29 and Canadian Electrical Code requirements, including barriers.

- 2.3.2 EEMAC 1, rated at 120/208 V or 600/347 V, 3 phase, 4 wire, for distribution of normal and emergency power for lighting circuits, control circuits, power circuits and electric heating circuits as shown on Contract Documents and unless noted otherwise.
- 2.3.3 Panelboard interiors factory assembled, with bolt-on circuit breakers and designed so circuit breakers for replacement without disturbing adjacent devices and without removing main bus connectors.
- 2.3.4 Panelboards with tin plated copper buses, bus bracing 10 kA @ 240 V AC or 22 kA @ 600 V AC unless noted otherwise.
- 2.3.5 Main bus bars shall be rated for continuous current as indicated on the Contract Documents. Bussing shall be of sufficient cross-sectional area to meet CSA C22-2 No. 29 standard for temperature rise.
- 2.3.6 Solid neutral bus shall be designed to meet the requirements of CSA C22.2 Nos. 0.4 and 29. Neutral bussing shall have a suitable lug for each outgoing feeder and spaces on the panel board. Neutral bussing shall be overrated as indicated on the Contract Documents.
- 2.3.7 Solidly bonded copper ground bus shall be provided. Additional copper isolated ground bus as indicated on the Contract Documents.
- 2.3.8 All circuit carrying parts shall be insulated from ground and phase-to-phase by high dielectric strength barrier or equivalent.
- 2.3.9 Main circuit breaker and main lug panel board interior shall be field convertible for top or bottom incoming feed.
- 2.3.10 All unused space provided, unless otherwise specified, shall be fully equipped for future devices, including all appropriate connectors and mounting hardware.
- 2.3.11 Interior trim shall be dead-front construction to shield user from energized parts. Empty spaces shall be provided with blanking plates.
- 2.3.12 Connections with solderless lugs on main and neutral busbars and at circuit breaker load terminals.
- 2.3.13 Cabinets of steel sheet, thickness equal to code gauge for similar steel cabinets, fabricated in C form type style and having spot-welded seams.
- 2.4 CIRCUIT BREAKERS (MAIN AND BRANCH)**
- 2.4.1 All circuit breakers: Moulded case, over-centre, trip-free, toggle mechanism, operated with quick-make, quick-break contact action, calibrated at 40°C, bolted into panel assemblies of busses and connectors. Trip ratings as shown on the Contract Documents, or as ordered by TTC.
- 2.4.2 Circuit breakers: one, two or three pole as required, equipped with thermal and magnetic trip units having inverse time current characteristics. Two-pole and three-pole breakers shall have common trip action between individual trip elements for each pole. Automatic tripping indicated by breaker handle assuming distinctive position from manual "on" and "off" positions.
- 2.4.3 Circuit breakers (main and branch) frame size as shown on Contract Documents meeting requirements of CSA C22.2 No. 5M with minimum 10 kAIC at 208 V or 22 kAIC at 600 V unless noted otherwise.
- 2.4.4 Circuit breakers handle and faceplate shall indicate rated ampacity. Standard construction of circuit breakers shall comply for reverse connection without restrictive line or load markings.

2.4.5 Branch circuit breaker shall be CSA or cUL listed as HACR (Suitable for Heating, Air-conditioning Loads) or SWD (Switch duty of fluorescent or High Intensity Discharge Lighting Load).

2.4.6 Provide ground fault circuit breaker with 30 mA sensitivity as shown on Contract Documents. Ground fault circuit-breaker with minimum 10 kAIC at 208 V or 600 V.

## **2.5 SUPPORT CHANNELS AND FASTENERS**

2.5.1 Support channels: In accordance with Section 26 05 29.

2.5.2 Fasteners: As recommended by panelboard manufacturer for particular substrate.

## **2.6 IDENTIFICATION**

2.6.1 Identify panelboards with nameplates in accordance with Section 26 05 53.

## **2.7 ENCLOSURES**

2.7.1 Constructed from galvanized steel sheet, of thickness equal to code gauge for similar steel cabinets, fabricated by "forming up" and having spot-welded seams. Panelboard cabinet assembly to comply with CSA enclosure type 2.

2.7.2 Enclosure width shall be maximum 660 mm, minimum 508 mm.

2.7.3 Enclosures shall have end walls with knockouts complete with welded interior mounting studs.

2.7.4 Finish on enclosures and trim as follows:

2.7.4.1 High quality metal primer coat to CAN/CGSB-1.81-M, Type 1 and filler and body coats then applied on inside and outside surfaces.

2.7.4.2 Finish coats alkyd base enamel conforming to CAN/CGSB-1.104-M colour conforming to CGSB 1-GP-12c, Section 5, Code 501-211, grey semi-gloss, type 11. Each enamel coat dried and rubbed before following coat applied.

2.7.4.3 Cardholder for circuit designation cards, consisting of heavy white paper under transparent cover and mounted in suitable metal frame, supplied on back of each panel door.

## **2.8 TRIM**

2.8.1 Trim: Galvanized steel sheet, of code thickness.

2.8.2 Trim shall be one piece with hinged door and mounted with trim screws door-in-door. Mounting shall be flush or surface as indicated on the Contract Documents.

2.8.3 Front cover plate complete with lock shall be hinged to door.

2.8.4 Each door with latch and flush cylinder type lock operated with key. Supply two keys for each lock. Fasten trim to cabinets by means of approved non-corroding clamps.

## **2.9 PANEL CIRCUIT SCHEDULE**

2.9.1 After panelboards phase balanced, fill-in panel circuit schedule and insert it into cardholder provided on back of panel door. Schedule typewritten and neatly arranged indicating which loads fed by each circuit.

3 Execution

**3.1 INSTALLATION**

3.1.1 Install support channels to concrete and masonry substrates in accordance with Section 26 05 29.

3.1.2 Where no mounting surface available, install steel supports for mounting of panelboard cabinets. Steel supports and primer finish specified in Section 05 50 00.

3.1.3 Install panelboards to support channels in locations shown on Contract Drawings and in accordance with manufacturer's written instructions. Use minimum of 4 fasteners for each panel.

3.1.4 Where panelboard cabinets mounted on concrete surfaces, mount cabinets with minimum of 4 bolts and anchors.

3.1.5 Set panelboards plumb, true and square with adjacent surfaces at location shown on Contract Drawings.

3.1.6 Make electrical connections, including grounding, as shown on Contract Drawings and as specified in Section 26 05 26.

**3.2 FIELD QUALITY CONTROL AND COMMISSIONING**

3.2.1 Perform commissioning in accordance with Sections 01 91 00, 26 05 00 and 26 08 00.

**END OF SECTION**





1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment and services necessary for wiring devices Work in accordance with the Contract Documents.

**1.2 REFERENCES**

1.2.1 ASTM A167, Standard Specification for Stainless and Heat-Resistant Chromium-Nickel Steel Plate, Sheet and Strip.

1.2.2 CSA C22.2 No. 0, General Requirements.

1.2.3 CSA C22.2 No. 18.1, Metallic Outlet Boxes (Tri-National Standard, with ANCE NMX-J-23/1 and UL 514A).

1.2.4 CSA C22.2 No. 42, General-Use Receptacles, Attachment Plugs and Similar Wiring Devices.

1.2.5 CSA C22.2 No. 42.1, Cover Plates for Flush-Mounted Wiring Devices (Bi-National Standard, with UL 514D).

1.2.6 CSA C22.2 No. 111, General-Use Snap Switches (Bi-National Standard, with UL 20).

**1.3 SUBMITTALS**

1.3.1 Submit in accordance with Section 01 33 00.

**1.3.2 Product Data:**

1.3.2.1 Submit manufacturer's Product data indicating:

1.3.2.1.1 Technical data, supplemented by bulletins, component illustrations, detailed views, technical descriptions of items and parts lists.

2 Products

**2.1 MANUFACTURERS**

2.1.1 Hubbell.

2.1.2 Cooper (Eaton).

2.1.3 Thomas & Betts (T&B).

2.1.4 Crouse-Hinds.

2.1.5 Appleton.

**2.2 MATERIALS**

2.2.1 Material requirements: All wiring devices listed in this Section shall be extra heavy-duty industrial grade.

**2.2.2 Switches:**

2.2.2.1 Rated 20 A at 120 V AC, single pole or 3-way.

2.2.2.1.1 Manufacturer(s):

2.2.2.1.1.1 Hubbell.

2.2.2.1.1.2 Cooper (Eaton).

- 2.2.2.2 Flush mounted switches: Wiring device box shall be CSA approved for recessed mounting and complete with stainless steel covers.
- 2.2.2.3 Surface mounted switches: Wiring device boxes shall be CSA approved Type 'FS' or 'FD', cast hub, constructed of malleable iron and zinc-electroplated. Covers shall be of the same material, complete with stainless steel screws and neoprene gaskets, either weatherproof or for dry locations, as indicated on Contract Drawings.
  - 2.2.2.3.1 Manufacturer(s):
    - 2.2.2.3.1.1 Appleton.
    - 2.2.2.3.1.2 Crouse-Hinds.
- 2.2.2.4 Device boxes encased in concrete shall be PVC slab boxes, suitable for PVC rigid conduit connections. Refer to Section 26 05 34 for PVC conduit manufacturers.
- 2.2.3 Convenience Outlet Receptacles:**
  - 2.2.3.1 Convenience outlet receptacles: Heavy-duty, specification grade duplex U ground type, rated at 15 A, 125 V.
  - 2.2.3.2 Convenience outlet receptacles: Heavy-duty, specification grade duplex U ground type, rated at 20 A, 125 V; type: CSA 5-20RA.
  - 2.2.3.3 Isolated ground receptacles: Heavy-duty, specification grade duplex U ground type, rated 15 A, 125 V, orange colour.
  - 2.2.3.4 Receptacle covers: Refer to wiring devices schedule.
  - 2.2.3.5 Convenience outlet GFCI duplex receptacles: Heavy-duty, specification grade duplex U ground type, rated at 15 A, 125 V.
  - 2.2.3.6 Convenience outlet GFI duplex receptacles: Heavy-duty, specification grade duplex U ground type, rated at 20 A, 125 V; type: CSA 5-20RA.
  - 2.2.3.7 Flush mounted receptacles: Wiring device boxes shall be CSA approved for recessed mounting and complete with stainless steel covers.
    - 2.2.3.7.1 Manufacturer(s):
      - 2.2.3.7.1.1 Hubbell.
      - 2.2.3.7.1.2 Cooper (Eaton).
  - 2.2.3.8 Surface mounted receptacles: Wiring device boxes shall be Type 'FS' or "FD", cast hub, constructed of malleable iron and zinc-electroplated. Covers shall be of the same material, complete with stainless steel screws and neoprene gaskets, either weatherproof or for dry locations, as indicated on Contract Drawings.
    - 2.2.3.8.1 Manufacturer(s):
      - 2.2.3.8.1.1 Appleton.
      - 2.2.3.8.1.2 Crouse-Hinds.
  - 2.2.3.9 Device boxes encased in concrete shall be PVC slab boxes, suitable for PVC rigid conduit connections. Refer to Section 26 05 34 for PVC box manufacturers.

- 2.2.4 Refer to the following schedule for a list of materials for various wiring devices. Refer to Contract Drawings for the type of wiring devices required in different location.

Wiring Device Schedule				
	PART NUMBER	ITEM	TYPE	RATING
1	HBL5252ICN, Hubbell	Convenience Receptacle	Duplex	125 V, 15 A
2	GFR5252IA, Hubbell	GFI Receptacle	Duplex	125 V, 15 A
3	IG5262CN, Hubbell	IG Receptacle, Orange Colour	Duplex	125 V, 15 A
4	HBL5352ICN, Hubbell	Convenience Receptacle	Duplex, CSA 5-20RA	125 V, 20 A
5	GFR5352IA, Hubbell	GFI Receptacle	Duplex, CSA 5-20RA	125 V, 20 A
6	S8, Hubbell	Receptacle cover	Stainless steel	
7	FSK-1VDR, Appleton	Receptacle cover	Weather proof, Malleable Iron	
8	FSK-1DR-C, Appleton	Receptacle cover	Cast Malleable Iron	
9	S26, Hubbell	GFI Receptacle cover	Stainless steel	
10	FSK-WGF1, Appleton	GFI Receptacle cover	Weather proof, Malleable Iron	
11	BCMBD-1-K, Iberville (T&B)	Receptacle box	Recessed Masonry	125 V
12	BC3104-LSSX, Iberville (T&B)	Receptacle box	Recessed Gypsum board	125 V
13	FD-2, Appleton	Receptacle or Switch box	Surface, Malleable Iron	

Note: The manufacturer and part number of devices are for guidance purpose. Substitution of manufacturer is acceptable with the list of manufacturers listed in this Section, Paragraph 2.1.

### 3 Execution

#### 3.1 INSTALLATION

- 3.1.1 Install wiring devices in boxes as indicated on Contract Drawings. Type and manufacturer in accordance with wiring devices schedule unless indicated otherwise.
- 3.1.2 Measure mounting heights of equipment from finished floor/grade to centreline of equipment unless indicated otherwise.
- 3.1.3 If mounting height of equipment is not indicated, verify with TTC before proceeding with installation.
- 3.1.4 Connect bonding conductor to wiring device ground terminal.
- 3.1.5 Install electrical equipment at following heights above finished floor/grade unless indicated otherwise:
- 3.1.5.1 Local switches: 1200 mm.
- 3.1.5.2 Welding receptacles: 1000 mm.
- 3.1.5.3 Drop cord receptacles: 2000 mm.

- 3.1.5.4 Wall Receptacle: 400 mm; 1000 mm in Storage Room; 850 mm in Office, Zone Hub Areas. Verify site condition before installation.
- 3.1.6 Connect convenience outlets in running structure to two branch circuits. Remove jumper on line side between two halves of duplex receptacle and wire units separately, using back wiring facility.
- 3.1.7 Install outlet boxes recessed in Office, Zone Hub, and Storage Room.
- 3.1.8 Install isolated ground receptacles with separate insulated bonding conductor all the way back to the distribution equipment. Cable/Wires to isolated ground receptacles shall have a green bond conductor and insulated green conductor. Installations with taped green conductors are not acceptable.

**END OF SECTION**

1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment, and services necessary for lighting equipment Work in accordance with the Contract Documents.

**1.2 REFERENCES**

1.2.1 ANSI C136.37, Solid State Lighting Sources Used in Roadway and Area Lighting.

1.2.2 CSA C22.2 No. 9.0, General Requirements for Luminaires.

1.2.3 CSA C22.2 No. 74, Equipment for Use with Electric Discharge Lamps.

1.2.4 CSA C22.2 No. 141, Emergency Lighting Equipment.

1.2.5 CSA C22.2 No. 206, Lighting Poles.

1.2.6 CSA C22.2 No. 250.0, Luminaires.

1.2.7 CSA C22.2 No. 250.4, Portable Luminaires.

1.2.8 CAN/CSA-A14, Concrete Poles.

1.2.9 CAN/CSA-C22.2 No. 250.13-14, Lighting Emitting Diode (LED) Equipment for Lighting Applications.

1.2.10 CAN/CSA-E920, Ballasts for Tubular Fluorescent Lamps - General and Safety Requirements.

1.2.11 CAN/CSA-E922, Ballasts for Discharge Lamps (Excluding Tubular Fluorescent Lamps - General Safety Requirements.

1.2.12 CAN/CSA-E928, Auxiliaries for Lamps - A.C. Supplied Electronic Ballasts for Tubular Fluorescent Lamps.

1.2.13 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.

1.2.14 CAN/CSA-S157, Strength Design in Aluminum.

1.2.15 CSA W59, Welded Steel Construction (Metal Arc Welding).

1.2.16 IES LM-79, Approved Method: Electrical and Photometric Testing of Solid-State Lighting Devices.

1.2.17 IES LM-80, Approved Method: Measuring Lumen Depreciation of LED Light Sources.

1.2.18 IES TM-21, Projecting Long Term Lumen Maintenance of LED Light Sources.

1.2.19 NEMA SH5, Standards for Tubular Steel, Aluminum and Prestressed Concrete Roadway Lighting Poles.

1.2.20 NEMA SSL-1, Electronic Drivers for LED Devices, Arrays, or Systems.

1.2.21 OESC, Ontario Electrical Safety Code.

1.2.22 Toronto Green Development Standards.

1.2.23 UL 8750, Light Emitting Diode (LED) Equipment for Use in Lighting Products.

**1.3 SUBMITTALS**

1.3.1 Submit in accordance with Section 01 33 00.

**1.3.2 Shop Drawings:**

1.3.2.1 Submit Product data indicating:

1.3.2.1.1 Technical data, supplemented by bulletins, component illustrations, detailed views, technical descriptions of items, and parts lists.

1.3.2.1.2 Luminaire photometric data:

1.3.2.1.2.1 Computer generated illuminance print out for area lit by luminaire.

1.3.2.2 Submit manufacturer's technical documentation for lamps such as operating voltages, wattage, lumens, rated life, colour temperature K, base type, and lamp shape.

1.3.2.3 Submit Shop Drawings in accordance with Section 01 33 23 indicating:

1.3.2.3.1 Elevations, sections, and details of fixtures and components, dimensions, gauges, finishes, and relationship to adjacent construction.

**1.3.3 Commissioning Submittals:**

1.3.3.1 Submit the following in accordance with Section 01 91 00:

1.3.3.1.1 Commissioning Procedures.

1.3.3.1.2 Certificate of Readiness.

**1.3.4 Commissioning Closeout:**

1.3.4.1 Submit the following in accordance with Section 01 91 00:

1.3.4.1.1 Deficiency Report.

1.3.4.1.2 Commissioning Closeout Report.

**1.3.5 Closeout Submittals Package:**

1.3.5.1 Submit the following for incorporation into the Operation and Maintenance Manuals, in accordance with Section 01 78 23:

1.3.5.1.1 Identification: Manufacturer's name and Product's type, year, serial number, number of units, capacity, and identification to related systems.

1.3.5.1.2 Ballast documentation.

1.3.5.1.3 Lenses documentation.

1.3.5.1.4 Safety precautions.

1.3.5.1.5 Operating instructions and precautions.

1.3.5.1.6 Component parts availability, including names and addresses of spare part(s) suppliers.

1.3.5.1.7 Final tests and commissioning reports.

## **1.4 QUALITY ASSURANCE**

### **1.4.1 Manufacturer:**

1.4.1.1 Manufacturers' qualifications: Company specializing in manufacturing Products specified in this Section, with minimum 10 years documented experience.

1.4.1.2 Energy Star Rated Products.

## **1.5 ILLUMINANCE LEVEL**

1.5.1 Maintain illuminance level for areas in accordance with Attachment 26 50 00.01 - Illuminance Level Schedule.

## **1.6 GREEN LIGHTING DESIGN**

1.6.1 Use energy-efficient fixtures, lamps, photocells, timers, and occupancy sensors.

## **1.7 WARRANTY**

1.7.1 Five-year full replacement parts and labour included warranty.

## **2 Products**

## **2.1 MATERIALS AND ACCESSORIES**

2.1.1 Electrical equipment and devices: CSA approved or ULC listed.

2.1.2 Masonry anchors: Expanding, metallic type, cinch two unit threaded anchorages. Size anchors to suit fasteners as indicated on Contract Drawings.

2.1.3 Mounting accessories: Supplied with fixture, bolted in position infield with hot-dip galvanized hardware.

2.1.4 Internal fixture wire:

2.1.4.1 Buildings: #16 minimum Types TFF or TEW rated for 150°C @ 600 volt or 1000 volt.

2.1.4.2 Poles: #10 minimum Type RW90 XLPE.

2.1.5 Connectors: Insulated solderless connector (non-crimping type).

2.1.6 Finishes: In accordance with Section 26 05 00.

## **2.2 LUMINAIRES**

2.2.1 Provide luminaires as noted in Contract Documents.

2.2.2 Generally, fixture bodies to be minimum 20 gauge, cold-rolled prime steel of rigid construction with knockouts as required, unless otherwise noted.

2.2.3 Luminaires rigidity to permit any suspension method without sag.

2.2.4 Fluorescent suitable for either individual or continuous row mounting.

2.2.5 Fixtures finished in baked white enamel. Fixtures finish to resist chipping, corrosion, and discolouration. Before finishing, metal to be chemically degreased and neutralized. Finish not less than two coats of enamel, sprayed and baked on. Reflecting surfaces white with reflectance minimum 85%.

2.2.6 Luminaires' lenses and diffusers to be rigid enough to be self-supporting without sag, easily removable but not loose. Provide additional thickness of lens to prevent sag at no extra cost.

2.2.7 LED module/diode manufacturer(s):

2.2.7.1 Cree, Inc.

2.2.7.2 Philips Lighting Holding B.V.

2.2.7.3 Osram-Sylvania Ltd.

2.2.7.4 Nichia Corporation.

2.2.8 LED driver manufacturer(s):

2.2.8.1 Philips Lighting Holding B.V.

2.2.8.2 Universal Lighting Technologies.

2.2.8.3 Cree, Inc.

2.2.8.4 Osram-Sylvania Ltd.

2.2.8.5 Nichia Corporation.

**2.2.9 LED Lamps/Driver:**

2.2.9.1 Colour temperature of 4000 K +/-250, unless otherwise specified.

2.2.9.2 Minimum CRI of 65.

2.2.9.3 Form factor: Round or square in accordance with the application.

2.2.9.4 L70 of  $\geq 50,000$  hours (70% of initial lumens) at 25°C outdoor and 55°C for indoor, and supported by IES LM-80 and IES TM-21 calculations.

2.2.9.5 LED light engine/module, driver, and all accessory components to be field replaceable.

2.2.9.6 With fixture-integrated passive heat sinking.

2.2.9.7 IES file based on IES LM-79.

2.2.9.8 LED retrofit luminaire conversion kits not acceptable.

2.2.9.9 LED fixtures to be in service 24/7. Colour temperature shift or L70 rating de-rating is not allowed.

2.2.9.10 Power supply: 120 V.

**2.3 LED EXIT SIGNS**

2.3.1 Exit signs to be Green Running Man signage, suitable for wall or ceiling mount as indicated on Contract Documents.

2.3.2 Housing: aluminum, brushed aluminum finish, with faceplate with snap out or pre-specified directional arrows.

2.3.3 Face and back plates: Die-cast aluminum.

2.3.4 Power supply: 120 V AC input without the need of external transformer (integral transformer).

2.3.5 Lamps: LED Type, self-contained, 6 to 24 V DC, and over 50,000 hours.

2.3.6 Manufacturer(s):

2.3.6.1 Lumacell, brand of Thomas & Betts, a member of the ABB Group.

2.3.6.2 Emergi-lite, brand of Thomas & Betts, a member of the ABB Group.



3 Execution

**3.1 INSTALLATION**

**3.1.1 Light Fixtures:**

- 3.1.1.1 Install lamps/LED engines in all fixtures unless otherwise indicated on Contract Drawings.
- 3.1.1.2 Generally, ballasts/drivers to be integral with fixture unless otherwise noted.
- 3.1.1.3 Install lighting fixtures in locations indicated on Contract Drawings, or as directed by TTC. Align luminaires parallel or perpendicular to building grid line.
- 3.1.1.4 Where fixtures mounted on masonry or concrete, fasten with two bolts of minimum dia. of 10 mm placed maximum of 1 m apart.
- 3.1.1.5 Solidly ground frames and casings of lighting fixtures to wiring system and ground loops. Make final connections to fixtures recessed in ceilings by means of 11 mm of specified flexible conduit. Connect fixture wires to ballast leads inside lighting fixture with specified and approved connector properly applied. Apply single wrap of adhesive thermoplastic electrical tape over connector and wires so connector not loosened by vibration.
- 3.1.1.6 Where recessed fixtures are installed in suspended ceiling, install frames, plaster rings, and suspension brackets and suitable ceiling trims or flanges to match ceiling finishes.
- 3.1.1.7 Provide trims and supports suitable for mounting in linear metal ceiling. Coordinate with linear metal ceiling installer for exact size and location of cut-outs and mounting details.
- 3.1.1.8 Install steel support for lighting fixtures as required.
- 3.1.1.9 Provide wall mounted light fixtures with bottom cable entry only.
- 3.1.1.10 Luminaires to be properly cleaned at time of installation. Luminaires showing marks or scratches due to handling or tool-marked will be rejected without cost to TTC.
- 3.1.1.11 Do not suspend light fixtures from ductwork, piping, mechanical equipment or their supports. Fixtures to be supported independently off ceiling system.
- 3.1.1.12 Noisy ballasts or drivers replaced without cost to TTC. Decision as to what constitutes noisy ballast rests with TTC.
- 3.1.1.13 Where luminaires are mounted on wiring channels or assemblies, provide necessary barrier to isolate dual power sources.
- 3.1.1.14 Luminaires in service and new office areas to be installed after mechanical equipment are in place. Luminaires to be located clear of obstructions.
- 3.1.1.15 Apply to Hydro for rebate for using energy efficient lamps, ballasts, and fixtures in the Contract. Pass rebate to TTC. No extra cost allowed for making application to Hydro for rebate. Information required by Hydro for the application to be supplied by TTC.

**3.2 FIELD QUALITY CONTROL AND COMMISSIONING**

- 3.2.1 Perform commissioning in accordance with Sections 01 91 00, 26 05 00, and 26 08 00.

**3.3 MAINTENANCE**

3.3.1 Maintain equipment and systems until Substantial Performance in accordance with Section 01 78 25.

3.3.2 Carry out regular scheduled maintenance of equipment and systems following Substantial Performance until Contract Completion, in accordance with Section 01 78 25.

**END OF SECTION**

ILLUMINANCE LEVEL SCHEDULE

STATION AREA

AREA	AVERAGE MAINTAINED ILLUMINANCE LEVELS (in lux)	LIGHT LOSS FACTOR (LLF)	
		FLUORESCENT /HID	LED
Public Washrooms	200	0.75	0.85
Station Entrance - above ground	150/days 50/nights	0.65 0.65	0.80
Stairs	150	0.65	0.80
Passageway Enclosed	100	0.65	0.80
Station Public Areas	150	0.75	0.85
Station Platform	100	0.65	0.80
Station Platform Edge	200	0.65	0.80
Designated Waiting Areas	250	0.65	0.80
Escalator Area	150	0.65	0.80
Building Connection	100	0.65	0.80
Bus Terminal - Loading and unloading	100	0.65	0.80
Bus Terminal - Loops	50	0.65	0.80
Passenger pickup and drop-off	50	0.65	0.80
Park and Ride - Open parking	25	0.65	0.80
Park and Ride - Covered parking	50	0.65	0.80
Park and Ride: - Pedestrian areas, ramps, and corners (Note 1)	100/days; 50/nights	0.65	0.80
- Entrance areas (Note 2)	500/days; 50/nights	0.65	0.80
Pedestrian ways: - Open	50	0.65	0.80
- Covered	100	0.65	0.80
Mezzanine	150	0.65	0.80
Corridors General and Service Areas	150	0.65	0.80
Fare vending machines	250	0.65	0.80
Fare barriers/gates	250	0.65	0.80
Landscape	As required for accent	0.75	0.85
Traction Power Substation - exterior (transformer yard and control room)	50	0.65	0.80
Collector's Booth	200	0.65	0.80
Collector's Anteroom	150	0.65	0.80
Collector's Washroom	150	0.65	0.80
Operator's Lunchroom	250	0.65	0.80
Inspector's Room	250	0.65	0.80

AREA	AVERAGE MAINTAINED ILLUMINANCE LEVELS (in lux)	LIGHT LOSS FACTOR (LLF)	
		FLUORESCENT /HID	LED
Staff Washroom	150	0.65	0.80
Unassigned Area	100	0.65	0.80
Designated Retail Areas	200	0.65	0.80
News Stand and Storage	200	0.65	0.80
Electrical Room	250	0.65	0.80
UPS Room	250	0.65	0.80
Plant Electrical Maintenance Room	150	0.65	0.80
D.C. Tie Breaker Room	250	0.65	0.80
Communication Room	250	0.65	0.80
Telephone Room	250	0.65	0.80
Traction Power Room	250	0.65	0.80
Communication Maintenance Room	250	0.65	0.80
Passenger Station Electrical Room	250	0.65	0.80
VFD Room	250	0.65	0.80
Line Mechanics' Service Room	250	0.65	0.80
Track Patrol Room	100	0.65	0.80
Mechanical Room	250	0.65	0.80
Sump Pump Room	100	0.65	0.80
Refuse Storage Room	100	0.65	0.80
Scrubber Machine Repair Shop	150	0.65	0.80
Valve Room	100	0.65	0.80
Janitor Service Room	100	0.65	0.80
Janitor Closet	100	0.65	0.80
Janitor's Change Room	250	0.65	0.80
Scrubber Machine Battery Room	150	0.65	0.80
Janitorial Relamper's Room	100	0.65	0.80
Fire Prevention Room	150	0.65	0.80
Carpenter's Room	150	0.65	0.80
Plumber's Maintenance Room	150	0.65	0.80
Bricklayer's Room	150	0.65	0.80
HVAC Room	150	0.65	0.80
Subway Ventilation Room (Concourse)	100	0.65	0.80
Subway Ventilation Room (Track)	100	0.65	0.80
Elevating Devices Storage	100	0.65	0.80

AREA	AVERAGE MAINTAINED ILLUMINANCE LEVELS (in lux)	LIGHT LOSS FACTOR (LLF)	
		FLUORESCENT /HID	LED
Elevator Machine Room	150	0.65	0.80
Escalator Service Room	150	0.65	0.80
Mechanical Maintenance Shop	150	0.65	0.80
Security Room	100	0.65	0.80
Signal Local Tower Room	250	0.65	0.80
Signal Relay Room	250	0.65	0.80
Signal Power Supply Room	250	0.65	0.80
Signal Zone Control Panel Room	250	0.65	0.80
Signal Motor Alternator Room	250	0.65	0.80
Signal Maintainer's Lunchroom	250	0.65	0.80
Signal Maintainer's Change Room	250	0.65	0.80
Signal Maintainer's Maintenance Room	150	0.75	0.85
Signal Maintainer's Storage Room	100	0.75	0.85
Traction Power Substation Transformer Yard and Control Room (Exterior)	50	0.65	0.80
Traction Power Transformer Yard (Interior)	50	0.75	0.85
Control Room	250	0.65	0.80
Cable Room	100	0.75	0.85
Battery Room	250	0.75	0.85
Washroom	150	0.75	0.85
Staff Lunchroom	250	0.75	0.85
Rectifier Room	250	0.65	0.80
Storage Room	100	0.75	0.85
Escalator Truss	150	0.65	0.80
Elevator Shaft (top)	100	0.65	0.80
Elevator Pit	100	0.65	0.80
Elevator Door Entrance and Vestibule	200	0.65	0.80
<p>Note 1: The effects of daylight to be considered in applicable areas for day and night periods.</p> <p>Note 2: In covered parking facilities, the entrance area to be defined as the portal or physical entrance to the covered portion of a parking structure to a point 15 m beyond the edge of the covering into the structure.</p> <p>Note 3: Emergency egress paths to be illuminated to a value of 50 lux, which is supplied from an emergency power source.</p>			

**END OF SCHEDULE**



1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment, tools, supervision and services necessary for electrical testing Work in accordance with the Contract Documents.

**1.2 DEFINITIONS**

1.2.1 Post Installation Tests: Tests performed following equipment or component installation within systems, to verify proper installation.

1.2.2 System Acceptance Tests: Tests that demonstrate the safe operation of equipment individually or grouped together into systems, to meet the required performance.

1.2.3 Terminal: A point where the controlled medium enters or leaves the distribution system.

1.2.4 Field Testing: The verification of the performance of equipment individually or grouped together into systems in accordance with the Contract Documents when the equipment is installed at the site in its permanent location and configuration.

1.2.5 Test Procedure: Documentation containing test description, test location, test instrumentation, test methodology, test sheets, and preliminary table of contents of test report.

1.2.6 Factory Acceptance Tests (FAT): Tests of equipment design capabilities conducted at Contractor facilities prior to shipment of equipment to site.

**1.3 RESPONSIBILITIES**

**1.3.1 TTC:**

1.3.1.1 Attend and witness testing at the Site.

**1.3.2 Contractor:**

1.3.2.1 Schedule and perform post installation testing.

1.3.2.2 Retain the services of manufacturer's factory service representatives to check installation if applicable, supervise start-up, adjust, and calibrate components. Provide these services for such a period, and for as many visits as necessary to put equipment into operation.

1.3.2.3 Schedule and perform system acceptance testing.

1.3.2.4 Provide adequate notice of testing to TTC.

1.3.2.5 Provide all submittals in a timely manner.

**1.4 SUBMITTALS**

1.4.1 Submit in accordance with Section 01 33 00.

**1.4.2 Quality Assurance Submittal(s):**

**1.4.2.1 Test Plans:**

1.4.2.1.1 Submit a Test Plan which outlines the goals and objectives of a testing program, defines the methods and individual test objectives required to meet those goals, and summarizes the duration and resource requirements.

- 1.4.2.2      **Test Procedures:**
- 1.4.2.2.1      At least 30 Days prior to the commencement of testing, submit complete and detailed test procedures.
- 1.4.2.2.2      Each test procedure shall:
- 1.4.2.2.2.1      Specify the objective of the test.
- 1.4.2.2.2.2      Identify the equipment or system under test.
- 1.4.2.2.2.3      Define the test equipment and instrumentation setups to be used for testing.
- 1.4.2.2.2.4      Identify any safety precautions required during the test.
- 1.4.2.2.2.5      Safety of personnel and equipment is paramount during test performance. The Supplier will identify all hazards and controls used to mitigate those hazards to the satisfaction of TTC. TTC will disallow or discontinue any tests or test sessions where safety is not properly addressed.
- 1.4.2.2.2.6      Define the test steps, their sequence and data to be recorded.
- 1.4.2.2.2.7      Provide clear and unambiguous PASS or FAIL criteria for each test step and for the complete test.
- 1.4.2.2.2.8      Define the type of results report to be issued.
- 1.4.2.2.2.9      Define the steps required to restore the equipment or system under test to its correct state.
- 1.4.2.3      Submit also the following:
- 1.4.2.3.1      Schedule of proposed factory tests, Site tests, Site demonstrations, and training both on Site and off Site.
- 1.4.2.3.2      Test procedures for manufacturer's recommended installation checks and performance testing requirements.
- 1.4.2.3.3      Certificates and factory test reports.
- 1.4.2.3.4      Complete test procedures.
- 1.4.2.3.5      Permits issued by regulatory authorities.
- 1.4.2.3.6      Completed electrical and mechanical test sheets as required unless noted otherwise in the Contract Documents.
- 1.4.2.3.7      Test reports for each system: PA, CCTV.
- 1.4.2.3.8      Shop Drawings.
- 1.5      TEST REPORTS**
- 1.5.1      Provide test reports for all items tested. Reports to contain test procedures, methods of calculation, date and time of test, ambient conditions, names of testing firm/personnel, name of manufacturer's testing representative if applicable, test results, and applicable completed test sheets.
- 1.5.2      Prepare final test reports at the completion of each test phase documenting the results obtained. Submit test reports to TTC for approval. Test reports shall satisfy the following requirements:
- 1.5.2.1      Prepare a test report for each corresponding test procedure document.



- 1.5.2.2 Each test and test report shall be signed by authorized representatives of the Contractor, including the Project Engineer, indicating satisfactory completion of the test.
- 1.5.2.3 Test reports shall include sufficient documentation to enable TTC to reproduce the tests and obtain the same results.
- 1.5.2.4 Prepare test reports utilizing field test results obtained on final (accepted) software and hardware configurations. Test results obtained on intermediate software or hardware configurations will not be accepted for inclusion in the final test reports. Repeat tests and revise test reports if system modifications are made, to reflect the final system configuration.
- 1.5.2.5 Test reports shall include a specific conclusion relative to the objective of the tests. After successful completion of testing issue a final test report stating that the system or equipment under test has been adequately tested and is fit for the intended purpose.
- 1.5.3 Provide all necessary diagrams and schematics showing connections between test equipment and units to be tested.
- 1.5.4 Design and submit to TTC for approval, a test form showing all test results performed at the factory and in the field.
- 2 Products
- 2.1 TEST EQUIPMENT**
- 2.1.1 Provide instruments, meters, equipment and personnel required to conduct tests as required.
- 3 Execution
- 3.1 TESTING**
- 3.1.1 Safety of personnel and equipment is of paramount importance during test performance. TTC will disallow or discontinue any tests or test sessions where safety is not properly addressed.
- 3.1.2 TTC will disallow or discontinue any tests or test sessions when, due to circumstances such as poor performance, the test objectives are not being met or the test results are invalid.
- 3.1.3 Provide labour, instruments and apparatus required for tests. TTC reserves the right to check instruments or to furnish other instruments for verification. Results of tests to be permanently recorded, with a copy submitted to TTC.
- 3.1.4 Test all functions of each system in accordance with the approved test procedures to prove that each function of each system operates as required. Perform the tests in the presence of, and to the satisfaction of TTC and authorities having jurisdiction.
- 3.1.5 Operate systems and demonstrate how they conform with Specification documents. Under supervision, make adjustments and fine tune systems.
- 3.1.6 Testing methods and test results to be in accordance with the Ontario Electrical Safety Code, authorities having jurisdiction, and manufacturer's recommendations.
- 3.1.7 Perform testing with the systems completely connected, both loaded and unloaded.

- 3.1.8 Disconnect and reconnect all connections as may be required to carry out the tests. Make adjustments and correct all defects in the systems that are necessary to place the system in proper operating condition.
- 3.1.9 Post installation test equipment and systems which are provided under this Contract for defects in accordance with the Contract Documents and recommendations of the manufacturers. Make all corrections and adjustments prior to requesting inspection by TTC.
- 3.1.10 Give 48 hours' notice to TTC and authorities having jurisdiction of the proposed time of the system acceptance tests so that they can be represented at the tests.
- 3.1.11 TTC reserves the right to witness any or all tests.
- 3.1.12 TTC reserves the right to demand proof of the accuracy of all instruments used. Calibration of test instruments shall be current and documented.
- 3.1.13 When tests are performed, TTC may require that equipment be opened and/or removed from their housings and/or outlet boxes in order that the interior of equipment may be examined. Provide all labour and tools for this purpose. Restore equipment to original condition following testing.
- 3.1.14 Conceal work only after testing and acceptance by TTC.
- 3.1.14.1 Testing of PA system: Tests shall include factory acceptance tests and all tests necessary to demonstrate system compliance with the Contract including, but not to be limited to, the following specific tests:
  - 3.1.14.1.1 Tests to verify that audio levels at new Hub and Office Area are in accordance with Section 27 51 16 under simulated ambient subway noise conditions at various times of day.
  - 3.1.14.1.2 Tests to verify that a speech transmission index of 0.6 or higher has been achieved throughout the Public and Non-Public Areas of the Station.
  - 3.1.14.1.3 Tests to verify the annunciation of failures to the station control system.
  - 3.1.14.1.4 Tests to verify correct operation of remote PA from TTC Transit Control Centre (TCC) and the ability to direct PA announcements to the entire station or just the Collector Booth.
  - 3.1.14.1.5 Tests from each PA microphone to ensure correct speaker zones are activated and that adjacent speakers are muted to avoid distortion due to feedback.
  - 3.1.14.1.6 Tests to verify correct operation of PA priority settings.
  - 3.1.14.1.7 Tests to ensure indication at TCC of PA system in use by user at the CACF panel.
  - 3.1.14.1.8 Tests to ensure system capable of playing each pre-recorded messages via the station control system.
  - 3.1.14.1.9 Test to ensure test message from TCC is audible at all speakers within each station and that it is played only when test message switch is depressed.
  - 3.1.14.1.10 Any other tests as recommended by the original equipment manufacturer.

- 3.1.14.2 **Testing of CCTV system:** Tests shall include factory acceptance tests and all tests necessary to demonstrate system compliance with the Contract and shall include, but not be limited to, the following specific tests:
- 3.1.14.2.1 Test the system to ensure the required field of view is displayed on the appropriate monitor by each camera (refer to computer generated images appended to Section 28 23 23). Adjust camera positions within housings and select lenses and auto irises as necessary to the satisfaction of TTC.
- 3.1.14.2.2 Test video switchers to ensure all video is being displayed to the satisfaction of TTC (i.e. good quality image, no distortion, proper lighting levels, etc.).
- 3.1.14.2.3 Test the annunciation of CCTV system failures to the SCADA system.
- 3.1.14.2.4 Check that correct numbers and text are displayed for each camera using a colour that stands out on the display and is easy to read.
- 3.1.14.2.5 Test video recorder to ensure it records at "Alarm Record Speed" when Collector Booth foot or hand switch is activated. Ensure also that audio from talk-through microphone is recorded. Ensure that the VCR records on an endless loop cycle.
- 3.1.14.2.6 Test the CCTV system to ensure correct video image appears on the alarm monitor as selected by the collector through the master intercom unit.
- 3.1.14.2.7 Any other tests as recommended by the original equipment manufacturer.
- 3.1.14.3 **Control and communications wires and cables:**
- 3.1.14.3.1 Check each cable and wire installed by the Contractor for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.
- 3.1.14.3.2 **Tests:**
- 3.1.14.3.2.1 After installing cable but before splicing and terminating, perform insulation resistance test with megger on each conductor.
- 3.1.14.3.2.2 Check insulation resistance after each splice and/or termination.
- 3.1.14.3.2.3 Test continuity of wires, conductor resistance, and capacitance.
- 3.1.14.3.2.4 Verify wiring interconnections by "ringout".
- 3.1.14.3.2.5 During testing ensure that terminations and accessory equipment are disconnected.
- 3.1.14.3.2.6 During testing ground shields, ground wires and conductors not under test.
- 3.1.14.3.2.7 Restore all termination connections, grounds, shields, ground wires and conductors after testing.
- 3.1.14.3.3 Provide TTC with a written list of test results showing location at which each test was made, circuit tested and result of each test. Provide assurance that conditions were restored.
- 3.1.14.3.4 Remove and replace entire length of cable if cable fails to meet any of test criteria.
- 3.1.14.4 **Control panels and cabinets:**
- 3.1.14.4.1 Verify system installations, connections and controls are complete and Product is in operable condition.
- 3.1.14.4.2 Prepare and insert additional data in Operation and Maintenance Manuals when the need for additional data becomes apparent during instructions.

- 3.1.14.5      **Grounding:** Verify resistance and continuity of driven electrodes, connections, grounding conductors, main bonding conductors, and supplementary bonding conductors.
- 3.1.14.6      **Electro magnetic interference (EMI) control:**
- 3.1.14.6.1      Perform EMI analysis and testing as required under the EMI Control Plan. Analyses, test plans, procedures and reports shall be prepared and submitted to TTC.
- 3.1.14.6.2      Submit regular reports on the status of the EMI Control program. These shall be included as part of QA reporting.

**END OF SECTION**

1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment, tools, supervision, and services necessary for communications cabinets Work in accordance with the Contract Documents.

**1.2 REFERENCES**

1.2.1 CSA C22.1, Canadian Electrical Code, Part 1.

**1.3 SUBMITTALS**

1.3.1 Submit in accordance with Section 01 33 00.

**1.3.2 Shop Drawing(s):**

1.3.2.1 Submit in accordance with Section 01 33 23 indicating:

1.3.2.1.1 Technical data supplemented by bulletins, component illustrations, detailed views, technical descriptions of items, and parts lists.

1.3.2.1.2 Performance criteria, compliance with appropriate reference standards, characteristics, and limitations.

1.3.2.1.3 Product transportation, storage, handling, and installation requirements.

1.3.2.1.4 Sections, details, hardware, fasteners, and full dimensions of cabinet components.

1.3.2.1.5 Complete electrical wiring diagrams for interconnecting wiring including electrical schematics.

1.3.2.1.6 Complete engineering design data to confirm cabinets and enclosures meet design criteria specified.

1.3.2.1.7 Interior general arrangement of communication cabinet complete with intercom system, CCTV equipment, and accessories such as locks, lights, power outlet, and terminal blocks.

**1.3.3 Closeout Submittal(s):**

1.3.3.1 Submit the following for incorporation into Operation and Maintenance Manuals in accordance with Section 01 78 23:

1.3.3.1.1 Component information for associated electrical equipment.

1.3.3.1.2 Identification of manufacturing name, type, year, serial number, number of units, capacity, and identification of related items.

1.3.3.1.3 Copy of full set of reviewed Shop Drawings and, if applicable, Marked-up Shop Drawings.

1.3.3.1.4 Final installed position of Products, interconnecting wiring of electrical components and electrical schematic diagrams.

1.3.3.1.5 Warranty information.

2 Products

**2.1 MANUFACTURERS**

2.1.1 Rittal Systems Ltd.

2.1.2 Hammond Manufacturing.

2.1.3 Telemecanique.

**2.2 FREE-STANDING CABINETS IN COMMUNICATION EQUIPMENT ROOMS**

2.2.1 Include the following components and accessories:

2.2.1.1 Power outlet strip with single receptacles 120 V, surge protection and EMI/RFI noise filters, and resettable 15 A circuit breaker complete with mounting hardware.

2.2.1.2 Fluorescent light fixture: 15 Watt lamp, 120 V complete with mounting accessories.

2.2.1.3 Cable collecting rails.

2.2.1.4 Grounding straps.

2.2.1.5 Writing board.

2.2.1.6 Cabinet door lock.

2.2.1.7 Door activated light switch complete with mounting hardware.

2.2.1.8 Terminal blocks "Entelec" heavy-duty switch blocks M4/6.SNB, including subassembly accessories.

2.2.1.9 Mounting hardware for 19" equipment mounting, including adjustable support rail, adaptors for wiring systems, C-rails for internal wiring, cable collecting rails, cable clips, 180° hinges, top and bottom cable entry.

2.2.1.10 Nameplate to suit.

2.2.2 Enclosure construction to be of single floor mounted, front and back accessible design fabricated from formed steel sheet and panels, thickness as follows:

Faces and back	2.6 mm
Internal finishing panels	3.2 mm
Framing	3.4 mm

2.2.3 Enclosure doors:

2.2.3.1 Gasketed and overlapping. Gaskets to be oil resistant and permanently secured and mechanically retained.

2.2.3.2 Secured with three point latch. Equip latch rods with rollers for easy door opening.

2.2.3.3 Heavy-duty continuous hinges.

2.2.3.4 Provide bonding studs on each door and grounding stud in the enclosure.

2.2.3.5 Provide print pockets at lower section of each door.

2.2.3.6 Mounting channels to be welded on inside of enclosure to provide enclosure rigidity and to facilitate mounting hardware.

2.2.3.7 Key-operated lockset with removable cylinder and equipped with microswitch.

2.2.3.8 Provide doors at front and back of each free-standing unit.

- 2.2.4 Provide suitable measures to prevent access by rodents and insects into enclosures.
- 2.2.5 Provide enclosure with gland plates to facilitate installation of floor conduit stubouts and top entry conduits. Provide enclosure with lifting eyes.
- 2.2.6 Prime and finish doors and enclosures with manufacturer's standard grey in accordance with Section 26 05 00.
- 2.2.7 Provide flexible conduit used in wiring of receptacles, light switch, and light fixture in accordance with Section 26 05 34. Wire and cable in accordance with Sections 26 05 21.
- 2.2.8 Mounting hardware: Include subassembly plates, system bars, heavy load slides for monitors, accessory rails, inner panels, support angles, drawers, mounting channels, finishing plates and fastenings to install CCTV and Network components.

### **2.3 FABRICATION**

- 2.3.1 Fabricate Work in accordance with details and reviewed Shop Drawings. Fabricate, fit, and assemble Work in shop where possible. Where shop fabrication is not possible, make trial assembly in shop.
- 2.3.2 Fabricate Work free from defects impairing appearance, strength, and durability.
- 2.3.3 Fabricate cabinets in accordance with NEMA Type 4 requirements.

## **3 Execution**

### **3.1 INSTALLATION**

- 3.1.1 Install Product level, aligned, and connected in accordance with reviewed Shop Drawings and manufacturer's written instructions.
- 3.1.2 Provide electrolytic isolation between dissimilar metals and materials.
- 3.1.3 Wire and install associated components.
- 3.1.4 Install conduit in accordance with Section 26 05 34.
- 3.1.5 Install wires and cables in accordance with Sections 26 05 21.
- 3.1.6 Ground Product in accordance with Section 26 05 26. Grounding system to provide bonding between disconnected metal parts to ensure continuity.
- 3.1.7 Identify wiring, cabling, panels, and cabinets to be identified in accordance with Section 26 05 53. Identify components of enclosure on finishing panel.
- 3.1.8 Enclosure:
  - 3.1.8.1 Install conduit and wiring for receptacles, light fixture, and light switch.
  - 3.1.8.2 Install specified Products.
  - 3.1.8.3 Wire pushbuttons, microswitch, and cabling.
  - 3.1.8.4 Install finishing panels.

**3.2 FIELD QUALITY CONTROL**

3.2.1 Verify installation in accordance with Section 27 08 00.

**END OF SECTION**



1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment, tools, supervision and services necessary for communications wires and cables Work in accordance with the Contract Documents.

**1.2 REFERENCES**

1.2.1 ASTM B3, Specification for Soft or Annealed Copper Wires.

1.2.2 ASTM D1047, Specification for Poly (Vinyl Chloride) Jacket for Wire and Cable.

1.2.3 CSA C22.2 No. 38, Thermoset Insulated Wires and Cables.

1.2.4 CSA C22.2 No. 75, Thermoplastic-Insulated Wires and Cables.

**1.3 SUBMITTALS**

1.3.1 Submit in accordance with Section 01 33 00.

**1.3.2 Product Data and Shop Drawings Package:**

**1.3.2.1 Product Data:**

1.3.2.1.1 Submit manufacturer's Product data indicating:

1.3.2.1.1.1 Characteristics, limitations, cable construction, capacities and weights, preparation and installation requirements, and Product storage, and handling criteria.

**1.3.2.2 Shop Drawings:**

1.3.2.2.1 Submit Shop Drawings in accordance with Section 01 33 23 indicating:

1.3.2.2.1.1 Fabrication and installation of fittings and supports as well as location of cables splices.

**1.3.3 Quality Assurance Submittals:**

1.3.3.1 After completion of cables installation, provide test results of end-to-end attenuation of each cable including splices and/or connectors in accordance with Section 26 08 00.

2 Products

**2.1 MANUFACTURERS**

2.1.1 Belden.

2.1.2 Bertek.

2.1.3 Provo Ltd.

**2.2 CABLES**

**2.2.1 Control cable:**

2.2.1.1 RW90 thermosetting cross-linked polyethylene insulated, minimum 600 V insulation. Multi-conductor, CSA IL/L-FT4.

2.2.1.2 Conductors to be soft annealed copper, minimum conductor size No. 14 AWG, stranded, tinned unless otherwise indicated on the Contract Drawings.

**2.2.2 Communication cable:**

2.2.2.1 Polyethylene insulated and PVC sheathed wire.

2.2.2.2 Wires and cables to have conductors of soft annealed copper. Conductors colour coded in consistent fashion. Common conductors white in colour and ground conductors green in colour.

2.2.2.3 **Intercom Cables:** Data Twisted Cat. 6, twisted pairs, polyolefin insulated and overall beldfoil shield, by Belden.

2.2.2.3.1 23 AWG, solid bare copper conductor.

2.2.2.3.2 D.C. resistance: maximum 9.38 ohms/100 m.

2.2.2.3.3 Jacket type: PVC.

2.2.2.3.4 Fire Test: FT-6.

2.2.2.3.5 Capacitance: 160 pf/100m.

**2.2.2.4 Multi-conductor Cable:**

2.2.2.4.1 Identify individual conductors of multi-conductor cable by solid coloured insulation, in clockwise sequence as follows:

Conductor	Colour
1	Black
2	Red
3	Green
4	Yellow
5	Brown
6	Orange
7	White

2.2.2.4.2 Assembly of Multi-conductor Cable: Length of lay of cabled conductors to be in accordance with Table 28 of CSA C22.2 No. 38. Fill interstices between conductors with non-hygroscopic material, where necessary. Tape together conductor assembly with one layer of mylar tape, lapped at least 6 mm.

2.2.2.4.3 Multi-conductor Cable Sheath: Continuously extruded thermoplastic polyvinyl chloride jacket to ASTM D1047, except with minimum elongation of 150%. Sheath thickness: 2 mm average, minimum 1.6 mm at any point.

2.2.2.4.4 Tests: Dielectric strength and insulation resistance tests on finished cable conform to CSA C22.2 No. 75. Conductor resistance not to exceed .654 ohms per 305 m for No. 8 AWG conductors, 1.62 ohms per 305 m for No. 12 AWG conductors, and 4.18 ohms per 305 m for No. 16 AWG conductors at 20°C.

2.2.2.4.5 Marker: Provide multi-conductor cables with identifying marker consisting of coloured threads incorporated in cable assembly or printed on surface of thermoplastic sheath.

**2.2.2.5 Coaxial Cable (CCTV): Belden RG59/U:**

2.2.2.5.1 Cable Impedance: 75 ohms.

2.2.2.5.2 Centre conductor, 20 AWG, D.C.R. not greater than 10 ohms/305 m.

2.2.2.5.3 100% pure copper conductor.

2.2.2.5.4 Minimum 95% Copper braid shield.

- 2.2.2.5.5 Jacket type: PVC.
- 2.2.2.5.6 Fire Test: FT-4.
- 2.2.2.5.7 Capacitance: 53.1 pf/m.
- 2.2.2.5.8 RG11/U used for runs of greater than 160 m length.
- 2.2.2.5.8.1 Specifications identical to RG59/U except centre conductor, 14 AWG, D.C.R. not greater than 3 ohms/305 m and capacitance of 52.4 pf/m

## 2.3 MATERIALS

- 2.3.1 **Identification:** In accordance with Section 26 05 53.
- 2.3.2 **Terminal Lugs:** Solderless pressure-applied type lugs of conductivity not less than that of wire or cable to which they are attached.

## 3 Execution

### 3.1 INSTALLATION

- 3.1.1 Pull in all wires in any one conduit at same time directly from reels or coil carefully to avoid damage to conductors or insulation.
- 3.1.2 No joints in any conductors between any boxes or outlets. Coaxial cables shield to be unbroken throughout their length.
- 3.1.3 Use proper crimping tool on pressure applied connectors.
- 3.1.4 Fit grommets in holes where wiring passes through knockout holes in platform wireway.
- 3.1.5 Identify cables where they terminate by means of fibre tags, embossed with cable identification shown on Contract Drawings. Colour code Alpeh sheathed cables as shown on Contract Drawings.
- 3.1.6 Carefully unroll cable from reels and coil and run cable as complete from one outlet or junction box to next.
- 3.1.7 Seal space between cables and sleeves after wires and cables have been installed.
- 3.1.8 If it becomes necessary to splice cable, make this splice in junction box of adequate size. Keep number of splices in any run of cable to an absolute minimum consistent with available coil length and with installation conditions. If in the opinion of TTC an excessive number of splices has been made in a cable, remove cable and replace by cable with proper number of splices.
- 3.1.9 Splices are not be permitted in coaxial cables.
- 3.1.10 Support cables on clips at maximum spacing of 1.2 m or as specified in Contract Documents. Make bends in cable with proper tools, to the following minimum radii measured inside bend:

Sheath Diameter (OD)	Minimum Bending Radius
Up to and including 19 mm	10 x sheath diameter
Above 19 mm and including 38 mm	12 x sheath diameter
Above 38 mm	15 x sheath diameter
- 3.1.11 Straighten cable runs to form neat and uniform appearance. Run cables, as far as possible, parallel to or at right angles to walls, ceilings and floors.

- 3.1.12 Carry all conductors of any branch circuit or feeder in same multi-conductor cable, unless otherwise noted or approved by TTC.
- 3.1.13 Exercise caution when installing cable. If cable is damaged during transportation to the Site or during installation replace cable at no cost to TTC.
- 3.1.14 Strip, straighten, bend, support and terminate in conformance with installation instructions of cable manufacturer. Bend cable with minimum radii, measured inside bend, of 10 times outside diameter of cable (or in accordance with the Ontario Electrical Safety Code).
- 3.1.15 Provide watertight cable connections, Thomas & Betts, where exposed cables enter junction or terminal boxes.
- 3.1.16 Do not exceed maximum pulling tension recommended by cable manufacturer during installation.
- 3.1.17 CCTV and Intercom Cables:
  - 3.1.17.1 Install cable in conduit, unless otherwise shown on Drawings.
  - 3.1.17.2 Strip, straighten, bend, support and terminate cables in accordance with cable manufacturer's instructions.
  - 3.1.17.3 Use CSA approved lubricant compatible with cable jacket to assist in pulling conductors through conduits. Do not exceed maximum pulling tension recommended by cable manufacturer.
- 3.2 CONDUIT LUBRICANT**
  - 3.2.1 Powder soapstone or other lubricant recommended by cable manufacturer may be used for pulling cables in conduit. Cable lubricant approved water-based solvent type.
- 3.3 COILING CABLES**
  - 3.3.1 Where cable is left coiled tie neatly and securely with straps.
  - 3.3.2 Leave length of cable necessary to make connections or as indicated on Contract Drawings.
  - 3.3.3 Locate coiled cable so not to interfere with other equipment.
- 3.4 TESTS**
  - 3.4.1 Perform tests in accordance with Sections 26 08 00.

**END OF SECTION**

- 1 General
  - 1.1 SECTION INCLUDES**
    - 1.1.1 Labour, Products, equipment and services necessary for telephone service Work in accordance with the Contract Documents.
  - 1.2 WORK BY OTHERS**
    - 1.2.1 Wiring and equipment for system supplied and installed by Bell and not part of this Contract.
  - 1.3 REFERENCES**
    - 1.3.1 CAN/CSA O141, Softwood Lumber.
  - 1.4 DESIGN REQUIREMENTS**
    - 1.4.1 System operation:**
      - 1.4.1.1 When telephone, of 500 common battery type inserted in jack, associated key equipment connects to system cable pair and supply line voltage.
      - 1.4.1.2 Signal levels and impedance of system compatible with existing Bell equipment.
      - 1.4.1.3 Have system provide acceptable operation and signal levels.
  - 1.5 SUBMITTALS**
    - 1.5.1 Submit in accordance with Section 01 33 00.
    - 1.5.2 Product Data:**
      - 1.5.2.1 Submit manufacturer's Product data indicating:
        - 1.5.2.1.1 Performance criteria, characteristics and limitations.
    - 1.5.3 Closeout Submittals:**
      - 1.5.3.1 Submit the following for incorporation into Operation and Maintenance Manuals in accordance with Section 01 78 23.
        - 1.5.3.1.1 Comprehensive descriptions and illustrations of maintenance telephone system including operation, overhaul, adjustments, part numbers and other pertinent information.
- 2 Products
  - 2.1 MATERIALS**
    - 2.1.1 **Backboards:** CAN/CSA 0141, 915, exterior grade. 19 mm plywood of following sizes:
      - 2.1.1.1 Main telephone strip: 1200 mm x 2400 mm.
      - 2.1.1.2 Secondary telephone strip: 700 mm x 1000 mm.
      - 2.1.1.3 Telephone only: 200 mm x 300 mm.
    - 2.1.2 **Cabinets:** Type C cabinets as shown on Contract Drawings for exclusive use of Bell.
    - 2.1.3 **Conduit Terminations:** Insulated Bushings.
    - 2.1.4 **Conduits:** In accordance with Section 26 05 34.

- 2.1.5 **Boxes:** Type 12; in accordance with Section 26 05 31.
- 2.1.6 **Cover plates:** In accordance with Section 26 05 21.
- 2.1.7 **Telephone Cable:** Do not use signal control cable for telephone circuits.
- 2.1.8 **Telephone Jacks:** Type 548A for inside mounting. Type 16151 for outside mounting.
- 2.1.9 **Key System:** Type 203A key system apparatus and associated power packs.

3 Execution

**3.1 INSTALLATION**

- 3.1.1 Install telephone raceway system including conduit, outlet boxes, pull boxes, coverplates and caps in locations shown on Contract Drawings, in accordance with Section 26 05 34 and manufacturer's written instructions.
- 3.1.2 Install Type C cabinet with internal backboard at telephone locations in running structure.
- 3.1.3 Make conduit facilities accessible, locate where installation and maintenance readily accomplished without danger from subway trains. Restrict conduit runs to equivalent of two 90 degree bends between open points or pull boxes. One additional bend permitted in conduit run, provided at extreme end of run. Conduit to enter at ends of pull boxes, only. Fit conduit terminations with insulated bushings. Terminate conduits 300 mm away from main terminal box (supplied by Bell) and 75 mm in front of main terminal backboard.
- 3.1.4 Terminate conduits at 1.14 m above floor where telephone backboard approached from below, or 1.6 m above floor where approach from above.
- 3.1.5 Install fish wire in raceway to facilitate cable pulling.
- 3.1.6 Identify raceways at both ends, by means of permanent stainless steel tags in accordance with Section 26 05 53.

**END OF SECTION**

1 General

**1.1 SECTION INCLUDES**

1.1.1 Design, labour, Products, equipment and services necessary for public address system Work in accordance with the Contract Documents.

**1.2 OPERATIONAL REQUIREMENTS**

1.2.1 Speakers to be installed in housings located throughout each station as shown in Contract Documents.

**1.3 SUBMITTALS**

1.3.1 Submit in accordance with Section 01 33 00.

**1.3.2 Product Data and Shop Drawings Package:**

**1.3.2.1 Product Data:**

1.3.2.1.1 Submit manufacturer's Product data indicating:

1.3.2.1.1.1 Characteristics, performance criteria and limitations.

1.3.2.1.1.2 Preparation, installation requirements and techniques, Product storage and handling criteria.

**1.3.2.2 Shop Drawings:**

1.3.2.2.1 Submit Shop Drawings in accordance with Section 01 33 23 indicating:

1.3.2.2.1.1 Sections and details of PA speaker, enclosure, hardware and operating components, dimensions, gauges and finishes.

1.3.2.2.1.2 Detailed descriptions and catalogue cuts of specified PA speaker assemblies.

1.3.2.2.1.3 Complete wiring diagrams including electrical schematics and sequence of operation for PA speaker assemblies.

**1.3.3 Closeout Submittals Package:**

1.3.3.1 Submit the following for each piece of equipment for incorporation into the Operation and Maintenance Manuals in accordance with Section 01 78 23:

1.3.3.1.1 Circuit diagrams and operating instructions.

1.3.3.1.2 Recommended spare parts list.

**1.4 QUALITY ASSURANCE**

1.4.1 **Pre-Installation Meetings:** Arrange for manufacturer's representative to review installation procedures with TTC 48 hours in advance of installation.

2 Products

**2.1 SPEAKERS**

2.1.1 **Speakers and line matching transformers:** Housed in weatherproof enclosures and of following types:

2.1.1.1 **Single:** 8 W reproducer, 70-14,000 Hz, complete with line matching transformer and volume level adjustment, of following types:

2.1.1.1.1 **Type 1:** Flush mounted, recessed in tile ceiling or mounted in ceiling space above metal strip LUXALON ceiling; Executone Model SR8W7, with acoustically treated backbox with faceplate.

3 Execution

**3.1 INSTALLATION**

3.1.1 Install equipment, wire and cable and connect as recommended by manufacturer of system. Identify speaker wiring at terminal blocks in cabinet.

3.1.2 Install PA speaker assemblies in accordance with manufacturer's written instructions and as shown on Contract Drawings.

3.1.3 Initially set speaker tap settings at 1 W.

3.1.4 Speaker tap settings adjusted on site after initial system testing to suit specific installation area geometry, finishes and to acceptance by TTC.

3.1.5 Provide trims and supports for mounting and integrating PA speaker assemblies into ceilings

**3.2 FIELD QUALITY CONTROL**

3.2.1 Arrange for services of Field Engineer supplied by manufacturer of system. Field Engineer to test and adjust system, including volume setting of each speaker, to acceptance by TTC. Refer to Section 01 40 00.

3.2.2 Conduct field inspections and tests on loudspeakers, transformers and enclosures in addition to quality control requirements and submit written reports to TTC in accordance with Section 26 08 00.

3.2.3 Conduit testing in accordance with manufacturer's recommendations and requirements.

**END OF SECTION**



1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment and services necessary for closed circuit television system (CCTV) Work in accordance with the Contract Documents.

**1.2 OPERATIONAL REQUIREMENTS**

1.2.1 CCTV cameras to be installed in housings located as shown in Contract Drawings. During system testing, each camera shall be adjusted and final selection of lenses will be approved by TTC. The selected lenses shall provide the specified field of vision. Also set white level/colour balance on camera.

1.2.2 The monitors shall be connected to the prescribed camera(s) either direct wired or through a switcher, multiplexer and/or other CCTV equipment in order to monitor the areas as indicated in the Contract Documents. Full video signal shall be applied to each monitor.

1.2.3 The CCTV cameras shall be mounted in the proximity shown on Contract Drawings. Each camera will present the required field of vision, as indicated in the Contract Documents. The minimum number of cameras supplied shall be as shown on the Contract Drawings. Supply more cameras, if necessary, in order to satisfy the required field of vision described in the Contract Documents.

1.2.4 The CCTV System shall be interfaced with the intercom system such that:

1.2.4.1 When a remote intercom station is activated or the remote intercom station is selected by the Collector via the master intercom station, the CCTV camera monitoring the remote intercom station shall be switched through to the designated "Alarm" monitor by way of dry relay contact closures.

1.2.4.2 Assign each CCTV camera a text identifier. This text identification shall be identical to the text identification assigned to the intercom station which is in the field of view of the CCTV camera. This text identifier shall be displayed simultaneously with the video imagery from a given CCTV camera on a given monitor in the lower left hand corner of the screen (or split screen in the case of quad displays, and recorded via time lapse VCR, if so equipped. Each text identifier shall uniquely and unambiguously identify the location of the CCTV camera and associated intercom station.

**1.2.5 Camera Locations**

1.2.5.1 Provide a camera at each location as indicated on Drawings.

1.2.6 **Field of vision:** The required field of vision for each CCTV camera location is described below and shown on the Contract Drawings. In areas where the ceiling height is greater than 2400 mm from the floor the field of vision shall include a height of 2400 mm unless otherwise stated. The entire required field of vision shall be displayed on no less than 90% of the monitor view area.

1.2.6.1 **Camera for Hub booth security system:** The required field of vision shall include the entrance to the booth and first turnstile. At the hub, all cameras shall be connected to the black and white monitor in the booth that can be viewed from outside the booth. Connect the security system camera to the time lapse VCR.

**1.3 SUBMITTALS**

1.3.1 Submit in accordance with Section 01 33 00.

**1.3.2 Product Data and Shop Drawings Package:**

**1.3.2.1 Product Data:**

1.3.2.1.1 Submit manufacturer's Product data indicating:

1.3.2.1.1.1 Characteristics, performance criteria and limitations.

1.3.2.1.1.2 Preparation, installation requirements and techniques, Product storage and handling criteria.

**1.3.2.2 Shop Drawings:**

1.3.2.2.1 Submit Shop Drawings in accordance with Section 01 33 23 of all CCTV system components, component layouts and wiring diagrams, including:

1.3.2.2.1.1 Layout of equipment.

1.3.2.2.1.2 Complete wiring diagram.

1.3.2.2.1.3 Connections to other systems.

1.3.2.2.1.4 Wiring and schematics of all existing, added and associated equipment.

1.3.2.2.1.5 Equipment enclosure details, mounting details, equipment layout and environmental rating.

**1.3.3 Commissioning Package:**

1.3.3.1 Submit the following in accordance with Section 01 91 00:

1.3.3.1.1 Commissioning Plan.

1.3.3.1.2 Commissioning Procedures.

1.3.3.1.3 Certificate of Readiness.

**1.3.4 Commissioning Closeout Package:**

1.3.4.1 Submit the following in accordance with Section 01 91 00:

1.3.4.1.1 Deficiency Report.

1.3.4.1.2 Commissioning Closeout Report.

**1.3.5 Training:**

1.3.5.1 Submit Training Plan, Training Course Material and Training Schedule in accordance with Section 01 79 00.

**1.3.6 Closeout Submittals Package:**

1.3.6.1 Submit the following for incorporation into the Operation and Maintenance Manuals in accordance with Section 01 78 23:

1.3.6.1.1 Operation and maintenance instructions for complete system to permit effective operation and maintenance, including:

1.3.6.1.1.1 External wiring diagram.

1.3.6.1.1.2 Circuit diagram of the components.

1.3.6.1.1.3 Troubleshooting instructions.

1.3.6.1.1.4 Technical data, illustrated parts list with catalogue numbers, include manufacturer's specification data for all specialty components.

1.3.6.1.1.5 Copy of all reviewed Shop Drawings.

1.3.6.1.1.6 Recommended spare parts list.

## **1.4 QUALITY ASSURANCE**

1.4.1 **Pre-installation meetings:** Arrange for manufacturer's representative to review installation procedures with TTC present 48 hours in advance of installation.

## **1.5 TRAINING**

1.5.1 Provide training in accordance with Section 01 79 00 and here as follows:

### **1.5.1.1 Operational Training:**

1.5.1.1.1 Design operational training for the end user of each piece of equipment with enough detail to familiarize TTC with operational characteristics of the equipment.

1.5.1.1.2 Provide 2 identical training sessions involving 2 separate groups of approximately 5 employees. Training sessions will be attended by the end users of supplied equipment and TTC maintenance personnel.

### **1.5.1.2 Technical training:**

1.5.1.2.1 Design technical training sessions with enough detail to train TTC technical staff to test, troubleshoot and repair the supplied systems and equipment in all respects, to the component level.

1.5.1.2.2 Provide a total of 3 identical training sessions as required to accommodate 3 separate groups of approximately 10 employees. Training sessions will be attended by the end users of supplied equipment and TTC maintenance personnel.

## **2 Products**

### **2.1 MATERIALS**

2.1.1 **Conduits:** Section 26 05 34.

2.1.2 **Boxes:** Section 26 05 31.

2.1.3 **Communications wires and cables:** Section 27 13 11.

### **2.2 EQUIPMENT**

2.2.1 **Cameras:** Colour CCD camera, with "C" and "CS" lens mount, 1/3" image format, 120 V/60 Hz. Model LTC0455/60 by Bosch.

2.2.2 **Lens:** Vari-focal length, with meter movement, DC-iris.

2.2.2.1 During testing of this system, the final selection of the lenses will be determined by TTC and the selected lenses shall agree with the required field.

2.2.3 **Monitors:** Complete with mounting kit, as follows:

2.2.3.1 **15" colour monitor:** Model TC2915/91 by Bosch.

2.2.3.2 **9" black and white monitor:** Model LTC2009 by Bosch.

2.2.4 **Video multiplexer:** True triplex operation, selectable quad/full screen colour display, alarm feature, 120V AC power sources, complete with EIA 19" rack mounting kit. Model LTC 2682/90 by Bosch.

- 2.2.5 **Housings:** Complete with 120 V AC duplex receptacle and mounting hardware including key lock with keys that match existing (FORT multi-function cam lock, Model MFW29058#D3100).
- 2.2.5.1 **Suspended ceiling/surface mounted:** Pelco EH1000 Series ceiling enclosure, complete with appropriate shroud.
- 2.2.5.2 **For corner application:** Bosch LTC9303 Series, security corner-mounted enclosure.
- 2.2.6 **VCR:** High resolution time-lapse video recorder, high density recording, "alarm ready" feature, 120 V AC power sources, complete with EIA 19" rack mounting kit. AG-TL950 by Panasonic.
- 2.2.7 **Ground isolation transformer:** Passive device with wide bandwidth that reduces ground-loop interference, waterproof enclosure. Model LTC8235GIT by Bosch.

3 Execution

**3.1 INSTALLATION**

- 3.1.1 **Conduits:** Section 26 05 34.
- 3.1.2 **Boxes:** Section 26 05 31.
- 3.1.3 **Communications wires and cables:** Section 27 13 11.
- 3.1.4 Install equipment in accordance with manufacturer's instructions and as shown on Contract Drawings.
- 3.1.5 Camera and mounting locations on Drawings are approximate only. Direction concerning exact location will be given on Site by TTC. Obtain direction from TTC before mounting CCTV equipment including racks, camera enclosures and monitor mounting hardware.
- 3.1.6 Provide trims and supports for mounting and integrating CCTV-camera enclosure/mounts into ceilings.
- 3.1.7 Mount CCTV cameras maximum 3200 mm from the floor.

**3.2 TESTING/COMMISSIONING**

- 3.2.1 After installation of system, test to ensure required field of vision is displayed on monitors and that full video is applied to the monitor. Adjust to acceptance by TTC.
- 3.2.2 The final selection of lenses and the lens focal length will be determined by TTC during the testing of the CCTV system at no additional cost to TTC.
- 3.2.3 Arrange for equipment manufacturer's representative to complete start-up testing and conduct commissioning tests in the presence of TTC.

**END OF SECTION**

1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment and services necessary for security equipment Work in accordance with the Contract Documents.

**1.2 REFERENCES**

1.2.1 ASTM A240, Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels.

1.2.2 ASTM A312, Specification for Seamless and welded Austenitic Stainless Steel Pipe.

**1.3 SUBMITTALS**

**1.3.1 Shop Drawings:**

1.3.1.1 Submit Shop Drawings in accordance with Sections 01 33 00 and 01 33 23 indicating:

1.3.1.1.1 Elevations, sections, details, operating components, dimensions, gauges and finishes of control box, control console and talk-through communicator.

2 Products

**2.1 BURGLAR ALARM SYSTEM**

2.1.1 Conduits: Section 26 05 34.

2.1.2 Boxes: Section 26 05 31.

2.1.3 Wires and cables: Section 26 05 21.

2.1.4 Install door contact and access keypad as shown on Contract Drawings.

3 Execution

**3.1 BURGLAR ALARM SYSTEM**

3.1.1 Install switch contact in door of Zone Hub as shown on Contract Drawings.

3.1.2 Connect burglar alarm keypad and contact to existing station burglar alarm system.

**END OF SECTION**



1 General

**1.1 SECTION INCLUDES**

1.1.1 Labour, Products, equipment, and services for fire alarm system Work in accordance with the Contract Documents.

1.1.2 Complete modifications of existing fire alarm control panel (FACP) to add a new remote annunciator as indicated on Drawing.

**1.2 REFERENCES**

1.2.1 ANSI/ASA S3.2, Method for Measuring Intelligibility of Speech over Communication Systems.

1.2.2 AODA, Accessibility for Ontarians with Disabilities Act.

1.2.3 ASME A17.1/CSA B44, Safety Code for Elevators and Escalators (Bi-National Standard, with ASME A17.1).

1.2.4 CAN/ULC-S524, Standard for the Installation of Fire Alarm Systems.

1.2.5 CAN/ULC-S525, Audible Signal Devices for Fire Alarm Systems, Including Accessories.

1.2.6 CAN/ULC-S526, Visible Signal Devices for Fire Alarm Systems, including Accessories.

1.2.7 CAN/ULC-S527-11-AMD1, Standard for Control Units for Fire Alarm Systems.

1.2.8 CAN/ULC-S528, Manual Stations for Fire Alarm Systems, Including Accessories.

1.2.9 CAN/ULC-S529, Standard for Smoke Detectors for Fire Alarm Systems.

1.2.10 CAN/ULC-S530, Standard For Heat Actuated Fire Detectors for Fire Alarm Systems.

1.2.11 CAN/ULC-S536, Standard for Inspection and Testing of Fire Alarm Systems.

1.2.12 CAN/ULC-S537, Standard for Verification of Fire Alarm Systems.

1.2.13 CAN/ULC-S1001, Integrated Systems Testing of Fire Protection and Life Safety Systems.

1.2.14 CSA C22.1, Canadian Electrical Code, Part I, Safety Standard for Electrical Installations.

1.2.15 CSA C282, Emergency Electrical Power Supply for Buildings.

1.2.16 NFPA 72, National Fire Alarm and Signaling Code.

1.2.17 OBC, Ontario's Building Code.

1.2.18 OESC, Ontario Electrical Safety Code.

1.2.19 OFC, 2007 Fire Code Compendium , which includes the Fire Protection and Prevention Act, 1997, the 2007 Fire Code (O.Reg. 213/07), Appendices and the Fire Code Supplement FCS-1.

1.2.20 ULC, Underwriters Laboratories of Canada.

**1.3 ACRONYMS**

1.3.1 BACS: Building Automation and Control System.

1.3.2 CACF: Central alarm and control facility (cabinet). Note: This is a dedicated housing of safety-related systems and devices such as emergency elevator controls, fan-controls, mag-lock release, and the FACP/CPU/DCC.

- 1.3.3 CPU: Central processing unit.
- 1.3.4 DCC: Display and control centre.
- 1.3.5 DCL: Data communication link.
- 1.3.6 FACP: Fire alarm control panel.
- 1.3.7 LCD: Liquid crystal display.
- 1.3.8 LDM: Lamp driver module.
- 1.3.9 LED: Light emitting diode.
- 1.3.10 TCC: Transit Control Centre.
- 1.3.11 CFAA: Canadian Fire Alarm Association.

#### **1.4 SYSTEM DESCRIPTION**

- 1.4.1 Base existing fire alarm system on single stage, zoned, non-coded microprocessor controlled, intelligent fire alarm, to form complete, operative, coordinated system.

##### **1.4.2 Wiring Methods:**

- 1.4.2.1 Wire in accordance with CAN/ULC-S524 including, but not limited to, DCL-A and DCL-C survivability and fault tolerance performance for intelligent digital circuits.
- 1.4.2.2 Provide Class A raceway and circuit topology for audible and visible signalling notification appliance circuits.
- 1.4.3 Use only ULC listed components.
- 1.4.4 Make system compatible with addressable devices specified.
- 1.4.5 Provide output signals, auxiliary contacts, and relay modules devices to shutdown associated ventilation equipment.

#### **1.5 SUBMITTALS**

- 1.5.1 Submit in accordance with Section 01 33 00.

##### **1.5.2 Shop Drawings:**

- 1.5.2.1 Submit manufacturer's Product data indicating:
  - 1.5.2.1.1 Performance criteria, compliance with appropriate reference standards, data sheets describing equipment components including manufacturer's model numbers, physical dimensions, weight and temperature limitations.
  - 1.5.2.1.2 Complete description of system operation.
  - 1.5.2.1.3 Product transportation, storage, handling, and installation requirements.
- 1.5.2.2 Submit Shop Drawings in accordance with Section 01 33 23 indicating:
  - 1.5.2.2.1 Elevations, sections, details, operating components, dimensions, and finishes.
  - 1.5.2.2.2 Riser diagram indicating system interconnections and wiring details, addressable device identification, wire sizes and number of wires required, and main system components.
  - 1.5.2.2.3 Complete engineering design data and calculations to confirm fire alarm system meets design criteria specified.
  - 1.5.2.2.4 Fire alarm zoning.



- 1.5.2.2.5 Complete electrical wiring diagrams and sequence of operation.
- 1.5.2.2.6 Battery capacity calculations.
- 1.5.2.2.7 Control equipment and FACP, physical arrangement and features, rack arrangement and interconnection wiring.
- 1.5.2.2.8 Mounting and installation details of addressable modules.
- 1.5.2.2.9 Installation manual.
- 1.5.2.2.10 Programming manual.
- 1.5.2.2.11 Complete parts list for system components.
- 1.5.2.2.12 Complete input/output listing and assignments of devices.
- 1.5.2.2.13 Complete manufacturer's technical data of devices and control panel components.

**1.5.3 Quality Assurance Submittal:**

- 1.5.3.1 Submit inspection and testing reports and verification reports in accordance with CAN/ULC-S536, CAN/ULC-S537, and Section 26 08 00.
- 1.5.3.2 Submit integration testing plan and integration testing report in accordance with CAN/ULC-S1001.
- 1.5.3.3 Submit Verification Certificate.

**1.5.4 Commissioning Package:**

- 1.5.4.1 Submit the following in accordance with Section 01 91 00:
  - 1.5.4.1.1 Commissioning Procedures.
  - 1.5.4.1.2 Certificate of Readiness.

**1.5.5 Commissioning Closeout Package:**

- 1.5.5.1 Submit the following in accordance with Section 01 91 00:
  - 1.5.5.1.1 Deficiency Report.
  - 1.5.5.1.2 Commissioning Closeout Report.

**1.5.6 Closeout Submittals Package:**

- 1.5.6.1 Submit the following for incorporation into Operation and Maintenance Manuals in accordance with Section 01 78 23:
  - 1.5.6.1.1 Printed operating instructions and maintenance data.
  - 1.5.6.1.2 Functional description detailing operation and control of components.
  - 1.5.6.1.3 Performance criteria and maintenance data.
  - 1.5.6.1.4 Safety precautions.
  - 1.5.6.1.5 Installation instruction manuals and drawings including terminal arrangement and locations, power and control wiring diagrams with wire designations and part numbers.
  - 1.5.6.1.6 Reviewed Shop Drawings.
  - 1.5.6.1.7 Battery Safety Data Sheets (SDS) information and maintenance instructions.

- 1.5.6.1.8 Recommended spare parts list including names and addresses of spare part suppliers.
- 1.5.6.1.9 Maintenance and troubleshooting procedures and recommended equipment for repair.
- 1.5.6.1.10 Final tests and commissioning reports.
- 1.5.6.1.11 Complete commissioned parts list for system components.
- 1.5.6.1.12 Fire Alarm Verification Certificate/Report
- 1.5.6.1.13 Access passwords and keys.
- 1.5.6.1.14 After verification and final inspection, two electronic copies of FACP program shall be provided to TTC.
- 1.5.6.1.15 Full set of reviewed Shop Drawings include Mark-up Shop Drawings. Drawings shall accurately show location of all device, zones, door numbers, full riser diagram, and pertinent information.

## **1.6 QUALITY ASSURANCE**

- 1.6.1 Manufacturer's representative: A registered CFAA certified member with experience in fire alarm systems Work of comparable complexity and scope.
- 1.6.2 Retain a manufacturer's representative to perform the following services as part of the Work of this Section:
  - 1.6.2.1 Conduct Site inspections, testing, and verification, and submit written inspection reports verifying that Work is in accordance with Contract Documents and reviewed Shop Drawings.
  - 1.6.2.2 Be present and provide technical assistance during commissioning and final acceptance testing.
  - 1.6.2.3 Perform modifications required on existing fire alarm system.
  - 1.6.2.4 Provide Verification Certificate and obtain acceptance from authorities having jurisdiction.

## **1.7 SITE CONDITIONS**

- 1.7.1 Facility has multi-zone, single stage fire alarm system with remote annunciator. Connect new and ULC listed devices to control unit as extensions to existing or as new additional active field and supporting field devices.

## **1.8 TRAINING**

- 1.8.1 Provide training plan, training course material, training schedule, and training in accordance with Section 01 79 00.

## **2 Products**

## **2.1 GENERAL EQUIPMENT AND MATERIALS**

- 2.1.1 Provide new initiating or signalling devices compatible to existing fire alarm system.
- 2.1.2 Provide end of line devices for the monitoring and control of supervisory current to ensure correct fault condition, producing audible and visual alarm at DCC, FACP, and LCD annunciators.

- 2.1.3 Equipment, components, and devices shall be new, tested, and ULC listed and approved for fire alarm system service. Used equipment and components are not acceptable.
- 2.1.4 Equipment and components to be installed in compliance with the manufacturer's recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation. Refer to the riser/connection diagram for all specific system installation, termination, and wiring data.
- 2.1.5 Equipment to be attached to walls and ceiling/floor assemblies, and to be held firmly in place. Fasteners and supports to be adequate to support the required load.
- 2.1.6 Field devices shall be of the same manufacturer as the existing FACP. The list of field devices includes, but is not limited to:
  - 2.1.6.1 Manual station.
  - 2.1.6.2 Spot type smoke detectors.
  - 2.1.6.3 Spot type thermal (heat) detectors.
  - 2.1.6.4 Combination Horn/Strobe.

## **2.2 GENERAL SYSTEM PERFORMANCE REQUIREMENTS**

- 2.2.1 Capable of full system wide annunciation regardless of the number of addressable devices.
- 2.2.2 Including a full-featured operator interface control and annunciation panel.
- 2.2.3 Including a back-lit large graphic liquid crystal display and queue, individual, colour coded system status LEDs, and an alphanumeric keypad for the field programming and control of the fire alarm system.
- 2.2.4 Programming or editing of the existing program in the system to be done by the manufacturer's representative using the programming facility and lap top computer, capable of immediate downloading of new or changed status for storage, reference, and back up.

## **2.3 GENERAL INTELLIGENT DEVICES**

- 2.3.1 Intelligent and addressable detectors, connected to FACP signalling line circuits with 2-wire and ground.
- 2.3.2 Provide test means where detectors simulate alarm condition and report condition to control panel. Test initiated at detector itself (by activating magnetic switch) or initiated remotely on command from control panel.
- 2.3.3 Addressable devices to provide address-setting means using rotary decimal switches.
- 2.3.4 Addressable devices to use simple to install and maintain decade (numbered 0 to 9) type address switches.

## **2.4 INTELLIGENT MANUAL FIRE ALARM PULL STATIONS**

- 2.4.1 Dual-action design.
- 2.4.2 Addressable type with address setting by use of rotary decimal switches.
- 2.4.3 Built-in bicolor LED, which is visible through the handle of the station, flashes in normal operation and latches steady red when in alarm.

- 2.4.4 Handle latches in down position and the word "ACTIVATED" appears to clearly indicate the station has been operated.
- 2.4.5 Captive screw terminals wire-ready for easy connection to SLC loop (accepts up to 12 AWG/3.25 mm<sup>2</sup> wire).
- 2.4.6 To connect with 2-wire and ground to one of the control panel SLC loops. The manual station shall, on command from the control panel, send data to the panel representing the state of the manual switch.
- 2.4.7 Suitable for surface mounting on matching backbox, or semi-flush mounting on a standard single-gang, double-gang, or 101.6 mm (4") square electrical box, and installed within the limits defined by the AODA.
- 2.4.8 Non-coded, with a key operated reset lock in order that it may be tested.
- 2.4.9 Designed that after actual Emergency Operation, it cannot be restored to normal except by use of a key reset.
- 2.4.10 Highly visible and complete with Braille text on station handle.
- 2.4.11 An operated station shall automatically condition itself so that is visually detected, as operated.
- 2.4.12 Shell, door, and handle: Molded of red-colored durable polycarbonate material, with a textured finish.
- 2.4.13 Operating instructions shall be clearly provided on the cover. The word FIRE shall appear on the front of the station in white letters, minimum 25.4 mm (1 in) high.

## **2.5 ISOLATOR MODULES**

- 2.5.1 To be provided to automatically isolate wire-to-wire short circuits to provide both DCL-A and DCL-C performance.
- 2.5.2 To limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the DCL link segment or branch.
- 2.5.3 If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the DCL. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
- 2.5.4 To work automatically without requiring resetting or addressing.
- 2.5.5 To provide a single LED that flashes to indicate that the isolator is operational and to illuminate steadily to indicate that a short circuit condition has been detected and isolated.

## **2.6 PROGRAMMABLE AUDIBLE SIGNAL DEVICES**

- 2.6.1 Operating on 24 V DC nominal.
- 2.6.2 Field programmable without the use of special tools, at a sound level of at least 90 dBA measured at 3 m (10 ft) from the device.
- 2.6.3 Explosion proof horn: Rated for hazardous area's listed for use in Class 1, Division 1, Groups B, C, and D; Class 2, Division 1, Groups E, F, and G; and Class 3, Division 1 locations.

## **2.7 END OF LINE DEVICES**

- 2.7.1 Suitable for single gang standard electrical box mounting.
- 2.7.2 Provide outside of plate, a lamacoid nameplate-identifying zone and/or circuit number and device type. Lamacoid nameplate mechanically affixed to end of line plate (such as riveted).
- 2.7.3 End of line devices may be installed within the field device if there is only one device on the circuit. In such cases, the nameplate shall be attached to the field device in a visible location.

## **2.8 REMOTE ANNUNCIATOR**

- 2.8.1 To communicate to the existing FACP via 2-wire and ground for communications data communication link and 2-wire and ground for power.
- 2.8.2 Remote annunciator shall be of the same manufacturer as the existing FACP, mounted as indicated on Contract Drawings.
- 2.8.3 Provide substation annunciator with red alarm long-life LEDs.

## **2.9 FIRE ALARM CABLE**

- 2.9.1 Shielded, multi-conductor, solid bare copper conductor, PVC insulated, red PVC jacket, 300 V, -20°C to 105°C, CSA/UL-FT4 rating, manufactured by Belden or Provo Ltd.

- 3 Execution

## **3.1 INSTALLATION**

- 3.1.1 Install fire alarm system in accordance with CAN/ULC-S524 and CSA C22.1, as indicated on Contract Drawings and the fire alarm manufacturer's instructions.
- 3.1.2 Provide wiring within metallic conduit as specified in Section 26 05 34. Conduits and boxes for fire alarm devices to be rigid hot-dip galvanized steel complete with weatherproof and/or watertight connections and fittings to suit Site conditions.
- 3.1.3 Install wires and cables in separate raceway for signal circuit and notification circuit.
- 3.1.4 Install system in accordance with manufacturer's recommendations and instructions, and with ULC Product listing.
- 3.1.5 Provide wires, pull boxes, electrical boxes, and terminal cabinets and/or terminal boxes in accordance with manufacturer's recommendations and Division 26.
- 3.1.6 Provide watertight conduit fittings and NEMA 4X polycarbonate boxes for connections underneath clapper of dry pipe valve to sprinkler system devices: Supervisory valves, tamper switches, flow switches and pressure switches, or any device located near sprinkler valves. Route wiring in liquid-tight metal conduit from device to NEMA-4 box on nearest adjacent wall.
- 3.1.7 Provide electrical identification in accordance with Section 26 05 53.
  - 3.1.7.1 Provide lamacoid nameplate to relay module cover with equipment identification it is associated with.
  - 3.1.7.2 Provide lamacoid nameplate to fault isolation module cover with device address identification.

- 3.1.8 Mount all devices where they can easily be accessed or removed for verification/testing purposes. Devices shall be accessible from floor level, using a standard test kit, without need for ladders or lifts. Devices shall be located in areas where easily accessible for removal or maintenance.
- 3.1.9 Joints and splices to fire alarm wires and cables are not allowed.
- 3.1.10 Where joints and splices are required and have been approved by TTC, they shall be made in terminal boxes.
- 3.1.11 Install separate ground conductor in all conduits sized to OESC unless noted otherwise.
- 3.1.12 Provide conduit, wiring, connections, auxiliary control relays, and related electrical components to shut down facility ventilation equipment.

### **3.2 INSTALLATION CRITERIA FOR SYSTEM DEVICES**

- 3.2.1 Installation requirements in accordance with CAN/ULC-S524.
- 3.2.2 Mount ceiling fire detection devices as close as possible to centre of ceiling in rooms and portions of corridors as indicated on Contract Drawings.
- 3.2.3 Mount smoke and fire detectors at highest point of area to be protected.
- 3.2.4 Mount detectors at a minimum distance of 1200 mm from supply air diffusers.
- 3.2.5 Isolation Modules to be accessible and mounted not more than 1.8 m above floor level.
- 3.2.6 Mounting material necessary for installation of fire detectors to be non-combustible.
- 3.2.7 Components used in system, such as, alarm signalling devices, fire detectors, circuits to remote monitoring system, etc., to be wired, installed and supervised so that removal or grounding of any device in system will cause visual and audible trouble indication on fire alarm panel and remote annunciator panels.
- 3.2.8 Audible/Visual signal device mounted so centre of device is not less than 1950 mm above floor level.
- 3.2.9 Back boxes firmly fixed to walls, ceilings, or structural columns and not supported by conduit.
- 3.2.10 Supplier to verify audible/visual signal device placement adequate to provide audibility rating acceptable to authorities having jurisdiction.
- 3.2.11 End of line devices mounting height 1800 mm above finished floor to suit site conditions. Preferred height is 1600 mm.
- 3.2.12 Devices to be mounted in areas where they are accessible with standard test kits.
- 3.2.13 Provide necessary wire, raceway, junction boxes, wall boxes, devices for BACS, and necessary or required installation to complete system.

### **3.3 FIELD QUALITY CONTROL**

- 3.3.1 The manufacturer's representative shall perform the following:
  - 3.3.1.1 Field quality control inspection and testing in accordance with Section 26 08 00.
  - 3.3.1.2 Carrying out testing and verification of fire alarm system.
  - 3.3.1.3 Submission of written verification certificate to TTC, upon completion of inspection and testing.

### **3.4 SYSTEM START-UP TESTING, VERIFICATION, AND CERTIFICATION CRITERIA**

- 3.4.1 Each alarm initiating device, alarm signalling device, central station connection, alarm initiation circuits, and alarm signalling circuits individually tested for both alarm initiation, as applicable, and trouble initiation, as applicable, to ensure the following:
  - 3.4.1.1 System is complete and functional in accordance with Contract Documents.
  - 3.4.1.2 System is installed and connected in accordance with CAN/ULC-S524.
  - 3.4.1.3 System is installed in accordance with manufacturer's recommendations and instructions.
  - 3.4.1.4 System components are installed in accordance with ULC Product listing.
  - 3.4.1.5 Fire alarm system shall be installed, verified, tested, and inspected in accordance with construction staging requirements. Fire alarm system shall be maintained during construction. Where modification or augmentation are required to fire alarm system to satisfy the construction staging requirements, the Contractor is responsible to provide additional testing, verification, and inspection.
  - 3.4.1.6 Audible, Visual, Combination audible/visual, alarm device(s) placement and output levels are adjusted such that alarm signalling is audible and visual throughout facility.
  - 3.4.1.7 Equipment controls function in accordance with Contract Documents.
- 3.4.2 Testing of system: In accordance with CAN/ULC-S536 for inspection and testing of fire alarm system.
- 3.4.3 System verification: In accordance with CAN/ULC-S537 for verification of fire alarm system.
- 3.4.4 After completion of installation, conduct complete and thorough start-up testing and verification of system with fire alarm equipment supplier.
- 3.4.5 Test all smoke detectors for proper sensitivity with calibrated test meter in accordance with manufacturer's recommendation. Test alarm bells with test meter to verify audibility.
- 3.4.6 Deficiencies to be corrected and verification resumed. Additional testing and verification to be done at the Contractor's expense and may include any additional expense incurred by TTC due to delays.
- 3.4.7 On successful completion of start-up and verification, Contractor to provide written report of verification to TTC for review.
  - 3.4.7.1 Submit to TTC for review, upon completion of verification testing, point-by-point checklist indicating date of each item tested, test conducted, audible and visual signals activated.
  - 3.4.7.2 Where items are deficient in initial operation during testing include date and details of Work performed to correct deficiency on checklist. Subsequently issue retesting checklists.
- 3.4.8 Fire alarm system test overview:
  - 3.4.8.1 Test each device and alarm circuit to ensure manual stations, thermal (heat) and smoke detectors, and sprinkler system monitoring devices transmit alarm to DCC, FACP, and LCD annunciators and transponder/control unit for each of the prescribed sequences of operation.
  - 3.4.8.2 Check annunciator panels to ensure zones are indicated correctly.

- 3.4.8.3 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of system.
- 3.4.9 Addressable circuits system style DCL-A and DCL-C.
  - 3.4.9.1 Test each conductor on all DCL-A and DCL-C addressable links for capability of providing three or more subsequent alarm signals on each side of single open circuit fault condition imposed near midmost point of each link. Operate Acknowledge/Silence switch after reception of each of the three signals. Correct imposed fault after completion of each series of tests.
  - 3.4.9.2 Test each conductor on all DCL-A and DCL-C addressable links for capability of providing three or more subsequent alarm signals during ground fault condition imposed near midmost point of each link.
  - 3.4.9.3 Operate Acknowledge/Silence switch after reception of each of the three signals.
  - 3.4.9.4 Remove imposed fault after completion of each series of tests.
- 3.4.10 Consult with TTC when the system is equipped with optional features. Consult the manufacturer's manual to determine the proper testing procedures.
  - 3.4.10.1 This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, and verification functionality.

### **3.5 INTEGRATED SYSTEMS TESTING OF FIRE PROTECTION AND LIFE SAFETY SYSTEMS**

- 3.5.1 Provide integration of Systems Testing of Fire Protection and Life Safety Systems in accordance with CAN/ULC-S1001.
- 3.5.2 Verify and document interconnections between systems providing fire protection and life safety functions installed and operating in conformance with their design criteria.
- 3.5.3 Provide an Integration Testing Coordinator responsible for the development and implementation of the integration testing plan, knowledgeable and experienced in the design, installation, and operation of their relevant fire protection and life safety system(s).
- 3.5.4 Integration testing plan to outlining the required tests and necessary functional results to conduct integrated fire protection and life safety systems testing.
- 3.5.5 Submit an integration testing report to TTC for review.

### **3.6 COMMISSIONING**

- 3.6.1 Perform commissioning in accordance with Sections 01 91 00, 26 05 00 and 26 08 00.
- 3.6.2 The manufacturer's representative shall be present and provide technical assistance during commissioning, and shall demonstrate that the system functions properly in every respect in accordance with Contract Documents.
- 3.6.3 Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
- 3.6.4 Close each sprinkler system control valve and verify proper supervisory alarm at the DCC, FACP, and LCD annunciators.
- 3.6.5 Verify activation of flow switches.
- 3.6.6 Open initiating device circuits and verify that the trouble signal actuates.



- 3.6.7 Open and short signalling device circuits and verify that trouble signal actuates.
- 3.6.8 Ground initiating device circuits and verify response of trouble signals.
- 3.6.9 Ground signalling line circuits and verify response of trouble signals.
- 3.6.10 Ground notification appliance circuits and verify response of trouble signals.
- 3.6.11 Check presence and audibility of tone at alarm signalling devices.
- 3.6.12 Check installation, supervision, and operation of intelligent smoke detectors test.
- 3.6.13 Each of the alarm conditions that the system is required to detect shall be introduced on the system. Verify the receipt and the processing of the signal at the DCC, FACP, and LCD annunciators, and the correct activation of the control points.
- 3.7 VERIFICATION CERTIFICATE (FIRE ALARM VERIFICATION REPORT)**
  - 3.7.1 Issue to TTC a certificate of verification on CFAA forms confirming that inspection has been completed, deficiencies have been corrected and retested after correction as noted in checklist and system is installed and functioning in conformance with Contract Documents.
  - 3.7.2 Certify that verification has been completed in accordance with CAN/ULC-S537 and installation in accordance with CAN/ULC-S524.
  - 3.7.3 Submit the verification certificate to authorities having jurisdiction for final acceptance/testing of the fire alarm system.
  - 3.7.4 Schedule final acceptance/testing of the fire alarm system with authorities having jurisdiction and TTC.
    - 3.7.4.1 Correct deficiencies discovered during final acceptance/testing at no extra cost to TTC. Perform additional testing requested by the authorities having jurisdiction, as a result of deficiencies, at no extra cost to TTC.

**END OF SECTION**



# **Appendix 1**

## **Designated Substances and Hazardous Materials Survey**



TORONTO TRANSIT COMMISSION

# DESIGNATED SUBSTANCES AND HAZARDOUS MATERIALS SURVEY

SHEPPARD STATION - STATION MANAGER'S OFFICE  
HUB (SH35-8)

April 12, 2018

CONFIDENTIAL





# DESIGNATED SUBSTANCES AND HAZARDOUS MATERIALS SURVEY

**SHEPPARD STATION - STATION  
MANAGER'S OFFICE HUB (SH35-8)**

**TORONTO TRANSIT COMMISSION**

REPORT VERSION 2.0  
CONFIDENTIAL

PROJECT NO.: 161-04731-00-230.078  
DATE: April 2018

WSP  
51 CONSTELLATION COURT  
TORONTO, ONTARIO M9W 1K4

WSP.COM



51 CONSTELLATION COURT  
TORONTO, ONTARIO M9W 1K4

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April 12, 2018

CONFIDENTIAL

Toronto Transit Commission  
5140 Yonge Street, 6th Floor  
Toronto, Ontario M2N 6L6

**Attention:** Mr. Andrew Drevininkas

**Subject:** Designated Substances and Hazardous Materials Survey, Sheppard Station - Station Manager's Office Hub (SH35-8)

WSP Canada Inc. (WSP) was retained by the Toronto Transit Commission (TTC) to carry out a Designated Substances & Hazardous Materials Survey (DSS) at selected areas within TTC's Sheppard Station in Toronto, Ontario.

The purpose of this survey is to determine the presence/absence of designated substances within the work areas and to provide designated substance information to contractors at the time of tender to ensure complete and correct removal or handling of materials prior to scheduled renovations.

The following report discusses the methodologies and findings of this survey.

We trust that the attached report is satisfactory for your purposes at this time. Please contact the undersigned should you have any questions or concerns

Yours sincerely,

A handwritten signature in blue ink, appearing to read 'Erin Kennealy'.



Erin Kennealy, CIH

Occupational Hygienist

EK/dv  
WSP ref.:161-04731-00-230.078

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# QUALITY MANAGEMENT

ISSUE/REVISION	FIRST ISSUE	REVISION 1	REVISION 2	REVISION 3
Remarks	Draft Report Submission	Final Report Submission		
Date	March 23, 2018	April 12, 2018		
Prepared by	Danielle Vella	Danielle Vella		
Signature				
Checked by	Erin Kennealy	Erin Kennealy		
Signature				
Authorised by				
Signature				
Project number	161-04731-00-230.078	161-04731-00-230.078		
Report number	1.0	2.0		
File reference				



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## SIGNATURES

### PREPARED BY



---

Danielle Vella  
Environmental Officer – Hazardous Materials  
Environment

### REVIEWED BY



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Erin Kennealy, CIH  
Manager – Hazardous Materials  
Environment

This report was prepared by WSP for the account of Toronto Transit Commission, in accordance with the professional services agreement. The disclosure of any information contained in this report is the sole responsibility of the intended recipient. The material in it reflects WSP's best judgement in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. WSP accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. This limitations statement is considered part of this report.

The original of the technology-based document sent herewith has been authenticated and will be retained by WSP for a minimum of ten years. Since the file transmitted is now out of WSP's control and its integrity can no longer be ensured, no guarantee may be given with regards to any modifications made to this document.

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# EXECUTIVE SUMMARY

WSP Canada Inc. (WSP) was retained by the Toronto Transit Commission (TTC) to carry out a Designated Substances & Hazardous Materials Survey (DSS) at selected areas within TTC's Sheppard Station in Toronto, Ontario.

The work areas include selected areas within TTC's Sheppard Station located in Toronto, Ontario. It is understood that the scope of work for this project includes the demolition of the existing Collector's Booth and Retail Space, modifications to electrical and mechanical systems, and the installation of new sprinkler and ceiling systems in order to accommodate the construction of a new Station Manager's Office and Zone Hub. As such, WSP conducted the DSS within selected areas, as specified by TTC representatives and the drawings provided. Refer to **Appendix B** attached for description of this scope of work.

The purpose of this survey is to determine the presence/absence of designated substances within the work areas and to provide designated substance information to contractors at the time of tender to ensure complete and correct removal or handling of materials prior to renovations.

A summary of the results of WSP's site inspection and bulk sampling is presented below.

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## ASBESTOS

Based on the laboratory results, none of the eleven (11) homogeneous building material samples collected and analyzed are considered to be asbestos-containing (defined as material that contains 0.5% or more asbestos by dry weight).

Certificates of Analysis can be found in **Appendix A**. Sample locations are provided in **Drawing 1** attached.

As electrical components were live and operational during the site visit, these materials were not sampled. As such, electrical components should be considered to be asbestos-containing until the system can be decommissioned and materials can be sampled for asbestos analysis.

---

## LEAD

Based on the laboratory analysis, detectable concentrations of lead were identified in one (1) of the six (6) paint samples collected and analyzed. The following paint is considered to be lead-containing:

- Red paint on pipes observed in the janitor service room (room 51P 321). This paint is expected to be present on all sprinkler lines throughout the work area.

Certificates of Analysis from this investigation can be found in **Appendix A**. Sample locations are provided in **Drawing 1** attached.

Lead is also expected to be present in the following construction components:

- in lead acid batteries in emergency lighting;
- as a component in ceramic building products such as tiles and bricks;
- as a component of the solder on sweated joints between copper pipe and fittings;
- as a component of the solder on wire connections of electric components; and
- as a component of solder used to seal the bell fitting of cast iron rain water leader pipes.

---

## SILICA

Crystalline Silica should be assumed to be present in concrete, cement and mortar.

---

## MERCURY

Although no samples were analyzed for mercury, it is presumed to be present as a vapour in light bulbs within the work areas.

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## ARSENIC

Arsenic was formerly used as an additive in paint. It should be assumed that all lead-containing paint has the potential to contain arsenic.

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## POLYCHLORINATED BIPHENYLS (PCBS)

Based on laboratory results, PCB-containing caulking materials were not identified within the work area. Certificates of Analysis can be found in **Appendix A**. Sample locations are provided in **Drawing 1** attached.

Individual fluorescent light ballasts were not inspected for the presence of PCBs as they were operational at the time of the site visit and therefore inaccessible to the surveyor. Fluorescent light ballasts may contain PCBs.

Transformers potentially containing PCBs were not observed during the survey.

---

## RECOMMENDATIONS

It is our understanding that selected areas within TTC's Sheppard-Young Station are proposed for renovations. As such, special precautions are required for working near or for the removal of specific designated substances.

Special precautions should be taken when disturbing any concrete or painted surfaces given the presence of lead, silica and potentially arsenic. All designated substances must be handled in accordance with the appropriate guidelines and regulations. The Ministry of Labour (MOL) has published guidelines for handling and controlling lead and silica in construction and it is recommended that these guidelines be followed when removing and cutting into the concrete. Coring, sawing or breaking up the materials containing silica should be completed only with appropriate dust suppression methods, proper respiratory protection and general worker safety precautions as outlined in the MOL Guidance documents and in the Occupational Health and Safety Act.

In the event of removal, fluorescent light ballast labels should be inspected for PCB content, and if encountered, removal of PCB-containing materials (e.g. ballasts, caulking) must be completed using health and safety procedures that will protect workers against exposure to PCBs (i.e. to avoid ingestion or inhalation of the material). The handling of PCB-containing materials must be completed in a manner to prevent release to the environment. The disposal of PCB-containing materials must be completed in accordance with Federal and Provincial regulations.

The presence of mercury within assembled units (e.g. light bulbs) should not be considered a hazard provided that the assembled units remain sealed and intact. Avoid direct skin contact with mercury and avoid inhalation of mercury vapour. Dispose of mercury following applicable legislative requirements.

Other designated substances may be required to be removed as part of the renovation work. Except for asbestos, all other Designated Substances Regulations apply to industrial establishments and not to construction. Due to this condition, it is imperative that a contractor retained for the renovations has a proven record in managing designated substances and operates under a control program. Designated Substance and Hazardous Material information will require updating if corrective measures have been instituted and materials have been removed from the building.

If during renovations, materials suspect of containing asbestos are encountered, they must be handled as asbestos and in accordance with the appropriate guidelines and regulations. It should be noted that asbestos may be present in the enclosed spaces not accessible at the time of the site visit.

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## ***TABLES***

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TABLE 2	SUMMARY OF ASBESTOS SAMPLING RESULTS
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## ***APPENDICES***

### DRAWING

A	ANALYTICAL RESULTS – ASBESTOS, LEAD & PCBS
B	TTC PROVIDED SCOPE OF WORK
C	PREVIOUS REPORTS
D	SITE PHOTOGRAPHS

# 1 INTRODUCTION

WSP Canada Inc. (WSP) was retained by the Toronto Transit Commission (TTC) to carry out a Designated Substances & Hazardous Materials Survey (DSS) at selected areas within TTC's Sheppard-Yonge Station in Toronto, Ontario.

The work areas include selected areas within TTC's Sheppard Station located in Toronto, Ontario. It is understood that the scope of work for this project includes the demolition of the existing Collector's Booth and Retail Space, modifications to electrical and mechanical systems and the installation of new sprinkler and ceiling systems in order to accommodate the construction of a new Station Manager's Office and Zone Hub. As such, WSP conducted the DSS within selected areas, as specified by TTC representatives and the drawings provided. Refer to **Appendix B** attached for description of this scope of work.

Section 30 of the Ontario Occupational Health and Safety Act (OHSA) requires that an owner determine whether any designated substances are present, prepare a list and distribute the list to prospective contractors as part of any construction tender package. This report presents the designated substance information required for the owner to comply with the Act.

Regulation 490/09 states that all necessary measures and procedures are to be taken to ensure the time-weighted average exposure of a worker to any form of airborne asbestos does not exceed 0.1 fibres per cubic centimeter of air, averaged over an 8-hour work period. In order to abide by this regulation, contractors specializing in asbestos removal are required to remove all asbestos-containing construction materials from the work area prior to any renovation or demolition that will disturb these materials.

This investigation was conducted by WSP representative Ms. Danielle Vella on January 19, 2018. At that time samples were collected for asbestos, lead, and PCB analysis.

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## 1.1 PURPOSE

The purpose of this survey is to determine the presence/absence of designated substances within the work areas and to provide designated substance information to contractors at the time of tender to ensure complete and correct removal or handling of materials prior to renovations.

This survey is intended to form the basis of a Designated Substance list as per the requirements of Section 30 of the Occupational Health & Safety Act. This report should be provided to all prospective contractors (and in turn to their sub-trades) who are likely to handle, come into contact with, or disturb construction materials. Contractors who may work in close proximity to the identified materials and who may also disturb the materials should also be notified.

The purpose of the survey was to:

- 1 Determine the presence or absence of each of the designated substances;
- 2 Identify the locations of designated substances present;
- 3 In the case of asbestos, establish the type, location and condition of asbestos-containing materials (ACM).

The asbestos information in this survey report complies with the requirements of the Occupational Health & Safety Act, Ontario Regulation 278/05: Designated Substance - Asbestos on Construction Projects and in Buildings and Repair Operations, with respect to asbestos-containing materials within the subject work area.

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## 1.2 SCOPE OF WORK / METHODOLOGY

This designated substances & hazardous materials survey entailed:

- Inspection of accessible areas of the work area to identify materials which could contain asbestos and other designated substances;



- Bulk sampling and analysis of representative materials suspected of containing asbestos and lead;
- Assessment of the condition of the asbestos-containing materials; and
- Assessment of the likelihood of exposure to the other designated substances with recommendations for appropriate corrective action where required.

The survey included the identification of potential friable and non-friable asbestos-containing materials within the work area. Asbestos means any of the following fibrous silicates: actinolite, amosite, anthophyllite, chrysotile, crocidolite or tremolite. According to the above-mentioned Ontario Regulation 278/05, the term ‘friable material’ is applied to a material that when dry, can be crumbled, pulverized or powdered by hand pressure, or is crumbled, pulverized or powdered. Asbestos-containing materials that are friable have a greater potential to release airborne asbestos fibres when disturbed. Common friable asbestos-containing construction materials used in the past include sprayed fireproofing, stucco texture coat, and thermal pipe insulation.

Common non-friable asbestos-containing materials include vinyl floor tiles, gasket materials, asbestos cement (Transite™) pipe, Transite™ board and asbestos textiles. If these materials do however release fine dust due to deterioration or during removal, the free dust is considered friable.

The survey did not involve destructive sampling (i.e. inspection within plaster/drywall (false) walls or ceilings, within mechanical equipment such as boilers, furnaces, HVAC systems, or within electrical equipment). These areas are considered not accessible to the surveyor and as such materials suspected to contain asbestos may be present within these inaccessible areas.

## 2 SITE DESCRIPTION

The work areas include selected areas within TTC’s Sheppard Station located in Toronto, Ontario. It is understood that the scope of work for this project includes the demolition of the existing Collector’s Booth and Retail Space, modifications to electrical and mechanical systems and the installation of new sprinkler and ceiling systems in order to accommodate the construction of a new Station Manager’s Office and Zone Hub. As such, WSP conducted the DSS within selected areas, as specified by TTC representatives and the drawings provided. Refer to **Appendix B** attached for description of this scope of work.

The floors within the work area generally consist of concrete and ceramic tiles. The walls and ceilings generally consist of concrete, tiles and concrete block. Lighting is provided by fluorescent lights.

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### 2.1 HEATING SYSTEM

The work area was heated via HVAC units with associated ventilation. Mechanical piping and ductwork systems were either uninsulated or insulated with non-asbestos fibreglass insulation.

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### 2.2 PREVIOUS REPORTS

WSP reviewed the following previous reports:

- “Asbestos Reassessment Services for Subway Stations and Tunnels, Sheppard Subway Station, Yonge Street and Sheppard Avenue West, Toronto (YUS-S03).” Prepared for Toronto Transit Commission by Coffey Geotechnics dated January 2013.
- “Asbestos Sampling – Industrial Facility Requirements – Sheppard SRB Mock-up”. Prepared for Toronto Transit Commission by WSP Canada Inc. dated September 2016.
- “Designated Substances & Hazardous Materials Survey, Sheppard-Yonge Station – Subway Rule Book Hands on Training (SH35-7).” Prepared for Toronto Transit Commission by WSP Canada Inc. dated November 2017.

Based on review of the previous reports, the following materials were identified to be asbestos-containing or presumed to be asbestos-containing:

#### **Non-Friable**

- \*Dark grey firestop observed in Room 21Y-21 at Street Level; (10% Chrysotile asbestos)
- \*Transite pipe observed in Room 51P-303 Elevator Machine Room at Concourse Level (assumed)
- \*Acoustic ceiling tiles observed in the Lotto Center, Gateway News Stand and Rainbow N' Things, Cinnabon, Room 21Y 54 and 51- 349 on the concourse level (suspected)

#### **Friable**

- \*Sprayed fireproofing observed above the lexalon ceiling at the north and south platform level of the station and below the platform lip on track level; (1.3% - 8% Chrysotile asbestos)
- \*Plaster observed in the Rooms 21Y-68, 21Y-65, 21Y-69, 21Y-73, 21Y-74/75 on the platform level and 21Y-3S on the Concourse Level. (1.2% Chrysotile asbestos)
- \* Texture coat was observed applied to the stairwell ceilings at platform level; however, was inaccessible at the time of the site investigation. Sprayed fireproofing was present on the ceiling in various locations throughout platform level; however, was inaccessible at the time of the site investigation. The sprayed fireproofing and texture coat are considered to be asbestos-containing until confirmed otherwise.

Items marked with \* were either not found during the site visit for this investigation, identified to be outside of the work area for this investigation, or were sampled during this investigation. Based on the review of the previous report, none of the above noted asbestos-containing materials were observed within the work area.

Based on the review of the previous reports, detectable concentrations of lead were not identified in the paint samples collected and analyzed.

Based on review of previous reports, PCB-containing caulking materials were not identified in the work areas.

The above-noted reports are attached at the end of this report within **Appendix C**.

## **3 REGULATORY FRAMEWORK**

The survey was executed to identify designated substances as required by the Ontario Occupational Health and Safety Act. The following sections and tables list the applicable regulations for the survey.

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### **3.1 DESIGNATED SUBSTANCES REGULATIONS**

The Designated Substance and Hazardous Materials Survey was conducted in accordance with the following regulations and guidance documents:

- Ontario Regulation (O. Reg.) 490/09 Designated Substances
- O. Reg. 278/05 Asbestos on Construction Projects and in Building and Repair Operations and the corresponding Guideline (Ontario Ministry of Labour (MOL), November 2007, as amended)
- Guideline for Lead on Construction Projects (MOL, September 2004, as amended)
- Guideline for Silica on Construction Projects (MOL, September 2004, as amended)
- Canadian Surface Coating Materials Projects (SOR/2005-109 dated April 19, 2005, as amended), pursuant to the 2005 Hazardous Products Act
- The United States Department of Housing and Urban Development (HUD) Guidelines for the Evaluation and Control of Lead-Based Paint in Housing
- Canadian PCB Regulations (SOR/2008-273)
- O. Reg. 362 Waste Management – PCBs
- Mercury-Containing Products Pollution Prevention Fact Sheet #21 (Ministry of Environment (MOE), September 2001, as amended)

- O. Reg. 347/90 General Waste Management
- Canadian Construction Association document CCA 82/2004
- Canadian Chlorofluorocarbon Regulations (SOR/90-127), Ozone-depleting, Substances Regulation (SOR/94-408) and Ozone Depleting Substances Products Regulations (SOR/90-584)
- O. Reg. 463/10 ODS and Other Halocarbons

## 4 DESIGNATED SUBSTANCES SURVEY

Information in this section of the report should be provided to all prospective contractors who are likely to handle, come into contact with, or disturb asbestos or other designated substances.

Contractors and maintenance personnel should be warned of the possibility of undisclosed materials when breaking into enclosed areas. Friable construction materials discovered in enclosed areas should be treated as asbestos until proven otherwise and other substances, self-evident as designated substances, should be handled in a likewise fashion.

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### 4.1 SURVEY METHODOLOGY

The survey of the work areas for designated substances consisted of a walk through and physical examination of suspect materials in the work area as depicted in drawings provided by the TTC and as identified by the TTC representative. A physical examination was completed to assess the condition of materials and to examine for underlying layers.

A visual assessment was conducted for asbestos, lead, polychlorinated biphenyls, acrylonitrile, arsenic, benzene, coke oven emissions, ethylene oxide, isocyanates, mercury, silica, vinyl chloride, mould, ozone depleting substances, radioactive materials, man-made mineral fibres and Foamglas™ insulation.

When potential materials that may contain asbestos were identified, visual inspection was augmented with bulk sampling and laboratory analysis. Bulk samples were taken from representative locations of friable material and non-friable or manufactured product suspected of containing asbestos. Sample collection was performed with consistency to obtain a general pattern of asbestos use in the structures. Homogeneous materials were visually identified and representative samples were collected in accordance with Section 3 of O. Reg. 278/05.

Asbestos samples are collected by taking a small volume of material (approximately two square centimeters in size) from either intact material or preferably from a damaged section. The collected samples were placed in ziplock plastic bags, sealed and forwarded to an analytical laboratory. Bulk samples are analyzed by Polarized Light Microscopy. The method and procedures for establishing whether material is asbestos-containing is determined according to the U.S. Environmental Protection Agency Method for the Determination of Asbestos in Bulk Building Materials (Test Method EPA/600/R-93/116).

Paint samples collected for lead analysis are collected by taking a small volume of the paint from building finishes. The collected samples were placed in zipper storage bags, sealed and forwarded to an analytical laboratory. Bulk Lead samples are analyzed by Atomic Absorption Spectrophotometry.

## 5 SURVEY FINDINGS

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### 5.1 ASBESTOS

Asbestos is a strong mineral fiber that is resistant to heat (especially fire) and chemicals. In the past, asbestos was widely used as insulating and fireproofing material in a range of residential, commercial and industrial structures

as well as in the construction of ships, airplanes, vehicles and appliances. Asbestos is still used in non-friable materials such as Transite™ piping and roof drains.

An inspection of various construction materials was conducted during a walk-through of the work area. As materials suspected of containing asbestos were identified, representative sampling and laboratory testing of these materials was conducted.

The survey did not involve destructive sampling (i.e. excavation work or within electrical equipment). These areas are considered not accessible to the surveyor and as such materials suspected to contain asbestos may be present within these inaccessible areas.

A total of eleven (11) homogeneous construction materials were observed, sampled and analyzed as part of this survey. O. Reg. 278/05 outlines a requirement for the collection of multiple samples of each homogeneous material suspected of containing asbestos, as presented in **Table 1**.

**Table 1 O. Reg. 278/05 Minimum Asbestos Bulk Material Sample Requirements**

TYPE OF MATERIAL	SIZE OF HOMOGENEOUS MATERIAL	MINIMUM NUMBER OF BULK SAMPLES
Surfacing material, including without limitation material that is applied to surfaces by spraying, by troweling or otherwise, such as acoustical plaster on ceilings, fireproofing materials on structural members and plaster	Less than 90 m <sup>2</sup>	3
	90 m <sup>2</sup> or more, but less than 450 m <sup>2</sup>	5
	450 m <sup>2</sup> or more	7
Thermal insulation, except as described below	Any size	3
Thermal insulation patch	Less than 2m or 0.5 m <sup>2</sup>	1
Other material	Any size	3

As per these requirements, a total of thirty-five (35) samples were collected and submitted for asbestos analysis as part of this survey.

Asbestos samples were submitted to EMSL Analytical for analysis of bulk asbestos for Polarized Light Microscopy (PLM) Point Count (analytical certificates are presented in Appendix A). EMSL is a participant in the National Voluntary Laboratory Accreditation Program (NVLAP) for bulk asbestos fibre analysis, Laboratory Code 200877-0. The method detection limit used in the analysis is <0.5% asbestos by dry weight. A summary of the analytical results from the recent representative sampling program is summarized in **Table 2** below.

**Table 2 Summary of Asbestos Sampling Results**

SAMPLE ID	LOCATION	SAMPLE DESCRIPTION	FRIABLE/ NON-FRIABLE	ASBESTOS CONTENT (%)
AS 1-1	Room 51P 321 – Janitor's Service Room	Expansion Joint Caulking & Caulking Around Pipe/Floor Conduits (Grey)	Non-Friable	None Detected
AS 1-2	Room 51P 322 – Cable Pull Room	Expansion Joint Caulking & Caulking Around Pipe/Floor Conduits (Grey)	Non-Friable	None Detected

AS 1-3	Retail Unit – Chelsea NY – Storage Closet	Expansion Joint Caulking & Caulking Around Pipe/Floor Conduits (Grey)	Non-Friable	None Detected
AS 2-1	Retail Unit – Chelsea NY	Ceiling Tile – 2' x 2' Textured with Pin Pricks	Non-Friable	None Detected
AS 2-2	Retail Unit – Chelsea NY	Ceiling Tile – 2' x 2' Textured with Pin Pricks	Non-Friable	None Detected
AS 2-3	Retail Unit – Chelsea NY	Ceiling Tile – 2' x 2' Textured with Pin Pricks	Non-Friable	None Detected
AS 3-1	Retail Unit – Chelsea NY	Drywall Joint Compound	Non-Friable	None Detected
AS 3-2	Outside Retail Unit – Chelsea NY	Drywall Joint Compound	Non-Friable	None Detected
AS 3-3	Outside Retail Unit – Chelsea NY	Drywall Joint Compound	Non-Friable	None Detected
AS 4-1	Outside Retail Unit – Chelsea NY	Ceramic Tile Mortar	Non-Friable	None Detected
AS 4-2	Outside Retail Unit – Chelsea NY	Ceramic Tile Mortar	Non-Friable	None Detected
AS 4-3	Outside Retail Unit – Chelsea NY	Ceramic Tile Mortar	Non-Friable	None Detected
AS 5-1	Throughout Concourse Level (Above Ceiling Slats)	Sprayed Fireproofing Material	Friable	None Detected
AS 5-2	Throughout Concourse Level (Above Ceiling Slats)	Sprayed Fireproofing Material	Friable	None Detected
AS 5-3	Throughout Concourse Level (Above Ceiling Slats)	Sprayed Fireproofing Material	Friable	None Detected
AS 5-4	Throughout Concourse Level (Above Ceiling Slats)	Sprayed Fireproofing Material	Friable	None Detected
AS 5-5	Throughout Concourse Level (Above Ceiling Slats)	Sprayed Fireproofing Material	Friable	None Detected
AS 6-1	Throughout Concourse Level (Above Ceiling Slats)	Cementitious Firestop Material Around Conduits	Friable	None Detected
AS 6-2	Throughout Concourse Level (Above Ceiling Slats)	Cementitious Firestop Material Around Conduits	Friable	None Detected
AS 6-3	Throughout Concourse Level (Above Ceiling Slats)	Cementitious Firestop Material Around Conduits	Friable	None Detected
AS 7-1	Throughout Concourse Level (Above Ceiling Slats)	Duct Sealant Material (Grey)	Non-Friable	None Detected
AS 7-2	Throughout Concourse Level (Above Ceiling Slats)	Duct Sealant Material (Grey)	Non-Friable	None Detected
AS 7-3	Throughout Concourse Level (Above Ceiling Slats)	Duct Sealant Material (Grey)	Non-Friable	None Detected
AS 8-1	Room 51P 326 – Collector's Ante Room	Ceiling Tile – 2' x 4' Textured with Pin Pricks	Non-Friable	None Detected

AS 8-2	Room 51P 326 – Collector’s Ante Room	Ceiling Tile – 2’ x 4’ Textured with Pin Pricks	Non-Friable	None Detected
AS 8-3	Room 51P 326 – Collector’s Ante Room	Ceiling Tile – 2’ x 4’ Textured with Pin Pricks	Non-Friable	None Detected
AS 9-1	Room 51P 326 – Collector’s Ante Room	Grout Behind Brown Patterned Ceramic Tiles	Non-Friable	None Detected
AS 9-2	Room 51P 326 – Collector’s Ante Room	Grout Behind Brown Patterned Ceramic Tiles	Non-Friable	None Detected
AS 9-3	Room 51P 326 – Collector’s Ante Room	Grout Behind Brown Patterned Ceramic Tiles	Non-Friable	None Detected
AS 10-1	Room 51P 325 – Collector’s Washroom	Duct Sealant Material (Red)	Non-Friable	None Detected
AS 10-2	Room 51P 325 – Collector’s Washroom	Duct Sealant Material (Red)	Non-Friable	None Detected
AS 10-3	Room 51P 325 – Collector’s Washroom	Duct Sealant Material (Red)	Non-Friable	None Detected
AS 11-1	Room 51P 321 – Janitor’s Service Room	Concrete Block Mortar	Non-Friable	None Detected
AS 11-2	Room 51P 321 – Janitor’s Service Room	Concrete Block Mortar	Non-Friable	None Detected
AS 11-3	Room 51P 321 – Janitor’s Service Room	Concrete Block Mortar	Non-Friable	None Detected

**Table 2 Notes:** Method detection limit (MDL) = <0.5%  
Description provided refers to colour and patterns observed on the surface of the material by the surveyors at the time of sampling, and should be used to identify the material in the work areas. Laboratory colour descriptions on the Certificates of Analysis in some cases describe the cross-sectional colour of the material.

Based on the laboratory results, none of the eleven (11) homogeneous building material samples collected and analyzed are considered to be asbestos-containing (defined as material that contains 0.5% or more asbestos by dry weight).

Certificates of Analysis can be found in **Appendix A**. Sample locations are provided in **Drawing 1** attached.

#### General Recommendations:

For the purposes of renovation/demolition, suspect friable and non-friable building materials discovered and not discussed in this report should be treated as asbestos until proven otherwise and other substances, self-evident as designated substances, should be handled in an appropriate fashion. If any potential asbestos-containing materials are encountered unexpectedly, a qualified person should be contacted to sample, monitor and/or document the removal of asbestos-containing materials, and to ensure that appropriate procedures are being followed.

As electrical components were live and operational during the site visit, these materials were not sampled. As such, electrical components should be considered to be asbestos-containing until the system can be decommissioned and materials can be sampled for asbestos analysis.

## 5.2 ACRYLONITRILE

Acrylonitrile is mostly used as a feedstock or chemical aid in the production of nitrile-butadiene rubber and in acrylonitrile-butadiene-styrene and styrene-acrylonitrile polymers. Acrylonitrile is also used to make other

chemicals such as plastics, synthetic rubber, and acrylic fiber (e.g. clothing, blankets, carpeting) and nitrile rubber for oil-resistant hoses.

Acrylonitrile is not expected to be present in the work area.

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## 5.3 ARSENIC

Arsenic is used with other metals (chiefly copper, lead and zinc) to make alloys. Arsenic compounds are also used in pigments, animal poisons, insecticides, paints, wallpaper, ceramics, and poison gases for chemical warfare, glass making, in calico and indigo printing, pyrotechnics, integrated circuits and transistors. Arsenic is also a major waste material from the gold mining industry.

Arsenic was formerly used as an additive in paint. It should be assumed that all lead-containing paint has the potential to contain arsenic. As such, every precaution and procedure should be taken during demolition/renovation activities to control the time-weighted exposure of a worker to airborne/respirable arsenic.

Coring, sawing or breaking up painted materials potentially containing arsenic should be completed only with appropriate dust suppression methods, proper respiratory protection and general worker safety precautions.

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## 5.4 BENZENE

Benzene is widely used in the chemical industry as a starting material and solvent. Benzene occurs naturally in crude oil and is present in all gasoline products, automobile emissions and cigarette smoke. Benzene is highly volatile, and will release into the atmosphere over a short time.

Benzene is not expected to be present in the work area.

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## 5.5 COKE OVEN EMISSIONS

Coke oven emissions are complex mixtures of coal and coke particles, various vapors, gases and tars emitted during carbonization of coal to produce coke. The primary use of coke (pure carbon) is in the manufacture of iron and steel. Coke is also used to synthesize calcium carbide and to manufacture graphite and electrodes.

Coke oven emissions are not expected to be present in the work area.

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## 5.6 ETHYLENE OXIDE

Ethylene Oxide is an extremely flammable gas used in the manufacture of several industrial chemicals including textiles, detergents, polyurethane foam, antifreeze (especially ethylene glycol), solvents, medicinal products, adhesives, and other related products. It is also used as a fumigant and as a sterilizing agent for food (spices), cosmetics, and surgical tool and plastic devices in hospitals as an alternative to steam.

Ethylene oxide is not expected to be present in the work area.

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## 5.7 ISOCYANATES

Isocyanates are the raw materials from which all polyurethane products are made. Isocyanates are widely used in the manufacture of flexible and rigid foams, fibres, coatings such as paints and varnishes, elastomers, and also in materials used in auto body repair and building insulation.

Isocyanates are not expected to be present in the work area.



## 5.8 LEAD

The Ontario Ministry of Labour (MOL) has not prescribed specific criteria for classification of lead-containing paints or other surface coatings and construction materials. In the past, the abatement industry has generally used regulations set by the federal Hazardous Products Act (HPA) and the U.S. Department of Housing and Urban Development (HUD) to determine whether a material is considered lead-containing. Until July 2005, the HPA classified all lead-containing paints and coatings as 0.5% lead by weight as determined by bulk chemical analysis. In April 2005, the HPA was amended by the Surface Coating Materials Regulation (SOR/2005-109) to harmonize with US legislation that prescribes an acceptable lead level of 0.06% (600 ppm) lead by weight or less in certain paints. In October 2010, this was further revised to 0.009% (90 ppm) lead by dry weight or less, as determined by bulk chemical analysis in accordance with good laboratory practises. Under the Surface Coating Materials Regulation (SOR/2005-109) Section 4.2, the following paints and surface coatings are excluded from the above noted acceptable lead level:

- as an anti-corrosive or an anti-weathering coating applied on any structure other than a building, that is used for an agricultural, industrial or public purpose;
- as a touch-up coating for metal surfaces;
- on traffic signs;
- for graphic art on billboards or similar displays;
- for identification marks in industrial buildings; or
- as materials for the purposes of arts, crafts or hobbies, other than material for use by children.

However, based on a recent publication (EACO Lead Guideline For Construction, Renovation, Maintenance or Repair dated October 2014) from the Environmental Abatement Council of Ontario (EACO), an industry group representing consultants and contractors in the Ontario abatement industry, various occupational and workplace safety authorities and agencies consider that any detectable amount of lead in paint and similar materials has the potential to produce an airborne hazard to workers and building occupants when these materials are disturbed. As such, for the purpose of this survey, WSP has classified any material containing detectable/measurable amounts of lead as “lead-containing” materials and recommends that all disturbances to these materials be conducted in accordance with the MOL document *Guideline, Lead on Construction Projects*.

Representative samples of suspected lead-containing materials were collected and analyzed, as summarized in **Table 3** below:

**Table 3 Summary of Lead Sampling Results**

SAMPLE ID	LOCATION	SAMPLE DESCRIPTION	LEAD CONTENT (%)
Pb1	Room 51P 321 – Janitor Service Room	Blue Paint on Ductwork	<0.019%
Pb2	Room 51P 321 – Janitor Service Room	Green Paint on Doors	<0.0084%
Pb3	Room 51P 321 – Janitor Service Room	Light Blue Paint on Pipes	<0.057%
Pb4	Room 51P 321 – Janitor Service Room	Pink Paint on Pipes	<0.074%
<b>Pb5</b>	<b>Room 51P 321 – Janitor Service Room</b>	<b>Red Paint on Pipes</b>	<b>0.0095%</b>
Pb6	Room 51P 321 – Janitor Service Room	Brown Paint on Walls	<0.0083%

Table 3 Notes: Bolding and highlighting indicates lead-containing material

Based on the laboratory analysis, detectable concentrations of lead were identified one (1) of the six (6) paint samples collected and analyzed. The following paints are considered to be lead-containing:



- Red paint on pipes observed in the janitor service room (room 51P 321). This paint is expected to be present on all sprinkler lines throughout the work area.

Certificates of Analysis can be found in **Appendix A**. Sample locations are provided in **Drawing 1** attached.

Lead is expected to be present in the following construction components:

- as a component in ceramic building products such as tiles and bricks;
- as a component of the solder on sweated joints between copper pipe and fittings;
- as a component of the solder on wire connections of electric components; and
- as a component of solder used to seal the bell fitting of cast iron rain water leader pipes.

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## 5.9 MERCURY

Mercury is used in thermometers, batteries and some electrical switches. It is also used in dental fillings and in latex paint to protect against fungal attack and mildew. Mercury vapour is also present as a vapour in fluorescent lights, metal halide lights and mercury vapour lights.

Although no samples were analyzed for mercury, it is presumed to be present as a vapour in light bulbs within the work areas.

The presence of mercury within assembled units (e.g. light bulbs) should not be considered a hazard provided that the assembled units remain sealed and intact. Avoid direct skin contact with mercury and avoid inhalation of mercury vapour. Dispose of mercury following applicable legislative requirements.

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## 5.10 SILICA

Silica, or silicon dioxide (SiO<sub>2</sub>), is the basic component of sand, quartz and granite rock. Crystalline Silica (the designated substance) is encountered in industry in three forms: quartz, tridymite, and cristobalite. Unless proven otherwise, crystalline Silica should be assumed to be present in sandblasting abrasives, brick, concrete, cement, mortar, granite, sandstone, slate, rock and stone, sand, topsoil, and asphalt.

No samples were taken for silica, however, it is presumed to be present concrete, cement and mortar. Every precaution and procedure should be taken during demolition/renovation activities to control the time-weighted exposure of a worker to silica dust. Coring, sawing or breaking up the materials containing silica should be completed only with appropriate dust suppression methods, proper respiratory protection and general worker safety precautions as outlined in the MOL Guidance document and in the Occupational Health and Safety Act.

The Ministry of Labour (MOL) has published a Guideline for Silica on Construction Projects, dated September 2004 (as amended). This document is available online and should be referenced prior to initiating any work where exposure to airborne silica is anticipated.

---

## 5.11 VINYL CHLORIDE

Vinyl chloride is the parent compound of polyvinyl chloride (PVC) which is a widely used plastic. Vinyl chloride is also used in various resins (e.g. plastic food wrap), and in the glass, rubber, and paper industries. Vinyl chloride is also formed by the degradation of the chlorinated solvents trichloroethylene (TCE), 1,1,1-trichloroethane (111TCA) and tetrachloroethylene (also known as perchloroethylene or dry cleaning solvent), especially in soil or groundwater that has been contaminated with these solvents.

Vinyl chloride is not expected to be present in the work area.

## 5.12 POLYCHLORINATED BIPHENYLS

The federal government has published Regulation SOR/2008-273 (September 5, 2008), which states that any solid material containing 50 parts per million (ppm) or more of PCBs must be handled as a PCB-containing material in accordance with all applicable regulations. The Regulation phases in a ban on the use of all PCB-containing equipment (other than light ballasts or pole-mounted transformers) containing more than 500 mg/kg PCB and applies to equipment containing 50-500 mg/kg PCBs including, light ballasts and pole-mounted transformers (with the exceptions noted below) by December 31, 2025. Equipment containing 50-500 mg/kg PCBs (except for light ballasts and pole mount transformers) cannot be used or stored at or within 100 m of a drinking water treatment plant or a food or feed processing plant, child care facility, preschool, primary school, secondary school, hospital, or senior citizens' care facility. In addition, the Regulation provides labeling requirements for PCB equipment in use (except for equipment that is too small to bear a standard PCB label such light ballasts) or storage and requires all PCBs (including those in light ballasts) to be stored no longer than 30 days of being taken out of use before being sent to an authorized destruction facility. The Regulation also prescribes PCB storage site and reporting requirements and the conditions under which an applicant may apply for extensions of certain sections of the Regulation.

Individual fluorescent light ballasts were not inspected for the presence of PCBs as they were operational at the time of the site visit and therefore inaccessible to the surveyor. Fluorescent light ballasts may contain PCBs.

Transformers potentially containing PCBs were not observed during the survey.

PCBs were also widely used in caulking and elastic sealant materials, and therefore may be present in the caulk used in windows, door frames, masonry columns and other masonry building materials in any building constructed or renovated between 1950 and 1978. In some instances, PCBs may represent a high percentage of the caulk, e.g. 100,000 parts per million (ppm) or higher.

As such, representative sampling of suspected PCB-containing caulking was collected and analyzed, as summarized in Table 4 below.

**Table 4 Summary of PCB Sampling Results**

SAMPLE ID	SAMPLE LOCATION		PARAMETER	UNIT	RL	CONCENTRATION
	AND DESCRIPTION					
PCB1	Retail Unit – Chelsea NY – Storage Closet		PCBs	Mg/Kg	0.94	None Detected

Table 4 Notes: RL = Reporting Limit

Results are based on the weight of caulking extracted

A level of 50 ppm or greater is considered to be a PCB-containing material

Based on laboratory results, PCB-containing caulking materials were not identified within the work area. Certificates of Analysis can be found in **Appendix A**. Sample locations are provided in **Drawing 1** attached.

## 6 IN CLOSING

The following designated substances & hazardous materials have been identified or are suspected in the work area as detailed in this report:

- Asbestos
- Lead
- Silica
- Arsenic
- Mercury

Recommendations pertaining to each of these materials are found in individual sections of this report. Special precautions are required for the removal of specific designated substances. Except for asbestos, Designated Substances Regulation O. Reg. 490/09 applies to industrial establishments and not to construction. Due to this condition, it is imperative that a contractor retained for the renovations has a proven record in managing designated substances and operates under a control program.

All designated substances must be handled in accordance with the appropriate guidelines and regulations. Designated Substance and Hazardous Material information will require updating as corrective measures are instituted and materials have been removed from various sections of the work area.

## 7 LIMITATIONS

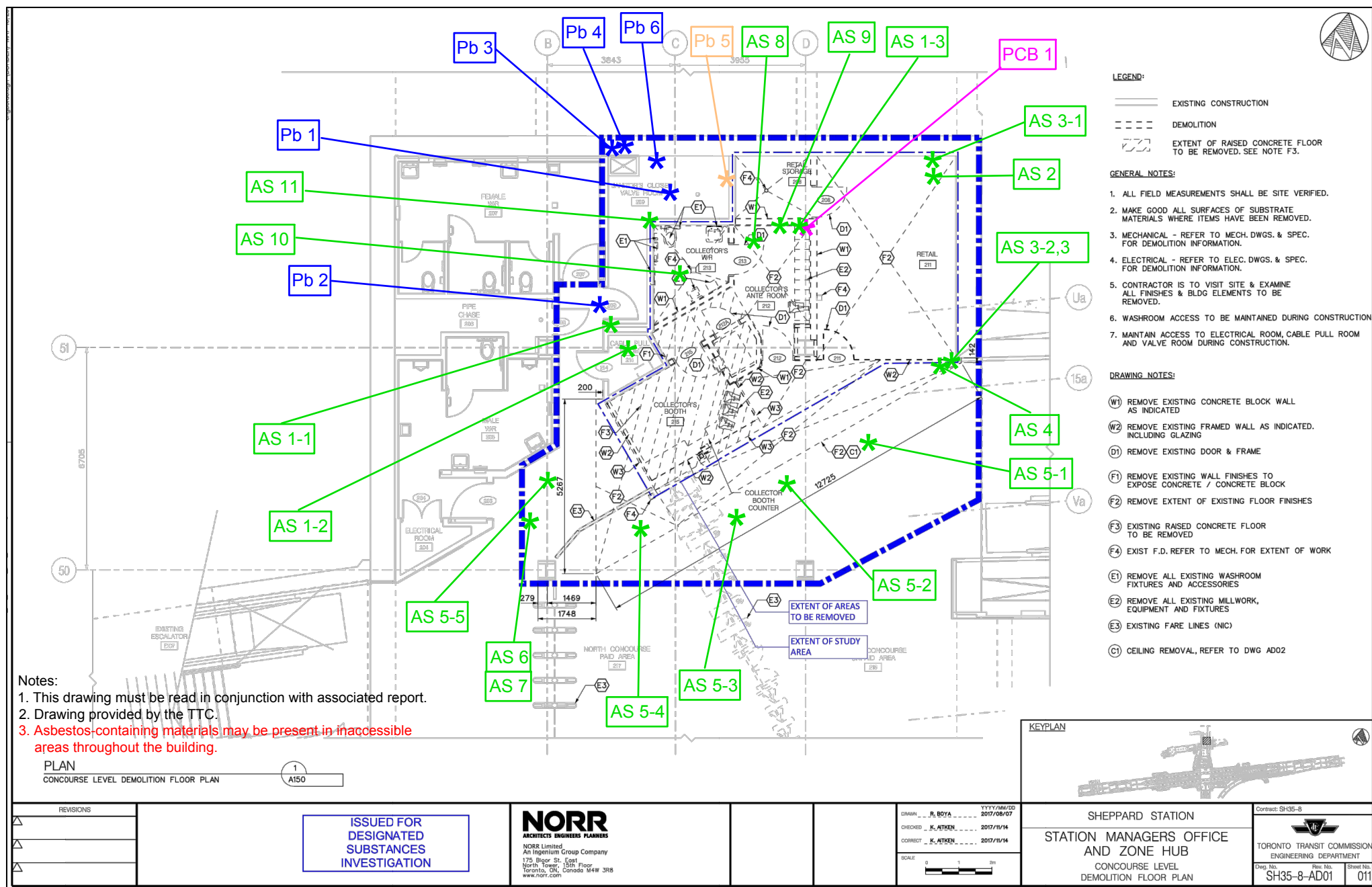
As this survey was generally non-destructive in nature, asbestos or other designated substances could be present in areas not accessible to the surveyors for identification. Contractors and maintenance personnel should be warned of the possibility of unidentified materials when breaking into enclosed areas. Suspect friable and non-friable building materials discovered in these areas should be treated as asbestos until proven otherwise and other substances, self-evident as designated substances, should be handled in an appropriate fashion. Materials equivalent or identical in description to those listed in Section 5.1, above, should be considered to be ACM and handled appropriately.

This report is prepared for the sole use of Toronto Transit Commission. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of the third party. The conclusions and recommendations contained in this assessment report are based upon professional opinions with regard to the subject matter. These opinions are in accordance with currently accepted industry practices for designated substance surveys and regulatory requirements for sampling and identifying designated substances and are subject to the following inherent limitations:

- The data and findings presented in this report are valid as of the date(s) of the investigation only. The passage of time, manifestation of latent conditions or occurrence of future events may warrant further exploration of the Site, analysis of the data, and re-evaluation of the findings, observations, and conclusions expressed in this report.
- The findings, observations, conclusions, and recommendations expressed by WSP Canada Inc. in this report do not represent an opinion concerning compliance of any past or present owner or operator of the Site with any federal, provincial or local laws or regulations.
- WSP Canada Inc.'s assessment presents professional opinions and findings of a scientific and technical nature. While attempts were made to relate the data and findings to applicable environmental and occupational health & safety laws and regulations, the report shall not be construed to offer legal opinion or representations as to the requirements of, nor compliance with, environmental and occupational health and safety laws, rules, regulations or policies of federal, provincial, or local governmental agencies. WSP Canada Inc. liability extends only to its client and not to other parties who may obtain this assessment report. Issues raised by the report should be reviewed by appropriate legal counsel.


# APPENDIX

## DRAWING



**Legend:**

- ★ Negative Asbestos Result
- ★ No Detectable Concentrations of Lead
- ★ Lead-Containing Result
- ★ Negative PCB Result

Client: TORONTO TRANSIT COMMISSION		Project No.: 161-04731-00-230.078	Drawing No.: 1
Drawn: DV	Approved: EK	Title: SHEPPARD STATION SITE PLAN - SAMPLING LOCATIONS	
Date: March 2018	Scale: NTS	Project: DESIGNATED SUBSTANCES & HAZARDOUS MATERIALS SURVEY SHEPPARD STATION - STATION MANAGERS OFFICE AND ZONE HUB	
Original Size: Letter	Rev: N/A	 <div>51 Constellation Court Toronto, ON M9W 1K4 T: 416-798-0065 F: 416-798-0518</div>	

# APPENDIX

**A**

ANALYTICAL RESULTS –  
ASBESTOS, LEAD & PCBS



# EMSL Canada Inc.

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<http://www.EMSL.com> / [torontolab@emsl.com](mailto:torontolab@emsl.com)

EMSL Canada Order 551801331  
 Customer ID: 55SPLC25  
 Customer PO: Erin Kennealy  
 Project ID: TTC Project - 161-0

**Attn:** Erin Kennealy  
 WSP Canada Inc.  
 51 Constellation Court  
 Toronto, ON M9W 1K4

**Phone:** (416) 798-0065  
**Fax:**  
**Collected:**  
**Received:** 2/02/2018  
**Analyzed:** 2/09/2018

**Proj:** 161-04731-00-230.078 Sheppard-Yonge (TTC Project - 161-04731-00)

## Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: AS1-1

Lab Sample ID: 551801331-0001

Sample Description: Room 51P 321 - Janitor Service Room/Grey Expansion Joint Caulking and Around Pipe/Floor Conduits

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	2/09/2018	Gray	0.0%	100%	None Detected	

Client Sample ID: AS1-2

Lab Sample ID: 551801331-0002

Sample Description: Room 51P 322 - Cable Pull Room/Grey Expansion Joint Caulking and Around Pipe/Floor Conduits

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	2/09/2018	Gray	0.0%	100%	None Detected	

Client Sample ID: AS1-3

Lab Sample ID: 551801331-0003

Sample Description: Retail Unit - Chelsea NY Storage Closet/Grey Expansion Joint Caulking and Around Pipe/Floor Conduits

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	2/09/2018	Gray	0.0%	100%	None Detected	

Client Sample ID: AS2-1

Lab Sample ID: 551801331-0004

Sample Description: Retail Unit - Chelsea NY /2'x2' Ceiling Tile; Textured with Pinpricks

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/09/2018	Tan	95%	5%	None Detected	

Client Sample ID: AS2-2

Lab Sample ID: 551801331-0005

Sample Description: Retail Unit - Chelsea NY /2'x2' Ceiling Tile; Textured with Pinpricks

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/09/2018	Tan	95%	5%	None Detected	

Client Sample ID: AS2-3

Lab Sample ID: 551801331-0006

Sample Description: Retail Unit - Chelsea NY /2'x2' Ceiling Tile; Textured with Pinpricks

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/09/2018	Gray	95%	5%	None Detected	

Client Sample ID: AS3-1

Lab Sample ID: 551801331-0007

Sample Description: Retail Unit - Chelsea NY /Drywall Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/09/2018	White	0%	100%	None Detected	





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EMSL Canada Order 551801331  
Customer ID: 55SPLC25  
Customer PO: Erin Kennealy  
Project ID: TTC Project - 161-0

## Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

**Client Sample ID:** AS3-2 **Lab Sample ID:** 551801331-0008

**Sample Description:** Outside Retail Unit - Chelsea NY /Drywall Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/09/2018	White	0%	100%	None Detected	

**Client Sample ID:** AS3-3 **Lab Sample ID:** 551801331-0009

**Sample Description:** Outside Retail Unit - Chelsea NY /Drywall Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/09/2018	White	0%	100%	None Detected	

**Client Sample ID:** AS4-1 **Lab Sample ID:** 551801331-0010

**Sample Description:** Outside Retail Unit - Chelsea NY /Ceramic Tile Mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/09/2018	White	0%	100%	None Detected	

**Client Sample ID:** AS4-2 **Lab Sample ID:** 551801331-0011

**Sample Description:** Outside Retail Unit - Chelsea NY /Ceramic Tile Mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/09/2018	White	0%	100%	None Detected	

**Client Sample ID:** AS4-3 **Lab Sample ID:** 551801331-0012

**Sample Description:** Outside Retail Unit - Chelsea NY /Ceramic Tile Mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/09/2018	White	0%	100%	None Detected	

**Client Sample ID:** AS5-1 **Lab Sample ID:** 551801331-0013

**Sample Description:** Throughout Concourse Level Above Ceiling Slats/Sprayed Fireproofing

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/09/2018	Gray	15%	85%	None Detected	

**Client Sample ID:** AS5-2 **Lab Sample ID:** 551801331-0014

**Sample Description:** Throughout Concourse Level Above Ceiling Slats/Sprayed Fireproofing

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/09/2018	Gray	15%	85%	None Detected	

**Client Sample ID:** AS5-3 **Lab Sample ID:** 551801331-0015

**Sample Description:** Throughout Concourse Level Above Ceiling Slats/Sprayed Fireproofing

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/09/2018	Gray	15%	85%	None Detected	





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EMSL Canada Order 551801331  
Customer ID: 55SPLC25  
Customer PO: Erin Kennealy  
Project ID: TTC Project - 161-0

## Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

**Client Sample ID:** AS5-4 **Lab Sample ID:** 551801331-0016

**Sample Description:** Throughout Concourse Level Above Ceiling Slats/Sprayed Fireproofing

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/09/2018	Gray	15%	85%	None Detected	

**Client Sample ID:** AS5-5 **Lab Sample ID:** 551801331-0017

**Sample Description:** Throughout Concourse Level Above Ceiling Slats/Sprayed Fireproofing

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/09/2018	Gray	15%	85%	None Detected	

**Client Sample ID:** AS6-1 **Lab Sample ID:** 551801331-0018

**Sample Description:** Throughout Concourse Level Above Ceiling Slats/Cementitious Firestop Around Conduits

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/09/2018	Gray	0%	100%	None Detected	

**Client Sample ID:** AS6-2 **Lab Sample ID:** 551801331-0019

**Sample Description:** Throughout Concourse Level Above Ceiling Slats/Cementitious Firestop Around Conduits

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/09/2018	Gray	0%	100%	None Detected	

**Client Sample ID:** AS6-3 **Lab Sample ID:** 551801331-0020

**Sample Description:** Throughout Concourse Level Above Ceiling Slats/Cementitious Firestop Around Conduits

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/09/2018	Gray	0%	100%	None Detected	

**Client Sample ID:** AS7-1 **Lab Sample ID:** 551801331-0021

**Sample Description:** Throughout Concourse Level Above Ceiling Slats/Grey Duct Sealant

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	2/09/2018	Gray	0.0%	100%	None Detected	

**Client Sample ID:** AS7-2 **Lab Sample ID:** 551801331-0022

**Sample Description:** Throughout Concourse Level Above Ceiling Slats/Grey Duct Sealant

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	2/09/2018	Gray	0.0%	100%	None Detected	

**Client Sample ID:** AS7-3 **Lab Sample ID:** 551801331-0023

**Sample Description:** Throughout Concourse Level Above Ceiling Slats/Grey Duct Sealant

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	2/09/2018	Gray	0.0%	100%	None Detected	



# EMSL Canada Inc.

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EMSL Canada Order 551801331  
Customer ID: 55SPLC25  
Customer PO: Erin Kennealy  
Project ID: TTC Project - 161-0

## Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: AS8-1

Lab Sample ID: 551801331-0024

Sample Description: Room 51P 326 - Collector's Ante Room/2'x4' Ceiling Tile; Textured with Pinpricks

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/09/2018	Tan	95%	5%	None Detected	

Client Sample ID: AS8-2

Lab Sample ID: 551801331-0025

Sample Description: Room 51P 326 - Collector's Ante Room/2'x4' Ceiling Tile; Textured with Pinpricks

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/09/2018	Tan	95%	5%	None Detected	

Client Sample ID: AS8-3

Lab Sample ID: 551801331-0026

Sample Description: Room 51P 326 - Collector's Ante Room/2'x4' Ceiling Tile; Textured with Pinpricks

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/09/2018	Gray	95%	5%	None Detected	

Client Sample ID: AS9-1

Lab Sample ID: 551801331-0027

Sample Description: Room 51P 326 - Collector's Ante Room/Grout Behind Brown Patterned Ceramic Tiles

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/09/2018	Gray	0%	100%	None Detected	

Client Sample ID: AS9-2

Lab Sample ID: 551801331-0028

Sample Description: Room 51P 326 - Collector's Ante Room/Grout Behind Brown Patterned Ceramic Tiles

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/09/2018	Gray	0%	100%	None Detected	

Client Sample ID: AS9-3

Lab Sample ID: 551801331-0029

Sample Description: Room 51P 326 - Collector's Ante Room/Grout Behind Brown Patterned Ceramic Tiles

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/09/2018	Gray	0%	100%	None Detected	

Client Sample ID: AS10-1

Lab Sample ID: 551801331-0030

Sample Description: Room 51P 326 - Collector's Ante Room/Red Duct Sealant

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	2/09/2018	Brown	0.0%	100%	None Detected	

Client Sample ID: AS10-2

Lab Sample ID: 551801331-0031

Sample Description: Room 51P 325 - Collector's Washroom/Red Duct Sealant

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	2/09/2018	Brown	0.0%	100%	None Detected	



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EMSL Canada Order 551801331  
Customer ID: 55SPLC25  
Customer PO: Erin Kennealy  
Project ID: TTC Project - 161-0

## Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

**Client Sample ID:** AS10-3 **Lab Sample ID:** 551801331-0032  
**Sample Description:** Room 51P 325 - Collector's Washroom/Red Duct Sealant

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	2/09/2018	Brown	0.0%	100%	None Detected	

**Client Sample ID:** AS11-1 **Lab Sample ID:** 551801331-0033  
**Sample Description:** Room 51P 321 - Janitor Service Room/Concrete Block Mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/09/2018	Gray	0%	100%	None Detected	

**Client Sample ID:** AS11-2 **Lab Sample ID:** 551801331-0034  
**Sample Description:** Room 51P 321 - Janitor Service Room/Concrete Block Mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/09/2018	Gray	0%	100%	None Detected	

**Client Sample ID:** AS11-3 **Lab Sample ID:** 551801331-0035  
**Sample Description:** Room 51P 321 - Janitor Service Room/Concrete Block Mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/09/2018	Gray	0%	100%	None Detected	

### Analyst(s):

Anne Balayboa PLM Grav. Reduction (3)  
Jon Delos Santos PLM Grav. Reduction (6)  
Michelle Skillman PLM (26)

### Reviewed and approved by:

Matthew Davis or other approved signatory  
or Other Approved Signatory

None Detected = <0.1%. EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. Samples received in good condition unless otherwise noted. This report must not be used to claim product endorsement by NVLAP of any agency of the U.S. Government.

Samples analyzed by EMSL Analytical, Inc. Depew, NY NVLAP Lab Code 200056-0, NYS ELAP 11606

Initial report from: 02/09/2018 16:05:29

**EMSL Canada Inc.**

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EMSL Canada Or	551801264
CustomerID:	55SPLC25
CustomerPO:	Erin Haatvedt
ProjectID:	TTC Project - 161-0

Attn: **Erin Haatvedt**  
**WSP Canada Inc.**  
**51 Constellation Court**  
**Toronto, ON M9W 1K4**

Phone: (416) 798-0065  
Fax:  
Received: 02/02/18 10:47 AM  
Collected:

Project: **161-04731-00-230.078 Sheppard - Yonge****Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)\***

<i>Client Sample</i>	<i>Description</i>	<i>Collected</i>	<i>Analyzed</i>	<i>Weight</i>	<i>RDL</i>	<i>Lead Concentration</i>
Pb1 551801264-0001	Site: Room 51P 321 - Janitor Service Room - Blue Paint on Ductwork		2/6/2018	0.1028 g	0.019 % wt	<0.019 % wt
Pb2 551801264-0002	Site: Room 51P 321 - Janitor Service Room - Green Paint on Doors		2/6/2018	0.2367 g	0.0084 % wt	<0.0084 % wt
Pb3 551801264-0003	Site: Room 51P 321 - Janitor Service Room - Light Blue Paint on Pipes		2/6/2018	0.0349 g	0.057 % wt	<0.057 % wt
Pb4 551801264-0004	Site: Room 51P 321 - Janitor Service Room - Pink Paint on Pipes		2/6/2018	0.0272 g	0.074 % wt	<0.074 % wt
Pb5 551801264-0005	Site: Room 51P 321 - Janitor Service Room - Red Paint on Pipes		2/6/2018	0.2251 g	0.0089 % wt	0.0095 % wt
Pb6 551801264-0006	Site: Room 51P 321 - Janitor Service Room - Brown Paint on Walls		2/6/2018	0.2422 g	0.0083 % wt	<0.0083 % wt

Insufficient sample to reach reporting limit for samples 551801264-0001/-0003/-0004

Rowena Fanto, Lead Supervisor  
or other approved signatory

\*Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.010 % wt based on the minimum sample weight per our SOP. Unless noted, results in this report are not blank corrected. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. The QC data associated with the sample results included in this report meet the recovery and precision requirements unless specifically indicated otherwise. Definitions of modifications are available upon request.

Samples analyzed by EMSL Canada Inc. Mississauga, ON A2LA Accredited Environmental Testing Cert #2845.08

Initial report from 02/09/2018 08:24:51



**EMSL Analytical, Inc.**

200 Route 130 North, Cinnaminson, NJ 08077

Phone: (856) 303-2500 Fax: (856) 858-4571 Email: EnvChemistry2@emsl.com

Attn:

**Erin Haatvedt**  
**WSP Canada Inc.**  
**51 Constellation Court**  
**Toronto, ON M9W 1K4**

Phone: (905) 856-0065

Fax:

2/13/2018

The following analytical report covers the analysis performed on samples submitted to EMSL Analytical, Inc. on 2/6/2018. The results are tabulated on the attached data pages for the following client designated project:

**161-04731-00-230.078 Sheppard - Yonge**

The reference number for these samples is EMSL Order #011800846. Please use this reference when calling about these samples. If you have any questions, please do not hesitate to contact me at (856) 303-2500.

Approved By:

Phillip Worby, Environmental Chemistry  
Laboratory Director



The test results contained within this report meet the requirements of NELAP and/or the specific certification program that is applicable, unless otherwise noted.  
NELAP Certifications: NJ 03036, NY 10872, PA 68-00367, CA ELAP 1877

The samples associated with this report were received in good condition unless otherwise noted. This report relates only to those items tested as received by the laboratory. The QC data associated with the sample results meet the recovery and precision requirements established by the NELAP, unless specifically indicated. All results for soil samples are reported on a dry weight basis, unless otherwise noted. This report may not be reproduced except in full and without written approval by EMSL Analytical, Inc.

**EMSL Analytical, Inc.**

200 Route 130 North, Cinnaminson, NJ 08077

Phone/Fax: (856) 303-2500 / (856) 858-4571

<http://www.EMSL.com>[EnvChemistry2@emsl.com](mailto:EnvChemistry2@emsl.com)

EMSL Order: 011800846  
CustomerID: SPLC25  
CustomerPO: 551801323  
ProjectID:

Attn: **Erin Haatvedt**  
**WSP Canada Inc.**  
**51 Constellation Court**  
**Toronto, ON M9W 1K4**

Phone: (905) 856-0065  
Fax:  
Received: 02/06/18 12:40 PM

Project: 161-04731-00-230.078 Sheppard - Yonge

**Analytical Results**

**Client Sample Description** PCB 1 **Collected:** **Lab ID:** 011800846-0001  
Retail Unit - Chelsea NY Storage Closet

Method	Parameter	Result	RL	Units	Prep Date	Analyst	Analysis Date	Analyst
3540C/8082A	Aroclor-1016	ND	0.94	mg/Kg	2/8/2018	SD	2/12/2018	EH
3540C/8082A	Aroclor-1221	ND	0.94	mg/Kg	2/8/2018	SD	2/12/2018	EH
3540C/8082A	Aroclor-1232	ND	0.94	mg/Kg	2/8/2018	SD	2/12/2018	EH
3540C/8082A	Aroclor-1242	ND	0.94	mg/Kg	2/8/2018	SD	2/12/2018	EH
3540C/8082A	Aroclor-1248	ND	0.94	mg/Kg	2/8/2018	SD	2/12/2018	EH
3540C/8082A	Aroclor-1254	ND	0.94	mg/Kg	2/8/2018	SD	2/12/2018	EH
3540C/8082A	Aroclor-1260	ND	0.94	mg/Kg	2/8/2018	SD	2/12/2018	EH
3540C/8082A	Aroclor-1262	ND	0.94	mg/Kg	2/8/2018	SD	2/12/2018	EH
3540C/8082A	Aroclor-1268	ND	0.94	mg/Kg	2/8/2018	SD	2/12/2018	EH

**Definitions:**

ND - indicates that the analyte was not detected at the reporting limit

RL - Reporting Limit (Analytical)

1 - This analyte is not accredited for the reported Method. The result is for informational purposes only.

A thick white diagonal bar starts from the left edge of the page, below the letter 'B', and extends towards the bottom right corner.

**B**

TTC PROVIDED SCOPE OF WORK

SP: #####



## Request for Designated Substance Survey (DSS)

**Contract No.:** SH35-8      **Contract Title:** SHEPPARD STATION - STATION MANAGERS OFFICE AND ZONE HUB

<b>Senior Project Engineer:</b> Trisha Neilson (SPC)	<b>Email:</b> trisha.neilson@ttc.ca	<b>Telephone:</b> 416-590-6831
<b>Project Manager:</b> Mario Nalli	<b>Project Controls Analyst:</b> Cosmo Romeo	<b>Account No.:</b> 7873

**Date Required:** (Allow 6 weeks minimum. Delivery time can be reduced, however higher fees will apply)  
29-Jan-18

### Summary of Work:

Demo the existing collector's booth and retail space to construction a new Station Managers Office and Zone Hub. The work includes:

1. Removal of existing collector booth, safe room, anteroom, washroom, retail and retail storage areas including walls, concrete curbs, ceilings, floor finishes, millwork and fixtures.
2. Mechanical and electrical removals and modifications for new spaces, power, lighting, data, and voice..
3. New sprinkler distribution as required for the new spaces, currently only the retail and retail storage are sprinklered

### Special Constraints (i.e.. Restricted hours, confined space, other physical barriers, etc.)

Work to be scheduled during Non-Operating hours in collector booth or as coordinated with the Station Manager, Michael Sosedov.

Notify and arrange with Paul Occiogrosso, TTC Retail & Parking Officer for access to retail tenant space.

EM, BM or MM keys may be needed to for access to the 3 service rooms behind the collector booth.

### List of Attachments:

See attached drawing pdf file 'Appendix A dwgs'.

**NOTE:** Drawings provided must clearly outline area to be surveyed and also include title block with drawing number and label marked:



### Originator of Request:

T. Neilson

### Date Issued:

1-Dec-17

COPY: Chief Geotechnical Engineer  
Project Manager



## Senior Project Engineer/Senior Project Coordinator

# APPENDIX

C

PREVIOUS REPORTS

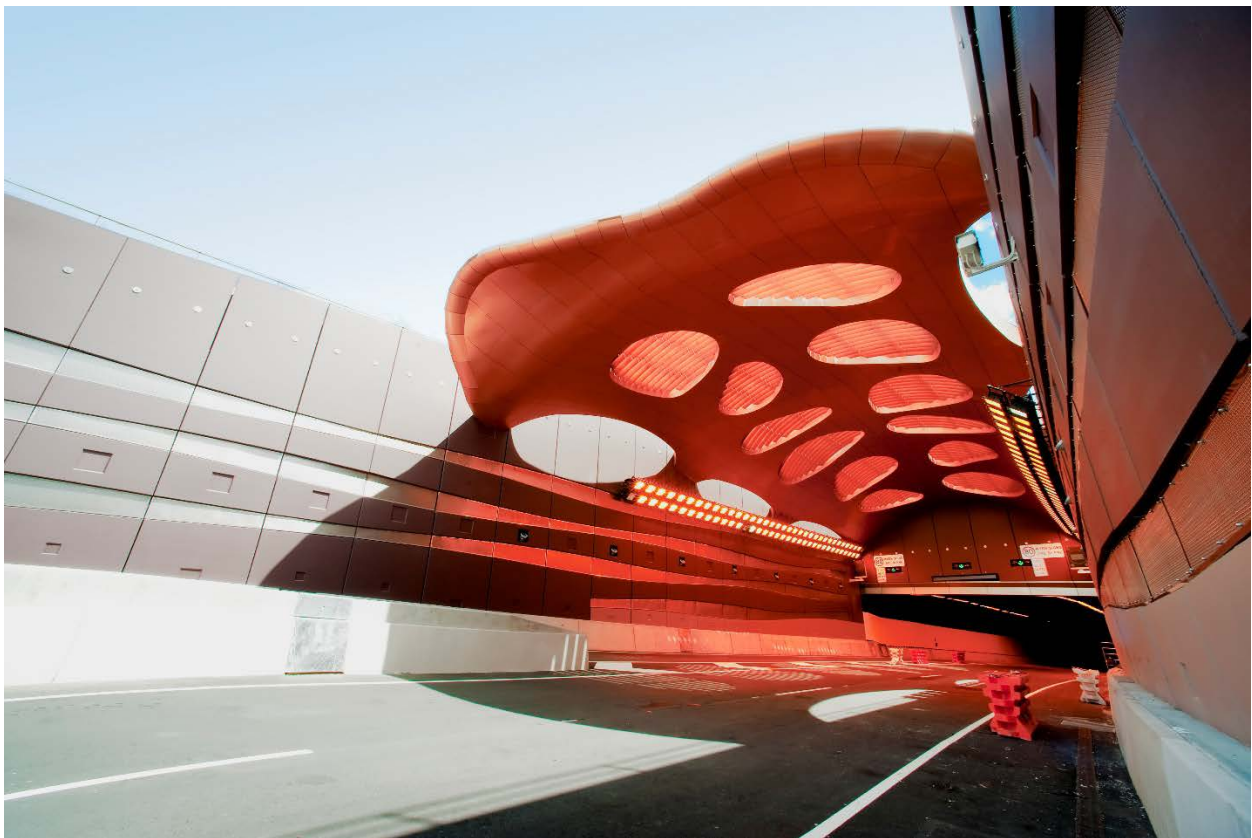
TORONTO TRANSIT COMMISSION

# DESIGNATED SUBSTANCES AND HAZARDOUS MATERIALS SURVEY

SHEPPARD-YONGE STATION – SUBWAY RULE BOOK  
HANDS ON TRAINING (SH35-7)

NOVEMBER 16, 2017

CONFIDENTIAL





# DESIGNATED SUBSTANCES AND HAZARDOUS MATERIALS SURVEY

**SHEPPARD-YONGE STATION –  
SUBWAY RULE BOOK HANDS ON  
TRAINING (SH35-7)**

**TORONTO TRANSIT COMMISSION**

REPORT VERSION 2.0  
CONFIDENTIAL

PROJECT NO.: 161-04731-00-230.064  
DATE: NOVEMBER 2017

WSP  
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November 16, 2017

CONFIDENTIAL

TORONTO TRANSIT COMMISSION  
5140 Yonge Street, 6th Floor  
Toronto, Ontario M2N 6L6

**Attention:** Mr. Andrew Drevininkas

**Subject:** Designated Substances and Hazardous Materials Survey

Dear Sir:

WSP Canada Inc. (WSP) was retained by the Toronto Transit Commission (TTC) to carry out a Designated Substances & Hazardous Materials Survey (DSS) at selected areas within TTC's Sheppard-Yonge Station in Toronto, Ontario.

The purpose of this survey is to determine the presence/absence of designated substances within the work areas and to provide designated substance information to contractors at the time of tender to ensure complete and correct removal or handling of materials prior to renovations.

The following report discusses the methodologies and findings of this survey.

We trust that the attached report is satisfactory for your purposes at this time. Please contact the undersigned should you have any questions or concerns

Yours sincerely,



A handwritten signature in blue ink, appearing to read 'Erin Kennealy'.

Erin Kennealy, CIH  
Occupational Hygienist

EK/DV  
WSP ref.: 161-04731-00-230.064

---

# QUALITY MANAGEMENT

ISSUE/REVISION	FIRST ISSUE	REVISION 1	REVISION 2	REVISION 3
Remarks	Draft Report Submission	Final Report Submission		
Date	October 6, 2017	November 16, 2017		
Prepared by	Danielle Vella	Danielle Vella		
Signature				
Checked by	Erin Kennealy	Erin Kennealy		
Signature				
Authorised by				
Signature				
Project number	161-04731-00-230.064	161-04731-00-230.064		
Report number	1.0	2.0		
File reference				

---

## SIGNATURES

### PREPARED BY



---

Danielle Vella  
Environmental Officer

### REVIEWED BY



---

Erin Kennealy, CIH  
Manager – Hazardous Materials  
Environment

This report was prepared by WSP for the account of TORONTO TRANSIT COMMISSION, in accordance with the professional services agreement. The disclosure of any information contained in this report is the sole responsibility of the intended recipient. The material in it reflects WSP's best judgement in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. WSP accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. This limitations statement is considered part of this report.

The original of the technology-based document sent herewith has been authenticated and will be retained by WSP for a minimum of ten years. Since the file transmitted is now out of WSP's control and its integrity can no longer be ensured, no guarantee may be given with regards to any modifications made to this document.

---

# EXECUTIVE SUMMARY

WSP Canada Inc. (WSP) was retained by the Toronto Transit Commission (TTC) to carry out a Designated Substances & Hazardous Materials Survey (DSS) at selected areas within TTC's Sheppard-Yonge Station in Toronto, Ontario.

The work areas include selected areas within TTC's Sheppard-Yonge Station located in Toronto, Ontario. It is understood that the scope of work for this project includes renovations to the existing vacant spaces at the lower Yonge line and the East side of the lower concourse to accommodate a training facility for the Training Department. As such, WSP conducted the DSS within selected areas, as specified by TTC representatives and the drawings provided. Refer to **Appendix B** attached for description of this scope of work.

The purpose of this survey is to determine the presence/absence of designated substances within the work areas and to provide designated substance information to contractors at the time of tender to ensure complete and correct removal or handling of materials prior to renovations.

A summary of the results of WSP's site inspection and bulk sampling is presented below.

---

## ASBESTOS

Based on the laboratory results, none of the five (5) homogeneous building material samples collected and analyzed are considered to be asbestos-containing (defined as material that contains 0.5% or more asbestos by dry weight).

Based on a previous investigation, asbestos-containing sprayed fireproofing was present above lexalon ceilings on the north and south platform levels.

Texture coat was observed applied to the stairwell ceilings within the work area; however, was inaccessible at the time of the site investigation. Sprayed fireproofing was present on the ceiling in various locations throughout the work area; however, was inaccessible at the time of the site investigation. The sprayed fireproofing and texture coat are considered to be asbestos-containing until confirmed otherwise.

Certificates of Analysis can be found in **Appendix A**. Sample locations are provided in **Drawing 1** attached.

As electrical components were live and operational during the site visit, these materials were not sampled. As such, electrical components should be considered to be asbestos-containing until the system can be decommissioned and materials can be sampled for asbestos analysis.

---

## LEAD

Based on the laboratory analysis, detectable concentrations of lead were not identified within the four (4) paint samples collected and analyzed.

Certificates of Analysis can be found in **Appendix A**. Sample locations are provided in **Drawing 1** attached.

Lead is also expected to be present in the following construction components:

- in lead acid batteries in emergency lighting;
- as a component in ceramic building products such as tiles and bricks;
- as a component of the solder on sweated joints between copper pipe and fittings;
- as a component of the solder on wire connections of electric components; and



- as a component of solder used to seal the bell fitting of cast iron rain water leader pipes.

---

## SILICA

Crystalline Silica should be assumed to be present in concrete, cement and mortar.

---

## MERCURY

Although no samples were analyzed for mercury, it is presumed to be present as a vapour in light bulbs within the work areas.

---

## POLYCHLORINATED BIPHENYLS (PCBS)

Based on laboratory results, PCB-containing caulking materials were not identified within the work area. Certificates of Analysis can be found in **Appendix A**. Sample locations are provided in **Drawing 1** attached.

Individual fluorescent light ballasts were not inspected for the presence of PCBs as they were operational at the time of the site visit and therefore inaccessible to the surveyor. Fluorescent light ballasts may contain PCBs.

Transformers potentially containing PCBs were not observed during the survey.

---

## RECOMMENDATIONS

It is our understanding that selected areas within TTC's Sheppard-Yonge Station are proposed for renovations. As such, special precautions are required for working near or for the removal of specific designated substances.

Removal of all asbestos-containing materials must be conducted before any demolition that may damage these materials. Removal must be conducted in accordance with the Occupational Health and Safety Act (OSHA) regarding worker protection, to avoid the inhalation or ingestion of asbestos fibres. The friable asbestos materials identified must be removed using Type 2 or Type 3 removal procedures, depending on the specific removal procedures used by abatement contractors. Confirmation that the asbestos removal has been conducted in accordance with the OSHA is recommended prior to any contract work in areas proposed for renovation or demolition. O. Reg. 278/05 also requires that clearance air sampling be conducted upon completion of all Type 3 asbestos abatement work to document that airborne levels of asbestos fibres are below 0.01 fibres per cubic centimeter of air prior to re-occupancy of the space. In the event of full demolition, air sampling is not mandatory.

Special precautions should be taken when disturbing any concrete or painted surfaces given the presence of silica. All designated substances must be handled in accordance with the appropriate guidelines and regulations. The Ministry of Labour (MOL) has published guidelines for handling and controlling lead and silica in construction and it is recommended that these guidelines be followed when removing and cutting into the concrete. Coring, sawing or breaking up the materials containing silica should be completed only with appropriate dust suppression methods, proper respiratory protection and general worker safety precautions as outlined in the MOL Guidance documents and in the Occupational Health and Safety Act.

In the event of removal, fluorescent light ballast labels should be inspected for PCB content, and if encountered, removal of PCB-containing materials (e.g. ballasts, caulking) must be completed using health and safety procedures that will protect workers against exposure to PCBs (i.e. to avoid ingestion or

inhalation of the material). The handling of PCB-containing materials must be completed in a manner to prevent release to the environment. The disposal of PCB-containing materials must be completed in accordance with Federal and Provincial regulations.

The presence of mercury within assembled units (e.g. light bulbs) should not be considered a hazard provided that the assembled units remain sealed and intact. Avoid direct skin contact with mercury and avoid inhalation of mercury vapour. Dispose of mercury following applicable legislative requirements.

Other designated substances may be required to be removed as part of the renovation work. Except for asbestos, all other Designated Substances Regulations apply to industrial establishments and not to construction. Due to this condition, it is imperative that a contractor retained for the renovations has a proven record in managing designated substances and operates under a control program. Designated Substance and Hazardous Material information will require updating if corrective measures have been instituted and materials have been removed from the building.

If during renovations, materials suspect of containing asbestos are encountered, they must be handled as asbestos and in accordance with the appropriate guidelines and regulations. It should be noted that asbestos may be present in the enclosed spaces not accessible at the time of the site visit.

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## ***TABLES***

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---

## ***APPENDICES***

### **DRAWINGS**

<b>A</b>	ANALYTICAL RESULTS - ASBESTOS, LEAD AND PCBS
<b>B</b>	TTC PROVIDED SCOPE OF WORK
<b>C</b>	PREVIOUS REPORT
<b>D</b>	SITE PHOTOGRAPHS

# 1 INTRODUCTION

WSP Canada Inc. (WSP) was retained by the Toronto Transit Commission (TTC) to carry out a Designated Substances & Hazardous Materials Survey (DSS) at selected areas within TTC's Sheppard-Yonge Station in Toronto, Ontario.

The work areas include selected areas within TTC's Sheppard-Yonge Station located in Toronto, Ontario. It is understood that the scope of work for this project includes renovations to the existing vacant spaces at the lower Yonge line and the East side of the lower concourse to accommodate a training facility for the Training Department. As such, WSP conducted the DSS within selected areas, as specified by TTC representatives and the drawings provided. Refer to **Appendix B** attached for description of this scope of work.

Section 30 of the Ontario Occupational Health and Safety Act (OHSA) requires that an owner determine whether any designated substances are present, prepare a list and distribute the list to prospective contractors as part of any construction tender package. This report presents the designated substance information required for the owner to comply with the Act.

Regulation 490/09 states that all necessary measures and procedures are to be taken to ensure the time-weighted average exposure of a worker to any form of airborne asbestos does not exceed 0.1 fibres per cubic centimeter of air, averaged over an 8-hour work period. In order to abide by this regulation, contractors specializing in asbestos removal are required to remove all asbestos-containing construction materials from the work area prior to any renovation or demolition that will disturb these materials.

This investigation was conducted by WSP representative Ms. Danielle Vella on September 14, 2017. At that time samples were collected for asbestos, lead and PCB analysis.

---

## 1.1 PURPOSE

The purpose of this survey is to determine the presence/absence of designated substances within the work areas and to provide designated substance information to contractors at the time of tender to ensure complete and correct removal or handling of materials prior to renovations.

This survey is intended to form the basis of a Designated Substance list as per the requirements of Section 30 of the Occupational Health & Safety Act. This report should be provided to all prospective contractors (and in turn to their sub-trades) who are likely to handle, come into contact with, or disturb construction materials. Contractors who may work in close proximity to the identified materials and who may also disturb the materials should also be notified.

The purpose of the survey was to:

- 1 Determine the presence or absence of each of the designated substances;
- 2 Identify the locations of designated substances present;
- 3 In the case of asbestos, establish the type, location and condition of asbestos-containing materials (ACM).

The asbestos information in this survey report complies with the requirements of the Occupational Health & Safety Act, Ontario Regulation 278/05: Designated Substance - Asbestos on Construction Projects and in Buildings and Repair Operations, with respect to asbestos-containing materials within the subject work area.

---

## 1.2 SCOPE OF WORK / METHODOLOGY

This designated substances & hazardous materials survey entailed:

- Inspection of accessible areas of the work area to identify materials which could contain asbestos and other designated substances;
- Bulk sampling and analysis of representative materials suspected of containing asbestos and lead;

- Assessment of the condition of the asbestos-containing materials; and
- Assessment of the likelihood of exposure to the other designated substances with recommendations for appropriate corrective action where required.

The survey included the identification of potential friable and non-friable asbestos-containing materials within the work area. Asbestos means any of the following fibrous silicates: actinolite, amosite, anthophyllite, chrysotile, crocidolite or tremolite. According to the above-mentioned Ontario Regulation 278/05, the term 'friable material' is applied to a material that when dry, can be crumbled, pulverized or powdered by hand pressure, or is crumbled, pulverized or powdered. Asbestos-containing materials that are friable have a greater potential to release airborne asbestos fibres when disturbed. Common friable asbestos-containing construction materials used in the past include sprayed fireproofing, stucco texture coat, and thermal pipe insulation.

Common non-friable asbestos-containing materials include vinyl floor tiles, gasket materials, asbestos cement (Transite™) pipe, Transite™ board and asbestos textiles. If these materials do however release fine dust due to deterioration or during removal, the free dust is considered friable.

The survey did not involve destructive sampling (i.e. inspection within plaster/drywall (false) walls or ceilings, within mechanical equipment such as boilers, furnaces, HVAC systems, or within electrical equipment). These areas are considered not accessible to the surveyor and as such materials suspected to contain asbestos may be present within these inaccessible areas.

## 2 SITE DESCRIPTION

The work areas include selected areas within TTC's Sheppard-Yonge Station located in Toronto, Ontario. It is understood that the scope of work for this project includes renovations to the existing vacant spaces at the lower Yonge line and the East side of the lower concourse to accommodate a training facility for the Training Department. As such, WSP conducted the DSS within selected areas, as specified by TTC representatives and the drawings provided. Refer to **Appendix B** attached for description of this scope of work.

The floors within the work area generally consist of concrete. The walls and ceilings generally consist of concrete and concrete block. Lighting is provided by fluorescent lights.

### 2.1 HEATING SYSTEM

The work area was heated via HVAC units with associated ventilation. Mechanical piping and ductwork systems were either uninsulated or insulated with non-asbestos fibreglass insulation.

### 2.2 PREVIOUS REPORTS

WSP reviewed the following previous reports:

- *"Asbestos Reassessment Services for Subway Stations and Tunnels, Sheppard Subway Station, Yonge Street and Sheppard Avenue West, Toronto (YUS-S03)."* Prepared for Toronto Transit Commission by Coffey Geotechnics dated January 2013.
- *"Asbestos Sampling - Industrial Facility Requirements - Sheppard SRB Mock-up"*. Prepared for Toronto Transit Commission by WSP Canada Inc. dated September 2016.

Based on review of the previous reports, the following materials were identified to asbestos-containing:

- \*Dark grey firestop observed in Room 21Y-21 at Street Level; (10% Chrysotile asbestos)
- Sprayed fireproofing observed above the lexalon ceiling at the north and south platform level of the station and below the platform lip on track level; (1.3% - 8% Chrysotile asbestos)
- \*Plaster observed in the Rooms 21Y-68, 21Y-65, 21Y-69, 21Y-73, 21Y-74/75 on the platform level and 21Y-3S on the Concourse Level. (1.2% Chrysotile asbestos)

Items marked with \* were either not found during the site visit for this investigation, identified to be outside of the work area for this investigation, or were sampled during this investigation. The above-noted reports are attached at the end of this report within **Appendix C**.

## 3 REGULATORY FRAMEWORK

The survey was executed to identify designated substances as required by the Ontario Occupational Health and Safety Act. The following sections and tables list the applicable regulations for the survey.

---

### 3.1 DESIGNATED SUBSTANCES REGULATIONS

The Designated Substance and Hazardous Materials Survey was conducted in accordance with the following regulations and guidance documents:

- Ontario Regulation (O. Reg.) 490/09 Designated Substances
- O. Reg. 278/05 Asbestos on Construction Projects and in Building and Repair Operations and the corresponding Guideline (Ontario Ministry of Labour (MOL), November 2007, as amended)
- Guideline for Lead on Construction Projects (MOL, September 2004, as amended)
- Guideline for Silica on Construction Projects (MOL, September 2004, as amended)
- Canadian Surface Coating Materials Projects (SOR/2005-109 dated April 19, 2005, as amended), pursuant to the 2005 Hazardous Products Act
- The United States Department of Housing and Urban Development (HUD) Guidelines for the Evaluation and Control of Lead-Based Paint in Housing
- Canadian PCB Regulations (SOR/2008-273)
- O. Reg. 362 Waste Management – PCBs
- Mercury-Containing Products Pollution Prevention Fact Sheet #21 (Ministry of Environment (MOE), September 2001, as amended)
- O. Reg. 347/90 General Waste Management
- Canadian Construction Association document CCA 82/2004
- Canadian Chlorofluorocarbon Regulations (SOR/90-127), Ozone-depleting, Substances Regulation (SOR/94-408) and Ozone Depleting Substances Products Regulations (SOR/90-584)
- O. Reg. 463/10 ODS and Other Halocarbons

## 4 DESIGNATED SUBSTANCES SURVEY

Information in this section of the report should be provided to all prospective contractors who are likely to handle, come into contact with, or disturb asbestos or other designated substances.

Contractors and maintenance personnel should be warned of the possibility of undisclosed materials when breaking into enclosed areas. Friable construction materials discovered in enclosed areas should be treated as asbestos until proven otherwise and other substances, self-evident as designated substances, should be handled in a likewise fashion.

---

### 4.1 SURVEY METHODOLOGY

The survey of the work areas for designated substances consisted of a walk through and physical examination of suspect materials in the work area as depicted in drawings provided by the TTC and as identified by the TTC



representative. A physical examination was completed to assess the condition of materials and to examine for underlying layers.

A visual assessment was conducted for asbestos, lead, polychlorinated biphenyls, acrylonitrile, arsenic, benzene, coke oven emissions, ethylene oxide, isocyanates, mercury, silica, vinyl chloride, mould, ozone depleting substances, radioactive materials, man-made mineral fibres and Foamglas™ insulation.

When potential materials that may contain asbestos were identified, visual inspection was augmented with bulk sampling and laboratory analysis. Bulk samples were taken from representative locations of friable material and non-friable or manufactured product suspected of containing asbestos. Sample collection was performed with consistency to obtain a general pattern of asbestos use in the structures. Homogeneous materials were visually identified and representative samples were collected in accordance with Section 3 of O. Reg. 278/05.

Asbestos samples are collected by taking a small volume of material (approximately two square centimeters in size) from either intact material or preferably from a damaged section. The collected samples were placed in ziplock plastic bags, sealed and forwarded to an analytical laboratory. Bulk samples are analyzed by Polarized Light Microscopy. The method and procedures for establishing whether material is asbestos-containing is determined according to the U.S. Environmental Protection Agency Method for the Determination of Asbestos in Bulk Building Materials (Test Method EPA/600/R-93/116).

Paint samples collected for lead analysis are collected by taking a small volume of the paint from building finishes. The collected samples were placed in zipper storage bags, sealed and forwarded to an analytical laboratory. Bulk Lead samples are analyzed by Atomic Absorption Spectrophotometry.

Bulk samples of caulking materials suspected to contain Polychlorinated Biphenyls (PCBs) are collected by placing a sample of the suspect material into a zip lock bag, sealing, and forwarding to an accredited laboratory for analysis by EPA Method SW-846 3541 & 8082.

## 5 SURVEY FINDINGS

### 5.1 ASBESTOS

Asbestos is a strong mineral fiber that is resistant to heat (especially fire) and chemicals. In the past, asbestos was widely used as insulating and fireproofing material in a range of residential, commercial and industrial structures as well as in the construction of ships, airplanes, vehicles and appliances. Asbestos is still used in non-friable materials such as Transite™ piping and roof drains.

An inspection of various construction materials was conducted during a walk-through of the work area. As materials suspected of containing asbestos were identified, representative sampling and laboratory testing of these materials was conducted.

The survey did not involve destructive sampling (i.e. excavation work or within electrical equipment). These areas are considered not accessible to the surveyor and as such materials suspected to contain asbestos may be present within these inaccessible areas.

A total of five (5) homogeneous construction materials were observed, sampled and analyzed as part of this survey. O. Reg. 278/05 outlines a requirement for the collection of multiple samples of each homogeneous material suspected of containing asbestos, as presented in **Table 1**.

**Table 1 O. Reg. 278/05 Minimum Asbestos Bulk Material Sample Requirements**

TYPE OF MATERIAL	SIZE OF HOMOGENEOUS MATERIAL	MINIMUM NUMBER OF BULK SAMPLES
	Less than 90 m2	3

TYPE OF MATERIAL	SIZE OF HOMOGENEOUS MATERIAL	MINIMUM NUMBER OF BULK SAMPLES
Surfacing material, including without limitation material that is applied to surfaces by spraying, by troweling or otherwise, such as acoustical plaster on ceilings, fireproofing materials on structural members and plaster	90 m2 or more, but less than 450 m2	5
	450 m2 or more	7
Thermal insulation, except as described below	Any size	3
Thermal insulation patch	Less than 2m or 0.5 m2	1
Other material	Any size	3

As per these requirements, a total of fifteen (15) samples were collected and submitted for asbestos analysis as part of this survey.

Asbestos samples were submitted to EMSL Analytical for analysis of bulk asbestos for Polarized Light Microscopy (PLM) Point Count (analytical certificates are presented in Appendix A). EMSL is a participant in the National Voluntary Laboratory Accreditation Program (NVLAP) for bulk asbestos fibre analysis, Laboratory Code 200877-0. The method detection limit used in the analysis is <0.5% asbestos by dry weight. A summary of the analytical results from the recent representative sampling program is summarized in **Table 2** below.

**Table 2 Summary of Asbestos Sampling Results**

SAMPLE ID	LOCATION	SAMPLE DESCRIPTION	FRIABLE/ NON-FRIABLE	ASBESTOS CONTENT (%)
AS1-1	Room 214 121	Beige Expansion Joint Caulking	Non-Friable	None Detected
AS1-2	Room 214 121	Beige Expansion Joint Caulking	Non-Friable	None Detected
AS1-3	Corridor Between Rooms	Beige Expansion Joint Caulking	Non-Friable	None Detected
AS2-1	Room 214 121	Concrete Block Mortar	Non-Friable	None Detected
AS2-2	Room 214 122	Concrete Block Mortar	Non-Friable	None Detected
AS2-3	Corridor Between Rooms	Concrete Block Mortar	Non-Friable	None Detected
AS3-1	Corridor Between Rooms	Grey Firestop Caulking Around Conduits	Non-Friable	None Detected

AS3-2	Corridor Between Rooms	Grey Firestop Caulking Around Conduits	Non-Friable	None Detected
AS3-3	Corridor Between Rooms	Grey Firestop Caulking Around Conduits	Non-Friable	None Detected
AS4-1	Room 214 125	Compound over Wallboard	Non-Friable	None Detected
AS4-2	Room 214 125	Compound over Wallboard	Non-Friable	None Detected
AS4-3	Room 214 125	Compound over Wallboard	Non-Friable	None Detected
AS5-1	Stairs to Center Platform	White Compound on Walls	Non-Friable	None Detected
AS5-2	Stairs to Center Platform	White Compound on Walls	Non-Friable	None Detected
AS5-3	Stairs to Center Platform	White Compound on Walls	Non-Friable	None Detected

**Table 2 Notes:** Method detection limit (MDL) = <0.5%

Description provided refers to colour and patterns observed on the surface of the material by the surveyors at the time of sampling, and should be used to identify the material in the work areas. Laboratory colour descriptions on the Certificates of Analysis in some cases describe the cross-sectional colour of the material.

Based on the laboratory results, none of the five (5) homogeneous building material samples collected and analyzed are considered to be asbestos-containing (defined as material that contains 0.5% or more asbestos by dry weight).

Based on a previous investigation, asbestos-containing sprayed fireproofing was present above lexalon ceilings on the north and south platform levels.

Texture coat was observed applied to the stairwell ceilings within the work area; however, was inaccessible at the time of the site investigation. Sprayed fireproofing was present on the ceiling in various locations throughout the work area; however, was inaccessible at the time of the site investigation. The sprayed fireproofing and texture coat are considered to be asbestos-containing until confirmed otherwise.

Certificates of Analysis can be found in **Appendix A**. Sample locations are provided in **Drawing 1** attached.

#### General Recommendations:

Removal of all asbestos-containing materials must be conducted before any demolition that may damage these materials. Removal must be conducted in accordance with the Occupational Health and Safety Act (OSHA) regarding worker protection, to avoid the inhalation or ingestion of asbestos fibres. The friable asbestos materials identified must be removed using Type 2 or Type 3 removal procedures, depending on the specific removal procedures used by abatement contractors. Confirmation that the asbestos removal has been conducted in accordance with the OHSA is recommended prior to any contract work in areas proposed for renovation or demolition. O. Reg. 278/05 also requires that clearance air sampling be conducted upon completion of all Type 3 asbestos abatement work to document that airborne levels of asbestos fibres are below 0.01 fibres per cubic centimeter of air prior to re-occupancy of the space. In the event of full demolition, air sampling is not mandatory.

For the purposes of renovation/demolition, suspect friable and non-friable building materials discovered and not discussed in this report should be treated as asbestos until proven otherwise and other substances, self-evident as designated substances, should be handled in an appropriate fashion. If any potential asbestos-containing materials are encountered unexpectedly, a qualified person should be contacted to sample, monitor and/or document the removal of asbestos-containing materials, and to ensure that appropriate procedures are being followed.

---

## 5.2 ACRYLONITRILE

Acrylonitrile is mostly used as a feedstock or chemical aid in the production of nitrile-butadiene rubber and in acrylonitrile-butadiene-styrene and styrene-acrylonitrile polymers. Acrylonitrile is also used to make other chemicals such as plastics, synthetic rubber, and acrylic fiber (e.g. clothing, blankets, carpeting) and nitrile rubber for oil-resistant hoses.

Acrylonitrile is not expected to be present in the work area.

---

## 5.3 ARSENIC

Arsenic is used with other metals (chiefly copper, lead and zinc) to make alloys. Arsenic compounds are also used in pigments, animal poisons, insecticides, paints, wallpaper, ceramics, and poison gases for chemical warfare, glass making, in calico and indigo printing, pyrotechnics, integrated circuits and transistors. Arsenic is also a major waste material from the gold mining industry.

Arsenic was formerly used as an additive in paint. It should be assumed that all lead-containing paint has the potential to contain arsenic. As such, every precaution and procedure should be taken during demolition/renovation activities to control the time-weighted exposure of a worker to airborne/respirable arsenic.

Arsenic is not expected to be present within the work area.

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## 5.4 BENZENE

Benzene is widely used in the chemical industry as a starting material and solvent. Benzene occurs naturally in crude oil and is present in all gasoline products, automobile emissions and cigarette smoke. Benzene is highly volatile, and will release into the atmosphere over a short time.

Benzene is not expected to be present in the work area.

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## 5.5 COKE OVEN EMISSIONS

Coke oven emissions are complex mixtures of coal and coke particles, various vapors, gases and tars emitted during carbonization of coal to produce coke. The primary use of coke (pure carbon) is in the manufacture of iron and steel. Coke is also used to synthesize calcium carbide and to manufacture graphite and electrodes.

Coke oven emissions are not expected to be present in the work area.

---

## 5.6 ETHYLENE OXIDE

Ethylene Oxide is an extremely flammable gas used in the manufacture of several industrial chemicals including textiles, detergents, polyurethane foam, antifreeze (especially ethylene glycol), solvents, medicinal products, adhesives, and other related products. It is also used as a fumigant and as a sterilizing agent for food (spices), cosmetics, and surgical tool and plastic devices in hospitals as an alternative to steam.

Ethylene oxide is not expected to be present in the work area.

## 5.7 ISOCYANATES

Isocyanates are the raw materials from which all polyurethane products are made. Isocyanates are widely used in the manufacture of flexible and rigid foams, fibres, coatings such as paints and varnishes, elastomers, and also in materials used in auto body repair and building insulation.

Isocyanates are not expected to be present in the work area.

## 5.8 LEAD

The Ontario Ministry of Labour (MOL) has not prescribed specific criteria for classification of lead-containing paints or other surface coatings and construction materials. In the past, the abatement industry has generally used regulations set

- as an anti-corrosive or an anti-weathering coating applied on any structure other than a building, that is used for an agricultural, industrial or public purpose;
- as a touch-up coating for metal surfaces;
- on traffic signs;
- for graphic art on billboards or similar displays;
- for identification marks in industrial buildings; or
- as materials for the purposes of arts, crafts or hobbies, other than material for use by children.

However, based on a recent publication (EACO Lead Guideline For Construction, Renovation, Maintenance or Repair dated October 2014) from the Environmental Abatement Council of Ontario (EACO), an industry group representing consultants and contractors in the Ontario abatement industry, various occupational and workplace safety authorities and agencies consider that any detectable amount of lead in paint and similar materials has the potential to produce an airborne hazard to workers and building occupants when these materials are disturbed. As such, for the purpose of this survey, WSP has classified any material containing detectable/measurable amounts of lead as “lead-containing” materials and recommends that all disturbances to these materials be conducted in accordance with the MOL document *Guideline, Lead on Construction Projects*.

Representative samples of suspected lead-containing materials were collected and analyzed, as summarized in **Table 3** below:

**Table 3** Summary of Lead Sampling Results

SAMPLE ID	LOCATION	SAMPLE DESCRIPTION	LEAD CONTENT (%)
<b>Pb1</b>	Room 214 121	Red Paint on Sprinkler Lines	<0.0090
<b>Pb2</b>	Room 214 122	Blue Paint on Ductwork	<0.0095
<b>Pb3</b>	Room 214 122	Teal Paint on Pipes	<0.020
<b>Pb4</b>	Stairwells	Yellow Paint on Railings	<0.0090

**Table 3 Notes:** Bolding and highlighting indicates lead-containing material

Based on the laboratory analysis, detectable concentrations of lead were not identified within the four (4) paint samples collected and analyzed.

Certificates of Analysis can be found in **Appendix A**. Sample locations are provided in **Drawings 1 to 3** attached.

Lead is expected to be present in the following construction components:

- as a component in ceramic building products such as tiles and bricks;
- as a component of the solder on sweated joints between copper pipe and fittings;
- as a component of the solder on wire connections of electric components; and
- as a component of solder used to seal the bell fitting of cast iron rain water leader pipes.

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## 5.9 MERCURY

Mercury is used in thermometers, batteries and some electrical switches. It is also used in dental fillings and in latex paint to protect against fungal attack and mildew. Mercury vapour is also present as a vapour in fluorescent lights, metal halide lights and mercury vapour lights.

Although no samples were analyzed for mercury, it is presumed to be present as a vapour in light bulbs within the work areas.

The presence of mercury within assembled units (e.g. light bulbs) should not be considered a hazard provided that the assembled units remain sealed and intact. Avoid direct skin contact with mercury and avoid inhalation of mercury vapour. Dispose of mercury following applicable legislative requirements.

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## 5.10 SILICA

Silica, or silicon dioxide (SiO<sub>2</sub>), is the basic component of sand, quartz and granite rock. Crystalline Silica (the designated substance) is encountered in industry in three forms: quartz, tridymite, and cristobalite. Unless proven otherwise, crystalline Silica should be assumed to be present in sandblasting abrasives, brick, concrete, cement, mortar, granite, sandstone, slate, rock and stone, sand, topsoil, and asphalt.

No samples were taken for silica, however, it is presumed to be present concrete, cement and mortar. Every precaution and procedure should be taken during demolition/renovation activities to control the time-weighted exposure of a worker to silica dust. Coring, sawing or breaking up the materials containing silica should be completed only with appropriate dust suppression methods, proper respiratory protection and general worker safety precautions as outlined in the MOL Guidance document and in the Occupational Health and Safety Act.

The Ministry of Labour (MOL) has published a Guideline for Silica on Construction Projects, dated September 2004 (as amended). This document is available online and should be referenced prior to initiating any work where exposure to airborne silica is anticipated.

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## 5.11 VINYL CHLORIDE

Vinyl chloride is the parent compound of polyvinyl chloride (PVC) which is a widely used plastic. Vinyl chloride is also used in various resins (e.g. plastic food wrap), and in the glass, rubber, and paper industries. Vinyl chloride is also formed by the degradation of the chlorinated solvents trichloroethylene (TCE), 1,1,1-trichloroethane (111TCA) and tetrachloroethylene (also known as perchloroethylene or dry cleaning solvent), especially in soil or groundwater that has been contaminated with these solvents.

Vinyl chloride is not expected to be present in the work area.

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## 5.12 POLYCHLORINATED BIPHENYLS

The federal government has published Regulation SOR/2008-273 (September 5, 2008), which states that any solid material containing 50 parts per million (ppm) or more of PCBs must be handled as a PCB-containing material in accordance with all applicable regulations. The Regulation phases in a ban on the use of all PCB-containing equipment (other than light ballasts or pole-mounted transformers) containing more than 500 mg/kg PCB and

applies to equipment containing 50-500 mg/kg PCBs including, light ballasts and pole-mounted transformers (with the exceptions noted below) by December 31, 2025. Equipment containing 50-500 mg/kg PCBs (except for light ballasts and pole mount transformers) cannot be used or stored at or within 100 m of a drinking water treatment plant or a food or feed processing plant, child care facility, preschool, primary school, secondary school, hospital, or senior citizens' care facility. In addition, the Regulation provides labeling requirements for PCB equipment in use (except for equipment that is too small to bear a standard PCB label such light ballasts) or storage and requires all PCBs (including those in light ballasts) to be stored no longer than 30 days of being taken out of use before being sent to an authorized destruction facility. The Regulation also prescribes PCB storage site and reporting requirements and the conditions under which an applicant may apply for extensions of certain sections of the Regulation.

Individual fluorescent light ballasts were not inspected for the presence of PCBs as they were operational at the time of the site visit and therefore inaccessible to the surveyor. Fluorescent light ballasts may contain PCBs.

Transformers potentially containing PCBs were not observed during the survey.

PCBs were also widely used in caulking and elastic sealant materials, and therefore may be present in the caulk used in windows, door frames, masonry columns and other masonry building materials in any building constructed or renovated between 1950 and 1978. In some instances, PCBs may represent a high percentage of the caulk, e.g. 100,000 parts per million (ppm) or higher.

As such, representative sampling of suspected PCB-containing caulking was collected and analyzed, as summarized in Table 4 below.

**Table 4 Summary of PCB Sampling Results**

SAMPLE ID	SAMPLE LOCATION		PARAMETER	UNIT	RL	CONCENTRATION
	AND DESCRIPTION					
PCB1	Room 214 121; Beige Expansion Joint Caulking		PCBs	ppm	4.7	None Detected

Table 4 Notes: RL = Reporting Limit

Results are based on the weight of caulking extracted

A level of 50 ppm or greater is considered to be a PCB-containing material

Based on laboratory results, PCB-containing caulking materials were not identified within the work area. Certificates of Analysis can be found in **Appendix A**. Sample locations are provided in **Drawings 1 to 3** attached.

## 6 IN CLOSING

The following designated substances & hazardous materials have been identified or are suspected in the work area as detailed in this report:

- Arsenic
- Silica
- Mercury
- PCBs

Recommendations pertaining to each of these materials are found in individual sections of this report. Special precautions are required for the removal of specific designated substances. Except for asbestos, Designated Substances Regulation O. Reg. 490/09 applies to industrial establishments and not to construction. Due to this condition, it is imperative that a contractor retained for the renovations has a proven record in managing designated substances and operates under a control program.

All designated substances must be handled in accordance with the appropriate guidelines and regulations. Designated Substance and Hazardous Material information will require updating as corrective measures are instituted and materials have been removed from various sections of the work area.

## 7 LIMITATIONS

As this survey was generally non-destructive in nature, asbestos or other designated substances could be present in areas not accessible to the surveyors for identification. Contractors and maintenance personnel should be warned of the possibility of unidentified materials when breaking into enclosed areas. Suspect friable and non-friable building materials discovered in these areas should be treated as asbestos until proven otherwise and other substances, self-evident as designated substances, should be handled in an appropriate fashion. Materials equivalent or identical in description to those listed in Section 5.1, above, should be considered to be ACM and handled appropriately.

This report is prepared for the sole use of Toronto Transit Commission. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of the third party. The conclusions and recommendations contained in this assessment report are based upon professional opinions with regard to the subject matter. These opinions are in accordance with currently accepted industry practices for designated substance surveys and regulatory requirements for sampling and identifying designated substances and are subject to the following inherent limitations:

- The data and findings presented in this report are valid as of the date(s) of the investigation only. The passage of time, manifestation of latent conditions or occurrence of future events may warrant further exploration of the Site, analysis of the data, and re-evaluation of the findings, observations, and conclusions expressed in this report.
- The findings, observations, conclusions, and recommendations expressed by WSP Canada Inc. in this report do not represent an opinion concerning compliance of any past or present owner or operator of the Site with any federal, provincial or local laws or regulations.
- WSP Canada Inc.'s assessment presents professional opinions and findings of a scientific and technical nature. While attempts were made to relate the data and findings to applicable environmental and occupational health & safety laws and regulations, the report shall not be construed to offer legal opinion or representations as to the requirements of, nor compliance with, environmental and occupational health and safety laws, rules, regulations or policies of federal, provincial, or local governmental agencies. WSP Canada Inc. liability extends only to its client and not to other parties who may obtain this assessment report. Issues raised by the report should be reviewed by appropriate legal counsel.

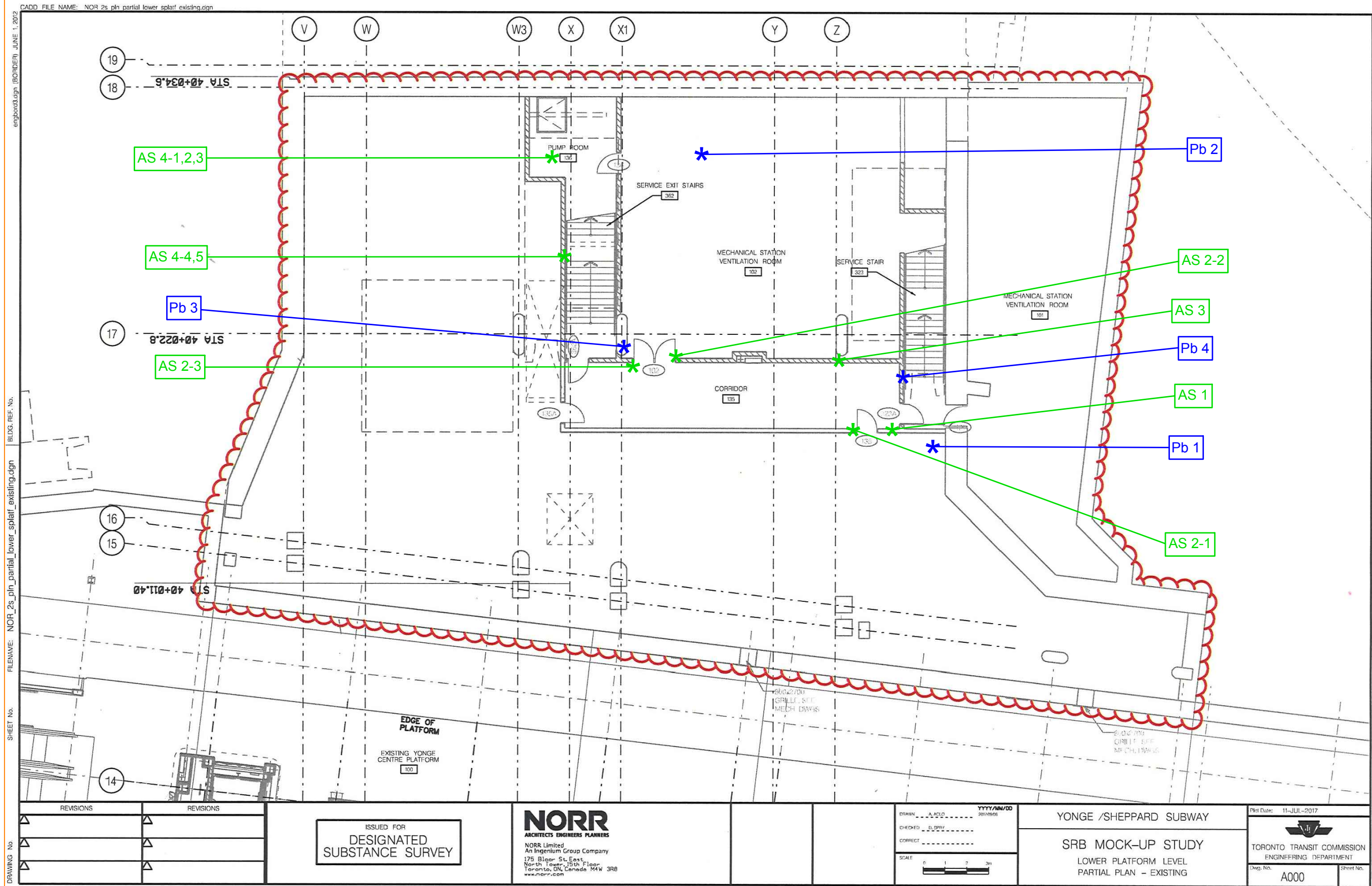


# APPENDIX

## DRAWINGS



T:\Environmental\000 161-04731-00 - TTC DSS Contract 685-341B\230.064 - SH35-7 Sheppard-Yonge Subway Rule Book\03 Drawings\230.064.dwg



Client: TORONTO TRANSIT COMMISSION		Project No.: 161-04731-00-230.064	Drawing No.: 1
Drawn: JB	Approved: EK	Title: SAMPLING LOCATIONS	
Date: October 2017	Scale: As Shown	Project: DESIGNATED SUBSTANCES & HAZARDOUS MATERIALS SURVEY SUBWAY RULEBOOK MOCK-UP STUDY (SH35-7)	
Original Size: Tabloid	Rev: N/A	wsp	

# APPENDIX

**A**

ANALYTICAL RESULTS –  
ASBESTOS, LEAD AND PCBS



# EMSL Canada Inc.

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EMSL Canada Order 551710571  
 Customer ID: 55SPLC25  
 Customer PO: Erin Haatvedt  
 Project ID: TTC Project - 161-0

**Attn:** Erin Haatvedt  
 WSP Canada Inc.  
 51 Constellation Court  
 Toronto, ON M9W 1K4

**Phone:** (416) 79-0065  
**Fax:**  
**Collected:**  
**Received:** 9/19/2017  
**Analyzed:** 9/26/2017

**Proj:** 161-04731-00-230.064 DSS Sheppard Yonge Rulebook (TTC Project - 161-04731-00)

## Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

**Client Sample ID:** AS1-1 **Lab Sample ID:** 551710571-0001

**Sample Description:** Room 214 121 - Beige Expansion Joint Caulking

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	9/26/2017	Beige	0.0%	100%	None Detected	

**Client Sample ID:** AS1-2 **Lab Sample ID:** 551710571-0002

**Sample Description:** Room 214 121 - Beige Expansion Joint Caulking

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	9/26/2017	Beige	0.0%	100%	None Detected	

**Client Sample ID:** AS1-3 **Lab Sample ID:** 551710571-0003

**Sample Description:** Corridor Between Rooms - Beige Expansion Joint Caulking

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	9/26/2017	Beige	0.0%	100%	None Detected	

**Client Sample ID:** AS2-1 **Lab Sample ID:** 551710571-0004

**Sample Description:** Room 214 121 - Concrete Block Mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	9/25/2017	Gray	0%	100%	None Detected	

**Client Sample ID:** AS2-2 **Lab Sample ID:** 551710571-0005

**Sample Description:** Room 214 122 - Concrete Block Mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	9/25/2017	Gray	0%	100%	None Detected	

**Client Sample ID:** AS2-3 **Lab Sample ID:** 551710571-0006

**Sample Description:** Corridor Between Rooms - Concrete Block Mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	9/26/2017	Gray	0%	100%	None Detected	

**Client Sample ID:** AS3-1 **Lab Sample ID:** 551710571-0007

**Sample Description:** Corridor Between Rooms - Grey Firestop Caulking Around Conduits

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	9/26/2017	Gray	0.0%	100%	None Detected	



# EMSL Canada Inc.

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EMSL Canada Order 551710571  
Customer ID: 55SPLC25  
Customer PO: Erin Haatvedt  
Project ID: TTC Project - 161-0

## Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

**Client Sample ID:** AS3-2 **Lab Sample ID:** 551710571-0008

**Sample Description:** Corridor Between Rooms - Grey Firestop Caulking Around Conduits

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	9/26/2017	Gray	0.0%	100%	None Detected	

**Client Sample ID:** AS3-3 **Lab Sample ID:** 551710571-0009

**Sample Description:** Corridor Between Rooms - Grey Firestop Caulking Around Conduits

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM Grav. Reduction	9/26/2017	Gray	0.0%	100%	None Detected	

**Client Sample ID:** AS4-1 **Lab Sample ID:** 551710571-0010

**Sample Description:** Room 214 125 - Compound over Wallboard

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	9/25/2017	White	0%	100%	None Detected	

**Client Sample ID:** AS4-2 **Lab Sample ID:** 551710571-0011

**Sample Description:** Room 214 125 - Compound over Wallboard

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	9/25/2017	White	0%	100%	None Detected	

**Client Sample ID:** AS4-3 **Lab Sample ID:** 551710571-0012

**Sample Description:** Room 214 125 - Compound over Wallboard

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	9/26/2017	White	0%	100%	None Detected	

**Client Sample ID:** AS5-1 **Lab Sample ID:** 551710571-0013

**Sample Description:** Stairs to Center Platform - White Compound on Walls

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	9/25/2017	White	0%	100%	None Detected	

**Client Sample ID:** AS5-2 **Lab Sample ID:** 551710571-0014

**Sample Description:** Stairs to Center Platform - White Compound on Walls

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	9/25/2017	White	0%	100%	None Detected	

**Client Sample ID:** AS5-3 **Lab Sample ID:** 551710571-0015

**Sample Description:** Stairs to Center Platform - White Compound on Walls

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	9/26/2017	White	0%	100%	None Detected	



## EMSL Canada Inc.

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EMSL Canada Order 551710571  
Customer ID: 55SPLC25  
Customer PO: Erin Haatvedt  
Project ID: TTC Project - 161-0

### Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

---

#### Analyst(s):

Anne Balayboa PLM (6)  
Shorthri Kalikutty PLM (3)  
PLM Grav. Reduction (6)

#### Reviewed and approved by:

Matthew Davis  
or Other Approved Signatory

None Detected = <0.1%. EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. Samples received in good condition unless otherwise noted. This report must not be used to claim product endorsement by NVLAP of any agency of the U.S. Government.

Samples analyzed by EMSL Canada Inc. Mississauga, ON NVLAP Lab Code 200877-0

Initial report from: 09/26/2017 13:50:36



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EMSL Canada Or	551710570
CustomerID:	55SPLC25
CustomerPO:	Erin Haatvedt
ProjectID:	TTC Project - 161-0

Attn: **Erin Haatvedt**  
**WSP Canada Inc.**  
**51 Constellation Court**  
**Toronto, ON M9W 1K4**

Phone: (416) 798-0065  
Fax:  
Received: 09/20/17 9:00 AM  
Collected:

Project: 161-04731-00-230.064 DSS Sheppard Yonge Rulebook

**Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)\***

<i>Client Sample Description</i>	<i>Lab ID</i>	<i>Collected</i>	<i>Analyzed</i>	<i>Lead Concentration</i>
Pb-1	551710570-0001	9/25/2017		<0.0090 % wt
	Site: Room 214 121 - Red Paint on Sprinkler Lines			
Pb-2	551710570-0002	9/25/2017		<0.0095 % wt
	Site: Room 214 122 - Blue Paint on Ductwork			
	Insufficient sample to reach reporting limit.			
Pb-3	551710570-0003	9/25/2017		<0.020 % wt
	Site: Room 214 122 - Teal Paint on Pipes			
	Insufficient sample to reach reporting limit.			
Pb-4	551710570-0004	9/25/2017		<0.0090 % wt
	Site: Stairwells - Yellow Paint on Railings			

Rowena Fanto, Lead Supervisor  
or other approved signatory

\*Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.010 % wt based on the minimum sample weight per our SOP. Unless noted, results in this report are not blank corrected. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. The QC data associated with the sample results included in this report meet the recovery and precision requirements unless specifically indicated otherwise. Definitions of modifications are available upon request.

Samples analyzed by EMSL Canada Inc. Mississauga, ON A2LA Accredited Environmental Testing Cert #2845.08

Initial report from 09/27/2017 08:06:50



**EMSL Analytical, Inc.**

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Attn:

**Erin Haatvedt**  
**WSP Canada Inc.**  
**51 Constellation Court**  
**Toronto, ON M9W 1K4**

Phone: (905) 856-0065

Fax:

9/28/2017

The following analytical report covers the analysis performed on samples submitted to EMSL Analytical, Inc. on 9/21/2017. The results are tabulated on the attached data pages for the following client designated project:

**161-04731-00-230.064 Sheppard Yonge**

The reference number for these samples is EMSL Order #011707621. Please use this reference when calling about these samples. If you have any questions, please do not hesitate to contact me at (856) 303-2500.

Approved By:

Phillip Worby, Environmental Chemistry  
Laboratory Director



The test results contained within this report meet the requirements of NELAP and/or the specific certification program that is applicable, unless otherwise noted.  
NELAP Certifications: NJ 03036, NY 10872, PA 68-00367, CA ELAP 1877

The samples associated with this report were received in good condition unless otherwise noted. This report relates only to those items tested as received by the laboratory. The QC data associated with the sample results meet the recovery and precision requirements established by the NELAP, unless specifically indicated. All results for soil samples are reported on a dry weight basis, unless otherwise noted. This report may not be reproduced except in full and without written approval by EMSL Analytical, Inc.



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EMSL Order: 011707621  
CustomerID: SPLC25  
CustomerPO: 551710162  
ProjectID:

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**Toronto, ON M9W 1K4**

Phone: (905) 856-0065  
Fax:  
Received: 09/21/17 9:30 AM

Project: 161-04731-00-230.064 Sheppard Yonge

**Analytical Results**

**Client Sample Description** PCB-1  
Room 214 121  
**Collected:** 9/14/2017  
**Lab ID:** 011707621-0001

Method	Parameter	Result	RL	Units	Prep Date	Analyst	Analysis Date	Analyst
3540C/8082A	Aroclor-1016	ND	4.7	mg/Kg	9/26/2017	AB	9/28/2017	TL
3540C/8082A	Aroclor-1221	ND	4.7	mg/Kg	9/26/2017	AB	9/28/2017	TL
3540C/8082A	Aroclor-1232	ND	4.7	mg/Kg	9/26/2017	AB	9/28/2017	TL
3540C/8082A	Aroclor-1242	ND	4.7	mg/Kg	9/26/2017	AB	9/28/2017	TL
3540C/8082A	Aroclor-1248	ND	4.7	mg/Kg	9/26/2017	AB	9/28/2017	TL
3540C/8082A	Aroclor-1254	ND	4.7	mg/Kg	9/26/2017	AB	9/28/2017	TL
3540C/8082A	Aroclor-1260	ND	4.7	mg/Kg	9/26/2017	AB	9/28/2017	TL
3540C/8082A	Aroclor-1262	ND	4.7	mg/Kg	9/26/2017	AB	9/28/2017	TL
3540C/8082A	Aroclor-1268	ND	4.7	mg/Kg	9/26/2017	AB	9/28/2017	TL

**Definitions:**

ND - indicates that the analyte was not detected at the reporting limit

RL - Reporting Limit (Analytical)

# APPENDIX

# B

## TTC PROVIDED SCOPE OF WORK



SP: #####



## Request for Designated Substance Survey (DSS)

**Contract No.:** SH35-7      **Contract Title:** SHEPPARD-YONGE STATION SUBWAY RULE BOOK HANDS ON TRAINING

<b>Senior Project Engineer:</b> Trisha Neilson (SPC)	<b>Email:</b> trisha.neilson@ttc.ca	<b>Telephone:</b> 416-590-6831
<b>Project Manager:</b> Mario Nalli	<b>Project Controls Analyst:</b> Cosmo Romeo	<b>Account No.:</b> 6505-

**Date Required:** (Allow 6 weeks minimum. Delivery time can be reduced, however higher fees will apply)  
18-Aug-17

### Summary of Work:

Fit up the existing vacant space within Sheppard Station at the lower Yonge line, the East Side of the lower concourse. The fit up is for a hands on training facility for the Training Department complete with track and switch layout mock ups, classrooms, office, storage, locker room, janitor room and an electrical/communications room.

The scope of work for the fit up will include wall partitions and finishes, HVAC, plumbing, electrical, communications and life safety.

### Notes:

1. Black dust was previously tested in 2016 for this project.

### Special Constraints (i.e.. Restricted hours, confined space, other physical barriers, etc.)

Need BM and MM key for access

### Notes:

1. Black dust was previously tested in 2016 for this project.
2. See attache Conceptual Layout SKA-001 for reference of space allocation.
2. The existing Mechanical/Ventilation Room included in DSS dwgs as there will be equipment added and wall penetrations/coring for mechanical ducts, etc.

### List of Attachments:

A000 - drawing for DSS indicating area of work.  
SKA-001 - concept layout

**NOTE:** Drawings provided must clearly outline area to be surveyed and also include title block with drawing number and label marked:



### Originator of Request:

T. Neilson

### Date Issued:

12-Jul-17

COPY: Chief Geotechnical Engineer  
Project Manager

# APPENDIX

C

PREVIOUS REPORT



## **Asbestos Reassessment Services for Subway Stations and Tunnels**

### **Sheppard Subway Station, Yonge Street and Sheppard Avenue West, Toronto (YUS-S03)**

Coffey Geotechnics Inc. (Coffey) was retained by the Safety and Environment Department of the Toronto Transit Commission (TTC) to conduct asbestos assessment surveys at all TTC subway stations and tunnels in order to update the existing asbestos records to meet the requirements of Ontario Regulation 278/05 (O. Reg. 278/05). It should be noted that this appendix is a summary of the asbestos containing materials identified at the Sheppard Subway Station Building only. A more detailed description of the general scope of work and methodology of this project can be found in the introductory section of this report.

An assessment of the building materials was carried out during the building walk-through by Coffey Geotechnics (Coffey) staff on September 6<sup>th</sup> and 7<sup>th</sup>, 2011. The assessment on September 6<sup>th</sup> was conducted by Mr. Glenn Wood, Mr. Chris Nielsen, Ms. Amy Proctor, Mr. Kevin Sue, Ms. Veena Lalman and Ms. Ramila Senanayake. Coffey was accompanied by TTC escorts Ms. Khadija Jafferji and Mr. Tony Maglio. The September 7<sup>th</sup> assessment was conducted by Mr. Glenn Wood, Mr. Kevin Sue, Ms. Veena Lalman and Ms. Ramila Senanayake. Coffey staff were accompanied by TTC escort – Mr. Tony Maglio. The track level platform reassessment was conducted by Mr. Frank Rossi and Ms. Sophia Sestito on June 20, 2012. Coffey staff were accompanied by TTC track escort Mr. Ryan Jenik.

During the survey, building materials suspected of containing asbestos were observed; therefore representative sampling and laboratory testing of the collected materials was conducted. In total, twenty-two (22) homogenous building materials suspected of containing asbestos were identified and sampled. To meet the requirements of O. Reg. 278/05 sixty-four (64) samples suspect for asbestos were collected and submitted for analysis as part of this survey.

In accordance with the O. Reg. 278/05, if a material was found to contain greater than 0.5% asbestos by dry weight, additional bulk material samples taken from the same homogeneous material were not analyzed – this is the Stop Positive method.

Based on the laboratory results, two (2) of the twenty-two (22) submitted for analysis were identified to be an Asbestos Containing Materials (ACMs), which is defined in O. Reg. 278/05 as material that contains 0.5% or more asbestos by dry weight.

Pinchin Environmental Ltd. (Pinchin) previously conducted an asbestos survey and issued an associated report entitled, “Asbestos Building Material Report” by Pinchin Environmental Ltd. (project number 17442.008) dated May 15<sup>th</sup>, 2004. Through representative sampling Pinchin identified various building materials throughout the assessment that contain asbestos which included: sprayed fireproofing, thermal insulation, textured finishes, mechanical insulation, asbestos cement products (i.e. Transite) and ceiling tiles. Materials previously identified as asbestos-containing in Pinchin's survey are still asbestos-containing under O. Reg. 278/05 and therefore were not sampled during Coffey's sampling and analysis program.

**Table 1** (attached) summarizes the asbestos-containing materials in each room / area as well as material sampling information, friability and recommendations. **Table 2** (attached) summarizes the results from Coffey's sampling and analysis program. Sample locations are summarized in

**Drawings (1 to 10) attached.** Photographs of selected areas are attached and referenced in **Tables 1 and 2**. Certificates of Analysis are also attached.

### **Asbestos Survey Findings:**

The following sections summarize the findings based on distinct materials collected and analyzed. **Table 1** summarizes the asbestos findings based on the location of the sample (room/area) as well as material sampling information, friability and recommendations.

### **MECHANICAL THERMAL INSULATION**

#### **Piping**

Parging cement was observed in Room 21Y-18 (Street Level) on four (4) pipe fittings. This material was sampled and based on laboratory results identified to be non-asbestos containing. (Sample numbers YUS-S03-AS19-A, B, C). Please refer to Site Photograph 2 in the attached Photo table.

Parging cement debris was observed in Room 21Y-69 (Platform Level) on piping and on the ground. This material was sampled and based on laboratory results identified to be non-asbestos containing. (Sample numbers YUS-S03-AS03-A, B, C)

All other piping within the building is either observed to be not insulated, insulated with non-asbestos fiberglass insulation or other materials not deemed to contain asbestos.

#### **Mechanical Equipment**

Brown Mastic was observed on ductwork in Room 51P-318 (Platform Level). This material was sampled and based on laboratory results identified to be non-asbestos containing. (Sample number YUS-S03-AS14-A, B, C)

All ductwork observed was either not insulated or insulated with non-asbestos fiberglass insulation.

Flex connectors were observed to be present as a component of the ductwork throughout the building and should be treated as **suspect-asbestos containing unless proven otherwise**.

### **FIREPROOFING**

Dark Grey Fire Stop was observed in Room 21Y-21 (Street Level). This material was sampled and based on laboratory results identified to be an **asbestos-containing material**. (Sample numbers YUS-S03-AS20-A). This material was noted to be in good condition at the time of the survey. Please refer to Site Photograph #3 in the attached photo table.

Red Fire Stop was observed in Room 21Y-67 (Platform Level). This material was sampled and based on laboratory results, identified to be non-asbestos containing (Sample number YUS-S03-AS01-A, B, C).

Grey Fire Stop was observed in Room 21Y-75/76 (Platform Level). This material was sampled and based on laboratory results identified to be non-asbestos containing. (Sample number YUS-S03-AS05-A, B, C)

Red Fire Stop was observed in Room 51P-315 (Platform Level). This material was sampled and based on laboratory results identified to be non-asbestos containing. (Sample number YUS-S03-AS11-A, B, C)

Grey Fire Stop was observed in Room 51P-313 (Platform Level). This material was sampled and based on laboratory results identified to be non-asbestos containing. (Sample number YUS-S03-AS13-A, B, C)

Grey Fire Stop was observed in Room 51P-322 (Platform Level). This material was sampled and based on laboratory results identified to be non-asbestos containing. (Sample numbers YUS-S03-AS15-A, B, C)

Fire Stop was identified in the following locations, but was not sampled due to the reasons listed below:

#### **Platform Level**

- Room 21Y-69, 21Y-72 – Red fire stop which was visually similar to Sample numbers YUS-S03-AS01-A, B, C and it should be considered a non-asbestos containing material.
- Room 51P-318/319, 51P-322 – Red fire stop which was visually similar to Sample numbers YUS-S03-AS11-A, B, C and it should be considered a non-asbestos containing material.
- Room 51P-328 – Grey fire stop which was visually similar to Sample numbers YUS-S03-AS15-A, B, C and it should be considered a non-asbestos containing material.
- Throughout Concourse – Red fire stop which was visually similar to Sample numbers YUS-S03-AS11-A, B, C and it should be considered a non-asbestos containing material.

#### **Concourse Level**

- Room 51P-330, 51P-302, 21Y-59, 21Y-62 – Grey fire stop which was visually similar to Sample numbers YUS-S03-AS15-A, B, C and it should be considered a non-asbestos containing material.
- Room 51P-302 – Red fire stop which was visually similar to Sample numbers YUS-S03-AS01-A, B, C and it should be considered a non-asbestos containing material.

#### **Street Level**

- Room 21Y-17/18 – Grey fire stop which was visually similar to Sample numbers YUS-S03-AS13-A, B, C and it should be considered a non-asbestos containing material.

#### **SPRAY ON FIRE PROOFING OR ACOUSTIC INSULATION**

Sprayed on fire proofing was previously sampled by Pinchin above the lexalon ceiling at the north and south platform level of the station and was determined to be **asbestos-containing** (Samples 1759491-010, 1759490-009, 1759489-008, 1759495-014, 1759493-012, 1759497-016, 1759496-015, 1759494-013, 1759498-017, and 1759492-011). This material was noted to be in fair to good condition at the time of the survey. Please refer to Site Photograph #6 in the attached photo table.

Sprayed on fire proofing was previously sampled by Pinchin below the platform lip on the track level of the station and was determined to be asbestos-containing (Samples 1745861-266, 1745862-267, 1745863-268, 1745864-269, 1745865-270, 1745866-271, 1745867-272, 1745868-273, 1745869-274, 1745870-275, 1745871-276, 1745872-277, 1745873-278, 1745874-279, 1745875-280 and 1745876-281). The material was noted to be in good condition at the time of the survey.

Sprayed-on fire proofing was observed in Rooms 21Y-115 and 21Y-117 (Platform level). This material was sampled and based on laboratory results, identified to be non-asbestos containing. (Sample numbers YUS-S03-AS09-A, B, C). Please refer to site photograph#5 in the attached photo table.

Sprayed-on fire proofing overspray was observed in Rooms 51P-304 (Concourse Level). This material was sampled and based on laboratory results identified to be non-asbestos containing. (Sample numbers YUS-S03-AS17-A, B, C and YUS-S03-AS18-A, B, C) Please refer to site photograph 4 in the attached photo table.

Spray on fire proofing was identified in the following locations but was not sampled due to the reasons listed below:

#### **Concourse level**

- Throughout Concourse – spray on fire proofing which was visually similar to Sample numbers YUS-S03-AS17-A, B, C, and YUS-S03-AS18-A, B, C, and should be considered non-asbestos containing.

#### **Platform level**

- Platform – spray on fire proofing on support beams. Unable to sample due to the volume of passengers occupying the area. This material was visually similar to Sample 1759490-009 and should be considered **asbestos containing material**. The spray on fire proofing was observed to be in good condition at the time of the assessment.
- Platform – residual spray on fire proofing on platform ceiling. Unable to sample due to the volume of passengers occupying the area. This material was visually similar to Sample 1759490-009 and should be considered **asbestos containing material**. The spray on fire proofing was observed to be in good condition at the time of the assessment.

#### **ACOUSTIC CEILING TILES**

Acoustic ceiling tiles (24" x 48" white, textured and pinholes) were observed in the Chelsea NY clothing store (Concourse level). This material appeared to be in good condition but could not be sampled at the time of the survey because of entry restrictions. This material should be considered **suspect-asbestos containing** unless proven otherwise.

Acoustic ceiling tile was observed in the "Lotto Centre" (Concourse level) however based on entry restrictions the type and size were unable to be identified. Coffey personnel were also unable to sample this material base on entry restrictions. This material should be considered **suspect-asbestos containing** unless proven otherwise.

The "Gateway News Stand" (Concourse level) has a visually distinct acoustic ceiling tile (24' x 24' white with pinholes and small fissures). This material appeared to be in good condition but could



not be sampled at the time of this survey as entry to the retail space was also restricted. This material should be considered **suspect-asbestos containing** unless proven otherwise.

Acoustic ceiling tiles were also noted in the “Rainbow ‘n’ Things” store (Concourse level) however; based on entry restrictions the type and size could not be identified at the time of this survey. Samples of this material could not be taken at the time of this survey, due to entry restrictions. This material should be considered **suspect-asbestos-containing** unless proven otherwise.

Acoustic ceiling tiles (brown fibre board) were noted in Room 21Y 54 “Collector’s Booth” (South Concourse). This material was sampled and based on laboratory results identified to be non-asbestos containing (Sample numbers YUS-S03-AS22-A, B, C).

Acoustic ceiling tiles (24” x 24” white) were noted in the Cinnabon store (Concourse level), however, based on entry restrictions sampling of the material was unable to be completed. This material should be considered **suspect asbestos containing**, until proven otherwise.

Pinchin previously observed acoustic ceiling tiles to be present in Room 51P 323 (Collector’s Booth) (Sheppard line Platform level). However Coffey had access restrictions to this room and could not deny or confirm the presence of the acoustic ceiling tiles. This material should be considered **suspect asbestos containing**, until proven otherwise.

Pinchin previously observed acoustic ceiling tiles to be present in Room 51P 349 (Partial West Concourse level). However Coffey had access restrictions to this room and could not deny or confirm the presence of the acoustic ceiling tiles. This material should be considered **suspect asbestos containing**, until proven otherwise.

#### **TEXTURE COAT**

No texture coat was identified at the time of the survey.

#### **PLASTER**

Plaster is present in various locations throughout out the building. This material was noted to be in good condition. This material was sampled from Room Men’s washroom (21Y-68) and based on laboratory results identified to **asbestos-containing**. (Sample numbers YUS-S03-AS02-A, B, C). Please refer to Site Photograph #1 in the attached photo table.

Plaster was identified in the following location(s), but was not sampled due to the reasons listed below:

#### **Platform Level**

- Rooms 21Y-65, 21Y-68, 21Y-69, 21Y-73, 21Y-74/75 – plaster ceiling which was visually similar to sample numbers YUS-S03-AS02-A, B, C and it **should be considered asbestos containing material until proven otherwise**.

#### **Concourse Level**

- Room 21Y-3S – Plaster ceiling which was visually similar to Sample numbers YUS-S03-AS02-A, B, C and it **should be considered asbestos containing**.

### **DRYWALL JOINT COMPOUND**

No drywall joint compound was visually identified at the time of the survey.

### **VINYL SHEET FLOORING (LINOLEUM)**

No suspect vinyl sheet flooring was identified at the time of the survey.

### **VINYL FLOOR TILES**

Vinyl floor tiles (12' x 12" blue with white specs) were noted in Room 21Y-73 and 21Y-74/75 (Platform level). This material was sampled and based on laboratory results identified to be non-asbestos containing. (Sample numbers YUS-S03-AS04-A, B, C)

Vinyl floor tiles (12" x 12" blue with white specs) were identified in the following location(s), but were not sampled due to the reasons listed below:

#### **Concourse Level**

- Room 21Y-54 (Collector Booth) – Vinyl floor tiles (12" x 12" blue with white specs) which were visually similar to Sample numbers YUS-S03-AS04-A, B, C and they should be considered non-asbestos containing.

Based on the findings of the laboratory results, all vinyl floor tiles observed in this building are considered to be non-asbestos containing.

### **ASBESTOS CEMENT MATERIALS**

#### **Transite™**

Transite™ was not sampled as it is known to contain asbestos. Transite™ **should be considered to contain asbestos unless proven otherwise.**

Transite™ pipe was observed in Room 51P-303 Elevator Machine Room (Concourse level). This material was noted to be in good condition in this assessment.

### **MISCELLANEOUS ASBESTOS MATERIALS**

#### **Caulking**

Caulking (grey) surrounding a door was noted in Room 51P-331 (South Concourse Level). This material was sampled and based on laboratory results identified to be non-asbestos containing. (Sample numbers YUS-S03-AS06-A, B, C)

Caulking (grey) located between concrete block was noted in Room 21Y-116 (Platform Level). This material was sampled and based on laboratory results identified to be non-asbestos containing. (Sample numbers YUS-S03-AS07-A, B, C)

Caulking (grey) located on concrete walls was noted in Room 21Y-117 (Platform Level). This material was sampled and based on laboratory results, identified to be non-asbestos containing. (Sample numbers YUS-S03-AS10-A, B, C)

Caulking (grey) located on concrete walls was noted in Room 51P-316 (Platform Level). This material was sampled and based on laboratory results, identified to be non-asbestos containing. (Sample numbers YUS-S03-AS12-A, B, C)

Caulking (grey) located on concrete walls outside Room 21Y-62 (South Concourse Level). This material was sampled and based on laboratory results identified to be non-asbestos containing. (Sample numbers YUS-S03-AS21-A, B, C)

Caulking (black) located around the base of transfer vending machines was noted on the Platform Level (Sheppard). This material was sampled and based on laboratory results, identified to be non-asbestos containing. (Sample numbers YUS-S03-AS16-A, B, C)

Caulking has only been sampled during this assessment where it was deemed to not interfere with the integrity of the building envelope or a building component. Other caulking present throughout the building should be treated as **suspect-asbestos containing** unless proven otherwise.

### **Fibre Board**

Tan fibre board material located on the ceiling of Room 21Y-116 (Platform Level) was observed during this assessment. The fibre board material was sampled and based on laboratory results identified to be non-asbestos containing. (Sample numbers YUS-S03-AS08-A, B, C)

Brown fibre board material located on the ceiling of Room 21Y-54 (Concourse Level) was observed during this assessment. The fibre board material was sampled and based on laboratory results identified to be non-asbestos containing. (Sample numbers YUS-S03-AS22-A, B, C)

### **Expansion Joints**

Expansion joints throughout the building have not been sampled during this assessment as to not interfere with the integrity of the building envelope or a building component. Expansion joints should be treated as **suspect-asbestos containing** unless proven otherwise.

### **Fire Doors**

All number, locked or restricted doors observed are considered to be “fire doors” and should be presumed to be constructed with **suspect-asbestos-containing material** as an internal component, unless proven otherwise.

### **Gaskets**

Gaskets in mechanical systems throughout the building were not assessed as part of the survey as they were typically inaccessible unless the systems were damaged or taken apart to gain access. Gaskets should be treated as **suspect-asbestos containing** unless proven otherwise.

### **Electrical Equipment**

All electrical equipment (e.g., older wall mounted electric heater and certain parts of electrical equipment) observed within the station should be treated as **suspect-asbestos containing** unless proven otherwise.

### **AREAS/ROOMS NOT ASSESSED (NOT OTHERWISE IDENTIFIED IN THIS REPORT)**

In general, areas above luxalon ceiling panels could not be assessed, had limited access where panel sections were open or had limited views through the gaps between panels.

The majority of exterior building materials such as roofing materials, caulking and mortars applied to exterior façade were not sampled during this survey.

The following rooms/areas were not assessed during the survey for the reasons listed below:

- North Collector's Booth (Platform Level) - Coffey personnel did not have access to this area because of TTC safety regulations
- Lotto Centre- Concourse Level - Tenant would not grant Coffey access to their retail space
- Chelsea NY- Tenant would not grant Coffey access to their retail space
- Rainbow 'n' Things- Tenant would not grant Coffey access to their retail space
- Cinnabon- Tenant would not allow Coffey to sample in their retail space
- Gateway News Stand- Tenant would not grant Coffey access to their retail space
- Room 51P-330 – no access, no key

#### **RECOMMENDATIONS**

Prior to any renovations or demolition conducted throughout the building, potentially impacted component materials should be inventoried and treated as suspect-asbestos containing, unless proven otherwise. Label, monitor and maintain in good repair known asbestos containing materials.

For and on behalf of Coffey Geotechnics Inc.

Prepared by:



**Frank Rossi**

**Environmental Consultant**

Reviewed by:



**Glenn Wood PhD, CIH, ROH**

**Principal Health and Safety Specialist-Environmental**

*Attachments to this summary:*

- *Table 1 – Asbestos Occurrence Report*
- *Table 2 – Bulk Sampling Report*
- *Drawing 1 – Legend and Notes*
- *Drawing 2 – Street Level Floor Plan*
- *Drawing 3 – Partial West Concourse Level Floor Plan*
- *Drawing 4 – Partial South Concourse Level Floor Plan*
- *Drawing 5 – Partial North Concourse Level Floor Plan*
- *Drawing 6 – Sheppard Line Platform Level Floor Plan*
- *Drawing 7 – Sheppard Line Platform Level Floor Plan*
- *Drawing 8 – Yonge Line Platform Level Floor Plan*
- *Drawing 9 – Yonge Line Platform Level Floor Plan*
- *Drawing 10 – Yonge Line Platform Level Floor Plan*
- *Site Photographs*
- *Certificates of Analysis*

FACILITY ID # YUS-S03

Table 1: Asbestos Occurrence Table

Sheppard Subway Station

Level	Area/Room	System Component	Component Material	Condition (Estimated Quantity)***			Asbestos Content	Friable?	Visible?	Access.	Coffey's Sample Number**	Pinchin Report Findings	Comments/ Notes	Recommendations
				Good	Fair	Poor								
Platform	21Y-68	Ceiling	Plaster	1500sf	0	0	PC1.2% Chrysotile	No	Yes	C	YUS-S03-AS02	Not identified	See Photograph #1	Condition to be reassessed annually.
Platform	21Y-65	Ceiling	Plaster	1500sf	0	0		No	Yes	C	Visually similar to YUS-S03-S02	Not identified		Condition to be reassessed annually.
Platform	21Y-69	Ceiling	Plaster	1500sf	0	0		No	Yes	C	Visually similar to YUS-S03-S02	Not identified		Condition to be reassessed annually.
Platform	21Y-73	Ceiling	Plaster	100sf	0	0		No	Yes	C	Visually similar to YUS-S03-S02	Not identified		Condition to be reassessed annually.
Platform	21Y-74/75	Ceiling	Plaster	100sf	0	0		No	Yes	C	Visually similar to YUS-S03-S02	Not identified		Condition to be reassessed annually.
Concourse	21Y-3S	Ceiling	Plaster	500sf	0	0		No	Yes	C	Visually similar to YUS-S03-	Not identified		Condition to be reassessed annually.

**Accessibility Classification**  
A - Areas of the building within reach (from floor level) of all building users  
B - Frequently entered maintenance areas within reach of maintenance staff, without the need of a ladder  
C - Areas of the building above 2.4 m where use of a ladder is required to reach the asbestos  
D - Areas of the building behind inaccessible solid ceiling systems, walls, or mechanical equipment, etc., where demolition of the ceiling, wall, or equipment, etc., is required to reach the asbestos

**Visibility**  
Yes - Suspect material is visible without opening hatches or lifting ceiling tiles  
No - Suspect material can only be viewed if access hatches are opened or ceiling tiles lifted

**\* Based on a non-intrusive visual inspection of visible surfaces within the room space**  
**\*\* Refer to Analytical Data for Details**  
**\*\*\* If Estimated Quantity is 0, no asbestos is present in this condition**

**Condition**  
Good - ACM shows no significant signs of damage or deterioration.  
  
Fair - Only applicable to asbestos containing mechanical insulation which exhibits minor penetrating damage to jacket insulation or undamaged insulation that had never been jacketed. Damage can be repaired.  
  
Poor - ACM shows signs of damage, deterioration or delaminated. Damage cannot be readily repaired.

**Notes:**  
ACM - asbestos-containing material  
SACM - suspect asbestos-containing material  
Access. - accessibility  
nq - not quantified  
na - not applicable  
ns - not sampled  
REF - reference sample  
X - estimated number of units  
  
LF - Linear Feet  
SF - Square Feet  
E - individual pipe elbows/fittings

FACILITY ID # YUS-S03

Table 1: Asbestos Occurrence Table

Sheppard Subway Station

Level	Area/Room	System Component	Component Material	Condition (Estimated Quantity)***			Asbestos Content	Friable?	Visible?	Access.	Coffey's Sample Number**	Pinchin Report Findings	Comments/ Notes	Recommendations
				Good	Fair	Poor								
Concourse	Chelsea NY	Ceiling	Acoustic Ceiling Tile 24" x 48" white, textured and pinholes	250sf	0	0	SACM	Yes	Yes	C	S02 Not sampled due to entry restrictions			Condition to be reassessed annually. Should be assessed prior to any future renovation activity
Concourse	Lotto Centre	Ceiling	Acoustic Ceiling Tile 24" x 24" white pinholes and small fissures	80sf	0	0	SACM	Yes	Yes	C	Not sampled due to entry restrictions			Condition to be reassessed annually. Should be assessed prior to any future renovation activity.
Concourse	Cinnabon	Ceiling	Acoustic Ceiling Tile 24" x24" white	300sf	0	0	SACM	Yes	Yes	C	Not sampled due to entry restrictions			Condition to be reassessed annually. Should be assessed prior to any future renovation activity

Accessibility Classification

- A - Areas of the building within reach (from floor level) of all building users
- B - Frequently entered maintenance areas within reach of maintenance staff, without the need of a ladder
- C - Areas of the building above 2.4 m where use of a ladder is required to reach the asbestos
- D - Areas of the building behind inaccessible solid ceiling systems, walls, or mechanical equipment, etc., where demolition of the ceiling, wall, or equipment, etc., is required to reach the asbestos

Visibility

- Yes - Suspect material is visible without opening hatches or lifting ceiling tiles
- No - Suspect material can only be viewed if access hatches are opened or ceiling tiles lifted

Condition

- Good - ACM shows no significant signs of damage or deterioration.
- Fair - Only applicable to asbestos containing mechanical insulation which exhibits minor penetrating damage to jacket insulation or undamaged insulation that had never been jacketed. Damage can be repaired.
- Poor - ACM shows signs of damage, deterioration or delaminated. Damage cannot be readily repaired.

Notes:

- ACM - asbestos-containing material
- SACM - suspect asbestos-containing material
- Access. - accessibility
- nq - not quantified
- na - not applicable
- ns - not sampled
- REF - reference sample
- X - estimated number of units

\* Based on a non-intrusive visual inspection of visible surfaces within the room space

\*\* Refer to Analytical Data for Details

\*\*\* If Estimated Quantity is 0, no asbestos is present in this condition

LF - Linear Feet

SF - Square Feet

E - individual pipe elbows/fittings

FACILITY ID # YUS-S03

Table 1: Asbestos Occurrence Table

Sheppard Subway Station

Level	Area/Room	System Component	Component Material	Condition (Estimated Quantity)***			Asbestos Content	Friable?	Visible?	Access.	Coffey's Sample Number**	Pinchin Report Findings	Comments/ Notes	Recommendations
				Good	Fair	Poor								
Concourse	Gateway News Stand	Ceiling	Acoustic Ceiling Tile 24 “ x 24” white with pinholes and small fissures	80sf	0	0	SACM	Yes	Yes	C	Not sampled due to entry restrictions			Condition to be reassessed annually. Should be assessed prior to any future renovation activity
Concourse	Rainbow ‘n’ Things	Ceiling	Acoustic Ceiling Tile	200sf	0	0	SACM	Yes	Yes	C	Not sampled due to entry restrictions		Description of Ceiling tiles could not be confirmed as entry was restricted	Condition to be reassessed annually. Should be assessed prior to any future renovation activity
Concourse	51P-303 Elevator Machine Rm.	Piping	Transite™	15lf	0	0	SACM	No	Yes	B	NS, SACM	Not identified		Material known to contain asbestos. Condition to be reassessed annually. Assess prior to any future renovation activity.
Concourse	51P-349	Ceiling	Acoustic Ceiling Tile	100SF	0	0	SACM	Yes	Yes	C	NS	NS,SACM	Material was not confirmed during survey	Condition to be reassessed annually. Should be assessed prior to any future renovation activity

Accessibility Classification

- A - Areas of the building within reach (from floor level) of all building users
- B - Frequently entered maintenance areas within reach of maintenance staff, without the need of a ladder
- C - Areas of the building above 2.4 m where use of a ladder is required to reach the asbestos
- D - Areas of the building behind inaccessible solid ceiling systems, walls, or mechanical equipment, etc., where demolition of the ceiling, wall, or equipment, etc., is required to reach the asbestos

Visibility

- Yes - Suspect material is visible without opening hatches or lifting ceiling tiles
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Condition

- Good - ACM shows no significant signs of damage or deterioration.
- Fair - Only applicable to asbestos containing mechanical insulation which exhibits minor penetrating damage to jacket insulation or undamaged insulation that had never been jacketed. Damage can be repaired.
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Notes:

- ACM - asbestos-containing material
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\* Based on a non-intrusive visual inspection of visible surfaces within the room space

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LF - Linear Feet

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E - individual pipe elbows/fittings



FACILITY ID # YUS-S03

Table 1: Asbestos Occurrence Table

Sheppard Subway Station

Level	Area/Room	System Component	Component Material	Condition (Estimated Quantity)***			Asbestos Content	Friable?	Visible?	Access.	Coffey's Sample Number**	Pinchin Report Findings	Comments/ Notes	Recommendations
				Good	Fair	Poor								
Platform	51P-330	All	All	NQ	NQ	NQ	SACM	NA	NA	NA	NS	NA	No key to access room	Building materials should be assessed prior to any future renovation activity.
Platform	Yonge Line Southbound Platform	Ceiling above luxalon	Sprayed fire proofing	1500sf	0	0	PC 4.8% Chrysotile	Yes	Yes	C	Not sampled	Sampled. Sample # 1759489-008. Asbestos content PC 4.8% Chrysotile	Coffey did not resample, but presence was confirmed by visual inspection. Please refer to site photograph 6 in the attached photo table.	Condition to be reassessed annually.
Platform	Yonge Line Southbound Platform	Ceiling above luxalon	Sprayed fire proofing	1500sf	0	0	PC 5.1% Chrysotile	Yes	Yes	C	Not sampled	Sample # 1759495-014. Asbestos content PC 5.1% Chrysotile	Coffey did not resample, but presence was confirmed by visual inspection.	Condition to be reassessed annually.

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Sheppard Subway Station

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				Good	Fair	Poor								
Platform	Yonge Line Northbound Platform	Ceiling above luxalon	Sprayed fire proofing	1500sf	0	0	6.5% Chrysotile	Yes	Yes	C	Not Sampled	Sample # 1759496-015	Coffey did not resample, but presence was confirmed by visual inspection.	Condition to be reassessed annually.
Platform	Yonge Line	Ceiling above luxalon	Sprayed fire proofing	1500sf	0	0	PC 4.0% Chrysotile	Yes	Yes	C	Not sampled	Sampled. Sample # 1759493-012. Asbestos content PC 4.0% Chrysotile	Coffey did not resample, but presence was confirmed by visual inspection.	Condition to be reassessed annually.
Platform	Yonge Line Northbound	Ceiling above luxalon	Sprayed fire proofing	1500sf	0	0	PC 4.5% Chrysotile	Yes	Yes	C	Not sampled	Sampled. Sample # 1759497-016. Asbestos content PC 4.5% Chrysotile	Coffey did not resample, but presence was confirmed by visual inspection.	Condition to be reassessed annually.

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FACILITY ID # YUS-S03

Table 1: Asbestos Occurrence Table

Sheppard Subway Station

Level	Area/Room	System Component	Component Material	Condition (Estimated Quantity)***			Asbestos Content	Friable?	Visible?	Access.	Coffey's Sample Number**	Pinchin Report Findings	Comments/ Notes	Recommendations
				Good	Fair	Poor								
Platform	Yonge Line Southbound	Ceiling above luxalon	Sprayed fire proofing	1500sf	0	0	PC 3.7% Chrysotile	Yes	Yes	C	Not sampled	Sampled. Sample # 1759491-010. Asbestos content PC 3.7% Chrysotile	Coffey did not resample, but presence was confirmed by visual inspection.	Condition to be reassessed annually.
Platform	Yonge Line Southbound	Ceiling above luxalon	Sprayed fire proofing	1500sf	0	0	PC 5.0% Chrysotile	Yes	Yes	C	Not sampled	Sampled. Sample # 1759490-009. Asbestos content PC 5.0% Chrysotile	Coffey did not resample, but presence was confirmed by visual inspection.	Condition to be reassessed annually.
Platform	Yonge Line Southbound	Ceiling above luxalon	Sprayed fireproofing	1500sf	0	0	PC 5.0% Chrysotile	Yes	Yes	C	Not sampled	Sampled. Sample 1759492-011	Coffey did not resample, but presence was confirmed by visual inspection.	Condition to be reassessed annually.
Platform	Yonge Line Southbound	Ceiling above luxalon	Sprayed fireproofing	1500sf	0	0	PC 6.0% Chrysotile	Yes	Yes	C	Not sampled	Sampled. Sample 1759494-013	Coffey did not resample, but presence was confirmed by	Condition to be reassessed annually.

Accessibility Classification

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LF - Linear Feet

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Table 1: Asbestos Occurrence Table														
FACILITY ID # YUS-S03				Sheppard Subway Station										
Level	Area/Room	System Component	Component Material	Condition (Estimated Quantity)***			Asbestos Content	Friable?	Visible?	Access.	Coffey's Sample Number**	Pinchin Report Findings	Comments/ Notes	Recommendations
				Good	Fair	Poor								
Platform	Yonge Line Southbound	Ceiling above luxalon	Sprayed fireproofing	1500sf	0	0	PC 3.3% Chrysotile	Yes	Yes	C	Not sampled	Sampled. Sample 1759498-017	visual inspection. Coffey did not resample, but presence was confirmed by visual inspection.	Condition to be reassessed annually.
Platform	Northbound under platform lip	Wall	Sprayed fireproofing	900sf	0	0	1.3% Chrysotile	Yes	Yes	B		Sample 1745861-266	Coffey did not resample, but presence was confirmed by visual inspection.	Condition to be reassessed annually.
Platform	Northbound under platform lip	Wall	Sprayed fireproofing	900sf	0	0	6.5% Chrysotile	Yes	Yes	B		Sample 1745862-267	Coffey did not resample, but presence was confirmed by visual inspection .	Condition to be reassessed annually.
Platform	Northbound under	Wall	Sprayed	900sf	0	0	7.3% Chrysotile	Yes	Yes	B		Sample 1745863-268	Coffey did not resample, but presence was	Condition to be reassessed annually.
<b>Accessibility Classification</b>													<b>Notes:</b>	
A - Areas of the building within reach (from floor level) of all building users													ACM - asbestos-containing material	
B - Frequently entered maintenance areas within reach of maintenance staff, without the need of a ladder													SACM - suspect asbestos-containing material	
C - Areas of the building above 2.4 m where use of a ladder is required to reach the asbestos													Access. - accessibility	
D - Areas of the building behind inaccessible solid ceiling systems, walls, or mechanical equipment, etc., where demolition of the ceiling, wall, or equipment, etc., is required to reach the asbestos													nq - not quantified	
													na - not applicable	
<b>Visibility</b>													ns - not sampled	
Yes - Suspect material is visible without opening hatches or lifting ceiling tiles													REF - reference sample	
No - Suspect material can only be viewed if access hatches are opened or ceiling tiles lifted													X - estimated number of units	
* Based on a non-intrusive visual inspection of visible surfaces within the room space													LF - Linear Feet	
** Refer to Analytical Data for Details													SF - Square Feet	
*** If Estimated Quantity is 0, no asbestos is present in this condition													E - individual pipe elbows/fittings	

FACILITY ID # YUS-S03

Table 1: Asbestos Occurrence Table

Sheppard Subway Station

Level	Area/Room	System Component	Component Material	Condition (Estimated Quantity)***			Asbestos Content	Friable?	Visible?	Access.	Coffey's Sample Number**	Pinchin Report Findings	Comments/ Notes	Recommendations
				Good	Fair	Poor								
	platform lip		fireproofing										confirmed by visual inspection.	
Platform	Northbound under platform lip	Wall	Sprayed fireproofing	900sf	0	0	6.2% Chrysotile	Yes	Yes	B		Sample 1745864-269	Coffey did not resample, but presence was confirmed by visual inspection.	Condition to be reassessed annually.
Platform	Northbound under platform lip	Wall	Sprayed fireproofing	900sf	0	0	5.6% Chrysotile	Yes	Yes	B		Sample 1745865-270	Coffey did not resample, but presence was confirmed by visual inspection.	Condition to be reassessed annually.
Platform	Southbound under platform lip	Wall	Sprayed fireproofing	900sf	0	0	6.0% Chrysotile	Yes	Yes	B		Sample 1745866-271	Coffey did not resample, but presence was confirmed by visual inspection.	Condition to be reassessed annually.

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Condition

- Good - ACM shows no significant signs of damage or deterioration.
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LF - Linear Feet

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FACILITY ID # YUS-S03

Table 1: Asbestos Occurrence Table

Sheppard Subway Station

Level	Area/Room	System Component	Component Material	Condition (Estimated Quantity)***			Asbestos Content	Friable?	Visible?	Access.	Coffey's Sample Number**	Pinchin Report Findings	Comments/ Notes	Recommendations
				Good	Fair	Poor								
Platform	Southbound under platform lip	Wall	Sprayed fireproofing	900sf	0	0	5.4% Chrysotile	Yes	Yes	B		Sample 1745868-273	Coffey did not resample, but presence was confirmed by visual inspection	Condition to be reassessed annually.
Platform	Southbound under platform lip	Wall	Sprayed fireproofing	900sf	0	0	5.8% Chrysotile	Yes	Yes	B		Sample 1745869-274	Coffey did not resample, but presence was confirmed by visual inspection.	Condition to be reassessed annually.
Platform	Southbound under platform lip	Wall	Sprayed fireproofing	900sf	0	0	5.2% Chrysotile	Yes	Yes	B		Sample 1745870-275	Coffey did not resample, but presence was confirmed by visual inspection.	Condition to be reassessed annually.
Platform	Southbound under platform lip	Wall	Sprayed fireproofing	900sf	0	0	4.0% Chrysotile	Yes	Yes	B		Sample 1745871-276	Coffey did not resample, but presence was confirmed by visual inspection.	Condition to be reassessed annually.

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Condition

- Good - ACM shows no significant signs of damage or deterioration.
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FACILITY ID # YUS-S03

Table 1: Asbestos Occurrence Table

Sheppard Subway Station

Level	Area/Room	System Component	Component Material	Condition (Estimated Quantity)***			Asbestos Content	Friable?	Visible?	Access.	Coffey's Sample Number**	Pinchin Report Findings	Comments/ Notes	Recommendations
				Good	Fair	Poor								
Platform	Southbound under platform lip	Wall	Sprayed fireproofing	900sf	0	0	6.0% Chrysotile	Yes	Yes	B		Sample 1745872-277	Coffey did not resample, but presence was confirmed by visual inspection.	Condition to be reassessed annually.
Platform	Southbound under platform lip	Wall	Sprayed fireproofing	900sf	0	0	6.3% Chrysotile	Yes	Yes	B		Sample 1745873-278	Coffey did not resample, but presence was confirmed by visual inspection.	Condition to be reassessed annually.
Platform	Southbound under platform lip	Wall	Sprayed fireproofing	900sf	0	0	8.0% Chrysotile	Yes	Yes	B		Sample 1745874-279	Coffey did not resample, but presence was confirmed by visual inspection.	Condition to be reassessed annually.

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Sheppard Subway Station

Level	Area/Room	System Component	Component Material	Condition (Estimated Quantity)***			Asbestos Content	Friable?	Visible?	Access.	Coffey's Sample Number**	Pinchin Report Findings	Comments/ Notes	Recommendations
				Good	Fair	Poor								
Platform	Southbound under platform lip	Wall	Sprayed fireproofing	900sf	0	0	7.5% Chrysotile	Yes	Yes	B		Sample 1745875-280	Coffey did not resample, but presence was confirmed by visual inspection.	Condition to be reassessed annually.
Platform	Southbound under platform lip	Wall	Sprayed fireproofing	900sf	0	0	5.5% Chrysotile	Yes	Yes	B		Sample 1745876-281	Coffey did not resample, but presence was confirmed by visual inspection.	Condition to be reassessed annually.
Platform	Sheppard line	Ceiling	Acoustic Ceiling Tile	100SF	0	0	SACM	Yes	Yes	C	NS	NS,SACM	Material was not confirmed during survey	Condition to be reassessed annually. Should be assessed prior to any future renovation activity
Street	21Y-21	Wall	Dark Grey Fire Stop	<10sf	0	0	10% Chrysotile	No	Yes	C	YUS-S03-AS20	Not Identified	Please refer to Site Photograph 3 in the attached photo table.	Condition to be reassessed annually

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Sheppard Subway Station

Level	Area/Room	System Component	Component Material	Condition (Estimated Quantity)***			Asbestos Content	Friable?	Visible?	Access.	Coffey's Sample Number**	Pinchin Report Findings	Comments/ Notes	Recommendations
				Good	Fair	Poor								
Station	Station	Electrical Systems	Electrical Components	NA	NA	NA	SACM	NA	NA	B/C/D	NS	Unknown (SACM)	Electrical systems/components were not assessed as part of the survey.	Should be assessed prior to any future renovation activity.
Station	Station	Expansion Joints	Expansion Material	NA	NA	NA	SACM	NA	NA	A/B/C/D	NS	Not identified	Expansion joints were not assessed as part of the survey.	Should be assessed prior to any future renovation activity.
Station	Station	Fire Door	Interior Composition	NA	NA	NA	SACM	NA	NA	B	NS	Not identified	Fire doors were not assessed as part of the survey.	Should be assessed prior to any future renovation activity.

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FACILITY ID # YUS-S03

Table 1: Asbestos Occurrence Table

Sheppard Subway Station

Level	Area/Room	System Component	Component Material	Condition (Estimated Quantity)***			Asbestos Content	Friable?	Visible?	Access.	Coffey's Sample Number**	Pinchin Report Findings	Comments/ Notes	Recommendations
				Good	Fair	Poor								
Station	Station	Ductwork	Flex Connector	NQ	NQ	NQ	SACM	No	Yes	B/C	NS	NS, SACM	All flex connectors are considered SACM until proven otherwise.	Should be assessed prior to any future renovation activity.
Station	Station	Mechanical	Gaskets	NQ	NQ	NQ	SACM	No	Yes	B/C	NS	NS, SACM	Gaskets were not assessed as part of the survey. All gaskets as SACM	Should be assessed prior to any future renovation activity.
Station	Station	Exterior Door/Window	Caulking	NQ	NQ	NQ	SACM	No	Yes	A/B/ C	NS	NS, SACM	Exterior door and window caulking were not sampled as part of the survey to avoid damaging the building envelope.	Should be assessed prior to any future renovation activity.

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Table 1: Asbestos Occurrence Table

Sheppard Subway Station

Level	Area/Room	System Component	Component Material	Condition (Estimated Quantity)***			Asbestos Content	Friable?	Visible?	Access.	Coffey's Sample Number**	Pinchin Report Findings	Comments/ Notes	Recommendations
				Good	Fair	Poor								
Station	Station	Above Ceiling	NA	NA	NA	NA	SACM	NA	NA	C	NS	Unknown (SACM)		Should be assessed prior to any future renovation activity.
Station	Station	Roof	Roofing Materials	NA	NA	NA	SACM	NA	NA	B/C/D	NS	Unknown (SACM)	Roofing materials/compon ents were not assessed as part of the survey. All roofing materials are SACM.	Should be assessed prior to any future renovation activity.

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- A - Areas of the building within reach (from floor level) of all building users
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- C - Areas of the building above 2.4 m where use of a ladder is required to reach the asbestos
- D - Areas of the building behind inaccessible solid ceiling systems, walls, or mechanical equipment, etc., where demolition of the ceiling, wall, or equipment, etc., is required to reach the asbestos

Visibility

- Yes - Suspect material is visible without opening hatches or lifting ceiling tiles
- No - Suspect material can only be viewed if access hatches are opened or ceiling tiles lifted

Condition

- Good - ACM shows no significant signs of damage or deterioration.
- Fair - Only applicable to asbestos containing mechanical insulation which exhibits minor penetrating damage to jacket insulation or undamaged insulation that had never been jacketed. Damage can be repaired.
- Poor - ACM shows signs of damage, deterioration or delaminated. Damage cannot be readily repaired.

Notes:

- ACM - asbestos-containing material
- SACM - suspect asbestos-containing material
- Access. - accessibility
- nq - not quantified
- na - not applicable
- ns - not sampled
- REF - reference sample
- X - estimated number of units

\* Based on a non-intrusive visual inspection of visible surfaces within the room space

\*\* Refer to Analytical Data for Details

\*\*\* If Estimated Quantity is 0, no asbestos is present in this condition

LF - Linear Feet

SF - Square Feet

E - individual pipe elbows/fittings

FACILITY ID: YUS-S03									
Sheppard Subway Station									
Level	Area/Room	System Component	Component Material	Asbestos Content	Coffey's Sample Number**	Friable?	Visible?	Access.	Comments/ Notes
Platform	21Y-73	Floor	12" x 12" Vinyl Floor Tile-Blue with White Specs	None Detected	YUS-S03-AS04-A	No	Yes	B	
Platform	21Y-74/75	Floor	12"x 12" Vinyl Floor Tile-Blue with White Specs	None Detected	YUS-S03-AS04-B	No	Yes	B	
Platform	21Y-74/75	Floor	12" x 12" Vinyl Floor Tile- Blue with White Specs	None Detected	YUS-S03-AS04-C	No	Yes	B	
Platform	21Y-68	Ceiling	Plaster	1.2% Chrysotile	YUS-S03-AS02-A	No	Yes	C	Please refer to site photograph 1 in the attached photo table
Platform	21Y-68	Ceiling	Plaster	Sample not analyzed. visually similar to YUSS03-AS02-A	YUS-S03-AS02-B	No	Yes	C	
Platform	21Y-68	Ceiling	Plaster	Sample not analyzed. visually similar to YUS S03-AS02-A	YUS-S03-AS02-C	No	Yes	C	
South Concourse	21Y-54	Ceiling	Brown Fibre Board	None Detected	YUS-S03-AS22-A	Yes	Yes	B/C	
South Concourse	21Y-54	Ceiling	Brown Fibre Board	None Detected	YUS-S03-AS22-B	Yes	Yes	B/C	

PLEASE NOTE: THIS TABLE DOES NOT IDENTIFY VISUALLY SIMILAR MATERIALS WHICH ARE ADDRESSED ELSEWHERE IN THE ASSOCIATED REPORT AND SUPPORTING DOCUMENTATION. PLEASE REFER TO SUCH DOCUMENTATION FOR FURTHER INFORMATION.

**Accessibility Classification**

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B - Frequently entered maintenance areas within reach of maintenance staff, without the need of a ladder

C - Areas of the building above 2.4 m where use of a ladder is required to reach the asbestos

D - Areas of the building behind inaccessible solid ceiling systems, walls, or mechanical equipment, etc., where demolition of the ceiling, wall, or equipment, etc., is required to reach the asbestos

**Notes:**

ACM - asbestos-containing material

SACM - suspect asbestos-containing material

Access. - accessibility

nq - not quantified

na - not applicable

ns - not sampled

PC-Point Count

REF - reference sample

**Visibility**

Yes - Suspect material is visible without opening hatches or lifting ceiling tiles

No - Suspect material can only be viewed if access hatches are opened or ceiling tiles lifted

\* Based on a non-intrusive visual inspection of visible surfaces within the room space

\*\* Refer to Analytical Data for Details

\*\*\* indicates these samples were not analyzed by the laboratory due to the positive identification of asbestos in the initial samples analyzed (i.e. RNV-VT5-2, RNV-VT5-3)

PC Trace/PC 0.25 = indicates these samples are not considered to be asbestos containing materials (ACM)

FACILITY ID: YUS-S03									
Sheppard Subway Station									
Level	Area/Room	System Component	Component Material	Asbestos Content	Coffey's Sample Number**	Friable?	Visible?	Access.	Comments/ Notes
South Concourse	21Y-54	Ceiling	Brown Fibre Board	None Detected	YUS-S03-AS22-C	Yes	Yes	B/C	
Platform	21Y-116	Ceiling	Tan Fibre Board	None Detected	YUS-S03-AS08-A	No	Yes	C	
Platform	21Y-116	Ceiling	Tan Fibre Board	None Detected	YUS-S03-AS08-B	No	Yes	C	
Platform	21Y-116	Ceiling	Tan Fibre Board	None Detected	YUS-S03-AS08-C	No	Yes	C	
Platform	21Y-115	Above ceiling	Sprayed on Fireproofing	None Detected	YUS-S03-AS09-A	Yes	Yes	C	Please refer to site photograph 5 in the attached photo table.
Platform	21Y-115	Above ceiling	Sprayed on Fireproofing	None Detected	YUS-S03-AS09-B	Yes	Yes	C	
Platform	21Y-117	Above ceiling	Sprayed on Fireproofing	None Detected	YUS-S03-AS09-C	Yes	Yes	C	
West Concourse	51P-304	Wall	Cementitious Over Spray	None Detected	YUS-S03-AS17-A	Yes	Yes	B	Please refer to Site photograph 4 in the attached photo table
West Concourse	51P-304	Wall	Cementitious Over Spray	None Detected	YUS-S03-AS17-B	Yes	Yes	B	

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**Accessibility Classification**

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D - Areas of the building behind inaccessible solid ceiling systems, walls, or mechanical equipment, etc., where demolition of the ceiling, wall, or equipment, etc., is required to reach the asbestos

**Visibility**

Yes - Suspect material is visible without opening hatches or lifting ceiling tiles

No - Suspect material can only be viewed if access hatches are opened or ceiling tiles lifted

\* Based on a non-intrusive visual inspection of visible surfaces within the room space

\*\* Refer to Analytical Data for Details

\*\*\* indicates these samples were not analyzed by the laboratory due to the positive identification of asbestos in the initial samples analyzed (i.e. RNV-VT5-2, RNV-VT5-3)

PC Trace/PC 0.25 = indicates these samples are not considered to be asbestos containing materials (ACM)

**Notes:**

ACM - asbestos-containing material

SACM - suspect asbestos-containing material

Access. - accessibility

nq - not quantified

na - not applicable

ns - not sampled

PC-Point Count

REF - reference sample

Photographs are representative photographs only and are provided for first occurrence of specific ACM matrix listed.

Level	Area/Room	System Component	Component Material	Asbestos Content	Coffey's Sample Number**	Friable?	Visible?	Access.	Comments/ Notes
West Concourse	51P-304	Wall	Cementitious Over Spray	None Detected	YUS-S03-AS17-C	Yes	Yes	B	
West Concourse	51P-304	Wall	Cementitious Over Spray	None Detected	YUS-S03-AS18-A	Yes	Yes	B	
West Concourse	51P-304	Wall	Cementitious Over Spray	None Detected	YUS-S03-AS18-B	Yes	Yes	B	
West Concourse	51P-304	Wall	Cementitious Over Spray	None Detected	YUS-S03-AS18-C	Yes	Yes	B	
Sheppard Line Platform	Transfer Machines	Floor	Caulking (black)	None Detected	YUS-S03-AS16-A	No	Yes	A	
Sheppard Line Platform	Transfer Machines	Floor	Caulking (black)	None Detected	YUS-S03-AS16-B	No	Yes	A	
Sheppard Line Platform	Transfer Machines	Floor	Caulking (black)	None Detected	YUS-S03-AS16-C	No	Yes	A	

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**Accessibility Classification**

A - Areas of the building within reach (from floor level) of all building users

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D - Areas of the building behind inaccessible solid ceiling systems, walls, or mechanical equipment, etc., where demolition of the ceiling, wall, or equipment, etc., is required to reach the asbestos

**Visibility**

Yes - Suspect material is visible without opening hatches or lifting ceiling tiles

No - Suspect material can only be viewed if access hatches are opened or ceiling tiles lifted

\* Based on a non-intrusive visual inspection of visible surfaces within the room space

\*\* Refer to Analytical Data for Details

\*\*\* indicates these samples were not analyzed by the laboratory due to the positive identification of asbestos in the initial samples analyzed (i.e. RNV-VT5-2, RNV-VT5-3)

PC Trace/PC 0.25 = indicates these samples are not considered to be asbestos containing materials (ACM)

**Notes:**

ACM - asbestos-containing material

SACM - suspect asbestos-containing material

Access. - accessibility

nq - not quantified

na - not applicable

ns - not sampled

PC-Point Count

REF - reference sample

Photographs are representative photographs only and are provided for first occurrence of specific ACM matrix listed.



Table 2: Bulk Sampling Table  
Sheppard Subway Station

FACILITY ID: YUS-S03									
Level	Area/Room	System Component	Component Material	Asbestos Content	Coffey's Sample Number**	Friable?	Visible?	Access.	Comments/ Notes
Platform	21Y-75/76	Floor	Grey Fire Stop	None Detected	YUS-S03-AS05-A	No	Yes	B	
Platform	21Y-75/76	Floor	Grey Fire Stop	None Detected	YUS-S03-AS05-B	No	Yes	B	
Platform	21Y-75/76	Floor	Grey Fire Stop	None Detected	YUS-S03-AS05-C	No	Yes	B	
Sheppard Line Platform	51P-313	Floor	Grey Fire Stop	None Detected	YUS-S03-AS13-A	No	Yes	B	
Sheppard Line Platform	51P-313	Floor	Grey Fire Stop	None Detected	YUS-S)3-AS13-B	No	Yes	B	
Sheppard Line Platform	51P-313	Floor	Grey Fire Stop	None Detected	YUS-S03-AS13-C	No	Yes	B	
Platform	21Y-67	Wall	Red Fire Stop	None Detected	YUS-S03-AS01-A	No	Yes	C	
Platform	21Y-67	Wall	Red Fire Stop	None Detected	YUS-S03-AS01-B	No	Yes	C	
Platform	21Y-67	Wall	Red Fire Stop	None Detected	YUS-S03-AS01-C	No	Yes	C	

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<b>Accessibility Classification</b> A - Areas of the building within reach (from floor level) of all building users B - Frequently entered maintenance areas within reach of maintenance staff, without the need of a ladder C - Areas of the building above 2.4 m where use of a ladder is required to reach the asbestos D - Areas of the building behind inaccessible solid ceiling systems, walls, or mechanical equipment, etc., where demolition of the ceiling, wall, or equipment, etc., is required to reach the asbestos	<b>Notes:</b> ACM - asbestos-containing material SACM - suspect asbestos-containing material Access. - accessibility nq - not quantified na - not applicable ns - not sampled PC-Point Count REF - reference sample  Photographs are representative photographs only and are provided for first occurrence of specific ACM matrix listed.
<b>Visibility</b>  Yes - Suspect material is visible without opening hatches or lifting ceiling tiles  No - Suspect material can only be viewed if access hatches are opened or ceiling tiles lifted	

\* Based on a non-intrusive visual inspection of visible surfaces within the room space

\*\* Refer to Analytical Data for Details

\*\*\* indicates these samples were not analyzed by the laboratory due to the positive identification of asbestos in the initial samples analyzed (i.e. RNV-VT5-2, RNV-VT5-3)

PC Trace/PC 0.25 = indicates these samples are not considered to be asbestos containing materials (ACM)



Table 2: Bulk Sampling Table  
Sheppard Subway Station

FACILITY ID: YUS-S03									
Level	Area/Room	System Component	Component Material	Asbestos Content	Coffey's Sample Number**	Friable?	Visible?	Access.	Comments/ Notes
Sheppard Line Platform	51P-315	Wall	Red Fire Stop	None Detected	YUS-S03-AS11-A	No	Yes	C	
Sheppard Line Platform	51P-315	Wall	Red Fire Stop	None Detected	YUS-S03-AS11-B	No	Yes	C	
Sheppard Line Platform	51P-315	Wall	Red Fire Stop	None Detected	YUS-S03-AS11-C	No	Yes	C	
Platform	21Y-116	Wall	Grey Caulking	None Detected	YUS-S03-AS07-A	No	Yes	B	
Platform	21Y-116	Wall	Grey Caulking	None Detected	YUS-S03-AS07-B	No	Yes	B	
Platform	21Y-116	Wall	Grey Caulking	None Detected	YUS-S03-AS07-C	No	Yes	B	
Platform	21Y-117	Wall	Grey Caulking	None Detected	YUS-S03-AS10-A	No	Yes	B	
Platform	21Y-117	Wall	Grey Caulking	None Detected	YUS-S03-AS10-B	No	Yes	B	
Platform	21Y-117	Wall	Grey Caulking	None Detected	YUS-S03-AS10-C	No	Yes	B	

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**Notes:**

ACM - asbestos-containing material

SACM - suspect asbestos-containing material

Access. - accessibility

nq - not quantified

na - not applicable

ns - not sampled

PC-Point Count

REF - reference sample

**Visibility**

Yes - Suspect material is visible without opening hatches or lifting ceiling tiles

No - Suspect material can only be viewed if access hatches are opened or ceiling tiles lifted

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PC Trace/PC 0.25 = indicates these samples are not considered to be asbestos containing materials (ACM)

FACILITY ID: YUS-S03									
Sheppard Subway Station									
Level	Area/Room	System Component	Component Material	Asbestos Content	Coffey's Sample Number**	Friable?	Visible?	Access.	Comments/ Notes
Platform	51P-316	Wall	Grey Caulking	None Detected	YUS-S03-AS12-A	No	Yes	C	
Platform	51P-316	Wall	Grey Caulking	None Detected	YUS-S03-AS12-B	No	Yes	C	
Platform	51P-316	Wall	Grey Caulking	None Detected	YUS-S03-AS12-C	No	Yes	C	
South Concourse	Outside 21Y-62	Wall	Grey Caulking	None Detected	YUS-S03-AS21-A	No	Yes	B	
South Concourse	Outside 21Y-62	Wall	Grey Caulking	None Detected	YUS-S03-AS21-B	No	Yes	B	
South Concourse	Outside 21Y-62	Wall	Grey Caulking	None Detected	YUS-S03-AS21-C	No	Yes	B	
South Concourse	51P-331	Door	Grey Caulking	None Detected	YUS-S03-AS06-A	No	Yes	B	
South Concourse	51P-331	Door	Grey Caulking	None Detected	YUS-S03-AS06-B	No	Yes	B	
South Concourse	51P-331	Door	Grey Caulking	None Detected	YUS-S03-AS06-C	No	Yes	B	

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D - Areas of the building behind inaccessible solid ceiling systems, walls, or mechanical equipment, etc., where demolition of the ceiling, wall, or equipment, etc., is required to reach the asbestos

Visibility

Yes - Suspect material is visible without opening hatches or lifting ceiling tiles  
  
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Notes:

ACM - asbestos-containing material  
SACM - suspect asbestos-containing material  
Access. - accessibility  
nq - not quantified  
na - not applicable  
ns - not sampled  
PC-Point Count  
REF - reference sample  
  
Photographs are representative photographs only and are provided for first occurrence of specific ACM matrix listed.

Level	Area/Room	System Component	Component Material	Asbestos Content	Coffey's Sample Number**	Friable?	Visible?	Access.	Comments/ Notes
Platform	51P-318	Duct	Brown Mastic	None Detected	YUS-S03-AS14-A	No	Yes	B	
Platform	51P-318	Duct	Brown Mastic	None Detected	YUS-S03-AS14-A	No	Yes	B	
Platform	51P-318	Duct	Brown Mastic	None Detected	YUS-S03-AS14-A	No	Yes	B	
Street	21Y-18	Pipe Fittings	Parging Cement	None Detected	YUS-S03-AS19-A	Yes	Yes	B	Please refer to Site photograph 2 in the attached photo table
Street	21Y-18	Pipe Fittings	Parging Cement	None Detected	YUS-S03-AS19-B	Yes	Yes	B	
Street	21Y-18	Pipe Fittings	Parging Cement	None Detected	YUS-S03-AS19-C	Yes	Yes	B	
Platform	21Y-69	Pipe Fittings	Parging Cement	None Detected	YUS-S03-AS03-A	Yes	Yes	B	
Platform	21Y-69	Pipe Fittings	Parging Cement	None Detected	YUS-S03-AS03-B	Yes	Yes	B	
Platform	21Y-69	Pipe Fittings	Parging Cement	None Detected	YUS-S03-AS03-C	Yes	Yes	B	

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**Visibility**

Yes - Suspect material is visible without opening hatches or lifting ceiling tiles

No - Suspect material can only be viewed if access hatches are opened or ceiling tiles lifted

\* Based on a non-intrusive visual inspection of visible surfaces within the room space

\*\* Refer to Analytical Data for Details

\*\*\* indicates these samples were not analyzed by the laboratory due to the positive identification of asbestos in the initial samples analyzed (i.e. RNV-VT5-2, RNV-VT5-3)

PC Trace/PC 0.25 = indicates these samples are not considered to be asbestos containing materials (ACM)

**Notes:**

ACM - asbestos-containing material

SACM - suspect asbestos-containing material

Access. - accessibility

nq - not quantified

na - not applicable

ns - not sampled









PC-Point Count


REF - reference sample

Photographs are representative photographs only and are provided for first occurrence of specific ACM matrix listed.

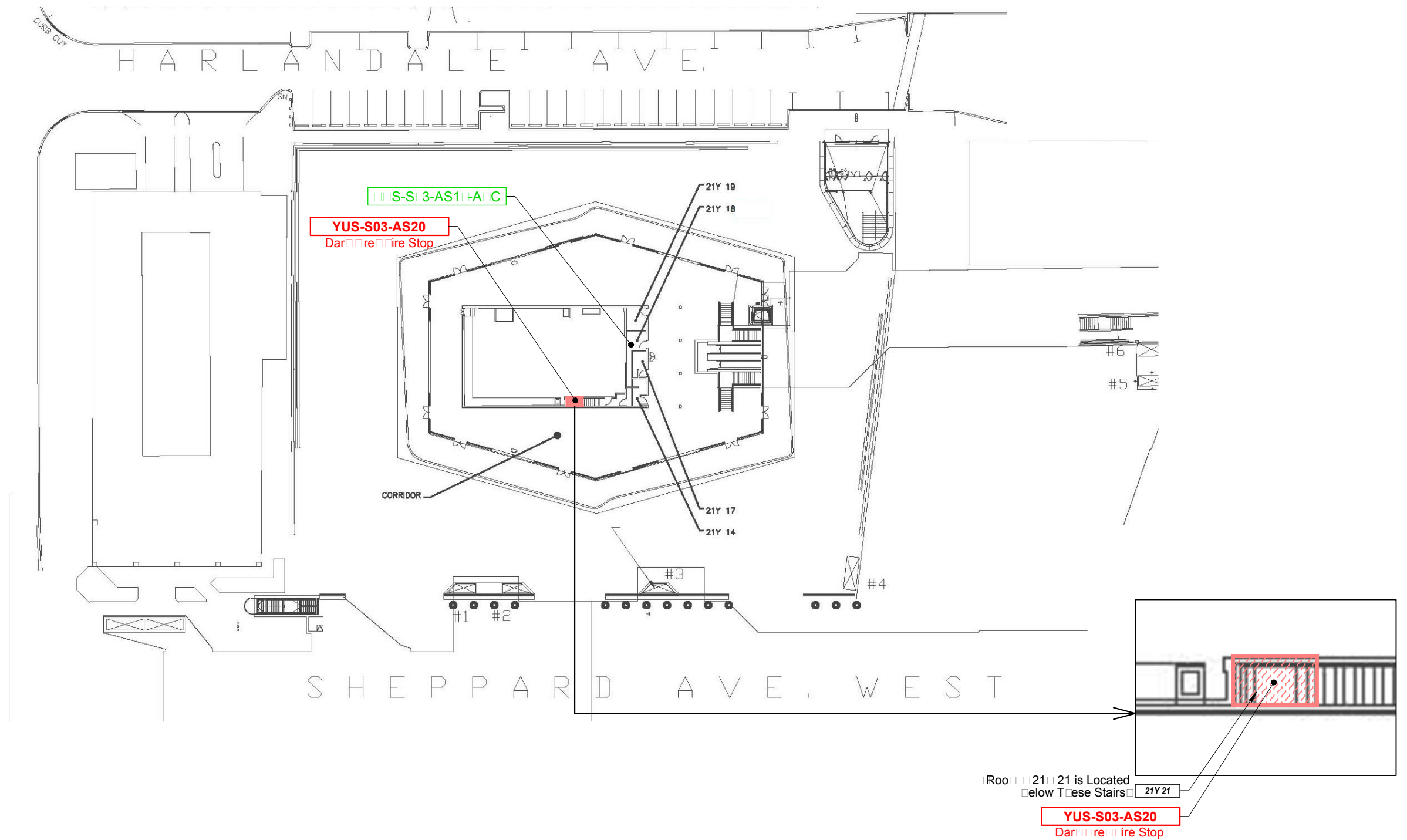
SHEPPARD SUBWAY STATION (YUS-S03)  
LEGEND AND NOTES

- GENERAL NOTES:**
- 1. THIS DRAWING MUST ONLY BE USED IN CONNECTION WITH A COMPLETE REPORT OF THE ASSOCIATED REPORT.
  - 2. FLOOR PLANS ADAPTED FROM DRAWINGS PROVIDED BY CLIENT.
  - 3. ASBESTOS CONTAINING MATERIALS (ACMs) MAY BE PRESENT IN INACCESSIBLE AREAS THROUGHOUT THE STATION. PLEASE REFER TO REPORT FOR CONFIRMED LOCATIONS.
  - 4. IN SITUATIONS WHERE ASBESTOS CONTAINING MATERIALS EXTEND INTO AN INACCESSIBLE AREA, SUCH AS PLASTERED ABOVE ALL CEILING JOINTS OR WALLS, IT MUST BE ASSUMED THAT THE ASBESTOS CONTAINING MATERIALS ARE ALSO PRESENT IN THESE AREAS.
  - 5. CONTRACTORS AND MAINTENANCE PERSONNEL SHOULD BE AWARE OF THE POSSIBILITY OF UNDISCLOSED MATERIALS PENETRATING INTO ENCLOSED OR OTHERWISE INACCESSIBLE AREAS. SUSPECT CRACKS AND NON-CRAACKED MATERIALS DISCOVERED IN THESE AREAS SHOULD BE TREATED AS ASBESTOS UNTIL PROVEN OTHERWISE.
  - 6. NO DESTRUCTIVE EXAMINATIONS ARE PERFORMED AS PART OF THIS SERVICE.
  - 7. ASBESTOS CONTAINING MATERIALS PROPOSED IDENTIFIED IN PLAN AND IN ALL REPORTS AS CONTAINING 100% ASBESTOS ARE NOT SAMPLED IN THIS SERVICE BUT ARE INCLUDED IN THIS DRAWING FOR IDENTIFICATION OF THE PROPOSED ORDER AND THE ASSOCIATED REPORT.
  - 8. INSULATION BETWEEN ALL GROUND DOORS ARE SUSPECTED OF CONTAINING ASBESTOS.

LEGEND	
<b>YUS-S03-AS02</b>	Asbestos Sample Location - Positive Result
<b>S-S03-AS00-A00</b>	Asbestos Sample Location - Negative Result
S-001	Pinned Sample Location Number
S-272	Pinned Sample Location Number from under Platform Lip
	Location of Asbestos Containing Materials as identified by Pinned
51P 331 21Y 65	Room identified by Coffee Room identified by Pinned
	Additional Areas identified by Coffee
	Rooms inaccessible During Site Inspection
	Asbestos Containing Fire Stop
	Suspect Asbestos Containing Ceiling Tile
	Asbestos Containing Plaster
	Suspect Asbestos Containing Transit Pipe
	Asbestos Containing Sprayed Fireproofing

drawn	FR/SSH/MV		client:	TORONTO TRANSIT COMMISSION	
approved	GAW		project:	ASBESTOS REASSESSMENT SERVICES FOR SUBWAY STATIONS SHEPPARD STATION (YUS-S03) TORONTO, ONTARIO	
date	APR. 2012		title:	LEGEND AND NOTES	
scale	NTS		project no:	ENVSETOB06703AC	drawing no: 1
original size	Letter				

## STREET LEVEL FLOOR PLAN



Legend

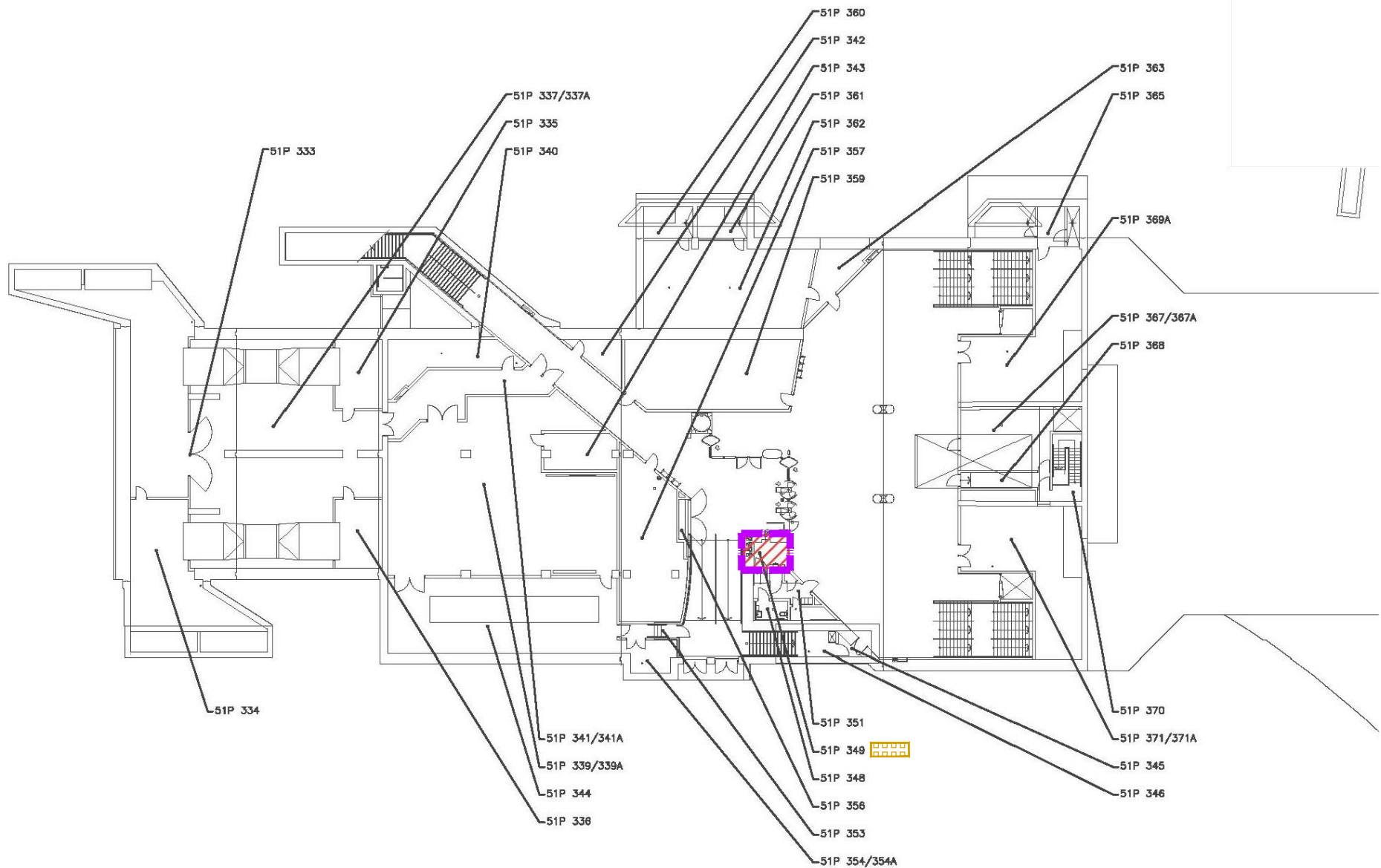
YUS-S03-AS20	Asbestos Sample Location - Positive Result
C-S03-AS1-C	Asbestos Sample Location - Negative Result
21Y 21	Room Identified by Coffee Room Identified by Pinpoint
21Y 14	Additional Areas Identified by Coffee
	Asbestos Containing Fire Stop

drawn	<b>KS/CM/SSH/MV</b>
approved	<b>GAW</b>
date	<b>APR. 2012</b>
scale	<b>NTS</b>
original size	<b>Letter</b>



client:	TORONTO TRANSIT COMMISSION		
project:	ASBESTOS REASSESSMENT SERVICES FOR SUBWAY STATIONS SHEPPARD STATION (YUS-S03) TORONTO, ONTARIO		
title:	STREET LEVEL FLOOR PLAN		
project no:	ENVSETOB06703AC	drawing no:	2

SHEPPARD SUBWAY STATION (YUS-S03)  
PARTIAL WEST CONCOURSE LEVEL FLOOR PLAN



Legend



Location of Asbestos Containing Material: as identified by Pinpoint

51P 351



Room identified by Pinpoint

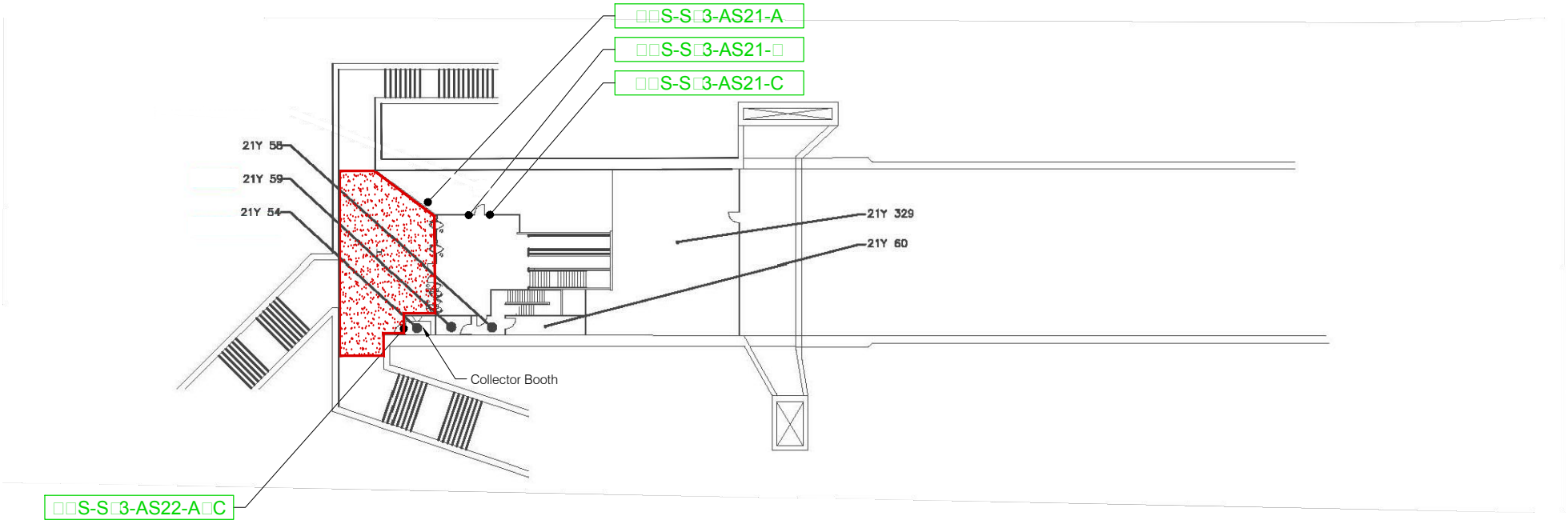
Asbestos-Containing Ceiling Tile

drawn	KS/CM/SSH/MV
approved	GAW
date	APR. 2012
scale	NTS
original size	Letter



client:	TORONTO TRANSIT COMMISSION	
project:	ASBESTOS REASSESSMENT SERVICES FOR SUBWAY STATIONS SHEPPARD STATION (YUS-S03) TORONTO, ONTARIO	
title:	PARTIAL WEST CONCOURSE LEVEL FLOOR PLAN	
project no:	ENVSETOB06703AC	drawing no: 3

SHEPPARD SUBWAY STATION (YUS-S03)  
PARTIAL SOUTH CONCOURSE LEVEL FLOOR PLAN



Legend

S-S-3-AS21-A Asbestos Sample Location - Negative Result

21Y 54

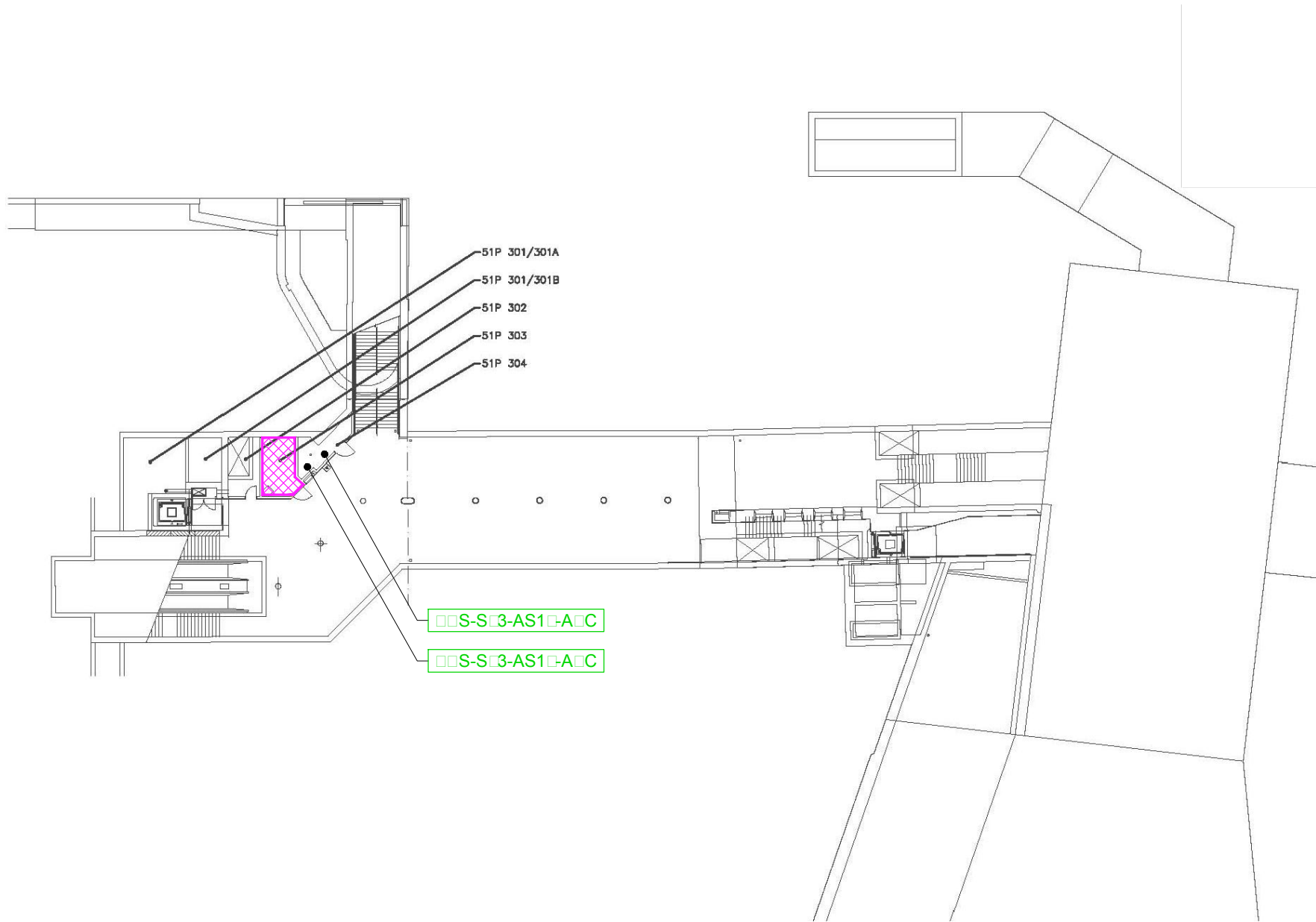
Asbestos Containing Plaster

drawn	KS/CM/SSH/MV
approved	GAW
date	APR. 2012
scale	NTS
original size	Letter



client:	TORONTO TRANSIT COMMISSION	
project:	ASBESTOS REASSESSMENT SERVICES FOR SUBWAY STATIONS SHEPPARD STATION (YUS-S03) TORONTO, ONTARIO	
title:	PARTIAL SOUTH CONCOURSE LEVEL FLOOR PLAN	
project no:	ENVSETOB06703AC	drawing no: 4

SHEPPARD SUBWAY STATION (YUS-S03)  
PARTIAL NORTH CONCOURSE LEVEL FLOOR PLAN



L  
Asbestos Sample Location - Negative Result  
51P 302  
Suspect Asbestos Containing Transite Pipe

Asbestos Sample Location - Negative Result  
Room identified by Pinpoint  
Suspect Asbestos Containing Transite Pipe

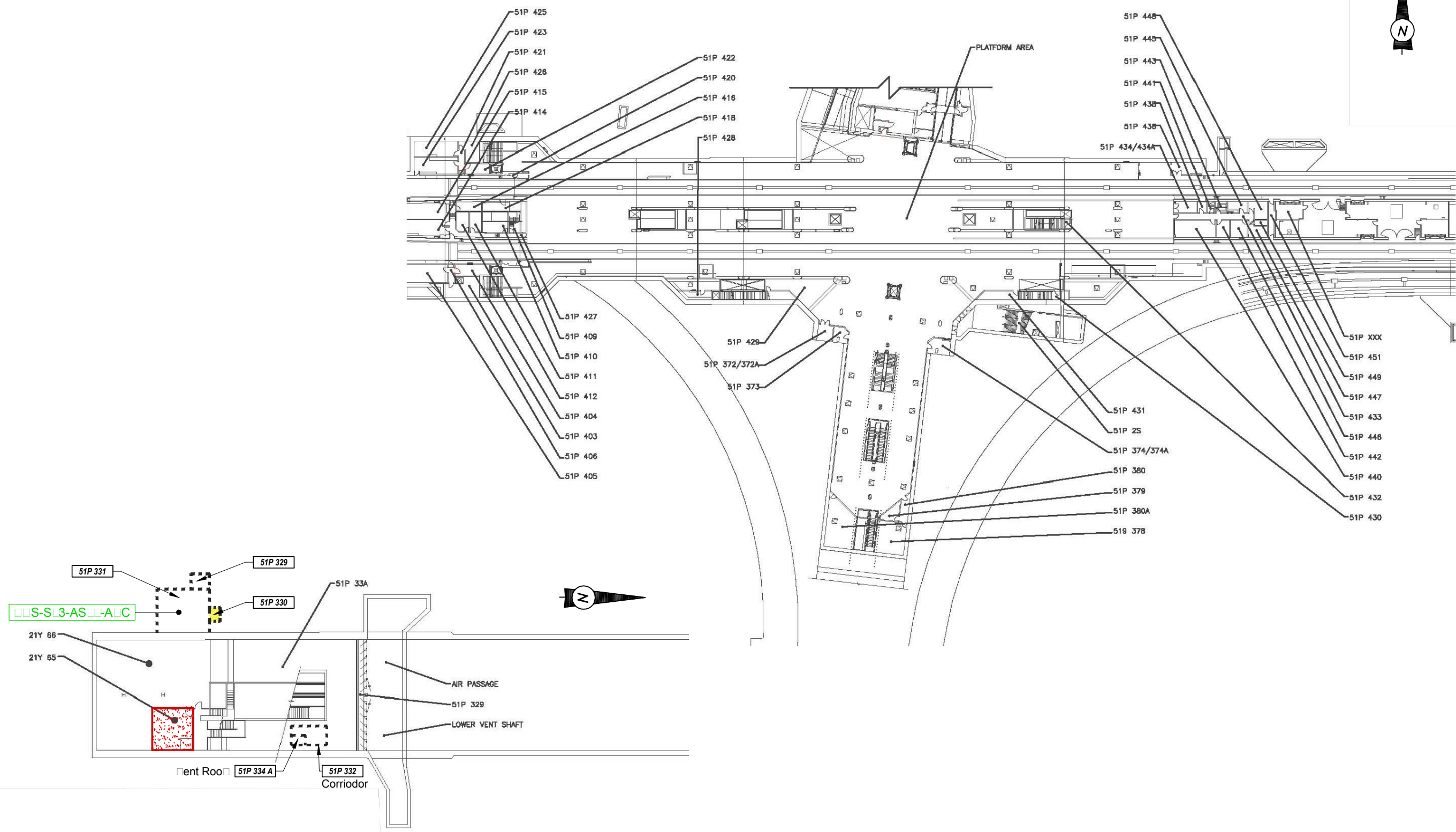
drawn	KS/CM/SSH/MV
approved	GAW
date	APR. 2012
scale	NTS
original size	Letter



client:	TORONTO TRANSIT COMMISSION	
project:	ASBESTOS REASSESSMENT SERVICES FOR SUBWAY STATIONS SHEPPARD STATION (YUS-S03) TORONTO, ONTARIO	
title:	PARTIAL NORTH CONCOURSE LEVEL FLOOR PLAN	
project no:	ENVSETOB06703AC	drawing no: 5



SHEPPARD SUBWAY STATION (YUS-S03)  
SHEPPARD LINE PLATFORM LEVEL FLOOR PLAN



Legend

**Asbestos Sample Location - Negative Result**

51P 330 51P 329

Roofs identified by Coffey Roofs identified by Pincin

Additional Areas identified by Coffey

Roofs inaccessible During Site Inspection

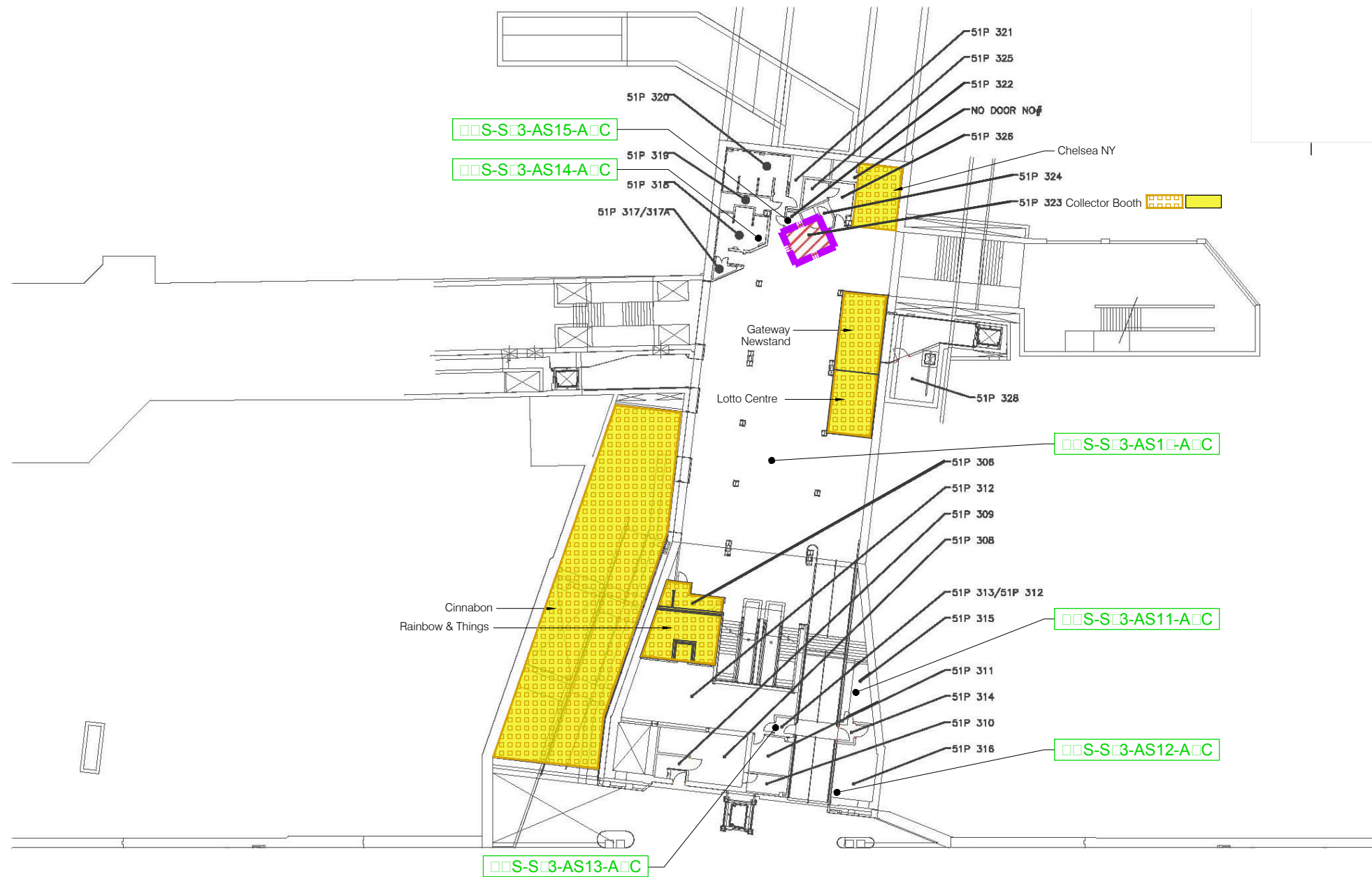
Asbestos Containing Plaster

drawn	KS/CM/SSH/MV
approved	GAW
date	APR. 2012
scale	NTS
original size	Letter



client:	TORONTO TRANSIT COMMISSION	
project:	ASBESTOS REASSESSMENT SERVICES FOR SUBWAY STATIONS SHEPPARD STATION (YUS-S03) TORONTO, ONTARIO	
title:	SHEPPARD LINE PLATFORM LEVEL FLOOR PLAN	
project no:	ENVSETOB06703AC	drawing no: 6

SHEPPARD SUBWAY STATION (YUS-S03)  
SHEPPARD LINE PLATFORM LEVEL FLOOR PLAN



Legend

**S-S-3-AS11-A-C** Asbestos Sample Location - Negative Result

Location of Asbestos Containing Materials as identified by Pinpoint

Rooms identified by Pinpoint

Rooms inaccessible during site inspection

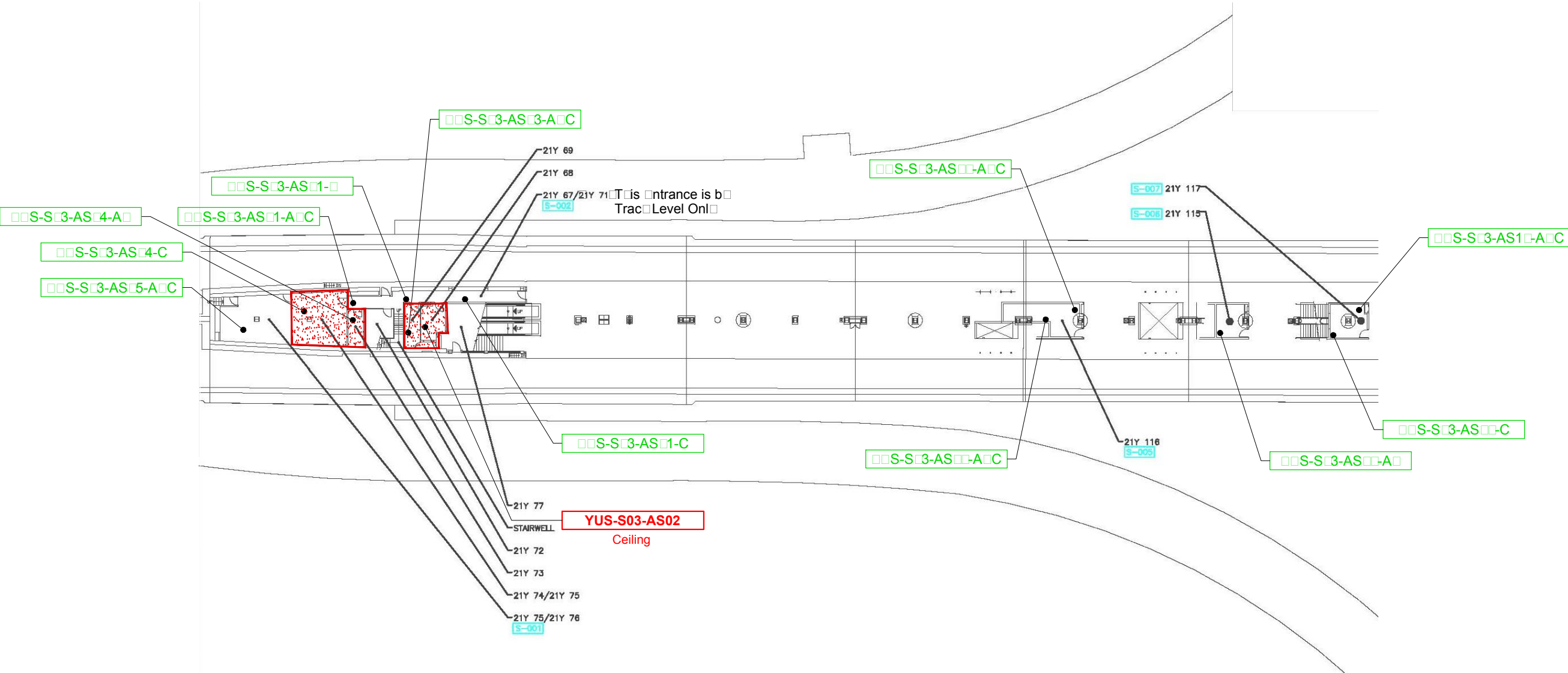
Suspect Asbestos Containing Ceiling Tile

drawn	KS/CM/SSH/MV
approved	GAW
date	APR. 2012
scale	NTS
original size	Letter



client:	TORONTO TRANSIT COMMISSION	
project:	ASBESTOS REASSESSMENT SERVICES FOR SUBWAY STATIONS SHEPPARD STATION (YUS-S03) TORONTO, ONTARIO	
title:	SHEPPARD LINE PLATFORM LEVEL FLOOR PLAN	
project no:	ENVSETOB06703AC	drawing no: 7

SHEPPARD SUBWAY STATION (YUS-S03)  
YONGE LINE PLATFORM LEVEL FLOOR PLAN



Legend	
YUS-S03-AS02	Asbestos Sample Location - Positive Result
C-S-3-AS-A-C	Asbestos Sample Location - Negative Result
S-001	Pinch Sample Location Number
21Y 72	Room identified by Pinch
	Asbestos Containing Plaster

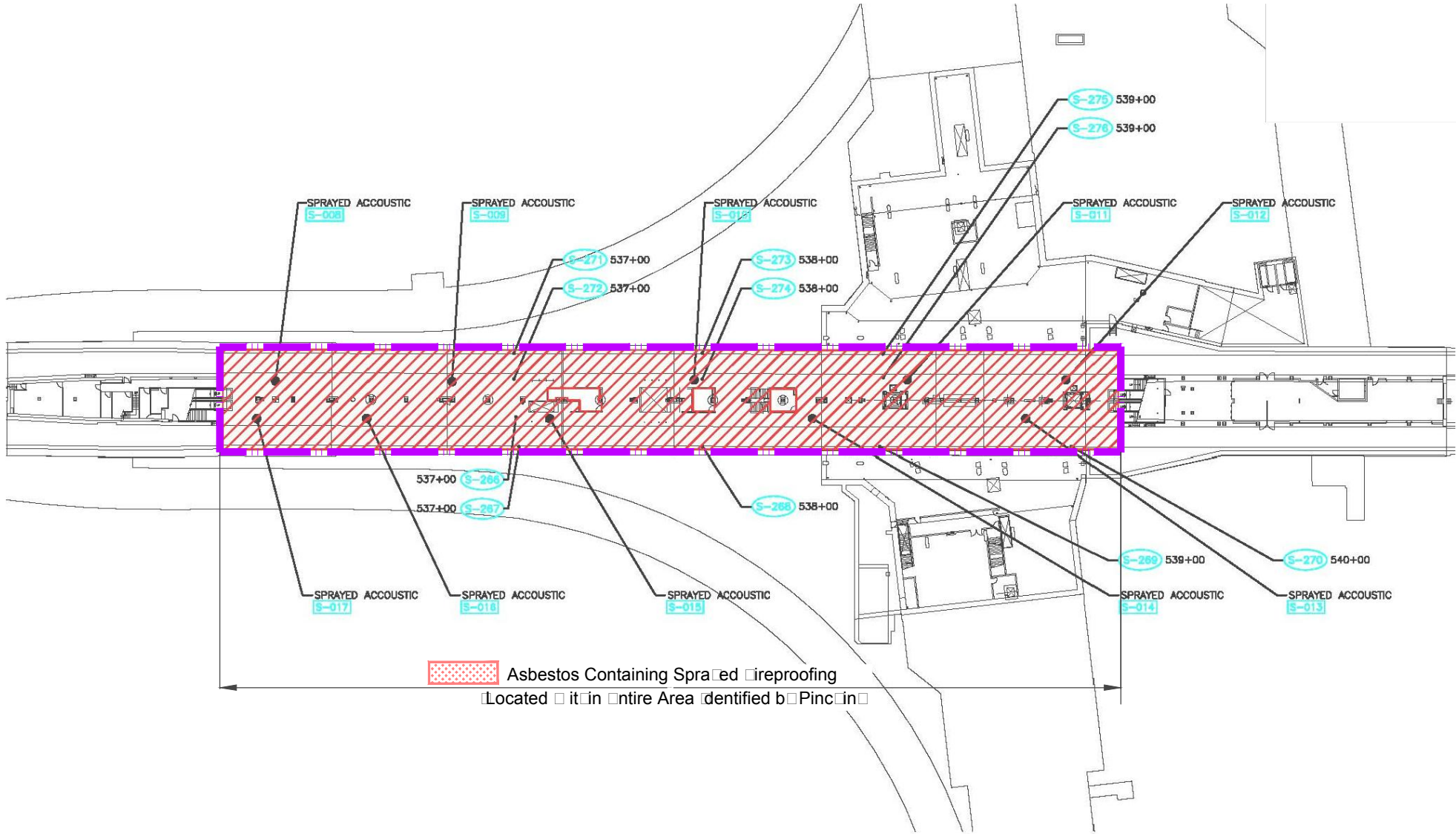
drawn	KS/CM/SSH/MV
approved	GAW
date	APR. 2012
scale	NTS
original size	Letter



client:	TORONTO TRANSIT COMMISSION	
project:	ASBESTOS REASSESSMENT SERVICES FOR SUBWAY STATIONS SHEPPARD STATION (YUS-S03) TORONTO, ONTARIO	
title:	YONGE LINE PLATFORM LEVEL FLOOR PLAN	
project no:	ENVSETOB06703AC	drawing no: 8



SHEPPARD SUBWAY STATION (YUS-S03)  
YONGE LINE PLATFORM LEVEL FLOOR PLAN



L

ND

S-017

S-272


537+00

Pincin Sample Location Number

Pincin Sample Location Number from Under Platform Lip

Location of Asbestos Containing Materials as identified by Pincin

Room identified by Pincin

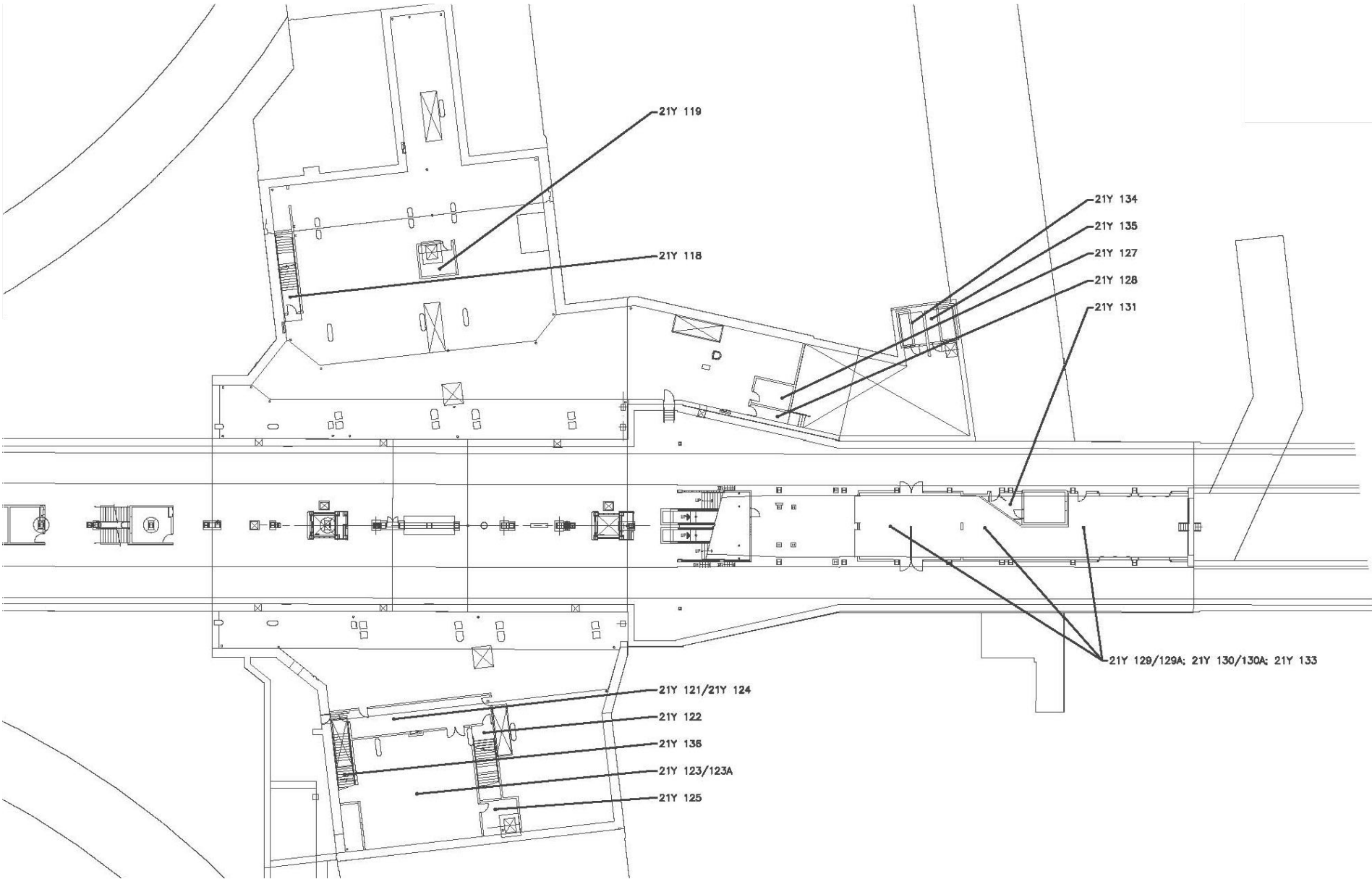
 Asbestos Containing Sprayed Fireproofing  
Located in entire Area identified by Pincin

drawn	KS/CM/SSH/MV
approved	GAW
date	APR. 2012
scale	NTS
original size	Letter

client:	TORONTO TRANSIT COMMISSION	
project:	ASBESTOS REASSESSMENT SERVICES FOR SUBWAY STATIONS SHEPPARD STATION (YUS-S03) TORONTO, ONTARIO	
title:	YONGE LINE PLATFORM LEVEL FLOOR PLAN	
project no:	ENVSETOB06703AC	drawing no: 9

F:\GEO\ENVIRO\0 Projects\ENVSETOB 10000AA to ENVSETOB ---\0 - OLD Numbers with ENV SETOB\06703AC TTC Subway ACM ReAssessment\YUS Line\YUSS03 Sheppard Station\YUSS03 CAD\06703AC YUSS03 -Sheppard Apr 2012.dwg

SHEPPARD SUBWAY STATION (YUS-S03)  
YONGE LINE PLATFORM LEVEL FLOOR PLAN



L  
21Y 136  
Room identified by Pin

drawn	KS/CM/SSH/MV
approved	GAW
date	APR. 2012
scale	NTS
original size	Letter



client:	TORONTO TRANSIT COMMISSION	
project:	ASBESTOS REASSESSMENT SERVICES FOR SUBWAY STATIONS SHEPPARD STATION (YUS-S03) TORONTO, ONTARIO	
title:	YONGE LINE PLATFORM LEVEL FLOOR PLAN	
project no:	ENVSETOB06703AC	drawing no: 10

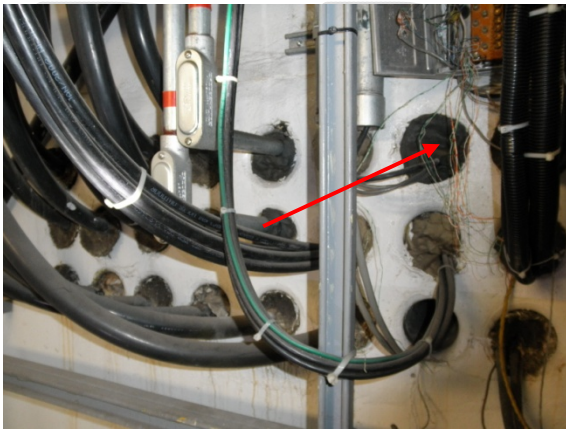




**1 – View of asbestos-containing plaster in Room 21Y-68 (Platform Level).**



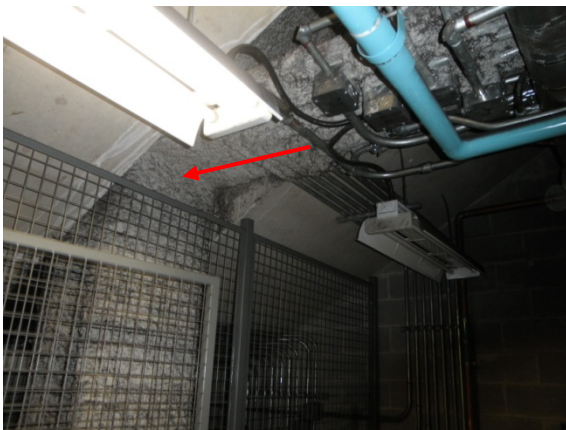
**2 – View of non-asbestos parging cement on pipe fittings in Room 21Y-18 (Street Level).**



**3 – View of asbestos-containing dark grey fire stop in Room 21Y-21 (Street Level).**



**4 – View of non-asbestos overspray material in Room 51P-304 (Concourse Level).**



**5 – View of non-asbestos containing sprayed on fire proofing in Room 21Y-15 (Platform Level).**



**6 – View of asbestos-containing spray on fire proofing the deck (Track Level).**



International Asbestos  
Testing Laboratories

9000 Commerce Parkway Suite B Mt. Laurel, NJ 08054

Telephone: 856-231-9449 Fax: 856-231-9818

## CERTIFICATE OF ANALYSIS

<b>Client:</b>	Coffey Geotechnics	<b>Report Date:</b>	01/10/2011
	20 Meteor Drive	<b>Report No.:</b>	253129
	Toronto, ON	<b>Project:</b>	TTC Station: Sheppard
	M9W 1A4	<b>Project No.:</b>	EE06703AC

## BULK SAMPLE ANALYSIS SUMMARY

Project #	Sample #	Lab #	Location	Description	Method	% Asbestos	Asbestos Type
EE06703AC	YUS-SO3-AS01-A	4436545	21Y-67	Red Fire Stop	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS01-B	4436546	21Y-67	Red Fire Stop	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS01-C	4436547	21Y-67	Red Fire Stop	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS02-A	4436548	21Y-68	Plaster	PLM	PC 1.2	Chrysotile
EE06703AC	YUS-SO3-AS02-B	4436549	21Y-68	Plaster	PLM	*	Sample Not Analyzed
EE06703AC	YUS-SO3-AS02-C	4436550	21Y-68	Plaster	PLM	*	Sample Not Analyzed
EE06703AC	YUS-SO3-AS03-A	4436551	21Y-69	Parging Cement	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS03-B	4436552	21Y-69	Parging Cement	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS03-C	4436553	21Y-69	Parging Cement	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS04-A	4436554	21Y-73	12"x12" Vinyl Floor Tile - Blue with White Specs	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS04-B	4436555	21Y-73	12"x12" Vinyl Floor Tile - Blue with White Specs	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS04-C	4436556	21Y-73	12"x12" Vinyl Floor Tile - Blue with White Specs	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS05-A	4436557	21Y-75	Grey Fire Stop	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS05-B	4436558	21Y-75	Grey Fire Stop	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS05-C	4436559	21Y-75	Grey Fire Stop	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS06-A	4436560	51P-331	Grey Caulking	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS06-B	4436561	51P-331	Grey Caulking	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS06-C	4436562	51P-331	Grey Caulking	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS07-A	4436563	21Y-116	Grey Caulking	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS07-B	4436564	21Y-116	Grey Caulking	PLM	None Detected	None Detected



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## CERTIFICATE OF ANALYSIS

**Client:** Coffey Geotechnics  
20 Meteor Drive  
Toronto, ON  
M9W 1A4

**Report Date:** 01/10/2011  
**Report No.:** 253129  
**Project:** TTC Station: Sheppard  
**Project No.:** EE06703AC

## BULK SAMPLE ANALYSIS SUMMARY

Project #	Sample #	Lab #	Location	Description	Method	% Asbestos	Asbestos Type
EE06703AC	YUS-SO3-AS07-C	4436565	21Y-116	Grey Caulking	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS08-A	4436566	21Y116	Tan Fibre Board	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS08-B	4436567	21Y116	Tan Fibre Board	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS08-C	4436568	21Y116	Tan Fibre Board	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS09-A	4436569	21Y-115	Tan Sprayed on Fireproofing	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS09-B	4436570	21Y-115	Tan Sprayed on Fireproofing	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS09-C	4436571	21Y-115	Tan Sprayed on Fireproofing	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS10-A	4436572	21Y-117	Grey Caulking	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS10-B	4436573	21Y-117	Grey Caulking	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS10-C	4436574	21Y-117	Grey Caulking	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS11-A	4436575	51P-315	Red Fire Stop	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS11-B	4436576	51P-315	Red Fire Stop	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS11-C	4436577	51P-315	Red Fire Stop	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS12-A	4436578	51P-316	Grey Caulking	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS12-B	4436579	51P-316	Grey Caulking	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS12-C	4436580	51P-316	Grey Caulking	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS13-A	4436581	51P-313	Grey Fire Stop	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS13-B	4436582	51P-313	Grey Fire Stop	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS13-C	4436583	51P-313	Grey Fire Stop	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS14-A	4436584	51P-318	Brown Mastic	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS14-B	4436585	51P-318	Brown Mastic	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS14-C	4436586	51P-318	Brown Mastic	PLM	None Detected	None Detected





International Asbestos  
Testing Laboratories

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Telephone: 856-231-9449 Fax: 856-231-9818

## CERTIFICATE OF ANALYSIS

**Client:** Coffey Geotechnics  
20 Meteor Drive  
Toronto, ON  
M9W 1A4

**Report Date:** 01/10/2011  
**Report No.:** 253129  
**Project:** TTC Station: Sheppard  
**Project No.:** EE06703AC

## BULK SAMPLE ANALYSIS SUMMARY

Project #	Sample #	Lab #	Location	Description	Method	% Asbestos	Asbestos Type
EE06703AC	YUS-SO3-AS15-A	4436587	51P-322	Grey Fire Stop	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS15-B	4436588	51P-322	Grey Fire Stop	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS15-C	4436589	51P-322	Grey Fire Stop	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS16-A	4436590	Concourse- Transfer Machines	Black Caulking	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS16-B	4436591	Concourse- Transfer Machines	Black Caulking	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS16-C	4436592	Concourse- Transfer Machines	Black Caulking	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS17-A	4436593	51P-304	Tan Cementitious Over Spray	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS17-B	4436594	51P-304	Tan Cementitious Over Spray	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS17-C	4436595	51P-304	Tan Cementitious Over Spray	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS18-A	4436596	51P-304	Grey Cementitious Over Spray	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS18-B	4436597	51P-304	Grey Cementitious Over Spray	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS18-C	4436598	51P-304	Grey Cementitious Over Spray	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS19A	4436608	21Y-18	Tan Parging Cement	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS19B	4436609	21Y-18	Tan Parging Cement	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS19C	4436610	21Y-18	Tan Parging Cement	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS20-A	4436599	21Y-21	Dark Grey Firestop	PLM	10	Chrysotile
EE06703AC	YUS-SO3-AS20-B	4436600	21Y-21	Dark Grey Firestop	PLM	*	Sample Not Analyzed



International Asbestos

9000 Commerce Parkway Suite B Mt. Laurel, NJ 08054

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**CERTIFICATE OF ANALYSIS**

---

**Client:** Coffey Geotechnics  
20 Meteor Drive  
Toronto, ON  
M9W 1A4

**Report Date:** 01/10/2011  
**Report No.:** 253129  
**Project:** TTC Station: Sheppard  
**Project No.:** EE06703AC

---

**BULK SAMPLE ANALYSIS SUMMARY**

Project #	Sample #	Lab #	Location	Description	Method	% Asbestos	Asbestos Type
EE06703AC	YUS-SO3-AS20-C	4436601	21Y-21	Dark Grey Firestop	PLM	*	Sample Not Analyzed
EE06703AC	YUS-SO3-AS21-A	4436602	21Y-62	Grey Caulking	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS21-B	4436603	21Y-62	Grey Caulking	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS21-C	4436604	21Y-62	Grey Caulking	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS22-A	4436605	21Y-54	Brown Fibre Board	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS22-B	4436606	21Y-54	Brown Fibre Board	PLM	None Detected	None Detected
EE06703AC	YUS-SO3-AS22-C	4436607	21Y-54	Brown Fibre Board	PLM	None Detected	None Detected

TORONTO TRANSIT COMMISSION

# ASBESTOS SAMPLING

INDUSTRIAL FACILITY REQUIREMENTS –  
SHEPPARD SRB MOCK-UP

SEPTEMBER 2016

# ASBESTOS SAMPLING

## INDUSTRIAL FACILITY REQUIREMENTS – SHEPPARD SRB MOCK-UP

**Toronto Transit Commission**

### **Report Version 1.0**

Project n° : 161-04731-00-230.018

Date : September 2016

—  
**WSP Canada Inc.**  
51 Constellation Court  
Toronto, Ontario M9W 1K4

Phone: +1 416-798-0065

Fax: +1 416-798-0518

**[www.wspgroup.com](http://www.wspgroup.com)**



# 1 INTRODUCTION

WSP Canada Inc. (WSP) was retained by the Toronto Transit Commission (TTC) to collect representative samples of a suspected asbestos-containing/contaminated dust within a specified room as outlined by TTC drawings and TTC staff at TTC's Sheppard Station in Toronto, Ontario as part of the Industrial Facility Requirements – Sheppard SRB Mock-Up project.

An inspection of the proposed work area was conducted by WSP representative Ms. Erin Haatvedt on September 13, 2016. It is our understanding that contractors may disturb dust within the work area during planned renovations. As such, representative samples of dust within the work area were collected for asbestos.

## 2 ASBESTOS SAMPLING AND RESULTS

In accordance with O. Reg. 278/05, a total of five (5) samples were collected by WSP submitted for asbestos analysis. Asbestos samples were submitted to EMSL Analytical for analysis of bulk asbestos for Polarized Light Microscopy (PLM) Point Count. (analytical certificates are presented in **Appendix A**). EMSL is a participant in the National Voluntary Laboratory Accreditation Program (NVLAP) for bulk asbestos fibre analysis, Laboratory Code 200877-0. The method detection limit used in the analysis is <0.25% asbestos by dry weight. A summary of the analytical results from the recent representative sampling program is summarized in **Table 1** below. Sample locations are provided in **Drawing 1** attached.

**Table 1 Summary of Asbestos Sampling Results**

SAMPLE ID	LOCATION	SAMPLE DESCRIPTION	FRIABLE/ NON- FRIABLE	ASBESTOS CONTENT (%)
DS1-1	Sheppard Station – Platform Level	Dust	Friable	None Detected
DS1-2	Sheppard Station – Platform Level	Dust	Friable	None Detected
DS1-3	Sheppard Station – Platform Level	Dust	Friable	None Detected
DS1-4	Sheppard Station – Platform Level	Dust	Friable	None Detected
DS1-5	Sheppard Station – Platform Level	Dust	Friable	None Detected

**Table 1 Notes:** Method detection limit (MDL): <0.5%  
Description provided refers to colour and patterns observed on the surface of the material by the surveyors at the time of sampling, and should be used to identify the material in the work area. Laboratory colour descriptions on the Certificates of Analysis in some cases describe the cross-sectional colour of the material.

Based on the laboratory results, the dust samples collected and analysed are not considered to be asbestos-containing (defined as material that contains 0.5% or more asbestos by dry weight). Analytical results are provided in **Appendix A**. Sample locations are provided in **Drawing 1** attached.

### 3 LIMITATIONS

The data reported and the findings, observations and conclusions expressed in this letter report are limited by the Scope of Work as outlined by TTC. The Scope of Work was defined by the request of the client, the time and budgetary constraints imposed by the client, and availability of access to the work area.

For the purposes of renovation/demolition, suspect friable and non-friable construction materials discovered and not discussed in this report should be treated as asbestos until proven otherwise and other substances, self-evident as designated substances, should be handled in an appropriate fashion. If any potential asbestos-containing materials are encountered unexpectedly, a qualified person should be contacted to sample, monitor and/or document the removal of asbestos-containing materials, and to ensure that appropriate procedures are being followed.

We trust that the above is satisfactory for your purposes at this time. Please contact the undersigned should you have any questions or concerns.

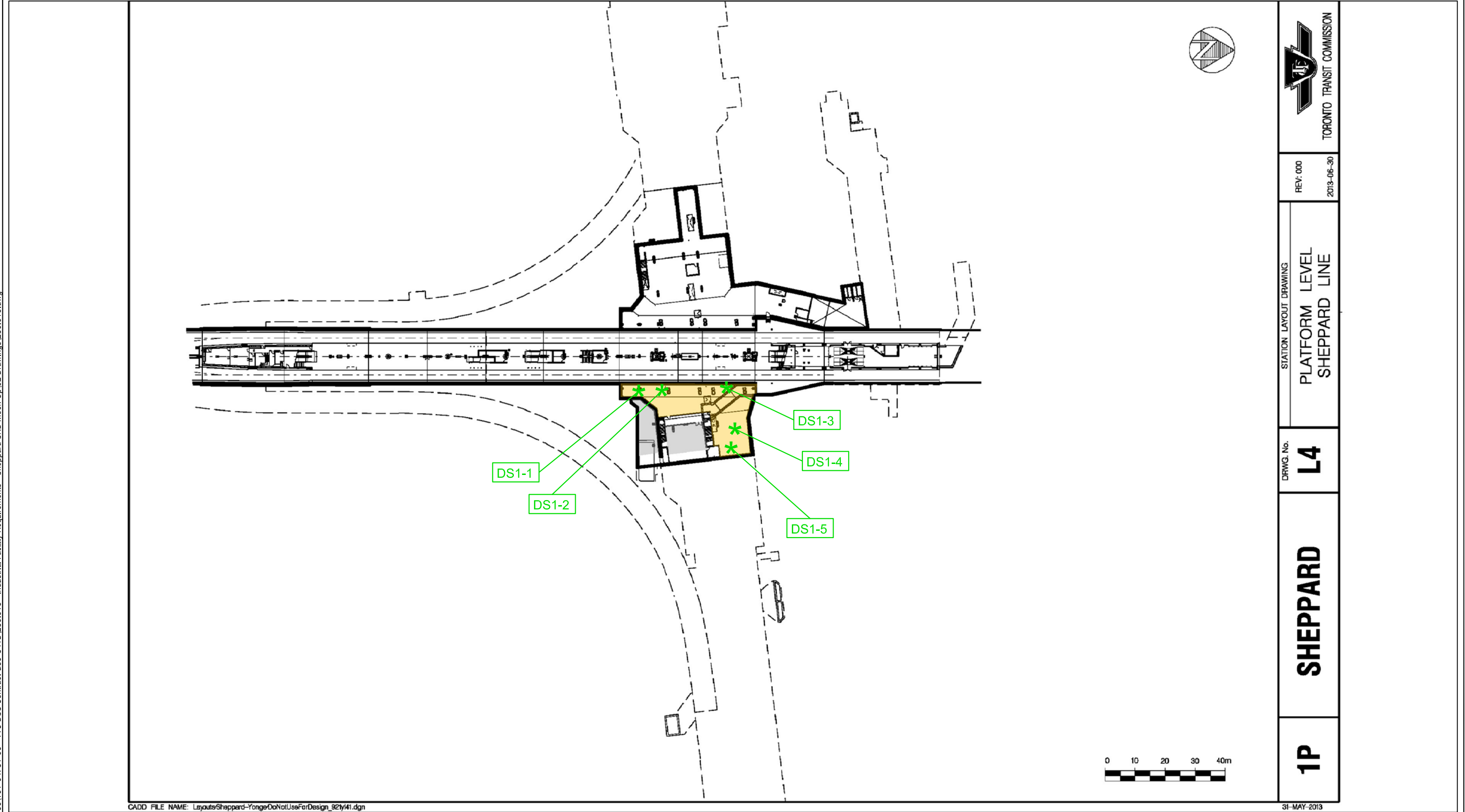
Very truly yours,  
**WSP CANADA INC.**



**Erin Haatvedt, CIH**  
**Project Manager, Environment**

# Drawings

T:\Environmental\000 161-04731-00 - TTC DSS Contract G85-341B\230.018 - Industrial Facility Requirements - Sheppard SRB Mock-Up\02 Drawings\230.018.dwg



CADD FILE NAME: Layouts\Sheppard-Yonge\DoNotUseForDesign\_921y141.dgn

31-MAY-2013

Legend:

\* Negative Asbestos Result

Notes:

1. This drawing must be read in conjunction with associated report.
2. Base drawing was provided to WSP by the client.
3. Asbestos-containing materials may be present in inaccessible spaces throughout the work area.

Client: TORONTO TRANSIT COMMISSION		Project No.: 161-04731-00-230.018	Drawing No.: 1
Drawn: SP	Approved: GW	Title: PLATFORM LEVEL	
Date: September 2016	Scale: As Shown	Project: ASBESTOS SAMPLING INDUSTRIAL FACILITY REQUIREMENTS - SHEPPARD SRB MOCK-UP	
Original Size: Tabloid	Rev: N/A		



# Appendix A

**ANALYTICAL RESULTS – ASBESTOS**



# EMSL Canada Inc.

2756 Slough Street Mississauga, ON L9T 5N4  
Phone/Fax: 289-997-4602 / (289) 997-4607  
<http://www.EMSL.com> / [torontolab@emsl.com](mailto:torontolab@emsl.com)

EMSL Canada Order 551609829  
Customer ID: 55SPLC25  
Customer PO: 161-04731-00  
Project ID: TTC Project - 161-0

**Attn:** Erin Haatvedt  
WSP Canada Inc.  
51 Constellation Court  
Toronto, ON M9W 1K4

**Phone:** (905) 856-0065  
**Fax:**  
**Collected:** 9/13/2016  
**Received:** 9/14/2016  
**Analyzed:** 9/14/2016

**Proj:** 161-04731-00-TTC SHEPPARD STATION (TTC Project - 161-04731-00)

## Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

**Client Sample ID:** DS1-1 **Lab Sample ID:** 551609829-0001

**Sample Description:** DUST SAMPLE 1

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	9/14/2016	Gray	35%	65%	None Detected	

**Client Sample ID:** DS1-2

**Lab Sample ID:** 551609829-0002

**Sample Description:** DUST SAMPLE 2

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	9/14/2016	Gray	25%	75%	None Detected	

**Client Sample ID:** DS1-3

**Lab Sample ID:** 551609829-0003

**Sample Description:** DUST SAMPLE 3

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	9/14/2016	Gray	20%	80%	None Detected	

**Client Sample ID:** DS1-4

**Lab Sample ID:** 551609829-0004

**Sample Description:** DUST SAMPLE 4

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	9/14/2016	Gray	25%	75%	None Detected	

**Client Sample ID:** DS1-5

**Lab Sample ID:** 551609829-0005

**Sample Description:** DUST SAMPLE 5

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	9/14/2016	Black	8%	92%	None Detected	



## EMSL Canada Inc.

2756 Slough Street Mississauga, ON L9T 5N4  
Phone/Fax: 289-997-4602 / (289) 997-4607  
<http://www.EMSL.com> / [torontolab@emsl.com](mailto:torontolab@emsl.com)

EMSL Canada Order 551609829  
Customer ID: 55SPLC25  
Customer PO: 161-04731-00  
Project ID: TTC Project - 161-0

### Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

---

#### Analyst(s):

Natalie D'Amico PLM (5)

#### Reviewed and approved by:

Matthew Davis  
or Other Approved Signatory

None Detected = <0.1%. EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. Samples received in good condition unless otherwise noted. This report must not be used to claim product endorsement by NVLAP of any agency of the U.S. Government.

Samples analyzed by EMSL Canada Inc. Mississauga, ON NVLAP Lab Code 200877-0

Initial report from: 09/14/2016 12:59:32

# APPENDIX

D

SITE PHOTOGRAPHS



### PHOTO NO. 1

#### DATE:

September 14, 2017

#### DESCRIPTION:

View of beige expansion joint caulking observed throughout the work area.

View of concrete block mortar observed throughout the work area.

#### SAMPLE

#### NUMBER(S):

AS1, AS2, PCB1

#### RESULT(S):

Non-asbestos-  
containing

Non-PCB-Containing



### PHOTO NO. 2

#### DATE:

September 14, 2017

#### DESCRIPTION:

View of grey firestop caulking observed around conduits throughout the work area.

#### SAMPLE

#### NUMBER(S):

AS3

#### RESULT(S):

Non-asbestos-  
containing





**PHOTO NO. 3**

**DATE:**

September 14, 2017

**DESCRIPTION:**

View of white compound over wallboard observed within Room 214 125.

**SAMPLE  
NUMBER(S):**

AS4

**RESULT(S):**

Non-asbestos-  
containing



**PHOTO NO. 4**

**DATE:**

September 14, 2017

**DESCRIPTION:**

View of white compound on walls observed within the stairs to the center platform.

View of yellow paint observed on stairwell railings.

**SAMPLE  
NUMBER(S):**

AS5, Pb4

**RESULT(S):**

Non-asbestos-  
containing  
No detectable  
concentrations of lead



**PHOTO NO. 5**

**DATE:**

September 14, 2017

**DESCRIPTION:**

View of red paint observed on sprinkler lines throughout the work area.

**SAMPLE**

**NUMBER(S):**

Pb1

**RESULT(S):**

No detectable concentrations of lead



**PHOTO NO. 6**

**DATE:**

September 14, 2017

**DESCRIPTION:**

View of blue paint on ductwork observed throughout the work area.

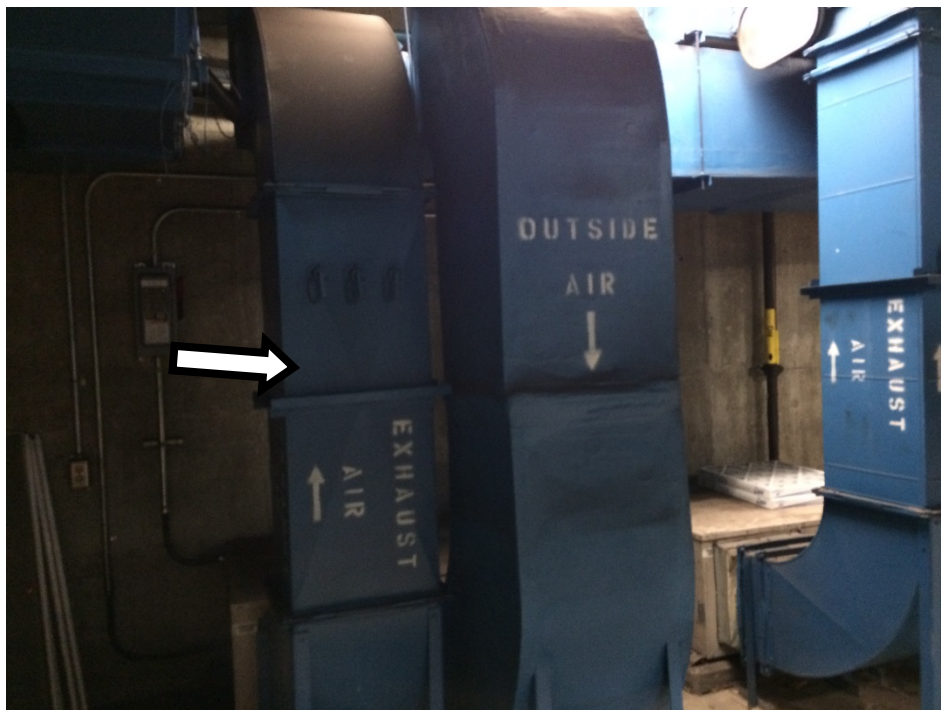
**SAMPLE**

**NUMBER(S):**

Pb2

**RESULT(S):**

No detectable concentrations of lead





**PHOTO NO. 7**

**DATE:**

September 14, 2017

**DESCRIPTION:**

View of inaccessible sprayed fireproofing observed on ceilings in various locations throughout the work area.

**SAMPLE**

**NUMBER(S):**

N/A

**RESULT(S):**

N/A – Inaccessible.  
Assumed to be  
**asbestos-containing**



**PHOTO NO. 8**

**DATE:**

October 2, 2017

**DESCRIPTION:**

View of inaccessible texture coat observed on ceilings within the stairwells of the work area.

**SAMPLE**

**NUMBER(S):**

N/A

**RESULT(S):**

N/A – Inaccessible.  
Assumed to be  
**asbestos-containing**





# APPENDIX

D

SITE PHOTOGRAPHS



**PHOTO NO. 1**

**DATE:**

January 19, 2018

**DESCRIPTION:**

View of grey expansion joint caulking and caulking around pipe/ floor conduits observed in various locations throughout the work area.

**SAMPLE**

**NUMBER(S):**

AS1, PCB1

**RESULT(S):**

Non-asbestos-  
containing

Non-PCB-containing



**PHOTO NO. 2**

**DATE:**

January 19, 2018

**DESCRIPTION:**

View of 2'x2' Ceiling tiles; textured with pinpricks, observed within Chelsea NY

**SAMPLE**

**NUMBER(S):**

AS2

**RESULT(S):**

Non-asbestos-  
containing



**PHOTO NO. 3**

**DATE:**

January 19, 2018

**DESCRIPTION:**

View of ceramic tile  
mortar observed  
outside of Chelsea NY

**SAMPLE  
NUMBER(S):**

AS3

**RESULT(S):**

Non-asbestos-  
containing



**PHOTO NO. 4**

**DATE:**

January 19, 2018

**DESCRIPTION:**

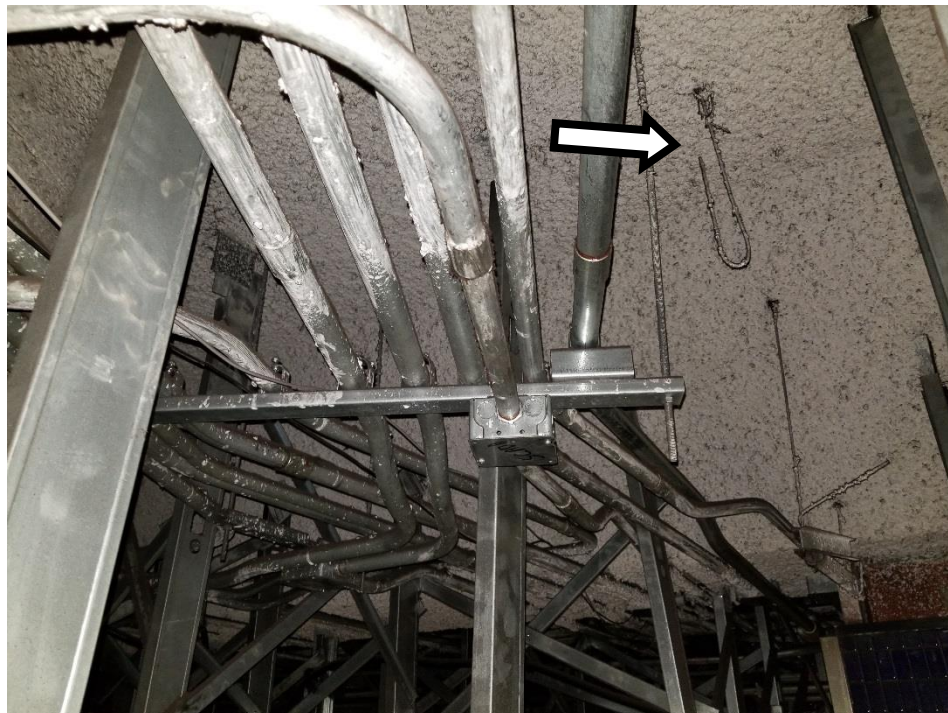
View of sprayed  
fireproofing observed  
above ceiling slats  
throughout the  
concourse level work  
area

**SAMPLE  
NUMBER(S):**

AS5

**RESULT(S):**

Non-asbestos-  
containing





**PHOTO NO. 5**

**DATE:**

January 19, 2018

**DESCRIPTION:**

View of grey duct sealant observed on ductwork throughout the work area.

**SAMPLE**

**NUMBER(S):**

AS7

**RESULT(S):**

Non-asbestos-containing



**PHOTO NO. 6**

**DATE:**

January 19, 2018

**DESCRIPTION:**

View of 2'x4' ceiling tiles; textured with pinpricks, and grout behind brown patterned ceramic tile observed within Collector's Ante Room.

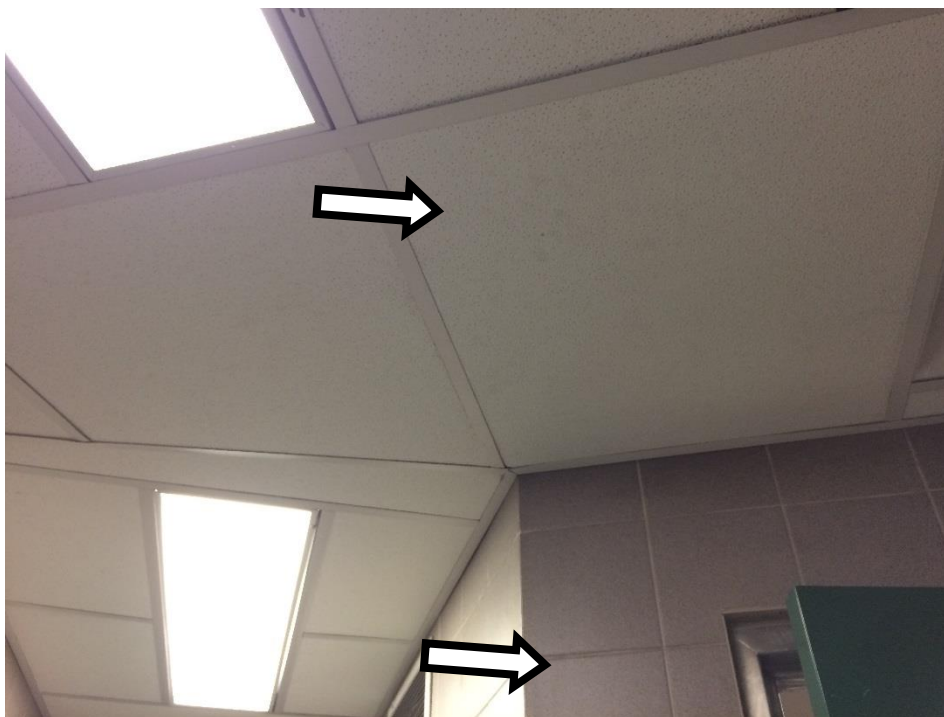
**SAMPLE**

**NUMBER(S):**

AS8, AS9

**RESULT(S):**

Non-asbestos-containing



**PHOTO NO. 7**

**DATE:**

January 19, 2018

**DESCRIPTION:**

View of red duct sealant observed on ductwork within the work area.

**SAMPLE  
NUMBER(S):**

AS10

**RESULT(S):**

Non-asbestos-  
containing



**PHOTO NO. 8**

**DATE:**

January 19, 2018

**DESCRIPTION:**

View of blue paint on ductwork within the work area.

**SAMPLE  
NUMBER(S):**

Pb1

**RESULT(S):**

No Detectable  
Concentrations of Lead





**PHOTO NO. 9**

**DATE:**

January 19, 2018

**DESCRIPTION:**

View of green paint on doors throughout the work area.

**SAMPLE**

**NUMBER(S):**

Pb1

**RESULT(S):**

No Detectable  
Concentrations of Lead



**PHOTO NO. 10**

**DATE:**

January 19, 2018

**DESCRIPTION:**

View of light blue, pink, and red paint observed on pipes throughout the work area.

View of brown paint observed on walls within Room 51P 321.

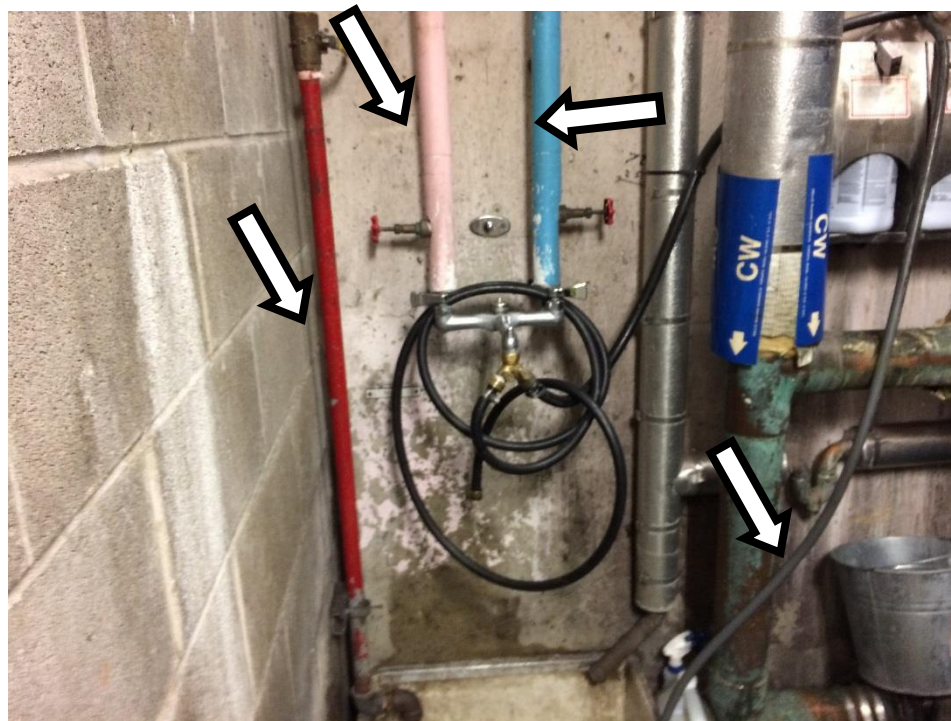
**SAMPLE**

**NUMBER(S):**

Pb3, Pb4, **Pb5** and Pb6

**RESULT(S):**

No Detectable  
Concentrations of Lead  
**Lead-Containing**  
**(0.0095%) Red Paint**



# **Appendix 2**

## **Submittal List**







**SH35-8 - Sheppard Station**  
**Station Manager's Office and Zone Hub**

Submittal No.	Rev.	Title		Date Rcvd	Date Sent	Date Rtrnd	Date Frwd	BIC (Auto)	Type	Reviewer	2nd Reviewer	Comments
<b>01-32-16</b>		<b>Schedule (BAR)</b>										
01-32-16-001		Contract Baseline Schedule	UNS						Schedule			
01-32-16-002		Monthly Contract Schedule Update	UNS						Schedule			
01-32-16-003		Two Week Look Ahead Schedule	UNS						Schedule			
<b>01-33-00</b>		<b>Submittals</b>										
01-33-00-001		None	UNS						N.A.			
<b>01-33-23</b>		<b>Shop Drawings</b>										
01-33-23-001		None	UNS						N.A.			
<b>01-40-00</b>		<b>Quality Requirements</b>										
01-40-00-001		Inspection and Testing Plan	UNS						Plan			
01-40-00-002		Inspection and Testing Records	UNS						Other			
01-40-00-003		Quality Plan	UNS						Plan			
<b>01-43-11</b>		<b>Key Contractor Personnel</b>										
01-43-11-001		Qualification of key contractor personnel	UNS						Other			
01-43-11-002		Construction Staging Traffic and Logistics Plan	UNS						Plan			
01-43-11-003		Disruption management documents and other notices and plans	UNS						Other			
01-43-11-004		Communications Plan	UNS						Plan			
<b>01-50-00</b>		<b>Construction Facilities, Temporary Controls and Utilities</b>										
01-50-00-001		Shop Drawings	UNS						Shop Drawings			
01-50-00-002		Compliance certificates	UNS						Certificate			
01-50-00-003		Record of temporary installation to remain	UNS						Other			
<b>01-57-19</b>		<b>Environmental Controls</b>										
01-57-19-001		Environmental Controls and Methods	UNS						Plan			
01-57-19-002		Contingency Plan	UNS						Plan			
01-57-19-003		Noise Management Pan	UNS						Plan			
01-57-19-004		Vibration Management Plan	UNS						Plan			
<b>01-59-00</b>		<b>Safety</b>										
01-59-00-001		Evidence of training qualifications for the Supervisor in Charge	UNS						Other			
01-59-00-002		Evaluation of Contractor's Health and Safety Policy and Program	UNS						Other			
01-59-00-003		Site Specific Safety Plan Guideline	UNS						Plan			
01-59-00-004		Site Specific Emergency Response and Evacuation Plan Guideline	UNS						Plan			
01-59-00-005		Emergency Response Planning for Construction Projects	UNS						Plan			
01-59-00-006		Site Specific Traffic Protection and Control Plan Guideline	UNS						Plan			
01-59-00-007		Site Specific Safety Orientation Package	UNS						Other			
01-59-00-008		Contractor Work Area Separation Plan	UNS						Plan			
01-59-00-009		Guideline/associated diagrams	UNS						Other			
01-59-00-010		Contractor Work Area Separation	UNS						Other			
01-59-00-011		Request for Construction Product Safety Data Sheet Evaluation	UNS						Other			
01-59-00-012		Copies of Notice of Project/updated Notices of Project/MOL Form 1000	UNS						Other			
01-59-00-013		Site Specific Worker Hearing Conservation Plan	UNS						Plan			
01-59-00-014		Compliance Plan for designated substance	UNS						Plan			
01-59-00-015		Asbestos Abatement Plan	UNS						Plan			
01-59-00-016		Dust Control Plan	UNS						Plan			
01-59-00-017		Emission Control Plan	UNS						Plan			
01-59-00-018		Info on Contractor Service and Utility Locate Notification/Verification	UNS						Other			
01-59-00-019		Contractor Access Request	UNS						Other			
01-59-00-020		Contractor Hot Work Permit request	UNS						Other			
01-59-00-021		Electrical Rooms/Signal Rooms/Comm Rooms/Subst/Tie Breaker Rooms access request	UNS						Other			
01-59-00-022		Job Safety Analysis/Safety Plan	UNS									
01-59-00-023		Documentation for Safety Professional training qualifications	UNS						Plan			
01-59-00-024		Safe Work Method, Job Safety Analysis or equivalent	UNS						Other			
01-59-00-025		Safety Plan for high Risk activities	UNS						Other			
01-59-00-026		Energy/system isolation request	UNS						Plan			
01-59-00-027		Energy/system restoration request	UNS						Other			
01-59-00-028		Copies of MOL Notice of Project	UNS						Other			
01-59-00-029		MOL Form 1000 filled	UNS						Other			
<b>01-71-00</b>		<b>Examination, Protection, and Restoration of Property</b>										
01-71-00-001		Condition survey report	UNS						Report			
01-71-00-002		Video record/CD with actual photographs	UNS						Other			
<b>01-73-29</b>		<b>Cutting and Remedial Work</b>										
01-73-29-001		Request for equipment relocation	UNS						Report			
01-73-29-002		Request for cutting steel/structural elements	UNS						Report			
01-73-29-003		Work proposal for cutting/remedial	UNS						Report			
01-73-29-004		SDS for all Products intended for use	UNS						Product Data			
01-73-29-005		As-Built drawings	UNS						As-Built			
<b>01-74-11</b>		<b>Cleaning</b>										
01-74-11-001		None	UNS						N.A.			
<b>01-74-19</b>		<b>Waste Management</b>										
01-74-19-001		Waste Management Plan	UNS						Plan			
01-74-19-002		Waste Tracking Record	UNS						Other			
<b>01-78-23</b>		<b>Operation and Maintenance Manuals</b>										
01-78-23-001		Draft O&M Manuals	UNS						Manual			
01-78-23-002		Final O&M Manuals	UNS						Manual			
<b>01-78-25</b>		<b>Maintenance</b>										
01-78-25-001		Maintenance Plan	UNS						Plan			
01-78-25-002		Closeout Maintenance Report	UNS						Report			
<b>01-78-39</b>		<b>As-Built Drawings</b>										
01-78-39-001		As-Built Drawings	UNS						Other			
<b>01-78-43</b>		<b>Special Tools and Extra Stock Materials</b>										
01-78-43-001		Special Tools and Extra Stock Materials	UNS						Other			
<b>01-79-00</b>		<b>Training</b>										
01-79-00-001		Training plan/course material/schedule Packages (refer to Spec. no.)	UNS						Plan			



**SH35-8 - Sheppard Station**  
**Station Manager's Office and Zone Hub**

Submittal No.	Rev.	Title		Date Rcvd	Date Sent	Date Rtrnd	Date Frwd	BIC (Auto)	Type	Reviewer	2nd Reviewer	Comments
<b>01-91-00</b>		<b>Commissioning</b>										
01-91-00-001		Commissioning Plan	UNS						Plan			
<b>02-41-23</b>		<b>Demolition and Removals</b>										
02-41-23-001		Shop Drawings	UNS						Shop Drawings			
02-41-23-002		Work Plan	UNS						Other			
02-41-23-003		Contract Baseline Schedule	UNS						Other			
02-41-23-004		Reports	UNS						Report			
02-41-23-005		Fire and Safety Safety Procedures	UNS						Other			
<b>03-10-00</b>		<b>Concrete Formwork and Falsework</b>										
03-10-00-001		Shop Drawings	UNS						Shop Drawings			
03-10-00-002		Inspection reports	UNS						Report			
<b>03-20-00</b>		<b>Concrete Reinforcement</b>										
03-20-00-001		Shop drawings	UNS						Shop Drawings			
03-20-00-002		Certified copies of mill test reports and chemical analysis	UNS						Report			
03-20-00-003		Epoxy coating applicator certificates	UNS						Certificate			
<b>03-30-00</b>		<b>Cast-In-Place Concrete</b>										
03-30-00-001		Shop Drawings	UNS						Shop Drawings			
03-30-00-002		Certificate of ready mixed concrete production facilities	UNS						Certificate			
03-30-00-003		Certificate for RMCAO Seal of Special Quality Concrete	UNS						Certificate			
03-30-00-004		Credentials of testing laboratory	UNS						Certificate			
03-30-00-005		Work plan	UNS						Plan			
03-30-00-006		Concrete Testing Program	UNS						Plan			
03-30-00-007		Mix design submission form	UNS						Report			
03-30-00-008		Mix design prequalification	UNS						Report			
03-30-00-009		Material data	UNS						Report			
03-30-00-010		Patching material specification	UNS						Report			
03-30-00-011		Results of on-going concrete tests	UNS						Report			
<b>04-20-00</b>		<b>Unit Masonry</b>										
04-20-00-001		Shop drawings	UNS						Shop Drawings			
04-20-00-002		Each type of brick, concrete block , Coloured mortar, Anchors, ties and flashings	UNS						Samples			
04-20-00-003		Installer's qualifications	UNS						Certificate			
04-20-00-004		Laboratory credentials	UNS						Certificate			
04-20-00-005		Manufacturer's certificate for material	UNS						Certificate			
04-20-00-006		Manufacturer's certificate for reinforcements	UNS						Certificate			
04-20-00-007		Field inspection reports and plant inspection reports	UNS						Report			
04-20-00-008		Work plan on material and equipment	UNS						Plan			
04-20-00-009		Pre-qualification, pre-construction and construction testing procedures	UNS						Plan			
04-20-00-010		Water penetration test	UNS						Report			
04-20-00-011		All test results from testing laboratory	UNS						Report			
04-20-00-012		P.Eng. confirmation for compliance	UNS						Report			
<b>05-12-00</b>		<b>Structural Steel</b>										
05-12-00-001		Shop drawings	UNS						Shop Drawings			
05-12-00-002		Mill test reports	UNS						Report			
05-12-00-003		Certifications for welding companies	UNS						Certificate			
05-12-00-004		P.Eng. confirmation for fabrication/erection	UNS						Certificate			
05-12-00-005		Field reports of shop and field inspections	UNS						Report			
<b>05-50-00</b>		<b>Metal Fabrications</b>										
05-50-00-001		Shop drawings	UNS						Shop Drawings			
05-50-00-002		Certification for welding companies	UNS						Certificate			
05-50-00-003		CWB certification letter	UNS						Certificate			
05-50-00-004		Shop and field inspections reports	UNS						Report			
05-50-00-005		P.Eng. confirmation for fabrication and erection compliance	UNS						Report			
<b>07-84-00</b>		<b>Firestopping and Smoke Seals</b>										
07-84-00-001		Shop drawings	UNS						Shop Drawings			
07-84-00-002		Qualifications of tech rep	UNS						Certificate			
07-84-00-003		Applicators Training letters	UNS						Certificate			
07-84-00-004		Engineering judgments	UNS						Certificate			
07-84-00-005		Letter of certification to ULC, C-UL or UL	UNS						Certificate			
<b>07-92-00</b>		<b>Sealants</b>										
07-92-00-001		Shop Drawings	UNS						Shop Drawings			
07-92-00-002		Pre-installation meeting reports	UNS						Report			
07-92-00-003		Field inspection and test reports	UNS						Report			
<b>08-11-19</b>		<b>Stainless Steel Doors and Frames</b>										
08-11-19-001		Shop drawings	UNS						Shop Drawings			
08-11-19-002		Laboratory test reports	UNS						Report			
<b>08-14-00</b>		<b>Wood Flush Doors</b>										
08-14-00-001		Shop drawings	UNS						Shop Drawings			
08-14-00-002		Certification of fire rating tests	UNS						Certificate			
08-14-00-003		Warranty information	UNS						Warranty			
<b>08-71-00</b>		<b>Finish Hardware</b>										
08-71-00-001		Shop Drawings	UNS						Shop Drawings			
08-71-00-002		ULC or WH-ETL certification	UNS						Certificate			
08-71-00-003		O&M Manual	UNS						Manual			
<b>08-81-00</b>		<b>Glazing</b>										
08-81-00-001		Shop drawings	UNS						Shop Drawings			
08-81-00-002		Each glazing type	UNS						Samples			
08-81-00-003		Certification for products compatibility	UNS						Certificate			
08-81-00-004		Proof of certification by IGMAC	UNS						Certificate			
08-81-00-005		IGMAC Certification numbers for products	UNS						Certificate			
08-81-00-006		Test results, statement, and test data for sealant	UNS						Report			
08-81-00-007		Verification test/analysis for each type of insulating glass unit	UNS						Report			
08-81-00-008		Shop inspection and testing for glass	UNS						Report			
08-81-00-009		Testing for values and performance levels	UNS						Report			
<b>09-29-00</b>		<b>Gypsum and Cement Board</b>										
09-29-00-001		Shop drawings	UNS						Shop Drawings			
09-29-00-002		Assembly certification for fire-resistance rated	UNS						Certificate			
09-29-00-003		Certification for suspended ceiling system design	UNS						Certificate			





**SH35-8 - Sheppard Station**  
**Station Manager's Office and Zone Hub**

Submittal No.	Rev.	Title		Date Rcvd	Date Sent	Date Rtrnd	Date Frwd	BIC (Auto)	Type	Reviewer	2nd Reviewer	Comments
<b>09-30-00</b>		<b>Tiling</b>										
09-30-00-001		Shop drawings	UNS						Shop Drawings			
09-30-00-002		Each type/class/finish/colour/texture/size/pattern	UNS						Samples			
09-30-00-003		Installers proof of membership	UNS						Certificate			
09-30-00-004		Certification of each floor tile type	UNS						Certificate			
09-30-00-005		O&M Manual	UNS						Manual			
<b>09-51-00</b>		<b>Acoustical Ceilings</b>										
09-51-00-001		Shop drawings	UNS						Shop Drawings			
09-51-00-002		Test results	UNS						Report			
<b>09-66-13</b>		<b>Portland Cement Terrazzo</b>										
09-66-13-001		Shop drawings	UNS						Shop Drawings			
09-66-13-002		Each colour terrazzo	UNS						Samples			
09-66-13-003		Each divider strip, screed, and weeping tube	UNS						Samples			
09-66-13-004		Full size sample panel	UNS						Samples			
09-66-13-005		TTMAC Maintenance Guide	UNS						Other			
<b>09-91-00</b>		<b>Painting</b>										
09-91-00-001		Shop Drawings	UNS						Shop Drawings			
09-91-00-002		Draw-down of each colour	UNS						Samples			
09-91-00-003		Certification of painters' 5 years experience	UNS						Certificate			
09-91-00-004		Certificate of workers' qualification with TQAA - ACA	UNS						Certificate			
09-91-00-005		Certified proof of 10 years work for Foreperson	UNS						Certificate			
09-91-00-006		Confirmation of materials compatibility	UNS						Certificate			
09-91-00-007		Certification of Work completion	UNS						Certificate			
09-91-00-008		Field inspection and test report results	UNS						Report			
09-91-00-009		Field quality control and test result reports	UNS						Report			
09-91-00-010		Manufacturer's specification for Electronic moisture meter	UNS						Report			
09-91-00-011		Record of latest meter calibration	UNS						Report			
09-91-00-012		O&M Manual	UNS						Manual			
<b>10-51-13</b>		<b>Lockers</b>										
10-51-13-001		Shop drawings	UNS						Shop Drawings			
<b>20-05-21</b>		<b>Pressure Gauges and Thermometers</b>										
20-05-21-001		Shop Drawings	UNS						Shop Drawings			
20-05-21-002		O&M Manual	UNS						Manual			
<b>20-05-29</b>		<b>Mechanical Hangers and Supports</b>										
20-05-29-001		Shop drawings	UNS						Shop Drawings			
20-05-29-002		Shop inspection and test reports	UNS						Report			
20-05-29-003		Manufacturer's field reports	UNS						Report			
20-05-29-004		Test Procedures	UNS						Manual			
20-05-29-005		Certificate of Readiness	UNS						Certificate			
20-05-29-006		Test Reports	UNS						Report			
20-05-29-007		Closeout Report	UNS						Report			
<b>20-05-48</b>		<b>Mechanical Vibration Control</b>										
20-05-48-001		Shop drawings	UNS						Shop Drawings			
20-05-48-002		Field testing reports	UNS						Report			
20-05-48-003		Manufacturer's certification	UNS						Certificate			
<b>20-05-53</b>		<b>Mechanical Identification</b>										
20-05-53-001		Shop drawings	UNS						Shop Drawings			
20-05-53-002		Sample of each product	UNS						Samples			
20-05-53-003		O&M Manual	UNS						Manual			
<b>21-13-00</b>		<b>Wet and Dry Pipe Sprinklers</b>										
21-13-00-001		Shop drawings	UNS						Shop Drawings			
21-13-00-002		Test Procedures	UNS						Manual			
21-13-00-003		Certificate of Readiness	UNS						Certificate			
21-13-00-004		Test Reports	UNS						Certificate			
21-13-00-005		Closeout Report	UNS						Report			
21-13-00-006		Contractor's material and test certificate	UNS						Report			
21-13-00-007		Monthly inspection and test reports	UNS						Report			
21-13-00-008		O&M Manual	UNS						Manual			
21-13-00-009		CADD files	UNS						Other			
21-13-00-010		Building Closeout Letter	UNS									
<b>21-25-00</b>		<b>Portable Fire Extinguishers</b>										
21-25-00-001		Shop drawings	UNS						Shop Drawings			
21-25-00-002		Inspection report	UNS						Report			
21-25-00-003		O&M Manual	UNS						Manual			
<b>22-07-19</b>		<b>Thermal Insulation for Piping</b>										
22-07-19-001		Shop drawings	UNS						Shop Drawings			
22-07-19-002		Trades' Master Insulator's Association	UNS						Certificate			
22-07-19-003		Trades' International Association	UNS						Certificate			
22-07-19-004		Tradesperson' International Association	UNS						Certificate			
22-07-19-005		O&M Manual	UNS						Manual			
22-07-19-006		Manufacturer's field inspection reports	UNS						Report			
22-07-19-007		Reviewed Shop Drawings	UNS						Shop Drawings			
22-07-19-008		Warranty information	UNS						Certificate			
<b>22-11-16</b>		<b>Domestic Water Piping</b>										
22-11-16-001		Shop drawings	UNS						Shop Drawings			
22-11-16-002		Design data and tests reports	UNS						Report			
22-11-16-003		Preliminary inspection test and reports	UNS						Report			
22-11-16-004		Final pressure test	UNS						Report			
22-11-16-005		Test Procedures	UNS						Manual			
22-11-16-006		Certificate of Readiness	UNS						Certificate			
22-11-16-007		Test Reports	UNS						Report			
22-11-16-008		Closeout Report	UNS						Report			
22-11-16-009		O&M Manual	UNS						Manual			
<b>22-16-16</b>		<b>Sanitary and Storm Drainage and Vent Piping</b>										
22-16-16-001		Shop Drawings	UNS						Shop Drawings			
22-16-16-002		Test Procedures	UNS						Manual			
22-16-16-003		Certificate of Readiness	UNS						Certificate			
22-16-16-004		Test Reports	UNS						Report			
22-16-16-005		Closeout Report	UNS						Report			
22-16-16-006		O&M Manual	UNS						Manual			
<b>22-42-00</b>		<b>Plumbing Fixtures and Specialties</b>										
22-42-00-001		Shop drawings	UNS						Shop Drawings			
22-42-00-002		Test Procedures	UNS						Manual			



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Submittal No.	Rev.	Title		Date Rcvd	Date Sent	Date Rtrnd	Date Frwd	BIC (Auto)	Type	Reviewer	2nd Reviewer	Comments
22-42-00-003		Certificate of Readiness	UNS						Certificate			
22-42-00-004		Test Reports	UNS						Report			
22-42-00-005		Closeout Report	UNS						Report			
22-42-00-006		O&M Manual	UNS						Manual			
<b>23-05-93</b>		<b>Testing, Adjusting and Balancing (TAB) of Mechanical Systems</b>										
23-05-93-001		Names of personnel proposed to perform TAB	UNS						Other			
23-05-93-002		Documentation for qualifications/successful experience	UNS						Other			
23-05-93-003		Proposed TAB methodology/procedure	UNS						Other			
23-05-93-004		List of instruments	UNS						Other			
23-05-93-005		Preliminary TAB report	UNS						Report			
23-05-93-006		TAB report	UNS						Report			
<b>23-07-13</b>		<b>Thermal Insulation for Ductwork</b>										
23-07-13-001		Shop drawings	UNS						Shop Drawings			
23-07-13-002		Mechanical Subcontractor's membership	UNS						Certificate			
23-07-13-003		Installers' membership	UNS						Certificate			
<b>23-23-00</b>		<b>Refrigerant Piping</b>										
23-23-00-001		Shop Drawings	UNS						Shop Drawings			
23-23-00-002		Ozone Depletion Cards	UNS						Report			
23-23-00-003		Brazing certification	UNS						Certificate			
23-23-00-004		Certificate of Qualification	UNS						Certificate			
23-23-00-005		TSSA Certificate of Authorization	UNS						Certificate			
23-23-00-006		Forms listed in TSSA Package	UNS						Report			
23-23-00-007		TSSA package requirements	UNS						Report			
23-23-00-008		O&M Manual	UNS						Manual			
<b>23-31-14</b>		<b>Ducts - Low Pressure</b>										
23-31-14-001		Shop drawings	UNS						Shop Drawings			
23-31-14-002		Field inspection and duct leakage test reports	UNS						Report			
23-31-14-003		O&M Manual	UNS						Manual			
<b>23-33-00</b>		<b>Duct Accessories</b>										
23-33-00-001		Shop drawings	UNS						Shop Drawings			
23-33-00-002		O&M Manual	UNS						Manual			
<b>23-33-13</b>		<b>Dampers</b>										
23-33-13-001		Shop drawings	UNS						Shop Drawings			
23-33-13-002		Test Procedures	UNS						Manual			
23-33-13-003		Certificate of Readiness	UNS						Certificate			
23-33-13-004		Test Reports	UNS						Report			
23-33-13-005		Closeout Report	UNS						Report			
23-33-13-006		O&M Manual	UNS						Manual			
<b>23-33-46</b>		<b>Flexible Ductwork</b>										
23-33-46-001		Shop Drawings	UNS						Shop Drawings			
23-33-46-002		O&M Manual	UNS						Manual			
<b>23-33-53</b>		<b>Acoustic Duct Lining</b>										
23-33-53-001		Shop Drawings	UNS						Shop Drawings			
23-33-53-002		Trades Certificates	UNS						Certificate			
23-33-53-003		Tradespersons Certificates	UNS						Certificate			
23-33-53-004		O&M Manual	UNS						Manual			
<b>23-37-13</b>		<b>Grilles, Registers, and Diffusers</b>										
23-37-13-001		Shop Drawings	UNS						Shop Drawings			
23-37-13-002		O&M Manual	UNS						Manual			
<b>26-05-00</b>		<b>Electrical General Requirements</b>										
26-05-00-001		None	UNS						N.A.			
<b>26-05-21</b>		<b>Wires and Cables 0 – 1000 V</b>										
26-05-21-001		Shop drawings	UNS						Shop Drawings			
26-05-21-002		Proof of 10 years manufacturer's experience	UNS						Certificate			
26-05-21-003		Alternative cable routing information	UNS						Report			
26-05-21-004		Letter from MI cables manufacturer	UNS						Certificate			
26-05-21-005		Letter from MC cables manufacturer	UNS						Certificate			
26-05-21-006		Test Procedures	UNS						Manual			
26-05-21-007		Certificate of Readiness	UNS						Certificate			
26-05-21-008		Test Reports	UNS						Report			
26-05-21-009		Closeout Report	UNS						Report			
<b>26-05-26</b>		<b>Grounding and Bonding</b>										
26-05-26-001		Shop drawings	UNS						Shop Drawings			
26-05-26-002		Test results continuity/resistance	UNS						Report			
26-05-26-003		Test results of lighting protective system	UNS						Report			
26-05-26-004		Test Procedures	UNS						Manual			
26-05-26-005		Certificate of Readiness	UNS						Certificate			
26-05-26-006		Test Reports	UNS						Report			
26-05-26-007		Closeout Report	UNS						Report			
26-05-26-008		O&M Manual	UNS						Manual			
<b>26-05-29</b>		<b>Hangers and Supports</b>										
26-05-29-001		Shop Drawings	UNS						Shop Drawings			
<b>26-05-31</b>		<b>Splitters, Junction Boxes, Pullboxes and Cabinets</b>										
26-05-31-001		Shop drawings	UNS						Shop Drawings			
<b>26-05-34</b>		<b>Conduits</b>										
26-05-34-001		Shop drawings	UNS						Shop Drawings			
26-05-34-002		Report results per Section 26 08 00	UNS						Report			
26-05-34-003		Test Procedures	UNS						Manual			
26-05-34-004		Certificate of Readiness	UNS						Certificate			
26-05-34-005		Test Reports	UNS						Report			
26-05-34-006		Closeout Report	UNS						Report			
<b>26-05-53</b>		<b>Electrical Identification</b>										
26-05-53-001		Shop drawings	UNS						Shop Drawings			
<b>26-08-00</b>		<b>Electrical Testing</b>										
26-08-00-001		None	UNS						N.A.			
<b>26-24-16</b>		<b>Panelboard</b>										
26-24-16-001		Shop drawings	UNS						Shop Drawings			
26-24-16-002		Test Procedures	UNS						Manual			
26-24-16-003		Certificate of Readiness	UNS						Certificate			
26-24-16-004		Test Reports	UNS						Report			
26-24-16-005		Closeout Report	UNS						Report			
26-24-16-006		O&M Manual	UNS						Manual			
<b>26-27-26</b>		<b>Wiring Devices</b>										
26-27-26-001		Manufacturer's product data	UNS						Shop Drawings			





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Submittal No.	Rev.	Title		Date Rcvd	Date Sent	Date Rtrnd	Date Frwd	BIC (Auto)	Type	Reviewer	2nd Reviewer	Comments
<b>26-50-00</b>		<b>Lighting Equipment</b>										
26-50-00-001		Shop drawings	UNS						Shop Drawings			
26-50-00-002		Test Procedures	UNS						Manual			
26-50-00-003		Certificate of Readiness	UNS						Certificate			
26-50-00-004		Test Reports	UNS						Report			
26-50-00-005		Closeout Report	UNS						Report			
26-50-00-006		O&M Manual	UNS						Manual			
<b>27-08-00</b>		<b>Communication Equipment Testing</b>										
27-08-00-001		Test Plan	UNS						Plan			
27-08-00-002		Test procedures	UNS						Plan			
27-08-00-003		PLC templates	UNS						Plan			
27-08-00-004		Various Schedules	UNS						Plan			
27-08-00-005		Test procedures for installation checks	UNS						Plan			
27-08-00-006		Certificates and factory test reports	UNS						Report			
27-08-00-007		Complete test procedures	UNS						Report			
27-08-00-008		Regulatory authorities' permits	UNS						Certificate			
27-08-00-009		Electrical and mechanical test sheets	UNS						Report			
27-08-00-010		Test reports for each system	UNS						Report			
27-08-00-011		Shop drawings	UNS						Shop drawings			
<b>27-11-16</b>		<b>Communications Cabinets</b>										
27-11-16-001		Shop drawings	UNS						Shop Drawings			
27-11-16-002		O&M Manual	UNS						Manual			
<b>27-13-11</b>		<b>Communications Wires and Cables</b>										
27-13-11-001		Shop drawings	UNS						Shop Drawings			
27-13-11-002		Test Results per Section 26 08 00	UNS						Report			
<b>27-31-00</b>		<b>Telephone Service</b>										
27-31-00-001		Manufacturer's product data	UNS						Shop Drawings			
27-31-00-002		O&M Manual	UNS						Manual			
<b>27-51-16</b>		<b>Public Address System</b>										
27-51-16-001		Shop drawings	UNS						Shop Drawings			
27-51-16-002		O&M Manual	UNS						Manual			
<b>28-23-23</b>		<b>Closed Circuit Television System (CCTV)</b>										
28-23-23-001		Shop drawings	UNS						Shop Drawings			
28-23-23-002		Test Procedures	UNS						Manual			
28-23-23-003		Certificate of Readiness	UNS						Certificate			
28-23-23-004		Test Reports	UNS						Report			
28-23-23-005		Closeout Report	UNS						Report			
28-23-23-006		O&M Manual	UNS						Manual			
<b>28-26-00</b>		<b>Security Equipment</b>										
28-26-00-001		Shop drawings	UNS						Shop drawings			
<b>28-31-00</b>		<b>Fire Alarm Systems</b>										
28-31-00-001		Shop drawings	UNS						Shop Drawings			
28-31-00-002		Testing/inspection/verification reports	UNS						Report			
28-31-00-003		Integration testing plan and report	UNS						Report			
28-31-00-004		Verification Certificate	UNS						Certificate			
28-31-00-005		Test Procedures	UNS						Manual			
28-31-00-006		Certificate of Readiness	UNS						Certificate			
28-31-00-007		Test Reports	UNS						Report			
28-31-00-008		Closeout Report	UNS						Report			
28-31-00-009		O&M Manual	UNS						Manual			

