CITY OF BRAMPTON FIRE STATION #201

27 RUTHERFORD ROAD SOUTH, BRAMPTON, ONTARIO

salter pilon architecture inc.

Project Manual

Volume 1
Divisions 0-33

Project Number: 20019
Date of Issue: September 2021
Issued for Tender

Read Jones Christoffersen Limited
Structural Consultants

Quasar Consulting Group
Mechanical Consultants

Quasar Consulting Group
Electrical Consultants

MTE Consultants Inc
Civil Consultants

Hill Design Studio Inc
Landscape Consultants

ARCHITECTURAL SUBCONSULTANT'S SEAL

CIVIL SUBCONSULTANT'S SEAL

LANDSCAPE SUBCONSULTANT'S SEAL

STRUCTURAL SUBCONSULTANT'S SEAL

MECHANICAL & ELECTRICAL SUBCONSULTANT'S SEAL

DIVISION 06 WOOD, PLASTICS AND COMPOSITES

DIVISION 07 THERMAL AND MOISTURE PROTECTION

DIVISION 08 DOORS AND OPENINGS

DIVISION 09 FINISHES

DIVISION 10 SPECIALTIES

DIVISION 12 FURNISHINGS

DIVISION 20 MECHANICAL

DIVISION 21 FIRE SUPPRESSION

DIVISION 22 PLUMBING

DIVISION 23 HVAC

DIVISION 25 INTEGRATED AUTOMATION

DIVISION 26 ELECTRICAL

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END OF SECTION

1 GENERAL

.1 Information on existing conditions made available to bidders under this section, is included in the Bid Documents for information purposes only, and does not form part of the Contract Documents.

.2 The Owner and Consultant assume no responsibility for the scope and accuracy of the information contained in the documents listed herein.

.3 The Contractor shall be responsible for conducting an on-site evaluation of conditions which can be observed and for correlation of these conditions with the information included under this section.

.4 Information contained in documents listed here may be used by the Contractor to assist in an assessment of existing conditions. Evaluation of the information shall remain the responsibility of the Contractor.

2 GEOTECHNICAL REPORT

.1 Refer to specification Section 02 32 00 – Geotechnical Information.

END OF SECTION

1 SUMMARY OF WORK

.1 The project consists of the construction of a new one (1) storey fire station at 27 Rutherfor Road South, Brampton, Ontario.

.2 Work by Owner comprises the following:

.1 Installation of Owner equipment and furnishings.

2 WORK RESTRICTIONS

.1 Contractor's Use Of Site

.1 Use of site to the areas designated on the drawings for execution of the Work. Do not unreasonably encumber site with materials or equipment. Move stored products or equipment which interfere with operations of Owner, or other contractors. Obtain and pay for use of off-site additional storage, or work areas as required by the Work.

.2 Hours of Work

.1 Hours of work for this Contract are generally confined to regular daily business hours of 8am to 5pm, Monday to Friday. Where required by sequencing of the Work, portions of the Work may be required to be performed outside of regular daily business hours, or on weekends, but shall be performed at such times at no additional cost to the Owner.

.3 OFF SITE WORK

.1 All work beyond property lines, adjacent to the site, or beyond Extent of Contract (EOC) line is included in Contract unless noted otherwise.

END OF SECTION

1 GENERAL

.1 Include all allowances listed below in the Bid Price.

.2 Expend Cash Allowances as directed by the Consultant.

.3 Each Cash Allowance will be adjusted to actual cost as defined hereunder and Contract Price will be amended accordingly by written order.

.4 Progress payments for work and material authorized under Cash Allowances will be made in accordance with GC 5.3 of the Contract.

.5 Where costs under a cash allowance exceed amount of allowance, Contractor will be compensated for excess incurred and substantiated plus allowance for overhead and profit as set out in Contract Documents.

.6 Include progress payments on accounts of Work authorized under cash allowances in Consultant's monthly certificate for payment.

.7 Prepare schedule jointly with Consultant and Contractor to show when items called for under cash allowances must be authorized by Consultant for ordering purposes so that progress of Work will not be delayed.

.8 Cash allowances do not include H.S.T.

2 MATERIAL ALLOWANCES (SUPPLY ONLY)

.1 Material cash allowance shall include and provide payment for:
- .1 Net cost of material.
- .2 Applicable duties and taxes.
- .3 Delivery to the Place of the Work.

.2 Include in the Bid Price, in addition to the material cash allowance, costs for the following:
- .1 Handling at the Place of the Work, including unloading, uncrating, storage and hoisting.
- .2 Protection from damage by elements or otherwise.
- .3 Labour for installation and finishing.
- .4 Other expenses required to complete installation.
- .5 Overhead and profit.

3 ASSEMBLY ALLOWANCES (SUPPLY AND INSTALL)

.1 Assembly cash allowance shall include and provide payment for:
- .1 Net cost of material.
- .2 Applicable duties and taxes.
- .3 Delivery to the Place of the Work.
- .4 Assembly contractors'/suppliers' only, expenses relating to the following:
  - .1 Handling at site, including unloading, uncrating, storage and hoisting.
  - .2 Protection from damage by elements or otherwise.
  - .3 Labour installation and finishing.
  - .4 Other expenses required to complete installation.
  - .5 Overhead and profit.

.2 Include in the Bid Price any overhead and profit or related General Contractor costs.

4 TESTING & LABORATORY SERVICES

.1 Testing & Laboratory Services allowances shall include and provide payment for:

.1 Transportation costs to and from the Place of the Work,
.2 Personnel & equipment required to perform tests or inspections,
.3 Costs of shipping & handling samples to laboratory for testing,
.4 Applicable duties and taxes.

5 ALLOWANCE AMOUNTS

.1 The Total Cash Allowance to be included in the Stipulated Price is Three Hundred and Ninety-two Thousand and Five Hundred Dollars ($392,500) in Canadian funds.

.2 The Cash Allowance shall cover the following (in general):

.1 Inspection & Testing - for charges from independent company(s) to provide services related to all areas of the project that require inspection and testing.

.2 Pylon Sign - supply and installation of new exterior building signage. Note: conduit systems and provisions of power are supplied and installed as part of Division 26 - not changed against this Cash Allowance.

.3 Interior Signage - supply and installation of new interior building signage including all required room identification, way finding, department identification, etc.

.4 Finish Hardware – supply of all finish hardware for aluminum, wood, hollow metal doors and frames. Supply of finish hardware for aluminum doors installation by others.

.5 SCBA Compressor – Supply of equipment and installed outside of this Cash Allowance.

.6 Decommissioning of Monitoring wells.

.7 Communications Utility – supply and install of cabling and service. Note: The Electrical contractor shall be responsible for coordinating a serv ice agreement and all associated work with the communications company.

.8 Hydro Service Work – for charges from utility as required to provide new primary and portions of new secondary incoming electrical service.

.9 Natural Gas Utility – General Contractor to apply, obtain permit, complete testing and coordinate install.

.10 TRCA Permit Fees – General Contractor to apply and obtain permit with TRCA.

.11 Regional Service Permit Fees – General Contractor to apply and obtain permit with the Region of Peel.

.12 Water Utility –with the Region of Peel.

.13 Electrical Safety Authority – review of drawings and specifications by the ESA, refer to section 26 01 15 – Electrical Allowances and Fees. Electrical Note: General inspection fees are not to be part of this fee. The Contractors to determine general inspection fees and include in tender price.

END OF SECTION

1 MODIFICATIONS TO CONTRACT

.1 Supplemental Instruction: as issued by the Consultant, consistent with the intent of the Contract Documents, and will not involve an adjustment in Contract Price or Contract Time.

.2 Proposed Change: as issued by the Consultant, will notify the Contractor of an impending or proposed change to the Work, and will require submission of a quotation from the Contractor and all affected Subcontractors for each item noted. Submit quotation within the time period stipulated on the form, and indicate separate line items for labour and materials in each case. Work outlined in a Proposed Change must not proceed without the issuance of a Change Order signed by the Owner.

.3 Change Directive: will be issued by the Consultant where an immediate response is required to an on-site condition. This form will authorize the Contractor to proceed with the change, with the stipulation that accurate accounts of costs be recorded, and may contain an upset cost, as agreed upon by the Owner and the Contractor.

.4 Change Order: will be issued by the Consultant upon review and approval of quotations for a Proposed Change, or a Change Directive, and authorizes the Contractor to proceed with the change(s) proposed. A Change Order will amend the Contract Price, and/or the Contract Time.

2 FEES FOR CHANGES IN THE WORK

.1 The fees (mark-ups) permitted to be applied to the Contract Price for changes to the Work shall be in accordance with the Supplementary Conditions of the Contract (CCDC 2 - 2008) as provided.

.2 Fees (mark-ups) for Changes in the Work shall apply to all extras to the Contract Price in accordance with the Supplementary Conditions of the Contract (CCDC 2 - 2008) as provided.

.3 Fees (mark-ups) for Changes in the Work shall only apply to credits to the Contract Price in accordance with the Supplementary Conditions of the Contract (CCDC 2 - 2008) as provided.

END OF SECTION

1 APPLICATIONS FOR PAYMENT

.1 Applications for payment on account may be made monthly as the Work progresses, and shall be preceded by the submission of a Schedule of Values for review by the Consultant, in accordance with the Contract.

.2 The second and all subsequent applications for payment shall include a statement based on the Schedule of Values, a statutory declaration (CCDC 9A), and a standard Workers Compensation Certificate of Clearance.

2 SCHEDULE OF VALUES

.1 Submit Schedule of Values in spreadsheet form acceptable to the Consultant.

.2 Identify on each Schedule of Values, the following information:

.1 Date of Issue
.2 Project name
.3 Owner's name
.4 Contractor's name
.5 Payment period
.6 Payment certificate number

.3 Items of work listed shall include, but not be limited to, separate line items for the following:

.1 General Accounts
.2 Mobilization
.3 Supervision
.4 Bonds and Insurance
.5 Permits and Licenses
.6 Operations and Maintenance Manuals/As-Built Drawings
.7 All trades or portions of the Work, generally in chronological order
.8 Provision of other Products and/or services
.9 Cash Allowance expenditures
.10 Changes in the Work

.4 The total Contract amount for each trade or portion of the Work shall be listed beside each item.

.5 The Values of the Work shall be listed as to the aggregate percentage and dollar value completed, under the following major headings:

.1 Initial Contract Amounts for each line item,
.2 Progress to Date,
.3 Percent Complete,
.4 Current Invoice,
.5 Previous Billings,
.6 Contract Balance

.6 Work shall be subtotaled under original Contract amounts, Cash Allowance expenditures, and Changes to the Work.

.7 Final totals shall identify:
- .1 Total amount
- .2 Holdback deducted
- .3 Holdback released
- .4 Amount invoiced to date
- .5 Net amount
- .6 HST
- .7 Amount due this Certificate

END OF SECTION

1 PROJECT MANAGEMENT & COORDINATION

.1 Project Coordination

.1 The Contractor is responsible for the overall coordination of the Work. Coordinate the work of all subcontractors, and provide such assistance as is necessary, including but not limited to;

.1 Providing site dimensions and layout,

.2 Providing temporary facilities and controls,

.3 Scheduling subcontractors work to prevent conflicts,

.4 Scheduling and administering regular subtrade scheduling and coordination meetings throughout progress of the Work.

.5 Scheduling and administering regular subtrade safety meetings throughout progress of the Work.

.6 Coordinate construction sequences an schedules including all components of the Work, including all Divisions with interdependent responsibilities.

.2 The Contractor shall facilitate production of interference drawings where necessary for coordination of the Work. Provide such interference drawings to the Consultant for review.

.2 Project Supervision

.1 The Contractor shall provide and maintain full-time supervision on site until Substantial Performance is achieved and the deficiencies have been completed or otherwise agreed with the Owner. The supervisor shall be responsible for the overall day-to-day coordination on site between subtrades.

.2 The supervisor shall coordinate the work of all subcontractors, and provide such assistance as is necessary, including but not limited to;

.1 Layout,

.2 Rough carpentry work for blocking, strapping, nailers, etc.

.3 Project Meetings

.1 Attend all regular bi-weekly project progress meetings throughout progress of work.

.2 Consultant shall chair regular bi-weekly project progress meetings and shall record and distribute same to Owner, Contractor and Subconsultants. Contractor shall forward to appropriate subcontractors.

.4 Project Site Administration

.1 Maintain at job site, one copy each of the following:

.1 Contract drawings.

.2 Project manual.

.3 Addenda and Bid Revisions.

.4 Reviewed shop drawings.

.5 Change orders and other Contract modifications.

.6 Field test and inspection reports.

.7 Approved schedules.

.8 Manufacturer's installation and application instructions.

2 SCHEDULES

.1 Construction Progress Schedule.

.1 Prepare schedule in horizontal chart form, with weekly horizontal time scale identifying first/last work day of each week. Schedule must utilize "crtical path" method.

.2 Indicate separate line for each trade or operation of the Work. Arrange trades in chronological order for commencement of that part of the Work.

.3 Identify projected major milestones in the course of the Work such as completion of foundation work, structure, closing in, major inspections by building officials, Substantial Performance, etc.

.2 Submittal Schedule

.1 Provide schedule for submittal of all Shop Drawings, Product Data and Samples.

.2 Provide complete list of all manufacturered products to be used in the course of the Work, including those amended by addenda.

.3 Submission of Schedules

.1 Submit one copy of each schedule to the Consultant for review, prior to first progress billing. Amend schedule as required.

.2 Submit 4 copies of each subsequent issue of schedules to the Consultant.

.3 Update schedule on a regular basis or as requested by the Consultant.

3 ELECTRONIC FILE AGREEMENT

.1 Electronic files for this project will not be released until the Electronic Files Transfer Agreement, appended to this Section, has been completed and returned to the Consultant.

4 ADDITIONAL DOCUMENTS

.1 Consultant may issue additional documents in the form of drawings, specifications, schedules, or written instructions to assist proper execution of the Work. These documents shall take one of the following forms as defined in the Contract;

.1 Supplemental Instruction: no adjustment in Contract Price or Contract Time.

.2 Change Order: amendment to the Contract recommended by the Consultant, and agreed upon by the Owner and the Contractor.

5 SUBMITTAL PROCEDURES

.1 Submit to Consultant, all items specified for review, with reasonable promptness and in orderly sequence so as to not cause delay in the Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.

.2 The Contractor shall schedule a minimum of 10 working days in order for the Consultants to review each submission. This shall also apply to subsequent resubmissions.

.3 Do not proceed with work affected by the submittal until review is complete.

.4 Review all submittals prior to submission to the Consultant. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with the requirements of the Work and the Contract Documents. Submittals not stamped, signed, and dated will be returned without review.

.5 Verify field measurements and affected adjacent work are coordinated.

.6 Contractor's responsibility for errors and omissions in submission, or deviations from requirements of Contract Documents, is not relieved by Consultant's review of submittals.

.7 Keep one reviewed copy of each submission on site.

.8 Shop Drawings

.1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by the Contractor to illustrate details of a portion of the Work.

.2 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of the Section under which the adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.3 Adjustments made on shop drawings by the Consultant are not intended to change the Contract Price. If adjustments affect the value of Work, state such in writing to the Consultant prior to proceeding with the Work.

.4 Make changes in shop drawings as the Consultant may require, consistent with Contract Documents. When resubmitting, notify the Consultant in writing of any revisions other than those requested.

.5 Shop drawings shall be submitted electronically wherever possible. Files shall be in PDF format only.

.6 Shop drawings submitted by FAX, or as copies of FAX transmissions are not acceptable as shop drawings, and will not be reviewed.

.7 Reproductions of Consultants' drawings are not acceptable for the purpose of creating Shop Drawings. Any drawings submitted for review which contain drawings or any parts of drawings produced by the Consultant, will be rejected. The Consultant will not take responsibility for any resulting delays in construction as a result of the above.

.8 Shop drawings not submitted in the scale type of the contract documents (ie. metric for metric drawings) will not be reviewed.

.9 Product Data Sheets

.1 Manufacturer's standard schematics, catalogue sheets, diagrams, schedules, performance charts, illustrations and other descriptive data are acceptable in lieu of shop drawings, where specified.

.2 Product Data Sheets are acceptable provided they conform to the following:

.1 Information not applicable to project has been deleted.
.2 Supplement standard information to provide additional information applicable to project.
.3 Show dimensions and clearances required.
.4 Show performance characteristics and capacities.
.5 Show wiring diagrams, when requested, and controls.

.3 Submit product data sheets or brochures for requirements requested in specification Sections and as the Consultant may reasonably request where shop drawings will not be prepared due to standardized manufacture of product.

.4 Submit copies of all WHMIS Data Sheets.

.5 Submit 8 copies of Product Data Sheets.

.6 Product data sheets submitted by FAX, or as copies of FAX transmissions will not be accepted.

.10 Return of Submissions

.1 If upon review by the Consultant, no errors or omissions are discovered or if only minor corrections are made, the shop drawing transparency or one copy of the product data will be returned and fabrication and installation of Work may proceed.

.2 If shop drawings or data sheets are rejected, noted copy will be returned and resubmission of corrected shop drawings or data sheets through the same procedure indicated above, shall be performed before fabrication and installation of Work may proceed.

.11 Samples

.1 Submit samples for review, in duplicate, in sizes requested in respective specification sections. Label samples as to origin and intended use in the Work.

.2 Where colour, pattern or texture is criteria, submit full range of samples.

.3 Deliver samples prepaid to Consultant's office.

.4 Notify the Consultant in writing, at the time of submission of deviations in samples from requirements of Contract Documents.

.5 Adjustments made on samples by the Consultant are not intended to change the Contract Price. If adjustments affect the value of Work, state such in writing to the Consultant prior to proceeding with the work.

.6 Make changes in samples which the Consultant may require, consistent with Contract Documents.

.7 Reviewed samples or mock-ups will become standards of workmanship and material against which installed work will be checked on project.

.12 Submission Requirements

.1 Accompany submissions with transmittal letter containing:

.1 Date,
.2 Project title and number,
.3 Contractor's name and address,
.4 Drawing/page numbers of each shop drawing or data sheet,
.5 Identification (ie. "Structural Steel Shop Dwgs."), and
.6 Number of copies submitted.

.2 Submissions shall include (where applicable) :

.1 Date and revision date,
.2 Project title and number,
.3 Name of Contractor, Subcontractor(s), Supplier/Manufacturer,
.4 Identification of product or material,
.5 Relation to adjacent structure or materials,
.6 Field dimensions, clearly identified as such,
.7 Reference standards (CSA, CGSB, ASTM, etc.), and
.8 Contractor's stamp, initialled or signed, certifying review of submission, and verification of field measurements.

.13 Distribution of Submittals after Review

.1 Distribute copies of shop drawings and product data which carry Consultant's stamp as follows (where applcable):

.1 Job site file (Record documents),
.2 General Contractor’s office,
.3 Subcontractors, and
.4 Suppliers or Fabricators.

END OF SECTION

Electronic Files Transfer Agreement

Architect of Record ("The Consultant"): salter pilon architecture inc.

Contractor ("The Contractor"): _____

Re ("The Owner"): City of Brampton Fire Station #201

The Contractor hereby acknowledges requesting from the Consultant, electronic data containing the graphic (electronic) representation of the Architectural Drawings *as per attached list of drawings*, subject to the condition that the said drawings are to be used only for information and reference in connection with the Owner's use and occupancy of the Project. The Contractor shall be responsible for checking and verifying all dimensions, details, and quantities of materials, and for the coordination of related elements as required to facilitate complete and accurate fabrication and installation. Any omissions or discrepancies shall be reported to the Consultant. The Contractor hereby warrants to the Consultant that the files will be used solely for the development of shop drawings. The drawings shall not be used for any other purpose on this project and shall not be used on any other project either by the Contractor or by others. The Contractor further warrants not to alter the electronic data or the information contained therein, in any way except for the above-noted purposes, and acknowledges that such unauthorized use or alteration of the original work is protected in accordance with the Copyright Act and subject to the penalties prescribed therein.

The Contractor hereby acknowledges that the said electronic data contain information which may be updated or altered at any time by the Consultant, and that it is the responsibility of the Contractor to make themselves aware of these changes, in a timely manner. In the event of a conflict between the drawings issued to the Contractor and the sealed contract drawings, the sealed contract drawings shall govern.

The Contractor agrees to pay the Consultant $200.00 per file, plus any and all applicable taxes. The fees are to cover the costs of preparation of the electronic data, and disbursements related to the preparation and shipment/forwarding of the electronic data only. By paying the fees, the Contractor has in no way purchased the drawings or any rights to the drawings or the information contained therein, and the Contractor may only alter the drawings for the purposes noted above.

The Contractor shall, to the fullest extent permitted by law, indemnify, defend and hold harmless the Consultant, and its sub-consultants from all claims, damages, losses, expenses, penalties and liabilities of any kind, including attorney's fees, arising out of, or resulting from the use of the electronic files by the Contractor, or by third party recipients of the electronic files from the Contractor.

The Consultant believes that no licensing or copyright fees are due to others on account of the transfer of the electronic files, but to the extent any are, the Contractor will pay the appropriate fees and hold the Consultant harmless from such claims.

Any purchase order number provided by the Contractor is for Contractor's accounting purposes only. Purchase order terms and conditions are void and are not a part of this agreement.

The laws of the Province of Ontario shall govern this agreement.

The conditions and undertakings expressed herein apply to partners, employees, agents, successors, assigns and legal or other representatives of the Contractor.

AUTHORIZED ACCEPTANCE

by Consultant

_____
Signature

_____
Print Name and Title

Date _____

by Contractor

_____
Signature

_____
Print Name and Title
(Authorized Signing Officer)

Date _____

1 GENERAL

.1 Provide construction photographs in accordance with procedures and submission requirements specified in this section.

.2 Photographs shall be taken using a digital camera.

2 PROGRESS PHOTOGRAPHS

.1 Provide 1 digital set of construction photographs, documenting progress of the Work. Submit one digital set with each monthly progress draw. Maintain one printed set on site, in clear plastic photo sleeves bound in 3-ring binder.

.2 Submit progress photographs with each monthly progress draw, and at the following milestones;

.1 Completion of excavation and pouring of footings,
.2 Completion of foundations prior to backfilling,
.3 Completion of structural frame,
.4 Completion of rough-in of mechanical and electrical services before concealment.
.5 Completion of each major portion of work
.6 Completion of each major finish item.

.3 Orientation of Photographs: provide photos from 4 general viewpoints, as well as specific views as required by milestones specified above, and as determined by Consultant prior to first Progress Draw.

3 FINAL PHOTOGRAPHS

.1 Submit site copy of printed progress photographs with Operations & Maintenance Manuals at the completion of the project.

.2 In addition to progress photographs, provide 1 digital set of images, and 2 printed sets, of final photographs of the completed project.

.3 Orientation of Photographs: provide final photos as follows:

.1 General viewpoints as defined above,
.2 Views of all exterior elevations,
.3 One view from each street,
.4 Views of site showing parking areas and play surfaces,
.5 Interior views of all major spaces,
.6 One set of views of a typical room,
.7 Specific views as determined by Consultant (Max. 48 views).

.4 Identification: Typewritten identification on 20 x 50mm white label on top left corner of all photographs indicating the following:

.1 Project name and number,
.2 Orientation,
.3 Date of exposure.

.5 Photo Print Finish: matte with binding margin at one long edge.

.6 Mounting & Binding: Final photos shall be mounted in clear plastic sleeves purpose-made for 3-ring binder storage. Bind sets individually into black, 3-ring binders, labelled on front and spine as follows:

PROJECT RECORD PHOTOGRAPHS
City of Brampton Fire Station #201
Completed to follow

END OF SECTION

1 GENERAL

1.1 SECTION INCLUDES
- .1 Requirements for quality of work.
- .2 Requirements for for material inspection and testing.
- .3 Requirements for determination of defective materials and work.

1.2 REFERENCE STANDARDS
- .1 CSA A23.1; Concrete Materials and Methods of Concrete Construction.
- .2 CSA A23.2; Methods of Test for Concrete.
- .3 CSA S16.1; Limit States Design of Steel Structures.
- .4 CSA W47.1; Certification of Companies for Fusion Welding of Steel Structures.
- .5 CSA W59; Welded Steel Construction (Metal Arc Welding).
- .6 CISC; Code of Standard Practice for Structural Steel.
- .7 OPSS; Ontario Provincial Standard Specifications.

1.3 REGULATORY REQUIREMENTS
- .1 Products and services provided to complete the Work shall meet or exceed requirements of specified standards, municipal by-laws, building codes and referenced documents.

1.4 INDEPENDENT INSPECTION AND TESTING
- .1 Independent Inspection and Testing Consultants will be engaged by the Owner for the purpose of inspecting and/or testing individual portions of the Work. The cost of such services will be paid by Cash Allowance.

1.5 RESPONSIBILITIES
- .1 Inspection and Testing Consultants
  - .1 Inspection and Testing Consultants shall;
    - .1 Provide inspection and testing specified,
    - .2 Inform the Contractor and Consultant immediately upon observance of materials, systems, or procedures not in compliance with the specifications, and
    - .3 Submit complete reports to the Contractor and the Consultant in a timely manner.

- .2 Contractor
  - .1 Contractor shall:
    - .1 Provide access to the Work for Inspection/Testing Consultants, and
    - .2 Inform the Inspection/Testing Consultants in advance of day and time required for inspection and tests.

  - .2 It is the responsibility of the General Contractor to ensure the quality control requirements of the Contract are implemented.

- .3 Consultant
  - .1 The Consultant will make final decisions on changes to the scope of work of inspection and testing that may affect the Contract Price.

.2 When informed of of any material procedure or test result that does not meet or exceed the specifications, the Consultant will respond in an expedient manner to resolve the issue.

1.6 ACCESS TO WORK

.1 Allow inspection & testing companies access to the Work, as well as off site manufacturing and fabrication plants.

1.7 REPORTS

.1 Submit three copies of inspection and test reports to the Consultant.

.2 Provide copies to Subcontractor of work being inspected or tested, manufacturer or fabricator of material being inspected or tested.

.3 Submit one copy of inspection and test reports to the Building Official having jurisdiction, where required by that official.

.4 The cost of tests beyond those called for in the Contract Documents or beyond those required by the law of the Place of Work shall be appraised by the Consultant and may be authorized as recoverable.

1.8 EARTHWORK

.1 All earthwork shall be subject to inspection and testing as specified herein. Inspection and Testing shall include:

.1 Inspection of excavations for foundations.
.2 Inspection of subgrade and granular fill materials.
.3 Inspection of backfill operations.
.4 Inspection and testing of backfill compaction.
.5 Inspection of trenching and bedding associated with underground services.
.6 Inspection and testing of fill and compaction associated with underground services.

1.9 CAST-IN-PLACE CONCRETE

.1 All cast-in-place concrete shall be subject to inspection and testing as specified herein. Inspection and Testing shall include:

.1 Verification of materials delivered to site.
.2 Slump tests.
.3 Sampling of cylinders, and compressive strength tests.

1.10 MASONRY MORTAR

.1 All masonry mortar shall be subject to inspection and testing as specified herein. Inspection and Testing shall include:

.1 Visual inspection of all materials.
.2 Sampling and testing of mortar cubes.

1.11 STRUCTURAL STEEL

.1 All structural steel shall be subject to inspection and testing as specified herein. Inspection and Testing shall include:

.1 Confirmation that materials supplied meet specifications.
.2 Shop inspection during fabrication of steel.

.3 Checking welders' CWB Certification.
.4 Checking fabricated members against design member shapes.
.5 Checking fabricated members against allowable sweep and camber.
.6 Checking fabricated members against specified camber.
.7 Visual inspection of all welded connections including spot checking of joint preparation and fit-up.
.8 Non-destructive testing of welding.
.9 Sample checking that tolerances are not exceeded during erection including fit-up of field welded joints.
.10 Inspection of field cutting.
.11 Inspection and testing of all field bolted connections.
.12 Visual inspection of all welds securing steel deck to structural steel.
.13 Visual inspection of all bearing plate locations.

1.12 STRUCTURAL STEEL STUDS

.1 All structural steel studs shall be subject to inspection and testing as specified herein. Inspection and Testing shall include:
.1 Confirmation that materials supplied meet specifications.
.2 Shop inspection during fabrication.
.3 Checking welder’ CWB Certification.
.4 Checking fabricated members against design member shapes.
.5 Visual inspection of all welded connections including spot checking of joint preparation and fit-up.
.6 Sample checking that tolerances are not exceeded during erection including fit-up of field welded joints.
.7 Inspection of all field bolted or welded connections.

1.13 SPRAY-IN-PLACE INSULATION

.1 All spray-in-place insulation shall be subject to inspection and testing as specified herein. Inspection and Testing shall include:
.1 Visual inspection of total application for defects.
.2 Visual inspection of all transitions and detailing at penetrations.
.3 Verification of applied thickness.

1.14 AIR/VAPOUR BARRIERS

.1 All building envelope air/vapour barrier components shall be subject to inspection and testing as specified herein. Inspection and Testing shall include:
.1 Visual inspection of total membrane for defects.
.2 Visual inspection of all transition membranes.
.3 Pull test to verify adhesion.

1.15 SPRAY APPLIED THERMAL BARRIER

.1 All spray applied thermal barrier shall be subject to inspection and testing as specified herein. Inspection and Testing shall include:
.1 Inspection of all spray applied thermal barrier materials to verify compliance with specifications.
.2 Inspection of spray applied themral barrier application.

1.16 ROOFING

.1 All roofing shall be subject to inspection as specified herein. Inspection and Testing shall include:

.1 Inspection of all roofing materials to verify compliance with specifications.

.2 Inspection of roofing application.

1.17 FIRESTOPS AND SMOKE SEALS

.1 All firestopping and smoke seals shall be subject to inspection as specified herein. Inspection and Testing shall include:

.1 Inspection of materials to verify compliance with specifications.

.2 Visual inspection of all applications.

1.18 CURTAIN WALL

.1 All curtain wall systems shall be subject to inspection and testing as specified herein. Inspection and Testing shall include:

.1 Site inspection of materials and installation methods.

.2 Shop inspection of materials and fabrication, and

.3 Site testing for air/water penetration.

1.19 ASPHALT PAVING

.1 All asphalt paving shall be subject to inspection and testing as specified herein. Inspection and Testing shall include:

.1 Inspection and compaction testing of all granular base courses.

.2 Marshal Density testing of asphalt material.

.3 Compaction testing of all courses of asphalt paving.

2 PRODUCTS

(RESERVED)

3 EXECUTION

3.1 INSPECTION AND TESTING - GENERAL

.1 Furnish test results and mix designs as may be requested.

.2 The cost of tests and mix designs beyond those called for in the Contract Documents or beyond those required by the law of the Place of Work shall be appraised by the Consultant and may be authorized as recoverable.

3.2 INSPECTION AND TESTING - PROCEDURES

.1 Notify the appropriate agency and Consultant in advance of the requirement for tests, in order that attendance arrangements can be made.

.2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in the Work.

.3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store, cure and inspect test samples.

3.3 QUALITY OF THE WORK

.1 Quality of the Work shall be first class, executed by workers experienced and skilled in the respective duties for which they are employed. Immediately notify the Consultant if required work is such as to make it impractical to produce required results.

.2 Do not employ any unfit person or anyone unskilled in their required duties. The Consultant reserves the right to require the dismissal from the site, of workers deemed incompetent, careless, insubordinate or otherwise objectionable.

3.4 DEFECTIVE MATERIALS AND WORK

.1 Refer to GC 2.4 of CCDC 2-2008.

.2 Where evidence exists that defective work has occurred, or that work has been carried out incorporating defective products, the Consultant may have independent tests, inspections, or surveys performed in order to determine if work is defective.

.3 Tests, inspections, or surveys carried out under these circumstances will be made at the Contractor's expense in the event of defective work, or at the Owner's expense where work is in conformance. Where tests incorporate a number of samples, payment will be assessed, by the Consultant, based on the ratio of conforming to non-conforming results. This does not include re-testing of soil compaction during placement, where evidence exists of non-conformance with the Contract documents, but rather only if re-testing is called for after completion of compaction.

END OF SECTION

1 GENERAL

1 SECTION INCLUDES
- .1 Codes and Standards.
- .2 Authority Having Jurisdiction.
- .3 Permits and Fees.
- .4 Relics, Antiquities and Human Remains.

2 CODES AND STANDARDS

.1 Codes

.1 All construction shall conform to the Ontario Building Code, the National Building Code (NBC) and the National Fire Code (NFC) latest editions including all supplements and amendments.

.2 Conform to all other codes, by-laws and regulations as specified within individual sections of the specifications.

.2 Industry Standards

.1 Industry Standards are specified within individual sections as applicable to those portions of the Work. The latest editions of all industry standards shall be the standards for which quality of work shall be assessed.

.2 Comply with all relevent codes, standards and industry-accepted practices, as specified herein, or as applicable to the Work.

3 AUTHORITIES HAVING JURISDICTION

.1 The Chief Building Official of the Municipality of the Place of the Work, is the primary Authority Having Jurisdiction for compliance with all codes, by-laws and regulations as they apply to all construction.

.2 Other Authorities Having Jurisdiction may be required to review and approve certain portions of the Work. The Chief Building Official of the Municipality of the Place of the Work, will determine the requirements for such involvement.

4 PERMITS AND FEES

.1 No construction work may commence without a valid, posted Building Permit.

.2 The Owner is responsible for obtaining all necessary information and applying for the Building Permit, including payment of associated fees.

.3 The Contractor is responsible for applying for, and obtaining all necessary permits, licenses, or certificates required by the Work.

.4 Authorities Having Jurisdiction may levy fees for issuing permits, licenses, or certificates under their jurisdiction. The Contractor shall pay all such fees as required, and shall include the cost of such fees in their Contract Price.

.5 Furnish certificates and permits from other Authorities Having Jurisdiction when so requested by the Consultant.

.6 Prior to commencement of construction, post the Building Permit at the Place of the Work.

5 RELICS, ANTIQUITIES AND HUMAN REMAINS

.1 Comply with the General Conditions of the Contract with respect to relics, antiquities, and human remains.

.2 Isolate and protect human remains, relics, antiquities, items of historical, archeological or scientific interest such as cornerstones, commemorative plaques, inscribed tablets and other similar objects found during the course of the Work.

.3 If such items are discovered in the course of construction, stop work in the immediate vicinity, and give immediate notice to the Consultant as to the nature of the discovery, and await written instructions before proceeding with work in the area.

.4 Resume work only after the conclusion of any inspection and evaluation by experts engaged by the Owner, and only after being given permission to do so.

.5 Relics, antiquities and items of historical or specific interest remain the Owner's property.

END OF SECTION

Abbreviations listed, when used in the Contract Documents, shall have the following meanings:

ABBREVIATION	MEANING
AA	ALUMINUM ASSOCIATION
AAMA	ARCHITECTURAL ALUMINUM MANUFACTURERS` ASSOCIATION
AASHO	AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS
ACI	AMERICAN CONCRETE INSTITUTE
AGA	AMERICAN GAS ASSOCIATION
AIA	AMERICAN INSTITUTE OF ARCHITECTS
AIMA	ACOUSTICAL & INSULATING MATERIALS ASSOCIATION
AISC	AMERICAN INSTITUTE OF STEEL CONSTRUCTION
AISI	AMERICAN IRON AND STEEL INSTITUTE
AMCA	AIR MOVING AND CONDITIONING ASSOCIATION INC.
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
ASHRAE	AMERICAN SOCIETY OF HEATING, REFRIGERATING & AIR CONDITIONING ENGINEERS
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
AWI	ARCHITECTURAL WOODWORK INSTITUTE (USA)
AWMAC	ARCHITECTURAL WOODWORK MANUFACTURERS ASSOCIATION OF CANADA
AWS	AMERICAN WELDING SOCIETY
CCA	CANADIAN CONSTRUCTION ASSOCIATION
CCRC	CANADIAN CODE FOR RESIDENTIAL CONSTRUCTION
CEC	CANADIAN ELECTRICAL CODE
CFUA	CANADIAN FIRE UNDERWRITERS ASSOCIATION
CGA	CANADIAN GAS ASSOCIATION
CGSB	CANADIAN GENERAL STANDARDS BOARD
CIQS	CANADIAN INSTITUTE OF QUANTITY SURVEYORS
CISC	CANADIAN INSTITUTE OF STEEL CONSTRUCTION
CITC	CANADIAN INSTITUTE OF TIMBER CONSTRUCTION
CLA	CANADIAN LUMBERMEN`S ASSOCIATION
CMHC	CANADA MORTGAGE & HOUSING CORPORATION
COFI	COUNCIL OF FOREST INDUSTRIES OF BRITISH COLUMBIA
CPCI	CANADIAN PRESTRESSED CONCRETE INSTITUTE
CRCA	CANADIAN ROOFING CONTRACTORS ASSOCIATION
CSA	CANADIAN STANDARDS ASSOCIATION
CSC	CONSTRUCTION SPECIFICATIONS CANADA
CSI	CONSTRUCTION SPECIFICATIONS INSTITUTE (USA)
CSPI	CORRUGATED STEEL PIPE INSTITUTE
CSSBI	CANADIAN SHEET STEEL BUILDING INSTITUTE
CUA	CANADIAN UNDERWRITERS` ASSOCIATION
CWB	CANADIAN WELDING BUREAU
CWC	CANADIAN WOOD COUNCIL
DND	DEPARTMENT OF NATIONAL DEFENCE, CANADA
FM	FACTORY MUTUAL ENGINEERING CORPORATION
FS	FEDERAL SPECIFICATION (USA)
IES	ILLUMINATING ENGINEERING SOCIETY
IGMAC	INSULATED GLASS MANUFACTURERS ASSOCIATION OF CANADA
LTIC	LAMINATED TIMBER INSTITUTE OF CANADA
MIA	MARBLE INSTITUTE OF AMERICA
MPMDD	MODIFIED PROCTOR MAXIMUM DRY DENSITY
NAAMM	NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (USA)
NBFU	NATIONAL BOARD OF FIRE UNDERWRITERS
NBC	NATIONAL BUILDING CODE OF CANADA

NBS	NATIONAL BUREAU OF STANDARDS (USDC)
NEMA	NATIONAL ELECTRICAL MANUFACTURERS' ASSOCIATION
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
NHLA	NATIONAL HARDWOOD LUMBER ASSOCIATION (USA)
NLGA	NATIONAL LUMBER GRADES AUTHORITY
NRC	NATIONAL RESEARCH COUNCIL
OBC	ONTARIO BUILDING CODE
OHSA	OCCUPATIONAL HEALTH AND SAFETY ACT
OPSS	ONTARIO PROVINCIAL STANDARD SPECIFICATIONS
PCA	PORTLAND CEMENT ASSOCIATION
PCI	PRESTRESSED CONCRETE INSTITUTE
SDI	STEEL DECK INSTITUTE
SPMDD	STANDARD PROCTOR MAXIMUM DRY DENSITY
SSPC	STEEL STRUCTURES PAINTING COUNCIL
TTMAC	TERRAZZO, TILE & MARBLE ASSOCIATION OF CANADA
ULC	UNDERWRITERS LABORATORIES CANADA
UL	UNDERWRITERS LABORATORIES (USA)
USAS	UNITED STATES OF AMERICA STANDARDS INSTITUTE
WSIB	WORKPLACE SAFETY AND INSURANCE BOARD

END OF SECTION

1 REFERENCES

.1 Occupational Health and Safety Act and Regulations for Construction Projects (2011) (Ontario Regulation 213/91, amended by Reg. 631/94, & Reg. 145/00).
.2 National Fire Code of Canada (2015)
.3 Ontario Fire Code (2007)
.4 Ontario Building Code (2012)

2 INSTALLATION AND REMOVAL

.1 Provide temporary utilities, facilities and controls in order to execute the work expeditiously. Remove from site all such work after use.

3 VEHICULAR ACCESS & PARKING

.1 Provide and maintain adequate access to project site.

.2 Build and maintain temporary access roads where indicated or required, and provide snow removal during period of work.

.3 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractor's use of roads. Maintenance shall include requlars snow removal if not provided under separate contract, and regular power washing to remove mud and dirt.

.4 Where site access for construction vehicles necessitates use of public roads, remove mud and dirt from such roads where contaminated by construction vehicles.

.5 Traffic Control: Provide and maintain flagpersons, traffic signals, barricades and flares, lights, or lanterns as required to perform the work and protect the public.

.6 Construction Parking

.1 Parking for construction equipment vehicles will be limited to the site or immediate areas of work.

.2 Parking for Contractors' and Subcontactors' personal vehicles will be permitted on site provided it does not constitute a safety hazard nor disrupt the performance of Work. Parking areas will be designated by the Owner.

4 TEMPORARY UTILITIES

.1 Temporary Electricity and Lighting

.1 Arrange, pay for and maintain temporary electrical power supply in accordance with governing regulations and ordinances.

.2 Install temporary facilities for power such as pole line and underground cables to approval of local power supply authority.

.3 Electrical power and lighting systems installed under this contract can be used for construction requirements provided that guarantees are not affected thereby. Make good damage. Replace lamps which have been used more than a period of 3 months.

.4 Provide temporary lighting in all areas of construction, to the minimum requirements of the Occupational Health and Safety Act, and minimum requirements specified herein.

.2 Temporary Water Supply

.1 Arrange, pay for and maintain temporary water supply in accordance with governing regulations and ordinances.

.2 Permanent water supply system installed under this contract can be used for construction requirements provided that guarantees are not affected thereby. Make good damage.

.3 Temporary Heating and Ventilating

.1 Provide and maintain all temporary heat and ventilation necessary during construction, including cost of installation, fuel, operation, attendance and maintenance. Use of direct-fired heaters discharging waste products into work areas will not be permitted unless prior approval is given by Consultant.

.2 Provide temporary heat and ventilation in enclosed areas as required to:

.1 Facilitate progress of work.
.2 Protect work and products against dampness and cold.
.3 Prevent moisture condensation on surfaces.
.4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
.5 Provide adequate ventilation to meet health regulations for safe working environment.

.3 Maintain minimum temperature of 10°C or higher where construction is in progress and maintain until acceptance of structure by Consultant.

.4 Ventilating

.1 Prevent hazardous accumulation of dust, fumes, mists, vapours or gases in areas occupied during construction.
.2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
.3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
.4 Ventilate storage spaces containing hazardous or volatile materials.
.5 Ventilate temporary sanitary facilities.
.6 Continue operation of ventilation and exhaust system for a time after cessation of work process, to assure removal of harmful elements.

.5 Maintain strict supervision or operation of temporary heating and ventilating equipment.

.1 Conform with applicable codes and standards.
.2 Enforce safe practices.
.3 Prevent abuse of services.
.4 Prevent damage to finishes.

.5 Vent direct-fired combustion units to outside.

.6 The permanent HVAC systems of the building, or portions thereof, may not be used during construction.

5 CONSTRUCTION FACILITIES

.1 Field Office

.1 Provide minimum 2400 x 4800mm office and furnish with desk, drawing layout table, filing cabinet, and coat hooks.

.2 Provide minimum 750 Lx lighting level.

.3 Heat to maintain 22°C inside temperature.

.4 Provide 2 operable windows for cross ventilation, or air condition.

.2 Temporary Telephone and Facsimile

.1 Provide and pay for temporary telephone and FAX machine to be installed in Field Office.

.2 Provide separate data and telephone jacks for computer hook-up.

.3 Cellular telephones are acceptable. Pay telephone is not acceptable.

.3 Equipment, Tools and Materials Storage

.1 Provide adequate weathertight enclosures with raised floors, for storage of materials, tools, and equipment which are subject to damage by weather.

.2 Temporary enclosures required by subtrades as workshops shall be provided by those trades.

.4 Site Storage and Overloading

.1 Confine the Work and the operations of employees to limits indicated by the Contract Documents. Do not unreasonably encumber the premises with products.

.2 Do not load or permit to be loaded any part of the Work with a weight or force that will endanger the Work.

.5 Sanitary Facilities

.1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances. Post notices and take such precautions as required by local health authorities. Keep area and premises in sanitary condition. Where portable toilet facilities are provided, empty and sanitize such facilities on a weekly basis, or more frequently if required.

.2 Permanent new facilities shall not used by the Contractor.

6 CONSTRUCTION SAFETY MEASURES

.1 Observe all construction safety measures as required by the General Conditions of the Contract, the Occupational Health and Safety Act and Regulations for Construction Projects, and by all authorities having juridiction, provided that in case of conflict or discrepancy, the more stringent requirements shall apply.

.2 Provide applicable spare safety equipment such as helmets, safety glasses, and harnesses, and enforce their use by Consultants, the Owner, their representatives and any authorized visitors to the site.

.3 Provide and maintain fences, gates and locks, covered walkways, guard rails, barriers, night lights, and appropriate warning signage as required for the protection of the public, and of public and private property; as required by the General Conditions of the Contract, the Occupational Health and Safety Act and Regulations for Construction Projects, and by all authorities having jurisdiction. Erect and maintain sturdy railings around shafts, and the like, to protect workmen and the public from injury.

.4 Workplace Hazardous Materials Information System

.1 Comply with all requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of material safety data sheets.

.2 Include copies of all WHMIS data sheets in Operations and Maintenance Manuals.

7 CONSTRUCTION AIDS

.1 Falsework

.1 Design and construct falsework in accordance with CSA S269.1.

.2 Scaffolding

.1 Design, construct and maintain scaffolding in accordance with CSA S269.2.

.2 Erect scaffolding independent of walls. Remove promptly when no longer required.

.3 Hoisting

.1 Provide, operate and maintain hoists or cranes required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for use thereof.

.2 Hoists or cranes shall be operated by qualified operator.

8 TEMPORARY BARRIERS & ENCLOSURES

.1 Construction Isolation Fencing

.1 Erect isolation fencing around perimeter of construction areas to protect the public, workers, and the public from injury.

.2 Construction Isolation Fencing shall consist of:
.1 Temporary modular welded wire mesh fencing, minimum 1828 x 2440mm high, by CanFence Rentals Ltd., or equivalent.

.2 Provide lockable gates within hoarding / fencing for access to site by workers and vehicles.

.3 Provide barriers around trees and planting beds designated to remain. Protect from damage.

.4 Enclosure of Structure
.1 Provide temporary weathertight enclosures and protection for exterior openings until permanently enclosed.

.2 Erect enclosures to allow access for installation of materials and working inside enclosure.

.3 Erect enclosures to withstand wind pressure and snow loading.

.4 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work area for temporary heat.

.5 Dust Control
.1 Provide dust tight screens or partitions to localize dust generating activities, and for the protection of workers, or finished areas of Work.

.2 Dust screens shall consist of, as a minimum, 0.15mm thick polyethylene sheets secured to appropriate framing and sealed at all joints and at perimeter to prevent migration of dust.

.3 Maintain and relocate protection until such work is complete.

.4 Provide dust catching walk-off matting, at all construction entrances.

9 TEMPORARY CONTROLS
.1 Drainage & Erosion Control
.1 Refer to Civil Drawing (C2.3).

.2 Tree and Plant Protection
.1 Refer to Section 01 57 19 – Temporary Environmental Controls.

.3 Security Measures
.1 Where progress of construction reaches point where building exterior is fully enclosed, provide construction cylinders for doors, and secure building against intrusion. Where installation of fixtures and equipment, or storage of materials and equipment, inside the building has begun prior to installation of exterior windows and doors, provide temporary plywood enclosures for window and door openings to prevent intrusion until permanent closures are in place.

.4 Site Signs and Notices

.1 Maintain approved signs and notices in good condition for duration of project, and dispose of off site on completion of project or earlier if directed by Consultant.

.2 Project Sign: Provide one temporary project sign at location approved by Consultant.

.3 No other signs or advertisements of any description except notices regarding safety and instruction, shall be put up around the building, or site, without the approval of the Consultant.

END OF SECTION

1 REFERENCES

.1 National Building Code of Canada (2015)
.2 National Fire Code of Canada (2015)
.3 Ontario Fire Code (2007)
.4 Guidelines for Maintaining Fire Safety during Construction in Existing Buildings, (10/31/88) Ontario Ministry of the Solicitor General, Office of the Fire Marshal.
.5 Ontario Building Code (Regulation 350/06)

2 FIRE SAFETY

.1 Fire Fighting Equipment

.1 Provide and maintain in working order, ULC labelled, 9kg 4A 60BC type fire extinguishers, and locate in prominent positions to approval of authorities having jurisdiction.

.2 Fire Department Access

.1 Provide and maintain fire access routes as designed, as soon as construction sequence will allow. Access routes must have compacted granular subbase, and base in place before superstructure of building may proceed.

.2 Construction activities must not obstruct access routes designated for fire department equipment. If necessary that existing access be obstructed or deleted, alternative access, acceptable to the fire department, must be provided prior to commencement of construction, in accordance with Ontario Building Code location and design criteria for required access routes.

.3 Control of Combustible Materials

.1 The stockpiling of construction materials adjacent to the existing building must be carefully controlled in accordance with the Ontario Fire Code. Materials stored, and their proximity to, equipment used in construction may create a fire hazard. Control of combustibles on a construction site is regulated under the Occupational Health and Safety Act.

.4 Hot Work

.2 Conform to the requirements of the Occupational Health and Safety Act – Regulations for Construction Projects.

.3 Provide all necessary guards and barriers to protect workers, property, and the public when performing hot work such as torching, cutting or coring. Protect all adjacent combustible materials.

.4 Provide a "Fire Watch" for a minimum of 3 hours after each instance of discontinuing hot work.

END OF SECTION

1 DEFINITIONS

.1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade environment aesthetically, culturally and/or historically.

.2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction. Control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

2 SUBMITTALS

.1 Submittals: in accordance with Submittal Procedures.

.2 Prior to commencing construction activities or delivery of materials to Site, submit Environmental Protection Plan for review and approval by Consultant Environmental Protection Plan is to present comprehensive overview of known or potential environmental issues which must be addressed during construction.

.3 Address topics at level of detail commensurate with environmental issue and required construction tasks.

.4 Environmental protection plan: include:

.1 Name(s) of person(s) responsible for ensuring adherence to Environmental Protection Plan;

.2 Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from Site;

.3 Name(s) and qualifications of person(s) responsible for training site personnel;

.4 Descriptions of environmental protection personnel training program;

.5 Erosion and sediment control plan which identifies type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial and Municipal laws and regulations;

.6 Drawings showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on Site;

.7 Traffic control plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather. Plans include measures to minimize amount of mud transported onto paved public roads by vehicles or runoff;

.8 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use. Plan to include measures for marking limits of use areas including methods for protection of features to be preserved within authorized work areas;

.9 Spill Control Plan: including procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance;

.10 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris;

.11 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, do not become air borne and travel off-site;

.12 Contaminant prevention plan that: identifies potentially hazardous substances to be used on Site; identifies intended actions to prevent introduction of such materials into air, water or ground; and details provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials;

.13 Waste water management plan that identifies methods and procedures for management and/or discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water and water used in flushing of lines;

.14 Historical, archaeological, cultural resources biological resources and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands;

.15 Pesticide treatment plan: to be included and updated, as required.

3 FIRES

.1 Fires and burning of rubbish on Site is strictly prohibitted.

4 DISPOSAL OF WASTES

.1 Burying of rubbish and waste materials on Site is strictly prohibitted.

.2 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.

5 DRAINAGE & EROSION CONTROL

.1 Provide erosion and sediment control plan that identifies type and location of erosion and sediment controls to be provided. Plan: include monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.

.2 Storm Water Pollution Prevention Plan (SWPPP) may be substituted for erosion and sedimentations control plan.

.3 Provide temporary drainage and pumping as necessary to keep excavations and Site, free from water.

.4 Do not pump water containing suspended materials into waterways, sewer or drainage systems.

.5 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

.6 Provide and maintain temporary drainage and pumping as necessary to keep excavations and site free from excess water.

.7 Provide silt fencing at site perimeters and where required by local authorities to prevent contamination of adjoining properties from silt and water drainage.

6 TREE AND PLANT PROTECTION

.1 Protect existing trees and plants on all adjacent properties, where in close proximity to construction activities, or where construction access passes within 3m of trees or plants, whether indicated on drawings or not.

.2 Conform to all local By-Laws regarding tree preservation and protection.

.3 Protect existing trees and plants on site as indicated.

.4 Restrict tree removal to those designated by Consultant. Wrap in burlap trees and shrubs adjacent to construction work, storage areas and trucking lanes. Encase trees and shrubs with protective wood framework from grade level to height of 2134mm.

.5 Protect roots to minimum 1m beyond dripline during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones of protected trees. Minimize stripping of topsoil and vegetation.

.6 The Minimum Tree Protection Zone will be the drip line. Within this tree protection zone there will also be no construction activity including but not limited to no root cutting, no alteration or disturbance to existing grades of any kind, no changes to the grade by adding fill, excavating or scraping, no storage of construction materials or equipment, no stockpiling of soil, debris or construction waste, & no movement or storage of heavy vehicles or equipment. Tree protection barriers must be included and priced as part of the project. For short term project (up to 2 months), standard T-bars and plastic safety fence can be used. For a longer term project, use 10 gauge chain link fence and standard T-bars. In all cases, standard T-bars should not be spaced more than 6 to 7 feet apart. These protection barriers must be erected before the project starts, must be maintained throughout the project, and taken down when final inspection and signoffs are completed.

7 WORK ADJACENT TO WATERWAYS/DRAINAGE DITCHES

.1 Do not operate construction equipment in waterways.

.2 Do not use waterway beds for borrow material.

.3 Do not dump excavated fill, waste material or debris in waterways.

.4 Design and construct temporary crossings to minimize erosion to waterways.

.5 Do not skid construction materials across waterways.

.6 Avoid indicated spawning beds constructing temporary crossings of waterways.

8 POLLUTION CONTROL

.1 Maintain temporary erosion and pollution control features installed under this Contract.

.2 Prevent sandblasting and other extraneous materials from contaminating air and waterways beyond application area, by providing temporary enclosures.

.3 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

9 HISTORICAL / ARCHAEOLOGICAL ARTIFACTS

.1 In the event that buried archaeological remains are encountered on the property during construction activities, the Heritage Operations Unit of the Ministry of Tourism and Culture be notified immediately at (416) 326-9326.

.2 In the event that human remains are encountered during construction, the Contractor shall immediately contact both the Ministry of Tourism and Culture, and the Registrar or Deputy Registrar of Cemeteries at the Cemeteries Regulation Unit, Ministry of Government Services, (416) 326-8404.

10 NOTIFICATION

.1 Consultant will notify Contractor in writing of observed non-compliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan. Contractor shall, after receipt of such notice, inform Consultant of proposed corrective action and take such action for approval by Consultant.

.2 Consultant will issue stop order of Work until satisfactory corrective action has been taken.

.3 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

END OF SECTION

1 PRODUCT OPTIONS

.1 Provide products specified under individual specification sections. Where Specification lists two or more products, or two or more manufacturers of the same product, the Contractor may select one of the listed products or manufacturers. Confirm selection of products and manufacturers when requested by the Consultant.

.2 When only one product or manufacturer is listed in the specifications, it is intended that only that product or manufacturer is acceptable.

2 PRODUCT SUBSTITUTION PROCEDURES

.1 Substitution Procedures During Construction

.1 Products may only be substituted during the Construction period for one or more of the following reasons:

.1 Insolvency of the product manufacturer.

.2 Inability of the manufacturer to provide the product(s) in the timeframe required to maintain the construction schedule.

.3 Product specified has been discontinued.

.4 Substitution proposed offers better performance than that specified, at no additional cost.

.5 Substitution offers equivalent performance to that specified, at a reduced cost to the Owner (reduction in Contract Price).

.2 Items 2.1.1.2, and 2.1.1.3 will require a letter from the manufacturer, confirming their inability to provide the products specified, or inability to meet the schedule.

.3 Items 2.1.1.4, and 2.1.1.5 will be at the discretion of the Owner.

3 AVAILABILITY

.1 Immediately upon signing Contract, review Product delivery requirements, and identify lead times for supply of all Products. If lead times in supply of Products may affect the Construction Schedule, notify the Consultant in order that appropriate action may be authorized in ample time to prevent delay in performance of the Work.

.2 The Contractor shall order Products and materials in a timely fashion so as to ensure that delivery of such Products and materials shall coincide with the Construction Schedule. Failure of the Contractor or their Subcontractors to order Products and materials in a timely fashion, shall not be cause for substitution in accordance with the criteria set out under Article 2 – Product Substitution Procedures.

.3 In the event of failure to notify the Consultant of Product delivery problems at the commencement of the Work, and should it appear that the Work may be delayed for such reason, the Consultant reserves the right to substitute more readily available Products of similar character of their chosing, at no increase in Contract Price.

4 REFERENCE STANDARDS

.1 Within the specifications, reference standards are identified. Conform to these standards, in whole or part, as specifically requested.

.2 If there is question as to whether any product or system is in conformance with applicable standards, the Consultant reserves the right to have such products or systems tested to prove or disprove conformance.

.3 The cost for such testing will be born by the Owner in the event of conformance with Contract Documents or by the Contractor in the event of non-conformance.

.4 Conform to latest date of issue of referenced standards in effect on date of submission of bids, except where a specific date of issue is specifically noted.

5 PRODUCT TRANSPORTATION & DELIVERY

.1 Transportation and delivery costs of Products required in the performance of the Work, are included in the Contract Price.

.2 Transportation and delivery costs of Products supplied by the Owner will be paid for by the Owner. Unload, handle, and store such Products on site.

.3 Products must be appropriately crated, skidded, boxed, shrink-wrapped, or otherwise packaged to protect such products from damage during shipment. Products which arrive at the site in a damaged condition must be rejected and returned to the supplier/manufacturer for immediate replacement.

.4 Advise the Owner 30 days in advance of anticipated delivery dates for materials and equipment supplied by the Owner.

6 PRODUCT STORAGE, HANDLING AND PROTECTION

.1 Handle and store Products in a manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions.

.2 Store packaged or bundled Products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in the Work.

.3 Store products subject to damage from weather in weatherproof enclosures.

.4 Store cementitious products clear of earth or concrete floors, and away from walls.

.5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.

.6 Store sheet materials and lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.

.7 Store paints in a heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.

.8 Remove and replace damaged Products at own expense and to the satisfaction of the Consultant.

7 MANUFACTURER'S INSTRUCTIONS

.1 Unless otherwise indicated in the specifications, install or erect Products in accordance with manufacturer's printed instructions. Do not rely on labels or enclosures provided with Products. Obtain written instructions directly from manufacturers.

.2 Notify Consultant in writing, of conflicts between the specifications and manufacturer's instructions, so that Consultant may establish correct course of action.

.3 Improper installation or erection of Products, due to failure in complying with these requirements, authorizes the Consultant to require removal, replacement where necessary, and re-installation at no increase in Contract Price.

8 FASTENINGS

.1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.

.2 Prevent electrolytic action between dissimilar metals and materials.

.3 Use non corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in the affected specification Section.

.4 Space anchors within limits of load limit or shear capacity and ensure that they provide positive permanent anchorage. Wood or any other organic material plugs are not acceptable.

.5 Keep exposed fastenings to a minimum, space evenly and install neatly.

.6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

.7 Obtain Consultant's approval before using explosive actuated fastening devices.

9 QUALITY OF MATERIALS

.1 Products, materials, equipment and articles (referred to as Products throughout the specifications) incorporated in the Work shall be new, not damaged or defective, and of the best quality (compatible with specifications) for the purpose intended. If requested, furnish evidence as to type, source and quality of Products provided.

.2 Products relying on uniformity of colour and pattern for appearance, such as resilient flooring, carpeting, fabrics, and vinyl wallcovering, shall be from one dye lot for the project. All products delivered to the site must be labeled as to dye lot, or production run number, as well as production date.

.3 Defective products, whenever identified prior to the completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is a precaution against oversight or error. Remove and replace defective Products at own expense and be responsible for delays and expenses caused by rejection.

.4 Should any dispute arise as to the quality or fitness of Products, the Consultant may request additional testing based upon the requirements of the Contract Documents, to confirm acceptability of products or materials. Refer to Article 10 - Defective Materials And Work, and Section 01 40 00.

.5 Unless otherwise indicated in the specifications, maintain uniformity of manufacture for any particular or like item throughout the building.

.6 Permanent labels, trademarks and nameplates on Products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

10 DEFECTIVE MATERIALS AND WORK

.1 Where evidence exists that defective work has occurred, or that work has been carried out incorporating defective products, the Consultant may have independent tests, inspections, or surveys performed in order to determine if work is defective.

.2 Tests, inspections, or surveys carried out under these circumstances will be made at the Contractor's expense in the event of defective work, or at the Owner's expense where work is in conformance. Where tests incorporate a number of samples, payment will be assessed, by the Consultant, based on the ratio of conforming to non-conforming results. This does not include re-testing of soil compaction during placement, where evidence exists of non-conformance with the Contract documents, but rather only if re-testing is called for after completion of compaction.

11 WARRANTIES & GUARANTEES

.1 Warrant all products and labour forming part of the Work for the period specified in the Contract, unless otherwise specified herein.

.2 Warrant products and assemblies for the specified periods of time where in excess of the Contract Warranty, as specified within their respective sections.

.3 Guarantee aspects of the Work for the specified periods of time where in excess of the Contract Warranty, as specified within their respective sections.

.4 Warranties and Guarantees shall commence at Date of Substantial Performance of the Contract as certified by the Consultant.

.5 Warranties and Guarantees shall be original copies, printed on company letterhead, or on a standard company warranty certificate, bearing the name of the company.

.6 Warranties and Guarantees shall indicate:

.1 Name of the Principal (the Manufacturer/Subcontractor),
.2 Name of the Obligee (the Owner),
.3 Name and address of Project,
.4 Commencement date (Date of Substantial Performance),
.5 Duration of warranty or guarantee,

.6 Clear statement of what is included, and what if any exclusions there are, and

.7 Signature of Principal's representative having signing authority.

END OF SECTION

1 EXAMINATION

.1 Acceptance of Conditions

.1 The General Contractor shall examine all existing or pre-determined conditions, prior to commencing work in that area, and report to the Consultant all conditions unacceptable for work to proceed. Commencement of work shall imply acceptance of conditions as is.

.2 Subcontractors shall examine all existing or pre-determined conditions affecting their portion of the Work, prior to commencing such work, and report to the Contractor all conditions unacceptable for work to proceed. Commencement of work shall imply acceptance of conditions as is.

2 PREPARATION

.1 Field Engineering

.1 Locate, confirm and protect control points prior to starting the Work. Preserve permanent reference points during construction.

.2 Establish reference lines and elevations. Locate and lay out by instrumentation.

.2 Records

.1 Maintain a complete, accurate log of control points and survey work as work progresses.

3 CUTTING AND PATCHING

.1 Submit a written request in advance, for approval of cutting or alteration which affects:

.1 Structural integrity of any element of Project.
.2 Integrity of weather-exposed or moisture-resistant elements.
.3 Efficiency, maintenance, or safety of any operational element.
.4 Visual qualities of sight-exposed elements.
.5 Work of Owner or separate contractor.

.2 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.

.3 After uncovering, inspect conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

.4 Perform cutting, fitting and patching, including excavation and fill, to complete the Work. Perform work to avoid damage to other work.

.5 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.

.6 Cut rigid materials using power saw or core drill. Pneumatic or impact tools not allowed.

.7 Fit work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces. At penetration of fire-rated wall, ceiling, or floor construction, completely seal voids with firestopping material, full thickness of construction element.

.8 Refinish surfaces to match adjacent finishes; for continuous surfaces refinish to nearest intersection; for an assembly, refinish entire unit.

.9 Provide all openings greater than 200mm in non-structural elements of work for penetrations of mechanical and electrical work. Mechanical and Electrical Subcontractors shall provide all sleeves and locations for sleeves. The cost of all cutting and patching required by Mechanical and Electrical Subcontractors shall be paid for by those trades.

.10 Ensure that all cutting and patching work, including that by Mechanical and Electrical Subcontractors, is properly performed by the respective trades skilled in that line of work. Restore work with new products in accordance with Contract Documents.

4 LOCATION OF EQUIPMENT AND FIXTURES

.1 Location of mechanical and electrical equipment, fixtures and devices indicated or specified, are to be considered as approximate. Final location of such items will be determined on site, based on integration with structural and architectural elements, and as required by coordination with other trades. In the event of a conflict, final determination of location of these items rests with the Consultant.

.2 Prepare and submit for review by the Consultant, interference field drawings, to indicate relative position of various services and equipment, at the following locations as a minimum:

.1 Under all rooftop mechanical units.
.2 At locations of all major ductwork, piping, and conduit crossovers.
.3 Where ductwork passes under major structural elements.

.3 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.

.4 Request a review of items by Consultant once rough-in is underway, prior to final installation, and obtain approval for actual locations.

5 CONCEALMENT

.1 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas, except where indicated otherwise.

6 LIGHTING FIXTURES AT SUSPENDED CEILINGS

.1 Ensure that secure support is provided for lighting fixtures by suspended ceilings, or by separate hangers, or by both.

.2 Coordinate the ceiling system and lighting fixture installations to provide adequate support.

.3 Submit affidavits with acceptable design information confirming that the installation of the suspended ceiling system and/or separate fixture hangers will provide adequate support for the lighting fixtures without exceeding specified deflection tolerances for the ceiling system.

.4 Conform to current requirements of the Electrical Safety Authority (ESA).

7 PROTECTION OF WORK IN PROGRESS

.1 Adequately protect Work completed or in progress. Work damaged or defaced due to failure in providing such protection is to be removed and replaced, or repaired, as directed by the Consultant, at no increase in Contract Price.

.2 Prevent overloading of any part of the building. Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated, without written approval of Consultant.

.3 Protect finished surfaces with overlays of protective materials such as Kraft paper, cardboard, or plywood, as required for individual applications to provide adequate protection.

END OF SECTION

1 GENERAL

.1 Conduct cleaning and disposal operations to comply with local ordinances and environmental protection legislation.

.2 Store volatile wastes in covered metal containers, and remove from premises at end of each working day.

.3 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.

2 CLEANING DURING CONSTRUCTION

.1 Maintain the Work in tidy condition, free from accumulation of waste products and debris.

.2 Remove waste material and debris from the work areas and deposit in waste container at the end of each working day.

.3 Vacuum clean interior areas prior to start of finishing work. Maintain areas free of dust and other contaminants during finishing operations.

.4 Individual Subcontractors are responsible for the daily clean-up and removal of debris related to, or generated by, their own work. The overall responsibility for project cleanliness rests with the Contractor.

3 WASTE MANAGEMENT

.1 Audit, separate and dispose of construction waste generated by new construction or by demolition of existing structures in whole or in part, in accordance with Ontario Regulations 102/94 and 103/94 made under the Environmental Protection Act.

.2 Fires, and burning of rubbish or waste on site is prohibited.

.3 Burying of rubbish or waste materials, except as specified herein, is prohibited.

.4 Disposal of waste or volatile materials such as mineral spirits, oil, gasoline or paint thinner into ground, waterways, or sewer systems is prohibited.

.5 Empty waste containers on a regular basis to prevent contamination of site and adjacent properties by wind-blown dust or debris.

4 FINAL CLEANING OPERATIONS

.1 Immediately following Date of Substantial Performance, and prior to Owner occupancy of the building or portion of the building affected by the Work, conduct full and complete final cleaning operations.

.2 Final cleaning operations shall be performed by an experienced professional cleaning company, possessing equipment and personnel sufficient to perform full building cleaning operations.

.3 Remove all surplus products, tools, construction machinery and equipment not required for the performance of remaining work, and thereafter remove any remaining materials, equipment, waste and debris.

.4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.5 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

.6 Cleaning operations shall include the removal of all stains, spots, scuff marks, dirt, dust, remaining labels, adhesives or other surface imperfections.

.7 Remove all paint spots or overspray from all affected surfaces.

.8 Clean and polish all glass and mirrors. Replace broken, scratched or disfigured glazing. Remove remaining manufacturer's and safety "X" labels.

.9 Clean and polish all finished metal surfaces such as enamelled or stainless steel, chrome, aluminum, brass, and bronze.

.10 Clean and polish all vitreous surfaces such as plumbing fixtures, ceramic tile, porcelain enamel, or other such materials.

.11 Clean all ceramic tile surfaces in accordance with the manufacturer's instructions, and apply final coat of sealer where specified.

.12 Clean inside of all millwork and cabinetry.

.13 Vacuum, clean and dust behind grilles, louvres and screens.

.14 Seal and wax all resilient floor surfaces as specified, and as recommended by the manufacturer.

.15 Broom clean and spray wash all exterior paved surfaces.

.16 Remove dirt and other disfiguration from exterior surfaces.

.17 Clean all roofs, gutters, downspouts, areaways, drywells, and drainage systems.

.18 Clean all equipment and fixtures to a sanitary condition, clean or replace filters of mechanical equipment.

END OF SECTION

1 INSPECTION AND DECLARATION PROCEDURES

.1 Arrange for, conduct and document final inspections, close-out and commissioning at the completion of the Work in accordance with the procedures described in the General Conditions of the Contract, and OAA/OGCA Document 100.

2 SUBSTANTIAL PERFORMANCE

.1 Contractor's Inspection

.1 Refer to OAA/OGCA Document 100 – STAGE 2.

.2 The Contractor and all Subcontractors shall conduct an inspection of the work, identify deficiencies and defects, and make corrections as required to conform with the Contract Documents. Notify Consultant in writing of satisfactory completion of Contractor's Inspection and that corrections have been made. Request a Consultant's Inspection.

.2 Contractor's Application for Substantial Performance of the Work

.1 Refer to OAA/OGCA Document 100 – STAGE 3.

.2 When the Contractor has carried out the steps in Stage 2 of OAA/OGCA Document 100, and has determined that the requirements of the Contract have been substantially performed as defined by local Lien legislation, the Contractor shall make application for Substantial Performance of the Work.

.3 In addition to the requirements of OAA/OGCA Document 100, the following items shall accompany the Contractor's application for Substantial Performance. These items must be complete in all respects, and all verification certificates and reports having been submitted and approved by the Consultants:

.1 Completed (and accepted) Maintenance Manuals for all disciplines (No. of copies as specified),
.2 As-Built Drawings for all disciplines (No. of copies as specified),
.3 Mechanical, Sprinkler, and Electrical as-built CAD drawings,
.4 Occupancy Permit (where required by Municipality),
.5 Air Balance Report (legible technicians worksheets are acceptable),
.6 Gas fired appliances inspection,
.7 Plumbing Inspection,
.8 Domestic Water Quality Test Report,
.9 Sprinkler dry test verification letter stamped and signed by sprinkler design Engineer,
.10 Mechanical start-up reports (Boilers, HVAC Units, Chillers, Water Softeners, etc.),
.11 Fire Alarm verification (include legible technicians worksheets),
.12 Emergency Lighting verification,
.13 Electrical distribution system inspection,
.14 ESA Hydro Certificate, and
.15 Systems operations have been demonstrated to Owner's personnel.

.3 Consultant's Inspection

.1 The Consultants shall perform an inspection of the Work to assess the validity of the Contractors application, and shall identify in separate lists, unfinished work and deficiencies. Contractor shall correct work accordingly.

.4 Certificate of Substantial Performance

.1 Refer to OAA/OGCA Document 100 – STAGE 4.

.2 Should the Consultant concur with the Contractor's application for Substantial Performance, the Consultant shall notify the Contractor of approval of the application for Substantial Performance and issue a Certificate of Substantial Performance.

.3 The Contractor shall publish a copy of the Certificate of Substantial Performance in a construction trade newspaper, and shall provide the Consultant with proof of the date of publication.

3 LIEN PERIOD AND RELEASE OF BASIC HOLDBACK

.1 Refer to OAA/OGCA Document 100 – STAGE 5.

.2 Commencement of Lien Periods

.1 The day following the date of publication of Certificate of Substantial Performance shall be the date of commencement of the 60 day Lien Period prior to release of basic holdback, unless required otherwise by lien statute of the Place of the Work.

.2 When the Contractor has carried out the required steps in Stages 3 and 4 of OAA/OGCA Document 100, the Contractor shall make application for Release of Basic Holdback.

.3 The Consultant shall prepare the Certificate for Payment for release of basic holdback, and promptly upon receipt of the necessary documentation, issue the Certificate for Payment to the Owner.

4 FINAL INSPECTION AND PAYMENT

.1 Refer to OAA/OGCA Document 100 – STAGE 6.

.2 Submit a signed statement stating following have been performed:

.1 Work has been reviewed for compliance with Contract Documents,
.2 All defeciencies have been corrected,
.3 All unfinished work has been completed, and
.4 Work is complete and ready for Final Inspection.

.3 When items noted above are completed, a final inspection of the Work will be performed by the Owner, the Consultants, and the Contractor.

.4 If the Work is deemed to be incomplete, complete outstanding items and request a reinspection.

.5 If the Work is deemed to be complete, the Consultant will issue a Final Certificate for Payment.

5 DEFICIENCY REVIEW

.1 Following the issuance of the Certificate of Substantial Performance and prior to the Contractor's application for Final Payment and release of any monies retained as "Finishing Holdback", the Contractor shall continue to complete unfinished work and correct deficiencies. At the request of the Contractor, the Consultants shall conduct up to two general deficiency reviews during this period.

.2 The first review will be undertaken only if the Contractor has inspected the Work, and states in writing that the unfinished work noted in their application for Substantial Performance has been completed, and at least 50% of all deficiencies have been corrected.

.3 The second review will be undertaken only if the Contractor has inspected the Work, and states in writing that 90% of the deficiencies have been corrected.

.4 Should further review by Consultants be required due to failure of the Work to comply with Contract Documents or the criteria set out herein, the Owner will deduct amount of Consultant's compensation for reinspection services from monies owed to the Contractor.

END OF SECTION

1 REFERENCES

.1 OAA/OGCA Document 100; OAA/OGCA Take-Over Procedures.

2 OPERATION AND MAINTENANCE MANUALS

.1 General

.1 Prepare Operation and Maintenance Manual during the course of construction and have completed prior to Date of Substantial Performance.

.2 Submission

.1 Maintain one copy of the Operation and Maintenance Manual volume(s) for periodic review and comment, as requested by the Consultant during the course of construction.

.2 Submit two (2) final hard copies and one (1) USB device with PDF version of all documents of the final completed volume(s) with the application for Substantial Performance in accordance with OAA/OGCA Document 100.

.3 Format

.1 Bind data in commercial quality, 219 x 279mm, "D" ring binders, having clear cover and spline pockets.

.2 Identify each binder on the cover and spline with the following:

OPERATION & MAINTENANCE MANUALS
City of Brampton Fire Station #201
Brampton, Ontario
VOLUME ___ OF ___

.3 Provide table of contents and index tab sheets for each volume. Itemize and tabulate contents.

.4 Provide drawings with reinforced punched binder tab, or insert into clear sleeves in folded format. Group drawings as to content, and index for quick reference.

.4 Contents - Each Volume

.1 Table of Contents: provide title of Project, Date of submission and names:

.1 Addresses, and telephone numbers of Consultant and Contractor with name of responsible parties;

.2 Schedule of products and systems, indexed to content of volume.

.2 For each product or system: List names, addresses and telephone numbers of sub-contractors and suppliers, including local source of supplies and replacement parts.

.3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.

.4 Operation and Maintenance Manuals shall contain, as a minimum, the following information:

.1 List of Contents; cross-referenced to each Volume.
.2 Contact information for maintenance and repairs
.3 Warranty and guarantee certificates
.4 Equipment start-up and troubleshooting instructions
.5 Equipment schematics & diagrams
.6 Catalogue of all maintenance materials and quantities
.7 Complete list of Contractor, Subcontractors and suppliers, indicating name, address, telephone & fax numbers, email addresses, name of contact person and description of work done.
.8 Complete list of products used in the work, indicating product name and manufacturer for each listing.
.9 Copy of Finish Hardware List, complete with all amendments and revisions, if applicable.
.10 Schedule of paints and coatings. Include sufficient explanation to fully identify each surface with the applicable paint or coating used. Enclose copy of Colour Schedule.
.11 All “reviewed” shop drawings.
.12 Maintenance instructions for all finished surfaces.
.13 Brochures and cuts of all equipment and fixtures.
.14 Operating and maintenance instructions for all equipment.
.15 All Warranties and Guarantees required by the Specifications for this Work.

.5 Refer to Division 21, 22 and 23 for more specific mechanical data required beyond the description of this paragraph.

.6 Refer to Division 26 for more specific electrical data required beyond the description of this paragraph.

.7 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

.8 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3 AS-BUILT DRAWINGS

.1 Record information on a clean set of black line opaque drawings, provided by Owner.

.2 Maintain as-built drawings on site and update as construction progresses. Allow periodic review by Consultant as requested.

.3 Record information concurrently with construction progress. Do not conceal work until required information is recorded.

.4 Contract drawings and shop drawings: legibly mark each item to record actual construction, including:
- .1 Measured depths of elements of foundation in relation to finish first floor datum.
- .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
- .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
- .4 Field changes of dimension and detail.
- .5 Changes made by change orders.
- .6 Details not on original Contract Drawings.
- .7 References to related shop drawings and modifications.

4 EQUIPMENT AND SYSTEMS

.1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

.2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.

.3 Include installed colour coded wiring diagrams.

.4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

.5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

.6 Provide servicing and lubrication schedule, and list of lubricants required.

.7 Include manufacturer's printed operation and maintenance instructions.

.8 Include sequence of operation by controls manufacturer.

.9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

.10 Provide installed control diagrams by controls manufacturer.

.11 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.

.12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

.13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

.14 Include all test and balancing reports

.15 Additional requirements: As specified in individual specification sections.

5 MATERIALS AND FINISHES

.1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.

.2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.3 Moisture-protection and Weather-exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.4 Additional Requirements: as specified in individual specifications sections.

6 MAINTENANCE MATERIALS, SPARE PARTS & TOOLS

.1 Provide spare parts in quantities specified in individual specification sections. Provide identical items to those installed in the Work.

.2 Provide maintenance materials in quantities specified in individual specification sections. Provide identical items of same manufacturer, dye lot or production run as items in the Work.

.3 Provide special tools in quantities specified in individual specification sections, and tag items identifying their function and equipment or products to which they are associated.

.4 Receive and catalogue all items. Check inventory and include approved listings in Operations and Maintenance Manual.

.5 Obtain receipts for delivered products and submit prior to Substantial Performance.

.6 Quality

.1 Spare parts, maintenance materials and special tools provided shall be new, not damaged or defective, and of the same quality and manufacture as products provided in the Work.

.2 If requested, furnish evidence as to type, source and quality of Products provided.

.3 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.

.7 Delivery, Storage, And Handling

.1 Deliver all materials required as maintenance materials, spare parts or special tools, to the site, include shipping costs, and store as directed.

.2 Store spare parts, maintenance materials and special tools in a manner to prevent damage, or deterioration.

.3 Store in original and undamaged containers with manufacturer's seals or labels intact.

.4 Store materials subject to damage from severe climatic changes in a climate-controlled, weatherproof enclosure.

.5 Store paints and freezable materials in a moderately heated and ventilated room.

7 WARRANTIES AND BONDS

.1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.

.2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

.3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item of work.

.4 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.

.5 Verify that documents are in proper form, contain full information, and are notarized. Co-execute submittals when required.

.6 Retain warranties and bonds for 2 years of comprehensive material and labour warranty to be include for the entire project.

END OF SECTION

1 GEOTECHNICAL INFORMATION

1.1 A copy of the following detailed geotechnical information is appended to this Document:

.1 Report on Geotechnical Investigation
Propose Fire Hall
27 Rutherford Road South
Brampton, Ontario
Prepared by: SNC Lavalin Ontario Inc.
Report No.: 671835
Dated: June 11, 2020

1.2 This geotechnical information records properties of subsurface conditions and recommendations for the design of foundations, pavements and soil remediation as outlined in the information provided.

1.3 The geotechnical information by its nature, cannot reveal all conditions that exist or can occur on the Site. Should subsurface conditions be found to vary substantially from the report, immediately notify Consultant in writing and await instructions.

1.4 Contractor shall not be entitled to extra payment or extension of Contract Time for work which is required and which is reasonably inferable in the geotechnical information as being necessary.

1.5 In case of discrepancies between recommendations contained in geotechnical information and requirements of Contract Documents, the latter shall govern. Advise Consultant in writing of any discrepancies discovered.

END OF DOCUMENT

SNC·LAVALIN

Geotechnical Investigation: Proposed Fire Hall

25 Rutherford Road South, Brampton, ON

The City of Brampton

INFRASTRUCTURE

30 | July | 2021

FINAL REPORT

Internal ref. 671835

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Geotechnical Investigation For Proposed Fire Hall

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Our Reference: 671835

July 30, 2021

Distribution: Abed Yassine (1 PDF copy)

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NOTICE TO READER

This document contains the professional opinion *of SNC-Lavalin GEM Ontario Inc. (SNCL),* as to the matters set out herein, based on professional judgment and reasonable care. It is to be read in the context of the agreement (the "Agreement") between *SNCL* and the City of Brampton (herein after referred to as the "Client"), the methodology, procedures and techniques used *SNCL*'s assumptions, and the circumstances and constraints under which its mandate was performed. This document is written solely for the purpose stated in the Agreement, and for the sole and exclusive benefit of the Client, whose remedies are limited to those set out in the Agreement. This document is meant to be read as a whole, and sections or parts thereof should thus not be read or relied upon out of context.

SNCL has, in preparing the geotechnical parameters and recommendations, followed accepted methodology and procedures, and exercised due care consistent with the intended level of accuracy, using its professional judgment and reasonable care, and is thus of the opinion that there is a high probability that actual site geotechnical conditions will fall within the predicted range. However, no warranty should be implied as to the accuracy of estimates. Unless expressly stated otherwise, assumptions, data, and information supplied by, or gathered from other sources (including the Client, other consultants, testing laboratories and equipment suppliers, etc.) upon which *SNCL*'s opinions as set out herein are based, have not been verified by *SNCL*; *SNCL* makes no representation as to their accuracy and disclaims all liability with respect thereto.

SNCL disclaims any liability to third parties in respect of the publication, reference, quotation, or distribution of this report or any of its contents to and reliance thereon by any third party.

1 Introduction

SNC-Lavalin Inc. (SNCL), was retained by the City of Brampton to conduct a geotechnical investigation for a proposed Fire Hall to be constructed at 25 Rutherford Road South, Brampton, Ontario (herein referred to as the Site), as shown in Figure 1 of **Appendix A**.

It is our understanding that the City intends to develop the Site with 10,500 sq. ft. Fire Hall, with either four (4) bay apparatus (tandem) or a three (3) bay apparatus (side by side) configuration, office space and service areas. The proposed Fire Hall will be a slab-on-grade building, without basement, and consist of above grade parking.

The purpose of this geotechnical investigation was to obtain information on the subsurface conditions at the site by means of advancing a limited number of boreholes with associated in-situ tests and laboratory tests of select soil samples. Based on SNCL's interpretation of the obtained field information, recommendations are provided on the geotechnical aspects of the project.

The geotechnical investigation was carried out in conjunction with supplementary Environmental Site Assessments, and their findings are presented under separate cover.

The geotechnical investigation was completed in accordance with SNCL's approved proposal (Ref. No. 634196-14007, dated January 15, 2020).

This report contains the findings of SNCL's geotechnical investigation, together with recommendations and comments. These recommendations and comments are based on factual information and are intended only for the use of the design engineers. The recommendations and opinions in this report are applicable only to the proposed project as described in this Section. The Report Limitations is an integral part of this report.

2 Site Description and Previous Developments

The site is located on the west side of Rutherford Road South, approximately 300 m south of the intersection with Queen Street East. It is generally triangular, with an approximate area of 0.95 hectares. Land uses in the surrounding properties include mixed commercial and industrial land. An unnamed creek/drainage channel lies along the southern side of the site and falls within 30 m of the property line.

The site was historically used for cardboard manufacturing in 1971, and bulk storage of paints in 2006 with one (1) industrial building. We understand that the building was demolished in 2010. Following demolishing of the build, the site was being used by the City as a storage yard for mulch, cinder blocks and lumber. Currently, no permanent buildings are located at the site. The site is generally levelled, with asphalt along the northwest and east property lines, and topsoil, mulch and fill making up the remainder of the site.

It is our understanding the City plans to severe the property for the purpose of developing a Fire Hall on the north/northwest side of the site and possible road extension along the south/southwest side.

3 Regional Geology

This site is located within the geological formation known as the Peel Plain (reference The Physiography of Southern Ontario, Third Edition, compiled 1984). The underlying geological material of the plain consists of Halton Till deposits (reference: Quaternary Geology of Brampton Area; Ontario Geological Survey Map 2223, 2005).

The Halton Till matrix is half silt with subequal proportions of sand and clay and generally described as sandy silt to clayey silt till. The thickness of the Halton Till varies from 0 m (surface) to more than 10 m within the Brampton Area. The Till overlies older till (Wentworth or Newmarket), interbedded glaciofluvial and glaciolacustrine sediments, and commonly bedrock (reference: Quaternary Geology – Brampton Area; Ontario Geological Survey Report 257, 2005).

The bedrock within the Brampton Area consists of red shale (Queenston Formation) and grey shale with limestone interbeds (Georgian Bay Formation). The drift thickness within the site ranges from approximately 10 mbgs to 19 mbgs (reference: Ontario Geological Survey, Publication M2179, 1969).

4 Method of Investigation

4.1 Fieldwork

The fieldwork for the geotechnical investigation was performed between March 3rd and 13th, 2020 and consisted of advancing a total of thirty-five (35) boreholes. SNCL conducted a survey for borehole elevations and coordinates, where borehole location UTM coordinates and geodetic above mean sea level (MASL) elevations were taken by Trimble RX 5800 high precision unit. It should be noted that the ground surface elevations and coordinates at the borehole locations are approximate and should not be used for design and construction purposes.

The summary of borehole identification, depths, elevations and coordinates is presented in the following Table. It should be noted that borehole numbering (300 series and 400 series) was selected based on recommendations from SNC's Environmental group. Deeper boreholes, BH301 through BH321, were drilled within the proposed Fire Hall building, whereas relatively shallower boreholes, BH401 through BH414, were drilled within the proposed roadways, parking areas and sidewalk areas.

Table 1: Summary of Borehole Depths, Elevations, and Coordinates

Borehole ID	Borehole Depth (m bgs*)	Approximate Ground Elevation (MASL)	Borehole Easting (UTM Zone 17)	Borehole Northing (UTM Zone 17)
BH301	9.3	215.99	601494.77	4839210.68
BH302	9.3	215.80	601501.60	4839203.50
BH303	7.7	215.74	601510.19	4839199.91
BH304	9.1	215.99	601506.77	4839234.66
BH305	9.3	216.18	601516.19	4839227.15
BH306	9.2	215.99	601530.01	4839221.95
BH307	9.2	215.95	601513.30	4839241.86
BH308	9.2	215.98	601524.36	4839236.62
BH309	9.2	215.91	601534.72	4839224.26
BH310	9.2	215.72	601521.70	4839252.52
BH311	9.2	216.04	601531.34	4839245.52
BH312	9.2	215.90	601540.21	4839237.16
BH313	9.2	215.73	601529.28	4839262.34
BH314	9.2	216.04	601538.55	4839254.72
BH315	9.2	215.91	601547.51	4839247.02
BH316	9.2	215.67	601538.68	4839269.36
BH317	7.7	215.83	601546.36	4839263.89
BH318	9.2	215.88	601554.86	4839256.16
BH319	9.3	215.52	601542.59	4839279.39
BH320	9.2	215.87	601551.43	4839269.85
BH321	8.5	215.96	601560.24	4839261.30

Borehole ID	Borehole Depth (m bgs*)	Approximate Ground Elevation (MASL)	Borehole Easting (UTM Zone 17)	Borehole Northing (UTM Zone 17)
BH401	3.1	215.45	601444.06	4839160.06
BH402	3.1	215.49	601460.18	4839173.78
BH403	3.1	215.30	601468.83	4839169.59
BH404	3.1	215.79	601478.69	4839192.15
BH405	3.1	215.78	601485.50	4839187.34
BH406	3.1	215.62	601493.70	4839181.12
BH407	3.1	215.93	601545.18	4839219.86
BH408	3.1	215.91	601552.71	4839227.78
BH409	3.7	215.91	601560.08	4839237.83
BH410	3.1	215.89	601567.59	4839246.00
BH411	3.1	215.90	601571.16	4839254.92
BH412	2.5	215.73	601551.00	4839290.60
BH413	3.1	215.71	601558.84	4839282.40
BH414	3.1	215.67	601568.34	4839273.99

* m bgs = meters below ground surface

The Borehole Location Plan (Figure 1) are presented in **Appendix A** of this report.

The boreholes were advanced, using a 100 mm solid-stem equipped track mounted drill rig, under the full-time supervision of experienced geotechnical personnel from SNCL. Details of hole diameters, augers and rig types are provided in the individual Borehole logs in **Appendix B**.

Soil samples were generally taken at 0.76 m intervals from the ground surface to 3.1 m bgs and at 1.5 m intervals thereafter to termination depths while performing the Standard Penetration Test (SPT) in accordance with ASTM D1586. This consisted of freely dropping a 63.5 kg (140 lbs.) hammer for a vertical distance of 0.76 m (30 inches) to drive a 51 mm (2 inches) outer diameter (O.D.) split-barrel (split spoon) sampler into the ground. The number of blows of the hammer required to drive the sampler into the relatively undisturbed ground by a vertical distance of 0.30 m (12 inches) was recorded as the SPT 'N' value of the soil which indicated the consistency of cohesive soils or the relative density of non-cohesive soils. Vane shear testing and advancement of thin-walled tubes/Shelby tube were not possible due to the nature of the till deposit (Vane and Shelby tube refusal).

Ten (10) monitoring wells were installed in boreholes BH302/MW302, BH304/MW304, BH306/MW306, BH307/MW307, BH309/MW309, BH311/MW311, BH312/MW312, BH313/MW313, BH315/MW315 and BH320/MW320 to enable us to measure a stabilized groundwater reading. Upon completion of drilling, the soil samples were transported to our soil laboratory in Vaughan for further examination and laboratory testing.

5 Laboratory Testing

Visual soil classifications made in the field were verified by peer review in the laboratory. Moisture content determinations were completed on all recovered samples.

Grain size analysis (sieve and hydrometer) was performed on seventeen (17) select samples. The results of these tests are summarized in Table 2 and are also presented in **Appendix C** of the report.

Table 2: Grain-Size Laboratory Testing Results

Sample ID	Sample Depth (m bgs)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH301 / SS07	6.1 – 6.3	25	18	36	21
BH302 / SS06	4.6 – 4.8	45	30	25	
BH304 / SS05	3.0 – 3.6	29	32	31	8
BH306 / SS05	3.0 – 3.6	10	10	57	23
BH306 / SS06	4.6 – 4.9	12	45	43	
BH308 / SS06	4.6 – 5.2	20	16	48	16
BH311 / SS06	4.6 – 5.2	19	22	20	19
BH312 / SS04	2.3 – 2.9	9	29	42	20
BH313 / SS03	1.5 – 2.1	7	22	45	26
BH317 / SS03	2.3 – 2.9	6	27	47	20
BH319 / SS02	1.5 – 2.1	3	24	48	25
BH321 / SS05	4.6 – 5.2	19	17	47	17
BH401 / SS02	0.8 – 1.4	54	35	11	
BH406 / SS03	1.5 – 2.1	7	35	58	
BH408 / SS03	1.5 – 2.1	8	19	46	27
BH411 / SS02	0.8 – 1.4	4	39	57	
BH413 / SS01	0.0 – 0.6	2	29	69	

Atterberg Limits tests were conducted on nine (9) select samples. The results of these tests are presented in Table 3 and presented in **Appendix C** of the report.

Table 3: Atterberg Limits Results

Sample ID	Sample Depth (m bgs)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Soil Classification (1)
BH301 / SS07	6.1 – 6.3	30	19	11	Low to Medium Plasticity Inorganic Clay (CL-CI)
BH308 / SS06	4.6 – 5.2	30	18	12	Low to Medium Plasticity Inorganic Clay (CL-CI)
BH311 / SS06	4.6 – 5.2	27	17	10	Low Plasticity Inorganic Clay (CL)
BH312 / SS04	2.3 – 2.9	23	14	9	Low Plasticity Inorganic Clay (CL)
BH313 / SS03	1.5 – 2.1	29	18	11	Low Plasticity Inorganic Clay (CL)
BH317 / SS03	1.5 – 2.1	25	15	10	Low Plasticity Inorganic Clay (CL)
BH319 / SS02	0.8 – 1.4	29	15	14	Low Plasticity Inorganic Clay (CL)
BH321 / SS05	4.6 – 5.2	30	20	10	Low to Medium Plasticity Inorganic Clay (CL-CI)
BH408 / SS03	1.5 – 2.1	33	17	16	Low to Medium Plasticity Inorganic Clay (CL-CI)

Notes:

(1) In accordance with Canadian Foundation Engineering Manual (CFEM), 4th Edition

5.1 Chemical Attack Potential

Four (4) samples of native soil, identified as in Table 4, were submitted to an external analytical laboratory (ALS Laboratories) to assess the potential for the attack to buried concrete and ductile iron. Laboratory results and certificates are attached in **Appendix D** of this report.

A summary of the test results is presented in Tables 4 and 5:

Table 4: Buried Metal Attack Parameters

Sample ID	Depth (m bgs)	Parameters					Total Points	Corrosivity Potential
		Resistivity (ohm.cm)	pH	Redox Potential (mv)	Moisture (%)	Sulphides (2) (%)		
BH301/SS01	0.0 – 0.6	2780	7.56	175	17.6	<0.02	4	No
BH315/SS04	2.3 – 2.9	4440	7.93	174	10.9	<0.02	4	No
BH317/SS02	0.8 – 1.4	3700	7.85	181	12.2	<0.02	4	No
BH319/SS01	0.8 – 1.4	1450	7.72	193	12.3	<0.02	14	Yes

Note:

(1) Soil test evaluation carried out using AWWA C105/A21.5-05. A score of ten points or more indicates the soil is corrosive to ductile iron. Additional protection would be recommended if the score is 10 or greater.

(2) It was assumed that samples with a laboratory result less than the reported detection limit (RDL) for sulphides would be considered a trace condition (score of 2) and results greater than the RDL would be considered positive (score of 3.5).

Table 5: Summary of Water-soluble Sulphate Content

Sample ID	Depth (m bgs)	Sulphate (%)
BH301/SS01	0.0 – 0.6	0.0021
BH315/SS04	2.3 – 2.9	0.0081
BH317/SS02	0.8 – 1.4	0.0046
BH319/SS01	0.8 – 1.4	<0.0020

The following Table, refereeing from CSA A23.1-04/A23.2-04 ‘Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Procedure for Concrete’, divides the degree of exposure of concrete structures to sulphate attack into the following classes:

Table 6: Sulphate Exposure Classes

Degree of Exposure (Class)	Water Soluble Sulphate (SO_4) in Soil Samples (%)
Very Severe (S-1)	> 0.20
Severe (S-2)	0.20 – 2.0
Moderate (S-3)	0.10 – 0.20

The laboratory results (Table 5 above) indicated that the sulphate content of samples identified are in the S-3 class, indicating a low potential for sulphate attack on concrete to be placed below the ground surface. Based on these results, standard Portland cement should be suitable for use on this project.

6 Subsoil Conditions

6.1 Overview

In general, as indicated by the geology maps, subsurface conditions at this site was found to be fairly uniform. The typical stratigraphic sequence consists of fill or pavement structure/topsoil over fill (mainly cohesionless) underlain by native deposits (in descending order): cohesive till and till/shale complex.

For details of the subsurface conditions encountered at the borehole locations, reference should be made to the individual borehole record sheets presented in **Appendix B**. The properties of the soils encountered in the boreholes are described in generalized terms in the following sections.

The following summary is to assist the designers of the project with an understanding of the anticipated soil conditions across the site. However, it should be noted that the soil and groundwater conditions may vary between and beyond the borehole locations.

6.2 Ground Cover

The boreholes BH303, BH305, BH309, and BH320 were advanced through an approximately 80 mm to 250 mm thick layer of topsoil at the ground surface. Asphalt concrete pavement was encountered in boreholes BH317, BH321 and BH412 with thickness ranging from 50 mm to 150 mm. It should be noted that ground cover (topsoil/pavement) thicknesses may vary between and beyond borehole locations.

6.3 Fill Materials

6.3.1 Gravelly Sand to Sand and Gravel Fill

A fill layer consisting predominantly of gravelly sand to sand and gravel, with trace silt, trace clay, and rootlet was encountered in most of the boreholes. The thickness of this layer ranged from 0.2 to 1.5 m. The recovered samples were generally described to be in moist to wet condition. Moisture content measurements obtained on the extracted samples were found to be approximately 4 to 21 % by weight.

SPT ‘N’ values for this stratum varied between 14 and 42 blows per 300 mm, indicating compact to dense relative density.

6.3.2 Silty Sand to Sand Fill

Silty sand to Sand Fill, with trace to some gravel, and occasional rootlet was encountered in boreholes BH305, BH306, BH311, BH315, BH317, BH321 and BH408. The thickness of this layer ranged from 0.3 m to 1.3 m. The recovered samples were generally described to be in a moist to wet condition. Moisture content measurements obtained on the extracted samples were found to be approximately 7 to 24 % by weight.

SPT ‘N’ values for this fill layer varied between 9 and greater than 50 blows per 300 mm, indicating loose to very dense relative density.

6.3.3 Sandy Silty Clay to Silty Clay Fill

A fill layer consisting of sandy silty clay to silty clay with some sand, trace gravel, and rootlet was encountered in boreholes BH304 to BH306, BH308, BH311, BH320, BH405 to BH408, and BH411 to BH414. The depth of this layer ranged generally between ground surface and 1.5 m bgs, except for borehole BH412 where the depth was from 0.3 to 2.3 m bgs. The recovered samples were generally described to be in a moist to wet condition. Moisture content measurements obtained on the extracted samples were found to be approximately 13 to 36 % by weight.

SPT 'N' values for this fill layer varied generally between 6 and 13 blows per 300 mm, indicating firm to stiff consistency. In boreholes BH413/SS01 and BH414/SS01, SPT 'N' values were noted to be between 1 and 4 blows per 300 mm indicating a very soft to soft consistency.

6.4 Native Strata

6.4.1 Sandy Silty Clay to Silty Clay Till

A heterogenous relatively thick stratum of native soil consisting predominantly of sandy silty clay with trace to some gravel was encountered in all boreholes, except borehole BH403, at various depths ranging from existing ground surface to 6.1m bgs. This stratum was observed to become gravelly between 4.6 to 6.1 m bgs in borehole BH308. Cobbles were encounter randomly at various depths in this layer.

The recovered samples of this till layer were generally described to be in a moist to wet condition. Moisture content measurements obtained on the extracted samples were found to be between 7% and 28% by weight indicating moist to wet state.

SPT 'N' Values for this stratum varied between 9 and more than 100 blows per 300 mm, indicating a stiff to hard consistency in general. SPT 'N' values between 5 and 7 blows per 300 mm was noted in boreholes BH306/SS03, BH404/SS02 and BH404/SS03 indicating a firm consistency. In borehole BH406/SS02, SPT 'N' value of 3 was noted indicating a soft consistency.

6.4.2 Silty Sand to Sand Till

A stratum of native cohesionless till consisting predominantly of silty sand to sand with trace to some clay and trace to some gravel was encountered at the depths from existing ground surface to 9.2 m bgs in various boreholes. The soil layer becomes gravelly in boreholes BH304, from surface to a depth of 0.8 m bgs and BH404, from 2.3 to 4.6 m bgs.

The recovered samples were generally described to be in a moist to wet condition. Moisture content measurements obtained on the extracted samples were found to be between 2% and 23%.

SPT 'N' Values for this stratum varied between 12 and more than 100 blows per 300 mm, indicating a compact to very dense relative density. SPT 'N' value of 7 per 300 mm was noted in BH401/SS03 indicating a loose relative density.

6.4.3 Till-Shale Complex

A heterogeneous matrix of either silty clay till or silty sand till and weathered shale fragments was encountered in boreholes BH303, BH305, BH310, BH311, BH314, BH315, BH316, and BH320 below till at depths between 6.1 and 9.1 m bgs. This stratum was relatively difficult to auger due to its hard consistency and contained fragmented shale pieces. This matrix is a transitional deposit between the overlying till and bedrock and may also represent completely to highly weathered bedrock shale.

SPT refusal was encountered within this layer, indicating a hard consistency.

7 Groundwater Conditions

Groundwater observations were made in the boreholes as drilling proceeded and upon completion of drilling. Ten (10) monitoring wells were installed in boreholes BH302/MW302, BH304/MW304, BH306/MW306, BH307/MW307, BH309/MW309, BH311/MW311, BH312/MW312, BH313/MW313, BH315/MW315 and BH320/MW320 to enable us to measure a stabilized groundwater reading. Details of groundwater level in open boreholes, cave-in conditions and groundwater level measurement in monitoring wells are provided in the borehole logs in **Appendix C**. A summary of groundwater and cave-in recordings is presented in Table 6. It should be noted that there was not sufficient time available for the groundwater to stabilize inside the open boreholes.

Table 7: Groundwater and Cave-in Conditions

Borehole ID	Drilling Completion date	Groundwater Level Upon Completion of Drilling (m bgs)	Groundwater Level on March 25, 2020 (m bgs)	Cave-in Level Upon Completion of Drilling (m bgs)
BH301	March 03, 2020	Dry	n/a	4.6
BH302/MW302	March 11, 2020	3.4	2.0	Open
BH303	March 02, 2020	Dry	n/a	Open
BH304/MW304	March 10, 2020	3.3	2.2	4.3
BH305	March 10, 2020	3.4	n/a	4.5
BH306/MW306	March 11, 2020	8.2	2.4	9.2
BH307/MW307	March 05, 2020	-	2.2	-
BH308	March 09, 2020	Dry	n/a	8.8
BH309/MW309	March 10, 2020	Dry	2.2	Open
BH310	March 09, 2020	4.2	n/a	6.7
BH311/MW311	March 09, 2020	3.5	2.2	Open
BH312/MW312	March 12, 2020	3.3	2.6	Open
BH313/MW313	March 06, 2020	Dry	2.0	Open
BH314	March 06, 2020	2.7	n/a	9.0
BH315/MW315	March 05, 2020	Dry	2.1	9.0
BH316	March 03, 2020	Dry	n/a	Open
BH317	March 04, 2020	5.8	n/a	Open
BH318	March 04, 2020	Dry	n/a	Open
BH319	March 03, 2020	Dry	n/a	Open
BH320/MW320	March 04, 2020	3.7	2.0	Open
BH321	March 02, 2020	Dry	n/a	Open
BH401	March 12, 2020	Dry	n/a	Open
BH402	March 11, 2020	1.4	n/a	Open

BH403	March 11, 2020	Dry	n/a	3.0
BH404	March 12, 2020	Dry	n/a	Open
BH405	March 12, 2020	Dry	n/a	Open
BH406	March 12, 2020	Dry	n/a	Open
BH407	March 13, 2020	Dry	n/a	Open
BH408	March 13, 2020	Dry	n/a	Open
BH409	March 05, 2020	Dry	n/a	Open
BH410	March 13, 2020	Dry	n/a	Open
BH411	March 13, 2020	Dry	n/a	Open
BH412	March 12, 2020	Dry	n/a	Open
BH413	March 12, 2020	Dry	n/a	Open
BH414	March 13, 2020	Dry	n/a	Open

The groundwater at the site would fluctuate seasonally and can be expected to be somewhat higher in response to major weather events. In addition, perched groundwater can accumulate during and after wet seasons within the more pervious fill and native soils. In adverse conditions, the perched groundwater table may raise to near the ground surface. No long-term groundwater monitoring provisions were made in this geotechnical investigation program.

8 Engineering Discussion and Recommendations

It is our understanding that the proposed development will consist of a Fire Hall on the north side of the Site, with possible road extension along the south side. The proposed Fire Hall will be a slab on grade building with at grade parking. Thirty-five (35) boreholes were advanced at the Site, with twenty-one (21) boreholes covering the proposed building footprint, (9) boreholes covering the surface parking areas and five (5) boreholes covering boulevards and/or sidewalks (See **Appendix A** for locations). Further details such as structural drawings, anticipated loading, Finished Floor Elevations (FFE), etc. were not available at the time of preparation of this report.

Fill materials up to 1.5 thickness (typically) with loose compactness condition and very soft consistency and occasionally mixed with rootlet were encountered either at surface or below cover materials which will pose some challenges to the proposed development. Freestanding groundwater was encountered in eleven (11) boreholes in the site upon completion of drilling. A detailed hydrogeological study was beyond the scope of work for this geotechnical investigation. However, based on groundwater observations, excavations for shallow foundations may be anticipated to encounter groundwater during construction.

Based on above comments and the borehole information, and assuming them to be representative of the subsoil conditions across the site, following comments and recommendations are offered.

8.1 Site Preparation and Grading

Based on the conditions encountered in the boreholes as summarized in Section 6, the proposed development areas of the site primarily consists of ground cover of topsoil and asphaltic concrete gravel underlain by fill materials extending to depths ranging between 0.2 and 1.5 m bgs, with the exception of BH317 where fill was encountered to a depth of 2.3 m bgs. The fill consisted of mostly cohesionless material (gravelly/silty sand), however cohesive fill (silty clay) was encountered in boreholes BH320, BH401, BH406, BH413 and BH414. In general, the existing earth fill was found to contain rootlet and broken cobble pieces.

Prior to any construction, the existing ground surface cover and fill materials are to be removed from the area of the proposed development. The asphaltic concrete gravel is not suitable for site grading or foundation purposes and should be removed entirely from the footprint of the building. Any organics, deleterious materials, asphaltic concrete, and unsuitable fill exposed must be removed from the area of the proposed building and parking lot. All subgrade surfaces for the building, roadways and sidewalks are to be examined by qualified geotechnical personnel.

The fill and native soils encountered at the Site are generally suitable for reuse as backfill, provided it is free of organic and deleterious material and is within the optimum moisture content. However, due to the high silt content within the native soils, difficulties in achieving desired compaction of the material should be expected.

Prior to any fill placement, the material needs to be inspected and approved by SNCL's qualified geotechnical engineer. Further comments regarding the use of backfill are discussed in Section 8.5. However, re-use of removed topsoil should be limited to landscaping areas (as applicable).

8.2 Proof Rolling

Upon completion of initial site preparation activities (as discussed above), proof rolling of the subgrade should be conducted to verify that competent and uniform soil subgrade support conditions have been achieved. Proof rolling should not be conducted during or shortly following precipitation events, and heavy equipment shall not be allowed to travel on wet/soft subgrade soils until adequate drying has occurred. Proof rolling should be performed by two passes of a dual-wheel truck (or comparable equipment) with a minimum of 80 kN single axle load. Soils which display rutting or appreciable deflections upon proof-rolling should be over-excavated to expose more competent soil and replaced with suitable engineered fill. Alternately, the use of geosynthetics (woven geotextile, geogrid in conjunction with non-woven geotextile, or, combination geotextile/geogrid products), possibly in conjunction with some over-excavation, may be an alternative. If geosynthetics are utilized, it is recommended that granular fill materials be placed directly over the geosynthetics. The geosynthetics should be placed in accordance with the manufacturer's recommendations. Construction techniques should be designed to minimize the potential for damage to the geosynthetics and underlying subgrade soils (i.e., end-dump and spread methods, use of long reach and/or low contact pressure equipment, etc.). SNC-Lavalin should be retained to provide guidance with respect to subgrade improvement measures.

Following efforts to stabilize the soil, proof rolling should be repeated. All proof rolling and compaction efforts should include documentation detailing the findings, including photographs where possible. All finished subgrades should be protected from construction traffic and erosion as soon as possible.

8.3 Building Foundations

The following section provides recommendations for geotechnical design of foundations for the proposed building based on the subsurface conditions encountered at the Site:

8.3.1 Conventional Spread Footings

The existing fill layers that overlay the proposed building footprint are unsuitable to support building foundations. Footings may be placed on the native strata at depths ranging approximately 1.5 m to 2.3 m, using a geotechnical bearing resistance of 200 kPa for a Serviceability Limit States (SLS) and 300 kPa for a factored Ultimate Limit State (ULS) design. The minimum founding depth at each of the borehole locations is provided in the Table below. Additional details regarding SLS and ULS bearing capacity, for cases were the grade is raised, are provided in Section 8.5.1.

Table 8: Recommended Minimum Footing Depth / Elevation

Borehole	Approximate Depth (m bgs)	Approximate Elevation (MASL)
BH301	1.5	214.5
BH302	1.5	214.3
BH303	1.5	214.2
BH304	2.3	213.7
BH305	2.3	213.9
BH306	2.3	213.6
BH307	1.5	214.4
BH308	1.5	214.5
BH309	1.5	214.4
BH310	1.5	214.2
BH311	1.5	214.5
BH312	1.5	214.4
BH313	2.3	213.4
BH314	1.5	214.5
BH315	1.5	214.4
BH316	1.5	214.2
BH317	2.3	213.5
BH318	1.5	214.4
BH319	1.5	214.0
BH320	1.5	214.4
BH321	1.5	214.5

Conventional spread footings must be founded at least 0.2 meters into the native stratum for the geotechnical bearing resistance values provided. Excavation for sump pits, utility trenches, footings, or similar should not intersect a zone which would extend downward and an angle of 10 horizontal to 7 vertical from the outside underside of existing or proposed footings. Exposed footing subgrades are to be inspected, evaluated and approved by SNCL's qualified geotechnical engineer or their designate.

Footings designed to the specified bearing capacity at the serviceability limit states (SLS) are expected to settle less than 25 mm total and 19 mm differential.

A permanent soil cover of a minimum of 1.2 m or its thermal equivalent in insulation is required for frost protection of all foundations. Higher geotechnical bearing resistances would be available at a greater depth, if required. It is recommended that our office is allowed to review the structural drawings.

8.4 Dewatering

As discussed in Section 7, the measured groundwater levels in piezometers approximately two to three weeks after installation is about at 2 m depth below existing grade. Due to the relatively shallow static groundwater elevations and soils consisting of permeable deposits, active dewatering may be required for excavations at this site in areas where groundwater cannot be controlled through the use of gravity fed sumps and pumps.

Any form of dewatering must consider possible settlements that may be caused on the adjacent areas, including the possible adverse effects on the existing and nearby structures, roads,

underground services etc. It should also consider the large body of water present (e.g. the stream) as well as the relatively high permeability of the soils encountered in the boreholes.

The following general guidance is provided for designers of a dewatering system for this Site:

- Standby pumping capacity should be provided, in addition to an adequate primary capacity;
- Effective filters must be utilized in order to prevent migration of soil fines and ground loss;
- Pumped water must be discharged such that it will not interfere with excavations;
- Groundwater must be maintained at least 0.5 m below the base of any open excavations, including any progressively rising backfill during its placement in order to prevent 'pumping' of the base due to construction traffic/compaction efforts;
- Adequate monitoring of groundwater levels must be carried out – this may involve installation of additional monitoring wells prior to construction; and
- On completion of construction activities, dewatering systems should be gradually shut down to prevent the creation of transient critical exit gradient conditions, which may result in migration of fines.

It should be noted that if pumping volumes for construction dewatering are less than 400,000L per day, a Permit to Take Water (PTTW) from the Ontario Ministry of the Environment (MOE) is not required. However, registration under the Environmental Activity and Sector Registry (EASR) from the MOE will be required.

8.5 Backfill Considerations

Backfilling, if required can be accomplished by reusing the excavated soils or similar fill material provided the moisture content is maintained within 2 percent of optimum and the fill is free of topsoil, organics and any deleterious material. The fill placed in excavated foundations should be in thin lifts not exceeding 200 mm thick and compacted to not less than 98 percent of its Standard Proctor Maximum Dry Density (SPMDD) up to 500 mm below pavement structure or hardscaped areas.

In general, the on-site excavated clayey soils including silty clay and clayey fills, will be excavated in cohesive blocks and will be difficult to handle and compact, requiring the use of heavy compactors for proper compaction. For use as backfill, the cohesive blocks will have to be pulverized and placed in thin layers, provided their moisture contents are at or near the optimum moisture content. Unless the clayey soils are properly reduced in sized and compacted in sufficiently thin lifts, post-construction settlements could occur.

Backfill placed in the upper 500 mm below pavement structure or hardscaped areas should be compacted to 98 % to 100% of that material's SPMDD.

For any fill operation to be considered Engineered Fill, the following criteria must be satisfied:

- Engineered Fill should consist of uniform, homogeneous material. The fill material should also be free of organics, deleterious materials (i.e. building debris such as bricks, metal etc.). Materials meeting Ontario Provincial Standard Specification, such as Select Subgrade material, and/or OPSS Granular B Type I or II specifications or of better quality would be considered a suitable Engineered Fill material;

- Prior to the placement of Engineered Fill, it must be evaluated for suitability in the Geotechnical Laboratory. Samples should be provided to the Geotechnical Engineer and submitted for Standard Proctor, grain size analysis and moisture content determination;

- Engineered Fill must be compactable, and of a suitable moisture content such that it is within +/- 2.0% of its optimum moisture content, as determined through laboratory testing, and compacted to not less than 100% of the materials' Standard Proctor Maximum Dry Density (SPMDD), and placed and compacted in separate lifts up to 250mm in thickness or as otherwise noted;

- Engineered Fill must be placed under the continuous supervision of a Geotechnical Engineer or their designate;

- Field density tests must be taken under the supervision of the Geotechnical Engineer on each lift of Engineered Fill. Any Engineered Fill which is tested and found to be out of specification shall be either removed, reworked or retested;

- Material to be used as Engineered Fill must be environmentally acceptable, subject to confirmatory testing; and

- Engineered Fill placed underneath foundations must extend laterally a minimum of 0.6 D, but not less than 0.9 m from the outside edge of the footings, where D is the depth of Engineered Fill placed.

8.5.1 Engineered Fill Foundations

Engineered fill could be considered for supporting foundations or if grade raise is required. Due to the gentle slope at the site, if existing grades are required to be raised for general site grading, and to avoid stepping down footings, it is understood that proposed foundations for this building may be placed on engineered fill. If this is desired, the following procedure should be implemented.

- All existing fill and deleterious material within the proposed building area should be removed;

- The exposed subgrade should be inspected, evaluated and approved by a geotechnical engineer or designate. The exposed surface should be proof rolled using heavy construction equipment to identify any soft areas. These soft areas should be sub excavated and replaced with compacted engineered fill;

- Provided the underlying native soils are found suitable to support engineered fill, the subsequent engineered fill layers can be placed and compacted to raise Site grades; and

- If appropriate compaction is not achieved or if the native soils are deemed unacceptable, additional measures such as sub excavation will be required. These measures should be determined at the time of construction.

Provided the Engineered fill is used underneath the footings as noted above, the following bearing pressures can be used in the foundation design:

- Cohesive fill: a geotechnical bearing resistance of 100 kPa for a Serviceability Limit States (SLS) and 300 kPa for a factored Ultimate Limit State (ULS) design.

- Granular Fill: a geotechnical bearing resistance of 150 kPa for a Serviceability Limit States (SLS) and 350 kPa for a factored Ultimate Limit State (ULS) design

The selected backfill materials should reasonably match the existing soil profile within the zone of frost penetration (1.2 m below finished grades). Alternatively, if imported backfill (including granular material) are used, excavations should be provided with frost tapers – designers should refer to applicable OPSD for taper requirements.

8.6 Slab-on-Grade

In order to have a floor slab with minimum maintenance, we recommend that all objectionable materials (i.e. organic, wet, soft etc.) and fill soils are removed, and the exposed subgrade should be inspected, evaluated and approved and thoroughly proof rolled.

The existing fill is not suitable for supporting foundations as well as floor slabs. For the proposed building, the floor slab can be supported on grade provided all topsoil, fill, and surficial softened till are removed and the base thoroughly proof rolled. The engineered fill can consist of inorganic soil, placed in shallow lifts and compacted to not less than 100 percent of Standard Proctor Maximum Dry Density (SPMDD).

The slab-on-grade areas should be proof rolled. Underneath slabs, a minimum 200mm thick base layer consisting of Ontario Provincial Standard Specifications (OPSS) Granular A should be placed and compacted to 100% of its SPMDD. It is also recommended that the final lift of material beneath the slab consist of 150mm of clear stone material in order to provide a capillary break as well as for fine grading purposes.

The modulus of subgrade reaction appropriate for slab design would depend on the condition of the subgrade and the extent of sub-excavation required. If all unsuitable materials are removed beneath the proposed slab-on-grade and replaced with well-compacted Engineered Fill, then a modulus of subgrade reaction of 27,000 kN/m^2/m to 32,500 kN/m^2/m (100 to 120 pci) can be used for design purposes. Once the size of the slab is confirmed, SNCL needs to be notified and the modulus of subgrade reaction may need to be modified.

8.7 Seismic Site Classification

Buildings foundations are required to be structurally designed to resist a minimum earthquake force, as defined in the National Building Code of Canada, 2015 (NBCC).

In accordance with Section 4.1.8.4 of NBCC, the site classification for seismic site response was verified by measurement of the in-situ shear wave velocity by geophysical techniques. Geophysics GPR conducted multi-channel analysis of shear waves (MASW) at the project site, as shown in **Appendix E**. Based on the analysis, the average shear wave velocity for the top 30 m at the site was 796 m/s. Taking into account the estimated error in MASW and NBCC, a seismic site classification of 'C' can be considered at this project site.

8.8 Drainage

Perimeter drainage is not considered necessary for a structure with no basement and a floor slab set a minimum of 0.3 m above finished exterior grades. **Appendix F** presents typical sections of perimeter drains in accordance to the latest edition of the Canadian Foundation Engineering Manual. The drainage system should discharge to a protected and frost-resistant sump. The uppermost backfill should be impermeable soil.

It is generally recommended that all slabs-on-grade which are located at or near exterior grades be located a minimum of 300 mm above the final exterior grade, and that the ground surface around the perimeter of the buildings slope downward and away from the building walls.

Damp-proofing should be applied to exterior foundation walls in order to prevent moisture infiltration from the backfill materials. Waterproofing membranes could be considered as an additional precaution.

8.9 Excavation and Temporary Shoring

8.9.1 Open Cut

The OHSA regulations require that if workmen must enter an excavation deeper than 1.2 m, the excavation must be suitably sloped and/or braced in accordance with the OHSA requirements. OHSA specifies the maximum slope of the excavations for four broad soil types as summarized in the following table:

Table 9: Maximum Slope of Excavation for Soil Type

Soil Type	Base of Slope	Maximum Slope Inclination
Type 1	Within 1.2 metre of bottom	1 horizontal to 1 vertical
Type 2	Within 1.2 metre of bottom of trench	1 horizontal to 1 vertical
Type 3	From bottom of excavation	1 horizontal to 1 vertical
Type 4	From bottom of excavation	3 horizontal to 1 vertical

The fill at the Site above the groundwater can be classified as Type 3 soils. The Native clayey soils can be classified as Type 1 (hard) to 3 (firm to stiff) soils. The cohesionless soils encountered at depth at this site can be classified as Type 1 (very dense) to type 3 (compact) soils. If affected by groundwater or surface water seepage, the fill and native soils must be considered as Type 4 soils. The highest number of soil type identified in an excavation must govern the excavation slopes from top to bottom of the excavation.

If the above-recommended excavation side slopes cannot be maintained due to lack of space (i.e. due to building addition) or any other reason, the excavation sides must be supported by an engineered shoring system. The shoring system should be designed in accordance with relevant codes, standards, and regulations such as the latest version of the Canadian Engineering Foundation Manual and the OHSA Regulations for Construction Projects.

For all temporary construction excavation slopes, the stability of the cut slopes will have to be frequently monitored by the geotechnical engineer. If the temporary construction excavation slopes are subject to erosion (e.g., due to rainfall, high groundwater flow, etc.), slope stabilization measures (e.g., covering the slope/trench faces with plastic sheets, excavating flatter slope, etc.) will have to be implemented.

Stockpiles of excavated materials should be kept at least 3 m from the edge of the excavation to prevent slope instability, subject to confirmation by the geotechnical engineer. Care should also be taken to avoid overloading of any underground services/structures by stockpiles.

No major excavation difficulties are foreseen in the existing overburden soils within the depths drilled for this investigation, but allowance should be made for the possible presence of boulders and cobbles that may be found within the soil strata, so the use of appropriate equipment is recommended.

Temporary support for underground utilities (e.g. gas, water, cable, sewer, and telephone) and any existing footings/structures which may be exposed during the excavation may be required. Approval should be obtained from relevant authorities and utilities companies regarding excavation works around such services/footings.

8.9.2 Temporary Shoring and Lateral Earth Pressures

No basement is anticipated in proposed building area; however, service pits are anticipated. Any permanent walls or temporary shoring systems must be designed by a qualified engineer in order to resist unbalanced lateral earth pressures.

Cave-in conditions were noted in nine (9) boreholes at the Site at depths ranging from 3.0 to 9.2 m bgs. If required, shoring systems such as trench boxes could be employed for the site, if insufficient space is available to properly backslope excavation sidewalls. The temporary shoring system should be designed and provided in accordance with the latest version of the Canadian Foundation Engineering Manual, 4th Edition, and Ontario Health and Safety Regulations.

For design purposes, the following table presents geotechnical parameters related to lateral earth pressures can be considered:

Table 10: Lateral Earth Pressure Parameters

Soil Type	Bulk Unit Weight, γ (kN/m^3)	Angle of Internal Friction (Φ)	Coefficient of Lateral Earth Pressure		
			K_a	K_o	K_p
Existing Cohesionless Fill	19	30	0.33	0.50	3.00
Existing Cohesive Fill	19	26	0.39	0.56	2.56
Native Cohesionless Till	21	33	0.29	0.46	3.39
Native Cohesive Till	20	31	0.32	0.48	3.12
Compacted Granular 'B' Type II / "A"	22	35	0.27	0.43	3.69

Note: the above values were calculated considering a level surface behind the wall

Horizontal earth pressures can be calculated based on the following equation:

$P= K [\gamma(h-h_w) + \gamma' h_w + q] + \gamma_w.h_w$

where:

P = the horizontal pressure at depth, h (m)

K = the earth pressure coefficient,

γ = the bulk unit weight of soil, (kN/m3)

γ' = the submerged unit weight of soil, (kN/m3)

γ_w = the unit weight of water, (kN/m3)

h_w = the depth below the groundwater level (m)

q = the complete surcharge loading (kPa)

Where elevated groundwater level is not anticipated to be present or that a perimeter drainage system is used to eliminate hydrostatic pressures on the soil retaining structure, the above noted expression will be simplified as follows:

$P = K(\gamma h+ q)$

This equation assumes a drainage system which eliminates hydrostatic pressures would be present shoring system. It should be noted that shoring systems should be restrained and not allow lateral yielding, therefore the at-rest earth pressure coefficient should be used for their design. Surcharge loads related to compaction equipment should be taken into considerations for all designs.

8.10 Site Services

The boreholes showed that in their undisturbed state, the native soil will generally provide adequate support for utilities and allow the use of normal Class 'B' Type bedding (i.e. compacted granular bedding material - as per applicable OSPD standards e.g. OPSD 802.032). The recommended minimum thickness of granular bedding below proposed utilities is 150 mm. The thickness of the bedding may, however, have to be increased depending on the pipe diameter, as per specifications, or if wet or weak subgrade conditions are encountered. The Class 'B' Type bedding may need to be wrapped by a geotextile (e.g., Terrafix 270R or equivalent), as directed by the geotechnical engineer. HL6 clear stone wrapped in geo-textile and/or high-performance bedding (HBP) can be considered as alternative bedding if wet or unsuitable conditions are present at the subgrade.

In any event, after installing the pipe on the bedding, the compacted bedding material must surround the pipe and extend above the top of the pipe as set by the applicable standards, but not less than 300 mm, to avoid damage to the pipe during backfilling. Backfill immediately overlying the bedding must be compacted carefully using a suitable compactor to avoid damage to the pipe.

8.11 Pavement Design Selection and Recommendations

Based on the findings of the boreholes and visual condition of the project site, recommendations for the pavement design of the proposed parking areas and access road for fire truck are provided in this section. The pavement recommendations include a light-duty section for passenger vehicle parking areas, and a heavy-duty section for access roads (i.e. fire truck route). Flexible pavement design is recommended for both light-duty and heavy-duty traffic. In addition, rigid pavement option is recommended for heavy-duty traffic (fire hall).

The design recommendations for pavement structure for parking areas is as follows:

8.11.1 Design Considerations:

- It should be noted that the pavement designs are based on assumed traffic. If more accurate or reliable data are available, the pavement design should be revised.

- Based on MTO's Pavement Design and Rehabilitation Manual, 2nd Edition, the soils are considered as low to moderate frost susceptibility (LSFH to MSFH). The permanent ground water level should be at least 1.5 m below the proposed finished grade by providing positive drainage system (e.g. subdrains, storm sewer, etc.) to prevent frost heave. To promote effective surface drainage, the finished pavement surface must be free of depressions and sloped at a minimum grade of two percent towards a positive outlet for runoff. Surface water should not be allowed to pond at the outside edges of any pavement areas.

- All objectionable materials and surficial soft fill soils should be removed and the exposed subgrade thoroughly proof rolled. The pavement thicknesses recommended below considers that construction will be carried out during a dry seasonal period and that the subgrade soils are competent. If the subgrade becomes excessively wet or rutted during construction activities, sub-excavation and replacement with additional depth of granular sub-base material may be required. The disturbance of the subgrade material during site preparation, stripping,

proof rolling and granular fills must be avoided. If the granular pavement fill is placed on disturbed, undulating soils, water can be trapped and collect in the depression which could lead to differential frost heave and thus damage the asphaltic concrete surface.

8.11.2 Flexible Pavement: Light-Duty Parking Lot (Car Parking)

- Excavate/remove the existing topsoil/asphaltic concrete and underlying material in order to accommodate 540 mm pavement structure below the final grade of the proposed parking area;
- Perform subgrade preparation with 3% crossfall toward drainage outlets (catch basins, storm sewers, or ditch);
- Place and compact 300 mm Granular B Type II to minimum 100% of Standard Proctor Maximum Dry Density (SPMDD);
- Place and compact 150 mm of Granular A with 2% crossfall toward drainage outlets to minimum 100% SPMDD;
- Pave 50 mm Superpave 19.0 or HL8 binder course;
- Place SS-1 Tack Coat; and
- Pave 40 mm Superpave 12.5 or HL3 surface course.

8.11.3 Heavy Duty Traffic (Main Access Driveway to the Parking Lots,)

Option 1: Flexible Pavement

- Excavate/remove the existing topsoil/asphaltic concrete and underlying material in order to accommodate 650 mm pavement structure below the proposed final grade of the proposed parking area;
- Perform subgrade preparation with 3% crossfall toward drainage outlets (catch basins, storm sewers, or ditch);
- Place and compact 350 mm Granular B Type II to minimum 100% of Standard Proctor Maximum Dry Density (SPMDD);
- Place and compact 150 mm of Granular A with 2% crossfall toward drainage outlets to minimum 100% SPMDD;
- Pave 110 mm Superpave 19.0 or HL8 binder course in two lifts;
- Place SS-1 Tack Coat; and
- Pave 40 mm Superpave 12.5 or HL3 surface course.

Option 2: Rigid Pavement:

- Excavate/remove the existing topsoil/asphaltic concrete and underlying material in order to accommodate 730 mm (Granular A) or 630 mm (OGDL) pavement structure below the proposed final grade of the proposed parking area;
- Perform subgrade preparation with 3% crossfall toward drainage outlets (catch basins, storm sewers, or ditch);
- Place and compact 300 mm Granular B Type II to minimum 100% of Standard Proctor Maximum Dry Density (SPMDD);

- Place and compact 200 mm Granular A or 100 mm OGDL (Open Graded Drainage Layer), with 2% crossfall toward drainage outlets to minimum 100% SPMDD;
- Place 230 mm JPCP (Jointed Plain Concrete Pavement) in slabs not exceeding 4.5m in joint spacing, with 32mm dowel bars at slab joints (all directions) with 300mm dowel spacing.

8.11.4 Pavement Construction Material

Pavement construction material for new parking areas are summarized as follows:

Flexible Pavement

- The minimum grade of asphalt cement for this project should be PG 58-28, however, consideration may be given to a high-grade increase to PG 64-28 for the heavy-duty parking areas.
- New asphalt will be paved and compacted to minimum 92% of Maximum Relative Density (MRD)
- Tack coat should be applied to the top of binder course, as per OPSS PROV 308 and City of Brampton Specification.
- Civil designers and contractors should refer to and follow all applicable OPSS (Such as OPSS 310, 1010, 1150) and Peel Region/City standards regarding material specifications and construction procedures for new pavement construction.

Rigid Pavement

- The concrete should satisfy the requirements of CAN/CSA A23.1-04 Class C-2 concrete with a minimum compressive strength of 32 MPa and a minimum flexural strength of 5.0 MPa. The PCC concrete should meet the requirements of Peel Region/City specification.
- Dowel bars shall be plain round bars of grade 300 or better according to CSA G40.219 and shall be epoxy coated according to OPSS 1442.
- For concrete base specification, Dowel detail, Joint details, Concrete joint layout and Joint spacing, please refer to OPSS 350, OPSD 552.051, 552.010, 551.031 and 551.010, respectively.
- Wire shall be according to ATSM A 82M. Wire sizes shall be according to American Steel Wire Gauge.
- Standard subdrain should be installed as per OPSS and OPSD.

9 Closure

The recommendations provided in this report are based on subsoil data obtained at the sounding locations. Experience indicates that the subsoil and groundwater conditions can vary significantly between and beyond the sounding locations. For this reason, the recommendations given in this report are subject to a field verification of the subsoil conditions at the time of construction.

Should any site condition encountered differ from those at the tested locations or any changes in the project, we request that SNCL be notified immediately in order to permit reassessment of the recommendations.

10 General Conditions and Limitations

A. Use of the Report

A.1 The work performed in this report was carried out in accordance with the terms and conditions made part of our proposal and/or contract pursuant to which the report was issued. The conclusions presented in the report are based solely upon the scope of services, governed by the time and budgetary considerations to which this work is subject.

A.2 The factual data, interpretations and recommendations contained in this report pertain to a specific project as described in the report and are not applicable to any other project or site location. If the project is modified in concept, location or elevation or if the project is not initiated within twelve months of the date of the report, SNCL should be given an opportunity to confirm that the recommendations are still valid.

A.3 The comments given in this report are intended only for the guidance of the design engineer. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual test hole data, as to how subsurface conditions may affect their work.

A.4 The reader should be advised that geotechnical opinions, presented in this report, are subject to inherent uncertainties due to sampling limitations.

A.5 The report must be read as a whole, as sections taken out of context may be misleading. Drafts and working copies of study reports and other deliverables, whether or not marked "draft" and/or "for discussion purposes", do not necessarily reflect SNCL's final opinion following consideration of all matters which are the subject of the study giving rise thereto; they are issued for comment and information purposes only, and are subject to change. The reader should not rely on such documents for any purpose.

B. Follow-up

B.1 All details of the design and proposed construction may not be known at the time of submission of SNCL's report. It is recommended that SNCL be retained during the final design stage to review the design drawings and specifications related to foundations, earthworks, retaining systems and drainage, to determine that they are consistent with the intent of SNCL's report.

B.2 Retention of SNCL during construction is recommended to confirm and document that the subsurface conditions throughout the site do not materially differ from those given in SNCL's report and to confirm and document that construction activities did not adversely affect the design intent of SNCL's recommendations.

C. Soil and Rock Conditions

C.1 Soils and/or rock descriptions in this report are based on commonly accepted methods of classification and identification employed in professional geotechnical practice. Classification and identification of soil and rock involves judgment and

SNCL does not guarantee descriptions as exact but infers accuracy only to the extent that is common in current geotechnical practice.

C.2 The soils and rock conditions described in this report are those observed at the time of the study. Unless otherwise noted, those conditions form the basis of the recommendations in the report. The condition of the soil and rock may be significantly altered by construction activities (traffic, excavation, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting or drying. Unless otherwise indicated the soil and rock must be protected from these changes or disturbances during construction.

D. Logs of Test Holes and Subsurface Interpretations

D.1 The test hole logs indicate the approximate subsurface stratigraphy and conditions only at the locations of the test holes. Soil and rock formations are variable to a greater or lesser extent. Boundaries between zones on the logs are often not distinct, but rather are transitional and have been interpreted. The precision with which subsurface stratigraphy and conditions are indicated depends on the method of boring, the frequency of sampling, the method of sampling and the uniformity of subsurface stratigraphy and conditions.

D.2 Subsurface stratigraphy and conditions between test holes are inferred and may vary significantly from stratigraphy and conditions encountered at the test holes.

D.3 Groundwater elevations and conditions described in this report refer only to those observed at the place and time of observation noted in the report. These elevations and conditions may vary seasonally or as a consequence of construction activities on the site or adjacent sites.

E. Changed Conditions

E.1 Where conditions encountered at the site differ significantly from those described or anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of the use or reliance by the client on this report that SNCL is notified of the changes and provided with an opportunity to review the recommendations of this report. Recognition of changed soil and rock conditions requires experience and it is recommended that an experienced geotechnical engineer be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

F. Drainage

F.1 Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage can have serious consequences. SNCL can take no responsibility for the effects of drainage unless SNCL is specifically involved in the detailed design and follow-up site services during construction of the system.

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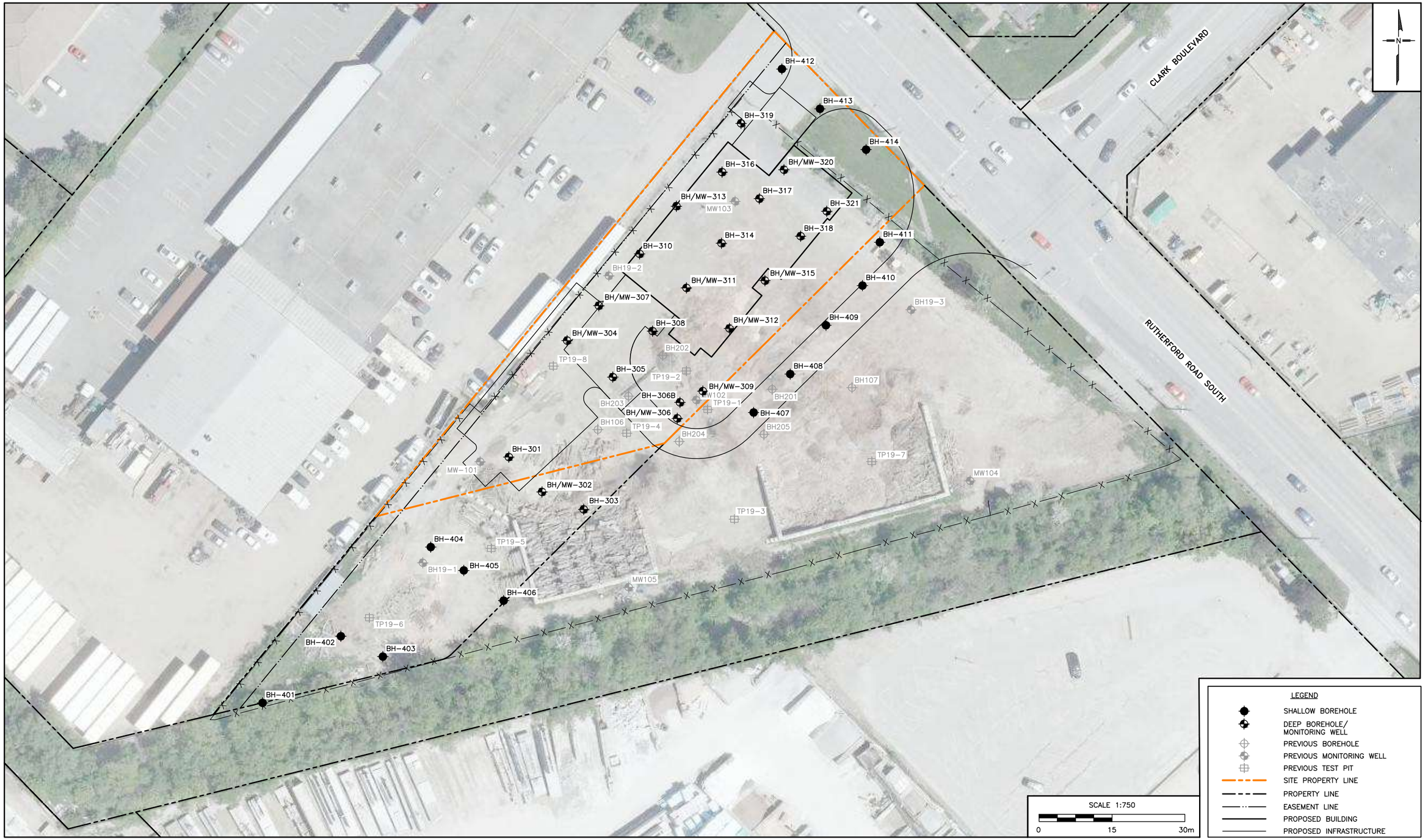
Appendix A

Site and Borehole Location Plan (1 pages)



NOTE(S):
1. SCALE AND SITE INFRASTRUCTURE LOCATIONS ARE APPROXIMATE
2. INFORMATION ON THIS FIGURE MAY BE LOST IF IT IS PRINTED, PHOTOCOPIED OR FAXED IN OTHER THAN ITS ORIGINAL SIZE AND COLOURS
3. 'm' : METRES

SOURCE(S):
1. CITY OF BRAMPTON, ONLINE MAP, JANUARY 2020
2. WOOD ENVIRONMENT AND INFRASTRUCTURE SOLUTIONS, PHASE TWO ENVIRONMENTAL SITE ASSESSMENT, BOREHOLE/MONITORING WELL AND TEST PIT LOCATION PLAN, FIGURE 5, PROJECT No. TOR190020.3000, OCTOBER 2019

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Client/Location: CITY OF BRAMPTON 25 RUTHERFORD ROAD SOUTH, BRAMPTON, ON		Title: BOREHOLE/MONITORING WELL LOCATION PLAN	
Project No: 671835	Filename: 007F01_671835	Date: JUNE 2020	Dwg No: FIGURE 1
Drawn: DM	Verified: WW	Project Manager: AY	

PAGE FORMAT: 11x17

FILENAME: P:\City of Brampton\Rutherford Rd South\671835\40_Execution\47_Wrkg_Vers\CAD_GIS\007 (GEM)\007F01_671835.dwg

Appendix B

Record of Borehole Logs (36 pages)

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NOTES TO RECORD OF BOREHOLES

DRILLING DATA

Method:

SolSt Auguring	-	Solid Stem Auguring
HolSt Auguring	-	Hollow Stem Auguring
WB	-	Washed Boring

SAMPLES TYPE

SS	-	Split Spoon
AS	-	Auger Sample
TW	-	Thin wall Open
TP	-	Thin wall Piston
WS	-	Washed Sample
BS	-	Block Sample
RC	-	Rock Core
PH	-	Sample Advanced Hydraulically
PM	-	Sample Advanced Manually

LABORATORY DATA

W_P	-	Plastic Limit
W	-	Water Content (%)
W_L	-	Liquid Limit
γ	-	Natural Unit Weight (kN/m^3)
UNDR STRNG or c_u	-	Undrained Shear Strength (kPa) Field Vane: St-sensitivity
pp	-	Pocket Penetrometer
UC	-	Unconfined Compression
UU	-	Unconsolidated Undrained at Overburden Pressure
CU	-	Consolidated Undrained
CD	-	Consolidated Drained
TOV	-	Total Organic Vapors

Standard Penetration Test, 'N'- Values: The Standard Penetration Test (SPT) 'N'-values are the number of blows required to cause a standard 51 millimeters o.d. split barrel sampler to penetrate 0.3 meter into undisturbed ground in a borehole when driven by a hammer with a mass of 63.5 kilograms falling freely a distance of a 0.76 meter. For penetrations of less than 0.3 meter, N-values are indicated as the number of blows for the penetration achieved (e.g. 50/25: 50 blows for 25 centimeters penetration).

Dynamic Cone Penetration Test: Continuous penetration of a conical steel point (51 millimeters o.d. 60^o cone angle) driven by 475 J impact energy on a size drill rods. The resistance to cone penetration is measured as the number of blows for each 0.3 meter advance of the conical point into the undisturbed ground.

Soils are described by their composition and consistency or relative density

CONSISTENCY: Cohesive soils are described on the basis of their undrained shear strength (c_u) or 'N'-values as follows:

c_u (kPa)	0 - 12	12 - 25	25 - 50	50 - 100	100 - 200	>200
	VERY SOFT	*SOFT*	*FIRM*	*STIFF*	*VERY STIFF*	*HARD*
N (blows/0.3 meter)	0 - 2	2 - 4	4 - 8	8 - 15	15 - 30	>30

COMPACTNESS CONDITION: Cohesionless soils are described on the basis of compactness condition as indicated by 'N'–values as follows:

N (blows/0.3 meters)	0 - 4	4 - 10	10 - 30	30 - 50	>50
	VERY LOOSE	*LOOSE*	*COMPACT*	*DENSE*	*VERY DENSE*

Rocks are described by their composition and structural features and/or strength

RECOVERY: Sum of all recovered rock core pieces from a coring run expressed as a percent of the total length of the coring run.

ROCK QUALITY DESIGNATION (RQD): Sum of those intact core pieces, 100 millimeters in length expressed as a percent of the length of the coring run. Classification of a rock based on the RQD value as follows:

RQD (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
	VERY POOR	*POOR*	*FAIR*	*GOOD*	*EXCELLENT*

JOINTING AND BEDDING:

SPACING	50 mm	50 - 300 mm	0.3 - 1.0 m	1.0 - 3.0 m	>3.0 m
JOINTING	*VERY CLOSE*	*CLOSE*	*MOD. CLOSE*	*WIDE*	*VERY WIDE*
BEDDING	*VERY THIN*	*THIN*	*MEDIUM*	*THICK*	*VERY THICK*

RECORD OF BOREHOLE No. BH301

Project Number:	671835	Drilling Location:	As per Borehole layout	Logged by:	RM
Client:	Region of Peel	Drilling Method:	100 mm Solid Stem Augering	Compiled by:	SR
Project Name:	Geotechnical Investigation: 25 Rutherford Road South	Drilling Machine:	Track Mounted Drill	Reviewed by:	MT
Location:	25 Rutherford Rd. South, Brampton, ON	Date Started:	Mar 3, 2020 Date Completed: Mar 3, 2020	Revision No.:	0

EASTING: 601494.769
NORTHING: 4839210.682

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 215.99 m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Unit Weight (kN/m³)	COMMENTS
	FILL Brown, dense, gravelly SAND, trace silt, wet. 215.4	SS	01	59	42				
	NATIVE TILL 0.6 Brown, stiff to very stiff, sandy silty CLAY, trace gravel, trace oxidation, moist.	SS	02	51	11	1	215		
		SS	03	100	27	2	214	22.17	
		SS	04	144	100/ 250mm				SPT Refusal due to possible cobbles/boulders
		SS	05	111	50/ 125mm	3	213		SPT Refusal due to possible cobbles/boulders
		SS	06	100	50/ 100mm	4	212		
	209.9					5	211		
	SHALE-TILL COMPLEX 6.1 Grey, hard, gravelly silty CLAY, some sand, some shale particles, moist. GA: 25%, SA:18%, SI:36%, CL:21%	SS	07	87	50/ 75mm	6	210		SPT Refusal due to possible weathered bedrock
		SS	08	100	50/ 100mm	7	209		SPT Refusal due to possible weathered bedrock
	206.7					8	208		
	End of borehole 9.3 Notes: 1. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay.	SS	09	100	50/ 125mm	9	207		SPT Refusal due to possible weathered bedrock

FIELD TESTING
Penetration Testing: ○ SPT ● DCPT
MTO Vane*: △ Intact ▲ Remould
Nilcon Vane*: ◇ Intact ◆ Remould
* Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING
★ Pocket Penetrometer (kg/cm²) 1 2 3 4
Soil Vapour Reading △ parts per million (ppm) 100 200 300 400
▲ Lower Explosive Limit (LEL)
✱ Passing 75 um (%)
○ Moisture Content (%)
Atterberg Limits W_P 20 40 60 80 W_L

INSTRUMENTATION INSTALLATION

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▽ No freestanding groundwater measured in open borehole upon completion of drilling ■ Cave in depth recorded on completion of drilling: 4.6 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commisioned and the accompanying'Notes to Record of Boreholes'.

Scale: 1 : 58

RECORD OF BOREHOLE No. BH302(MW)

Project Number:	671835	Drilling Location:	As per Borehole layout	Logged by:	RM
Client:	Region of Peel	Drilling Method:	100 mm Solid Stem Augering	Compiled by:	SR
Project Name:	Geotechnical Investigation: 25 Rutherford Road South	Drilling Machine:	Track Mounted Drill	Reviewed by:	MT
Location:	25 Rutherford Rd. South, Brampton, ON	Date Started:	Mar 11, 2020 Date Completed: Mar 11, 2020	Revision No.:	0

EASTING: 601485.784
NORTHING: 4839187.368

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 215.80 m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT ○ / DCPT ●); MTO Vane* (Intact △ / Remould ▲); Nilcon Vane* (Intact ◇ / Remould ◆); * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: ★ Pocket Penetrometer (kg/cm²) 1 2 3 4; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL); ✱ Passing 75 um (%); ○ Moisture Content (%); Atterberg Limits W_P ■ ○ W_L 20 40 60 80	INSTRUMENTATION INSTALLATION	Unit Weight (kN/m³)	COMMENTS
	FILL Grey, compact, gravelly SAND, moist. 215.5	SS	01	67	15				10			
	NATIVE TILL 0.3 Brown, stiff to hard, sandy silty CLAY, trace to some gravel, oxidized, moist.	SS	02	84	10	1	215		20			
	trace broken cobble pieces	SS	03	77	47	2	214		15			
	213.5											
	Brown, dense to very dense, silty SAND, trace clay, trace gravel, moist 2.3	SS	04	100	36	3	213		9			
		SS	05	100	50/ 125mm				8			SPT Refusal due to possible cobbles/boulders
	211.2					4	212					
	SHALE-TILL COMPLEX 4.6 Grey, very dense, silty SAND, some gravel, trace clay, trace broken cobble pieces, shale pieces, moist.	SS	06	100	50/ 125mm	5	211		5			SPT Refusal due to possible weathered bedrock
		SS	07	100	50/ 50 mm	6	210		10			SPT Refusal due to possible weathered bedrock
		SS	08	100	50/ 100mm	7	209		17			SPT Refusal due to possible weathered bedrock
	206.5	SS	09	100	50/ 125mm	8	208		19			SPT Refusal due to possible weathered bedrock
	End of borehole 9.3					9	207					

Notes:

1. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay.

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▽ Groundwater depth on completion of drilling: 3.4 m

▼ Groundwater depth observed on 3/25/2020 at a depth of: 2.0 m.

■ Cave in depth recorded on completion of drilling: Open

Scale: 1 : 58

RECORD OF BOREHOLE No. BH303

Project Number:	671835	Drilling Location:	As per Borehole layout	Logged by:	RM
Client:	Region of Peel	Drilling Method:	100 mm Solid Stem Augering	Compiled by:	SR
Project Name:	Geotechnical Investigation: 25 Rutherford Road South	Drilling Machine:	Track Mounted Drill	Reviewed by:	MT
Location:	25 Rutherford Rd. South, Brampton, ON	Date Started:	Mar 2, 2020 Date Completed: Mar 2, 2020	Revision No.:	0

EASTING: 601510.188
NORTHING: 4839199.907

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 215.74 m)	Elev. (m)	Depth (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	Unit Weight (kN/m³)	COMMENTS
	TOPSOIL ~ 250 mm	215.5							
	NATIVE TILL Dark brown to brown, firm to very stiff, sandy silty CLAY, trace gravel, trace oxidation, wet to moist.	0.3		SS	01	67	7		
			1	SS	02	67	17		
				SS	03	84	28	21.91	
		213.4	2						
	Brown, very dense, silty SAND, some gravel, some clay, trace broken cobble pieces, trace oxidation, wet.	2.3		SS	04	75	71		
			3	SS	05	100	95/ 250mm		SPT Refusal due to possible cobble/boulders
		211.2							
	Grey, hard, sandy silty CLAY, some gravel, moist.	4.6	4	SS	06	67	71		
	becomes gravelly, trace cobble pieces.		5						
			6	SS	07	59	84		
		208.1	7						
	Highly weathered Shale	7.7		SS	08	100	50/ 25mm		SPT Refusal due to possible weathered bedrock
	End of borehole								

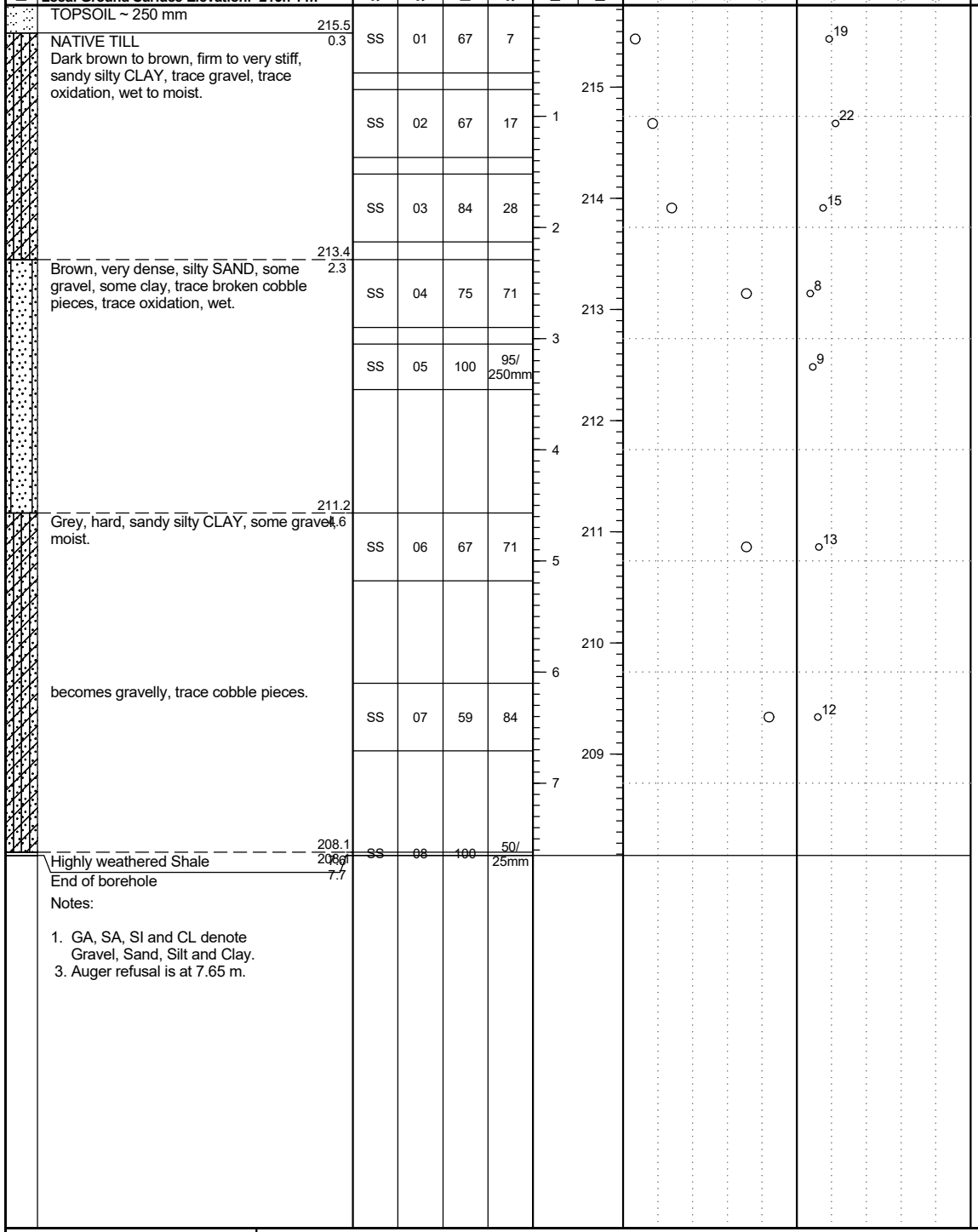
Notes:

1. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay.
3. Auger refusal is at 7.65 m.

FIELD TESTING: Penetration Testing (○ SPT ● DCPT); MTO Vane* (△ Intact ▲ Remould); Nilcon Vane* (◇ Intact ◆ Remould); * Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: ★ Pocket Penetrometer (kg/cm²) 1 2 3 4; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL); ✱ Passing 75 um (%); ○ Moisture Content (%); Atterberg Limits W_P 20 40 60 80 W_L

INSTRUMENTATION INSTALLATION



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▽ No freestanding groundwater measured in open borehole upon completion of drilling ■ Cave in depth recorded on completion of drilling: Open

Scale: 1 : 58

RECORD OF BOREHOLE No. BH304(MW)

Project Number:	671835	Drilling Location:	As per Borehole layout	Logged by:	RM
Client:	Region of Peel	Drilling Method:	100 mm Solid Stem Augering	Compiled by:	SR
Project Name:	Geotechnical Investigation: 25 Rutherford Road South	Drilling Machine:	Track Mounted Drill	Reviewed by:	MT
Location:	25 Rutherford Rd. South, Brampton, ON	Date Started:	Mar 10, 2020 Date Completed: Mar 10, 2020	Revision No.:	0

EASTING: 601506.765
NORTHING: 4839234.664

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 215.99 m)	Elev.	Depth	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Undrained Shear Strength (kPa)	LAB TESTING	INSTRUMENTATION INSTALLATION	Unit Weight (kN/m³)	COMMENTS
	FILL Grey, compact, SAND and GRAVEL, wet	215.7	0.3	SS	01	54	10				15			
	Dark brown, stiff, silty CLAY, trace sand, trace gravel, rootlet, moist to wet.										7			
				SS	02	67	13	1	215		28			
		214.5	1.5											
	Grey, hard, sandy silty CLAY, trace to some gravel, trace oxidation,moist to wet.			SS	03	62	38	2	214		21			
		213.7	2.3											
	NATIVE TILL Brown to grey, compact to dense, gravelly silty SAND, trace clay, trace broken cobble pieces, moist to wet.			SS	04	79	21				15			
	GA:29%, SA:32%, SI:31%, CL:8%			SS	05	59	30	3	213		12			
		211.4	4.6					4	212					
	Grey, very dense, silty SAND, some gravel, some broken cobble pieces, trace oxidation,moist to wet.			SS	06	46	73	5	211		9			
		209.9	6.1	SS	07	100	50/ 75mm	6	210		10			SPT Refusal due to possible cobble/boulders
	Grey, hard, sandy silty CLAY, some gravel to gravelly, trace broken cobble pieces, moist.							7	209					
				SS	08	100	50/ 25mm				15			SPT Refusal due to possible cobble/boulders
								8	208					
		206.9	9.1	SS	09		50/ 00mm	9	207		17			SPT Refusal due to possible cobble/boulders
	End of borehole													

Notes:

1. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay.

Groundwater depth on completion of drilling: 3.3 m

Cave in depth recorded on completion of drilling: 4.3 m.

Groundwater depth observed on 3/25/2020 at a depth of: 2.2 m.

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RECORD OF BOREHOLE No. BH305

Project Number:	671835	Drilling Location:	As per Borehole layout	Logged by:	RM
Client:	Region of Peel	Drilling Method:	100 mm Solid Stem Augering	Compiled by:	SR
Project Name:	Geotechnical Investigation: 25 Rutherford Road South	Drilling Machine:	Track Mounted Drill	Reviewed by:	MT
Location:	25 Rutherford Rd. South, Brampton, ON	Date Started:	Mar 10, 2020 Date Completed: Mar 10, 2020	Revision No.:	0

EASTING: 601516.186
NORTHING: 4839227.152

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 216.18 m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Unit Weight (kN/m³)	COMMENTS
	TOPSOIL Topsoil ~ 80 mm (216.1) 0.1								
	FILL Brown, compact, SAND, some gravel, trace silt, moist to wet. (215.6) 0.6	SS	01	67	20				
	Dark Grey, firm, silty CLAY, trace gravel, trace rootlet, trace sand, moist. (214.7) 1.5	SS	02	67	7	1	215		
	NATIVE TILL Brownish grey, very stiff, sandy silty CLAY, trace to some gravel, trace oxidized, moist. (213.9) 2.3	SS	03	100	16	2	214	21.69	
	Brown, compact to very dense, gravelly SAND, some silt, trace to some clay, trace oxidation, moist.	SS	04	100	29	3	213		
	broken cobble pieces (210.1) 6.1	SS	05	100	50/100mm				SPT Refusal due to possible cobble/boulder
		SS	06	100	50/25mm	4	212		SPT Refusal due to possible cobble/boulder
	SHALE-TILL COMPLEX Dark grey, hard, clayey SILT, some sand, trace broken cobble pieces, moist	SS	07	100	50/125 mm	5	211		
		SS	08	100	50/25mm	6	210		SPT Refusal due to possible cobble/boulder and/or weathered bedrock
	(206.9) 9.3	SS	09	100	50/125mm	7	209		SPT Refusal due to possible cobble/boulder and/or weathered bedrock
	End of borehole					8	208		SPT Refusal due to possible cobble/boulder and/or weathered bedrock
						9	207		

FIELD TESTING
Penetration Testing: ○ SPT ● DCPT
MTO Vane*: △ Intact ▲ Remould
Nilcon Vane*: ◇ Intact ◆ Remould
* Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING
★ Pocket Penetrometer (kg/cm²) 1 2 3 4
Soil Vapour Reading: △ parts per million (ppm) 100 200 300 400
▲ Lower Explosive Limit (LEL)
✱ Passing 75 um (%)
○ Moisture Content (%)
Atterberg Limits: W_P 20 40 60 80 W_L

Notes:

1. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay.

▽ Groundwater depth on completion of drilling: 3.4 m

■ Cave in depth recorded on completion of drilling: 4.5 m.

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RECORD OF BOREHOLE No. BH306(MW)

Project Number:	671835	Drilling Location:	As per Borehole layout	Logged by:	RM
Client:	Region of Peel	Drilling Method:	100 mm Solid Stem Augering	Compiled by:	SR
Project Name:	Geotechnical Investigation: 25 Rutherford Road South	Drilling Machine:	Track Mounted Drill	Reviewed by:	MT
Location:	25 Rutherford Rd. South, Brampton, ON	Date Started:	Mar 11, 2020 Date Completed: Mar 11, 2020	Revision No.:	0

EASTING: 601529.457
NORTHING: 4839218.653

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 215.91 m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT ○ / DCPT ●); MTO Vane* (△ Intact / ▲ Remould); Nilcon Vane* (◇ Intact / ◆ Remould); * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: ★ Pocket Penetrometer (kg/cm²) 1 2 3 4; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL); ✱ Passing 75 um (%); ○ Moisture Content (%); Atterberg Limits W_P ■ ○ W_L 20 40 60 80	INSTRUMENTATION INSTALLATION	Unit Weight (kN/m³)	COMMENTS
	FILL Brownish grey, dense, SAND, some silt, trace to some gravel, trace organic, moist. 215.3	SS	01	70	42			○	○ 9			
	Dark Brown, firm to stiff, silty CLAY, trace sand, trace gravel, trace rootlet, moist. 0.6	SS	02	54	8	1	215	○	○ 13			
	214.4 NATIVE TILL 1.5 Brownish grey, firm to hard, silty CLAY, trace to some sand, trace gravel, trace oxidation, moist.	SS	03	54	7	2	214	○	○ 25			
	becomes sandy	SS	04	100	50/ 100mm				○ 28			SPT Refusal due to possible cobble/boulder
	212.9 Grey, very stiff, silty CLAY, trace sand, trace gravel, trace broken cobble pieces, moist to wet. GA: 10%, SA: 10%, SI: 57%, CL:3% 3.1	SS	05	100	29	3	213		○ 12			
	211.3 Grey, hard, sandy silty, CLAY, trace gravel, 4.6 moist to wet. GA: 12%, SA:45%, SI&CL: 43%.	SS	06	100	90/ 200mm	4	212		○ 12			SPT Refusal due to possible cobble/boulder
		SS	07	100	50/ 100mm	5	211		○ 7			SPT Refusal due to possible cobble/boulder and/or weathered bedrock
		SS	08	100	50/ 25mm	6	210		○ 20			SPT Refusal due to possible cobble/boulder and/or weathered bedrock
	206.7 End of borehole 9.2	SS	09	100	50/ 25mm	7	209		○ 29			SPT Refusal due to possible cobble/boulder and/or weathered bedrock
	Notes: 1. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay.					8	208					
						9	207					

▽ Groundwater depth on completion of drilling: 8.2 m

■ Cave in depth recorded on completion of drilling: 9.2 m.

▼ Groundwater depth observed on 3/25/2020 at a depth of: 2.4 m.

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RECORD OF BOREHOLE No. BH307(MW)

Project Number:	671835	Drilling Location:	As per Borehole layout	Logged by:	RM
Client:	Region of Peel	Drilling Method:	100 mm Solid Stem Augering	Compiled by:	SR
Project Name:	Geotechnical Investigation: 25 Rutherford Road South	Drilling Machine:	Track Mounted Drill	Reviewed by:	MT
Location:	25 Rutherford Rd. South, Brampton, ON	Date Started:	Mar 5, 2020 Date Completed: Mar 5, 2020	Revision No.:	0

EASTING: 601513.298
NORTHING: 4839241.863

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 215.95 m)	Elev.	Depth	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	Unit Weight (kN/m³)	COMMENTS
	ASPHALT PAVEMENT ~ Thickness Assumed	215.9 / 0.7							
	Granular Pavement Structure ~ Thickness Assumed	215.2		AS	01				
	NATIVE TILL Grey, stiff to very stiff, sandy silty CLAY, trace gravel, trace oxidation,moist to wet.	0.8	1	SS	02	62	13		
				SS	03	67	27		
		213.7	2						
	Brown, very dense, silty SAND, some gravel, trace clay, moist.	2.3		SS	04	75	55		
		212.9	3						
	Brown to grey, hard, sandy silty CLAY, some gravel, broken cobble pieces, moist.	3.1		SS	05	93	50/ 250mm		SPT Refusal due to possible cobble/boulder
		211.4	4						
	Grey, hard, sandy silty CLAY, some gravel, broken cobble pieces, moist.	4.6	5	SS	06	67	36		
		209.9	6						
	SHALE-TILL COMPLEX Grey, hard, sandy silty CLAY, some gravel broken cobble pieces, trace shale fragments, moist to wet.	6.1		SS	07	100	50/ 125mm		SPT Refusal due to possible cobble/boulder and/or weathered bedrock
			7	SS	08	100	50/ 25mm		SPT Refusal due to possible cobble/boulder and/or weathered bedrock
		206.8	8						
	End of borehole	9.2	9	SS	09	100	50/ 50mm		SPT Refusal due to possible cobble/boulder and/or weathered bedrock

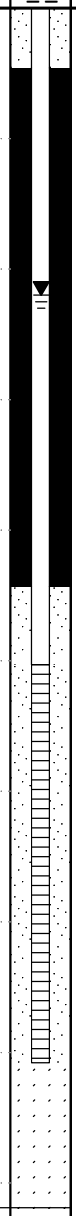
Notes:

1. Borehole information based on environmental log
2. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay.

FIELD TESTING
Penetration Testing: ○ SPT ● DCPT
MTO Vane*: △ Intact ▲ Remould
Nilcon Vane*: ◇ Intact ◆ Remould
* Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING
★ Pocket Penetrometer (kg/cm²) 1 2 3 4
Soil Vapour Reading: △ parts per million (ppm) 100 200 300 400
▲ Lower Explosive Limit (LEL)
✱ Passing 75 um (%)
○ Moisture Content (%)
Atterberg Limits: W_P 20 40 60 80 W_L

INSTRUMENTATION INSTALLATION



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Tel: 905-851-0090

▽ No freestanding groundwater measured in open borehole upon completion of drilling ■ Cave in depth recorded on completion of drilling: Open m.
▼ Groundwater depth observed on 3/25/2020 at a depth of: 2.2 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commisioned and the accompanying'Notes to Record of Boreholes'.

Scale: 1 : 58

RECORD OF BOREHOLE No. BH308

Project Number:	671835	Drilling Location:	As per Borehole layout	Logged by:	RM
Client:	Region of Peel	Drilling Method:	100 mm Solid Stem Augering	Compiled by:	SR
Project Name:	Geotechnical Investigation: 25 Rutherford Road South	Drilling Machine:	Track Mounted Drill	Reviewed by:	MT
Location:	25 Rutherford Rd. South, Brampton, ON	Date Started:	Mar 9, 2020 Date Completed: Mar 9, 2020	Revision No.:	0

EASTING: 601524.357
NORTHING: 4839236.621

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 215.98 m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT / DCPT), MTO Vane* (Intact / Remould), Nilcon Vane* (Intact / Remould), * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: Pocket Penetrometer (kg/cm²) 1 2 3 4; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL); * Passing 75 um (%); Moisture Content (%); Atterberg Limits W_P 20 40 60 80 W_L	INSTRUMENTATION INSTALLATION	Unit Weight (kN/m³)	COMMENTS
	FILL Grey, compact, gravelly SAND, some silt, moist to wet.	SS	01	67	18				13			
	215.4 0.6 Brownish grey, firm to stiff, silty CLAY, trace sand, trace gravel, trace rootlet, trace oxidation, wet to moist.	SS	02	62	8	1	215		21			
	214.5 1.5 NATIVE TILL Brown, very stiff to hard, sandy silty CLAY, trace gravel, moist.	SS	03	84	23	2	214		16			
		SS	04	100	50/ 50mm				13			SPT Refusal due to possible cobble/boulder
		SS	05	92	55	3	213		13			
	211.4 4.6 Brown to grey, hard, gravelly silty CLAY,, some sand, some broken cobble pieces, moist. GA: 20%, SA: 16%, SI: 45%, CL:16%	SS	06	92	42	4	212		12			
	209.9 6.1 SHALE-TILL COMPLEX Grey, very dense, silty SAND, some clay, trace broken cobble pieces, moist.	SS	07	100	50/ 50mm	5	211		7			SPT Refusal due to possible cobble/boulder and/or weathered bedrock
		SS	08	100	50/ 100mm	6	210		8			SPT Refusal due to possible cobble/boulder and/or weathered bedrock
	206.8 9.2 End of borehole	SS	09	100	50/ 75mm	7	209		6			SPT Refusal due to possible cobble/boulder and/or weathered bedrock
						8	208					
						9	207					

Notes:

1. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay.

▽ No freestanding groundwater measured in open borehole upon completion of drilling ■ Cave in depth recorded on completion of drilling: 8.8 m.

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Scale: 1 : 58

RECORD OF BOREHOLE No. BH309(MW)

Project Number:	671835	Drilling Location:	As per Borehole layout	Logged by:	RM
Client:	Region of Peel	Drilling Method:	100 mm Solid Stem Augering	Compiled by:	SR
Project Name:	Geotechnical Investigation: 25 Rutherford Road South	Drilling Machine:	Track Mounted Drill	Reviewed by:	MT
Location:	25 Rutherford Rd. South, Brampton, ON	Date Started:	Mar 10, 2020 Date Completed: Mar 10, 2020	Revision No.:	0

EASTING: 601534.718
NORTHING: 4839224.258

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Unit Weight (kN/m³)	COMMENTS
	Local Ground Surface Elevation: 215.91 m								
	TOPSOIL>> ~ 25 mm 215.9								
	FILL 215.6	SS	01	92	23				
	Brown, compact, gravelly SAND, trace silt, moist. 0.3								
	215.3 0.6								
	Brown, compact, SAND, some silt, trace clay, moist.	SS	02	75	9	1	215		
	NATIVE TILL								
	Brown to Dark Brown, stiff to hard, sandy silty CLAY, trace gravel, trace oxidation, moist.	SS	03	100	18	2	214		
		SS	04	56	50/ 200mm				SPT Refusal due to possible cobble/boulder
		SS	05	100	43	3	213		
	211.3					4	212		
	SHALE-TILL COMPLEX 4.6								
	Grey, hard, sandy silty CLAY, trace gravel, weathered shale fragments, trace broken cobble pieces, moist.	SS	06	78	67/ 300mm	5	211		SPT Refusal due to possible cobble/boulder and/or weathered bedrock
		SS	07	100	50/ 75mm	6	210		SPT Refusal due to possible cobble/boulder and/or weathered bedrock
						7	209		
		SS	08	100	50/ 25mm	8	208		SPT Refusal due to possible cobble/boulder and/or weathered bedrock
	206.7					9	207		
	End of borehole 9.2	SS	09	100	50/ 30mm				

FIELD TESTING
Penetration Testing: ○ SPT ● DCPT
MTO Vane*: △ Intact ▲ Remould
Nilcon Vane*: ◇ Intact ◆ Remould
* Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING
★ Pocket Penetrometer (kg/cm²) 1 2 3 4
Soil Vapour Reading: △ parts per million (ppm) 100 200 300 400
▲ Lower Explosive Limit (LEL)
✱ Passing 75 um (%)
○ Moisture Content (%)
Atterberg Limits: W_P 20 40 60 80 W_L

INSTRUMENTATION INSTALLATION

Notes:

1. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay.

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▽ No freestanding groundwater measured in open borehole upon completion of drilling ■ Cave in depth recorded on completion of drilling: Open

▼ Groundwater depth observed on 3/25/2020 at a depth of: 2.2 m.

RECORD OF BOREHOLE No. BH310

Project Number:	671835	Drilling Location:	As per Borehole layout	Logged by:	RM
Client:	Region of Peel	Drilling Method:	100 mm Solid Stem Augering	Compiled by:	SR
Project Name:	Geotechnical Investigation: 25 Rutherford Road South	Drilling Machine:	Track Mounted Drill	Reviewed by:	MT
Location:	25 Rutherford Rd. South, Brampton, ON	Date Started:	Mar 9, 2020 Date Completed: Mar 9, 2020	Revision No.:	0

EASTING: 601521.704
NORTHING: 4839252.523

Lithology Plot	DESCRIPTION	Elev.	Depth	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	Elevation (m)	Depth (m)	FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	Unit Weight (kN/m³)	COMMENTS
	Local Ground Surface Elevation: 215.72 m									Penetration Testing: ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Pocket Penetrometer (kg/cm²) 1 2 3 4; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL); ✱ Passing 75 um (%); ○ Moisture Content (%); Atterberg Limits W_P ■ ○ W_L 20 40 60 80			
	FILL Brown, compact, gravelly SAND, some silt, moist.	215.4 0.3		SS	01	67	22	215	1		4			
	NATIVE TILL Brownish grey, stiff to hard, sandy silty CLAY, trace to some gravel, trace oxidation, moist.			SS	02	100	12				15			
				SS	03	84	26	214	2		10			
				SS	04	100	67	213	3		11			
	Grey, compact, silty SAND, trace to some clay, trace gravel, trace broken cobble pieces, moist.	212.7 212.5 3.2		SS	05	111	50/ 125mm				8			SPT Refusal due to possible cobble/boulder and/or weathered bedrock
	SHALE-TILL COMPLEX Grey, hard, sandy silty CLAY, trace gravel, trace weathered shale, trace broken cobble pieces, moist.							212	4			▽		
				SS	06	100	34	211	5		11			
								210	6					
	Grey, hard, weathered Shale, moist.	209.6 6.1		SS	07	100	50/ 25mm				8			SPT Refusal due to possible cobble/boulder and/or weathered bedrock
								209	7					
				SS	08	100	50/ 10mm	208	8		16			SPT Refusal due to possible cobble/boulder and/or weathered bedrock
								207	9					
	End of borehole	206.5 9.2		SS	09	100	50/ 25mm				13			SPT Refusal due to possible cobble/boulder and/or weathered bedrock

Notes:

1. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay.

▽ **Groundwater depth on completion of drilling: 4.2 m**

■ **Cave in depth recorded on completion of drilling: 6.7 m.**

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Scale: 1 : 58

RECORD OF BOREHOLE No. BH311(MW)

Project Number:	671835	Drilling Location:	As per Borehole layout	Logged by:	RM
Client:	Region of Peel	Drilling Method:	100 mm Solid Stem Augering	Compiled by:	SR
Project Name:	Geotechnical Investigation: 25 Rutherford Road South	Drilling Machine:	Track Mounted Drill	Reviewed by:	MT
Location:	25 Rutherford Rd. South, Brampton, ON	Date Started:	Mar 9, 2020 Date Completed: Mar 9, 2020	Revision No.:	0

EASTING: 601531.342
NORTHING: 4839245.519

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Undrained Shear Strength (kPa)	LAB TESTING: Moisture Content (%)	INSTRUMENTATION INSTALLATION	Unit Weight (kN/m³)	COMMENTS
	Local Ground Surface Elevation: 216.04 m											
	FILL Brown, compact, gravelly SAND, trace silt, trace clay, moist. 215.7 / 0.3	SS	01	79	24							
	Brown, compact, SAND, some silt, trace gravel, trace clay, moist. 215.4 / 0.6											
	Brownish grey, stiff, sandy silty CLAY, trace gravel, trace to some rootlet, moist.	SS	02	70	11	1	215					
	214.5											
	NATIVE TILL 1.5 Brownish grey, very stiff to hard, sandy silty CLAY, trace gravel, trace broken cobble pieces, oxidized, moist.	SS	03	79	25	2	214					
		SS	04	100	66							
		SS	05	100	85	3	213					
	211.5											
	Grey, hard, sandy silty CLAY, trace to some gravel, moist. 4.6 GA: 19%, SA: 22%, SI: 20%, CL: 19%	SS	06	70	44	4	212					
	209.9											
	SHALE-TILL COMPLEX 6.1 <<Grey, hard, sandy silty CLAY, trace gravel, weathered shale fragments, trace broken cobble pieces, moist.	SS	07	180	50/ 50mm	5	211					SPT Refusal due to possible cobble/boulder and/or weathered bedrock
						6	210					
		SS	08	100	50/ 30mm	7	209					SPT Refusal due to possible cobble/boulder and/or weathered bedrock
						8	208					
	206.9	SS	09	100	50/ 50mm	9	207					SPT Refusal due to possible cobble/boulder and/or weathered bedrock
	End of borehole 9.2											

Notes:

1. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay.

Penetration Testing: ○ SPT ● DCPT
MTO Vane*: △ Intact ▲ Remould
Nilcon Vane*: ◇ Intact ◆ Remould
* Undrained Shear Strength (kPa) 20 40 60 80

★ Pocket Penetrometer (kg/cm²) 1 2 3 4
Soil Vapour Reading △ parts per million (ppm) 100 200 300 400
▲ Lower Explosive Limit (LEL)
✱ Passing 75 um (%)
○ Moisture Content (%)
Atterberg Limits W_P 20 40 60 80 W_L

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▽ **Groundwater depth on completion of drilling:** 3.5 m
▼ **Groundwater depth observed on** 3/25/2020 **at a depth of:** 2.2 m.
Cave in depth recorded on completion of drilling: Open

RECORD OF BOREHOLE No. BH312(MW)

Project Number:	671835	Drilling Location:	As per Borehole layout	Logged by:	RM
Client:	Region of Peel	Drilling Method:	100 mm Solid Stem Augering	Compiled by:	SR
Project Name:	Geotechnical Investigation: 25 Rutherford Road South	Drilling Machine:	Track Mounted Drill	Reviewed by:	MT
Location:	25 Rutherford Rd. South, Brampton, ON	Date Started:	Mar 12, 2020 Date Completed: Mar 12, 2020	Revision No.:	0

EASTING: 601540.205
NORTHING: 4839237.157

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Unit Weight (kN/m³)	COMMENTS
	Local Ground Surface Elevation: 215.90 m								
	FILL Brown, compact, gravelly SAND, some silt, some rootlet, moist. 215.3	SS	01	33	17				
	NATIVE TILL 0.6 Brown, very stiff, sandy silty CLAY, trace gravel, trace oxidation, moist to wet.	SS	02	75	17	1	215		
		SS	03	84	30	2	214		
	GA: 9%, SA: 29%, SI: 42%, CL:20%	SS	04	95	30				
	212.9					3	213		
	Brown, very dense, silty SAND, some gravel, trace clay, trace broken cobble pieces, moist. 3.0	SS	05	67	50/ 110mm				SPT Refusal due to possible cobble/boulder
	211.3					4	212		
	Grey, dense to very dense, sandy silty CLAY, some gravel, trace broken cobble pieces, moist. 4.6	SS	06	100	31	5	211	20.91	
		SS	07	100	50/ 25mm	6	210		SPT Refusal due to possible cobble/boulder and/or weathered bedrock
		SS	08		50/ 00mm	7	209		SPT Refusal due to possible cobble/boulder and/or weathered bedrock
	206.7					8	208		
	End of borehole 9.2	SS	09	100	50/ 25mm	9	207		SPT Refusal due to possible cobble/boulder and/or weathered bedrock

Notes:

1. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay.

FIELD TESTING
Penetration Testing: ○ SPT ● DCPT
MTO Vane*: △ Intact ▲ Remould
Nilcon Vane*: ◇ Intact ◆ Remould
* Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING
★ Pocket Penetrometer (kg/cm²) 1 2 3 4
Soil Vapour Reading △ parts per million (ppm) 100 200 300 400
▲ Lower Explosive Limit (LEL)
✱ Passing 75 um (%)
○ Moisture Content (%)
Atterberg Limits W_P 20 40 60 80 W_L

INSTRUMENTATION INSTALLATION

Groundwater depth on completion of drilling: 3.3 m
Cave in depth recorded on completion of drilling: Open.
Groundwater depth observed on 3/25/2020 **at a depth of:** 2.6 m.

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RECORD OF BOREHOLE No. BH313(MW)

Project Number:	671835	Drilling Location:	As per Borehole layout	Logged by:	RM
Client:	Region of Peel	Drilling Method:	100 mm Solid Stem Augering	Compiled by:	SR
Project Name:	Geotechnical Investigation: 25 Rutherford Road South	Drilling Machine:	Track Mounted Drill	Reviewed by:	MT
Location:	25 Rutherford Rd. South, Brampton, ON	Date Started:	Mar 6, 2020 Date Completed: Mar 6, 2020	Revision No.:	0

EASTING: 601521.259
NORTHING: 4839252.573

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 215.73 m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT / DCPT), MTO Vane* (Intact / Remould), Nilcon Vane* (Intact / Remould), * Undrained Shear Strength (kPa)	LAB TESTING: Pocket Penetrometer (kg/cm²), Soil Vapour Reading (parts per million (ppm)), Lower Explosive Limit (LEL), * Passing 75 um (%), Moisture Content (%), Atterberg Limits	INSTRUMENTATION INSTALLATION	Unit Weight (kN/m³)	COMMENTS
	NATIVE TILL Brownish grey, stiff to hard, sandy silty CLAY, trace gravel, trace oxidation, moist.	SS	01	79	10				14			
		SS	02	100	16	1	215					
	GA: 7%, SA: 22%, SI:45%, CL:26%.	SS	03	100	10	2	214		15			
		SS	04	100	46	3	213		9			
	trace broken cobble pieces.	SS	05	95	51	4	212		10			
		SS	06	100	39	5	211		9			
	becomes gravelly.	SS	07	154	50/ 125mm	6	210		15		20.5	SPT Refusal due to possible cobble/boulder and/or weathered bedrock
		SS	08	267	50/ 25mm	7	209		9			SPT Refusal due to possible cobble/boulder and/or weathered bedrock
	206.6	SS	09	1000	50/ 10mm	8	208		8			SPT Refusal due to possible cobble/boulder and/or weathered bedrock
	End of borehole 9.2					9	207					

Notes:

1. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay.

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No freestanding groundwater measured in open borehole upon completion of drilling. Cave in depth recorded on completion of drilling: Open

Groundwater depth observed on 3/25/2020 at a depth of: 2.0 m.

RECORD OF BOREHOLE No. BH314

Project Number:	671835	Drilling Location:	As per Borehole layout	Logged by:	RM
Client:	Region of Peel	Drilling Method:	100 mm Solid Stem Augering	Compiled by:	SR
Project Name:	Geotechnical Investigation: 25 Rutherford Road South	Drilling Machine:	Track Mounted Drill	Reviewed by:	MT
Location:	25 Rutherford Rd. South, Brampton, ON	Date Started:	Mar 6, 2020 Date Completed: Mar 6, 2020	Revision No.:	0

EASTING: 601531.303
NORTHING: 4839245.522

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 216.04 m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT ○ / DCPT ●); MTO Vane* (Intact △ / Remould ▲); Nilcon Vane* (Intact ◇ / Remould ◆); * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: ★ Pocket Penetrometer (kg/cm²) 1 2 3 4; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL); ✱ Passing 75 um (%); ○ Moisture Content (%); Atterberg Limits W_P ■ ○ W_L 20 40 60 80	INSTRUMENTATION INSTALLATION	Unit Weight (kN/m³)	COMMENTS
	FILL Grey, dense, gravelly SAND, trace silt, trace clay, moist. 215.4	SS	01	67	33				13			
	NATIVE TILL 0.6 Brown, very stiff to hard, sandy, silty CLAY, trace gravel, trace oxidation, moist.	SS	02	62	16	1	215		17			
		SS	03	95	24	2	214		14			
	trace broken cobble pieces.	SS	04	217	50/ 60mm				13			SPT Refusal due to possible cobble/boulder
	211.5	SS	05	100	77	3	213		12	▽		
	SHALE-TILL COMPLEX 4.6 Grey, hard, sandy, silty CLAY, trace gravel, trace broken cobble pieces, trace weathered shale fragment, moist.	SS	06	46	59	4	212		9			
		SS	07	220	50/ 130mm	5	211					
		SS	08	650	50/ 15mm	6	210		6			SPT Refusal due to possible cobble/boulder and/or weathered bedrock
						7	209					
						8	208		21			SPT Refusal due to possible cobble/boulder and/or weathered bedrock
	206.9	SS	09	650	50/ 15mm	9 ■	207		14			SPT Refusal due to possible cobble/boulder and/or weathered bedrock
	End of borehole 9.1 Notes: 1. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay.											

▽ **Groundwater depth on completion of drilling:** 2.7 m

■ **Cave in depth recorded on completion of drilling:** 9.0 m.

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Scale: 1 : 58

RECORD OF BOREHOLE No. BH315(MW)

Project Number:	671835	Drilling Location:	As per Borehole layout	Logged by:	RM
Client:	Region of Peel	Drilling Method:	100 mm Solid Stem Augering	Compiled by:	SR
Project Name:	Geotechnical Investigation: 25 Rutherford Road South	Drilling Machine:	Track Mounted Drill	Reviewed by:	MT
Location:	25 Rutherford Rd. South, Brampton, ON	Date Started:	Mar 5, 2020 Date Completed: Mar 5, 2020	Revision No.:	0

EASTING: 601547.506
NORTHING: 4839247.015

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 215.91 m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT ○ / DCPT ●); MTO Vane* (Intact △ / Remould ▲); Nilcon Vane* (Intact ◇ / Remould ◆); * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: ★ Pocket Penetrometer (kg/cm²) 1 2 3 4; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL); ✱ Passing 75 um (%); ○ Moisture Content (%); Atterberg Limits W_P ■ ○ W_L 20 40 60 80	INSTRUMENTATION INSTALLATION	Unit Weight (kN/m³)	COMMENTS
	FILL 215.7 Brown, loose, gravelly SAND, wet. 0.2	SS	01	84	16			○	○ 12			
	Brown, compact to very dense, SAND, trace gravel, trace broken cobble pieces, trace oxidation, wet.	SS	02	178	66/ 75mm	1	215		○ 15			SPT Refusal due to possible cobble/boulder
	214.4											
	NATIVE TILL 1.5 Brown, sandy silty CLAY, trace to some gravel, trace oxidation, moist.	SS	03	95	23	2	214	○	○ 15			
		SS	04	51	46			○	○ 11			
		SS	05	84	43	3	213	○	○ 12			
	211.3					4	212					
	SHALE-TILL COMPLEX 4.6 Grey, hard, sandy silty CLAY, trace to some gravel, trace broken cobble pieces, trace weathered shale fragments, moist.	SS	06	84	43	5	211	○	○ 10			
	209.8					6	210					
	grey, highly weathered shale 6.1 Grey, hard, weathered Shale, moist.	SS	07	71	50/ 60mm							SPT Refusal due to possible cobble/boulder and/or weathered bedrock
						7	209					
		SS	08	63	50/ 75mm	8	208					SPT Refusal due to possible cobble/boulder and/or weathered bedrock
	206.7					9	207					
	End of borehole 9.2	SS	09	100	50/ 75mm							SPT Refusal due to possible cobble/boulder and/or weathered bedrock

Notes:

1. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay.

▽ No freestanding groundwater measured in open borehole upon completion of drilling ■ Cave in depth recorded on completion of drilling: 9.0 m.

▼ Groundwater depth observed on 3/25/2020 at a depth of: 2.1 m.

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Scale: 1 : 58

RECORD OF BOREHOLE No. BH316

Project Number:	671835	Drilling Location:	As per Borehole layout	Logged by:	RM
Client:	Region of Peel	Drilling Method:	100 mm Solid Stem Augers	Compiled by:	SR
Project Name:	Geotechnical Investigation: 25 Rutherford Road South	Drilling Machine:	Track Mounted Drill	Reviewed by:	MT
Location:	25 Rutherford Rd. South, Brampton, ON	Date Started:	Mar 3, 2020 Date Completed: Mar 3, 2020	Revision No.:	0

EASTING: 601538.68
NORTHING: 4839269.36

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 215.67 m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT / DCPT), MTO Vane* (Intact / Remould), Nilcon Vane* (Intact / Remould), * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: Pocket Penetrometer (kg/cm²) 1 2 3 4; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL); * Passing 75 um (%); Moisture Content (%); Atterberg Limits W_P 20 40 60 80 W_L	INSTRUMENTATION INSTALLATION	Unit Weight (kN/m³)	COMMENTS
	FILL Brown, gravelly SAND, wet. 214.9											
	NATIVE TILL 0.8 Brown to grey, stiff to hard, sandy silty CLAY, trace to some gravel, trace oxidation, moist.	SS	01	33	14	1	215		15			
	trace broken cobble pieces.	SS	02	67	38	2	214		13			
		SS	03	87	50/ 75mm				13			SPT Refusal due to possible cobble/boulder
		SS	04	100	50/ 100mm	3	213		13			
	211.1 Grey, stiff to hard, sandy silty CLAY, trace gravel, moist. 4.6	SS	05	33	37	4	212		16			
	209.6 SHALE-TILL COMPLEX 6.1 Grey, stiff to hard, sandy silty CLAY, trace gravel, trace shale fragments, moist.	SS	06	100	100/ 100mm	5	211		7			SPT Refusal due to possible cobble/boulder and/or weathered bedrock
		SS	07	0	50/ 50mm	6	210					SPT Refusal due to possible cobble/boulder and/or weathered bedrock
	206.4 End of borehole 9.2	SS	08	100	50/ 100mm	7	209		18			SPT Refusal due to possible cobble/boulder and/or weathered bedrock
	Notes: 1. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay.					8	208					
						9	207					

No freestanding groundwater measured in open borehole upon completion of drilling. Cave in depth recorded on completion of drilling: Open

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Scale: 1 : 58

RECORD OF BOREHOLE No. BH317

Project Number:	671835	Drilling Location:	As per Borehole layout	Logged by:	RM
Client:	Region of Peel	Drilling Method:	100 mm Solid Stem Augering	Compiled by:	SR
Project Name:	Geotechnical Investigation: 25 Rutherford Road South	Drilling Machine:	Track Mounted Drill	Reviewed by:	MT
Location:	25 Rutherford Rd. South, Brampton, ON	Date Started:	Mar 4, 2020 Date Completed: Mar 4, 2020	Revision No.:	0

EASTING: 601546.357
NORTHING: 4839263.891

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 215.83 m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT ○ / DCPT ●); MTO Vane* (Intact △ / Remould ▲); Nilcon Vane* (Intact ◇ / Remould ◆); * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: ★ Pocket Penetrometer (kg/cm²) 1 2 3 4; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL); * Passing 75 um (%); ○ Moisture Content (%); Atterberg Limits W_P W_L 20 40 60 80	INSTRUMENTATION INSTALLATION	Unit Weight (kN/m³)	COMMENTS
	ASPHALT PAVEMENT ~ 150 mm (215.7)											
	FILL (0.2) Brown, compact, gravelly SAND, some silt, moist. (215.1)	SS	01	33	16			○	○ 16			
	FILL (0.8) Brown, compact, silty SAND, trace gravel, trace clay, moist.	SS	02	41	12	1	215	○	○ 12			
		SS	03	100	23	2	214	○	○ 12			
	(213.5) NATIVE TILL (2.3) Brown to grey, hard, sandy silty CLAY, trace gravel, moist. GA: 6%, SA:27%, SI:47%, CL:20%. some broken cobble pieces	SS	04	33	57	3	213	○	○ 9			
		SS	05	92	54			○	○ 8			
	some broken cobble pieces	SS	06	50	50/ 100mm	4	212		○ 9			SPT Refusal due to possible cobble/boulder
						5	211					
		SS	07	100	50/ 50mm	6	210		○ 8	▽		SPT Refusal due to possible cobble/boulder and/or weathered bedrock
	(208.2)											
		SS	08	0	50/ 50mm	7	209					SPT Refusal due to possible cobble/boulder and/or weathered bedrock
	End of borehole (7.7)											

Notes:

1. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay.

▽ Groundwater depth on completion of drilling: 5.8 m

Cave in depth recorded on completion of drilling: Open

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RECORD OF BOREHOLE No. BH318

Project Number:	671835	Drilling Location:	As per Borehole layout	Logged by:	RM
Client:	Region of Peel	Drilling Method:	100 mm Solid Stem Augering	Compiled by:	SR
Project Name:	Geotechnical Investigation: 25 Rutherford Road South	Drilling Machine:	Track Mounted Drill	Reviewed by:	MT
Location:	25 Rutherford Rd. South, Brampton, ON	Date Started:	Mar 4, 2020 Date Completed: Mar 4, 2020	Revision No.:	0

EASTING: 601554.855
NORTHING: 4839256.161

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 215.88 m)	Elev. (m)	Depth (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	Unit Weight (kN/m³)	COMMENTS
	FILL Brown, compact, gravelly SAND, trace silt, wet.	215.0	0	SS	01	75	14		
	NATIVE TILL Brown to grey, stiff to hard, sandy silty CLAY, trace to some gravel, trace oxidation, moist.	0.9		SS	02	84	14		
			1	SS	03	41	28		
	trace broken cobble pieces		2	SS	04	61	72/250mm		SPT Refusal due to possible cobble/boulder
	trace broken cobble pieces	211.3	3	SS	05	88	78/250mm		SPT Refusal due to possible cobble/boulder
	SHALE-TILL COMPLEX Grey, hard, sandy silty CLAY, trace to some gravel, trace to some shale fragments, moist.	4.6	4	SS	06	84	33		SPT Refusal due to possible cobble/boulder and/or weathered bedrock
			5	SS	07	65	50/75mm		SPT Refusal due to possible cobble/boulder and/or weathered bedrock
			6	SS	08	60	50/50mm		SPT Refusal due to possible cobble/boulder and/or weathered bedrock
		206.7	7	SS	09	0	50/25mm		SPT Refusal due to possible cobble/boulder and/or weathered bedrock
	End of borehole	9.2	8						
	Notes: 1. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay.		9						

FIELD TESTING
Penetration Testing: ○ SPT ● DCPT
MTO Vane*: △ Intact ▲ Remould
Nilcon Vane*: ◇ Intact ◆ Remould
* Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING
★ Pocket Penetrometer (kg/cm²) 1 2 3 4
Soil Vapour Reading: △ parts per million (ppm) 100 200 300 400
▲ Lower Explosive Limit (LEL)
✱ Passing 75 um (%)
○ Moisture Content (%)
Atterberg Limits: W_P 20 40 60 80 W_L

INSTRUMENTATION INSTALLATION

Elevation (m)	Moisture Content (%)
215	10
214	17
213	13
212	8
211	11
210	11
209	7
208	4

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▽ No freestanding groundwater measured in open borehole upon completion of drilling ■ Cave in depth recorded on completion of drilling: Open

RECORD OF BOREHOLE No. BH319

Project Number:	671835	Drilling Location:	As per Borehole layout	Logged by:	RM
Client:	Region of Peel	Drilling Method:	100 mm Solid Stem Augering	Compiled by:	SR
Project Name:	Geotechnical Investigation: 25 Rutherford Road South	Drilling Machine:	Track Mounted Drill	Reviewed by:	MT
Location:	25 Rutherford Rd. South, Brampton, ON	Date Started:	Mar 3, 2020 Date Completed: Mar 3, 2020	Revision No.:	0

EASTING: 601542.589
NORTHING: 4839279.39

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 215.52 m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT ○ / DCPT ●); MTO Vane* (Intact △ / Remould ▲); Nilcon Vane* (Intact ◇ / Remould ◆); * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: ★ Pocket Penetrometer (kg/cm²) 1 2 3 4; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL); ✱ Passing 75 um (%); ○ Moisture Content (%); Atterberg Limits W_P 20 40 60 80 W_L	INSTRUMENTATION INSTALLATION	Unit Weight (kN/m³)	COMMENTS
	FILL Brown, gravelly SAND, wet. 214.8											
	NATIVE TILL 0.8 Brown to grey, stiff to hard, sandy silty CLAY, trace gravel, trace cobble, trace oxidation, moist.	SS	01	67	14	1	215	○	○ 15			
	GA:3%, SA:4%, SI:48%, CL:25%	SS	02	75	24	2	214	○	○ 15			
		SS	03	124	90/ 250mm	3	213		○ 13			SPT Refusal due to possible cobble/boulder
	210.9	SS	04	150	50/ 100mm		212		○ 9			SPT Refusal due to possible cobble/boulder
	SHALE-TILL COMPLEX 4.6 Grey, hard, sandy silty CLAY, trace gravel, trace cobble, trace shale fragments, moist.	SS	05	100	50/ 75mm	5	211		○ 13			SPT Refusal due to possible cobble/boulder and/or weathered bedrock
		SS	06	100	50/ 50mm	6	210		○ 19			SPT Refusal due to possible cobble/boulder and/or weathered bedrock
		SS	07	100	50/ 25mm	8	208		○ 10			SPT Refusal due to possible cobble/boulder and/or weathered bedrock
	206.2	SS	08	100	50/ 125mm	9	207		○ 11			SPT Refusal due to possible cobble/boulder and/or weathered bedrock
	End of borehole 9.3 Notes: 1. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay.											

▽ No freestanding groundwater measured in open borehole upon completion of drilling ■ Cave in depth recorded on completion of drilling: Open

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RECORD OF BOREHOLE No. BH320(MW)

Project Number:	671835	Drilling Location:	As per Borehole layout	Logged by:	RM
Client:	Region of Peel	Drilling Method:	100 mm Solid Stem Augering	Compiled by:	SR
Project Name:	Geotechnical Investigation: 25 Rutherford Road South	Drilling Machine:	Track Mounted Drill	Reviewed by:	MT
Location:	25 Rutherford Rd. South, Brampton, ON	Date Started:	Mar 4, 2020 Date Completed: Mar 4, 2020	Revision No.:	0

EASTING: 601551.428
NORTHING: 4839269.847

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 215.87 m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT ○ / DCPT ●); MTO Vane* (△ Intact / ▲ Remould); Nilcon Vane* (◇ Intact / ◆ Remould); * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: ★ Pocket Penetrometer (kg/cm²) 1 2 3 4; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL); ✱ Passing 75 um (%); ○ Moisture Content (%); Atterberg Limits W_P 20 40 60 80 W_L	INSTRUMENTATION INSTALLATION	Unit Weight (kN/m³)	COMMENTS
	TOPSOIL ~ 150 mm (215.7)											
	FILL (0.2) Brown, firm, silty CLAY, trace gravel, trace oxidation, rootlet, moist. (215.1)	SS	01	75	5			○	○ 16			
	Brown, loose, silty CLAY, some sand to sandy, trace gravel, trace oxidation, moist. (0.8) (214.4)	SS	02	84	9	1	215	○	○ 18			
	NATIVE TILL (1.5) Brown to grey, very stiff to hard, sandy silty CLAY, some gravel, trace oxidation, moist.	SS	03	84	23	2	214	○	○ 13		21.95	
		SS	04	124	70/ 250mm				○ 9			SPT Refusal due to possible cobble/boulder
		SS	05	124	95/ 250mm	3	213		○ 13			SPT Refusal due to possible cobble/boulder
	(211.3) SHALE-TILL COMPLEX (4.6) Grey, hard, sandy silty CLAY, trace gravel, trace cobble, trace shale fragments, moist.	SS	06	25	48	4	212					
		SS	07	72	98/ 275mm	5	211	○	○ 9			
		SS	08	0	50/ 25mm	6	210		○ 8			SPT Refusal due to possible cobble/boulder and/or weathered bedrock
						7	209					
						8	208					SPT Refusal due to possible cobble/boulder and/or weathered bedrock
	(206.7) Grey, highly weathered shale. (9.2) (206.7) End of borehole	SS	09	0	50/ 15mm	9	207					SPT Refusal due to possible cobble/boulder and/or weathered bedrock

Notes:

1. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay.

▽ **Groundwater depth on completion of drilling:** 3.7 m

▼ **Groundwater depth observed on** 3/25/2020 **at a depth of:** 2.0 m.

Cave in depth recorded on completion of drilling: Open

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Scale: 1 : 58

RECORD OF BOREHOLE No. BH321

Project Number:	671835	Drilling Location:	As per Borehole layout	Logged by:	RM
Client:	Region of Peel	Drilling Method:	100 mm Solid Stem Augering	Compiled by:	SR
Project Name:	Geotechnical Investigation: 25 Rutherford Road South	Drilling Machine:	Track Mounted Drill	Reviewed by:	MT
Location:	25 Rutherford Rd. South, Brampton, ON	Date Started:	Mar 2, 2020 Date Completed: Mar 2, 2020	Revision No.:	0

EASTING: 601560.241
NORTHING: 4839261.3

Lithology Plot	DESCRIPTION	Elev.	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Unit Weight (kN/m³)	COMMENTS
	Local Ground Surface Elevation: 215.96 m									
	Asphalt Pavement ~ 150 mm	215.8								
	FILL Brown, SAND and GRAVEL, moist.	0.2 215.2								
	FILL Brown, loose to compact, silty SAND, some clay, trace gravel, moist.	0.8 214.4	SS	01	51	10	1	215		
	NATIVE TILL Brown to grey, very stiff to hard, sandy silty CLAY, trace to some gravel, trace oxidation, moist.	1.5	SS	02	100	24	2	214		
	trace broken cobble pieces		SS	03	100	50/ 50mm				SPT Refusal due to possible cobble/boulder
		212.9					3	213		
	SHALE-TILL COMPLEX Grey, hard, sandy silty CLAY, trace gravel, trace cobble, trace shale fragments, moist.	3.1	SS	04	40	50/ 100mm				SPT Refusal due to possible cobble/boulder and/or weathered bedrock
							4	212		
	GA: 19%, SA: 17%, SI: 47%, CL: 17%		SS	05	75	50	5	211		Higher percentage of GA likely due to shale fragments.
			SS	06	100	50/ 150mm	6	210		SPT Refusal due to possible cobble/boulder and/or weathered bedrock
							7	209		
			SS	07	100	50/ 50mm				SPT Refusal due to possible cobble/boulder and/or weathered bedrock
							8	208		
		207.4	SS	08		50/ 0mm				SPT Refusal due to possible cobble/boulder and/or weathered bedrock
	End of borehole	8.5								

Notes:

1. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay.

FIELD TESTING
Penetration Testing: ○ SPT ● DCPT
MTO Vane*: △ Intact ▲ Remould
Nilcon Vane*: ◇ Intact ◆ Remould
* Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING
★ Pocket Penetrometer (kg/cm²) 1 2 3 4
Soil Vapour Reading: △ parts per million (ppm) 100 200 300 400
▲ Lower Explosive Limit (LEL)
✱ Passing 75 um (%)
○ Moisture Content (%)
Atterberg Limits: W_P 20 40 60 80 W_L

INSTRUMENTATION INSTALLATION

○ 12 ○ 14 ○ 10 ○ 7 ○ 7 ○ 9 ○ 24

No freestanding groundwater measured in open borehole upon completion of drilling ■ **Cave in depth recorded on completion of drilling: Open**

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Scale: 1 : 58

RECORD OF BOREHOLE No. BH401

Project Number:	671835	Drilling Location:	As per Borehole layout	Logged by:	RM
Client:	Region of Peel	Drilling Method:	100 mm Solid Stem Augering	Compiled by:	SR
Project Name:	Geotechnical Investigation: 25 Rutherford Road South	Drilling Machine:	Track Mounted Drill	Reviewed by:	MT
Location:	25 Rutherford Rd. South, Brampton, ON	Date Started:	Mar 12, 2020 Date Completed: Mar 12, 2020	Revision No.:	0

EASTING: 601444.056
NORTHING: 4839160.062

Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 215.45 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING Penetration Testing: ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING ★ Pocket Penetrometer (kg/cm²) 1 2 3 4; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL); * Passing 75 um (%); ○ Moisture Content (%); Atterberg Limits W_P W_L 20 40 60 80	INSTRUMENTATION INSTALLATION	Unit Weight (kN/m³)	COMMENTS
	FILL Dark brown, soft to firm, silty CLAY, some sand, some rootlet, moist.	SS	01	67	4		215	○	20			
		SS	02	75	11	1		○	23			
	213.9						214					
	NATIVE TILL 1.5 Dark brown to brown, loose to very dense, silty SAND, trace clay, trace gravel, trace broken cobble pieces, wet.	SS	03	84	7	2		○	19			
		SS	04	86	90/ 200mm		213		18			SPT Refusal due to possible cobble/boulder
	212.4					3						
	End of borehole 3.1											

Notes:

1. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay.

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▽ No freestanding groundwater measured in open borehole upon completion of drilling ■ Cave in depth recorded on completion of drilling: Open

RECORD OF BOREHOLE No. BH402

Project Number:	671835	Drilling Location:	As per Borehole layout	Logged by:	RM
Client:	Region of Peel	Drilling Method:	100 mm Solid Stem Augering	Compiled by:	SR
Project Name:	Geotechnical Investigation: 25 Rutherford Road South	Drilling Machine:	Track Mounted Drill	Reviewed by:	MT
Location:	25 Rutherford Rd. South, Brampton, ON	Date Started:	Mar 11, 2020 Date Completed: Mar 11, 2020	Revision No.:	0

EASTING: 601460.177
NORTHING: 4839173.781

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT ○ / DCPT ●); MTO Vane* (Intact △ / Remould ▲); Nilcon Vane* (Intact ◇ / Remould ◆); * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: ★ Pocket Penetrometer (kg/cm²) 1 2 3 4; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL); ✱ Passing 75 um (%); ○ Moisture Content (%); Atterberg Limits W_P ○ W_L 20 40 60 80	INSTRUMENTATION INSTALLATION	Unit Weight (kN/m³)	COMMENTS
	Local Ground Surface Elevation: 215.49 m										
	FILL Brown, loose to compact, SAND & GRAVEL, trace silt, trace clay, trace rootlet, wet.	SS	01	84	8		215	○	○ 16		
	GA: 54%, SA: 35%, SI & CL: 11%	SS	02	75	10	1		○	○ 25	▽	
	214.0						214				
	NATIVE TILL 1.5 Brown, compact, silty SAND, some clay, trace gravel, trace broken cobble pieces, wet.	SS	03	25	20			○	○ 17		
	213.2					2					
	Brown, very dense, SAND, some silt, trace gravel, wet. 2.3	SS	04	75	75		213	○	○ 11		
	212.4					3					
	End of borehole 3.1										

Notes:

1. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay.

▽ **Groundwater depth on completion of drilling:** 1.4 m

Cave in depth recorded on completion of drilling: Open

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Scale: 1 : 26

RECORD OF BOREHOLE No. BH403

Project Number:	671835	Drilling Location:	As per Borehole layout	Logged by:	RM
Client:	Region of Peel	Drilling Method:	100 mm Solid Stem Augering	Compiled by:	SR
Project Name:	Geotechnical Investigation: 25 Rutherford Road South	Drilling Machine:	Track Mounted Drill	Reviewed by:	MT
Location:	25 Rutherford Rd. South, Brampton, ON	Date Started:	Mar 11, 2020 Date Completed: Mar 11, 2020	Revision No.:	0

EASTING: 601468.827
NORTHING: 4839169.59

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT ○ / DCPT ●); MTO Vane* (Intact △ / Remould ▲); Nilcon Vane* (Intact ◇ / Remould ◆); * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: ★ Pocket Penetrometer (kg/cm²) 1 2 3 4; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL); ✱ Passing 75 um (%); ○ Moisture Content (%); Atterberg Limits W_P 20 40 60 80 W_L	INSTRUMENTATION INSTALLATION	Unit Weight (kN/m³)	COMMENTS
	Local Ground Surface Elevation: 215.30 m											
	NATIVE STRATA Brown, loose to compact, SAND, some silt, some gravel, trace broken cobble pieces, moist.	SS	01	70	10		215	○	○ 14			
	214.4											
	Brown, compact to very dense, silty SAND, trace to some clay, trace to some gravel, trace oxidation, moist. 0.9	SS	02	75	16	1	214	○	○ 4			
	becomes moist to wet. some broken cobble pieces.	SS	03	100	19	2	213	○	○ 11			
		SS	04	100	76			○	○ 11			
	212.3					3						
	End of borehole 3.1											

Notes:

1. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay.

▽ No freestanding groundwater measured in open borehole upon completion of drilling ■ Cave in depth recorded on completion of drilling: 3.0 m.

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RECORD OF BOREHOLE No. BH404

Project Number:	671835	Drilling Location:	As per Borehole layout	Logged by:	RM
Client:	Region of Peel	Drilling Method:	100 mm Solid Stem Augering	Compiled by:	SR
Project Name:	Geotechnical Investigation: 25 Rutherford Road South	Drilling Machine:	Track Mounted Drill	Reviewed by:	MT
Location:	25 Rutherford Rd. South, Brampton, ON	Date Started:	Mar 12, 2020 Date Completed: Mar 12, 2020	Revision No.:	0

EASTING: 601478.693
NORTHING: 4839192.152

Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 215.79 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80)	LAB TESTING: ★ Pocket Penetrometer (kg/cm²) 1 2 3 4; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL); ✱ Passing 75 um (%); ○ Moisture Content (%); Atterberg Limits W_P W_L 20 40 60 80	INSTRUMENTATION INSTALLATION	Unit Weight (kN/m³)	COMMENTS
	NATIVE TILL Dark brown, compact, gravelly SAND, some silt, moist.	SS	01	59	25			○	16			
	215.0											
	Brown, firm, sandy silty CLAY, trace gravel, trace broken cobble pieces, moist. 0.8	SS	02	51	7	1	215	○	16			
		SS	03	41	5	2	214	○	20			
	becomes hard.	SS	04	100	40		213	○	21			
	212.7					3						
	End of borehole 3.1											

Notes:

1. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay.

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▽ No freestanding groundwater measured in open borehole upon completion of drilling ■ Cave in depth recorded on completion of drilling: Open

RECORD OF BOREHOLE No. BH405

Project Number:	671835	Drilling Location:	As per Borehole layout	Logged by:	RM
Client:	Region of Peel	Drilling Method:	100 mm Solid Stem Augering	Compiled by:	SR
Project Name:	Geotechnical Investigation: 25 Rutherford Road South	Drilling Machine:	Track Mounted Drill	Reviewed by:	MT
Location:	25 Rutherford Rd. South, Brampton, ON	Date Started:	Mar 12, 2020 Date Completed: Mar 12, 2020	Revision No.:	0

EASTING: 601485.498
NORTHING: 4839187.336

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 215.78 m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT / DCPT), MTO Vane* / Nilcon Vane* (Intact / Remould), * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: Pocket Penetrometer (kg/cm²) 1 2 3 4; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL); * Passing 75 um (%); Moisture Content (%); Atterberg Limits W_P 20 40 60 80 W_L	INSTRUMENTATION INSTALLATION	Unit Weight (kN/m³)	COMMENTS
	FILL Brown, compact, gravelly SAND, some brocken cobble pieces, moist. 215.5											
	Brown, stiff to very stiff, silty CLAY, trace gravel, trace sand, moist. 0.3 215.0	SS	01	46	18				15			
	NATVE TILL 0.8 Brown, stiff to hard, sandy silty CLAY, trace gravel, trace oxidation, moist.	SS	02	92	19	1	215		18			
	trace broken cobble pieces	SS	03	100	14	2	214		13			
		SS	04	70	72		213		12			
	212.7					3						
	End of borehole 3.1											

Notes:

1. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay.

No freestanding groundwater measured in open borehole upon completion of drilling. Cave in depth recorded on completion of drilling: Open

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RECORD OF BOREHOLE No. BH406

Project Number:	671835	Drilling Location:	As per Borehole layout	Logged by:	RM
Client:	Region of Peel	Drilling Method:	100 mm Solid Stem Augering	Compiled by:	SR
Project Name:	Geotechnical Investigation: 25 Rutherford Road South	Drilling Machine:	Track Mounted Drill	Reviewed by:	MT
Location:	25 Rutherford Rd. South, Brampton, ON	Date Started:	Mar 12, 2020 Date Completed: Mar 12, 2020	Revision No.:	0

EASTING: 601493.704
NORTHING: 4839181.121

Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 215.62 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING Penetration Testing: ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING ★ Pocket Penetrometer (kg/cm²) 1 2 3 4; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL); ✱ Passing 75 um (%); ○ Moisture Content (%); Atterberg Limits W_P W_L 20 40 60 80	INSTRUMENTATION INSTALLATION	Unit Weight (kN/m³)	COMMENTS
	FILL Brown, stiff, silty CLAY, some sand, trace to some gravel, trace broken cobble pieces, moist to wet.	SS	01	67	10		215	○	○ 30			
	214.9											
	NATIVE TILL 0.8 Brown, soft to very stiff, sandy silty CLAY, trace gravel, trace oxidation, moist..	SS	02	67	3	1		○	○ 18			
	becomes stiff trace oxidation GA: 6%, SA: 36%, SI & CL: 58%	SS	03	100	10	2	214	○	○ 14			
		SS	04	100	21		213	○	○ 13			
	212.6					3						
	End of borehole 3.1											

Notes:

1. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay.

▽ No freestanding groundwater measured in open borehole upon completion of drilling ■ Cave in depth recorded on completion of drilling: Open

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Scale: 1 : 26

RECORD OF BOREHOLE No. BH407

Project Number:	671835	Drilling Location:	As per Borehole layout	Logged by:	RM
Client:	Region of Peel	Drilling Method:	100 mm Solid Stem Augering	Compiled by:	SR
Project Name:	Geotechnical Investigation: 25 Rutherford Road South	Drilling Machine:	Track Mounted Drill	Reviewed by:	MT
Location:	25 Rutherford Rd. South, Brampton, ON	Date Started:	Mar 13, 2020 Date Completed: Mar 13, 2020	Revision No.:	0

EASTING: 601545.178
NORTHING: 4839219.856

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Unit Weight (kN/m³)	COMMENTS
	Local Ground Surface Elevation: 215.93 m								
	FILL Dark Grey, compact to loose, gravelly SAND, trace to some silt, trace, trace broken cobble pieces, moist.	SS	01	67	24				
		SS	02	100	8	1	215		
	214.4								
	Dark brown, firm to stiff, silty CLAY, some sand, trace gravel, rootlet, moist to wet. 1.5	SS	03	100	8	2	214	22.68	
	213.6								
	NATIVE TILL 2.3 Brown, compact, silty SAND, trace clay, trace gravel, moist.	SS	04	84	12				Unit Weight = 23.1 kN/m3
	212.9					3	213		
	End of borehole 3.1								

Notes:

1. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay.

FIELD TESTING
Penetration Testing: ○ SPT ● DCPT
MTO Vane*: △ Intact ▲ Remould
Nilcon Vane*: ◇ Intact ◆ Remould
* Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING
★ Pocket Penetrometer (kg/cm²) 1 2 3 4
Soil Vapour Reading △ parts per million (ppm) 100 200 300 400
▲ Lower Explosive Limit (LEL)
✱ Passing 75 um (%)
○ Moisture Content (%)
Atterberg Limits W_P 20 40 60 80 W_L

INSTRUMENTATION INSTALLATION

○7 ○20 ○36 ○19

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▽ No freestanding groundwater measured in open borehole upon completion of drilling ■ Cave in depth recorded on completion of drilling: Open

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commisioned and the accompanying'Notes to Record of Boreholes'.

Scale: 1 : 26

RECORD OF BOREHOLE No. BH408

Project Number:	671835	Drilling Location:	As per Borehole layout	Logged by:	RM
Client:	Region of Peel	Drilling Method:	100 mm Solid Stem Augering	Compiled by:	SR
Project Name:	Geotechnical Investigation: 25 Rutherford Road South	Drilling Machine:	Track Mounted Drill	Reviewed by:	MT
Location:	25 Rutherford Rd. South, Brampton, ON	Date Started:	Mar 13, 2020 Date Completed: Mar 13, 2020	Revision No.:	0

EASTING: 601552.709
NORTHING: 4839227.777

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 215.91 m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT ○, DCPT ●); MTO Vane* (Intact △, Remould ▲); Nilcon Vane* (Intact ◇, Remould ◆); * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: ★ Pocket Penetrometer (kg/cm²) 1 2 3 4; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL); ✱ Passing 75 um (%); ○ Moisture Content (%); Atterberg Limits W_P 20 40 60 80 W_L	INSTRUMENTATION INSTALLATION	Unit Weight (kN/m³)	COMMENTS
	FILL Grey, compact, SAND, trace silt, trace gravel, trace broken cobble pieces, trace rootlet, moist.	SS	01	62	19			○	○ 7			
	215.1											
	Grey, firm to stiff, silty CLAY, some sand, trace gravel, trace oxidation, moist. 0.8	SS	02	75	8	1	215	○	○ 18			
	214.4											
	NATIVE TILL 1.5 Brown, stiff to very stiff, sandy silty CLAY, trace gravel, trace broken cobble pieces, trace oxidation, moist. GA: 8%, SA: 19%, SI: 46%, CL:27%.	SS	03	100	14	2	214	○	○ 19			
		SS	04	100	30			○	○ 12			
	212.9					3	213					
	End of borehole 3.1											

Notes:

1. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay.

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▽ No freestanding groundwater measured in open borehole upon completion of drilling ■ Cave in depth recorded on completion of drilling: Open

RECORD OF BOREHOLE No. BH409

Project Number:	671835	Drilling Location:	As per Borehole layout	Logged by:	RM
Client:	Region of Peel	Drilling Method:	100 mm Solid Stem Augering	Compiled by:	SR
Project Name:	Geotechnical Investigation: 25 Rutherford Road South	Drilling Machine:	Track Mounted Drill	Reviewed by:	MT
Location:	25 Rutherford Rd. South, Brampton, ON	Date Started:	Mar 5, 2020 Date Completed: Mar 5, 2020	Revision No.:	0

EASTING: 601560.075
NORTHING: 4839237.826

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 215.91 m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (○ SPT ● DCPT); MTO Vane* (△ Intact ▲ Remould); Nilcon Vane* (◇ Intact ◆ Remould); * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: ★ Pocket Penetrometer (kg/cm²) 1 2 3 4; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL); * Passing 75 um (%); ○ Moisture Content (%); Atterberg Limits W_P 20 40 60 80 W_L	INSTRUMENTATION INSTALLATION	Unit Weight (kN/m³)	COMMENTS
	FILL Brown, dense, SAND & GRAVEL, some silt, trace clay, moist. 215.6											
	NATIVE TILL 0.3 Brown, very stiff to hard, sandy silty CLAY, trace gravel, trace oxidation, moist.	SS	01	67	32			○				
		SS	02	92	20	1	215	○				
		SS	03	100	25	2	214	○				
		SS	04	100	67			○				
		SS	05	92	37	3	213	○				
	212.3 End of borehole 3.7											

Notes:

1. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay.

▽ No freestanding groundwater measured in open borehole upon completion of drilling ■ Cave in depth recorded on completion of drilling: Open

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Scale: 1 : 26

RECORD OF BOREHOLE No. BH410

Project Number:	671835	Drilling Location:	As per Borehole layout	Logged by:	RM
Client:	Region of Peel	Drilling Method:	100 mm Solid Stem Augering	Compiled by:	SR
Project Name:	Geotechnical Investigation: 25 Rutherford Road South	Drilling Machine:	Track Mounted Drill	Reviewed by:	MT
Location:	25 Rutherford Rd. South, Brampton, ON	Date Started:	Mar 13, 2020 Date Completed: Mar 13, 2020	Revision No.:	0

EASTING: 601567.591
NORTHING: 4839246

Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 215.89 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT ○, DCPT ●); MTO Vane* (Intact △, Remould ▲); Nilcon Vane* (Intact ◇, Remould ◆); * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: ★ Pocket Penetrometer (kg/cm²) 1 2 3 4; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL); * Passing 75 um (%); ○ Moisture Content (%); Atterberg Limits W_P W_L 20 40 60 80	INSTRUMENTATION INSTALLATION	Unit Weight (kN/m³)	COMMENTS
	NATIVE TILL Brown, compact, silty SAND, trace to some clay, trace gravel, moist.	SS	01	67	19			○	21			
	215.1											
	NATIVE TILL 0.8 Brown, very stiff to hard, sandy silty CLAY, trace gravel, moist.	SS	02	70	18	1	215	○	23			
		SS	03	100	24			○	14			
	trace broken cobble pieces	SS	04	84	31	2	214	○	12		21.82	
	212.8					3	213					
	End of borehole 3.1											

Notes:

1. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay.

▽ No freestanding groundwater measured in open borehole upon completion of drilling ■ Cave in depth recorded on completion of drilling: Open

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RECORD OF BOREHOLE No. BH411

Project Number:	671835	Drilling Location:	As per Borehole layout	Logged by:	RM
Client:	Region of Peel	Drilling Method:	100 mm Solid Stem Augering	Compiled by:	SR
Project Name:	Geotechnical Investigation: 25 Rutherford Road South	Drilling Machine:	Track Mounted Drill	Reviewed by:	MT
Location:	25 Rutherford Rd. South, Brampton, ON	Date Started:	Mar 13, 2020 Date Completed: Mar 13, 2020	Revision No.:	0

EASTING: 601571.155
NORTHING: 4839254.918

Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 215.90 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT ○ / DCPT ●); MTO Vane* (△ Intact / ▲ Remould); Nilcon Vane* (◇ Intact / ◆ Remould); * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: ★ Pocket Penetrometer (kg/cm²) 1 2 3 4; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL); ✱ Passing 75 um (%); ○ Moisture Content (%); Atterberg Limits W_P 20 40 60 80 W_L	INSTRUMENTATION INSTALLATION	Unit Weight (kN/m³)	COMMENTS
	FILL Brown, loose to compact, gravelly SAND, trace rootlet, trace organics, moist	SS	01	67	10			○	13			
	215.1											
	Brown, firm, sandy silty CLAY, trace gravel, trace organics, moist. GA: 4%, SA: 40%, SI & CL: 56%	SS	02	100	5	1	215	○	18			
	214.4											
	NATIVE TILL Brown, very stiff, sandy silty CLAY, trace gravel, trace broken cobble pieces, moist.	SS	03	100	22	2	214	○	15			
	213.6											
	Brown, very dense, silty SAND, some gravel, trace clay, trace broken cobble pieces, moist.	SS	04	100	55		213	○	10			
	212.9					3						
	End of borehole											

1.8
1.5
2.3
3.1

Notes:

1. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay.

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▽ No freestanding groundwater measured in open borehole upon completion of drilling ■ Cave in depth recorded on completion of drilling: Open

RECORD OF BOREHOLE No. BH412

Project Number:	671835	Drilling Location:	As per Borehole layout	Logged by:	RM
Client:	Region of Peel	Drilling Method:	100 mm Solid Stem Augering	Compiled by:	SR
Project Name:	Geotechnical Investigation: 25 Rutherford Road South	Drilling Machine:	Track Mounted Drill	Reviewed by:	MT
Location:	25 Rutherford Rd. South, Brampton, ON	Date Started:	Mar 12, 2020 Date Completed: Mar 12, 2020	Revision No.:	0

EASTING: 601566.37
NORTHING: 4839268.681

Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 215.73 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING Penetration Testing: SPT ○ DCPT ●; MTO Vane* Intact △ Remould ▲; Nilcon Vane* Intact ◇ Remould ◆; * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING ★ Pocket Penetrometer (kg/cm²) 1 2 3 4; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL); ✱ Passing 75 um (%); ○ Moisture Content (%); Atterberg Limits W_P W_L 20 40 60 80	INSTRUMENTATION INSTALLATION	Unit Weight (kN/m³)	COMMENTS
	ASPHALT PAVEMENT ~ 50 mm 215.7 FILL 0.1 Brown, compact, gravelly SAND, moist.											
	215.4 Brown to brownish grey, firm to very soft, sandy silty CLAY, trace gravel, trace oxidation, trace rootlet, moist 0.3	SS	01	79	11			○	○ 5			
							215					
		SS	02	59	6	1		○	○ 14			
		SS	03	70	2		214	○	○ 21			
						2						
	213.4 NATIVE TILL 2.3 Brown, very dense, silty SAND, trace clay, trace gravel, trace broken cobble pieces, moist. 213.2 2.5	SS	04	100	50/ 50mm				○ 2			
	End of borehole											

Notes:

1. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay.

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▽ No freestanding groundwater measured in open borehole upon completion of drilling ■ Cave in depth recorded on completion of drilling: Open

RECORD OF BOREHOLE No. BH413

Project Number:	671835	Drilling Location:	As per Borehole layout	Logged by:	RM
Client:	Region of Peel	Drilling Method:	100 mm Solid Stem Augering	Compiled by:	SR
Project Name:	Geotechnical Investigation: 25 Rutherford Road South	Drilling Machine:	Track Mounted Drill	Reviewed by:	MT
Location:	25 Rutherford Rd. South, Brampton, ON	Date Started:	Mar 12, 2020 Date Completed: Mar 12, 2020	Revision No.:	0

EASTING: 601558.836
NORTHING: 4839282.401

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 215.71 m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT ○ / DCPT ●); MTO Vane* (Intact △ / Remould ▲); Nilcon Vane* (Intact ◇ / Remould ◆); * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: ★ Pocket Penetrometer (kg/cm²) 1 2 3 4; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL); ✱ Passing 75 um (%); ○ Moisture Content (%); Atterberg Limits W_P 20 40 60 80 W_L	INSTRUMENTATION INSTALLATION	Unit Weight (kN/m³)	COMMENTS
	FILL Dark grey, very soft to very stiff, sandy silty CLAY, trace gravel, trace rootlet, moist.	SS	01	79	1			○	23			
	GA: 2%, SA: 29%, SI & CL: 69%.						215					
		SS	02	100	26	1		○	17			
	214.2											
	NATIVE TILL 1.5 Brown, very stiff to hard, sandy silty CLAY, trace gravel, trace oxidation, moist.	SS	03	100	23		214	○	14			
						2						
		SS	04	79	62			○	12			
	trace broken cobble pieces						213					
	212.7					3						
	End of borehole 3.1											

Notes:

1. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay.

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No freestanding groundwater measured in open borehole upon completion of drilling ■ Cave in depth recorded on completion of drilling: Open

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commisioned and the accompanying'Notes to Record of Boreholes'.

Scale: 1 : 26

RECORD OF BOREHOLE No. BH414

Project Number:	671835	Drilling Location:	As per Borehole layout	Logged by:	RM
Client:	Region of Peel	Drilling Method:	100 mm Solid Stem Augering	Compiled by:	SR
Project Name:	Geotechnical Investigation: 25 Rutherford Road South	Drilling Machine:	Track Mounted Drill	Reviewed by:	MT
Location:	25 Rutherford Rd. South, Brampton, ON	Date Started:	Mar 13, 2020 Date Completed: Mar 13, 2020	Revision No.:	0

EASTING: 601568.339
NORTHING: 4839273.994

Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 215.67 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT ○ / DCPT ●); MTO Vane* (Intact △ / Remould ▲); Nilcon Vane* (Intact ◇ / Remould ◆); * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: ★ Pocket Penetrometer (kg/cm²) 1 2 3 4; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL); ✱ Passing 75 um (%); ○ Moisture Content (%); Atterberg Limits W_P 20 40 60 80 W_L	INSTRUMENTATION INSTALLATION	Unit Weight (kN/m³)	COMMENTS
	FILL Dark brown, soft to firm, silty CLAY, trace sand, trace gravel, rootlets, moist.	SS	01	84	4			○	26			
	214.9						215					
	NATIVE TILL 0.8 Brown, very stiff to hard, sandy silty CLAY, trace gravel, trace broken cobble pieces, trace oxidation, moist.	SS	02	100	19	1		○	17			
		SS	03	84	24		214	○	14		21.68	
		SS	04	100	77	2		○	10			
							213					
	212.6					3						
	End of borehole 3.1											

Notes:

1. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay.

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No freestanding groundwater measured in open borehole upon completion of drilling ■ Cave in depth recorded on completion of drilling: Open

Appendix C

Laboratory Testing Results (19 pages)

SNC·LAVALIN

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401 Hanlan Road
Vaughan, Ontario, Canada, L4L 3T1
905.851.0090 905.851.0091

Grain Size Analysis Test Report

Project No.: 671835 **Description:** Environmental and Geotechnical Consulting Services **Date:** Apr 20, 2020

Project Location: 25 Rutherford South, Brampton, ON

Contract No.:

SAMPLE DATA

Material: Soil
Date Sampled: Apr 20, 2020
Time Sampled:
Sample Type: Borehole
Sample Location: BH 302 SS06B
Lot: **Sublot:** **Station**
Source: Insitu
Sampled By: Technician

LAB DATA

Lab No.: **1521** **Date Tested:** Apr 20, 2020

Specification: OPSS 1010, SSM

PARTICLE ANALYSIS

TEST	Sample	Specification
Percent Crushed:		
% Asphalt Coated:		
% Flat and Elongated		

WASH PASS 0.075mm

TEST	Sample	Specs
Wash Pass 0.075 mm:		

FINENESS MODULUS	3.88

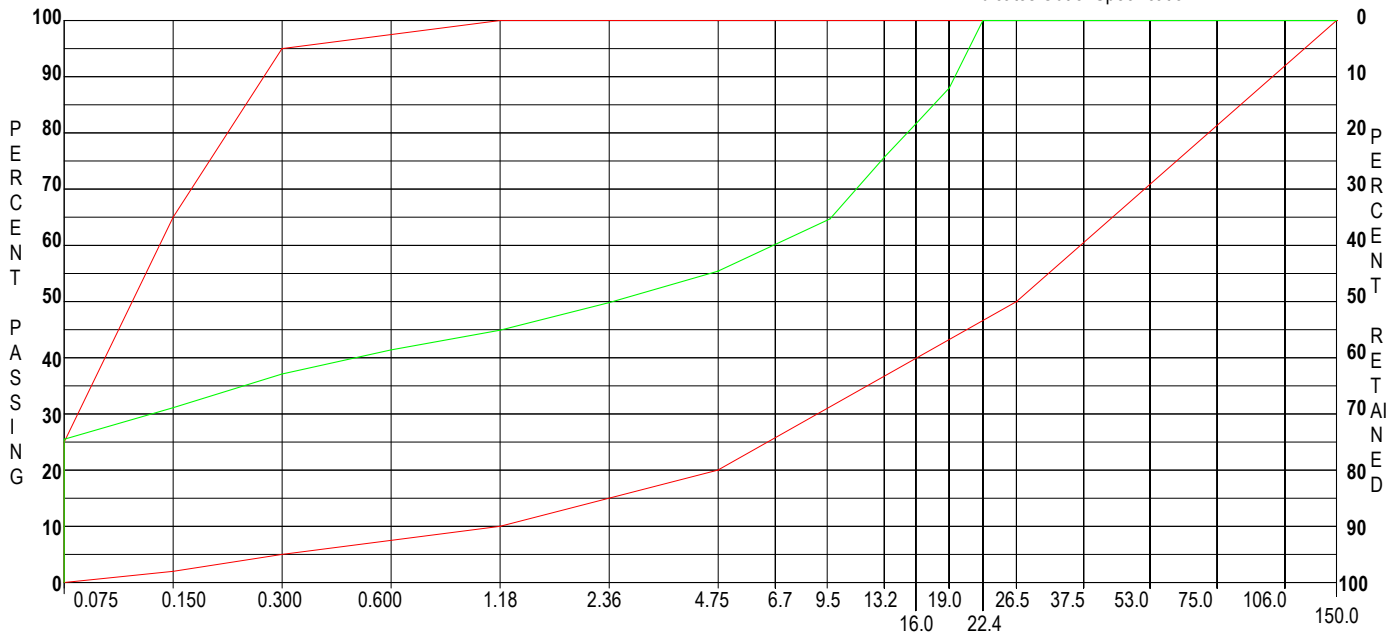
Comments:

Grain Size Analysis

Sieve Sizes (mm)	Percent Passing	
	Sample	Specification
150.0	**100**	100 - 100
106.0	**100**	-
75.0	**100**	-
53.0	**100**	-
37.5	**100**	-
26.5	**100**	50 - 100
22.4	**100**	-
19.0	**88**	-
16.0	**81.6**	-
13.2	**75.7**	-
9.5	**64.7**	-
6.7		-
4.75	**55.4**	20 - 100
2.36	**49.8**	-
1.18	**44.9**	10 - 100
0.600	**41.4**	-
0.300	**37.1**	5 - 95
0.150	**31.1**	2 - 65
0.075	**25.5***	0 - 25

* Indicates Out of Specification

Sample: **Specs:**



Project Manager: Mavara Turab

SNC·LAVALIN

SNC-Lavalin GEM Ontario Inc.
401 Hanlan Road
Vaughan, Ontario, Canada, L4L 3T1
905.851.0090 905.851.0091

Grain Size Analysis Test Report

Project No.: 671835 **Description:** Environmental and Geotechnical Consulting Services **Date:** Apr 20, 2020

Project Location: 25 Rutherford South, Brampton, ON

Contract No.:

SAMPLE DATA

Material: Soil
Date Sampled: Apr 20, 2020
Time Sampled:
Sample Type: Borehole
Sample Location: BH306 SS06
Lot: **Sublot:** **Station**
Source: Insitu
Sampled By: Technician

LAB DATA

Lab No.: **1522** **Date Tested:** Apr 20, 2020

Specification: OPSS 1010, SSM

PARTICLE ANALYSIS

TEST	Sample	Specification
Percent Crushed:		
% Asphalt Coated:		
% Flat and Elongated		

WASH PASS 0.075mm

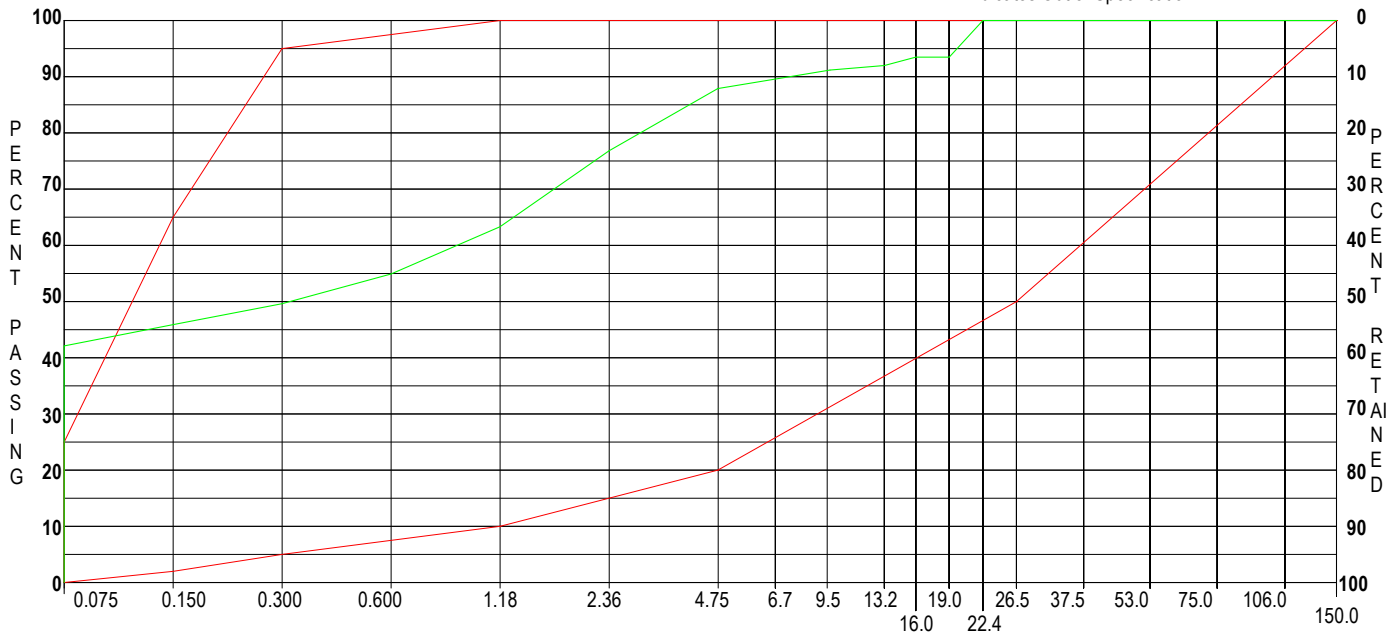
TEST	Sample	Specs
Wash Pass 0.075 mm:		
FINENESS MODULUS	2.37	

Comments:

Grain Size Analysis

Sieve Sizes (mm)	Percent Passing	
	Sample	Specification
150.0	**100**	100 - 100
106.0	**100**	-
75.0	**100**	-
53.0	**100**	-
37.5	**100**	-
26.5	**100**	50 - 100
22.4	**100**	-
19.0	**93.5**	-
16.0	**93.5**	-
13.2	**92**	-
9.5	**91.2**	-
6.7		-
4.75	**87.9**	20 - 100
2.36	**76.8**	-
1.18	**63.3**	10 - 100
0.600	**54.9**	-
0.300	**49.6**	5 - 95
0.150	**45.9**	2 - 65
0.075	**42.1***	0 - 25

* Indicates Out of Specification



Project Manager: Mavara Turab

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905.851.0090 905.851.0091

Grain Size Analysis Test Report

Project No.: 671835 **Description:** Environmental and Geotechnical Consulting Services **Date:** Apr 20, 2020

Project Location: 25 Rutherford South, Brampton, ON

Contract No.:

SAMPLE DATA

Material: Soil
Date Sampled: Apr 20, 2020
Time Sampled:
Sample Type: Borehole
Sample Location: BH402 SS02B
Lot: **Sublot:** **Station**
Source: Insitu
Sampled By: Technician

LAB DATA

Lab No.: **1523** **Date Tested:** Apr 20, 2020

Specification: OPSS 1010, SSM

PARTICLE ANALYSIS

TEST	Sample	Specification
Percent Crushed:		
% Asphalt Coated:		
% Flat and Elongated		

WASH PASS 0.075mm

TEST	Sample	Specs
Wash Pass 0.075 mm:		
FINENESS MODULUS	4.93	

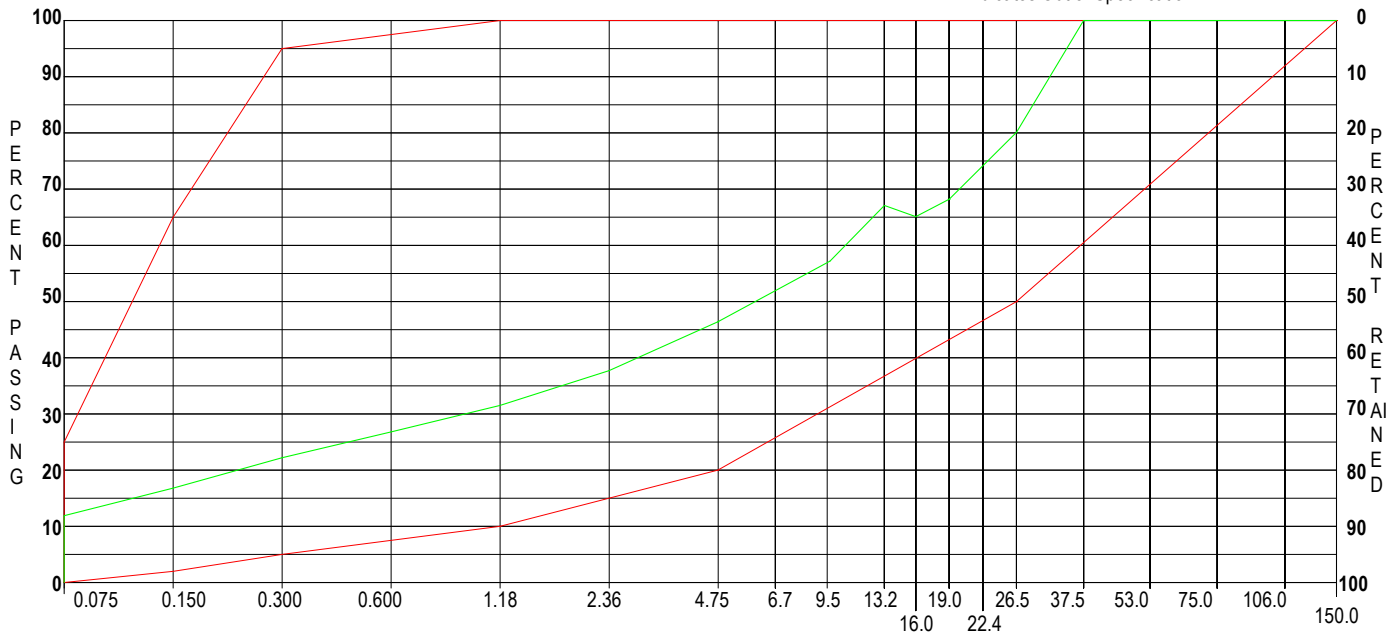
Comments:

Grain Size Analysis

Sieve Sizes (mm)	Percent Passing	
	Sample	Specification
150.0	**100**	100 - 100
106.0	**100**	-
75.0	**100**	-
53.0	**100**	-
37.5	**100**	-
26.5	**80.1**	50 - 100
22.4		-
19.0	**68.2**	-
16.0	**65.1**	-
13.2	**67.1**	-
9.5	**57.2**	-
6.7		-
4.75	**46.4**	20 - 100
2.36	**37.7**	-
1.18	**31.5**	10 - 100
0.600	**26.8**	-
0.300	**22.2**	5 - 95
0.150	**16.8**	2 - 65
0.075	**11.9**	0 - 25

* Indicates Out of Specification

Sample: **Specs:**



Project Manager: Mavara Turab

SNC·LAVALIN

SNC-Lavalin GEM Ontario Inc.
401 Hanlan Road
Vaughan, Ontario, Canada, L4L 3T1
905.851.0090 905.851.0091

Grain Size Analysis Test Report

Project No.: 671835 **Description:** Environmental and Geotechnical Consulting Services **Date:** Apr 20, 2020

Project Location: 25 Rutherford South, Brampton, ON

Contract No.:

SAMPLE DATA

Material: Soil
Date Sampled: Apr 20, 2020
Time Sampled:
Sample Type: Borehole
Sample Location: BH406 SS03A
Lot: **Sublot:** **Station**
Source: Insitu
Sampled By: Technician

LAB DATA

Lab No.: **1524** **Date Tested:** Apr 20, 2020

Specification: OPSS 1010, SSM

PARTICLE ANALYSIS

TEST	Sample	Specification
Percent Crushed:		
% Asphalt Coated:		
% Flat and Elongated		

WASH PASS 0.075mm

TEST	Sample	Specs
Wash Pass 0.075 mm:		

FINENESS MODULUS	1.03

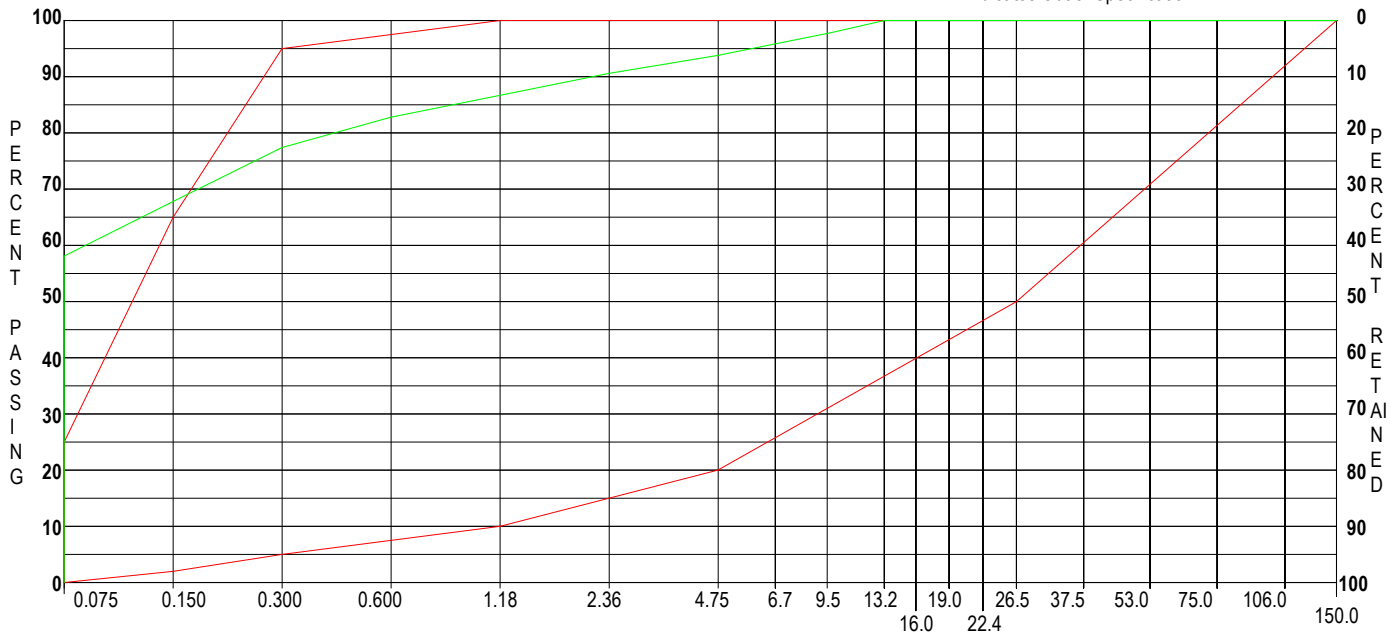
Comments:

Grain Size Analysis

Sieve Sizes (mm)	Percent Passing	
	Sample	Specification
150.0	**100**	100 - 100
106.0	**100**	-
75.0	**100**	-
53.0	**100**	-
37.5	**100**	-
26.5	**100**	50 - 100
22.4	**100**	-
19.0	**100**	-
16.0	**100**	-
13.2	**100**	-
9.5	**97.8**	-
6.7		-
4.75	**93.8**	20 - 100
2.36	**90.6**	-
1.18	**86.7**	10 - 100
0.600	**82.8**	-
0.300	**77.4**	5 - 95
0.150	**67.8***	2 - 65
0.075	**58.1***	0 - 25

* Indicates Out of Specification

Sample: **Specs:**



Project Manager: Mavara Turab

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SNC-Lavalin GEM Ontario Inc.
401 Hanlan Road
Vaughan, Ontario, Canada, L4L 3T1
905.851.0090 905.851.0091

Grain Size Analysis Test Report

Project No.: 671835 **Description:** Environmental and Geotechnical Consulting Services **Date:** Apr 20, 2020

Project Location: 25 Rutherford South, Brampton, ON

Contract No.:

SAMPLE DATA

Material: Soil
Date Sampled: Apr 20, 2020
Time Sampled:
Sample Type: Borehole
Sample Location: BH411 SS02
Lot: **Sublot:** **Station**
Source: Insitu
Sampled By: Technician

LAB DATA

Lab No.: **1525** **Date Tested:** Apr 20, 2020

Specification: OPSS 1010, SSM

PARTICLE ANALYSIS

TEST	Sample	Specification
Percent Crushed:		
% Asphalt Coated:		
% Flat and Elongated		

WASH PASS 0.075mm

TEST	Sample	Specs
Wash Pass 0.075 mm:		
FINENESS MODULUS	0.87	

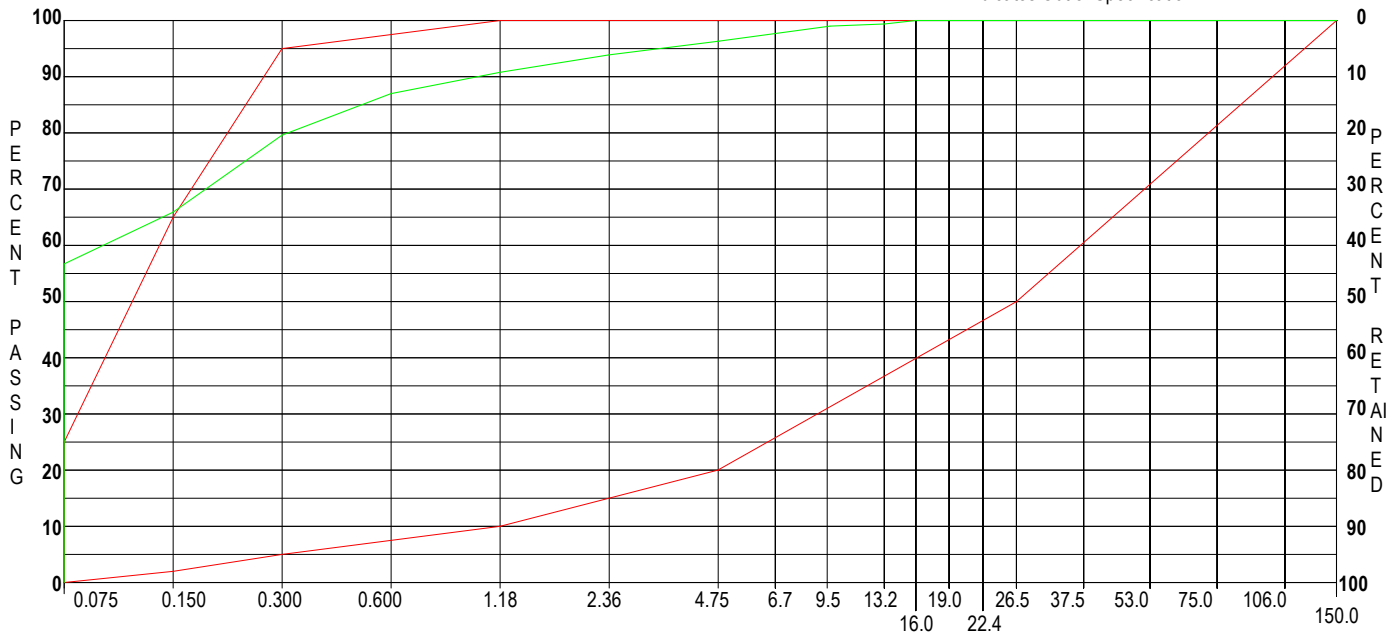
Comments:

Grain Size Analysis

Sieve Sizes (mm)	Percent Passing	
	Sample	Specification
150.0	**100**	100 - 100
106.0	**100**	-
75.0	**100**	-
53.0	**100**	-
37.5	**100**	-
26.5	**100**	50 - 100
22.4	**100**	-
19.0	**100**	-
16.0	**100**	-
13.2	**99.4**	-
9.5	**99**	-
6.7		-
4.75	**96.3**	20 - 100
2.36	**93.9**	-
1.18	**90.8**	10 - 100
0.600	**87**	-
0.300	**79.6**	5 - 95
0.150	**65.9***	2 - 65
0.075	**56.7***	0 - 25

* Indicates Out of Specification

Sample: **Specs:**



Project Manager: Mavara Turab

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SNC-Lavalin GEM Ontario Inc.
401 Hanlan Road
Vaughan, Ontario, Canada, L4L 3T1
905.851.0090 905.851.0091

Grain Size Analysis Test Report

Project No.: 671835 **Description:** Environmental and Geotechnical Consulting Services **Date:** Apr 20, 2020

Project Location: 25 Rutherford South, Brampton, ON

Contract No.:

SAMPLE DATA

Material: Soil
Date Sampled: Apr 20, 2020
Time Sampled:
Sample Type: Borehole
Sample Location: BH4133 SS01
Lot: **Sublot:** **Station**
Source: Insitu
Sampled By: Technician

LAB DATA

Lab No.: **1526** **Date Tested:** Apr 20, 2020

Specification: OPSS 1010, SSM

PARTICLE ANALYSIS

TEST	Sample	Specification
Percent Crushed:		
% Asphalt Coated:		
% Flat and Elongated		

WASH PASS 0.075mm

TEST	Sample	Specs
Wash Pass 0.075 mm:		

FINENESS MODULUS	0.58

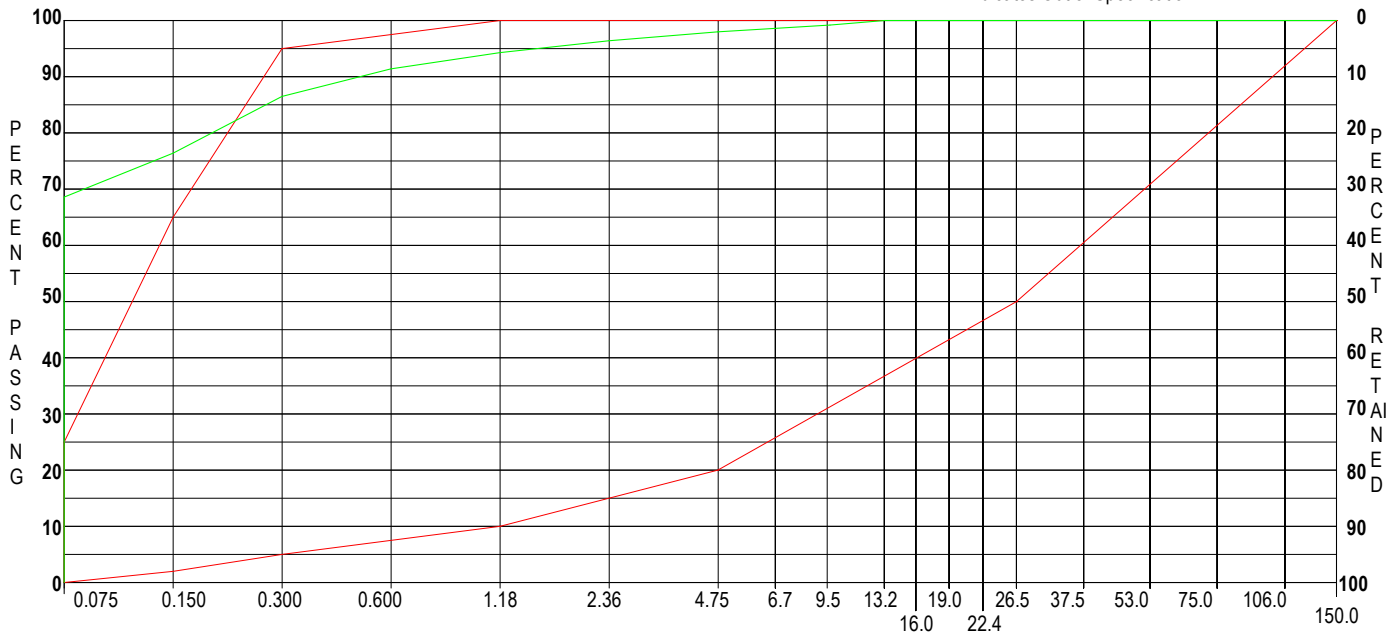
Comments:

Grain Size Analysis

Sieve Sizes (mm)	Percent Passing	
	Sample	Specification
150.0	**100**	100 - 100
106.0	**100**	-
75.0	**100**	-
53.0	**100**	-
37.5	**100**	-
26.5	**100**	50 - 100
22.4	**100**	-
19.0	**100**	-
16.0	**100**	-
13.2	**100**	-
9.5	**99.2**	-
6.7		-
4.75	**98**	20 - 100
2.36	**96.4**	-
1.18	**94.3**	10 - 100
0.600	**91.4**	-
0.300	**86.5**	5 - 95
0.150	**76.4***	2 - 65
0.075	**68.6***	0 - 25

* Indicates Out of Specification

Sample: **Specs:**

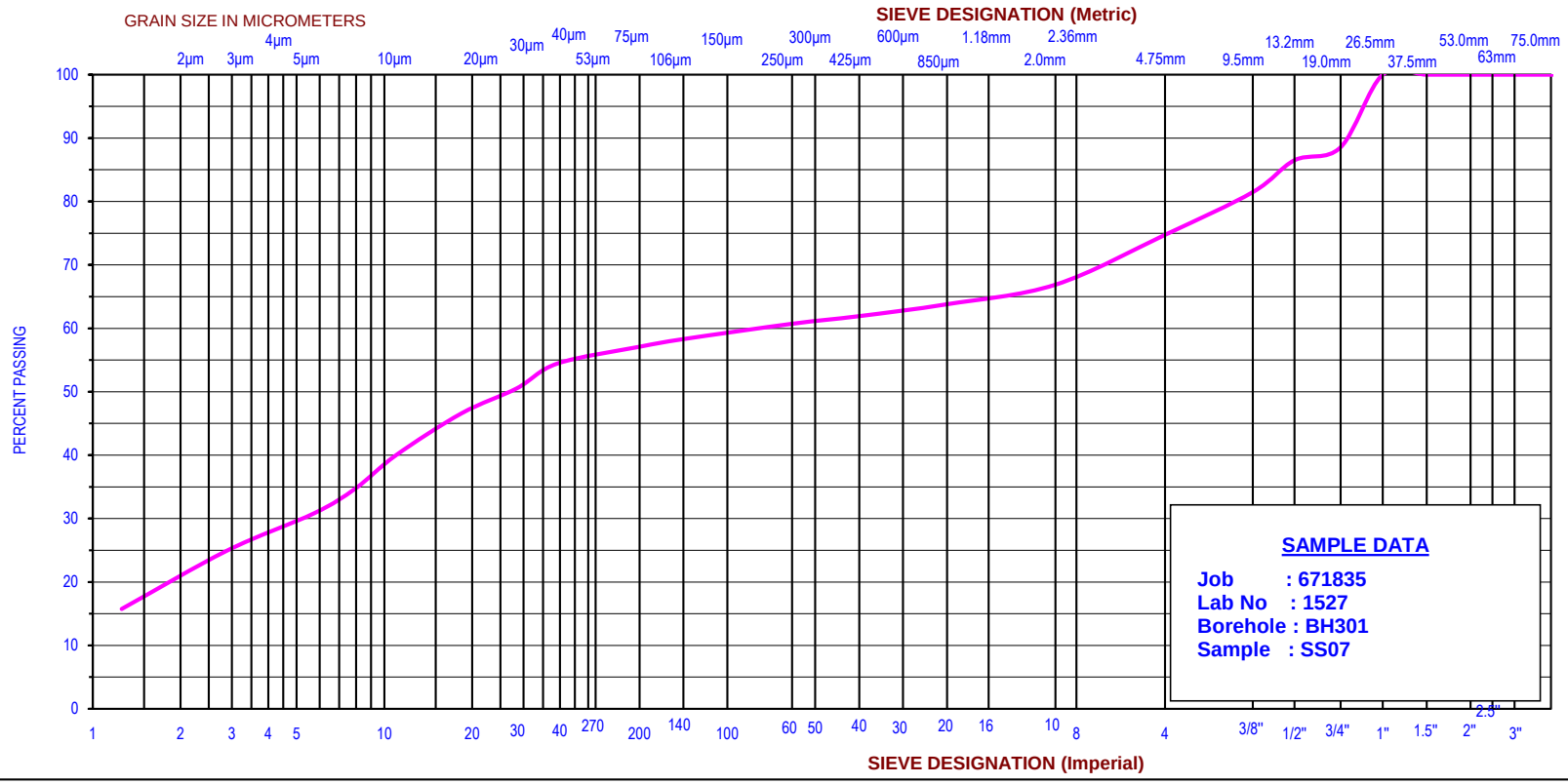


Project Manager: Mavara Turab

SNC·LAVALIN

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
	11	14	8	5	5	36	21

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GRAIN SIZE DISTRIBUTION

GRAVELLY / CLAYEY SILT

some sand

Client: City of Brampton

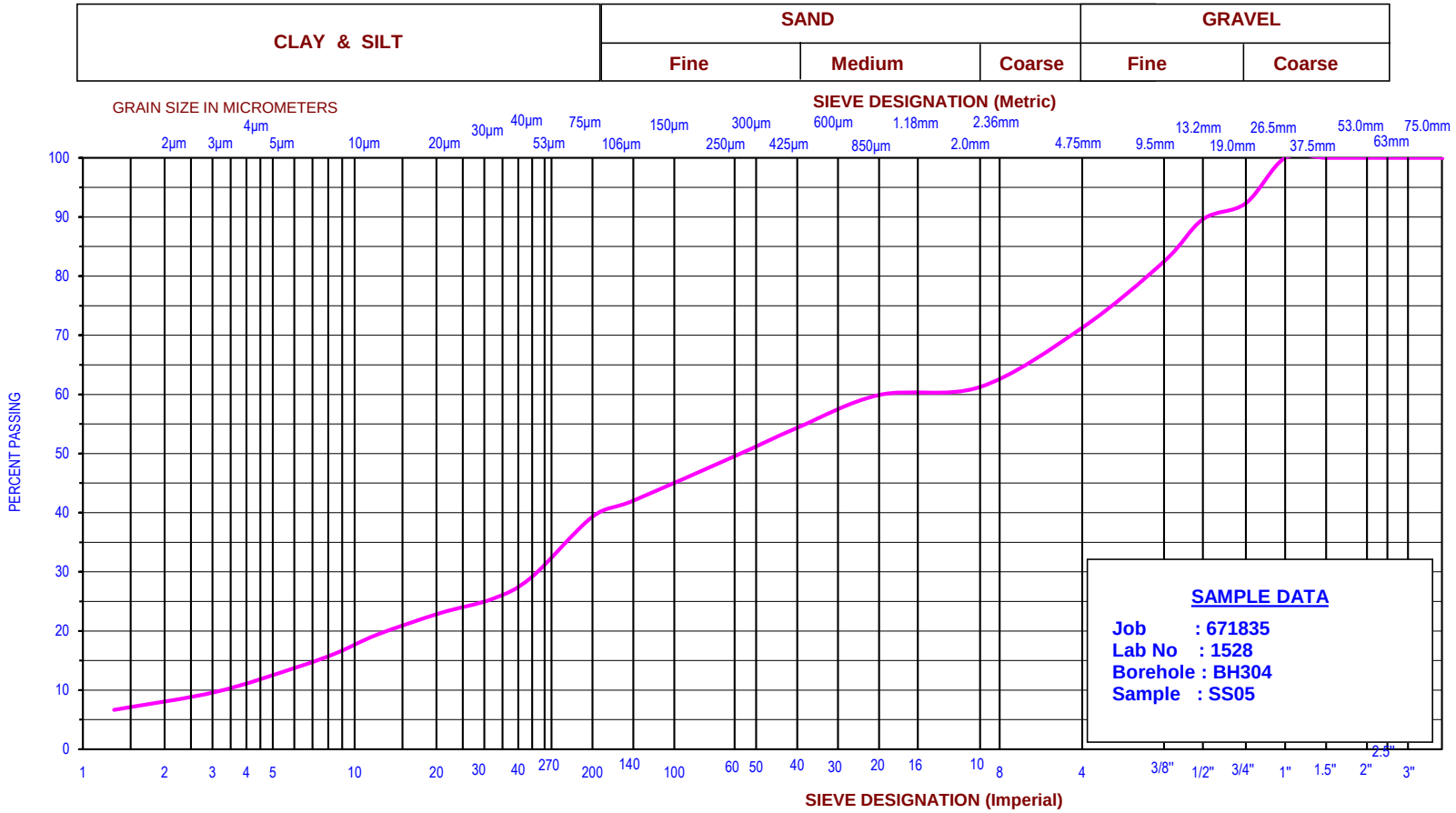
Project: Rutherford Rd South Brampton Geotechnical

Location: 25 Rutherford South Brampton, ON

Date: April 2020

SNC·LAVALIN

UNIFIED SOIL CLASSIFICATION SYSTEM



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
	8	21	10	7	15	31	8

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GRAIN SIZE DISTRIBUTION

GRAVELLY SAND AND SILT

trace clay

Client: City of Brampton

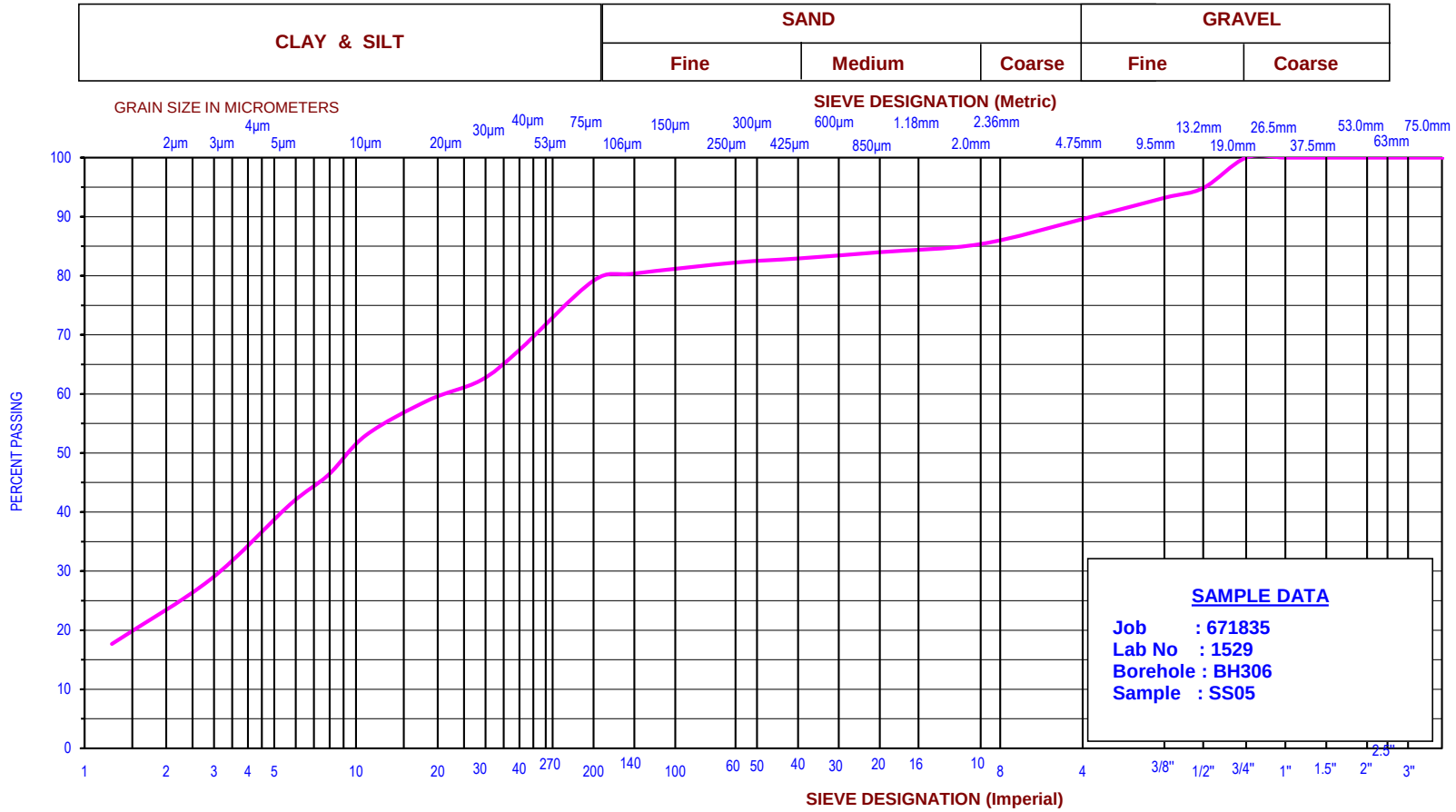
Project: Rutherford Rd South Brampton Geotechnical

Location: 25 Rutherford South Brampton, ON

Date: April 2020

SNC·LAVALIN

UNIFIED SOIL CLASSIFICATION SYSTEM



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
	0	10	4	2	4	57	23

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GRAIN SIZE DISTRIBUTION

CLAYEY SILT

some gravel, some sand

Client: City of Brampton

Project: Rutherford Rd South Brampton Geotechnical

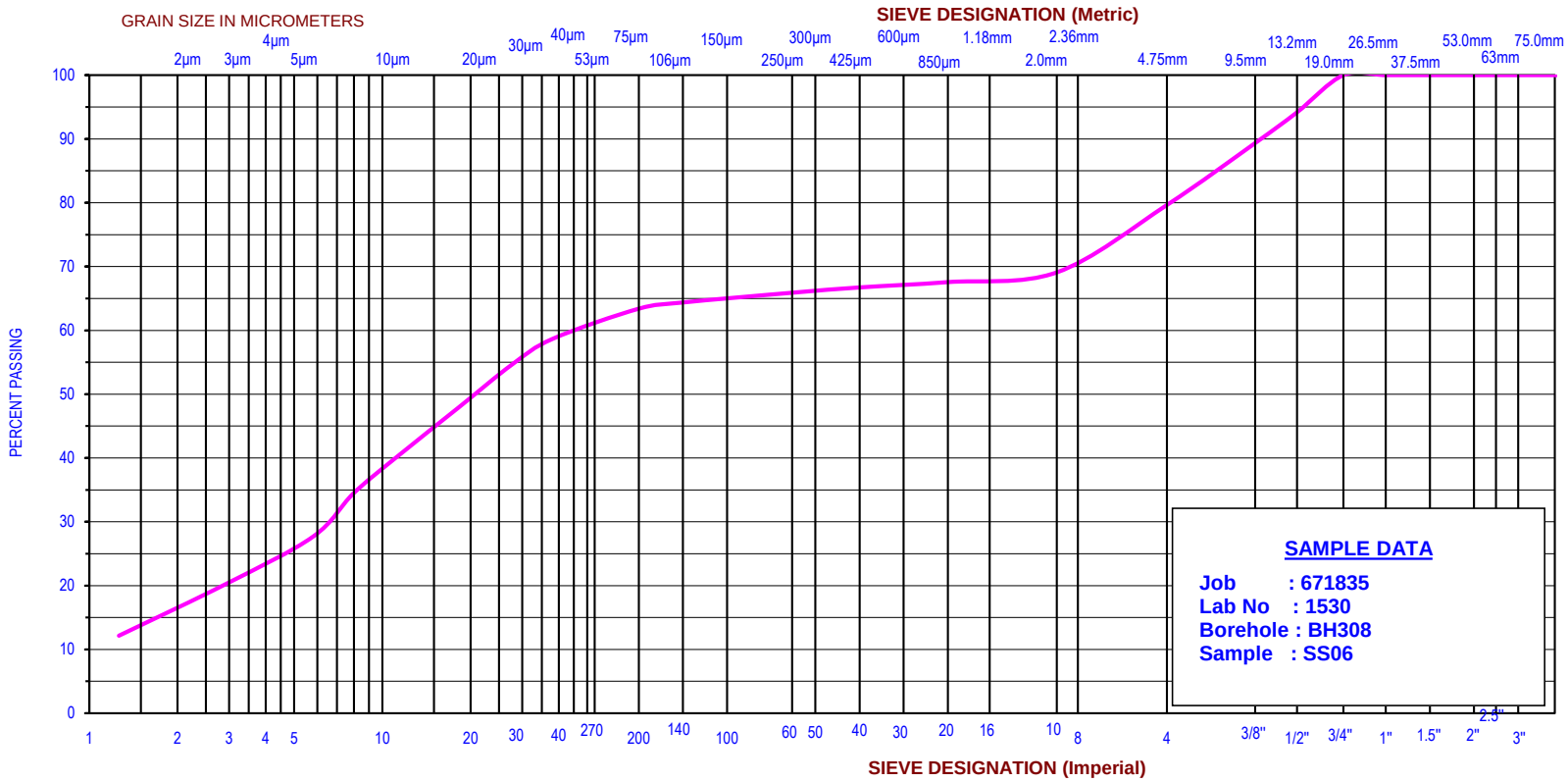
Location: 25 Rutherford South Brampton, ON

Date: April 2020

SNC·LAVALIN

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
	0	20	11	2	3	48	16

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GRAIN SIZE DISTRIBUTION

SILT (MIXED SHALE)

some gravel, some sand, some clay

Client: City of Brampton

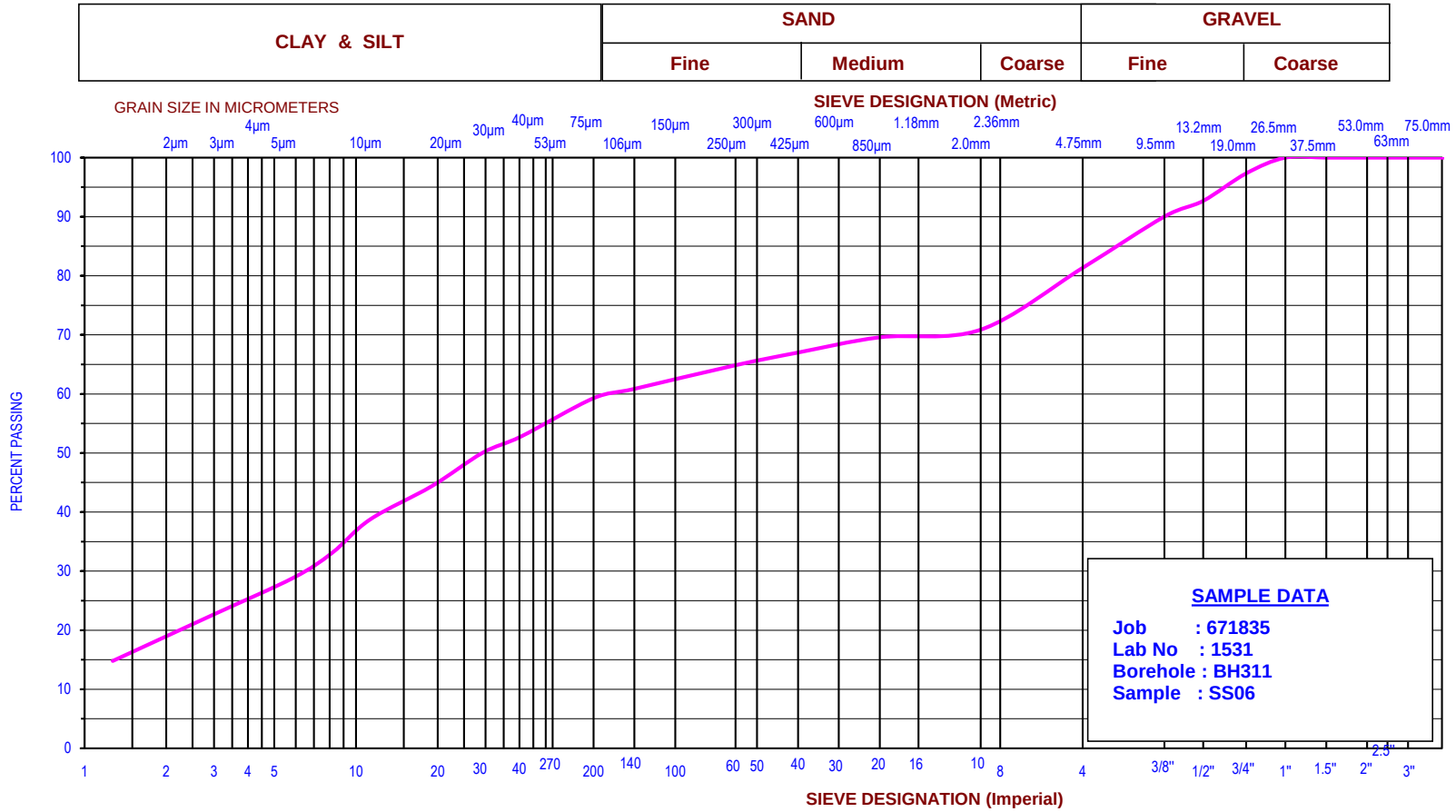
Project: Rutherford Rd South Brampton Geotechnical

Location: 25 Rutherford South Brampton, ON

Date: April 2020

SNC·LAVALIN

UNIFIED SOIL CLASSIFICATION SYSTEM



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
	3	16	10	4	8	40	19

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GRAIN SIZE DISTRIBUTION

SANDY SILT

some gravel, some clay

Client: City of Brampton

Project: Rutherford Rd South Brampton Geotechnical

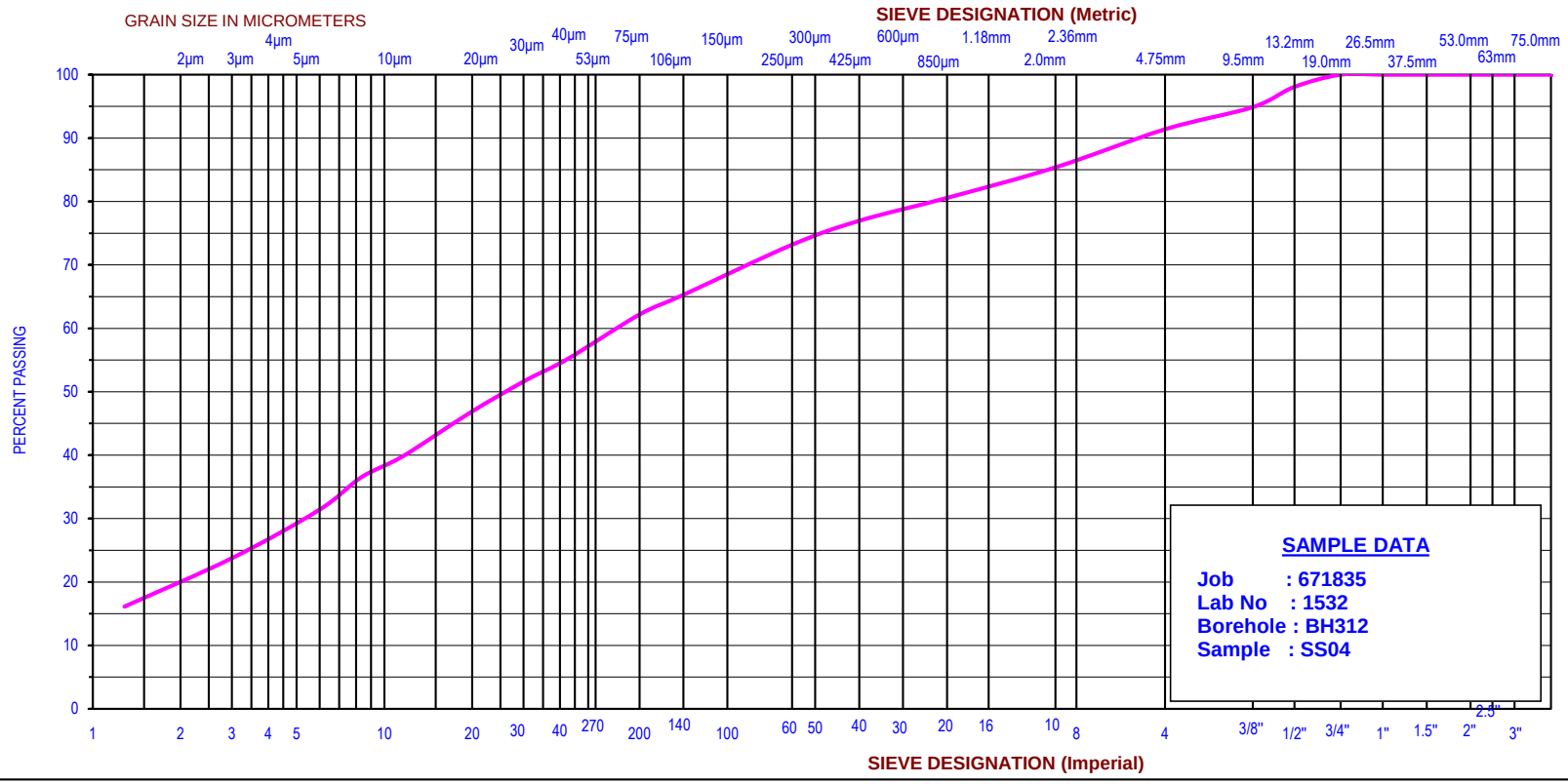
Location: 25 Rutherford South Brampton, ON

Date: April 2020

SNC·LAVALIN

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
	0	9	6	8	15	42	20

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GRAIN SIZE DISTRIBUTION

SANDY / CLAYEY SILT

trace gravel

Client: City of Brampton

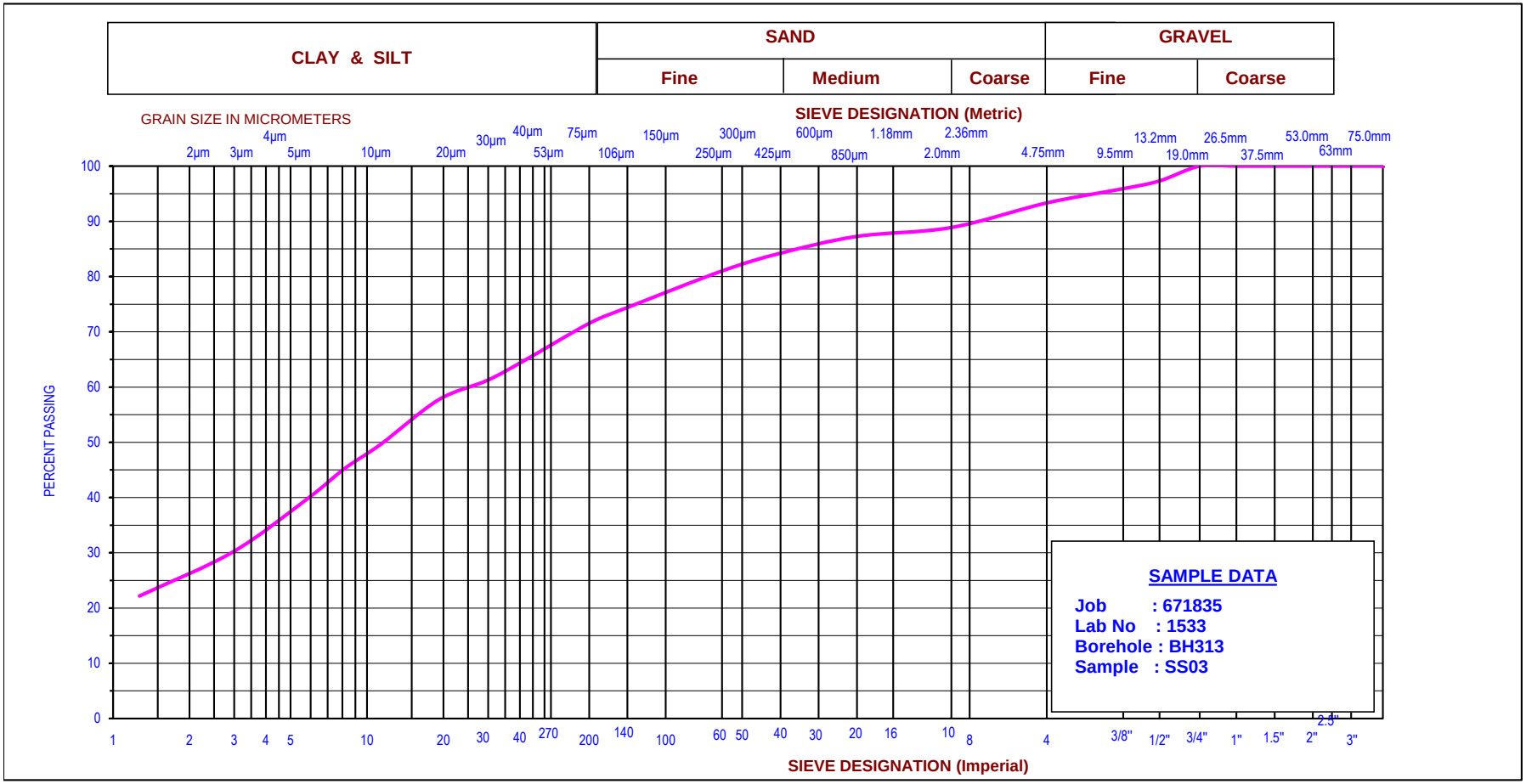
Project: Rutherford Rd South Brampton Geotechnical

Location: 25 Rutherford South Brampton, ON

Date: April 2020

SNC·LAVALIN

UNIFIED SOIL CLASSIFICATION SYSTEM



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
	0	7	4	5	13	45	26

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GRAIN SIZE DISTRIBUTION

CLAYEY / SANDY SILT

trace gravel

Client: City of Brampton

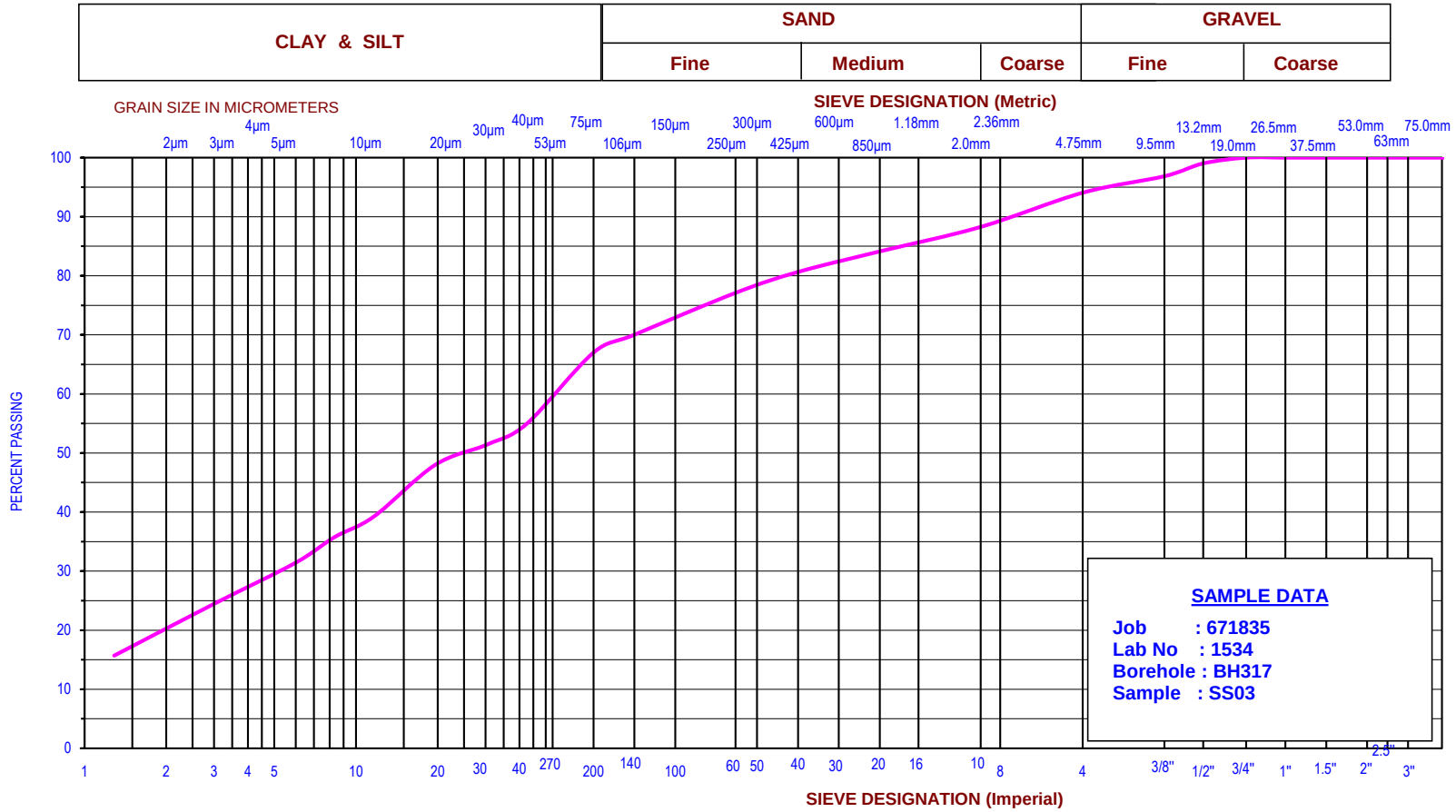
Project: Rutherford Rd South Brampton Geotechnical

Location: 25 Rutherford South Brampton, ON

Date: April 2020

SNC·LAVALIN

UNIFIED SOIL CLASSIFICATION SYSTEM



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
	0	6	6	7	14	47	20

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GRAIN SIZE DISTRIBUTION

SANDY / CLAYEY SILT

trace gravel

Client: City of Brampton

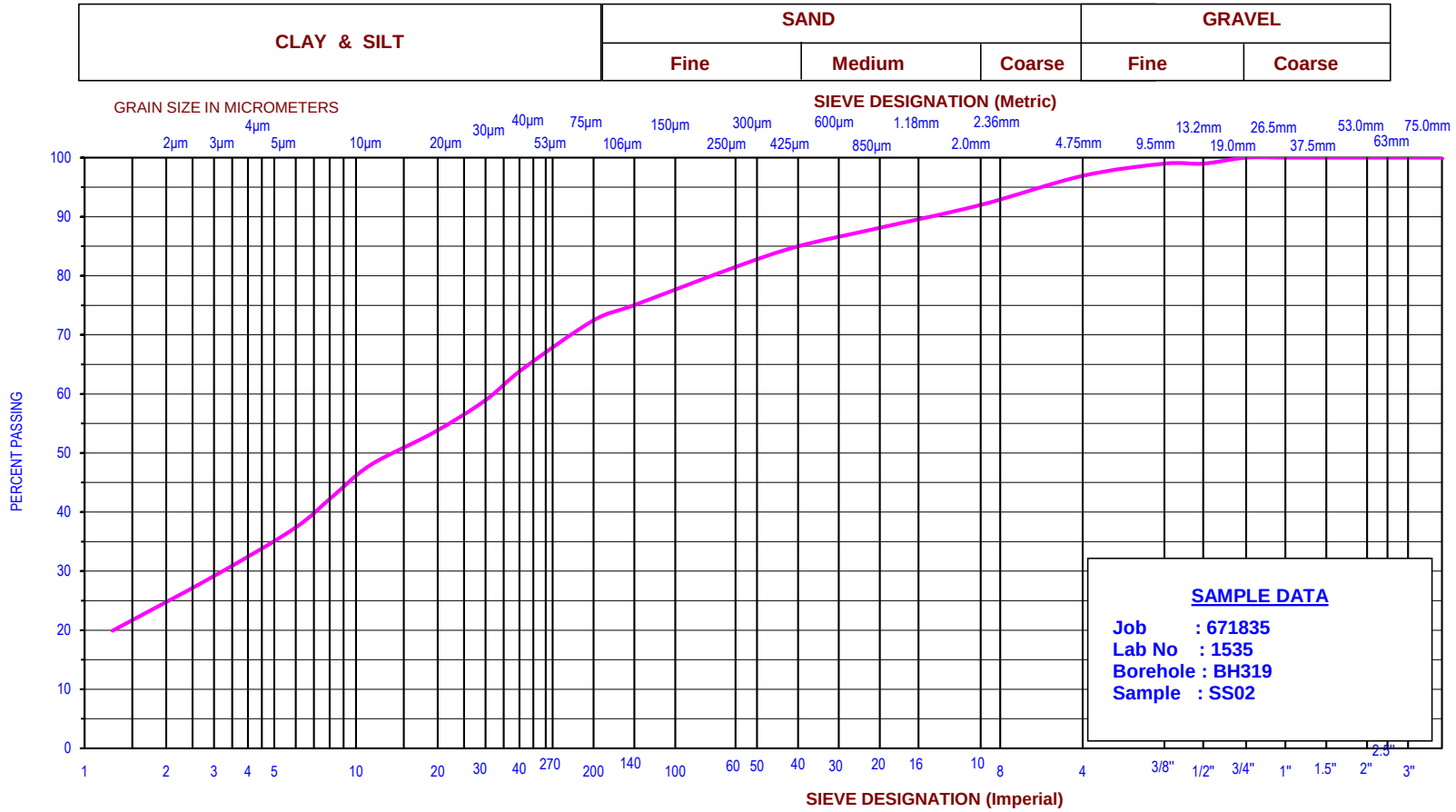
Project: Rutherford Rd South Brampton Geotechnical

Location: 25 Rutherford South Brampton, ON

Date: April 2020

SNC·LAVALIN

UNIFIED SOIL CLASSIFICATION SYSTEM



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
	0	3	5	7	12	48	25

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905.851.0090 905.851.0091

GRAIN SIZE DISTRIBUTION

CLAYEY / SANDY SILT

trace gravel

Client: City of Brampton

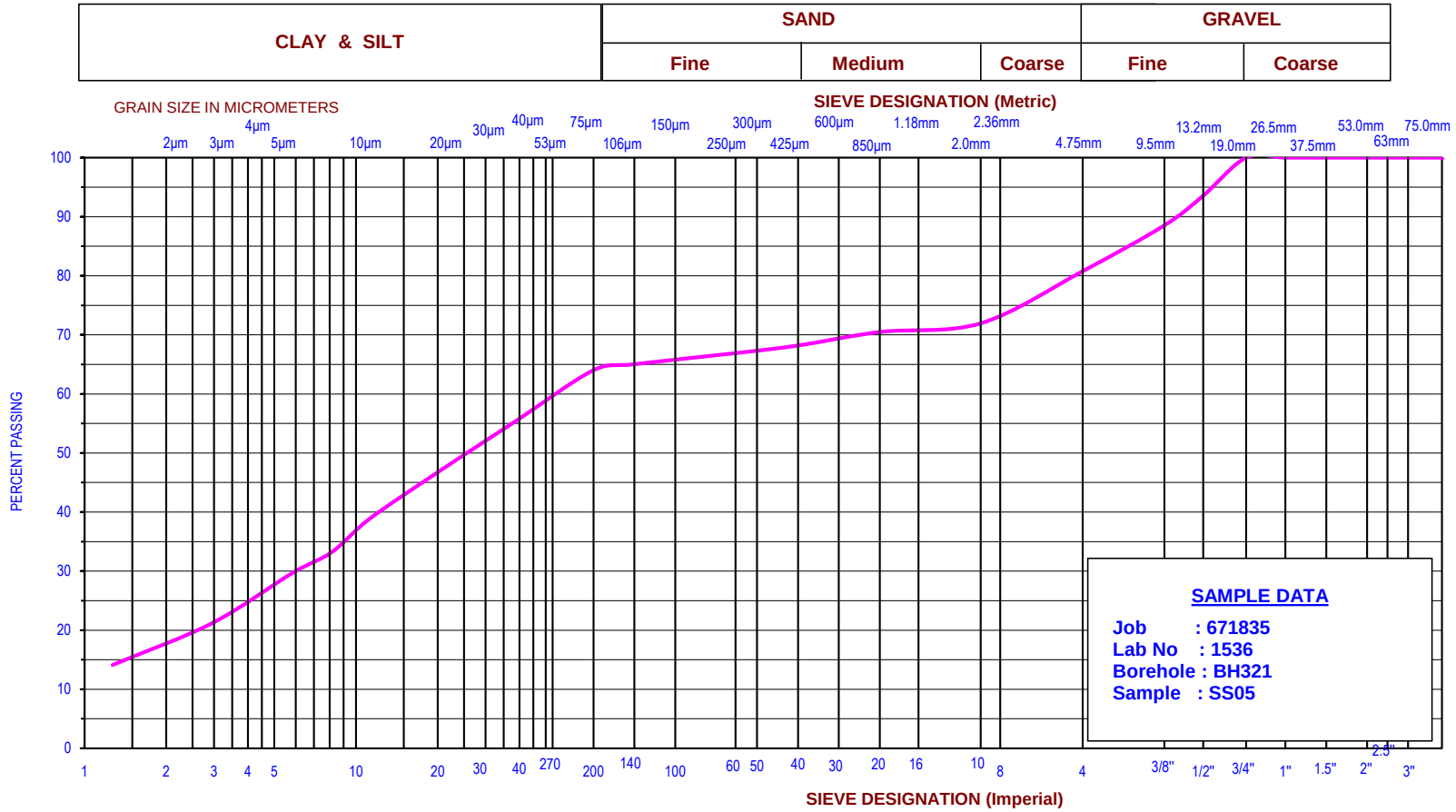
Project: Rutherford Rd South Brampton Geotechnical

Location: 25 Rutherford South Brampton, ON

Date: April 2020

SNC·LAVALIN

UNIFIED SOIL CLASSIFICATION SYSTEM



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
	0	19	9	4	4	47	17

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GRAIN SIZE DISTRIBUTION

SILT

some gravel, some sand, some clay

Client: City of Brampton

Project: Rutherford Rd South Brampton Geotechnical

Location: 25 Rutherford South Brampton, ON

Date: April 2020

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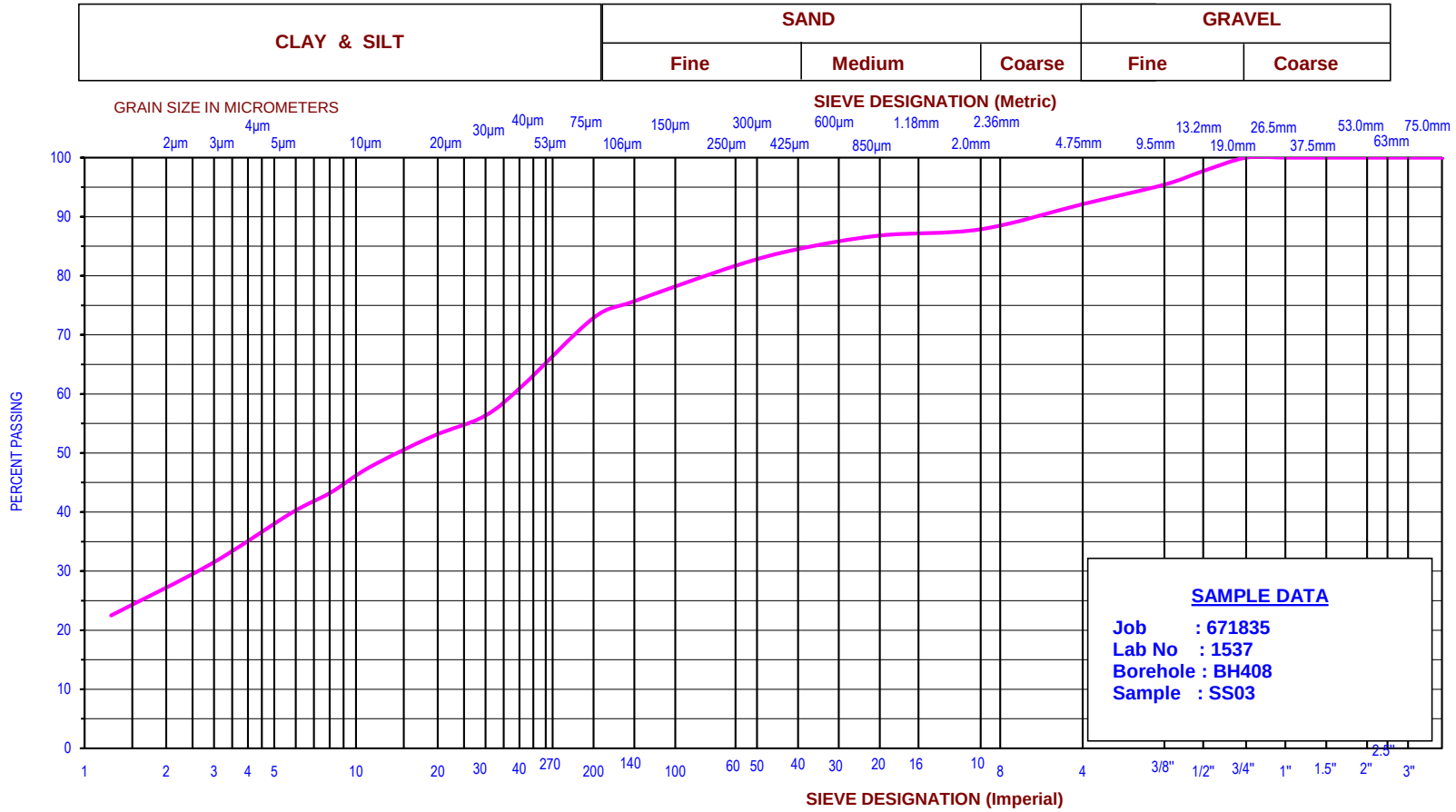
UNIFIED SOIL CLASSIFICATION SYSTEM



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
	0	8	4	3	12	46	27

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GRAIN SIZE DISTRIBUTION

CLAYEY SILT

some sand, trace gravel

Client: City of Brampton

Project: Rutherford Rd South Brampton Geotechnical

Location: 25 Rutherford South Brampton, ON

Date: April 2020

SNC·LAVALIN

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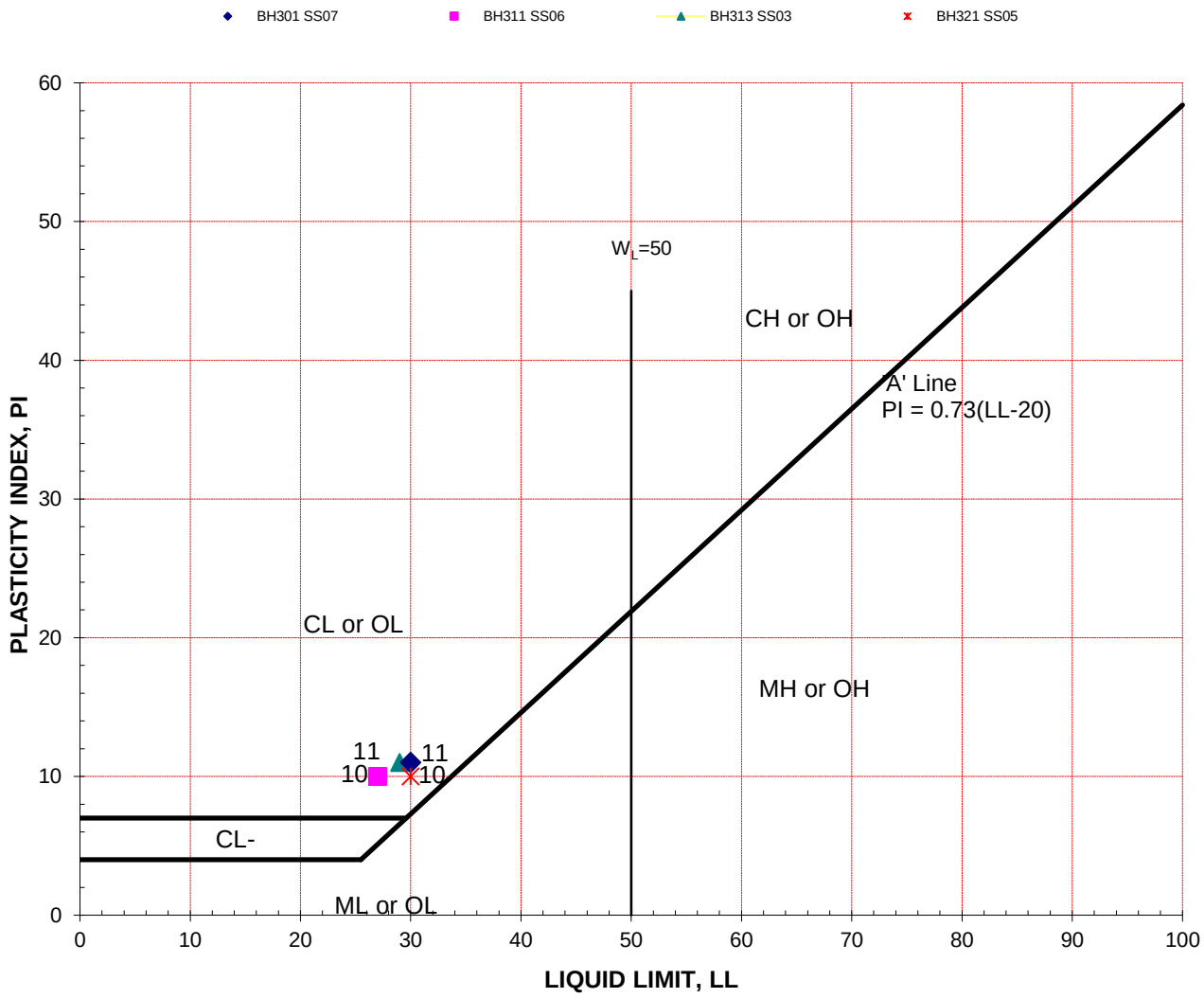
Vaughan, Ontario, Canada, L4L 3T1
905.851.0090 905.851.0091

PLASTICITY CHART

Job # :	671835		
Project Client:	City of Brampton	**Technician** :	UC
Project :	Rutherford Rd South Brampton Geotechnical	**Supervisor** :	KL
Location :	25 Rutherford South, Brampton, ON	**Date** :	04-21-20

TEST RESULTS

Specimen #	Sample #	Depth	LL%	PL%	PI	Fines	W%	Classification	Remarks
BH301	SS07		30	19	11		12	CL	Lab # 1527
BH311	SS06		27	17	10		10	CL	Lab # 1531
BH313	SS03		29	18	11		15	CL	Lab # 1533
BH321	SS05		30	20	10		7	CL	Lab # 1536



SNC·LAVALIN

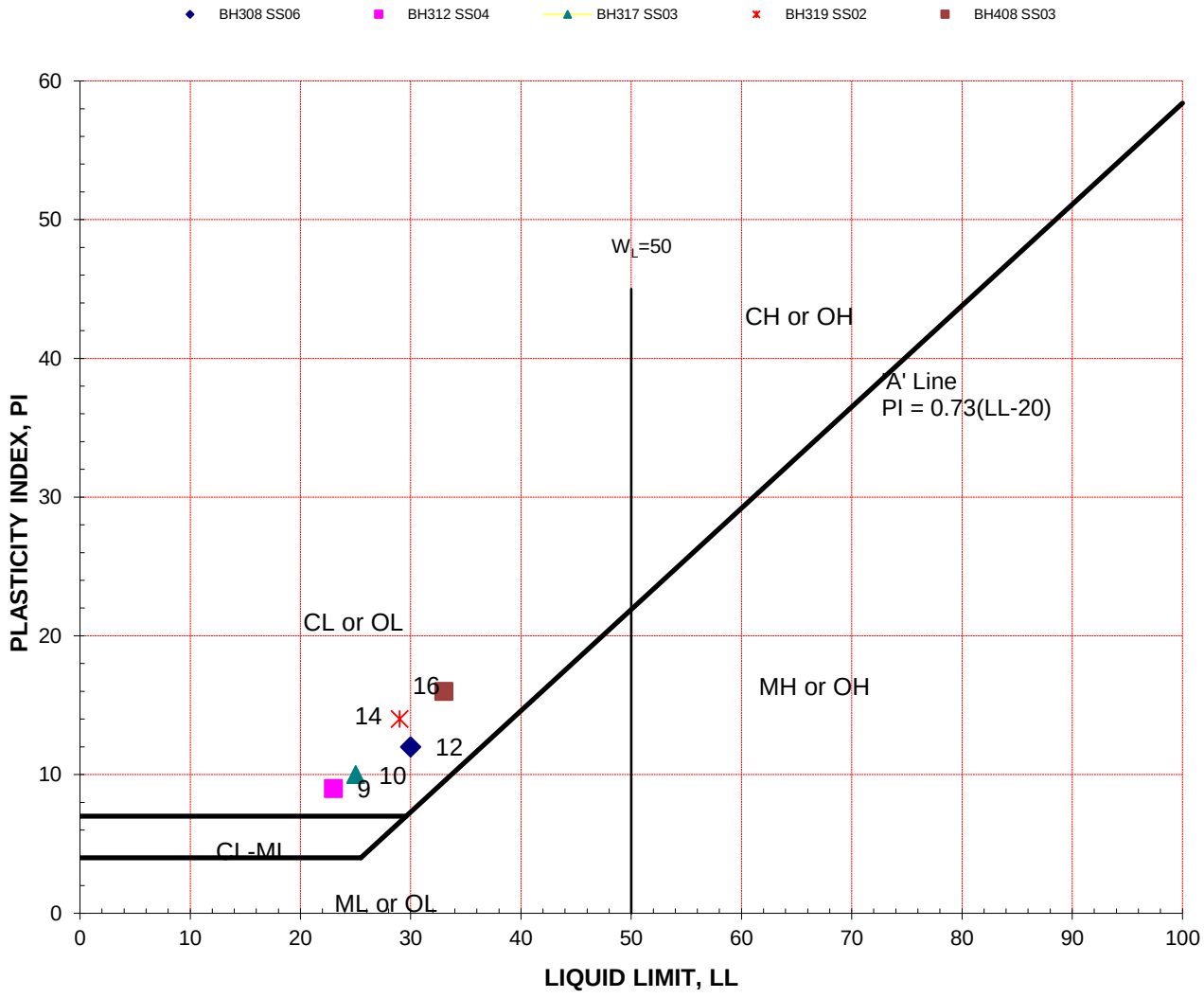
SNC-Lavalin GEM Ontario Inc.
401 Hanlan Road
Vaughan, Ontario, Canada, L4L 3T1
905.851.0090 905.851.0091

PLASTICITY CHART

Job # :	671835		
Project Client:	City of Brampton	**Technician** :	AL
Project :	Rutherford Rd South Brampton Geotechnical	**Supervisor** :	KL
Location :	25 Rutherford South, Brampton, ON	**Date** :	04-20-20

TEST RESULTS

Specimen #	Sample #	Depth	LL%	PL%	PI	Fines	W%	Classification	Remarks
BH308	SS06		30	18	12		12	CL	Lab # 1530
BH312	SS04		23	14	9		14	CL	Lab # 1532
BH317	SS03		25	15	10		12	CL	Lab # 1534
BH319	SS02		29	15	14		15	CL	Lab # 1535
BH408	SS03		33	17	16		19	CL	Lab # 1537



Appendix D

Analytical Laboratory Results (12 pages)

SNC-Lavalin Inc.
ATTN: Mavara Turab
401 Hanlan Road
Vaughan ON L4L 3T1

Date Received: 10-MAR-20
Report Date: 12-MAR-20 13:59 (MT)
Version: FINAL

Client Phone: 905-851-0090

Certificate of Analysis

Lab Work Order #: L2426098

Project P.O. #: NOT SUBMITTED
Job Reference: 671835
C of C Numbers: 17-795682
Legal Site Desc:

Gayle Braun
Senior Account Manager

ANALYTICAL REPORT

Summary of Guideline Exceedances

ALS ID	Client ID	Grouping	Analyte	Result	Guideline Limit	Unit
Guideline						
Ontario Regulation 153/04 - April 15, 2011 Standards - T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use						
L2426098-4	BH319 SS1	Physical Tests	Conductivity	0.690	0.57	mS/cm

ANALYTICAL REPORT

Physical Tests - SOIL

			Lab ID	L2426098-1	L2426098-2	L2426098-3	L2426098-4
			Sample Date	03-MAR-20	04-MAR-20	04-MAR-20	03-MAR-20
			Sample ID	BH301 SS2	BH315 SS4	BH317 SS2	BH319 SS1
Analyte	Unit	Guide Limits #1	#2				
Conductivity	mS/cm	0.57	-	0.360	0.225	0.270	0.690
% Moisture	%	-	-	17.6	10.9	12.2	12.3
pH	pH units	-	-	7.56	7.93	7.85	7.72
Redox Potential	mV	-	-	175	174	181	193
Resistivity	ohm*cm	-	-	2780	4440	3700	1450

Guide Limit #1: T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ANALYTICAL REPORT

Leachable Anions & Nutrients - SOIL

			Lab ID	L2426098-1	L2426098-2	L2426098-3	L2426098-4
			Sample Date	03-MAR-20	04-MAR-20	04-MAR-20	03-MAR-20
			Sample ID	BH301 SS2	BH315 SS4	BH317 SS2	BH319 SS1
Analyte	Unit	Guide Limits #1	#2				
Chloride	ug/g	-	-	74.1	47.2	54.0	374

Guide Limit #1: T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ANALYTICAL REPORT

Anions and Nutrients - SOIL

			Lab ID	L2426098-1	L2426098-2	L2426098-3	L2426098-4
			Sample Date	03-MAR-20	04-MAR-20	04-MAR-20	03-MAR-20
			Sample ID	BH301 SS2	BH315 SS4	BH317 SS2	BH319 SS1
Analyte	Unit	Guide Limits #1	#2				
Sulphate	mg/kg	-	-	21	81	46	<20

Guide Limit #1: T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ANALYTICAL REPORT

Inorganic Parameters - SOIL

				Lab ID	L2426098-1	L2426098-2	L2426098-3	L2426098-4
				Sample Date	03-MAR-20	04-MAR-20	04-MAR-20	03-MAR-20
				Sample ID	BH301 SS2	BH315 SS4	BH317 SS2	BH319 SS1
Analyte	Unit	Guide Limits #1	#2					
Acid Volatile Sulphides	mg/kg	-	-		<0.20	<0.20	<0.20	<0.20

Guide Limit #1: T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
CL-R511-WT	Soil	Chloride-O.Reg 153/04 (July 2011)	EPA 300.0

5 grams of dried soil is mixed with 10 grams of distilled water for a minimum of 30 minutes. The extract is filtered and analyzed by ion chromatography.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

EC-WT	Soil	Conductivity (EC)	MOEE E3138

A representative subsample is tumbled with de-ionized (DI) water. The ratio of water to soil is 2:1 v/w. After tumbling the sample is then analyzed by a conductivity meter.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

MOISTURE-WT	Soil	% Moisture	CCME PHC in Soil - Tier 1 (mod)
PH-WT	Soil	pH	MOEE E3137A

A minimum 10g portion of the sample is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil and then analyzed using a pH meter and electrode.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

REDOX-POTENTIAL-WT	Soil	Redox Potential	APHA 2580

This analysis is carried out in accordance with the procedure described in the "APHA" method 2580 "Oxidation-Reduction Potential" 2012. Samples are extracted at a fixed ratio with DI water. Results are reported as observed oxidation-reduction potential of the platinum metal-reference electrode employed, in mV.

RESISTIVITY-CALC-WT	Soil	Resistivity Calculation	APHA 2510 B

The reported Resistivity value is calculated as the inverse of the conductivity of a 2:1 water:soil leachate. This method does not use direct measurement of Soil Resistivity using a resistivity meter.

RESISTIVITY-CALC-WT	Soil	Resistivity Calculation	MOECC E3138

The reported Resistivity value is calculated as the inverse of the conductivity of a 2:1 water:soil leachate. This method does not use direct measurement of Soil Resistivity using a resistivity meter.

SO4-WT	Soil	Sulphate	EPA 300.0

5 grams of soil is mixed with 50 mL of distilled water for a minimum of 30 minutes. The extract is filtered and analyzed by ion chromatography.

SULPHIDE-WT	Soil	Sulphide, Acid Volatile	APHA 4500S2J

This analysis is carried out in accordance with the method described in APHA 4500 S2-J. Hydrochloric acid is added to sediment samples within a purge and trap system. The evolved hydrogen sulphide (H2S) is carried into a basic solution by inert gas. The acid volatile sulfide is then determined colourimetrically.

**ALS test methods may incorporate modifications from specified reference methods to improve performance.

Chain of Custody Numbers:

17-795682

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Reference Information

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information. Guideline limits are not adjusted for the hardness, pH or temperature of the sample (the most conservative values are used). Measurement uncertainty is not applied to test results prior to comparison with specified criteria values.

Quality Control Report

Workorder: L2426098 Report Date: 12-MAR-20

Client: SNC-Lavalin Inc.
401 Hanlan Road
Vaughan ON L4L 3T1
Contact: Mavara Turab

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CL-R511-WT	**Soil**							
Batch R5022208								
WG3290070-3 CRM		**AN-CRM-WT**						
Chloride			93.8		%		70-130	11-MAR-20
WG3290070-4 DUP		**L2426098-3**						
Chloride		54.0	53.9		ug/g	0.2	30	11-MAR-20
WG3290070-2 LCS								
Chloride			103.8		%		80-120	11-MAR-20
WG3290070-1 MB								
Chloride			<5.0		ug/g		5	11-MAR-20
EC-WT	**Soil**							
Batch R5021393								
WG3290066-4 DUP		**WG3290066-3**						
Conductivity		0.197	0.231		mS/cm	16	20	11-MAR-20
WG3290066-2 IRM		**WT SAR3**						
Conductivity			98.1		%		70-130	11-MAR-20
WG3290355-1 LCS								
Conductivity			99.5		%		90-110	11-MAR-20
WG3290066-1 MB								
Conductivity			<0.0040		mS/cm		0.004	11-MAR-20
MOISTURE-WT	**Soil**							
Batch R5020867								
WG3289728-3 DUP		**L2426245-1**						
% Moisture		18.6	19.5		%	4.2	20	11-MAR-20
WG3289728-2 LCS								
% Moisture			100.3		%		90-110	11-MAR-20
WG3289728-1 MB								
% Moisture			<0.25		%		0.25	11-MAR-20
PH-WT	**Soil**							
Batch R5021296								
WG3289558-1 DUP		**L2424783-2**						
pH		7.46	7.46	J	pH units	0.00	0.3	11-MAR-20
WG3290339-1 LCS								
pH			7.01		pH units		6.9-7.1	11-MAR-20
REDOX-POTENTIAL-WT	**Soil**							
Batch R5021379								
WG3290338-1 CRM		**WT-REDOX**						
Redox Potential			100.6		%		80-120	11-MAR-20
WG3289526-1 DUP		**L2425859-3**						

Quality Control Report

Client: SNC-Lavalin Inc.
401 Hanlan Road
Vaughan ON L4L 3T1
Contact: Mavara Turab

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
REDOX-POTENTIAL-WT	**Soil**							
Batch R5021379								
WG3289526-1 DUP		**L2425859-3**						
Redox Potential		217	213		mV	1.9	25	11-MAR-20
SO4-WT	**Soil**							
Batch R5022208								
WG3289492-4 CRM		**AN-CRM-WT**						
Sulphate			110.3		%		60-140	11-MAR-20
WG3289492-3 DUP		**L2425859-3**						
Sulphate		62	61		mg/kg	0.3	30	11-MAR-20
WG3289492-2 LCS								
Sulphate			104.8		%		80-120	11-MAR-20
WG3289492-1 MB								
Sulphate			<20		mg/kg		20	11-MAR-20
SULPHIDE-WT	**Soil**							
Batch R5021250								
WG3290225-3 DUP		**L2426098-2**						
Acid Volatile Sulphides		<0.20	<0.20	RPD-NA	mg/kg	N/A	45	11-MAR-20
WG3290225-2 LCS								
Acid Volatile Sulphides			102.7		%		70-130	11-MAR-20
WG3290225-1 MB								
Acid Volatile Sulphides			<0.20		mg/kg		0.2	11-MAR-20

Quality Control Report

Workorder: L2426098 Report Date: 12-MAR-20

Client: SNC-Lavalin Inc.
401 Hanlan Road
Vaughan ON L4L 3T1
Contact: Mavara Turab

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

ALS Environmental

www.alsglobal.com

Chain of Custody (COC) / Analytic Request Form

Canada Toll Free: 1 800 668 9878

L2426098-COFC

COC Number: 17 - 795682

Page of

MH

Report To	Contact and company name below will appear on the final report	Report Format / Distribution		Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)	
Company:	SNC	Select Report Format:	PDF EXCEL EDD (DIGITAL)	Regular [R]	Standard TAT if received by 3 pm - business days - no surcharges apply
Contact:	Navara Turab	Quality Control (QC) Report with Report	YES NO	PRIORITY (Business Days) 4 day [P4-20%]	EMERGENCY 1 Business day [E - 100%]
Phone:	905-851-0090	Compare Results to Criteria on Report - provide details below if box checked		3 day [P3-25%]	Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)]
Company address below will appear on the final report		Select Distribution:	EMAIL MAIL FAX	2 day [P2-50%]	
Street:	401 Hanlan Rd	Email 1 or Fax	Navara.turab@snclavalin.com	Date and Time Required for all E&P TATs:	dd-mmm-yy hh:mm
City/Province:	Woodbridge	Email 2	Nouras.Fall@SNCLavalin.com	For tests that can not be performed according to the service level selected, you will be contacted.	
Postal Code:	L4L 3T9	Email 3			

Invoice To		Invoice Distribution	
	Same as Report To YES NO	Select Invoice Distribution:	EMAIL MAIL FAX
	Copy of Invoice with Report YES NO		
Company:		Email 1 or Fax	
Contact:		Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#:
Job #:	671835	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	

ALS Lab Work Order # (lab use only): L2426098 MH

ALS Contact: GB

Sampler: M.F

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS (Conductivity Test)	SAMPLES ON HOLD	SUSPECTED HAZARD (see Special Instructions)
	BH301 SS2	03-03-20	09:15	SS	X		
	BH315 SS4	04-03-20	15:10	SS	X		
	BH317 SS2	04-03-20	9:10	SS	X		
	BH319 SS1	03-03-20	11:50	SS	X		

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

Analysis Request

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? YES NO	
Are samples for human consumption/ use? YES NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen | SIF Observations Yes No | Ice Packs | Ice Cubes | Custody seal intact Yes No | Cooling Initiated

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
9.9			1.1		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Nouras Fall	Mar 05, 2020	14:30		10/3/20	8:40		10-MAR-20	14:01

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

JUNE 2018 FRONT

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Appendix E

MASW Test Results (8 pages)

GEOPHYSICS GPR INTERNATIONAL INC.

6741 Columbus Road
Unit 14
Mississauga, Ontario
Canada, L5T 2G9

Tel.: 905-696-0656
Fax: 905-696-0570
info@geophysicsgpr.com
www.geophysicsgpr.com

February 26, 2020 GPR file: T202021

Mavara Turab, PMP
Geotechnical Project Manager
SNC-Lavalin
401 Hanlan Road
Woodbridge, Ontario
L4L 3T1

RE: Shear-wave velocity sounding for seismic site classification, 25 Rutherford Road South, Brampton, Ontario

Dear Ms Turab,

Geophysics GPR International Inc. has been requested by SNC-Lavalin to carry out a shear-wave velocity sounding at the above site in Brampton. Figure 1 shows the location of the test profile.

The survey was performed on February 18th, 2020.

The investigation included the multi-channel analysis of surface waves (MASW) and the refraction methods to generate shear-wave velocity model (Figure 4).

The following paragraphs describe the survey design, the principles of the test method, the methodology for interpreting the data, and provide a culmination of the results in table format.

Figure 1: Approximate location of the shear-wave velocity sounding.

MASW and MAM Surveys

Basic Theory

The Multi-channel Analysis of Surface Waves (MASW) and the Micro-tremor Array Measurements (MAM) are seismic methods used to evaluate the shear-wave velocities of subsurface materials through the analysis of the dispersion properties of Rayleigh surface waves ("ground roll"). The dispersion properties are measured as a change in phase velocity with frequency. Surface wave energy will decay exponentially with depth. Lower frequency surface waves will travel deeper and thus be more influenced by deeper velocity layering than the shallow higher frequency waves. Inversion of the Rayleigh wave dispersion curve yields a shear-wave (V_S) velocity depth profile (sounding). Figure 2 outlines the basic operating procedure for the MASW method. Figure 3 is an example image of a typical MASW record and resulting 1D V_S model. A more detailed description of the method can be found in the paper *Multi-channel Analysis of Surface Waves,*

Park, C.B., Miller, R.D. and Xia, J. Geophysics, Vol. 64, No. 3 (May-June 1999); P. 800–808.

Survey Design

The geometry of an MASW survey is similar to that of a seismic refraction investigation (i.e. 12 to 24 geophones in a linear array). The fundamental principle involves intentionally generating an acoustic wave at the surface and digitally recording the surface waves from the moment of source impact with a linear series of geophones on the surface. This is referred to as an "active source" method. A sledgehammer was used as the primary energy source with traces being recorded at 6 locations: approximately 6 m off both ends, 15 to 20 m off both ends, and in the middle of the spread. Data were collected with geophones spacing of 3 m and 1 m for a total of 10 shot records per sounding.

Unlike the refraction method, which produces a data point beneath each geophone, the shear-wave depth profile is the average of the bulk area within the middle third of the geophone spread.

The theoretical maximum depth of penetration (34.5 m) is half of the maximum seismic array length (69 m), in practice the maximum depth of penetration is often influenced by the geology.

The MAM/passive survey used the same geophone array set up as for the MASW survey. Unlike the MASW survey, the MAM method is considered a "passive source" method in that there is no time break and the motions recorded are from ambient energy generated by cultural noise such as traffic, wind, wave motion, etc. Data collection for the passive method involves recording approximately 10 minutes of background "noise". The records generated by the MAM method contain lower frequency data, thus increasing the data resolution at greater depths of investigation. Typically the MAM results aid in clarifying the MASW results for depths greater than 20 m; however, the direction of noise propagation relative to the spread orientation can influence the results.

Interpretation Method and Accuracy of Results

The main processing sequence involved plotting, picking, and 1-D inversion of the MASW/MAM shot records using the SeisimagerSW™ software package. In theory, all MASW shot records should produce a similar shear-wave velocity profile. In practice, however, differences can arise due to energy dissipation and localized surface variations. The results of the inversion process are inherently non-unique and the final model must be judged to be geologically realistic. The inversion modelling also assumes that all layering is flat/horizontal and laterally uniform.

Seismic refraction processing was also realized for the main geological layers and rock depth evaluation, as well as for compressional wave velocity. These results were used to guide the initial geophysical model, prior to the mathematical

inversions, for optimized and more accurate V_S results.

The results of the MASW/MAM test are presented in chart format as Figure 4. The chart presents the 1-D shear wave velocity values from the inversion models of the passive and active seismic records.

The V_S30 values for the sounding are presented in Table 1. The V_S30 values are based on the harmonic mean of the shear wave velocities over the upper 30 m. The V_S30 value is calculated by dividing the total depth of interest (e.g. 30 m) by the sum of the time spent in each velocity layer up to that depth. This harmonic mean value reflects the equivalent single layer response.

The estimated error in the average V_S30 value determined through MASW tests is typically +/-10 to 15% for overburden sites. The shear-wave velocities modelled through the MASW method within bedrock have a higher estimated error.

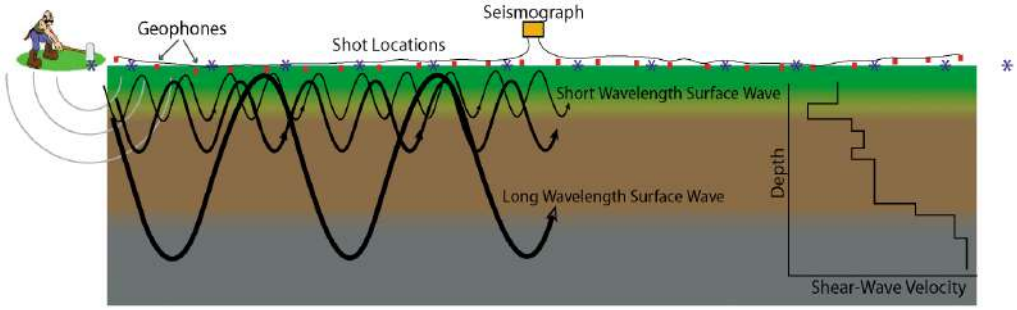
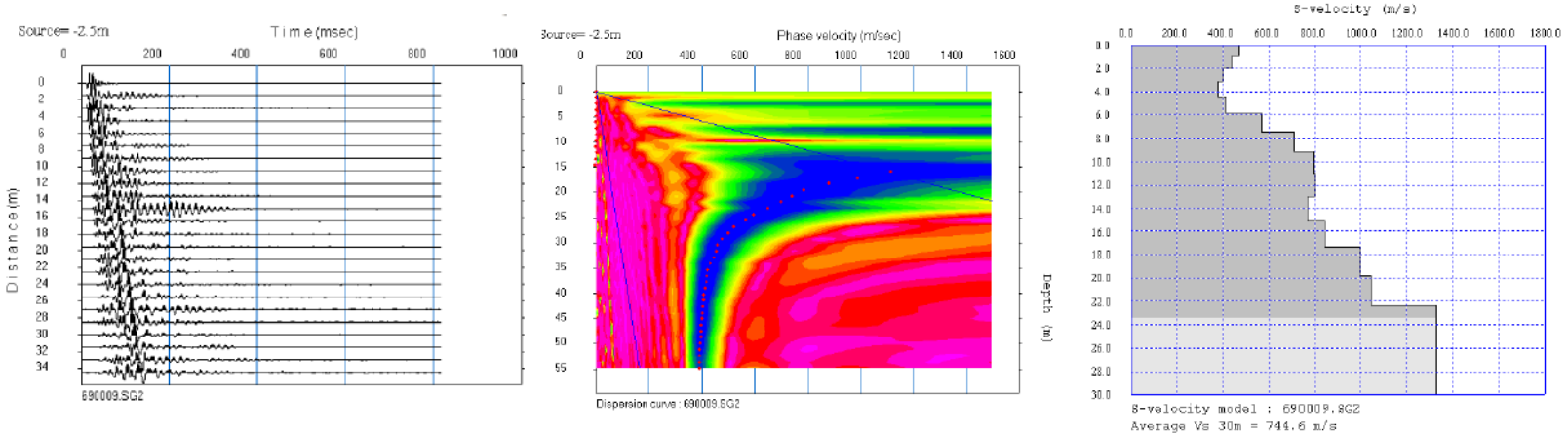


Figure 2: MASW operating principle



Raw Seismic Shot Record

Phase Velocity-Frequency Transformation indicating Dispersion Curve

1D Shear-Wave Velocity Profile from Inversion of Dispersion Curve

Figure 3: Example of a typical MASW shot record, phase velocity/frequency curve and resulting 1D shear-wave velocity model

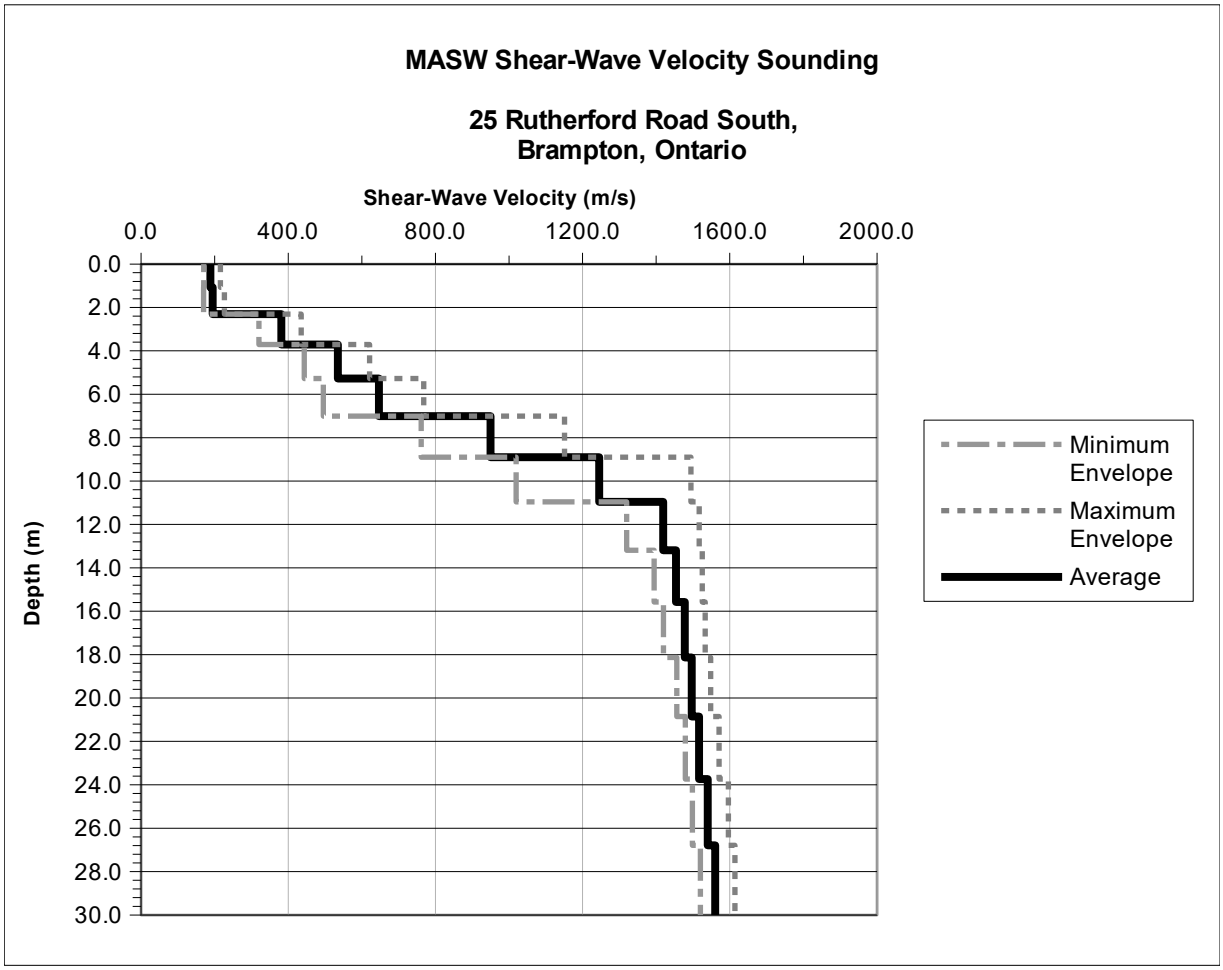


Figure 4: MASW shear-wave velocity model.

CONCLUSIONS

The approximate location of the shear-wave sounding is indicated in Figure 1.

The MASW shear-wave model is presented in Figure 4. The results are summarized in Table 1. The background seismic noise levels at this site were low. The quality of the seismic records was excellent and the resulting dispersion curves were well defined.

Simple critical distance calculations from the refracted wave arrivals show that the bedrock could be approximately 7.5 meters deep. The seismic refraction results showed a 3500 m/s bedrock compressional wave velocity (V_P), which is typical for very competent shale or moderately weathered to competent limestone. Considering a conservative Poisson ratio estimate of 0.4, the corresponding V_S value could be approximately 1500 m/s. These parameters were used to set the initial geophysical models prior to the mathematical inversions.

Table 1: Calculated V_S30 values (m/s) from the MASW data (0 to 30 m)

Sounding	Minimum	Average	Maximum	Site Class
1	704	**796**	892	**C***

* Given the estimated error in the MASW method (+/-10 to 15%).

The calculated average V_S30 value from the 1D MASW sounding was 796 m/s +/-10% to 15%. The V_S30 values calculated for the minimum and the maximum envelopes ranged from 704 to 892 m/s.

Based on the average V_S30 values (taking into account the estimated error in the MASW method of +/-10% to 15%) and table 4.1.8.4.A of the National Building Code of Canada, 2010 Edition, the investigated area is site class "C" ($360 < V_S30 \leq 760$ m/s).

It must be noted that the site classifications provided in this report are based solely on the V_S30 value as derived from the MASW method and that it can be superseded by other geotechnical information. This geotechnical information includes, but is not limited to, the presence of sensitive and/or liquefiable soils, more than 3 m of soft clays, high moisture content, etc. The reader is referred to section 4.1.8.4 of the National Building Code of Canada, 2010 Edition for more information on the requirements for site classification.

Processing of the seismic data was performed by Ilia Gusakov, P.Geo. This report has been written by Carolyn Boone, P.Geo.

I hope everything is to your satisfaction.

If you have any questions please do not hesitate to call.

Carolyn Boone, P.Geo.

Appendix F

Perimeter Drainage Details (1 pages)

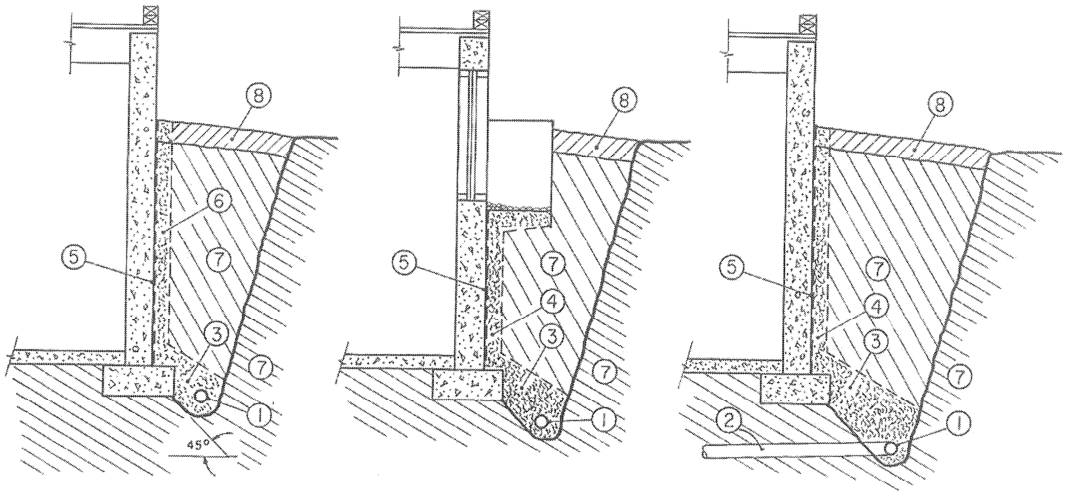


FIGURE 12.1 *Typical Sections Showing Arrangement of Subsurface Perimeter Drains around Shallow Foundations*

(1) perforated or slotted pipe placed about 300 mm below the upper level of the basement floor slab;
(2) unperforated drain pipe connected to appropriate trap and backwater valve before connecting to a sewer. The trap shall have provisions for inspection and cleaning;
(3) filter material that is compatible with the grain size characteristics of the fine-grained foundation and backfill soils, as well as with the perforations of the pipe;
(4) filter material continuously or intermittently placed next to the foundation wall to intercept water from window wells and from low areas near the building (see also 6);
(5) damp-proofing on wall - optional depending on the quality of the concrete wall;
(6) optional use of sheet drain, or synthetic filter blanket, next to the foundation wall to replace the soil filter according to (4);
(7) foundation and backfill soils, which may contain fine-grained and erodible materials; and
(8) "topping-off" material sloping outward to lead off the surface water. It is usually desirable to use low permeability soil to reduce the risk of overloading the pipe.

Refer to : Canadian Foundation Engineering Manual (2006), 4th Edition, Canadian Geotechnical Society, p. 184

SNC·LAVALIN

401 Hanlan Road
Vaughan, Ontario, Canada, L4L 3T1
905.851.0090 - 905.851.0091

1. General

1.1 DOCUMENTS

.1 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 DESCRIPTION OF WORK INCLUDED

.1 Provide all labour, materials, equipment and services necessary to supply, erect, and strip all formwork and falsework for poured-in-place concrete shown or indicated on the contract drawings and specifications.

.2 Install all anchor bolts, embedded metal, inserts, hangers, reglets, dovetail anchors etc. supplied by applicable trades for casting into concrete and assume responsibility for correct positioning within the agreed tolerance and in accordance to drawings supplied by the trade.

.3 Install all openings, sleeves, blockouts, etc. required by other trades and assume responsibility for correct positioning within the agreed tolerance and in accordance to drawings supplied by the trade.

1.3 RELATED WORK SPECIFIED ELSEWHERE

.1 Section 032000 - Concrete Reinforcement

.2 Section 033100 - Structural Cast-in-Place Concrete

1.4 REFERENCE STANDARDS

.1 Concrete formwork shall conform to the requirements of the following Standards unless otherwise required by this specification:

.1 Ontario Building Code - 2006.

.2 CSA-A23.1-04 - Concrete Materials and Methods of Concrete Construction.

.3 CSA-A23.3-04 - Code for the Design of Concrete Structures for Buildings.

.4 CSA-S269.3 – Concrete Formwork

.2 Where the Standard is referenced in this specification it shall mean the documents specified in this clause and their referenced documents.

.3 A copy of A23.1 and A23.2 shall be kept by the Contractor on site for the duration of the work and be made available for reference.

1.5 DEFINITIONS - FOR THIS SECTION

.1 “Owner”, “Contractor”, “Consultant” as per the General Conditions and Definitions.

.2 “Specialty Engineer” is a Professional Engineer registered in Ontario responsible for components designed by the Contractor and who seals and signs shop drawings.

.3 “Standard” and “Standards” shall mean the reference standards listed under “Reference Standards” in this section.

2. Products

2.1 GENERAL

.1 Products shall satisfy the requirements of the Standard unless otherwise specified herein or on the drawings.

2.2 MATERIALS

.1 Form Material

.1 Exposed surfaces - metal, plywood or plywood lined. Plywood to conform to the Standard.

.2 Unexposed surfaces - metal, plywood, or wood lumber to conform to the Standard.

.3 Plywood and wood formwork materials shall, conform to the Standard, be free from warp and sawn straight so that lines and shapes will be accurately retained.

.4 Un-lined forms for unexposed surfaces shall be made with a good grade of lumber_or plywood and fitted so that there will be no leakage of mortar.

.5 Use metal forms, plywood lined forms or plywood forms of sufficient structural strength for exposed surfaces. Plywood for lining shall be GIS exterior grade fir plywood with waterproof glue.

.6 Proprietary and/or modular forming systems shall be designed such that they do not interfere with the specified placement of reinforcement or other embedded hardware and must be pre-approved by the Consultant.

.2 Ties And Spreaders

.1 Use metal form ties that are adjustable in length to permit tightening of forms. Use only the snap-off type of form ties which will permit no metal within 25mm (1”) of the concrete surface after removal. Twisted wire form ties will not be accepted.

.2 Wood spreaders inside wall forms will not be permitted.

.3 Form Release Agent

.1 Use a non-staining form release agent that is compatible with any finishes specified elsewhere in the contract documents.

.4 Void Form

.1 Void form shall be of a deteriorating material.

.5 At exposed concrete:

.1 Form release agents shall be non-staining.

.6 At exposed concrete slab and beam soffits

.1 Plywood shall be peri plastic coated forms, or approved equivalent.

.2 Provide a mock-up of exposed concrete slab. Location of the mock-up within the structure to be determined by the architect. Mock-up shall use the same materials and procedures as will be used for the actual exposed concrete slabs. Assume a minimum mock-up size of 9m x 9m.

3. Execution

3.1 GENERAL

.1 All phases of concrete formwork construction shall be in accordance with the Standard unless otherwise specified herein or on the drawings. Only workers who are skilled and experienced in their trade shall do the work.

3.2 LINES AND LEVELS

.1 Verify lines, levels and column centres before proceeding with work and ensure that dimensions agree with drawings.

.2 Co-ordinate and co-operate with all other trades in forming and setting of recesses, chases, sleeves, inserts, bolts, and hangers.

3.3 DESIGN OF FORMWORK, FALSEWORK AND RESHORING

.1 Conform to the Standard.

.2 The Contractor shall assume full responsibility for the structural adequacy of the forms to withstand all concrete, environmental, and construction loads.

.3 As a minimum, the work shall conform to CSA-A23.1, Section 6.5 for regular work and Section 8.3.4 for architectural concrete.

.4 Where concrete is exposed to view, forms are to be laid out so that joints are kept to a minimum and located in an orderly and symmetrical arrangement wherever possible. Form ties shall be evenly spaced and located in straight horizontal and vertical lines. Spacing and location of form tie holes shall be detailed by the Contractor and approved by the Consultant. See also the architectural drawings and specifications for any special requirements for architectural concrete.

.5 The strength and rigidity of forms shall be such that they will not leak mortar or result in visible irregularities in the finished concrete. In addition the deflection of facing materials between studs, as well as the deflection of studs and whalers, shall not exceed 0.0025 times the span.

.6 Forms shall be so constructed that the finished concrete will conform to the shape, dimensions and tolerances as specified in the Standard or on the structural drawing, whichever is most rigorous. They shall also incorporate the cambers specified on the structural drawings. Movement resulting from form support deflection, closure of form joints, and elastic shortening of forms and shoring, must be calculated and added to the cambers indicated on the drawings.

.7 Construct forms so that they may be dismantled and removed without damaging the concrete.

.8 The Contractor shall submit details of the sequence and extent of formwork removal and re-shoring to the Consultant for review. Such details shall include magnitude of loads and location of all reshores at each level. Forms shall not be removed or adjusted until the review is complete. Such review does not relieve the Contractor of responsibility for formwork and safety during construction.

.9 Set shores on wedges or use adjustable shores so they may be removed without causing undue strains in the concrete.

.10 Do not exceed the safe capacity of the structure with any construction or shoring loads. The safe capacity of the structure may be taken as the design live load, as indicated on the structural drawings, multiplied by the ratio of the concrete strength at the time of loading to the specified concrete strength, but not greater than 1.0.

3.4 ERECTION

.1 Sleeves and openings shown on the structural drawings must be confirmed with mechanical, electrical and architectural drawings. Any discrepancies are to be reported to the Consultant.

.2 Sleeves and openings not shown on the structural drawings must be approved by the Consultant.

.3 Keep all untreated forms moist to prevent shrinkage prior to placing of concrete and wet the surface at time of placing.

.4 Treated formwork surfaces shall have the approved form coating applied in accordance with the manufacturer's recommendations, prior to placing reinforcing steel. Remove any excess form coating.

3.5 TOLERANCES

.1 The tolerances for all concrete work shall conform to the requirements of the Standard and Drawings.

3.6 PRODUCT HANDLING

.1 Protect formwork materials before, during and after installation and protect installed work and materials of other trades.

.2 In the event of damage, immediately make required repairs or replacements necessary to the approval of the Consultant at no extra cost to the Owners.

3.7 REMOVAL OF FORMWORK

.1 Forms shall not be removed until concrete has attained sufficient strength that no damage to strength or continuity of concrete will occur when forms are removed. Time for formwork removal of suspended concrete shall be approved by the Consultant. See also the requirements of Section 3.3.

.2 Prying against face of concrete to remove forms is not allowed, only wooden wedges shall be used.

.3 Removal of form ties shall be done carefully to avoid marking concrete and to allow for patching. Grout bottom of form tie hole to prevent rust staining.

End of Section 031100

1. General

1.1 DOCUMENTS

.1 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 DESCRIPTION OF WORK INCLUDED

.1 Provide all labour, materials, equipment and services necessary to supply and install reinforcing steel work shown or indicated in all the contract drawings and specifications including accessories such as hanger bars, spirals, wire ties, support bars, chairs, spacers supports or other devices required to position reinforcing properly.

1.3 RELATED WORK SPECIFIED ELSEWHERE

.1 Section 030050 - Testing of Concrete and Reinforcement

.2 Section 031100 - Concrete Formwork

.3 Section 033100 - Structural Cast-in-Place Concrete

.4 Section 051200 - Structural Steel Framing

1.4 REFERENCE STANDARDS

.1 Concrete reinforcing shall conform to the requirements of the following Standards unless otherwise required by this specification:

.1 Ontario Building Code - 2006.

.2 CSA-A23.1-04 - Concrete Materials and Methods of Concrete Construction.

.3 CSA-A23.2-04 - Methods of Test and Standard Practices for Concrete.

.4 CSA-A23.3-04 - Code for the Design of Concrete Structures for Buildings.

.5 CSA G30.5M - Welded Steel Wire Fabric for Concrete Reinforcement.

.6 CSA G30.15M - Welded Deformed Steel Wire for concrete reinforcement.

.7 CAN/CSA G30.18 - Billet Steel Bars for Concrete Reinforcement

.8 CSA-W47.1 - Certification Of Companies For Fusion Welding Of Steel Structures

.9 CSA-W186 - Welding of Reinforcing Bars in Reinforced Concrete Construction.

.2 Where the Standard is referenced in this specification it shall mean the documents specified in this clause and their referenced documents.

.3 A copy of A23.1 and A23.2 shall be kept by the Contractor on site for the duration of the work and be made available for reference.

1.5 DEFINITIONS FOR THIS SECTION

.1 "Owner", "Contractor", "Consultant" as per the General Conditions and Definitions.

.2 "Specialty Engineer" is a Professional Engineer registered in Ontario responsible for components designed by the Contractor and who seals and signs shop drawings.

.3 "Standard" and "Standards" shall mean the reference standards listed under "Reference Standards" in this section.

1.6 TESTING

.1 As per Section 030050 - Testing of Concrete and Reinforcement.

2. Products

2.1 GENERAL

.1 Products shall satisfy the requirements of the Standard unless otherwise specified herein or on the drawings.

2.2 MATERIALS

.1 Reinforcing bars shall conform to the Standard unless otherwise specified herein or on the drawings.

.2 Reinforcing bars to be welded shall conform to the Standard, G30.18W.

.3 Welded wire fabric shall conform to the Standard, size and gauges as shown on the drawings.

.4 Welded wire fabric for slabs shall be delivered in flat sheets.

.5 In suspended parking slabs, bar support chairs shall be plastic or plastic coated.

3. Execution

3.1 GENERAL

.1 All phases of concrete reinforcement work shall be in accordance with the Standards unless otherwise specified herein or on the drawings. The Contractor shall ensure that the work is executed only by workers skilled and experienced in their trade.

.2 The Contractor shall notify the Consultant at least 24 hours before any concrete is placed in order that the Consultant may review the work.

3.2 SHOP DRAWINGS

.1 Submit shop drawings for concrete reinforcement, bar support and accessories for review by the Consultant at least 14 days prior to the placement of rebar.

.2 Clearly indicate bar sizes, grades, spacing, location and quantities of reinforcing mesh, bar supports and accessories and identifying code marks to permit correct placement without reference to structural drawings.

.3 Placing drawings and bar lists will be reviewed for number and size of bars only and this review shall in no way relieve the Contractor of his responsibility for carrying for carrying out the Work in accordance with the drawings.

.4 Substitution of imperial reinforcing sizes and grades will only be accepted if placing drawings showing imperial sizes are submitted to the Consultant for review. Approval must be obtained before any work is commenced.

3.3 FABRICATION

.1 Fabricate all reinforcing to the Standard and contract documents.

.2 Reinforcing bars shall be cold bent. Bars shall not be straightened or re-bent.

.3 Splices in reinforcing bars at locations not shown on the drawings must be submitted for review by the Consultant. Such splices shall conform to the Standards.

.4 Color code each bar to correspond with code mark appearing on bar list.

3.4 PRODUCT DELIVERY, STORAGE AND HANDLING

.1 Store reinforcement in a manner to prevent excessive rusting and fouling with dirt, grease, form-oil and other bond-breaking coatings

.2 Reinforcement at the time concrete is placed shall be free from excessive rusting, mud, oil or other coatings that adversely affect its bonding capacity

3.5 PLACING

.1 Reinforcing of size and shapes shown on the structural drawings shall be accurately placed in accordance with the drawings and the requirements of the Standard.

.2 Reinforcement shall be adequately supported by chairs, spacers, support bars, hangers or other accessories, and secured against displacement within the tolerances permitted in the Standard. Support devices contacting surfaces exposed to the exterior shall be non-corroding.

.3 Bars that are not part of the structural design or drawings, and whose only function is supporting other reinforcing in lieu of other support accessories, shall be considered as accessories.

.4 In suspended parking slabs, uncoated metal ties shall not extend more than 5.0 mm (3/16") into the concrete cover.

.5 All rebar shall be adequately tied and chaired to maintain it in the specified location during pouring. Lifting of reinforcing or welded wire mesh into specified position during the concrete pour will not be allowed.

.6 Tolerances for bar placement shall be as per the Standard. Tolerances shall not be used to justify the use of chair, bolsters, or chair/support combinations which result in improper cover.

.7 At exposed concrete:

1. Rebar chairs shall be plastic coated to prevent rust stains.

2. Provide a mock-up of exposed concrete slab. Location of the mock-up within the structure to be determined by the architect. Mock-up shall use the same materials and procedures as will be used for the actual exposed concrete slabs. Assume a minimum mock-up size of 9m x 9m.

3.6 WELDING

.1 Any welding of reinforcing steel shall be in accordance with the Standard.

.2 Welding of concrete reinforcement shall be performed by workmen who are approved by the Canadian Welding Bureau in accordance with the Standard. Copies of the Canadian Welding Bureau approved welding procedure and certificate of current operator qualification shall be submitted to the Consultant prior to commencement of welding.

3.7 CONSTRUCTION REVIEW

.1 No concrete shall be placed until the Consultant has completed a review of reinforcing in place. The Contractor shall provide a minimum of 24 hours notice of the time when the reinforcement will be substantially in place and ready for the Consultants review. A minimum of 6 hours is to be provided for review and any required remedial work prior to concrete placement.

End of Section 032000

1 General

1.1 DOCUMENTS

.1 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 DESCRIPTION OF WORK INCLUDED

.1 Provide all labour, materials, equipment and services necessary to supply and install cast-in-place concrete work shown or indicated in all the contract drawings and specifications including concrete toppings, bases, sumps, curbs, posts, manholes, pits, paving, sidewalks, equipment bases or curbs, grouting of baseplates, etc.

.2 Coordinate concrete placement fully with other trades. Ensure other related work such as inserts, dowels, sleeves, reinforcement, etc. is complete before placing concrete.

1.3 RELATED WORK SPECIFIED ELSEWHERE

.1 Section 030050 - Testing of Concrete and Reinforcement

.2 Section 031100 - Concrete Forming

.3 Section 032000 - Concrete Reinforcement

.4 Section 051200 - Structural Steel Framing

.5 Section 053100 - Steel Decking

1.4 REFERENCE STANDARDS

.1 Concrete work shall conform to the requirements of the following Standards unless otherwise required by this specification:

.1 Ontario Building Code – 2005.

.2 CSA-A23.1-04 - Concrete Materials and Methods of Concrete Construction.

.3 CSA-A23.2-04 - Methods of Test for Concrete.

.4 CSA-A23.3-04 - Code for the Design of Concrete Structures for Buildings.

.2 Where the Standard is referenced in this specification it shall mean the documents specified in this clause and their referenced documents.

.3 A copy of A23.1 and A23.2 shall be kept by the Contractor on site for the duration of the work and be made available for reference.

1.5 DEFINITIONS FOR THIS SECTION

.1 “Owner”, “Contractor”, “Consultant” as per the General Conditions and Definitions.

.2 “Specialty Engineer” is a Professional Engineer registered in Ontario responsible for components designed by the Contractor and who seals and signs shop drawings.

.3 “Standard” and “Standards” shall mean the reference standards listed under “Reference Standards” in this section.

1.6 SUBMITTALS

.1 Keep a record at the job site showing time and place of each pour of concrete, together with a transit-mix delivery slip certifying contents of pour. Make the record available to the Owner for his inspection upon request. Upon completion of this portion of work, submit placing records and delivery slips to the Owner.

.2 Submit details of proposed methods of concrete curing and provisions for weather protection to the Consultant for review

.3 Submit plan locations and details of construction joints for the Consultants review

2 Products

2.1 GENERAL

.1 Products shall satisfy the requirements of the Standard unless otherwise specified herein or on the drawings.

.2 Provide samples of materials on request

2.2 MATERIALS

.1 Cement for S-1, S-2, and S-3 concrete shall be as per Table 3 A23.1 and conform to the Standard.

.2 Mixing water shall conform to the Standard.

.3 Air entraining admixtures to the Standard.

.4 Calcium chloride, either as a raw material or as a constituent in other admixtures, shall not be used unless approved in writing by the Consultant.

.5 Curing compounds shall conform to the specification and shall also be compatible with specified floor hardeners, covering adhesives and waterproofing compounds.

.6 Grout shall be preapproved, premixed, non-shrink conforming to the Standard. Exposed grout shall be non-staining cement grey in colour.

3 Execution

3.1 GENERAL

.1 All phases of concrete work shall be in accordance with the Standard unless otherwise specified herein or on the drawings. The work shall be executed only by experienced and skilled workers.

.2 The Contractor shall notify the Consultant at least 30 hours before any concrete is placed to allow the Consultant to review the work.

3.2 MIX DESIGNS

.1 Concrete mixes shall be proportioned by the supplier to meet the compressive strength, exposure class, and other performance specifications noted in the contract documents. In addition, concrete mix design shall satisfy the transport, placing, and finishing requirements of the Contractor. All concrete shall be normal weight unless noted otherwise. Concrete types are specified in accordance with CSA-A23.1 Table 5, Alternate 1.

.2 Concrete mix design is the responsibility of the supplier, including the use of admixtures, alone or in combination. The supplier is also responsible for ensuring the plastic and hardened properties of the concrete meet the construction and specified requirements. This includes the long term performance of the hardened mix.

.3 Pump mix slumps shall also conform to the above.

.4 Water/Cement ratios and air contents for exposure class shall be as per the Standard.

.5 The proposed mixes shall be submitted to the Consultant and Testing Agency for review.

.6 The mix designs shall note the constituents by weight, the properties required by the structural drawings, and the structural elements for which the mix is to be used.

.7 At exposed concrete:

1. Concrete shall not include fly ash.
2. Concrete shall include blast furnace slag and/or white Portland cement.
3. Provide a mock-up of exposed concrete slab. Location of the mock-up within the structure to be determined by the architect. Mock-up shall use the same materials and procedures as will be used for the actual exposed concrete slabs. Assume a minimum mock-up size of 9m x 9m.

3.3 PRODUCTION

.1 Production shall conform to the Standard.

3.4 TESTING

.1 As per Section 030050 - Testing of Concrete and Reinforcement

3.5 PLACING OF CONCRETE

.1 Conveying and placing of concrete is to conform to the Standard.

.2 All concrete shall be consolidated by means of vibrators of appropriate size operated by experienced workers.

.3 The use of vibrators to transport concrete shall not be permitted.

.4 Cement slurry used to prime concrete pumps shall be discarded and not placed in the project.

3.6 OPENINGS AND INSERTS

.1 The Contractor shall notify all trades sufficiently in advance to ensure that provision is made for openings, inserts and fasteners. The Contractor shall cooperate with all trades in the forming and setting of all slots, sleeves, bolts, dowels, hangers, inserts, conduits, clips, etc. Any embedded hardware may be subject to review by the Consultant.

.2 Openings and sleeves shown on the structural drawings must be confirmed with mechanical, electrical and architectural drawings.

.3 Openings and sleeves not shown on the structural drawings must be approved by the Consultant.

3.7 CONSTRUCTION AND CONTROL JOINTS

.1 Construction joints shall conform to the Standard except that for horizontal joints in walls it will be sufficient to place fresh concrete on a clean rough surface unless directed otherwise by the Consultant or otherwise noted on the structural drawings.

.2 Joints in slabs on grade shall be located as indicated on the structural and/or architectural drawings. Unless noted otherwise on the drawings a joint in the slab on grade may be a pour joint, trowelled joint, saw cut, or other pre-approved method. The depth of joints shall be a minimum of ¼ of the thickness of the slab. Saw cut joints are to be completed within 12 hr. of placing. Alternative joint details are to be submitted in writing to the Consultant.

.3 For vertical joints in walls below grade, see standard detail on structural drawings. For locations, see architectural and structural drawings.

.4 Construction joints in walls and columns shall occur at the top of slab and at the underside of slab/beam systems unless noted otherwise on the structural drawings.

.5 Construction joints not shown in the drawings or specifications shall be subject to the approval of the Consultant. The Consultant may require keys, or extra reinforcing to be provided at the Consultant's discretion with associated costs borne by the Contractor.

.6 The existing concrete surface at construction joints shall be wetted thoroughly immediately prior to placement of concrete.

.7 Construction joints exposed to view may be subject to non-structural review by Consultant.

.8 Unless noted otherwise on the drawings, control joints in walls are to be located at a maximum spacing of 9m (30') on centre and detailed as indicated on the structural drawings.

.9 Supply and install pre-molded water-stops in construction joints where indicated on the drawings. Weld joints to make watertight. Install waterstops in accordance with manufacturer's specifications and recommendations. Water stop procedures require approval of Consultant.

3.8 CURING AND PROTECTION

.1 Curing procedures shall be in accordance with the Standard. Alternate methods with Consultants approval, may be used providing they produce concrete that meets the contract documents.

.2 Cold and hot weather protection shall comply with the Standard or the requirements on the structural drawings, whichever are more rigorous.

.3 Concrete place during extreme drying conditions shall satisfy clause 7.4.2.2 of A23.1.

.4 Suspended parking slabs shall be wet cured for seven (7) days minimum, as per S413. Curing compounds are not allowed.

3.9 PATCHING

.1 Honeycomb, exposed reinforcement and other defects shall be repaired and patched by the Contractor at the Contractor's cost using a procedure preapproved by the Consultant. Exposed patching must also be approved by the Consultant.

.2 Immediately after the removal of forms, all bolts, ties, nails or other metal not specifically required for construction purposes shall be removed or cut back to a depth of 25 mm (1") from the surface of the concrete.

3.10 TOLERANCES

.1 Tolerances shall conform to the Standard or the requirements on the structural or architectural contract documents, whichever are more rigorous.

3.11 FINISHING - FLOORS

.1 Finishing shall conform to CSA-A23.1 - Section 7.5 as a minimum. Care shall be taken during finishing to maintain the cambers specified on the structural drawings. See also the architectural drawings and specifications for additional finish requirements.

.2 Unless noted otherwise, floor finishes shall be Class A "institutional and commercial floors" and have gaps less than or equal to 8.0 mm (5/16") under a 3000 mm (10'-0") straight edge. Only a single curvature within this distance is allowed.

3.12 FINISHES - FORMED SURFACES

.1 All formed surfaces shall be treated in accordance with CSA A23.1, Section 7.7 as a minimum. See also architectural drawings and specifications for additional finish requirements.

3.13 ARCHITECTURAL CONCRETE

.1 See architectural drawings and specifications for any requirements. Conform to CSA-A23.1 - Section 8.3 as a minimum.

3.14 OPENINGS THROUGH STRUCTURAL WORK

.1 If, after any part of the structural work has been completed, it is required that additional openings be made through the structure, the Consultant shall be so informed. No opening, including cored sleeves, shall be made through completed work without authorization in writing from the Consultant.

3.15 REJECTION OF DEFECTIVE WORK

.1 In the event that concrete tests do not conform to the requirements of this specification, or when conditions are such to cause doubt about the safety of the structure, testing of the structure will be undertaken at the direction of the Consultant. This may entail further concrete tests, coring or load testing as per the Standard, or any other test the Consultant deems suitable. Such test shall be made at the expense of the Contractor and to the satisfaction of the Consultant.

.2 Where, in the opinion of the Consultant, material or workmanship fails to meet the requirements of the specification, such work may be rejected. Work rejected shall be replaced or repaired to the approval of the Consultant and at no additional cost to the Owner.

End of Section 033100

1 General

1.1 **SECTION INCLUDES**

.1 Labour, Products, equipment and services necessary for masonry work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 ASTM A1064/A1064-M, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

.2 ASTM C207, Specification for Hydrated Lime for Masonry Purposes.

.3 CAN/CSA A82, Fired Masonry Brick Made From Clay or Shale.

.4 CSA A165 Series, CSA Standards on Concrete Masonry Units.

.5 CSA A179, Mortar and Grout for Unit Masonry.

.6 CSA A370, Connectors for Masonry.

.7 CSA A371, Masonry Construction for Buildings.

.8 CAN/CSA A3001, Cementitious Materials for Use in Concrete.

.9 CSA G30.18, Carbon Steel Bars for Concrete Reinforcement.

.10 CSA S304, Design of Masonry Structures.

1.3 **DESIGN REQUIREMENTS**

.1 Design unit masonry in accordance with following Climatic Design Data for Brampton contained in the Ontario Building Code:
  .1 Design temperature: January 1%, July 2 1/2%.
  .2 Hourly wind pressures: 1 in 50 year occurrence.

1.4 **SUBMITTALS**

.1 Shop drawings:
  .1 Submit shop drawings in accordance with Section 01 30 00 indicating.
  .2 Wall sections and details, reinforcing and anchors, special detailing, patterning and locations of control joints.
  .3 Seismic anchors, supports and accessories for complete installation.

.2 Samples:
  .1 Submit samples in accordance with Section 01 30 00:
  .2 Submit samples of each type and colour of masonry unit used prior to placing order.
  .3 Submit samples of coloured mortar to match masonry samples.

.4 Submit samples of masonry anchors, and ties.
.5 Submit 250 x 200 mm samples of dampproof course and flashing.

.3 Quality control submittals: Submit manufacturer's certificates stating that materials supplied are in accordance with this Specification.

1.5 QUALITY ASSURANCE

.1 Provide plain and reinforced masonry in accordance with CSA A370, CSA A371, and CSA S304.

.2 Retain a licensed Professional Engineer, registered in Province of Ontario, to perform following services for unit masonry work:
.1 Design of unit masonry work.
.2 Design of brick ties and anchors, including requirements necessary to meet seismic requirements.
.3 Review, stamp and sign shop drawings.
.4 Conduct shop and field inspections and prepare and submit inspection reports.

.3 Cold Weather Protection:
.1 To CAN/CSA-A371 and as follows:
.1 Maintain temperature of mortar between 5°C and 50°C until batch is used or becomes stable.
.2 Maintain ambient temperature of masonry work and it's constituent materials between 5°C and 50°C and protect site from windchill.
.3 Maintain temperature of masonry above 0°C for minimum of 3 days, after mortar is installed.
.4 Preheat unheated wall sections in enclosure for minimum 72 hours above 10°C, before applying mortar.
.5 Do not use scorched aggregate. Do not use salts or anti-freezes. Only use approved smokeless heaters.

.4 Hot Weather Requirements:
.1 To CAN/CSA-A371 and as follows:
.1 Plan in advance for hot weather construction. Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.
.2 Avoid using dry masonry in hot weather conditions. Use predampened masonry unit nominally saturated, but surface dry at time of laying. Do not dip masonry unit in bucket of water.
.3 Spread only enough mortar to permit soft setting of masonry units; do not over mix mortar materials; do not retemper mortar after 2 hours of use; do not retemper pigment coloured mortar; do not spread more than 900 mm (3') of mortar for placement of masonry unit.

.5 Mock-up:
.1 Construct one mock-up panel of unit masonry construction, 1200 mm wide x 1200 mm high in a location accepted by Consultant.

.2 Demonstrate use of reinforcement, ties, through-wall flashing, weep holes, jointing, coursing, and sills, mortar, bonding, control joints, and workmanship.

.3 Mock-up may form part of Work if accepted by Consultant. Mock-ups which do not form part of Work are to be removed from Site during final cleanup, or when directed by Consultant.

.4 Rejected mock-ups: Correct rejected mock-ups and requested re-review by Consultant.

1.6 **DELIVERY, STORAGE, AND HANDLING**

.1 Deliver, store and handle Products in accordance with the Conditions of the Contract and as specified herein.

.2 Remove unacceptable materials from Site and replace to acceptance of Consultant. Store materials off ground protected from wetting by rain, snow or ground water, or inter-mixture with earth or other materials. Store metal ties and reinforcement to prevent corrosion.

.3 Do not concentrate storage of materials on any part of structure beyond design load, take particular care not to overload unsupported portions of structure which may have not attained their full design strength.

.4 Comply with CSA A371. Do not use salt or calcium-chloride to remove ice from masonry surfaces.

.5 Deliver mortar materials in original unbroken and undamaged packages with the maker's name and brand distinctly marked thereon. Prevent damage to units.

.6 Keep masonry materials free from ice and frost. Keep units protected from concrete, mortar and other materials which could cause staining.

2 Products

2.1 **MASONRY UNITS**

.1 Brick cladding: CAN/CSA A82,Type X, Grade EG, metric jumbo, size to be selected by Consultant. ‘Cream Bricks’ by Belden Brick or approved alternative. Colour to be Acadia Velour.

.2 Concrete block units: Lightweight units for use at all fire rated applications and block exposed to view, CSA A165 Series, 200 mm thick unless otherwise indicated on Contract Drawing, classifications as follows:

.1 H/15/D/M.

.2 SS/15/D/M.

.3 SF/15/D/M.

.3 Concrete block units: Normalweight units for all non-fire rated applications and where concealed, CSA A165 Series, 250 mm thick unless otherwise indicated on Contract Drawing, classifications as follows:
- .1 H/15/A/M.
- .2 SS/15/A/M.
- .3 SF/15/A/M.

.4 Precast concrete sills and shapes: Reinforced and constructed of 27.5 MPa concrete with slopes in direction indicated. Provide drips. Dowel and hook anchors to be stainless steel. Finish: Smooth unless otherwise indicated.

.5 Special shapes:
- .1 Unless indicated otherwise, supply and install corner returns, bull-nosed or double bull-nosed units for exposed and external corners, bond beams, sash blocks for control joints, concrete block lintels over openings in concrete block walls and any additional special shapes as indicated.
- .2 Provide solid masonry units where required for mechanically fastening of blocking, furring, mechanically applied finishes or where noted.

.6 Obtain each masonry unit type from same manufacturer. Supply and install units of uniform texture and colour for each kind required.

.7 Supply masonry units with exposed surfaces free of cracks, chips, blemishes, and broken corners.

2.2 ACCESSORIES

.1 Reinforcement: CSA A370, CSA A371, and ASTM A1064/A1064-M, all components to be hot dip galvanized unless otherwise specified:
- .1 This specification is based on products manufactured by Blok-Lok Limited. Products by Dur-O-Wal Ltd. and Fero Corporation are approved alternatives.
- .2 Type 1 (single wythe): Truss type; ‘Blok-Trus BL30'.
- .3 Type 2 (double wythe): Truss type; ‘Blok-Trus BL32'.
- .4 Type 3 (cavity wall block back-up): Adjustable, bayonet-tie type, 1.6 mm steel plate with 4.76 mm diameter steel wire tie. ‘Adjustable Veneer Anchors BL507'.
- .5 Type 4 (cavity wall stud back-up): Anchors fabricated from 1.5 mm plate with 4.76 mm wire, complete with screws; ‘Adjustable Veneer Anchors BL607' with ‘Flex-O-Lok tie’.
- .6 Connectors: CSA A370 and CSA S304.1.
- .7 Reinforcing steel: CSA G30.18, Grade 400, refer to Contract Drawings for number, size, and location.
- .8 Corner reinforcing: Provide pre-manufactured ‘L’ and ‘T’ reinforcing at all corner units. Crimped metal strap ties are not acceptable for connecting intersecting walls.
- .9 Design of anchors, supports and accessories to meet seismic requirements.

.2 Cavity wall insulation: In accordance with Section 07 21 00 .

.3 Loose steel lintels and lateral support angles: Supplied as part of work of Section 05 50 00.

.4 Precast concrete shapes: Fabricate to shapes and sizes shown on drawings, 35 MPa concrete in accordance with CSA A23.4, galvanized steel reinforced. Dowel and hook anchors to be stainless steel.

.5 Dampproof course:
- .1 Metal flashing: Prefinished metal angle flashing in accordance with Section 07 62 00, continuous strips with a 19 mm folded drip edge.
- .2 Rubberized underlay: Adhered reinforced SBS rubberized asphalt damproof flashing over prefinished metal flashing and cut off flush with wall face as detailed on drawings; 'Blueskin TWF' by Henry or 'Airshield Thru Wall Flashing' by W.R. Meadows or approved alternative, complete with primer and adhesive recommended by flashing manufacturer.

.6 Control joint bond breaker: CSA A123.3; 15 lb, asphalt impregnated, non-perforated felt paper as manufactured by IKO Manufacturing Inc. or approved alternative.

.7 Mortar mesh: 250 mm high x thickness to suit cavity, 90% open HDPE mesh; 'Mortar Trap' by Blok-Lok Limited or 'Mortar Net' by Hohmann & Barnard, Inc.

.8 Weep hole vents:
- .1 Flexible ultra-violet resistant polypropylene-copolymer plastic, 'Cell-Vent' by Blok-Lok, 'Mortar Maze Cell Vents' by Advanced Building Products Inc. or approved alternative.
- .2 Provide manufacturer recommended clear silicone adhesive for suspended applications.
- .3 Colour: To be selected by the Consultant.

2.3 MORTAR MATERIALS

.1 Loadbearing masonry: CSA A179, Type S, proportion method.

.2 Interior non-loadbearing masonry: CSA A179, Type N, proportion method.

.3 Exterior non-loadbearing masonry: CSA A179, Premixed 1-1-6 Type N, portland cement/lime, proportion method.

.4 Cement: CAN/CSA A3001, normal Portland, Type GU. Provide white cement where required for white or light coloured mortars.

.5 Masonry aggregate: CSA A179. Provide white aggregate where required for white or light coloured mortars.

.6 Hydrated lime: ASTM C207, Type S.

.7 Water: Clean potable, free from deleterious elements and free from salts that can cause efflorescence.

.8 Concrete fill and grout: Minimum 12.5 Mpa concrete in accordance with CSA A179.

3 Execution

3.1 **EXAMINATION**

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of work of this Section means acceptance of existing conditions.

3.2 **PROTECTION**

.1 Supply and install temporary waterproof, non-staining coverings, secured against displacement, to extend over walls and down sides to protect masonry Work from snow and wind driven rain, and from drying too quickly, until masonry work is completed and protected by flashings or other permanent construction.

.2 Supply and install non-staining, protective coverings on horizontal and vertical surfaces to protect work of this Section from damage, staining, marking, and mortar droppings.

3.3 **WORKMANSHIP**

.1 Perform masonry work in accordance with CSA A371 and as indicated .

.2 Supply and install masonry work plumb, level and true to line, with vertical joints in alignment and horizontal courses level, uniform, and straight.

3.4 **MASONRY - GENERAL INSTALLATION**

.1 Construct masonry work as required by jurisdictional authorities.

.2 Before commencing masonry work, verify required limitations for wall heights, wall thicknesses, openings, bond, anchorage, lateral support, and compressive strengths of masonry units and mortars.

.3 Construct masonry fire protection and fire separations of the thickness indicated on Drawings for the fire resistant ratings as noted on Drawings, and conforming to the Fire-Performance Ratings, Appendix ‘D’ to the National Building Code of Canada.

.4 Fire Separations and Fire Separations with Fire Resistance Ratings: Construct walls tightly to construction above and at perimeter, and without openings or voids. Do not reduce the thickness of walls to less than the thickness indicated on the Drawings or for the required fire resistance rating where required.

.5 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.

.6 Do not use admixtures without Consultant's written acceptance.

.7 Tool mortar joints slightly concave with non-staining tools unless indicated otherwise. Strike joints flush in non exposed areas or where shown on Contract Drawings. Use sufficient force to press mortar tight against masonry units on both sides of joints. Remove excess, remaining mortar material and burrs.

.8 Install masonry walls 25 mm clear of underside of steel building frames, roof or floor deck. Install masonry with a 19 mm space beneath shelf angles and install compressible filler.

.9 Cut masonry units with a wet saw to obtain straight, clean, even, unchipped edges. Cut units as required to fit adjoining work neatly or for flush mounted electrical outlets, grilles, pipes, conduit, leaving 3 mm maximum clearance. Use full-size units without cutting wherever possible.

.10 Reinforce veneer walls with adjustable wall reinforcing at maximum 400 mm o.c. vertically and 600 mm o.c. horizontally. Install reinforcing in accordance with manufacturer’s instructions. In veneer walls extend reinforcement from support wall, spanning cavity into exterior wythe. Place at maximum 75 mm o.c. each way around perimeter of openings, within 300 mm of openings.

.11 Reinforce block walls with continuous wire reinforcement in every second block course. Supply and install prefabricated L and T sections. Cut, bend and lap reinforcing units as per manufacturer's printed directions for continuity at returns, offsets, pipe enclosures, and other special conditions. Bending of masonry reinforcement is not permitted.

.12 Reinforce masonry walls with reinforcing steel as indicated on Drawings. Vertical reinforcing shall be fully grouted in masonry cores with grout.

.13 At openings in block walls install extra reinforcement, so that first and second courses above and below openings are reinforced. Extend extra reinforcement 600 mm beyond opening in each direction.

.14 Reinforce joint corners and intersections with strap anchors 400 mm o.c.

.15 Do not place reinforcement across masonry wythes at control joints.

.16 Install masonry with 10 mm thick joints unless indicated otherwise. Make vertical and horizontal joints equal and of uniform thickness.

.17 Build control joints in masonry walls at intervals and in locations shown. Form joints for block walls using sash block units in accordance with details shown. Form joints for veneer walls by leaving head joints between stacked units void of mortar. Provide chase and joint with joint bond breaker full height of control joints and fill with mortar. Leave a depth of 13 mm for sealing unless otherwise shown.

.18 Install control joints in masonry walls where indicated on drawings and at projections and changes in direction. Where control joints have not been indicated provide joints at 6100 mm o.c. for exterior walls and 9150 mm o.c. for interior walls.

.19 If required, provide movement joints, similar to building control joints, installed between areas with different support conditions.

.20 Supply and install solid block or metal lath under block, and fill block cells solid for lintel bearing and as required to secure built-in anchor bolts and/or anchors shown.

.21 Do not tooth intersections of walls except as otherwise indicated.

.22 Install weep hole vents in accordance with manufacturer's directions, in exterior wythe of masonry above dampproof courses and flashings and at tops of walls using adhesive. Space weep hole vents maximum 600 mm o.c. horizontally. Prevent weep hole vents from becoming plugged with mortar or debris.

.23 Coordinate installation of masonry with installation of air barrier and vapour retarder to ensure continuity of these systems.

.24 Install seismic anchors, supports and accessories in accordance with reviewed shop drawings.

3.5 DAMPPROOF COURSES AND FLASHING

.1 Install dampproof courses beneath first masonry bearing course on slabs-on-grade. Trim dampproofing to conceal it.

.2 Install flashings in masonry in accordance with CSA A371.

.3 Install flashings under exterior masonry bearing on foundation walls, slabs, shelf angles, and steel angles over openings and elsewhere as indicated. Where flashings occur over openings in walls extend them past openings a minimum of 200 mm and turn up minimum 150 mm at each end to create a waterproof dam to prevent water draining into cavity.

.4 In veneer walls install flashings continuously from front edge of masonry, under outer wythe, turn up backing minimum 200 mm and provide watertight seal against support wall.

.5 Lap dampproofing and flashing 150 mm and seal in accordance with manufacturer's instructions.

.6 At bottom of cavity install mortar mesh to manufacturer's instructions. Apply additional mortar mesh layer as required to fill cavity thickness. Place mesh in continuous layer.

.7 Before masonry work begins, place specified dampproofing under first course of masonry. Install continuous dampproofing with ends lapped and cut flush with exterior face of wall. Place similar dampproofing over top course.

3.6 **MORTAR MIXING**

.1 Thoroughly mix mortar ingredients in proper quantities needed for immediate use to requirements of CSA A179.

.2 Measure and batch mortar materials either by volume or weight, to accurately control and maintain proportions. Do not measure materials by shovel.

.3 Mix mortar with maximum amount of water consistent with workability for maximum tensile bond strength within capacity of mortar.

.4 Do not use mortar which has begun to set. Use mortar within 2 hours after initial mixing. Re-temper mortar during 2 hour period only as required to restore workability.

3.7 **BLOCK**

.1 Lay blocks in running bond except as indicated otherwise. Align block webs vertically and install thicker ends of face shells up.

.2 Install a full bed of mortar for first courses of masonry, for masonry units 100 mm thick and less, and between solid units. For remaining courses bed face shells, including vertical end joints, fully in mortar.

.3 Install special shaped and sized concrete block units as indicated and as required for a complete and coordinated assembly and to minimize cut units.

.4 Supply and install two courses of solid block beneath lintel bearing.

.5 Stagger end joints in every course. Align joints plumb over each other in every other course.

.6 Bond intersecting block walls in alternate courses. Where block work abuts concrete, anchor each block course to concrete.

3.8 **MASONRY VENEER**

.1 Prior to installation of masonry veneer, coordinate installation of air and vapour retarder with Section 07 26 00.

.2 Prior to installation of cavity insulation, examine air and vapour retarder and make good damage. Install cavity wall insulation in accordance with Section 07 21 00 .

.3 Lay masonry veneer in running bond, unless indicated otherwise, and in a full bed of mortar.

.4 Form angle corners with special shaped units; cutting of units is not permitted.

.5 Erect exterior cavity wall construction as shown on Contract Drawings.

.6 Install masonry veneer to prevent mortar droppings and protrusions from impeding drainage and pressure equalization of rainscreen cavities and drained walls.

.7 Apply sufficient mortar on end of stretchers to ensure end joints are compressed full when masonry unit is pressed into place.

3.9 PRECAST SHAPES

.1 Install dampproofing or flashings continuous under full length of precast shapes.

.2 Install precast shapes in full mortar bed and secure units to each other with stainless steel dowels and to masonry units with stainless steel hook anchors, fully grouted.

3.10 LINTELS

.1 Install concrete block lintels over openings in masonry except where steel lintels are indicated.

.2 Set lintels with minimum of 200 mm uniformly distributed bearing at each end. Provide bond breaker under bearing ends.

.3 Install reinforcing steel and concrete fill in block lintels.

.4 Install loose steel lintels, as indicated in Contract Drawings. Centre over opening width.

3.11 LATERAL SUPPORT ANGLES

.1 Where non load bearing unit masonry partitions meet structural elements at top of partitions, install supplied lateral supports as required by the Ontario Building Code and in accordance with Structural details. In areas where ceilings are scheduled, use 150 mm lengths of steel angle located each side of partition at 1200 mm and staggered.

3.12 BUILT-IN ITEMS

.1 Coordinate and locate build-in items required to be built into masonry or supplied under work of other Sections including hollow metal doors, windows, lintels, sleeves, inserts, etc. Build-in items to present a neat, rigid, true and plumb installation.

.2 Build wall openings, slots, and recesses required for ducts, grilles, pipes and other items.

.3 Coordinate installation of conduit, outlet boxes and other mechanical and electrical built-ins with work of Divisions 21, 22, 23 and 26.

.4 Prevent displacement of built-in items during construction. Check plumb, location and alignment frequently, as Work progresses.

.5 Brace door jambs to maintain plumbness. Set anchors between metal frames and masonry and fill voids between hollow metal frames and masonry walls with mortar.

3.13 INSTALLATION TOLERANCES

.1 Install masonry work to a plane flatness and exposed end tolerance of 3 mm in 3000 mm.

.2 Variation in Alignment from Unit to Adjacent Unit: 1.5 mm maximum.

.3 Plumb within 6 mm in 3 m, or in 6 mm in 6 m at external corners, expansion joints, or other conspicuous lines.

.4 Level within 6 mm in any bay or 6 m maximum distance, and 12 mm in 12 m or more.

.5 Located from position shown, and from related position of columns, walls, and partitions within 12 mm in any bay or 6 m maximum distance, and 19 mm in 12 m or more.

.6 Opening sizes within 6 mm of designated dimension.

.7 Column and wall cross-section dimensions within minus 6 mm and plus 12 mm.

.8 Joint widths to dimensions indicated or specified herein, but in no case greater than 12 mm. Variation of Mortar Joint Thickness: 1 mm every metre.

3.14 REPAIR AND POINTING

.1 Remove and replace masonry units which are loose, chipped, broken, cracked, marked, stained, discoloured, or otherwise damaged. Supply and install new units to match adjoining units and install in fresh mortar, and point to eliminate evidence of replacement.

.2 During tooling of joints, enlarge any cracks, holes, or other defects, point and completely fill with mortar.

.3 Point-up joints including corners, openings and adjacent Work for a neat, uniform appearance, properly prepared for application of sealant compounds.

3.15 CLEANING

.1 Obtain and follow unit masonry manufacturer's written instructions for cleaning of masonry.

.2 Clean exposed, masonry surfaces, removing excess mortar as work progresses. Allow mortar droppings to partially dry then dry brush with a stiff fibre brush.

.3 Cleaning of stone work:

.1 Protect adjacent surfaces and other work from damage.

.2 Remove large particles with stiff fibre brushes without damaging surface. Saturate masonry with clean water and flush off loose mortar and dirt.

.3 Scrub with solution of 25 mL trisodium phosphate and 25 mL household detergent dissolved in 1 L of clean water using stiff fibre brushes, then clean off immediately with clean water using hose.

.4 Repeat cleaning process as often as necessary to remove mortar and other stains.

END OF SECTION

1 General

1.1 DOCUMENTS

.1 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Drawings include architectural, mechanical, and electrical drawings.

1.2 DESCRIPTION OF WORK INCLUDED

.1 Provide all labour, materials, equipment, access, cooperation, coordination and services to allow the testing of structural steel, open web steel joists, structural steel deck and welds to be carried out by a Testing Agency responsible to the Owner.

.2 The scope of the required quality assurance testing is described in this section to inform the Contractor of the type and scope of testing on the project and allow the Contractor to make appropriate allowances. The testing describe in this section is not the responsibility of the Contractor. It will be paid for by the Owner.

.3 Testing required by the Contractor for his own quality control will be paid for by the Contractor.

1.3 RELATED WORK SPECIFIED ELSEWHERE

.1 Section 051200 - Structural Steel Framing.

.2 Section 053100 - Steel Decking.

1.4 REFERENCE STANDARDS

.1 Testing of Structural Steel shall conform to the requirements of the following Standards unless otherwise required by the specification:

.1 Ontario Building Code –2005.

.2 CSA S16-01 - Limits States Design of Steel Structures.

.3 CSA S136-07 - North American Specification for the Design of Cold-Formed Steel Structural Members

.4 CSA W47.1-03 - Certification of Companies for Fusion Welding of Steel Structures.

.5 CSA W59-03 - Welded Steel Construction (Metal Arc Welding) (Metric version).

.6 CSA W178.1-08 - Certification of Welding Inspection Organizations.

.7 CSA G40.20-04 - General Requirements for Rolled or Welded Structural Quality Steel.

.8 CSA G40.21-04 - Structural Quality Steel.

.9 ASTM A653-07 - Sheet Steel, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.10 CSSBI 10M-06 - Standard for Steel Roof Deck.

.11 CSSBI 12M-06 - Standard for Composite Steel Deck.

.12 ASTM A123-02 - Zinc (Hot-Dip Galvanizing) Coatings on Iron and Steel Products.

.13 ASTM A143-07 - Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.

.14 ASTM A153-05 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.15 ASTM A384-07 - Safeguarding Against Warpage and Distortion During Hot Dip Galvanizing of Steel Assemblies.

.16 ASTM A780-01(2006) - Standard Practice for Repair of Damaged and Uncoated Areas of Hot Dip Galvanized Coatings.

.2 Where the Standard is referred to in this specification it shall mean the documents specified in this clause, and their referenced Standards.

1.5 DEFINITIONS FOR THIS SECTION

.1 "Owner", "Contractor" and "Consultant" as per the General Conditions and Definitions.

.2 "Structural Engineer" shall mean a representative of Read Jones Christoffersen Ltd.

.3 "Testing Agency" shall mean the testing agency responsible to the Owner.

.4 "Non-destructive Testing" shall mean magnetic particle, ultrasonic, or radiographic testing as determined appropriate by the Testing Agency.

.5 "Standard" and "Standards" shall mean the reference standards listed under "Reference Standards" in this section.

1.6 APPOINTMENT OF TESTING AGENCY

.1 The Owner will appoint a Testing Agency approved under W178.1 (Building Category).

.2 Testing paid for by the Owner is outlined in Section 3.0.

.3 Testing paid for by the Contractor.

.1 Testing of pre-approved connections not on the structural drawings and required by the Contractor for ease of fabrication, transportation or erection.

.2 Any additional costs due to overtime, shift work, holiday or weekend work required to meet the schedule.

.3 Costs for retesting or additional testing due to work having failed to meet the specified requirements.

.4 For the purpose of bidding, assume all welds will be examined by a nondestructive testing method. Non-destructive testing will be performed on samples of the work at the discretion of the Structural Engineer as well as outlined in this specification. Any repair and retesting costs shall be borne by the Contractor.

2 Duties

2.1 RESPONSIBILITY OF THE CONTRACTOR

.1 The Contractor shall cooperate fully with the Testing Agency. Allow free access to all parts of the work for the purpose of testing and review at all times.

.2 Notify the Testing Agency and Structural Engineer when work is ready for review.

.3 Prior to commencement of work, provide a schedule of shop fabrication and erection to the Testing Agency and Structural Engineer.

.4 Provide mill certificates in accordance with the Standard, properly correlated to the elements being fabricated.

.5 The Contractor is solely responsible to provide a finished product that meets the specifications and contract documents. Testing is not carried out for the Contractor's benefit, nor does it make the Structural Engineer or Testing Agency guarantors of the Contractor's work.

2.2 RESPONSIBILITY AND DUTIES OF THE TESTING AGENCY

.1 The Testing Agency is responsible to the Owner and has the authority to, and is expected to, reject any work not meeting the specifications.

.2 Review the structural drawings and specifications prior to carrying out the work.

.3 Provide testing as per the Standards and as per this specification.

.4 Provide timely test reports to the Structural Engineer, Consultant and Contractor.

3 Testing - Structural Steel, And Deck

3.1 GENERAL

.1 The Structural Engineer may reject at any time during the progress of the work a piece of material or any member which the Structural Engineer may find defective or not in accordance with the detailed drawings. This material may be rejected notwithstanding any previous acceptance and components so rejected shall be replaced at no expense to the Owner. In case of dispute, the decision of the Structural Engineer shall be final

.2 Testing in general shall conform to CSA S16 and W59. Acceptance criteria for welding to be for statically loaded structures as per W59.

.3 If initial tests indicate that the work failed to meet specification, the Structural Engineer shall decide if any additional testing is necessary. This testing shall be done by the Owner's agency. The proposed additional testing shall have prior approval of the Structural Engineer.

.4 Confirm that the fabricator and erector are certified to CSA-W47.1 and that all welders are properly qualified.

.5 Review welding procedures.

.6 Confirm welding consumables are properly stored in shop and field.

.7 Review mill certificates for the material used and forward to the Structural Engineer.

.8 Non-destructive testing operators to have Level II qualifications as a minimum.

3.2 TESTING OF STRUCTURAL STEEL

.1 Randomly check and record structural steel member sizes - 10% ± of columns and 5% ± total of beams and girders.

.2 Check grade markings on structural steel in fabricator's plant prior to fabrication.

.3 Provide a visual review of 100% of all types of welds and 100% of workmanship.

.4 Randomly select shop welds for nondestructive testing - 5% to 10% of connections.

.5 Randomly select field welds for nondestructive testing - 5% to 10% of connections.

.6 Review all snug tight bolted connections to determine that plates are in contact. Check 10% ± of bolts for snugness, including anchor bolts.

.7 For pre-tensioned bolted connections check 10% ± of bolts, minimum two (2) per connection. Pre-tensioned connections are :

.1 Seismic and wind brace connections and drag strut connections.

.2 Crane rail connections.

.3 Connections subject to repeated loads.

.4 Bolted trusses.

.5 Slotted holes with loads perpendicular to the slot or oversized holes.

.6 Connections noted as pre-tensioned on the structural drawings or the shop drawings.

.2 For the following critical welds, observe 20% ± being welded and provide suitable nondestructive testing to:

.1 Tension chord splices in trusses - 100%.

.2 Moment frame beam - column welds - 100%.

.3 Base welds at cantilever columns - 100%.

.4 Full strength beam flange and web connections - 100%.

3.3 TESTING OF HEADED STUDS AND DEFORMED BAR ANCHORS

.1 Visually inspect 100% of welds.

.2 Reinforcing bars butt welded to plates shall be tested as per this section, and shall be weldable grade (W) reinforcing.

.3 1%± of randomly selected studs will be tested by bending to an angle of 30%. Minimum of four (4) studs to be tested. Studs on composite beams shall be bent towards the nearest column.

.4 0.33% (1 in 300)± of randomly selected studs will be tested to destruction. Minimum of four (4) studs to be tested.

.5 Failure of the weld of any studs will be cause for rejection of the stud welding and cause for further testing at the Structural Engineer’s discretion and at the Contractor's expense.

.6 A 10% or greater failure rate at the welds of the tested studs will be cause for rejection of all studs.

.7 Studs tested to destruction shall be replaced by the Contractor and retested.

.8 Replacement of failed or rejected studs shall be at the Contractor’s expense.

3.4 TESTING OF STEEL DECK

.1 Visual review of 100% of deck welds and button punching.

.2 Verify galvanizing as per specification.

.3 Random review of 10%± of deck for required thickness.

End of Section 050050

1 General

1.1 DOCUMENTS

.1 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Drawings include architectural, mechanical, and electrical drawings.

1.2 DESCRIPTION OF WORK INCLUDED

.1 Provide all labour, materials, equipment and services to supply, design, and erect structural steel required and/or indicated on the drawings or specified herein, including the supply of plates and/or angles for support of masonry, embedded steel parts, headed stud and deformed bar anchors, wedge anchors, and epoxy anchors which will form the connection between the structural steel, open web steel joists and masonry or concrete; and reinforcement of steel deck openings larger than 400 mm (16"). Report any discrepancies between structural, mechanical, electrical and architectural drawings to the Consultant and Structural Engineer immediately.

.2 Co-ordinate with Section 053100 (Steel Deck) for the design, supply, and installation of headed stud shear connectors for composite beams and girders, and where required on other beams, girders, and drag struts.

1.3 RELATED WORK SPECIFIED ELSEWHERE

.1 Section 033100 – Structural Cast-in-Place Concrete

.2 Section 050050 - Testing of Structural Steel, and Deck

.3 Section 053100 - Steel Decking

1.4 REFERENCE STANDARDS

.1 Structural steel shall conform to the requirements of the following Standards unless otherwise required by the specification:

.1 Ontario Building Code –2005.

.2 CSA S16-01 - Limits States Design of Steel Structures.

.3 CSA S136-07 - North American Specification for the Design of Cold-Formed Steel Structural Members

.4 CSA W47.1-03 - Certification of Companies for Fusion Welding of Steel Structures.

.5 CSA W59-03 - Welded Steel Construction (Metal Arc Welding) (Metric version).

.6 CSA G40.20-04 - General Requirements for Rolled or Welded Structural Quality Steel.

.7 CSA G40.21-04 - Structural Quality Steel.

.8 CSA G30.18-M92 (R2007) - Billet Steel Bars for Concrete Reinforcement.

.9 CSA W186-M1990 (R2007) - Welding of Reinforcing Bars in Reinforced Concrete Construction.

.10 ASTM F1554-07a Standard Specification for 36, 55 and 105 ksi yield strength Steel Anchor Bolts.

.11 ASTM A193-08a – Standard Specification for Alloy-Steel Bolting Materials for Special Purpose Applications.

.12 ASTM A325-07a - Standard Specification for Structural Bolts, Steel, Heat Treated 120 / 105 ksi Minimum Tensile Strength.

.13 ASTM A490-08a - Standard Specification for Structural Bolts, Alloy Steel, Heat Treated 150 ksi Minimum Tensile Strength.

.14 ASTM A496-07 - Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.

.15 CISC / CPMA Standard 1-73a - A Quick-Drying One-Coat Paint for Use on Structural Steel.

.16 SSPC SP-6-2000 - Commercial Blast Cleaning

.17 ASTM A123-02 - Zinc (Hot-Dip Galvanizing) Coatings on Iron and Steel Products.

.18 ASTM A143-07 - Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.

.19 ASTM A153-05 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.20 ASTM A384-07 - Safeguarding Against Warpage and Distortion During Hot Dip Galvanizing of Steel Assemblies.

.21 ASTM A780-01(2006) - Standard Practice for Repair of Damaged and Uncoated Areas of Hot Dip Galvanized Coatings.

.2 Where the Standard is referenced in this specification it shall mean the documents specified in this clause and their referenced documents.

1.5 DEFINITIONS FOR THIS SECTION

.1 “Owner”, “Contractor” and “Consultant” as per the General Conditions and Definitions.

.2 “Structural Engineer” shall mean a representative of Read Jones Christoffersen Ltd.

.3 “Specialty Structural Engineer” is a Professional Engineer registered in Ontario responsible for components designed by the Contractor and who seals and signs shop drawings.

.4 “Testing Agency” shall mean the testing agency responsible to the Owner.

.5 “Standard” and “Standards” shall mean the reference standards listed under “Reference Standards” in this section.

1.6 QUALIFICATIONS

.1 Structural steel fabricator shall have not less than five (5) years experience in the fabrication of structural steel.

.2 Erector shall not have less than five (5) years experience in the erection of structural steel.

.3 Steel fabricators and erectors must be certified under requirements of CSA W47.1 as required by CSA S16.

.4 Welding procedures, welders and welding operations shall be qualified in accordance with Canadian Welding Bureau Standards.

1.7 EXAMINATIONS

.1 All dimensions shall be taken from the drawings and verified by field measurement. Be responsible for the correctness of such measurements and report to the Consultant and Structural Engineer in writing all discrepancies between measurements in the field and those shown on drawings prior to commencing work. Verify location of anchor bolts and embedded steel and ensure that work prepared by other trades is at a proper elevation, on line, level and true.

1.8 SUBMITTALS

.1 The Contractor shall submit, before starting work, written evidence of qualification of the steel fabricators and erectors for welding under Canadian Welding Bureau requirements.

.2 The Contractor shall submit, before starting work written evidence of ability to weld reinforcing steel to structural steel in accordance with CSA W186.

.3 When requested, submit copies of mill test reports properly correlated to the materials used on the project.

.4 Provide a schedule of fabrication to the Consultant, Structural Engineer and Testing Agency prior to the commencement of the fabrication.

1.9 SHOP DRAWINGS

.1 The Contractor shall notify the Consultant and Structural Engineer, in writing and before the submission of shop drawings, of the name of the Specialty Structural Engineer who will be designing and providing field review for the connections and components designed by the Contractor.

.2 Submit "design" drawings for review summarizing the proposed connection details to be used on the project. These drawings to be prepared by, or under supervision of, the Specialty Structural Engineer and submitted for review before start of shop drawing production. These design drawings shall show the complete connection and:

.1 How the connection assembly fits with the connected members.

.2 Sizes of plates, bolts, welds, etc.

.3 Capacities of the connection.

.4 Assumed eccentricities, lines of action of forces, etc.

.3 Submit shop drawings prepared under direction of the Specialty Structural Engineer. Drawings of components and connections designed by the Contractor shall be sealed and signed by this Specialty Structural Engineer or a letter shall be submitted at the end of the project signed and sealed by this Specialty Structural Engineer. The letter shall identify what was designed by the Specialty Structural Engineer and list the final shop drawings by number with dates and revision numbers.

.4 Shop drawings shall show complete shop and erection details necessary for fabrication and erection of the component parts of the structure, including cuts, copes, connections, holes, threaded fasteners, splices and location, type, size and extent of all welds. Splices not shown on the shop drawings will be rejected. All welds, both shop and field, shall be indicated by AWS Welding Symbols as specified in the CSA W59 Appendix D and E.

.5 Provide a shop drawing clearly locating all anchor bolts, embedded plates, baseplates, etc.

.6 Provide setting drawings, templates and directions for the installation of anchor bolts, plates and other devices.

.7 Prior to starting erection work, submit a description of the methods, sequence of erection and type of equipment proposed for use in erecting structural steel for review of the effects of construction loads on the remainder of the structure.

.8 Review of the shop drawings by the Structural Engineer is intended as an assistance to the Contractor and does not relieve the Contractor of his responsibility for the completeness or accuracy of his work and its conformance with the contract documents.

.9 Fabrication that commences prior to shop drawing review by the Structural Engineer is at the risk of the Contractor.

.10 Clearly identify on the shop drawing all revisions, changes, or modifications.

.11 Resubmit reviewed shop drawings where noted in the Read Jones Christoffersen Ltd.'s review stamp, or when the Contractor makes revisions for his own purposes.

.12 Allow at least two (2) weeks for shop drawing review by the Structural Engineer.

.13 Structural drawings are not prepared to be used as erection or shop drawings. However, electronic files or sepias may be used by the Contractor under the following conditions:

.1 Copyright remains with Read Jones Christoffersen Ltd.

.2 The drawings will only be used for shop drawings for this project and not be put to any other use.

.3 Read Jones Christoffersen Ltd. assumes no liability for errors or omissions in the drawings. The Contractor assumes all risk and expenses associated with the use of structural drawings in the production of his work.

.4 References to Read Jones Christoffersen Ltd. must be deleted from the title block.

.5 The Contractor signs a release available from Read Jones Christoffersen Ltd. that addresses the above items in more detail.

1.10 SUPPLY OF ALTERNATE PRODUCTS

.1 Should the rolled sections shown on the drawings not be procurable, or should substitution for those sections be desired, sections of equivalent strength, may be substituted if approved by the Consultant. In such cases full particulars, thereof must be submitted after contract award. Material substitutions after the closing of Bid, if accepted, will be at the Contractor's cost.

1.11 TESTING AND FIELD REVIEW

.1 See Section 050050 - Testing of Structural Steel, Steel Joists Framing and Steel Decking.

.2 The Specialty Structural Engineer responsible for shop drawings, or the Specialty Structural Engineer's representative, shall visit the site to review in place the connections and components designed by that Specialty Structural Engineer. The Specialty Structural Engineer shall be satisfied or take steps to ensure that these connections and components substantially comply with the Specialty Structural Engineer's design. The Specialty Structural Engineer shall then provide a sealed and signed letter to the Consultant and Structural Engineer to this effect.

.3 Prior to the commencement of work provide a schedule of shop fabrication to the Testing Agency.

.4 If requested, submit certified mill tests in accordance with the Standards.

.5 The Contractor shall advise the Testing Agency of the scheduling of all shop and field work pertaining to this Project. The Contractor shall permit the testing agency full access to the fabrication shop and the site, for the purpose of carrying out his work and he shall provide assistance required to aid in the performance of the inspection and testing.

1.12 STORAGE AND HANDLING

.1 The Contractor shall be responsible for the protection of all steelwork during fabrication, shipping, storage and construction. All small bends and damage shall be reported to the Structural Engineer for instructions. Steel work which is bent, broken or otherwise damaged, shall be repaired or replaced by the Contractor prior to erection to the satisfaction of the Structural Engineer at no cost to the Owner.

.2 The Contractor shall be responsible for proper scheduling of delivery and erection for the structural steel in accordance with the construction schedule.

.3 Store structural steel members at the site above ground on platforms, skids or other devices so that ground dampness will not affect the bottom members of the stacks.

.4 Steel, which is stored outdoors after fabrication, shall be protected from accumulations of standing water.

.5 Other materials shall be stored in a weather tight and dry place until ready for use in the Work.

.6 Packaged materials shall be stored in their original unbroken packages or containers.

1.13 COORDINATION WITH OTHER TRADES

.1 Supply all necessary instructions and drawings to other trades for setting bearing plates, anchor bolts, and other members that are built in with the work of other trades. Provide punched holes for the convenience of other trades in attaching wood blocking or other materials. Coordinate with drawings of other disciplines for locations and details. Supply the necessary material in accordance to the construction schedule.

2 Products

2.1 MATERIALS

.1 All steel shall be new unless otherwise indicated and be of sizes and shapes listed in the current CISC Handbook or AISC Handbook and as indicated on the drawings.

.2 Rolled shapes, except wide flanges, and rolled plate shall be to CSA G40.21 - grade 300W or equal.

.3 Wide flange rolled shapes and welded wide flange sections shall be to CSA G40.21 - grade 350W or equal.

.4 Hollow structural sections shall be to CSA G40.21 - grade 350W, Class H or C.

.5 High strength bolts shall be to ASTM A325 or A490, as required by the drawings.

.6 Standard anchor rods shall be to ASTM F1554, 36ksi. High strength anchor rods shall be to ASTM A193, grade B7, see drawings for locations, if required.

.7 Bolts and nuts shall be to ASTM A307.

.8 Primer for interior exposure not to receive a shop or field paint finish shall be to CISC / CPMA Standard 1-73a or other pre-approved, unless noted otherwise.

.9 Primer used in a multi-coat system where a final shop or field paint finish is to be applied shall conform to Section 09900 - Painting and shall be selected and preapproved by the Architect based on surface preparation, exposure conditions and compatibility with subsequent coatings, unless noted otherwise.

.10 Brick support angles and related framing materials exposed to weather, shall be galvanized to CSA G164.

.11 Headed shear stud connectors shall be Nelson anchors with fluxed ends or other pre-approved equal conforming to ASTM A108. Studs to be automatically end welded with suitable stud welding equipment or shop fillet welded to develop full strength of the stud. Field fillet welded studs will be rejected.

.12 Bar anchors shall be Nelson deformed bar anchors or pre-approved equal conforming to ASTM A496.

.13 Welding consumables for all processes shall be fully approved by the Canadian Welding Bureau and certified by the manufacturers as complying with the requirements of this specification. Such certificates shall be not more than two (2) years old.

.14 Electrode strengths to be equal to E49XX (E70XX) or better.

.15 Grout for column bases shall be non-metallic, non-expanding and non-shrink type with a minimum strength of 35 MPa at 28 days, unless noted otherwise. Grout may be place in a dry pack or flowable consistency.

2.2 DESIGN

.1 Unless otherwise noted connections and trusses shall be designed by the Contractor to the reference Standards by the Specialty Structural Engineer.

.2 Where connections are detailed, use connection of the type and detail shown on the drawings. Modifications to the specified connection types and details will not be permitted without prior approval from the Structural Engineer.

.3 The following connections, and any connections so noted on the structural drawings, shall be designed as slip critical and shall be pre-tensioned:

.1 Trusses.

.2 Elements resisting crane loads.

.3 Connections for supports of running machines or other live loads that produce impact or cyclic loads.

.4 Connections where bolts are subject to repeated tensile loads.

.5 Connections using slotted holes in the direction of the load or oversize holes unless specifically designed to accommodate movement.

.4 Connections for wind or seismic lateral load-resisting elements, such as bracing and drag struts, and others so noted on the structural drawings may be designed as bearing connections but shall be pre-tensioned.

.5 Other bolted connections may be snug tight.

.6 Use standard connection types where connections are not detailed on the structural drawings.

.7 Design shall be for the forces and loads shown on the drawings and shall allow for the effects of beam deflections. Provide a minimum of two (2) 19 mm (3/4") A325 bolts or an equivalent weld for all beam to girder and beam to column connections. If forces or loads are not given, the connection shall be designed for the maximum uniform distributed load that the member can carry for the span shown.

.8 Structural steel members spliced for ease of fabrication or transportation shall have splices designed to develop the full strength and stiffness of the member. Splices shall be subject to non-destructive testing as directed by the Structural Engineer. The cost for such testing shall be borne by the Contractor.

.9 Provide stiffeners in beam webs at all locations where beams pass over supports. Unless noted otherwise in the structural drawings, web stiffeners shall be 10 mm minimum.

.10 Provide separators for all double members in accordance with CSA S16.

3 Execution

3.1 FABRICATION

.1 Fabrication shall be to CSA S16 and reviewed shop drawings.

.2 Welding shall be to CSA W59.

.3 Structural steel work shall be executed by skilled and experienced workmen.

.4 Fabricated units shall be straight and true and without sharp kinks or bends, accurate to sizes shown.

.5 Fabricate rolled steel sections so that any camber and/or sweep resulting from manufacturing is positioned to create a hump up between the ends, not a sag down.

.6 Flame cut steel columns shall have their ends milled. Steel base plates supporting columns shall be flat.

.7 Unless noted otherwise, all hollow structural sections shall be dry inside and closed airtight with end plates sealed with welds.

.8 Visually inspect all plates and shapes for laminations. Replace plates or shapes that contain laminations.

.9 Headed shear stud connectors and deformed bar anchors shall be applied in strict accordance with the manufacturer's instructions and the Standards or shop fillet welded as per the Standards. Procedural control to be in accordance with W59 as a minimum. Field fillet welds will be rejected.

.10 Obtain Structural Engineer's approval for holes required through structural steel that are not shown on the drawings.

.11 Refer to Architectural drawings for extent and location of Architecturally exposed steel elements.

.12 Remove and replace any work which is not acceptable to the Consultant, when and as directed. Such operation shall not become an extra charge to the Owner.

.13 Steel members spliced for ease of fabrication shall develop the full strength and stiffness of the member.

.14 Where roof slopes exceed 5% and do not permit flush bearing of the steel deck on the beams, provide continuous 3mm bent plates to the pitch and necessary to ensure full bearing of the steel deck. Co-ordinate with the deck supplier the locations that will require these bent plates.

3.2 CLEANING AND PRIMING

.1 All steel shall be thoroughly cleaned of all loose mill scale, loose rust, oil or dirt.

.2 Architecturally exposed steel members, related framing and exterior steel shall be primed.

.3 Steel, which will be encased in concrete, fireproofed, zinc coated or galvanized, welded, receive shear studs, faying surfaces of slip resistant connections and the underside of base plates and bearing plates steel shall not be primed.

.4 Steel girder, beams, trusses, columns, bracing and connections plates on the perimeter of the building shall be primed.

.5 Other steel for interior exposure shall not be primed.

.6 Structural steel which will not receive a finish paint coat and is required to be primed for interior exposure shall be cleaned in accordance with CISC / CPMA Standard 1-73 (minimum).

.7 Structural steel to be primed for exterior exposure shall be cleaned in accordance with SSPC SP6 "Commercial Blast Cleaning" as a minimum.

.8 Structural steel to receive a shop or field paint finish shall be cleaned in accordance with Section 099100 - Painting or SSPC SP6 "Commercial Blast Cleaning", whichever produces a surface which has less rust and mill scale.

.9 Apply primers in accordance with the manufacturer's instructions.

.10 Use paint prepared by manufacturer without thinning or adding admixtures. Execute painting on dry surfaces, free from rust, scale, or grease. Do not paint in temperatures lower than 8°C.

.11 Where finish painting to parts inaccessible for finish painting after final assembly is required, apply two coats of paint during fabrication. Apply paint of 2 different colours so that missed areas can be detected.

.12 Provide the following touchup for steel in an exterior exposure or which has a finish paint coat. After erection and after connections are completed, provide a field touchup coat of primer to all surfaces that had no paint shop coat and have been chipped or scraped. Touch up with primer and paint all shop coat painted areas that have been chipped or scraped.

.13 Provide the following touchup for galvanized steel. After erection and after connections are completed, provide a field touchup coat of zinc rich paint to all surfaces that have been chipped or scraped.

3.3 ERECTION

.1 The erector is fully responsible for erection methods, equipment, workmanship and safety precautions.

.2 Confirm the setting of anchor bolts and bearing plates and make an instrument survey to verify the setting prior to erection of steel members.

.3 Cutting or burning of baseplates to accommodate anchor bolts shall be cause for rejection of baseplates.

.4 Install all temporary bracing that is required to stabilize the work against wind, earthquake and construction loads. Keep structure true and plumb until completion of the building. Assume complete responsibility for the extent and timing of the removal of such bracing. The bracing members indicated on the drawings are required for the finished structure and shall not be considered as adequate for temporary bracing. Any failure to make proper and adequate provision for stresses occurring during the erection from any causes whatsoever shall be entirely the responsibility of the Contractor.

.5 As erection progresses, the work shall be securely bolted up to take care of all loads including wind and seismic during erection. Any failure to make proper and adequate provisions for loads during erection shall be solely the responsibility of the Contractor.

.6 The Contractor shall be responsible for the design of all hooks, erection connections and handling gear.

.7 Whenever piles of materials, erection equipment, or other loads are carried during erection, proper provision shall be made to take care of stresses resulting from same. All construction loads shall be adequately distributed so as not to exceed the capacity of any member.

.8 Structural steel shall be assembled and erected in accordance with the approved erection drawings and specified reference Standards.

.9 Structural steel work on concrete shall be carefully located at the proper grade and rigidly secured in place, using steel shims. Spaces under the steel shall then be filled with nonshrink premix grout as soon as possible, and before placing any concrete toppings or precast concrete units.

.10 Plumb, level and align individual members of steel work as specified in CSA S16.

.11 The various members forming parts of complete frame or structure after being assembled shall be aligned and adjusted accurately before being fastened.

.12 Bearing surfaces and surfaces which will be in permanent contact shall be cleaned before the members are assembled.

.13 Temporary bolts, clips and angles etc. used to facilitate erection shall be removed unless noted otherwise on the drawings.

3.4 TEMPORARY FLOORING

.1 Provide all temporary flooring, planking and scaffolding necessary in connection with erection of structural steel, or support of erection machinery in accordance with governing regulations and by-laws.

3.5 WELDING

.1 Welding shall be done by the shielded metal-arc method in accordance with the requirements CSA W59. The welding operators shall be currently certified under CSA W47.1 for the work they are performing.

.2 Submit, when requested, welding procedures prepared and sealed by a Specialty Structural Engineer for review.

.3 Surfaces to be welded shall be free from loose scale, rust, paint, or other foreign matter. Where weld material is deposited in two (2) or more layers, each layer shall be cleaned before the next layer is deposited. Care shall be taken to minimize stresses due to heat expansion, contraction and distortion by using proper sequence in welding and by approved methods.

.4 Appearance, quality of welds made, methods of correcting defective work shall be in accordance with CSA W59.

.5 Welding of reinforcing bars to structural steel as per CSA W186.

3.6 COMPLETION

.1 The Specialty Structural Engineer responsible for the sealed shop drawings, or his representative shall visit the site to review in place connections and components designed by that Specialty Structural Engineer to ensure substantial compliance with his sealed shop drawings. He shall then submit a sealed and signed letter of substantial compliance to the Consultant and Structural Engineer.

.2 On completion of the work of this section, all protection erected in conjunction with the structural steel work shall be removed, all damage to this work and adjoining work shall be made good and all surplus materials and debris and all tools, plant and equipment shall be removed from the site.

End of Section 051200

1 GENERAL

1.1 DOCUMENTS

.1 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Drawings include architectural, mechanical, and electrical drawings.

1.2 DESCRIPTION OF WORK INCLUDED

.1 Provide all labour, materials, equipment and services to supply, design, and erect open web steel joists required and/or indicated on the drawings or specified herein. Report any discrepancies between structural, mechanical, electrical and architectural drawings to the Consultant and Structural Engineer immediately.

.2 Co-ordinate with Section 051200 (Structural Steel Framing) for the design, fabrication, supply, installation and erection of structural steel and accessories.

.3 Co-ordinate with Section 053100 (Steel Decking) for the design, supply, and installation of headed stud shear connectors for composite joists, and where required on other joists and drag struts.

1.3 RELATED WORK SPECIFIED ELSEWHERE

.1 Section 033000 - Structural Cast-in-Place Concrete

.2 Section 050050 - Testing of Structural Steel, Steel Joist Framing and Steel Decking

.3 Section 051200 - Structural Steel Framing

.4 Section 053100 - Steel Decking

1.4 REFERENCE STANDARDS

.1 Open web steel joists shall conform to the requirements of the following Standards unless otherwise required by the specification:

.1 Ontario Building Code – 2012.

.2 CSA S16 - Limits States Design of Steel Structures.

.3 CSA S136 - North American Specification for the Design of Cold-Formed Steel Structural Members.

.4 CSA W47.1 - Certification of Companies for Fusion Welding of Steel Structures.

.5 CSA W59 - Welded Steel Construction (Metal Arc Welding) (Metric version).

.6 CSA G40.20 - General Requirements for Rolled or Welded Structural Quality Steel.

.7 CSA G40.21 - Structural Quality Steel.

.8 CISC / CPMA Standard 1-73a - A Quick-Drying One-Coat Paint for Use on Structural Steel.

.9 SSPC SP-6 - Commercial Blast Cleaning

.10 ASTM A123 - Zinc (Hot-Dip Galvanizing) Coatings on Iron and Steel Products.

.11 ASTM A143 - Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.

.12 ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.13 ASTM A384 - Safeguarding Against Warpage and Distortion During Hot Dip Galvanizing of Steel Assemblies.

.14 ASTM A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot Dip Galvanized Coatings.

.15 LEED ® Canada-NC Green Building Rating.

.2 Where the Standard is referenced in this specification it shall mean the documents specified in this clause and their referenced documents.

.3 The revision date of all referenced codes, standards, and guidelines shall be as indicated in the above referenced Building Code. Where no reference is made within the Building Code, the latest published edition shall be used.

1.5 DEFINITIONS FOR THIS SECTION

.1 "Owner", "Contractor" and "Consultant" as per the General Conditions and Definitions.

.2 "Structural Engineer" shall mean a representative of Read Jones Christoffersen Ltd.

.3 "Specialty Structural Engineer" is a Professional Engineer registered in Ontario responsible for components designed by the Contractor and who seals and signs shop drawings.

.4 "Testing Agency" shall mean the testing agency responsible to the Owner.

.5 "Standard" and "Standards" shall mean the reference standards listed under "Reference Standards" in this section.

1.6 QUALIFICATIONS

.1 Open web steel joist fabricator shall have not less than five (5) years experience in the fabrication of open web steel joists.

.2 Erector shall not have less than five (5) years experience in the erection of open web steel joists.

.3 Steel fabricators and erectors must be certified under requirements of CSA W47.1 as required by CSA S16.

.4 Welding procedures, welders and welding operations shall be qualified in accordance with Canadian Welding Bureau Standards.

1.7 EXAMINATIONS

.1 All dimensions shall be taken from the drawings and verified by field measurement. Be responsible for the correctness of such measurements and report to the Consultant and Structural Engineer in writing all discrepancies between measurements in the field and those shown on drawings prior to commencing work. Verify location of embedded steel and ensure that work prepared by other trades is at a proper elevation, on line, level and true.

1.8 SUBMITTALS

.1 The Contractor shall submit, before starting work, written evidence of qualification of the steel fabricators and erectors for welding under Canadian Welding Bureau requirements.

.2 The Contractor shall submit, before starting work, written evidence of ability to weld reinforcing steel to structural steel in accordance with CSA W186.

.3 When requested, submit copies of mill test reports properly correlated to the materials used on the project.

.4 Provide a schedule of fabrication to the Consultant, Structural Engineer and Testing Agency prior to the commencement of the fabrication.

1.9 SHOP DRAWINGS

.1 Shop drawings shall show complete shop and erection details necessary for fabrication and erection of the joists, including connections, splices and location, type, size and extent of all welds. Splices not shown on the shop drawings will be rejected. All welds, both shop and field, shall be indicated by AWS Welding Symbols as specified in the CSA W59 Appendix D and E.

.2 Review of the shop drawings by the Structural Engineer is intended as an assistance to the Contractor and does not relieve the Contractor of his responsibility for the completeness or accuracy of his work and its conformance to the with the contract documents.

.3 Fabrication that commences prior to shop drawing review by the Structural Engineer is at the risk of the Contractor.

.4 Clearly identify on the shop drawing all revisions, changes, or modifications.

.5 Resubmit reviewed shop drawings where noted in the Read Jones Christoffersen Ltd.'s review stamp, or when the Contractor makes revisions for his own purposes.

.6 Allow at least two (2) weeks for shop drawing review by the Structural Engineer.

.7 Structural drawings are not prepared to be used as erection or shop drawings. However, electronic files or sepias can be used by the Contractor under the following conditions:

.1 Copyright remains with Read Jones Christoffersen Ltd..

.2 The drawings will only be used for shop drawings for this project and not be put to any other use.

.3 Read Jones Christoffersen Ltd. assumes no liability for errors or omissions in the drawings. The Contractor assumes all risk and expenses associated with the use of structural drawings in the production of his work.

.4 References to Read Jones Christoffersen Ltd. must be deleted from the title block.

.5 The Contractor signs a release available from Read Jones Christoffersen Ltd. that addresses the above items in more detail.

1.10 TESTING AND FIELD REVIEW

.1 See Section 050050 - Testing of Structural Steel, Steel Joist Framing and Steel Decking.

.2 Prior to the commencement of work provide a schedule of shop fabrication to the Testing Agency.

.3 If requested, submit certified mill tests in accordance with the Standards.

.4 The Contractor shall advise the Testing Agency of the scheduling of all shop and field work pertaining to this Project. The Contractor shall permit the testing agency full access to the fabrication shop and the site, for the purpose of carrying out his work and he shall provide assistance required to aid in the performance of the inspection and testing.

1.11 STORAGE AND HANDLING

.1 The Contractor shall be responsible for the protection of all joists during fabrication, shipping, storage and construction. Steel joists shall be handled at the job site in such a manner as to prevent bending or

damage of the joist. All small bends and damage shall be reported to the Structural Engineer for instructions. Damaged joists shall not be used. Joists which is bent, broken or otherwise damaged, shall be repaired or replaced by the Contractor prior to erection to the satisfaction of the Structural Engineer at no cost to the Owner.

.2 The Contractor shall be responsible for proper scheduling of delivery and erection for the joists, all in accordance with the construction schedule.

.3 Joists shall be stored at the site above ground on platforms, skids or other devices so that ground dampness will not affect the bottom members of the stacks. Stacks of joists shall not be of such height as to cause bending in members near the bottom.

.4 Joists, which are stored outdoors after fabrication, shall be protected from accumulations of standing water.

.5 Other materials shall be stored in a weather tight and dry place until ready for use in the Work.

.6 Packaged materials shall be stored in their original unbroken packages or containers.

1.12 COORDINATION WITH OTHER TRADES

.1 Provide punched holes for the convenience of other trades in attaching wood blocking or other materials. Coordinate with drawings of other disciplines for locations and details. Supply the necessary material in accordance to the construction schedule.

2 PRODUCTS

2.1 MATERIALS

.1 Steel shall be new unless otherwise indicated and be of sizes and shapes listed in the current CISC Handbook or AISC Handbook and as indicated on the drawings.

.2 Steel shall be to CSA G40.21.

.3 Primer for interior exposure not to receive a shop or field paint finish shall be to CISC / CPMA Standard 1-73a or other pre-approved, unless noted otherwise.

.4 Primer used in a multi-coat system where a final shop or field paint finish is to be applied shall conform to Section 099100 - Painting and shall be selected and preapproved based on surface preparation, exposure conditions and compatibility with subsequent coatings, unless noted otherwise.

.5 Welding consumables for all processes shall be fully approved by the Canadian Welding Bureau and certified by the manufacturers as complying with the requirements of this specification. Such certificates shall be not more than two (2) years old.

.6 Electrode strengths to be equal to E49XX or better.

2.2 DESIGN

.1 Unless otherwise noted all open web steel joists shall be designed by the Contractor to the reference Standards by the Specialty Structural Engineer.

.2 Open web steel joists spliced for ease of fabrication or transportation shall have splices designed to develop the full strength and stiffness of the member. Splices shall be subject to non-destructive testing as directed by the Structural Engineer. The cost for such testing shall be borne by the Contractor.

.3 Provide separators for all double members in accordance with CSA S16.

.4 Design of bridging for steel joists shall conform to the requirements of the CSA S16, unless otherwise indicated on the drawings. Refer to the drawings for areas of non-typical joist bridging and bracing.

.5 Design joists of the depth and spacing shown on drawings to carry the loads shown on the drawings in accordance with CSA S16.

.6 Joists shall have a live load deflection of less than 1/360 of the span unless noted otherwise.

.7 Line up openings and webs in adjacent to allow for the passage of pipe, ducts, conduits, etc. Make allowance in joist design for support of pipes, ducts, conduits, etc.

.8 Upon request by the Consultant or Authority Having Jurisdiction, submit calculations and such further proof as may be necessary to show that the steel joist construction conforms to the requirements set forth herein, as well as the municipal building bylaws.

.9 The joist manufacturer may be required, at the Structural Engineer's and Consultant's option, to demonstrate by testing or analysis, which includes the effects of actual joint eccentricities, that the joists provided have the capacity to resist the loads specified.

.10 In addition to the point loads called for in the governing building code, design joists for a 1.8 kN (0.4 kip) factored additional point load at any location on top chord and bottom chord (including the effects of local bending) concurrent with other design loads. Over mechanical areas the additional point loads shall be 4.5 kN (1.0 kip) factored. The additional point loads noted above on each chord need not be applied concurrently with each other.

.11 Where joists frame into both sides of a support, extend the top chord of the joists to the center of the support, unless shown otherwise.

.12 Where joists frame into one side of a support, extend the top chord of the joists to the far side of the support, unless shown otherwise.

.13 Provide extended ends of the joists as required to support edges of roofs and floors and walls and where shown.

.14 Extended ends of joists shall have a load carrying capacity at least equal to the loads shown on the drawings.

.15 Provide bracing as required for lateral stability of bottom chords in compression due to wind uplift, bottom chord extensions and other effects causing compression in the bottom chord.

3 EXECUTION

3.1 FABRICATION

.1 Fabrication shall be to CSA S16 and reviewed shop drawings.

.2 Welding shall be to CSA W59.

.3 Joist work shall be executed by skilled and experienced workmen.

.4 Fabricated units shall be straight and true and without sharp kinks or bends, accurate to sizes shown.

.5 Refer to Architectural drawings for extent and location of Architecturally exposed joist elements.

.6 Provide bridging for steel joists conforming to the requirements of the CSA S16, unless otherwise indicated on the drawings. Refer to the drawings for areas of non-typical joist bridging and bracing.

.7 Remove and replace any work which is not acceptable to the Consultant, when and as directed. Such operation shall not become an extra charge to the Owner.

.8 Joist and other steel members spliced for ease of fabrication shall develop the full strength and stiffness of the member.

.9 Where roof slopes exceed 5% and do not permit flush bearing of the steel deck on the joist top chords, provide continuous 3mm bent plates to the pitch and necessary to ensure full bearing of the steel deck. Co-ordinate with the deck supplier the locations that will require these bent plates.

3.2 CLEANING AND PRIMING

.1 Steel shall be thoroughly cleaned of all loose mill scale, loose rust, oil or dirt.

.2 Architecturally exposed joists and related framing and bridging and exterior steel shall be primed.

.3 All joists which will be encased in concrete, fireproofed, zinc coated or galvanized or welded shall not be primed.

.4 All other steel joists shall be shop primed.

.5 Joists which will not receive a finish paint coat and are required to be primed for interior exposure shall be cleaned in accordance with CISC / CPMA Standard 1-73 (minimum).

.6 Joists to receive a shop or field paint finish shall be cleaned in accordance with Section 099100 - Painting or SSPC SP6 “Commercial Blast Cleaning”, whichever produces a surface which has less rust and mill scale.

.7 Apply primers in accordance with the manufacturer’s instructions.

.8 Use paint prepared by manufacturer without thinning or adding admixtures. Execute painting on dry surfaces, free from rust, scale, or grease. Do not paint in temperatures lower than 8°C.

.9 Where finish painting to parts inaccessible for finish painting after final assembly is required, apply two coats of paint during fabrication. Apply paint of 2 different colours so that missed areas can be detected.

.10 Provide the following touchup for steel in an exterior exposure or which has a finish paint coat. After erection and after connections are completed, provide a field touchup coat of primer to all surfaces that had no paint shop coat and have been chipped or scraped. Touch up with primer and paint all shop coat painted areas that have been chipped or scraped.

.11 Primer for steel to receive Intumescent fireproofing: Determined to be acceptable based on adhesion and compatibility characteristics under laboratory conditions in accordance with ASTM D3359-09e2, Method A and/or ASTM D4541-09e1, and approved by manufacturer of Intumescent fireproofing to be applied.

.12 Surfaces to receive intumescent fireproofing shall be clean and free of dust, grease or other foreign matter. Existing coatings (except compatible coating manufacturer approved primer), mill scale or surface contaminants shall be removed.

.13 Coating manufacturers recommend Commercial Blast Cleaning (SSPC-SP6/NACE No.3). The quality of finish will depend on the quality of the surface to which the coating is applied. The coating will not hide substrate defects.

3.3 ERECTION

.1 The erector is fully responsible for erection methods, equipment, workmanship and safety precautions.

.2 Install all temporary bracing that is required to stabilize the work against wind, earthquake and construction loads. Assume complete responsibility for the extent and timing of the removal of such

bracing. The bracing members indicated on the drawings are required for the finished structure and shall not be considered as adequate for temporary bracing. Any failure to make proper and adequate provision for stresses occurring during the erection from any causes whatsoever shall be entirely the responsibility of the Contractor.

.3 As erection progresses, the work shall be securely connected to take care of all loads including wind and seismic during erection. Any failure to make proper and adequate provisions for loads during erection shall be solely the responsibility of the Contractor.

.4 The Contractor shall be responsible for the design of all hooks, erection connections and handling gear.

.5 Whenever piles of materials, erection equipment, or other loads are carried during erection, proper provision shall be made to take care of stresses resulting from same. All construction loads shall be adequately distributed so as not to exceed the capacity of any joist or joists.

.6 Joists and bridging shall be assembled and erected in accordance with the approved erection drawings and specified reference Standards.

.7 Co-ordinate with mechanical and electrical trades prior to erection of steel joists to ensure that the joists and bridging will not interfere with the installation of mechanical and electrical equipment.

.8 Support joists at 2 or more points during handling and erection.

.9 Steel joists shall bear on beams as per section 2.2, but in no case shall be less than 65mm on supporting steel members. Connect to supporting steel with a 5mm x 30mm long fillet weld at each side. Secure to bearing plates on masonry walls in the same manner, bearing 100mm minimum.

.10 Plumb, level and align individual joists as specified in CSA S16.

.11 Temporary bolts, clips and angles etc. used to facilitate erection shall be removed unless noted otherwise on the drawings.

3.4 JOIST BRIDGING

.1 Install bridging for steel joists conforming to the requirements of the CSA S16, unless otherwise indicated on the drawings. Refer to the drawings for areas of non-typical joist bridging and bracing.

.2 Where required for stability of bottom chord, additional bridging shall be provided. Such stability requirement shall be designed by the supplier using the loads provided on the drawings.

.3 Architecturally exposed joist bridging and bracing shall be butt spliced and splices shall be ground smooth to receive finish painting as specified in Architectural Finishes. Lap splices in architecturally exposed bridging will not be permitted.

3.5 WELDING

.1 Welding shall be done by the shielded metal-arc method in accordance with the requirements CSA W59. The welding operators shall be currently certified under CSA W47.1 for the work they are performing.

.2 Submit, when requested, welding procedures prepared and sealed by a Specialty Structural Engineer for review.

.3 Surfaces to be welded shall be free from loose scale, rust, paint, or other foreign matter. Where weld material is deposited in two (2) or more layers, each layer shall be cleaned before the next layer is deposited. Care shall be taken to minimize stresses due to heat expansion, contraction and distortion by using proper sequence in welding and by approved methods.

.4 Appearance, quality of welds made, methods of correcting defective work shall be in accordance with CSA W59.

END OF SECTION

1. General

1.1 DOCUMENTS

.1 This section, along with the drawings, forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Drawings include architectural, mechanical, and electrical drawings.

1.2 DESCRIPTION OF WORK INCLUDED

.1 Provide all labour, materials, closures, equipment and services necessary to design, supply, fabricate, erect and install the steel deck and field welded shear connectors to structural steel as indicated on the drawings and as hereinafter specified. Provide gauge metal formwork at all deck edges for composite deck or concrete-filled deck and reinforcement for deck openings as required herein.

.2 Coordinate with Section 051000 - Structural Steel for the design, supply and installation of headed stud shear connections for composite beams and girders and where required on other beams, girders and drag struts.

1.3 RELATED WORK SPECIFIED ELSEWHERE

.1 Section 031000 - Concrete Forming

.2 Section 032000 - Concrete Reinforcing

.3 Section 033000 – Structural Cast-in-Place Concrete

.4 Section 050050 - Testing of Structural Steel, and Steel Decking

.5 Section 051200 - Structural Steel Framing

1.4 REFERENCE STANDARDS

.1 Structural Steel Deck shall conform to the requirements of the following Standards unless otherwise required by the specification:

.1 Ontario Building Code – 2005.

.2 CSA W47.1-03 - Certification of Companies for Fusion Welding of Steel Structures.

.3 CSA W59-03 - Welded Steel Construction (Metal Arc Welding)

.4 CSA S136-07 - Cold Formed Steel Structural Members

.5 ASTM A653M-09a - Sheet Steel, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

.6 CSSBI 10M-06 - Standard for Steel Roof Deck.

.7 CSSBI 12M-06 - Standard for Composite Steel Deck.

.2 Where the Standard is referred to in this specification it shall mean the documents specified in this clause and their referenced documents.

1.5 DEFINITIONS FOR THIS SECTION

.1 “Owner”, “Contractor” and “Consultant” as per the General Conditions and Definitions.

.2 “Structural Engineer” shall mean a representative of Read Jones Christoffersen Ltd.

.3 “Specialty Structural Engineer” is a Professional Engineer registered in Ontario responsible for components designed by the Contractor and who seals and signs shop drawings.

.4 "Testing Agency" shall mean the testing agency responsible to the Owner.

.5 "Standard" and "Standards" shall mean the reference standards listed under "Reference Standards" in this section.

1.6 QUALIFICATIONS

.1 Steel deck fabricator shall have not less than five (5) years experience in the fabrication of steel deck.

.2 Erector shall not have less than five (5) years experience in the erection of steel deck.

.3 Steel deck welders must possess current Canadian Welding Bureau Certificates of Qualification for light gauge structural welding.

.4 The deck erectors must be certified under the requirements of CSA W47.1

1.7 EXAMINATION

.1 Examine and verify all necessary measurements and dimensions of previously executed work which may affect the work of this contract.

.2 Examine surfaces which work is to be placed on or against to ensure that they are square, true, level, plumb, of correct slope or shape and of proper surface to receive such work.

.3 Report any discrepancies to the Consultant and Structural Engineer immediately so that instructions may be given for the necessary remedial work.

.4 Commencement of work shall be construed as acceptance of all conditions and surfaces.

1.8 SHOP DRAWINGS

.1 Submit shop drawings prepared under the supervision of a Specialty Structural Engineer. Drawings of components designed by the Contractor shall be sealed and signed by this Specialty Structural Engineer.

.2 Shop drawings shall show the position, extent, type and arrangement of the units, their relationship to other materials, depth, core thickness, coating thickness, connections, openings, accessories, closures, light gauge formwork and reinforcement for openings, and complete stud shear connector details for composite beams.

.3 Calculations and/or test data may be requested with the shop drawings to justify deck design and shear connector design.

.4 Show deck load capacities, including point load capacities, and for composite deck confirm that these load capacities are compatible with the zinc coating.

1.9 TESTING AND FIELD REVIEW

.1 As per Section 050050 - Testing of Structural Steel and Deck.

1.10 STORAGE AND HANDLING

.1 Bundles of decking shall be stacked on wood blocking clear of the ground and tilted to ensure that no water lies on the material.

2. Products

2.1 GENERAL

.1 Products shall satisfy the requirements of the Standard unless otherwise specified herein or on the drawings.

2.2 MATERIALS

.1 Steel deck units shall be formed of zinc-coated sheet steel minimum CSSBI 10M Grade A with a base steel nominal thickness of 0.76 mm or greater. Unless noted otherwise, zinc coatings shall be:

.1 Interior Exposure Floors ZF75 Galvanneal; Roofs - ZF75 - Galvanneal

.2 Exterior ExposureZ275.

.2 Touchup paint for welds shall conform to CGSB –1.181 Ready-Mixed Organic Zinc Rich Coating.

.3 Cover plates, cell closures, etc. shall be of the same material as the deck with a minimum nominal thickness of 0.76 mm.

.4 Deck shall conform to the depths shown on the drawings. Deck receiving composite shear studs shall have an average bottom flute width equal to twice the deck depth.

.5 Shear stud connectors shall be Nelson headed anchors or other preapproved. Studs to be automatically end welded with suitable stud welding equipment in the field. Fillet welded studs will be rejected.

.6 Steel deck to receive concrete topping shall be composite deck unless noted otherwise.

.7 Steel deck that is indicated to be painted on the underside shall have factory applied, baked-on series 5000 paint finish. Painted steel deck shall be connected with alternate fasteners that do not damage the paint finish. Painted steel deck shall not be connected with welds.

.8 Alternate Fasteners – Note that any alternates must be reviewed by RJC:

.1 The following alternate fasteners are acceptable in lieu of welding to structural supports:

.1 Hilti X-ENP-19 L15, X-EDN19 THQ12 or X-EDNK22 THQ12 as recommended by the manufacturer for the application.

.2 6mm x 25mm HHA weather-guard screws at 300mm maximum centers at all bearing points (min. of 4 screws per sheet) for use on wood trusses.

.2 In lieu of button-punching, clinching or welding sidelaps, Hilti S-SLC01 M HWH or S-SLC02 M HWH, as recommended by the manufacturer for the application, are acceptable.

2.3 FABRICATION

.1 Composite steel deck shall be formed with integral locking lugs to provide mechanical lock between concrete and steel.

.2 Steel deck shall span over three (3) or more supports unless prevented by the structural steel layout.

.3 Steel deck shall have interlocking male and female side laps.

.4 Provide cell closures where required by architectural drawings and specifications at open ends of all cell runs at columns, openings, walls, etc., and where cells change direction.

.5 For deck with concrete topping provide necessary metal gauge formwork at the deck edges for full deck and concrete depth to prevent leaking of concrete topping. This includes, but is not limited to, edges formed by building edges, openings framed by structural steel, elevator shafts, stairwells, and around webs and flanges of columns.

2.4 DESIGN

.1 Steel deck shall be designed by the Contractor to the reference Standards and the loads on the drawings unless otherwise noted.

.2 Deck thickness, spacing of puddle welds and type and extent of side connections shall be proportioned to resist forces and loads shown on drawings, or as designated on drawings.

.3 Deck material thickness may be greater than the minimum thickness shown on the drawings.

.4 Design floor deck to support loads without temporary shoring and with deflection not exceeding 1/180th of the span under construction loading.

.5 Unless noted otherwise, the deflection under live load alone shall be limited to span/360 for floors, and for roof deck the deflection shall be limited to span/360.

.6 Where the diaphragm loads are not shown on the drawings or where shear requirements are not shown on the drawings, the design of the decking and its fastenings shall meet a minimum diaphragm shear requirement of 3.5 kN/m.

.7 Decking to be used as formwork shall conform to WCB formwork requirements.

.8 Shear stud connectors shall be designed for the forces indicated on the drawings. If the capacities of the individual studs are reduced because of the geometry of the particular deck profile used, provide additional studs so that the total shear transfer capacity provided is at least that indicated on the drawings.

.9 At splice locations, steel decking shall be installed with laps sufficient to ensure that both pieces of deck are properly fastened to the supporting member. As a minimum, over supporting members with uninterrupted top surfaces, such a W-beams and channels, the lap shall be 100mm and the welds or deck fasteners shall be at or near the centerline of the supporting members. Over supporting members with interrupted top surfaces, such as OWSJ's with double angle or hat-shaped top chords, each sheet shall extend a minimum of 25mm past the opposite edge of the joist chord, and the sheets shall not lap less than 100mm total. In this case the welds or deck fasteners shall be centered on the supporting surface nearer the end of the top deck sheet. See General Notes and Typical Details for clarification.

3. Execution

3.1 ERECTION

.1 The erection of the steel deck shall be carried out by personnel experienced in the installation of steel deck.

.2 Obtain and verify all dimensions at project site or from approved shop drawings.

.3 The Contractor shall be solely responsible for the accuracy of such measurements and precise fitting and assembly of the finished product.

.4 Use special care in unloading, handling and erecting the deck to avoid bending, twisting or otherwise distorting the panels.

.5 The steel deck units shall be laid in accordance with the approved shop drawings.

.6 At splice locations, steel decking shall be installed with laps sufficient to ensure that both pieces of deck are properly fastened to the supporting member. As a minimum, over supporting members with uninterrupted top surfaces, such a W-beams and channels, the lap shall be 100mm and the welds or deck fasteners shall be at or near the centerline of the supporting members. Over supporting members with interrupted top surfaces, such as OWSJ's with double angle or hat-shaped top chords, each sheet shall extend a minimum of 25mm past the opposite edge of the joist chord, and the sheets shall not lap less than 100mm total. In this case the welds or deck fasteners shall be centered on the supporting surface nearer the end of the top deck sheet. See General Notes and Typical Details for clarification.

.7 Metal closures and flashing shall be fastened in place by welding, sheet metal screws, or structural adhesive as recommended by the decking manufacturer.

.8 Unless noted otherwise the decking shall be welded to the supporting steel by means of 19mm

diameter fusion welds in every second flute and at 300mm maximum centers at all bearing points (minimum of 4 welds per sheet).

.9 Side laps shall be mechanically fastened (clinched) or welded together at not more than 600mm on center.

.10 At perimeter parallel to flutes deck edges shall be fastened to supporting steel at 300mm on center unless noted otherwise on the drawings.

.11 Alternate Fasteners – Note that any alternates must be reviewed by RJC:

.1 The following alternate fasteners are acceptable in lieu of welding to structural supports:

.1 Hilti X-ENP-19 L15, X-EDN19 THQ12 or X-EDNK22 THQ12 as recommended by the manufacturer for the application.

.2 6mm x 25mm HHA weather-guard screws at 300mm maximum centers at all bearing points (min. of 4 screws per sheet) for use on wood trusses.

.2 In lieu of button-punching, clinching or welding sidelaps, Hilti S-SLC01 M HWH or S-SLC02 M HWH, as recommended by the manufacturer for the application, are acceptable.

.12 Steel deck shall be placed on the supporting steel framework and adjusted to final position before being permanently fastened. Each section shall be brought to proper bearing. If the supporting framework is not in proper alignment or at the proper level, the Contractor shall so advise the Consultant and Structural Engineer of such irregularities and shall not make final placement until corrections are made.

.13 For steel deck that will not receive a concrete topping, immediately after the steel deck is welded in place, the steel deck surface shall be inspected, and all areas where zinc coating has been burned by welding shall be covered by a suitable zinc enriched paint, applied to the paint manufacturer's instructions.

.14 Cut openings in metal decking at locations shown on the project drawings. These openings shall be located and dimensioned in cooperation with the various trades at the time of erecting the steel deck. Unless noted otherwise, openings up to 150 mm (6") need not be reinforced. Openings between 150 mm (6") to 400 mm (16") in size shall be reinforced by this trade, using 75 mm x 75 mm x 5.0 mm x 1200 mm (48") steel angles welded to the flutes on either side of those cut.

.15 The Contractor shall accommodate the erection and welding sequence of the structural steel as required.

.16 Shear stud connectors to be applied in strict accordance with manufacturer's instructions and Standards. Procedural control to be in accordance with W59 as a minimum.

.17 Studs shall be placed in bottom flutes of steel deck on the side closest to the nearest end of the beam.

.18 After welding studs, the ceramic ferrule shall be removed and the stud fillet visually inspected by the operator. If the fillet is less than 360° around the base of the stud, then the stud is to be hammer tested by the operator by bending the stud 30° from the vertical away from the side of no fillet. If the weld fails, the stud is to be replaced. Bent studs may be left bent.

.19 If studs are welded to steel plates or members with temperature below 0°C, one (1) stud in each 100 is to be tested by the operator by bending 30° from the vertical.

.20 No stud welding is to be done when the base metal temperature is below -15°C or when the deck surface is wet or the structural steel surface below the deck is wet.

3.2 COVER PLATES AND CLOSURES

.1 Furnish, install and weld in position, sheet metal cover plates to close openings between deck sections and columns and to cover gaps where deck sections abut or change direction.

.2 For deck with concrete topping install all light gauge metal closures and edge strips necessary as formwork for the concrete.

.3 Install all closures as required by the architectural drawings and specifications.

3.3 CLEAN-UP

.1 Steel deck cuttings, strappings, packaging material and other debris pertaining to steel deck units shall be cleaned up.

.2 Remove all debris and excess material at completion of erection of steel deck and leave work ready for other trades.

.3 Touchup welds and other areas of damaged galvanizing with zinc rich paint.

.4 Repair any defects. Leave steel deck free of all oil, grease, paint and dirt.

End of Section 053100

1 General

1.1 **SECTION INCLUDES**

.1 Design, labour, Products, equipment and services necessary for load-bearing metal studs work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 ASTM A123, Specification for Zinc (Hot Dip Galvanized) Coatings on Iron & Steel Products.

.2 ASTM A653/A653 M, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.3 ASTM C1002, Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

.4 ASTM C1280, Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing.

.5 CISC/CPMA 1.73a, A Quick-Drying One-Coat Paint for Use on Structural Steel.

.6 CSA W47.1, Certification of Companies for Fusion Welding of Steel.

.7 CSA W55.3, Certification of companies for resistance welding of steel and aluminum.

.8 CSA W59, Welded Steel Construction (Metal Arc Welding).

.9 CSA S136, North American Specification for the Design of Cold Formed Steel Structural Members.

.10 Canadian Sheet Steel Building Institute CSSBI 52M, Lightweight Steel Framing Binder.

1.3 **DESIGN REQUIREMENTS**

.1 Design load-bearing metal studs to withstand live, dead, lateral, wind, seismic, handling, transportation, and erection loads.

.2 Design load-bearing metal studs based on Limit States Design principles using factored loads and resistances. Loads and load factors to be in accordance with the National Building Code (NBC). Resistance factors to be determined in accordance with the NBC and CAN/CSA-S136-M.

.3 Design bridging to prevent member rotation and member translation perpendicular to the minor axis. Provide for secondary stress effects due to torsion between lines of bridging.

.4 Design load-bearing metal studs in accordance with following Climatic Design Data for Brampton contained in the Ontario Building Code:
- .1 Design temperature: January 1%, July 2 ½%.
- .2 Wind (Hourly wind pressures): 1 in 50 year occurrence.

.5 Design load-bearing metal studs for the full specified design wind load with the following deflection limits:
- .1 Brick and stone veneer: L/720.
- .2 Metal siding and panels: L/360.

.6 Design load-bearing metal studs without relying on sheathing or gypsum board to resist torsion and weak axis buckling.

1.4 SUBMITTALS

.1 Product data:
- .1 Submit duplicate copies of manufacturer's Product data in accordance with Section 01 30 00 indicating:
  - .1 Performance criteria, compliance with appropriate reference standard, characteristics, and system limitations.
  - .2 Product transportation, storage, handling and installation requirements.

.2 Shop drawings:
- .1 Submit shop drawings in accordance with Section 01 30 00 indicating:
  - .1 Wall construction, load-bearing metal stud wall system, design loads, member sizes, materials, component details, depth and gauge designation exclusive of coatings, location and spacings of framing members, connection and bracing details, bearing, anchorage, loadings, temporary bracing, welds, types and locations of mechanical fasteners, splices, permanent bracing, and strapping.
  - .2 Indicate locations, dimensions, openings and requirements of related work.
  - .3 Indicate welds by welding symbols as defined in CSA W59.
  - .4 Complete engineering design data to confirm that load-bearing metal studs meet design requirements specified.

.3 Certificates: Prior to commencement of work, submit 2 certified copies of load-bearing metal stud mill reports covering material properties.

1.5 QUALITY ASSURANCE

.1 Retain a Professional Engineer, licensed in Province of Ontario, with experience in work of comparable complexity and scope, to perform following services as part of work of this Section:
- .1 Design of load-bearing metal studs.
- .2 Review, stamp, date and sign shop drawings and design calculations.

.3 Conduct shop and on-site inspections, prepare and submit written inspection reports verifying that this part of Work is in accordance with Contract Documents and reviewed shop drawings.

.2 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.

2 Products

2.1 **ACCEPTABLE MANUFACTURERS**

.1 Bailey Metal Products.

.2 Sanders Steel Inc.

.3 Steelform (West)/Fusion (East) Divisions of Imperial Building Products Ltd.

2.2 **MATERIALS**

.1 General: All materials under work of this Section, including but not limited to, primers are to have low VOC content limits.

.2 Steel: to CSA S136, Grade A to D steel with Z275 zinc coating designation in accordance with ASTM A653/A653M.

.3 Welding materials: to CSA W59 and certified by Canadian Welding Bureau.

.4 Screws: pan head, self-drilling, self-tapping sheet metal screws, corrosion protected to minimum requirements of CSSBI, length to suit intended end use.

.5 Anchors: concrete expansion anchors or other suitable drilled type fasteners.

.6 Bolts, nuts, washers: hot dipped galvanized to ASTM A123, 600 g/m² zinc coating.

.7 Primer paint: CAN/CGSB-1.40-M or CPMA 1.73a.

.8 Insulation: In accordance with Section 07 21 00.

.9 Sill Plate Gasket: Polyethylene foam, moisture resistant, 4.8 mm thick; ‘FoamSealR’ by Owens Corning or approved alternative.

.10 Isolation coating: Black bituminous coating, acid and alkali resistant material.

.11 Exterior sheathing: 12.7 mm,’GlasRoc Brand Sheathing’ with EGRG by CertainTeed Gypsum Canada, ‘Securock Glass-Mat Sheathing’ by CGC Inc. or ‘Dens-Glass Gold’ by Georgia-Pacific Canada LP.

.12 Sheathing screws: to ASTM C1002, Type S, corrosion resistant, 12.7 mm penetration into steel, complete with 38 mm diameter washers.

2.3 **METAL FRAMING**

.1 Metal studs: to CAN/CSA S136, fabricated from zinc coated steel, depth as indicated. Minimum steel thickness to be 0.91 mm.

.2 Stud tracks: fabricated from same material and finish as metal studs, depth to suit.
- .1 Bottom track: single piece.
- .2 Top track: two piece telescoping or single piece as required by design.

.3 Bridging: fabricated from same material and finish as studs, 38 x 12 x 1.22 mm minimum thickness.

.4 Angle clips: fabricated from same material and finish as studs, 38 x 38 mm x depth of metal stud, 1.22 mm minimum thickness.

.5 Tension straps and accessories: In accordance with reviewed shop drawings and as recommended by manufacturer.

3 Execution

3.1 **EXAMINATION**

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of work of this Section means acceptance of existing conditions.

3.2 **PREPARATION**

.1 Verify substrate surfaces are solid, free from surface water, frozen matter, and other foreign matter detrimental to performance. Ensure environmental and site conditions are suitable for installation of system.

3.3 **INSTALLATION**

.1 Install load-bearing metal studs in accordance with reviewed shop drawings and manufacturer's written instructions.

.2 Install sill plate gasket under bottom track at foundation wall locations and in locations indicated in accordance with manufacturer’s written instructions. Butt all end and perpendicular joints tightly.

.3 Perform work in accordance with CSSBI 52M. Perform welding in accordance with CSA W59.

.4 Erect studs plumb, aligned and securely attached with 2 screws minimum at each point of attachment, or welded in accordance with manufacturer's recommendations. Anchor tracks securely to structure at 800 mm o.c. maximum, unless lesser spacing prescribed on shop drawings.

.5 For telescoping tracks install 50 mm minimum telescoping track at top of walls where required to accommodate vertical deflection. Nest top track into deflection channel a minimum of 30 mm and a maximum of 40 mm. Do not fasten tracks together. Stagger joints.

.6 Seat studs into bottom tracks and top track. Install studs at not more than 50 mm from abutting walls, openings, and each side of corners and terminations with dissimilar materials.

.7 Brace metal studs with horizontal internal bridging at spacing shown on reviewed shop drawings. Fasten bridging to steel clips fastened to metal studs with screws or by welding.

.8 Frame openings in stud walls to adequately carry loads by use of additional framing members and bracing as detailed on shop drawings.

.9 Cutouts: Limit distance from centerline of last unreinforced cutout to end of member to less than 300 mm.

.10 Touch up welds with coat of zinc rich primer.

.11 Erection Tolerances;
- .1 Plumb: not to exceed 1/500th of member length.
- .2 Camber: not to exceed 1/1000th of member length.
- .3 Spacing: not more than 3 mm from design spacing.
- .4 Gap between end of stud and track web: not more than 4 mm.

.12 Install insulation in accordance with Section 07 21 00.

.13 Apply isolation coating over entire contact surfaces of all dissimilar materials to prevent electrolytic action for protection from galvanic corrosion.

3.4 SHEATHING INSTALLATION

.1 Install sheathing materials in accordance with ASTM C1280, reviewed shop drawings, and manufacturer’s written instructions.

.2 Install sheathing with long dimension perpendicular to metal studs, offset joints and butt tight, centre edges of sheathing over metal studs, mechanically fasten with specified fasteners and washers in accordance with manufacturer’s instructions.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Design, labour, Products, equipment and services necessary for the miscellaneous and metal fabrication work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 ASTM A53, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A123, Specification for Zinc (Hot Dip Galvanized) Coatings on Iron & Steel Products.

.3 ASTM A153, Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.4 ASTM A480/A480M-15, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

.5 ASTM A276, Specification for Stainless and Heat-Resisting Steel Bars and Shapes.

.6 ASTM A307, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.

.7 ASTM A653/A653M, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.

.8 CISC/CPMA 1.73a, A Quick-Drying One-Coat Paint for Use on Structural Steel.

.9 CAN/CSA-G40.20/G40.21-M, General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steels.

.10 CAN/CSA S16.1-M, Limit States Design of Steel Structures.

.11 CSA S136.1-M, Commentary on CAN/CSA S136-M, Cold Formed Steel Structural Members.

.12 CSA W47.1, Certification of Companies for Fusion Welding of Steel Structures.

.13 CSA W48, Filler Metal and Allied Materials for Metal Arc Welding.

.14 CSA W59-M, Welded Steel Construction (Metal Arc Welding).

.15 CAN/CSA W117.2-M, Safety in Welding, Cutting and Allied Processes.

.16 CAN/CGSB 1.40-M, Primer, Structural Steel, Oil Alkyd Type.

.17 CGSB 85-GP-16M, Painting Galvanized Steel.

.18 NAAMM, The National Association of Architectural Metal Manufacturers.

.19 Steel Structures Painting Council (SSPC), Steel Structures Painting Manual, Vol. 2.

1.3 **DESIGN REQUIREMENTS**

.1 Design details and connections, where not shown on Drawings, in accordance with CAN/CSA-S16.1 and CSA S136.1.

1.4 **SUBMITTALS**

.1 Shop drawings:
- .1 Submit shop drawings for fabrication and erection of miscellaneous and metal items in accordance with Section 01 30 00 indicating:
  - .1 Materials, core thicknesses, class of finish (AMP 555), connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.
  - .2 Ensure shop drawings are of one uniform size and based on field measurements.

1.5 **QUALITY ASSURANCE**

.1 Retain a Professional Engineer, licensed in the Province of Ontario, with experience in work of comparable complexity and scope, to perform the following services as part of the work of this Section:
- .1 Design metal fabrication items that are required to resist live, dead, lateral, wind, or seismic loads.
- .2 Review, stamp, date and sign shop drawings..

.2 Workmanship: Fabricate work of this Section to meet the required class of workmanship indicated below in accordance with NAAMM's AMP 555, Section 8.
- .1 Class 1: for use on direct exposed to view fabricated items:
  - .1 Exposed surfaces are finished smooth without pitts, mill marks, nicks, burrs, sharp edges, and scratches filled or ground off. Defects should not show when painted, polished, or finished.
  - .2 Welds should be concealed where possible. Exposed welds are ground to small radius with uniform sized cove unless otherwise noted.
  - .3 Distortions should not be visible to the eye.
  - .4 Exposed joints are fitted to a hairline finish.

.3 Execute welding by firms certified in accordance with CSA W47.1 Division 1 or 2.1. Ensure welding operators are licensed per CSA W47.1 for types of welding required by Work.

.4 Perform stainless steel work in accordance with NAAMM, Code of Standard Practice for the Metal Industry, Workmanship, Class 1.

2 Products

2.1 **MATERIALS**

.1 General:
- .1 All materials under work of this Section, including but not limited to, primers and paints are to have low VOC content limits.
- .2 Unless detailed or specified herein, standard products will be acceptable if construction details and installation meet intent of Drawings and Specifications.
- .3 Include all materials, products, accessories, and supplementary parts necessary to complete assembly and installation of work of this Section.
- .4 Incorporate only metals that are free from defects which impair strength or durability, or which are visible. Install only new metals of best quality, and free from rust or waves and buckles, and that are clean, straight, and with sharp defined profiles.

.2 Structural shapes, plates, and similar items: CAN/CSA-G40.20/G40.21-M, Grade 350W. Hollow structural sections: CAN/CSA-G40.20/G40.21-M, Grade 350W, Class H.

.3 Galvanized sheet steel: ASTM A653/A653M Grade A, Z275 Commercial Quality zinc coating, size and shape as shown.

.4 Stainless steel sheet and plate: ASTM A480/A480M, Type 304, finish to AISI No. 4. Size as shown.

.5 Stainless steel shapes: ASTM A276, Type 304, finish to AISI No. 4 or X-L Blend S as indicated. Sizes and shapes as shown.

.6 Bollards (protection posts): ASTM A53/A53-M, Schedule 40 standard weight steel pipe in quantity and sizes shown.

.7 Metal grating: Galvanized steel bar grating 'Standard Tru-Weld' type 19-2 by Fisher & Ludlow.

.8 Welding materials: CSA W48 and CSA W59-M.

.9 Fasteners: Conforming to ASTM A307, Grade A, in areas not exposed to view, use unfinished bolts with hexagon heads and nuts. In areas exposed to view, use bolts, nuts, washers, rivets, lock washers, anchor bolts, machine screws and machine bolts Z275 zinc coated in accordance with ASTM A653/A653M. Supply bolts of lengths required to suit thickness of material being joined, but not projecting more than 6 mm beyond nut, without the use of washers.

.10 Primer paint: CAN/CGSB-1.40-M or CPMA 1.73a.

.11 Galvanized primer paint: Inorganic zinc rich primer. For use on galvanized fabrications where touch up is to remain unpainted in finished work; Carbozinc 11WB

by Carboline Company, Catha-Coat 305 by Devoe Coatings or Zinc Clad XI by Sherwin Williams.

.12 Drilled inserts: “HSL-3" by Hilti Inc. or “Dynabolt Sleeve Anchors” by ITW Construction Products, heavy-duty anchors, sizes as shown.

.13 Adhesive anchor system: ‘HIT HY 200 Injectable Mortar with Hilti HAS Stainless Steel Anchor Rod System’ by Hilti Ltd. or approved alternative by ITW Construction Products, complete with all components required for a complete installation.

2.2 FABRICATION

.1 Verify dimensions of existing Work before commencing fabrications and report any discrepancies to the Consultant.

.2 Fit and assemble work in shop where possible. Execute work in accordance with details and reviewed shop drawings.

.3 Use self-tapping shake-proof screws on items requiring assembly by screws or as indicated. Use screws for interior metal work. Use welded connections for exterior metal work unless otherwise found acceptable by the Consultant.

.4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush. Seal exterior steel fabrications against corrosion in accordance with CAN/CSA S16.1-M.

.5 Execute shop welding to requirements specified .

.6 Carefully make and fit details. Take special care with exposed finished work to produce a neat and correct appearance to the Consultant's acceptance.

.7 Assemble members without twists or open joints.

.8 Correctly size holes for connecting work of other trades where such can be determined prior to fabrication. Where possible, show holes on shop drawings. Place holes not to cause appreciable reduction in strength of member.

.9 Draw mechanical joints to hairline tightness and seal countersunk screw and access holes for locking screws with metal filler where these occur on exposed surfaces.

2.3 FABRICATED ITEMS

.1 Refer to Drawings for details of metal fabrication work and related items not specifically listed in this Section.

.2 Where work is required to be built into work of other Sections supply such members to respective Sections.

.3 Provide miscellaneous and metal fabrications indicated on the drawings, listed below, and not indicated to be supplied under other Sections. Provide miscellaneous and metal fabrications including but not limited to the following:

.4 Lintels: Fabricated from CAN/CSA-G40.20/G40.21-M, Grade 350W, size and location as shown, width to be not less than 25 mm less than width of wall and extend 200 mm beyond opening at each end. Unless otherwise shown, fabricate lintels in block walls of steel sections.

5. Masonry lateral support angles:
   .1 Supply only, to Section 04 20 00 for installation, all horizontal lateral support anchors at top of non-load-bearing masonry walls.
   .2 Refer to Structural Drawings for size and spacing of required support anchors. Provide drilled holes as required for anchorage.
   .3 Galvanized for all exterior wall and unheated and high humidity locations.

6. Shelf Angles: Of size indicated on Drawings and as specified in structural steel specifications, with adjustable inserts for vertical adjustment and slotted holes for horizontal; galvanized.

.7 Wood privacy framing: Structural channel and angle framing continuously welded and securely anchored to structure. Design framing and anchorage to support assembly dead loads and live loads, and lateral loads attributable to misuse and vandalism. Finish: Prime painted.

.8 Steel ladders (interior and exterior):
   .1 Fabricate complete with steel stiffeners, rungs, angle rails, bent plate straps or angle brackets as shown.
   .2 Ladders in elevator pits shall extend 1220 mm high above finished floor.
   .3 Provide safety cages around ladders where indicated on Drawings, in accordance with Ministry of Labour requirements.
   .4 Provide safety grating at top landing of exterior ladder. Galvanized steel channel planks with serrated edges on diamond shaped openings. ‘Grip Span 9-1/2" Diamond’ by Fisher & Ludlow.
   .5 Finish: Hot dipped galvanized.

.9 Hose tower platform:
   .1 Fabricate platform complete with, but not limited to galvanized steel bar grating, guardrail and hose pegs:
      .1 Metal grating: 6 mm thick steel plate, size and pattern as indicated on drawings.
      .2 Guardrails, and posts:
         .1 Design railings to withstand minimum horizontal and vertical loads as required to meet requirements of authorities having jurisdiction. In no instance shall load design of railings be less than 3.0 kN/m horizontally and 1.5 kN/m vertically.
         .2 Close open ends of steel guardrails with 1.9 mm thick closure neatly welded. Fabricate guardrails as shown on drawings.

.3 Guardrail bracket: Fabricate as shown. After fabrication, galvanized bracket in accordance with ASTM A123.

.3 Hose pegs: Heavy duty galvanized steel.

.2 Finish: Hot dipped galvanized.

.10 Corner Guards: 100 x 100 x 3.0 mm, stainless steel 2000 mm high with adjustable masonry anchors welded to back at maximum 400 mm centres.

.11 Bollards (protection posts):

.1 Provide bollards as indicated on drawings. Posts to be 250 mm diameter with a wall thickness of 8 mm. Place posts into a 1500 mm foundation, fill with 20 Mpa concrete and round top. Project pipes 1500 mm above finished grade. Finish prime coat.

.2 Finish: Provide paint finish in accordance with Section 09 91 00, colour to be selected by Consultant.

.12 Vanity counter supports:

.1 Provide supports for vanity counters. Construct supports where indicated, conceal supports within cavity of drywall partition.

.2 Provide all drill holes required for concealed anchorage of counters and for anchoring to building structure.

.13 Bench Supports:

.1 Supply only, for installation under work of Section 06 20 00, bench supports constructed of steel plates of sizes noted. Provide supports at maximum 609 mm centres and not less than 152 mm from ends of bench run.

.2 Construct supports as detailed. Provide all drill holes required for concealed anchorage of wood bench and for anchoring to building structure.

.14 Miscellaneous steel brackets, supports and angles

.1 Supply and install or supply for installation by trades responsible, all loose steel brackets, supports and angles where indicated, except where such brackets, supports and angles are specified under work of other Sections. Drill for countersunk screws, expansion anchors and anchor bolts.

.2 Unless otherwise specified, prime paint for interior installation; galvanized finish for exterior installation.

2.4 STAINLESS STEEL WORK

.1 Take all necessary precautions to safeguard against latent surface discolouration due to disturbance of the natural protective oxide coating of the material or to contamination from other sources.

.2 Workmanship shall be the best standard practice for this type of work. Execute stainless steel work in accordance with the applicable instructions set forth in Atlas Stainless Steels' "Technical Data" handbook on stainless steel.

.3 Do all stainless steel fabrication in clean shops, located away from areas where carbon steel is burnt, ground, or cut with abrasive wheels to ensure that carbon steel dust will not be embedded into the stainless steel, and as follows:
- .1 In fabrication of stainless steel do not use tools and dies which have been used on carbon steels.
- .2 Ensure tools and dies use for forming and cutting stainless steel are free of nicks and other damage.
- .3 Do not use carbon grits and grinding wheels which will imbed foreign particles into stainless steel surfaces. Use only stainless steel wool when wool polishing is required.
- .4 Stainless steel items, on which rust stains appear, shall be replaced with new fabricated material.

2.5 ANCHORS AND FASTENING

.1 Use weld studs of size not larger than 10 mm for attaching miscellaneous materials and equipment to building steel. If weight of item requires larger fasteners use clips or brackets and secure by welding or through bolting.

.2 Use self drilling expansion type concrete anchors for attaching to masonry and concrete

.3 Do not secure items to steel deck.

.4 Use steel beam clamps of two bolt design to transmit load to beam web. Do not use C and I clamps.

2.6 WELDING

.1 Perform welding by electric arc process.

.2 Execute welding to avoid damage or distortion to Work. Execute welding in accordance with following standards:
- .1 CSA W48 - for Electrodes. If rods are used, only coated rods are allowed.
- .2 CSA W59-M and CSA W59S1-M for design of connections and workmanship.
- .3 CAN/CSA W117.2-M - for safety.

.3 Thoroughly clean welded joints and expose steel for a sufficient distance to perform welding operations. Finish welds smooth. Supply continuous and ground welds which will be exposed to view and finish paint.

.4 Test welds for conformance and remove work not meeting specified standards and replace to Consultant's acceptance.

2.7 SHOP PAINTING

.1 Clean steel to SSPC SP6 and remove loose mill scale, weld flux and splatter.

.2 Shop prime steel with one coat of primer paint to dry film thickness of 0.07 mm. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7 deg C. Paint items under cover and leave under cover until primer is dry. Follow paint manufacturer's recommendations regarding application methods, equipment, temperature, and humidity conditions.

.3 Shop prime galvanized steel in accordance with CGSB 85-GP-16M.

.4 Clean but do not paint surfaces being welded in field.

.5 Do not paint surfaces embedded in concrete, but clean as if they were to be primed.

.6 Do not prime steel to be fireproofed or to receive intumescent paint coating.

.7 Do not prime machine finished surfaces, but apply an effective anti-rust compound.

.8 Take precautions to avoid damage to adjacent surfaces.

2.8 **HOT DIP GALVANIZING**

.1 After fabrication, hot dip galvanize specific miscellaneous steel items as indicated. After galvanizing, plug relief vents air tight with appropriate aluminum plugs as suitable and required for intended metal fabricated item. Straighten shapes and assemblies true to line and plane after galvanizing. Repair damaged galvanized surfaces with zinc rich primer in accordance with manufacturer's printed directions.

.2 Hot-dip galvanize members in accordance with requirements of the following ASTM, with minimum coating weights or thicknesses as follows:

.1 Rolled, pressed and forged steel shapes, plates, bars and strips: ASTM A123; average weight of zinc coating per square/metre of actual surface, for 4.8 mm and less thickness members 600 g/m^2 for 6 mm and heavier members 640 g/m^2.

.2 Iron and steel hardware: ASTM A153; minimum weight of zinc coating, in ounces per square foot of surface, in accordance with ASTM A153,Table 1 for the various classes of materials used in the Work.

3 Execution

3.1 **EXAMINATION**

.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.

.2 Obtain Consultant's written approval prior to field cutting or altering of structural members.

3.2 **ERECTION**

.1 Install metal fabrications in accordance with reviewed shop drawings and manufacturer's written instructions.

.2 Fit joints and intersecting members accurately. Make work in true planes with adequate fastenings. 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 Perform drilling of concrete and steel as required to fasten work of this Section.

3.3 **TOUCH UPS**

.1 Paint bolt heads, washers, nuts, field welds and previously unpainted items. Touch up shop primer damaged during transit and installation, with primer to match shop primer.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Labour, Products, equipment and services necessary for rough carpentry work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 ASTM A153, Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.2 ASTM A325, Specification for Bolts Quenched/Tempered Steel Nominal Thread Diameter M16 - M36 For Structural Steel Joints.

.3 ASTM A653, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.4 ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials.

.5 ASTM F1667, Driven Fasteners: Nails, Spikes and Staples.

.6 CAN/CSA O80 Series M, Wood Preservation.

.7 CSA O121-M, Douglas Fir Plywood.

.8 CAN/CSA O141, Softwood Lumber.

.9 CSA O151-M, Canadian Softwood Plywood.

.10 CWC, Canadian Wood Council, Wood Reference Book.

.11 NLGA, Standard Grading Rules for Canadian Lumber, National Lumber Grades Authority

1.3 **QUALITY ASSURANCE**

.1 Lumber identification: Grade stamp of an agency certified by the Canadian Lumber Standards Accreditation Board.

.2 Plywood identification: Grade mark in accordance with applicable CSA standards.

.3 Lumber quality: Carefully select individual pieces so that knots and obvious defects will not interfere with placing bolts, proper nailing or making proper connections.

.4 Moisture Content of wood at time of construction shall be 19% maximum.

.5 Each piece of pressure treated lumber and fire retardant treated lumber shall be shop marked with the pressure treatment brand and ULC monogram respectively, in accordance with CAN/CSA O80-M.

6. Dimensions of lumber shall conform to dressed sizes specified in CAN/CSA-0141 unless actual dimensions are otherwise indicated or specified.

7. Dimensional references to lumber on Drawings and in Specifications are to nominal sizes unless actual dimensions are indicated. Such actual dimensions shall be dry size.

.8 Lumber defects: Discard wood with defects which will render a piece unable to serve its intended function. Lumber will be rejected by Consultant for excessive warp, twist, bow, crook, mildew, fungus, or mould, as well as for improper cutting and fitting, whether or not it has been installed.

1.4 ENVIRONMENTAL REQUIREMENTS

1. When it is required that wood maintain dimensional stability and tolerances to ensure accurate installation of later work, store and install it only in dry areas, and where no further installation of moist materials is contemplated.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

.1 Store materials in a dry area. Cover materials with tarpaulins or polyethylene sheets to prevent moisture absorption and impairment of structural and aesthetic properties. Vent to allow air movement. Tie covering to keep in place.

2 Products

2.1 MATERIALS

.1 General: All materials under work of this Section, including but not limited to, adhesives are to have low VOC content limits.

.2 Lumber: Softwood, G4S, moisture content 19% or less at time of installation, in accordance with the following:
- .1 Lumber shall be of same species and grade, equally seasoned and shall be processed and stamped at same mill.
- .2 CSA O141 and NLGA Standard Grading Rules for Canadian Lumber.
- .3 Board quality: Construction or better.
- .4 Dimension quality:
  - .1 Structural joists, planks, and framing: No. 1 Select Structural.
  - .2 Light framing: Construction.

.3 Plywood: CSA O121-M, G1S, T & G, standard construction, laminated with waterproof adhesive, exterior grade, Thickness as indicated on drawings.

4. Sheathing: Douglas Fir, CSA 0121-M or CSA O151-M; Select-Tight Face, exterior grade, T & G.

.5 Roof lumber: NLGA, Construction grade light framing, Jack Pine, S4S, pressure treated to CAN/CSA-O80 series using copper based waterborne preservative treatment, impregnated to a net retention of 4 kg/ m^3 of preservative unless otherwise specified by preservative manufacturer.

.6 Wood polymer lumber: Fabricated lumber constructed from 50% recycled wood fibre and 50% reclaimed polyethylene. Colour: To be selected by Consultant. 'Trex Wood Polymer Lumber' manufactured by Trex Company and distributed by Taiga Forest Products or approved alternative.

.7 Surface applied wood preservative: Green coloured copper napthenate or 5% pentachlorophenol solution, water repellant preservative or same copper based preservative as used for shop impregnation, in accordance with CAN/CSA O80.

.8 Fire retardant treatment of lumber and plywood (interior and protected locations): 'Dricon FRT' fire retardant treatment by Biewer Lumber or approved alternative, conforming to ASTM E84, to provide a flame spread rating of 25 or less.

.9 Rough hardware: Conforming to ASTM F1667; Nails, bolts, screws, anchors, expansion shields, and other fastenings required to frame and fix rough carpentry as follows:
- .1 Nails, spikes and staples: Spiral type.
- .2 Bolts: ASTM A325; 12.7 mm diameter minimum with nuts and washers unless noted otherwise.
- .3 Screws: Countersunk head, full thread type.
- .4 Proprietary fasteners: Toggle bolts, expansion shields, lag bolts, screws, inorganic fibre plugs, recommended for purpose by manufacturer.
- .5 Galvanize rough hardware used in fire treated wood and hardware exposed to the atmosphere.

.10 Fasteners for use in pressure treated wood: Provide hot dipped galvanized fasteners complying to ASTM A153 and connectors in accordance with ASTM A653, Class G185 for non-structural members. Provide type 304 or 316 stainless steel fasteners and connectors for use in Structural, pressure treated wood.

3 Execution

3.1 EXAMINATION

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of work of this Section means acceptance of existing conditions.

3.2 **GENERAL**

.1 Lay out work carefully and to accommodate work of others. Cut and fit accurately: erect in position indicated by Drawings.

.2 Install rough carpentry to allow for expansion and contraction of the materials.

.3 Cut work into lengths as long as practicable and with square ends. Align, level, square, plumb, and secure work permanently in place. Brace work temporarily as required. Join work only over solid backing.

.4 Bore holes true to line and to same size as bolts. Drive bolts into place for snug fit, and use plates or washers for bolthead and nut bearings. Turn up bolts and lag screws tightly when installed, and again just before concealed by other work or at completion of Work.

.5 Provide anchors, bolts, and inserts required for attachment of the work of this Section, to those performing the work of other Sections and who are responsible for their installation.

.6 Do not attach work by wood plugs or blocking in concrete or masonry. Use lead shields, expansion shields, or similar methods only as approved by Consultant.

3.3 **MISCELLANEOUS WOODWORK**

.1 Fit and install wood furring, strapping, grounds and blocking. Adequately size, correctly place and conceal members for finishes, fitments and for work under other Sections. Do not assume that Drawings show required work exactly or completely. Anchor wood members securely in place.

.2 Install rough bucks, nailing strips and linings to rough openings as required for backing for frames and other work.

.3 Except where steel supports are specifically shown, provide wood blocking and supports in metal stud partitions for fastening of item such as casework and other wall mounted accessories. Have respective trades approve the location of such wood blocking.

.4 Bolt wood blocking or nailing strips to steel framing.

.5 Align and plumb faces of furring and blocking to tolerance of 1:600.

.6 Use fire retardant lumber for blocking/framing in ceiling\ spaces, partitions and bulkheads.

.7 Wood Privacy Screen:

.1 Use pressure treated wood with hot dipped galvanized connectors, nails and bolts. Finish wood in accordance with Section 09 91 00.

.2 Coat wood below grade with two coats of Creosote unless indicated otherwise by Consultant.

.3 Install screen in sizes shown on Contract Drawings.

3.4 POLYMER LUMBER CONSTRUCTION

.1 Construct polymer lumber where indicated on drawings.

.2 Cut and pre-drill all wood polymer boards using carbide tipped equipment.

.3 Gapping: gap polymer lumber end to end with a 1.6 mm gap for every 20°F of difference between installation temperature and the hottest temperature expected. Gap width to width with a minimum 3 mm gap.

.4 Install polymer boards as recommended by manufacturer for summer or winter installations.

3.5 ROOF WOODWORK

.1 Install roof woodwork as indicated on drawings.

.2 Fasten roof woodwork at maximum 400 mm o.c. in staggered pattern unless noted otherwise.

3.6 BACKBOARDS

.1 Install plywood backboards, primed and painted white on both sides, with fire retardant paint.

.2 Use minimum 19 mm thick plywood on 19 x 38 mm furring around perimeter and at maximum 300 mm intermediate spacing.

3.7 FASTENERS

.1 Frame, anchor, fasten, tie and brace members for required strength and rigidity.

.2 Use hot dipped galvanized fasteners for exterior work and work below grade.

.3 Countersink bolts and bolt heads as required for clearance of other work.

.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.

.5 For plywood use spiral, annular or resin coated nails and staples.

3.8 SURFACE-APPLIED WOOD PRESERVATIVE

.1 Treat raw surfaces, drilled holes and cut ends of pressure treated wood with 2 coats of wood preservative immediately after cutting.

.2 Apply preservative by dipping, by brush or by pouring into plugged holes to completely saturate surface.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Labour, Products equipment and services necessary for the finish carpentry work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 ANSI A208.1, Particleboard.

.2 ANSI/HPVA HP-1, Hardwood and Decorative Plywood.

.3 ANSI/NEMA LD 3, High-Pressure Decorative Laminates.

.4 APA - The Engineered Wood Association.

.5 ASTM F1667, Driven Fasteners: Nails, Spikes and Staples.

.6 Architectural Woodwork Manufacturers Association of Canada (AWMAC).

.7 North American Architectural Woodwork Standards (NAAWS).

.8 CAN/CSA O141, Softwood Lumber.

.9 CSA O151-M, Canadian Softwood Plywood.

.10 National Hardwood Lumber Association (NHLA) Rules for the Measurement and Inspection of Hardwood and Cypress.

.11 National Lumber Grades Authority (NLGA) Standard Grading Rules for Canadian Lumber.

1.3 **SUBMITTALS**

.1 Shop drawings: Submit shop drawings of finish carpentry work in accordance with Section 01 30 00 indicating:
  .1 Materials, thicknesses, sizes, finishes, wood species, grades, profiles, connection attachments, shop jointing, field jointing, reinforcing, anchorage, fastener types and sizes, location of exposed fastenings, mechanical and electrical service routes, service outlets, cutout locations, and sizes.
  .2 Include erection drawings, plans, elevations, sections, and details as applicable.

.2 Samples: Submit samples of the following in accordance with the requirements of Section 01 30 00:
- .1 Two representative pieces of each type of wood to receive a stained or natural finish.
- .2 Two representative pieces of each type of wood finished as specified.
- .3 Two of each colour, pattern, gloss, and texture of plastic laminate, in manufacturer's standard tag size.
- .4 Two samples of laminated plastic joints, edging, cutouts and postformed profiles.
- .5 Two of each solid surface, in 100 x 75 x 12 mm samples.
- .6 Two samples of melamine surfaced board, edging and postformed profiles.
- .7 One of each item of finish carpentry hardware.

.3 Extended warranty: Submit extended warranty signed and registered by the manufacturer providing the warranty in the name of the Owner for the timeframe and coverage specified in this Section.

1.4 QUALITY ASSURANCE

.1 Execute work of this Section by member of AWMAC, with 5 years experience in finish carpentry work of comparable complexity and scope. Submit proof of experience upon Consultant’s request.

.2 Fabricate finish carpentry work in accordance with NAAWS, Premium Quality materials and installation unless otherwise indicated. Perform work in accordance with the definition of Good Workmanship as defined in the NAAWS.

.3 Remove and replace finish carpentry work which does not conform to the NAAWS or as amended by these Specifications.

.4 Mock-up:
- .1 Shop fabricate one mock-up of a base cabinet, wall cabinet, and counter top for each type of surfacing specified, complete with hardware and shop applied finishes, installed in location acceptable to Consultant.
- .2 Arrange for Consultant's review and acceptance, allow 48 hours after acceptance before proceeding with work.
- .3 When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of Work if accepted by Consultant. Remove and dispose of mock-ups which do not form part of Work.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, and handle finish carpentry in accordance with the NAAWS. Control the temperature and humidity in accordance with the NAAWS recommendations, before, during, and after finish carpentry delivery, and also during storage and installation.

.2 Cover finished plastic laminated work with heavy kraft paper or put in cartons during shipment. Protect installed surfaces by approved means. Do not remove until immediately before final inspection.

1.6 **EXTENDED WARRANTY**

.1 Submit an extended warranty for plastic laminate work of this Section in accordance with General Conditions, except that warranty period is extended to 2 years from date of Substantial Performance of the Work.
- .1 Warrant against defects in material and workmanship including but not limited to opening of joints, cracking, shrinkage, warpage, and delamination of plastic laminate.
- .2 Coverage: Complete replacement including affected adjacent Work.

2 Products

2.1 **MATERIALS**

.1 General: All materials under work of this Section, including but not limited to, adhesives and mastics, are to have low VOC content limits.

.2 Concealed framing lumber: Eastern Spruce, Balsam Fir, or Jack Pine, to CAN/CSA O141, NLGA, and NAAWS Custom Grade, S4S, average moisture content 7% +/- 2% at installation.

.3 Hardwood lumber (WD-1): Plain sliced grade A to NHLA and AWS Premium Grade, S4S, average moisture content 7% +/- 2% at installation. Provide the following wood species where required:
- .1 Eastern white Cedar.
- .2 Refer to Colour and Material Schedule.

.4 Hardwood Plywood (for cabinet frames, stretchers and blocking): Graded in accordance with AWMAC/AWI; average moisture content of 6-8 percent; species and grade as follows:
- .1 Shop sanded veneer core Maple plywood, 19 mm or 25 mm thickness.

.5 Softwood plywood for drawer body construction: Maple veneer core plywood (all laminations Maple veneer), interior grade plywood, G2S, sanded
- .1 Quality Standard: GOST 3916.1 (Russian), Veneer Grade: BB/BB;
- .2 Thicknesses: 12 mm (nine laminations) and 15 mm (eleven laminations)

.6 Hardwood veneer:
- .1 Maple unless otherwise indicated, conforming to ANSI/HPVA HP-1 having finishes and meeting grades as follows:
  - .1 Transparent finish, Grade AA.
- .2 Face veneer cut: Rotary cut.
- .3 Sizes, thickness, and shapes as indicated.

.7 Shelving: 19 mm thickness for spans up to 700 mm, 25 mm thickness for longer spans, Maple hardwood core veneers, with hardwood veneer edge banding.

.8 Cabinet Backs: Particle board core.

.9 Plastic laminate (PL-#): Provide plastic laminates conforming to ANSI/NEMA LD 3 as follows:
- .1 Flatwork face sheet: 1.2 mm thick, heavy wear resistance.
- .2 Vertical interior face sheets: 0.8 mm thick.
- .3 Postformed face sheet: 0.8 mm thick.
- .4 Backing sheet: thickness to match face sheet, high pressure laminate, manufactured by same manufacturer as face sheet.
- .5 Plastic laminate: As manufactured by Arborite, Formica, Lamin-Art, and Lamitech HPL (Weston Premium Woods) and Wilsonart.
- .6 Colours: Refer to Colour and Material Schedule.

.10 Compact laminate:
- .1 Provide compact laminates conforming to NEMA LD3, Grade GCS, 12 mm thick, consisting of multiple resin-impregnated kraft paper core with colour and clear melamine surface sheets, fused at high temperature.
- .2 Size: Refer to Drawing for sizes of each panels.
- .3 Finish: Solid colour with matte finish to be later selected by Consultant.
- .4 Compact laminate manufacturer: Formica, Wilsonart or approved alternative.

11. Melamine Surfaced Particleboard: ANSI A208.1, Grade M2 particleboard with a melamine impregnated decorative paper thermofused onto the surface. Edging to be done in minimum 0.5 mm thin PVC to match melamine colour. Refer to Colour and Material Schedule for melamine type.

.12 Particle board core (for cabinet door and drawer fronts): ANSI A208.1, Grade M2 of thickness indicated. Particleboard to be bound with waterproof adhesive and meeting the following minimum criteria:
- .1 Density: minimum 705 kg/m^3.
- .2 Internal bond: 0.45 N/mm^2.
- .3 Modulus of rupture: 14.5 N/mm^2.
- .4 Modulus of elasticity: 2250 N/mm^2.
- .5 Face screw holding: 1000 N.
- .6 Edge screw holding: 900 N.

.13 Tall Storage Units: 45 mm solid core wood doors with matching stiles. Doors to be installed on 38 mm x 45 mm solid hardwood rails. Rails to be rabbeted and glued to gables.

.14 Laminating adhesive: CSA O112 Series, water resistant type, low VOC content, selected by laminate manufacturer for intended end use.

.15 Engineered quartz countertop (QTZ-1): 93% crushed quartz combined with polyester resins and pigments formed into minimum 20 mm thick dense non-porous slabs with polished finish. Refer to Colour and Material Schedule for quartz colour and type.

.16 Solid Surfacing (SPS-1):
- .1 12 mm thick sheet stock, provide with bullnose edge and all cutouts as required. 'Avonite' solid surfacing or approved alternative. Refer to Colour and Material Schedule for colour type.
- .2 Installation and seam adhesives to be as recommended by solid surfacing manufacturer, colour matched to solid surfacing.

.17 Wood benches: Refer to Colour and Material Schedule for wood type in sizes and thickness shown on drawings.

.18 Draw bolts and splines: Type as recommended by fabricator.

.19 Nails and staples: Conforming to ASTM F1667; Size and type to suit application, galvanized for exterior work, interior humid areas and for treated lumber; plain finish elsewhere.

.20 Bolts, nuts, washers, blind fasteners, lags and screws: Size and type to suit application. Stapling is not acceptable.

.21 Adhesive and bituminous mastic: Selected by the millwork fabricator with low VOC content.

.22 Miscellaneous metals: In accordance with Section 05 50 00.

.23 Finishing: In accordance with Section 09 91 00.

2.2 HARDWARE

.1 The following hardware is the minimum quality standard for the work of this Section. Alternatives may be considered provided they are approved by Consultant prior to ordering of products.

.2 19 mm Door Hinges: Blum Press–In 170 degree self close full overlay or Salice equivalent. Hinges to be provided with factory installed knock in dowels. For quantity of hinges required per door, refer to hinge manufacturer's manual. Wood screw fastening system will not be accepted.

.3 19 mm Door Hinge Plates: One piece plate with min. 3 mm height adjustment. Hinge plates to be installed using pre-mounted system screws, Euro screw in 5mm pre-drilled hole. Wood screw fastening system will not be accepted.

.4 19 mm Door Dampener: Blumotion 971A with Cruciform Base or Salice equivalent required for all 19mm doors to allow for soft closing.

.5 19 mm Bumpers: Polyurethane 3 mm high X 10 mm diameter / minimum 2 per door and drawer front.

.6 Shelf Standards and Clips: KV 255 pilaster and KV 256 clip – satin nickel finish / Note: Pilasters to be fully recessed into gables.

.7 Drawer and cabinet pulls (H-#): Refer to Colour and Material Schedule.

.8 Coat Rods and Flanges: Richelieu # 122108140 and 1225140.

.9 Coat Hooks in Occasional Staff Lockers: '307 C26D' by GSH.

.10 Elbow catches: Richelieu Heavy Duty Elbow Catch # 5540180 / nickel finish / required at all two door units.

.11 Drawer Slides: Accuride 45 kg (100 lbs) #3832EC x length to suit. Finish C - Clear Electroplating.

.12 Locks:
- .1 Cam locks/deadbolt locks complete with lock core by Hafele, type to suit application and installation.
- .2 Each room to be keyed alike.
- .3 Tall storage unit door hinges and locksets, to be supplied by Hardware Supplier, installed by cabinet manufacturer.
- .4 All cabinet doors and drawers to be lockable. Provide three keys per key code and five master keys.

.13 Castors: 50 mm, general duty rubber swivel caster with brake and 57 kg (125 lb) weight capacity, 'Model F25086' by Richelieu.

.14 Safety release coat hook: High strength polycarbonate, screw mounted; Henkelhook.

2.3 PLASTIC LAMINATE WORK

.1 Perform plastic laminate Work in accordance with AWS Quality Standards and ANSI/NEMA LD 3.

.2 Ensure adjacent parts of continuous laminate work match in colour and pattern.

.3 Laminate plastic laminates to core materials in accordance with manufacturer's instructions.

.4 Fabricate core surfaces and profiles with continuous support and bond over entire surface to receive plastic laminate.

.5 Apply plastic laminate backing sheets to balance shrinkage stresses induced by plastic laminate face sheets.

.6 Minimize joints in plastic laminate Work; do not install joints in plastic laminate Work in less than 2400 mm o.c. Locate joints minimum 610 mm from cut-outs. Offset core and plastic laminate facing joints.

.7 Form shaped profiles and bends as indicated, using postformed grade laminate to laminate manufacturer's instructions.

.8 Use straight self-edging laminate strip to match adjacent colour, finish, gloss, and pattern to cover exposed edge of core material. Chamfer exposed edges uniformly at approximately 20 degrees. Do not mitre laminate edges.

.9 Apply laminated plastic liner sheet to interior of cabinetry and where indicated.

.10 Fabricate units by solid surfacing manufacturer's certified or approved fabricator/ installer. Fabricate built-up profiles as indicated.

2.4 **COMPACT LAMINATE WORK**

.1 Perform compact laminate Work in accordance with AWS Quality Standards and ANSI/NEMA LD 3.

.2 Ensure adjacent parts of continuous laminate work match in colour and pattern.

.3 Fabricate compact laminates to core materials in accordance with manufacturer's instructions. Refer to Drawings for location of panels.

.4 Fabricate bed frame and any additional items indicated on Drawings to be 12 mm thick compact laminate panels. Multiple resin-impregnated kraft and surface sheets shall be fused at high temperature and pressure with all edges finished and polished.

.5 Avoid stress cracking, do not use square-cut inside corners. All inside corners to have a minimum 3 mm radius and all edges routed smooth unless indicated otherwise by consultant.

.6 All corners shall be mitered. Both panels shall have reveal on inside corner to accommodate structural adhesive with metal spline.

.7 All fasteners shall be countersunk, complete with plug made flush with panel.

.8 Fabricate core surfaces and profiles with continuous support and bond over entire surface to receive compact laminate.

.9 Joints:
- .1 Install joints in accordance with reviewed shop drawings and manufacturer written instructions.
- .2 Jointing shall be placed at logical locations in intended millwork item and shall meet the overall aesthetic intent of the Consultant.
- .3 Minimize joints in laminate work.

.10 Form shaped profiles and bends as indicated, using postformed grade laminate to laminate manufacturer's instructions.

.11 Fabricate units by manufacturer's certified or approved fabricator/ installer. Fabricate built-up profiles as indicated.

2.5 **FABRICATION**

.1 Be responsible for methods of construction and for ensuring that materials are rigidly and securely attached and will not be loosened by the work of other sections.

.2 Coordinate locations of concealed supports and blocking with other parts of Work. Provide cutouts for outlet boxes and other fixtures.

.3 Fabricate work in a manner which will permit expansion and contraction of the materials without visible open joints. Conceal joints and connections in wherever possible.

.4 Set nails and countersink screws, apply wood filler to indentations, sand smooth and leave ready to receive finish.

.5 Mitre exposed corners, no end grain shall be visible in completed installation.

.6 Finish millwork in accordance with Section 09 91 00. Finished millwork shall be free from bruises, blemishes, mineral marks, knots, shakes and other defects and shall be selected for uniformity of colour, grain and texture.

.7 Shop assemble finish carpentry to accommodate delivery and handling and to ensure passage through building openings.

.8 Shop install cabinet hardware for doors, shelves and drawers. Recess shelf standards unless noted otherwise.

.9 Fabricate sills, screens, frames and moldings to profiles shown.

.10 Countertops:

- .1 Core material shall be 19 mm thick particleboard with the exception of window stools and countertops with sinks installed, these shall be plywood core.
- .2 Use draw bolts and splines in countertop joints. Maximum spacing 450 mm a.c., 76mm from edges.
- .3 Veneer laminated plastic to core material in accordance with adhesive manufacturer's instructions. Ensure core and laminate profiles coincide to provide continuous support and bond over entire surface. Use continuous lengths up to 3050 mm.
- .4 Keep laminate joints 305 mm from sink cutouts. Obtain Consultant's approval for locations of all laminate joints in counter tops prior to fabrication .
- .5 Make joints where approved to hairline width. Offset joints in plastic laminate from joints in substrate.
- .6 Provide cutouts as required for inserts, grilles, outlet boxes and other fixtures. Radius internal corners, chamfer laminate edges, and apply uncut shellac sealer to exposed edges of substrate at all cutouts.
- .7 Nosing: 32 mm x 3 mm PVC edge band.
- .8 Backsplash: square-edged, as detailed on the drawings.

2.6 CABINET FABRICATION

.1 General:
- .1 Cabinet Components: As specified in AWMAC QSI Section 400-G as amended by the following requirements;
- .2 Hardware: Supply hinges, drawer slides, products and materials as specified.
- .3 Door and Drawer Fronts: Particle board core.
- .4 Cabinet Boxes: Particle board core.
- .5 Rails, Toe Kicks and Cabinet Bases: Hardwood veneer core.
- .6 Backs: Particle board core.
- .7 Blocking: Solid lumber.
- .8 Provide Semi-Exposed surfaces in same quality and finish as Exposed parts.
- .9 Adjustable Shelf Techniques/Supports: AWMAC QSI 400B-T-9;
  - .1 Custom Grade: Adjustable shelf multiple holes (min. 5 mm diameter, single pin).
- .10 Joinery of case body members: AWMAC QSI 400B-T-10, stop-dado joints which are glued and mechanically fastened with screws.
- .11 All cabinets provided for this project shall meet or exceed the Custom requirements of AWMAC QSI 400-B-C-1 thru 6.

.2 Wood Cabinet Construction: AWMAC QSI Section 400-G-7 (A), flush overlay style, Custom Grade as amended by the following requirements;
- .1 Exposed and Semi-Exposed Parts (except countertops): Particle board core, minimum 19 mm thick with thermoset melamine.
- .2 Exposed and Semi-Exposed Parts - panel edge band: lapped joint; hardwood veneer edge banding to match exposed parts.

.3 Wall Cabinets: Finish to match base cabinets.
- .1 Provide top and bottom filler and corner panels.
- .2 Provide scribes and fillers with maximum 25 mm exposed dimension.
- .3 Underside of Cabinets: Type 'B' flush (one tight line visible).
- .4 Cabinet backs: Wall hung cabinet backs must not be relied upon to support the full weight of the cabinet and its anticipated locad for hanging/mounting purposes. Method of back joinery and hanging/mounting mechanisms should transer the load to case body members.

.4 Shelving: AWMAC QSI 400B-T-9 Premium Grade, as amended by the following:
- .1 Construction:
  - .1 Multiple hole configuration at 32 mm on centre, 'System 32'.
  - .2 Hardwood veneer on tops and bottoms and hardwood veneer edge banding on exposed edges to match exposed parts.
  - .3 Core: Particle board core, 19 mm thickness up to 700 mm spans, 25 mm thickness for spans greater than 700 mm.
- .2 Provide adjustable shelves in all cabinets.

.5 Wood doors at folding grille: 19 mm hardwood plywood with hardwood veneer, 3800 mm high x 310 wide. Provide cam lock and hinges to suit.

3 Execution

3.1 **INSTALLATION**

.1 Install Work in accordance with AWS Quality Standards and tolerances for Architectural Woodwork. Set and secure finish carpentry in place, rigid, plumb, square, and level.

.2 Scribe and cut as required, fit to abutting walls, and surfaces, fit properly into recesses and to accommodate columns, fixtures, outlets, or other projecting, intersecting or penetrating objects leaving a 0.8 mm gap maximum.

.3 Coordinate cutouts for plumbing fixtures, inserts, appliances, outlet boxes, and other fixtures, in finish carpentry. Round internal corners of cut-outs and seal exposed cores.

.4 Form joints to conceal shrinkage.

.5 Install draw bolts and splines in laminated plastic counter top joints at maximum spacing 450 mm o.c., and 75 mm from edge. Make joints flush, hairline butt joints.

.6 Install finishing hardware accurately and securely in accordance with manufacturer's directions, adjust and clean.

.7 Install prefinished millwork at locations shown on drawings. Position accurately, level, plumb straight.

.8 Apply bituminous coating over wood framing members in contact with masonry or cementitious construction.

.9 Melamine panels: Assemble melamine millwork using dowelled/wafered-and-glue construction. Installed melamine panels shall not show any exposed fasteners on finished/exposed surfaces.

.10 Solid surfacing:
- .1 Install solid surfacing in accordance with manufacturer's instructions.
- .2 Align work plumb and level.
- .3 Seal perimeter of fabrication to adjacent construction in accordance with Section 07 92 00.

.11 Stone countertops:
- .1 Construct countertops of sizes and details as noted.
- .2 Distribute stone units of ranging colour or texture evenly over the entire installation to avoid patches or streaks, to produce a homogeneous blending of all units. If an acceptable pattern or grain direction is apparent, due to natural appearance of stone, or finishing, install units so that pattern or grain is in one direction unless otherwise directed.
- .3 Clean stone exposed surfaces by washing with stiff fibre brush and clean water. Drench dry stones with clean water just before setting.

.4 Accurately and neatly cut, drill and fit stone as required for fixtures, fittings, and other appurtenances abutting or extending through stone and repair all stone after other Sections have finished.

.5 In cutting and fitting, the edges shall be carefully cut and ground to a perfect fit and all cutting shall be done in such a manner as not to impair the strength or appearance of the material.

.6 Apply grout in accordance with grout manufacturer's directions to produce watertight, filled joints without voids, cracks and excess grout.

.7 Apply 2 coats of stone sealer to all stonework in accordance with manufacturer's written instructions.

.12 Hardwood caps:

.1 Provide 13 mm thick plywood blocking mechanically fastened and glued to masonry with hardwood trim in reveal.

.2 Install 38 x 190 mm hardwood cap with rounded exposed edges and ends, glued and mechanically fastened to wood blocking with countersunk fasteners complete with plugs.

.13 Benches/Storage cubicles:

.1 Install 400 mm deep cubicles with vertical divisions as indicated on drawings.

.2 Mechanically fasten to substrate with blocking and countersunk/plugged fasteners.

.3 Construct wood benches of sizes and details as noted.

.4 Anchor wood to supports in a concealed manner.

.5 Mitre joints at corners. Keep joints to a minimum.

.6 Round all corners, edges and ends.

.7 Install bench brackets and supports supplied under work of Section 05 50 00.

.14 Fastening:

.1 Coordinate wall securement, anchorage, and blocking for finish carpentry items.

.2 Position items of finished carpentry work accurately, level, plumb, true and fasten or anchor securely.

.3 Design and select fasteners to suit size and nature of components being joined. Use proprietary devices as recommended by manufacturer.

.4 Provide heavy duty fixture attachments for wall mounted cabinets.

.5 Set finishing nails to receive filler. Where screws are used to secure members, countersink screw in round cleanly cut hole and plug with wood plug to match material being secured.

.15 Remove and replace damaged, marked, or stained finish carpentry.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Labour, Products, equipment and services necessary for the dampproofing work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 ASTM D41/D41M, Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.

.2 ASTM D4479/D4479M, Specification for Asphalt Roof Coatings, Asbestos Free.

1.3 **SUBMITTALS**

.1 Product data:
  .1 Submit manufacturer's Product data in accordance with Section 01 30 00 for each Product indicating:
    .1 Installation details, physical properties and detailed application and installation instructions, marked as applicable to Work.

.2 Certificates:
  .1 Submit manufacturer's certification stating compliance with criteria specified and that Products are compatible.

1.4 **QUALITY ASSURANCE**

.1 Installer's qualifications: Perform work of this Section by company approved by Product manufacturer and having 5 years recent experience in work of comparable complexity and scope.

1.5 **SITE CONDITIONS**

.1 Do not proceed with work when wind chill effect causes Product to set before correct curing takes place.

.2 Supply and install temporary protection and heating to maintain air temperature and structural base temperature at dampproofing installation area above 5 °C for 24 h before, during and 24 h after installation.

.3 Do not apply dampproofing in wet weather.

.4 Supply and install forced air circulation during installation and curing periods for enclosed applications.

2 Products

2.1 **MATERIALS**

.1 All materials under work of this Section, including but not limited to, primers are to have low VOC content limits.

.2 Primer: Penetrating asphalt primer to ASTM D41, Type 2; ‘HE910' by Henry Company Canada Inc. or ‘600 Asphalt Primer’ by W. R. Meadows.

.3 Dampproofing: Cold applied, solvent based, asphalt dampproofing to ASTM D4479, Type 1; ‘710-11' by Henry Company Canada Inc. or ‘501 Foundation Coating’ by W. R. Meadows.

.4 Sealing compound: Polymer modified sealing compound; ‘Polybitume 570-05' by Henry Company Canada Inc. or approved alternative by W. R. Meadows.

.5 Reinforcing fabric: Open weave, glass fibre reinforcing consisting of glass fibre yarn saturated with synthetic resins; 990-06 Yellow Jacket by Henry Company Canada Inc. or approved alternative by W. R. Meadows.

3 Execution

3.1 **EXAMINATION**

.1 Verify condition of previously installed Work upon which this Section depends. Report defects to Engineer. Commencement of work of this Section means acceptance of existing conditions.

.2 Ensure that surfaces of concrete are dry and in accordance with manufacturer's instructions before applying dampproofing material.

3.2 **PREPARATION**

.1 Seal exterior joints between foundation walls and footings, cracks in foundation walls, and around penetrations through dampproofing with sealing compound. Apply sealing compound in accordance with manufacturer's instructions.

.2 Prime substrates to be dampproofed in accordance with manufacturer's instructions.

3.3 **APPLICATION**

.1 Apply dampproofing in accordance with manufacturer's instructions.

.2 Seal exterior joints between foundation walls and footings with sealing compound before applying dampproofing.

.3 Apply dampproofing in continuous, uniform coating to exterior side of foundation walls enclosing rooms below finished grade. Dampproof from 50 mm below finished grade level to and including tops of foundation walls and footings. Include exterior backfilled portion of interior walls where floors in adjacent rooms are at different elevations.

.4 Brush reinforcing fabric into place overlapping fabric 50 mm at all joints with a soft bristle brush, eliminating wrinkles, air pockets or blisters and ensuring full contact.

.5 Apply two additional coats of dampproofing and two layers of reinforcing fabric to vertical corners and construction joints for minimum width of 230 mm on each side, around penetrations and along pipes passing through walls for minimum of 230 mm.

.6 Apply a seal coat of dampproofing over entire area at minimum 1 l/m^2

3.4 **CLEAN-UP**

.1 Clean, repair, or replace surfaces soiled or otherwise damaged in connection with work of this Section as directed by Engineer. Replace finishes or materials that cannot be cleaned to acceptance of Engineer.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Labour, Products, equipment and services necessary for the thermal insulation work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 ASTM C665, Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

.2 CGSB 71-GP-24M, Flexible Adhesive for Bonding Cellular Polystyrene Insulation.

.3 CAN/ULC-S701, Thermal Insulation, Polystyrene, Boards and Pipe Covering.

.4 CAN/ULC-S702, Mineral Fibre Thermal Insulation for Buildings.

1.3 **SUBMITTALS**

.1 Product data: Submit manufacturer's Product data in accordance with Section 01 30 00 indicating characteristics, performance criteria, and limitations. Indicate installation requirements and techniques, storage, and handling criteria and installation procedure acceptable to manufacturer.

.2 Certification: Submit installer's certification verifying compliance with specification requirements.

1.4 **QUALITY ASSURANCE**

.1 Qualifications: Execute work of this Section by company specializing in thermal insulation work with minimum of three years, recent, documented experience, on work of comparable complexity and scope.

2 Products

2.1 **MATERIALS**

.1 All materials under work of this Section, including but not limited to, adhesives are to have low VOC content limits.

2. Batt insulation:
   .1 Batt insulation (non-rated): CAN/ULC-S702, Type 1, friction fit; ‘Unfaced Thermal and Sound Control Batts’ by Johns Manville, ‘EcoTouch Pink Fiberglas Insulation’ by Owens Corning Canada or ‘ComfortBatt’ by Rockwool.

.2 Batt insulation (fire-rated/acoustic): ASTM C665, Paperless, semi-rigid, spun stone wool fibre mats, of thickness as indicated on Contract Drawings, 'MinWool SAFB' by Johns Manville, 'SAFB Thermafiber' by Owens Corning Inc. or 'Rockwool AFB' by Rockwool.

.3 Cavity wall insulation (masonry cavity walls): Sprayed applied polyurethane, refer to Section 07 21 19.

.4 Below grade insulation: CAN/ULC-S701, Type 4; Minimum RSI of 0.87, Extruded polystyrene, ship-lapped edges. Thickness: As indicated on Drawings.
.1 'Styrofoam SM' by Dupont de Nemours Inc.
.2 'Foamular C-300' by Owens Corning Canada Inc.

.5 Above grade insulation (not in cavity wall): CAN/ULC-S701, Type 3; Extruded polystyrene, square edges. Thickness: As indicated on Drawings.

.6 Under slab insulation: Closed cell extruded polystyrene sheets in thickness as indicated on drawings. Insulation to have a compressive strength of 690 kPa. PERIMATE (XPS) by Dupont de Nemours Inc. or 'Foamular 1000' by Owens Corning Canada Inc.

.7 Adhesive for polystyrene insulation: CGSB 71-GP-24M, Type 2, Class A, and approved by air/vapour barrier manufacturer when adhesive is in direct contact with air/vapour barrier membrane.

3 Execution

3.1 **EXAMINATION**

.1 Verify condition of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of work of this Section means acceptance of existing conditions.

.2 Ensure substrate surfaces are dry, clean, suitable to receive adhesive and free from other deleterious substances.

3.2 **INSTALLATION**

.1 Install thermal insulation in longest panel sizes possible in accordance with manufacturer's instructions.

.2 Butt insulation with moderate contact and, cut and fit them tightly around other construction elements. Offset single layer vertical joints and both vertical and horizontal joints in multiple layer applications.,

.3 Make thermal insulation continuous, maintain thermal protection continuity and secure to prevent displacement. Ensure that insulation is tight to substrate without air gaps.

.4 Cut and fit thermal insulation tightly around electrical boxes, plumbing and heating pipes and ducts, exterior doors and windows, and other protrusions.

.5 Leave 75 mm separation between thermal insulation and heat emitting devices such as recessed light fixtures.

.6 Cut and trim thermal insulation neatly to fit spaces; do not compress insulation to fit. Install only thermal insulation boards which are free from chipped or broken edges.

.7 Fill miscellaneous cavities with insulation to maintain continuity of thermal barrier. Do not compress insulation to fit.

.8 Arrange for Consultant to review thermal insulation before it is enclosed.

3.3 SECUREMENT

.1 Batt insulation (non-rated, fire-rated/acoustic):
- .1 Install batt insulation in partitions, between studs, and as indicated on Contract Drawings and in accordance with the manufacturer's instructions.
- .2 Fill stud cavities to full height of partitions and carefully cut and fit required batt insulation type around services and protrusions.

.2 Below grade insulation:
- .1 Interior application: Provide 50 mm thick insulation extending 600 mm vertically along foundation wall and 100 mm thick insulation extending 600 mm horizontally along underside of concrete floor slab. Apply suitable mastic adhesive for spot bonding insulation to foundation walls.

.3 Underslab insulation:
- .1 Install insulation boards in locations shown in accordance with manufacturer’s instructions.
- .2 Protect insulation board from damage by placing 200 mm layer of 19 mm crusher-run limestone over insulation board.
- .3 In drainage trenches, place insulation board to size and location as shown in Contract Drawings, with joints butted tight.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Labour, Products, equipment and services necessary for sprayed foam insulation work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 ASTM A653/A653M, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.

.2 ASTM D1621, Standard Test Method for Compressive Properties Of Rigid Cellular Plastics.

.3 ASTM D1622, Standard Test Method for Apparent Density of Rigid Cellular Plastics.

.4 ASTM D1623, Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.

.5 ASTM D2842, Standard Test Method for Water Absorption of Rigid Cellular Plastics.

.6 ASTM E96, Standard Test Methods for Water Vapor Transmission of Materials.

.7 CAN/ULC S705.1, Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density, Material Specification.

.8 CAN/ULC S705.2, Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density, Application.

1.3 **SUBMITTALS**

.1 Product data:
- .1 Submit duplicate copies of manufacturer's Product data in accordance with Section 01 30 00 indicating:
  - .1 Performance criteria, characteristics, and limitations.
  - .2 Product transportation, storage, handling and installation requirements.

.2 Shop drawings:
- .1 Submit shop drawings in accordance with Section 01 30 00 indicating:
  - .1 Elevations, sections, materials, details of joint conditions, including door, window, entrance framing, flashings, and roof parapet connection.

.3 Certificates: Submit the following certificates in accordance with Section 01 30 00:
- .1 Applicator’s current certificate of approval by CUFCA/NECA or BASF Canada’s training program.
- .2 Applicator’s current certificate of approval from material manufacturer.

1.4 **QUALITY ASSURANCE**

.1 Perform work of this Section by a company that has a minimum of five years proven experience in installations of similar size and nature.

.2 Contractor to be a certified member of the Canadian Urethane Foam Contractors Association/ National Energy Conservation Association (CUFCA/NECA) or be licensed under the BASF Canada Quality and Training Program “Raising Performance to New Heights” and in accordance with CAN/ULC S705.2 installation standard.

.3 Provide quality assurance testing in accordance with CAN/ULC S705.2. Record daily results in a log book for Consultant’s review.

.4 Provide adhesion tests on transition membranes, in accordance with manufacturer’s written instructions, at the perimeters of all openings. If the project comprises more than 10 openings, adhesion tests should be conducted on 15% of them. For jobs comprising 10 or fewer openings, 30% of these should undergo adhesion tests. Adhesion tests should be performed on the transition membranes at every tenth column or beam.

.5 Mock-up:
- .1 Construct mock-up of 3 m^2 minimum, of spray-in-place foam insulation to thickness as indicated on drawings, including one inside corner and one outside corner.
- .2 Arrange for Consultant's review and acceptance, allow 24 hours before proceeding with work.
- .3 When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of Work if accepted by Consultant. Remove and dispose of mock-ups which do not form part of Work.

1.5 **SITE CONDITIONS**

.1 Do not install work of this Section outside of following environmental ranges without Consultant's and Product manufacturer's written acceptance:
- .1 Ambient air and surface temperature: 5^0C to 40^0C.
- .2 Relative Humidity: Above 85%.

.2 Supply and install temporary protection and facilities to maintain Product manufacturer's, and above specified environmental requirements for 48 hours before, during, and 48 hours after installation.

2 Products

2.1 **MATERIALS**

.1 All materials under work of this Section, including but not limited to, primers and sealants are to have low VOC content limits.

.2 Sprayed foam insulation: Sprayed/frothed polyurethane foam conforming to CAN/ULC S705.1. and utilizing a HFO blowing agent and conforming to the following minimum requirements:
- .1 Density (ASTM D1622): 29.6 kg/m3.
- .2 Open cell content (ASTMD2856): 5.6%.
- .3 Tensile strength (ASTM D1623): 313 kPa.
- .4 Compressive strength (ASTM D1621): 236 kPa.
- .5 Water absorption (ASTM D2842): 0.6% by volume.
- .6 Water vapour permeance (ASTM E96): 50mm sample 56 ng/Pa·s·m2 (0.98 Perms).
- .7 Flame spread: <500.
- .8 Sprayed urethane foam: 'Walltite CM01' by BASF or 'Heatlok Soya HFO' by Demilec Inc.

.3 Primers: As recommended by sprayed foam insulation manufacturer.

3 Execution

3.1 EXAMINATION

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of work of this Section means acceptance of existing conditions.

3.2 PREPARATION

.1 Verify substrate surfaces are solid, free from surface water, frozen matter, dust, oil, grease, scaling or laitance, projections and any other foreign matter detrimental to performance. Obtain manufacturer's approval of substrate in writing, submit copy to Consultant.

.2 Provide ventilation in area to receive sprayed foam insulation, introducing and exhausting fresh air continuously during and for 24 hours after application.

.3 Provide temporary enclosures to prevent spray from contaminating air beyond application area, and damage from overspray and dusting on adjacent surfaces.

.4 Supply and install temporary protection to adjacent surfaces to prevent damage resulting from work of this Section.

.5 If required, apply primer to substrate surfaces in accordance with manufacturer's written instructions.

3.3 SPRAY INSULATION

.1 Install insulation in accordance with manufacturer's written instructions and conforming to CAN/ULC S705.2.

.2 Apply sprayed foam insulation to thickness indicated on drawings and to provide continuous air retarder in locations indicated on the Drawings. Apply insulation to within 3 mm of thickness indicated on drawings. Provide one measuring pin for every 50 m^2.

.3 Apply insulation in maximum 50 mm pass thickness, with a minimum wait time between passes as recommended by manufacturer.

.4 Insulation to be continuous, level, plumb and uniform thickness throughout. Insulation shall be free of voids and imbedded foreign materials.

3.4 **INSPECTION AND TESTING**

.1 Arrange for third party site-inspection by approved company. Cost of inspections shall be included in bid price.

.2 Site inspection shall be carried out at 5%, 50% and 95% completion to verify conformance with CAN/ULC S705.2, manufacturers written instructions and this Section.

.3 Written inspection reports shall be forwarded to Consultant within three (3) working days of test being performed.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Labour, Products, equipment and services necessary for air/vapour barriers Work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 ASTM E1643, Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

.2 ASTM E1745, Standard Specification for Water Vapour Retarders used in contact with Soil or Granular Fill under Concrete Slabs.

.3 CAN/CGSB 19.21-M, Sealing and Bedding Compound, Acoustical.

.4 CAN/CGSB-51.34-M, Vapour Barrier, Polyethylene Sheet, for Use in Building Construction.

1.3 **SUBMITTALS**

.1 Product data:
- .1 Submit duplicate copies of manufacturer's Product data in accordance with Section 01 30 00 indicating:
  - .1 Performance criteria, compliance with appropriate reference standard, characteristics, and limitations.
  - .2 Product transportation, storage, handling and installation requirements.

.2 Samples: Submit following samples in accordance with Section 01 30 00:
- .1 Two 300 x 300 mm samples of air/vapour barriers.
- .2 Two samples, 300 mm long, of fastening bar.
- .3 Duplicate samples of pipe and conduit boot.

1.4 **QUALITY ASSURANCE**

.1 Mock-up:
- .1 Construct one 10 m^2 mock-up of each type air/vapour barrier in location acceptable to Consultant indicating as a minimum one lap joint, one inside corner, one window interface, one wall electrical box, and floor pipe penetration.
- .2 Arrange for Consultant's review and acceptance.
- .3 Mock-up may remain as part of Work if accepted by Consultant. Remove and dispose of mock-ups which do not form part of Work.

1.5 **SITE CONDITIONS**

.1 Do not install the Work of this Section outside of environmental ranges as recommended by manufacturer without Consultant's and Product manufacturer's written acceptance.

.2 Supply and install temporary protection and facilities to maintain Product manufacturer's, and above specification, environmental requirements before, during, and after installation.

2 Products

2.1 **WALL AIR/VAPOUR BARRIER MATERIALS**

.1 All materials under Work of this Section, including but not limited to, primers and sealants are to have low VOC content limits.

.2 Membrane air/vapour barrier: 1.0 mm thick, single-ply, self adhering, self sealing, rubberised asphalt, bonded to a cross-laminated high density polyethylene film.
- .1 'CCW 705' by Carlisle Coatings & Waterproofing.
- .2 'Blueskin SA' by Henry Company Canada Inc.
- .3 'Sopraseal Stick 1100 T' by Soprema.
- .4 'Exo-Air 110' by Tremco.
- .5 'Air-Shield" by W. R. Meadows.

.3 Primer:
- .1 'Cav-Grip Primer' by Carlisle Coatings & Waterproofing.
- .2 'Blueskin Adhesive' by Henry Company Canada Inc.
- .3 'Elastocol Stick' by Soprema.
- .4 'ExoAir Primer' by Tremco
- .5 'Mel-Prime' by W.R. Meadows.

.4 Mastic:
- .1 'CCW 704 Mastic' by Carlisle Coatings & Waterproofing.
- .2 'Polybitume 570-05' by Henry Company Canada Inc.
- .3 'Sopramastic' by Soprema.
- .4 'Acoustical Sealant' by Tremco
- .5 'Sealtight Pointing Mastic' by W.R. Meadows.

.5 Fastening bar: Continuous 25 mm wide x 3 mm thick aluminum bar, predrilled for mechanical attachment.

.6 Fasteners: As specified herein or manufacturer's recommended fastener for attaching to Substrate.

2.2 **UNDERSLAB AIR/VAPOUR BARRIER MATERIALS**

.1 All materials under Work of this Section, including but not limited to, primers and sealants are to have low VOC content limits.

.2 Air/vapour barrier (under concrete slab-on-grade): ASTM E1745, Class A, 0.38 mm (15 mil) thick. Permeance as tested after conditioning, less than 0.010 perms (gr/ft2/hr/in.hg), 0.570 ng/(Pa*s*m2); 'Stego Wrap Vapor Barrier' by Stego Industries or 'Perminator' by W.R. Meadows.

.1 Joint sealing tape: High density polyethylene tape with pressure sensitive adhesive with minimum width 100 mm. Type recommended by sheet air/vapour barrier manufacturer.

.2 Pipe and conduit boots: Construct pipe and conduit boots from air/vapour barrier material and pressure sensitive tape as recommended by manufacturer.

2.3 **SHEET VAPOUR RETARDER MATERIALS**

.1 All materials under Work of this Section, including but not limited to, primers and sealants are to have low VOC content limits.

.2 Sheet vapour retarder 'Super Six' Polyethylene film to CAN/CGSB-51.34, 0.15 mm (6 mil) thick.

.1 Joint sealing tape: Air and vapour resistant pressure sensitive adhesive tape, type recommended by sheet vapour retarder manufacturer, 50 mm wide for lap joints and perimeter seals, 25 mm wide elsewhere.

.2 Sealant: CAN/CGSB 19.21; One-part, non-sag, non-bleeding, non-drying, non-hardening, sealant shall remain tacky for permanent bonding to all surfaces; 'Tremco Acoustical Sealant' by Tremco Ltd. or approved alternative.

3 Execution

3.1 **EXAMINATION AND COORDINATION**

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of Work means acceptance of existing conditions.

.2 Verify that existing substrates to receive air/vapour barrier are clean, dry, sound, smooth, and continuous.

.3 Coordinate installation of air/vapour barriers with work of other Sections to achieve a air/vapour tight building envelope.

3.2 **MEMBRANE WALL AIR/VAPOUR BARRIER INSTALLATION**

.1 Fill substrate voids, gaps, depressions, cracks, and joints with mastic until continuous, smooth, substrate for air/vapour barrier is achieved.

.2 Prime substrate surfaces to receive air/vapour barrier in accordance with manufacturer's instructions, at recommended application rate, allow to dry. Vary coverage to suit surface porosity.

.3 Prime surfaces. Re-prime surfaces if not covered with air/vapour barrier within 4 hours.

.4 Install mastic where required to ensure integrity of air/vapour barrier installation at protrusions and other complex details.

.5 Install air/vapour barrier in accordance with manufacturer's instructions in locations indicated.

.6 Lap air/vapour barrier ends and edges 50 mm minimum. Roll air/vapour barrier and laps for continuous adhesion over entire substrate area; use manufacturer's recommended roller.

.7 Extend air/vapour barrier as required to connect to other components of Work comprising air/vapour barrier system.

.8 Cut and fit air/vapour barrier as required for passage of protrusions, ensuring continuous adherence to substrate.

.9 At end of days' Work, trowel mastic water cut-off along uppermost edge of incomplete air/vapour barrier assembly, to prevent loss of adhesion and damage air/vapour barrier.

.10 Supply and install continuous mechanical fastening bar to clamp air/vapour barrier both sides of unfilled gaps, cracks, and joints.

3.3 UNDERSLAB AIR/VAPOUR BARRIER INSTALLATION

.1 Ensure services are installed and inspected prior to installation of barrier.

.2 Install sheet air/vapour barrier under the floor slab and return up adjacent walls prior to installation of floor slab, to form a continuous air/vapour barrier in accordance with ASTM E1643 and manufacturer’s written instructions.

.3 Lap air/vapour barrier over footings and seal to foundation walls.

.4 Overlap joints 150 mm and seal with manufacturer approved sealing tape.

.5 Seal all penetrations (including conduits and pipes) with manufacturer's pipe boot.

.6 Use sheets of largest practical size to minimize joints.

.7 Inspect for continuity. Repair punctures and tears by using patches of air/vapour barrier and overlapping damaged areas by minimum 150 mm on all sides and taping with sealing tape before work is concealed.

3.4 SHEET VAPOUR RETARDER INSTALLATION

.1 Ensure services are installed and inspected prior to installation of retarder.

.2 Install sheet vapour retarder on the warm side of exterior wall, roof, and ceiling assemblies, prior to installation of roof insulation or interior finishes to form a continuous vapour retarder.

.3 Use sheets of largest practical size to minimize joints.

.4 Inspect for continuity. Repair punctures and tears with sealing tape before work is concealed.

.5 At exterior surface openings, cut vapour retarder to form openings and ensure material is lapped and sealed to frame.

.6 Ensure continuity of vapour retarder is maintained at junctures with other materials.

.7 At perimeter seals, seal perimeter of sheet vapour retarder as follows:
- .1 Apply continuous bead of sealant to substrate at perimeter of sheets.
- .2 Lap sheet over sealant and press into sealant bead.
- .3 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

.8 Seal lap joints of sheet vapour retarder as follows:
- .1 Attach first sheet to substrate.
- .2 Apply continuous bead of sealant over solid backing at joint.
- .3 Lap adjoining sheet minimum 150 mm and press into sealant bead.
- .4 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

.9 Seal electrical switch and outlet device boxes that penetrate vapour retarder as follows:
- .1 Wrap boxes with film sheet providing minimum 300 mm perimeter lap flange.
- .2 Apply sealant to seal edges of flange to main vapour retarder and seal wiring penetrations through box cover.

3.5 FIELD QUALITY CONTROL

.1 Inspect air/vapour barrier continuity immediately prior to installation of subsequent construction. Repair punctures, rips and tears to ensure continuity of air/vapour barrier.

.2 Where punctures and tears are extensive, replace entire damaged section.

.3 Do not cover or permit to be covered any portion of air/vapour barrier until it has been inspected by Consultant.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Labour, Products equipment and services necessary for vapour permeable air barrier Work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 ASTM C920, Specification for Elastomeric Joint Sealants.

1.3 **SUBMITTALS**

.1 Product data: Submit manufacturer's Product data in accordance with Section 01 30 00 indicating installation details, physical properties and detailed application and installation instructions.

.2 Shop drawings:
- .1 Submit shop drawings in accordance with Section 01 30 00 indicating:
  - .1 Adjacent construction and typical details, dimensions, thickness, method of application, protection and penetration details.
  - .2 Location of each membrane penetration.

1.4 **QUALITY ASSURANCE**

.1 Installer's qualifications: Perform Work of this Section by company, approved by Product manufacturer and having 5 years recent experience in Work of comparable complexity and scope.

.2 Pre-installation meeting: Arrange with Consultant and manufacturer's representative to inspect substrates and review installation procedures 48 hours in advance of installation.

1.5 **DELIVERY, STORAGE AND HANDLING**

1. Protect materials from direct exposure to sunlight and physical damage.

2 Products

2.1 **MATERIALS**

.1 All materials under Work of this Section, including but not limited to, primers and sealants are to have low VOC content limits.

.2 Vapour permeable air barrier: 23 mils thick, single-ply, self adhering membrane consisting of engineered film and permeable adhesive with poly-release film; ‘Blueskin VP160’ by Henry Company Canada Inc. or approved alternative by Cosella-Dörken Products, Inc. or VaproShield.

.3 Primer: Low VOC quick setting rubber based adhesive ‘Blueskin LVC Adhesive' by Henry Company Canada Inc. or approved alternative by Cosella-Dörken Products, Inc. or VaproShield.

.4 Sealant: ASTM C920, Type S, Grade NS, Class 25; Moisture sure, medium modulus polymer modified sealing compound ‘HE925 BES’ by Henry Company Canada Inc. or approved alternative by Cosella-Dörken Products, Inc. or VaproShield.

3 Execution

3.1 **EXAMINATION**

.1 Verify condition of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of Work means acceptance of existing conditions.

3.2 **APPLICATION**

.1 Ensure surfaces to receive membrane are sound, dry, clean, and free from oil, grease, dirt, excess mortar or other contaminates.

.2 Fill substrate voids, gaps, depressions, cracks, and joints with mastic until continuous, smooth, substrate for air barrier is achieved.

.3 Prime substrate surfaces to receive air barrier in accordance with manufacturer's instructions, at recommended application rate, allow to dry. Vary coverage to suit surface porosity.

.4 Prime surfaces. Re-prime surfaces if not covered with air barrier within 4 hours.

.5 Install mastic where required to ensure integrity of air barrier installation at protrusions and other complex details.

.6 Install air barrier in accordance with reviewed shop drawings and manufacturer's instructions in locations indicated.

.7 Lap air barrier ends and edges 50 mm minimum. Roll air barrier and laps for continuous adhesion over entire substrate area; use manufacturer's recommended roller.

.8 Extend air barrier as required to connect to other components of Work comprising air barrier system.

.9 Cut and fit air barrier as required for passage of protrusions, ensuring continuous adherence to substrate.

.10 Seal around masonry reinforcing or ties and all penetrations with termination mastic.

.11 At end of days' Work, trowel mastic water cut-off along uppermost edge of incomplete air barrier assembly, to prevent loss of adhesion and damage air barrier.

.12 Do not expose air barrier to sunlight for more than 30 days prior to enclosure.

3.3 **FIELD QUALITY CONTROL**

.1 Do not cover or permit to be covered any portion of the membranes until they have been inspected by the Consultant or by an inspection agency appointed by the Consultant.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Design, labour, Products, tools, equipment and services necessary for exterior soffit system work complete in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 ASTM A653/A653M, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.

.2 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.

1.3 **DESIGN REQUIREMENTS**

.1 Design soffit system to accommodate expansion and contraction of soffit elements without causing buckling, failure of joints, undue stress on fasteners or other effects detrimental to appearance or performance.

1.4 **SUBMITTALS**

.1 Product data:
- .1 Submit duplicate copies of manufacturer's Product data in accordance with Section 01 30 00 indicating:
  - .1 Performance criteria, compliance with appropriate reference standard, characteristics, and system limitations.
  - .2 Product transportation, storage, handling and installation requirements.

.2 Shop drawings:
- .1 Submit shop drawings in accordance with Section 01 30 00 indicating:
  - .1 Details, sections, dimensions, tolerances, connections, terminations, control joints, system components, installation sequence, accessories and other pertinent information required for proper and complete installation.
  - .2 Complete design data to confirm that soffit system meet design requirements specified.

.3 Samples: Submit two 300 x 300 mm samples of complete soffit system in accordance with Section 01 30 00.

.4 Reports: Submit written inspection reports within 5 working days after each inspection.

.5 Closeout submittals: Submit maintenance and cleaning instructions for soffit system for incorporation into Operations and Maintenance Manuals in accordance with Section 01 78 00.

.6 Extended warranty: Submit extended warranty signed and registered by the manufacturer providing the warranty in the name of the Owner for the timeframe and coverage specified in this Section.

1.5 **QUALITY ASSURANCE**

.1 Installers qualifications: Perform work of this Section by a company that has a minimum of five years proven experience installing work of similar size and nature and that is approved by system manufacturer. Submit to Consultant, applicator's current certificate of approval by the material manufacturer as proof of compliance.

.2 Soffit system manufacturer shall conduct Site inspections, prepare and submit written inspection reports verifying that this part of Work is in accordance with Contract Documents and reviewed shop drawings. Perform inspections once per week minimum.

.3 Mock-up:
- .1 Construct one 3000 mm minimum mock-up of soffit system in location acceptable to Consultant.
- .2 Arrange for Consultant's review and acceptance.
- .3 Mock-up may remain as part of Work if accepted by Consultant. Remove and dispose of mock-ups which do not form part of Work.

1.6 **SITE CONDITIONS**

.1 Supply and install temporary protection and facilities to maintain Product manufacturer's, and above specified environmental requirements for 24 hours before, during, and 24 hours after installation.

.2 Do not proceed with application of materials immediately prior to, during or immediately after inclement conditions, or if wet weather is anticipated within 24 hours after application. Do not apply materials to wet, frozen, or frosted surfaces.

1.7 **EXTENDED WARRANTY**

.1 Submit an extended warranty for soffit system work in accordance with the General Conditions, except that the warranty period is extended to 5 years from date of Substantial Performance of the Work.
- .1 Warrant against failure to meet the design criteria and requirements such as failure to stay in place, cracking, warping, and finish degradation.
- .2 Coverage: Complete replacement including affected adjacent Work.

2 Products

2.1 **MATERIALS**

.1 All materials under work of this Section, including but not limited to, coatings, sealants, primers, and sealers are to have low VOC content limits.

.2 Perforated sheet steel: ASTM A653/A653M; Classification LFQ, Grade A, Z275 zinc coating designation, 0.55 mm (24 ga.) minimum base steel thickness, commercial quality, perforations as indicated on drawings, prefinished with Perspectra Series coating system by U.S. Steel Canada, or WeatherX by Vicwest Steel. Colour as selected by Consultant.

.3 Accessories: Hot-dip galvanized in accordance with CAN/CSA-G164-M, in locations shown on Contract Drawings.

.4 Fasteners: Provide type 304 stainless steel fasteners.

.5 Soffit vents: 115 mm wide continuous, high impact, rigid, polyvinyl chloride type soffit vent with continuous insect screen, `AMBICO AMSV-300-50' by AMICO Canada Inc., or`Vinyltech Item No. 548-50' by Plastic Components Inc., or approved alternative.

.6 Sealant and sealant primer: In accordance with Section 07 92 00.

3 Execution

3.1 **EXAMINATION**

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of work of this Section means acceptance of existing conditions.

3.2 **PREPARATION**

.1 Verify substrate surfaces are solid, free from surface water, frozen matter, dust, and other foreign matter detrimental to performance. Ensure environmental and site conditions are suitable for installation of system.

.2 Supply and install temporary protection to adjacent surfaces to prevent damage resulting from work of this Section.

.3 Prepare surfaces in accordance with manufacturer's written instructions.

.4 Protect finished work at end of each day or on completion of each section of work from water penetration. Protect completed installation from moisture for 48 hours minimum.

3.3 **SOFFIT SYSTEM**

.1 Install soffit system in accordance with reviewed shop drawings and manufacturer's written instructions. Comply with system manufacturer’s requirements regarding terminations at end of each days work and resumption of work.

.2 Seal all cut edges, ends, utility holes and fastener heads, as recommended by manufacturer.

.3 Tape and fill all joints and fastener heads using materials recommended by cement wallboard manufacturer.

.4 Install panels in accordance with reviewed shop drawings and manufacturer's written instructions. Comply with system manufacturer’s requirements regarding terminations at end of each days work and resumption of work.

.5 Install panels by nailing into center of nail slots. Drive nails straight, leaving 1/16 inch space between nail head and flange of panel.

.6 Install continuous soffit vents in soffits as indicated on drawings to provide ventilation of concealed soffit spaces in accordance with OBC requirements.

3.4 CONTROL JOINTS

.1 Install 12.7 mm control joints at the following locations:
- .1 Soffit abuts a structural element, dissimilar wall or other vertical penetration.
- .2 Construction changes within the plane of the soffit.
- .3 Ceiling or soffit dimensions exceed 15 m in either direction.
- .4 Locations indicated on drawings.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Design, labour, Products, equipment and services necessary for aluminum panel siding, soffit and screen work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 AAMA 2605, High Performance Organic Coatings on Architectural Extrusions and Panels.

.2 AAMA CW-10, Care and Handling of Architectural Aluminum from Shop to Site.

.3 ANSI B18.6.4, Screws, Tapping and Metallic Drive, Inch Series, Thread Forming and Cutting.

.4 ASTM C612, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

.5 ASTM C920, Specification for Elastomeric Joint Sealants.

.6 CAN/CSA-G40.20/G40.21M, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels.

.7 CSA S136, Cold Formed Steel Structural Members.

1.3 **DESIGN REQUIREMENTS**

.1 Design aluminum panel work in accordance with following Climatic Design Data for Brampton contained in the Ontario Building Code:
.1 Design temperature: January 1%, July 2 1/2%.
.2 Hourly wind pressures: 1 in 50 year occurrence.

.2 Design aluminum panel system as a “dry joint system” and to withstand live, dead, lateral, wind, seismic, handling, transportation, and erection loads, imposed and other loads.

3. Prevent rain penetration through system. Design system based on “Rain Screen Principle” in accordance with the National Research Council. Volume to vent ratio should not exceed 25 m. Panels should be compartmentalized at joints. Incorporate means of draining to the exterior.

.4 Design aluminum panel system to accommodate thermal movements of the components and structural movements to provide an installation free of oil canning, buckling, delamination, failure of joint seals, excessive stress on fasteners or any other detrimental effects.

.5 Design aluminum panel system to prevent rattling and vibration of panels, overstressing of fasteners and clips, and other detrimental effects on the system.

.6 Panel removal: System design to allow removal of individual panels within system.

.7 Design miscellaneous, additional structural framing members as required to complete aluminum panel system, where not indicated on Contract Drawings.

.8 The attachment face of subgirts supporting the panel system must not deflect vertically more than 3 mm due to the dead load of the panel system.

1.4 SUBMITTALS

.1 Product data:
- .1 Submit copies of manufacturer's Product data in accordance with Section 01 30 00 indicating:
  - .1 Performance criteria, compliance with appropriate reference standard, characteristics, limitations.
  - .2 Product transportation, storage, handling and installation requirements.

.2 Shop drawings:
- .1 Submit shop drawings in accordance with Section 01 30 00 indicating:
  - .1 Elevations, details, profiles, dimensions, thickness of materials, finishes, methods of joining, joint location, special joints, methods of anchoring, anchor and thermal clip details, types of sealants and gaskets, waterproof connections to adjoining work, details of other pertinent components of the work, and compliance with design criteria and requirements of related work.
  - .2 Seismic anchors, supports and accessories for complete installation.

.3 Samples:
- .1 Submit samples in accordance with Section 01 30 00:
  - .1 600 x 600 mm samples of panel system showing fully assembled components including face sheets, sub-girts, insulation, liner panel, thermal clip and concealed sealant. Sample to be fabricated using exact colour and gauges specified.
  - .2 300 x 300 mm face sheet samples for soffits and screens.

.4 Closeout Submittals: Provide maintenance instructions for incorporation into Operation and Maintenance Manual, specified in Section 01 78 00.

1.5 QUALITY ASSURANCE

.1 Retain a licensed Professional Engineer, registered in the Province of Ontario, to perform following services for prefinished panel work:
- .1 Design of aluminum panel system.
- .2 Design of anchors, supports and accessories to meet seismic requirements.
- .3 Review, stamp, and sign shop drawings.
- .4 Conduct shop and field inspections and prepare and submit inspection reports.

.2 Perform work of this Section only by a Subcontractor of recognized standing who has adequate plant, equipment, and skilled workers to perform it expeditiously, and is known to have been responsible for satisfactory installations similar to that specified during a period of at least the immediate past ten years.

.3 Execute steel welding to CSA W59-M by fabricators certified by the Canadian Welding Bureau to CSA W47.1.

.4 Execute aluminum welding by fabricators certified by the Canadian Welding Bureau to CSA W47.2-M.

.5 Execute finishing coatings and metal pre-treatments by applicators approved in writing by the manufacturer of the coatings and under the supervision of the manufacturer's qualified representative.

.6 Mock-up:
- .1 Fabricate, deliver, and erect a 3 m^2 mm high mock-up panel of aluminum panel system in location acceptable to Consultant.
- .2 Demonstrate full panel fabrication and installation techniques, confirm stiffness/absence of deformation, finish, anchoring devices, air barrier sealing, joint detailing and sealing, and quality of workmanship.
- .3 Mock-up may form part of final Work, if acceptable to Consultant. Remove and dispose of mock-ups which do not form part of Work.

.7 Pre-Installation Meeting: Arrange meeting on Site to be attended by Consultant, Contractor, and panel manufacturer’s representative to review installation procedures, interfaces with adjacent work, conditions under which work will be performed, inspect the surfaces to receive the vapour retarder, and installation procedures 48 hours in advance of installation.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Handle aluminum work in accordance with AAMA CW-10. Protect aluminum surfaces with strippable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather. Do not remove before final cleaning of building.

.2 Remove and replace all damaged and unsatisfactory materials which are deemed unsuitable for use at this Section's own expense.

1.7 EXTENDED WARRANTY

.1 Submit an extended warranty for aluminum panel work in accordance with General Conditions, except that warranty period is extended to 3 years from date of Substantial Performance of the Work.
- .1 Warrant against leaking, warping, twisting, joint, and finish failure.
- .2 Coverage: Complete replacement including affected adjacent parts.

.2 Manufacturer's Warranty: Provide panel manufacturer's written warranty naming Owner as beneficiary and covering failure of factory-applied exterior finish on prefinished metal panels within the warranty period; warrant finish per ASTM D4214 for chalk not in excess of 8 NBS units and fade not in excess of 5 NBS units. Warranty period for finish: 10 years from date Work is certified as substantially performed.

2 Products

2.1 **ACCEPTABLE PANEL MANUFACTURER(S)**

.1 Aluminum Panels: Horizontal or vertical, 1.78 mm aluminum alloy panels, pre-finished wood-look panels as manufactured by Longboard Inspiring Facades or approved alternative.

2.2 **MATERIALS**

.1 All materials under work of this Section, including but not limited to, sealants, paints, and coatings are to have low VOC content limits.

.2 Sheet aluminum: Aluminum Association 6061-T6 to ASTM B209.

.3 Finish: Exposed to view: Powder coat finish complying to AAMA 2604, AkzoNobel / Interpon D2000. Colour: Light Fir. Concealed aluminum finish: Mill finish.

.4 Structural shapes, plates, sag rods, and similar items: CAN/CSA-G40.20-G40.21-M, Grade 350W.

.5 Air/Vapour barrier: In accordance with Section 07 26 00.

.6 Z-girts and C channels: CAN/CSA S136-M; Minimum 1.2 mm thick, Z275 galvanized. Depth as indicated on Contract Drawings. Z-girts to be thermally broken at mid-point of insulation thickness.

.7 Thermal spacer: 100% pultruded glass fibre and thermoset polyester resin thermal spacer complete with fastener in depth indicated on Contract Drawings; Cascadia Clip by Interra Architectural Products or approved alternative.

.8 Provide all additional structural supports not shown on Drawings as required.

.9 Seismic anchors, supports and accessories: In accordance with reviewed shop drawings.

.10 Fasteners: Concealed, ANSI B18.6.4, stainless steel Type 304.

.11 Flashings, Closure Pieces, Trim: Same material and colour as panels.

.12 Insulation: Semi-rigid stone wool conforming to ASTM C612, minimum density 70 kg/m^3, thickness as indicated.
- .1 'CladStone 45' by Johns Manville.
- .2 'Thermafiber Rainbarrier 45' by Owens-Corning.
- .3 'CavityRock' by Rockwool Inc.

.13 Insulation fasteners:
- .1 Insulation clips: Galvanized steel clips with self locking type washers; 'Insul-Anchors by Continental Studwelding Ltd., 'Insulation Hanger Studs' by McMaster-Carr, or 'Stud Welders' by Midwest Fasteners Inc.
- .2 Clip adhesive: High strength adhesive having a bonding time of 0 to 30 minutes (rapid initial set) and 48 hours final set, compatible with insulation adhesive, insulation air barrier and substrate, non-corrosive to galvanized steel.

.14 Clips and Panel Reinforcement: Extruded aluminum.

.15 Sealant: ASTM C920, Type S, Grade NS, Class 100/50; One-part, low-modulus, moisture-curing, silicone. 'Dow Corning 790' by Dow Corning or 'Spectrem 1' by Tremco. Colour as selected by Consultant. Primer as recommended by manufacturer.

.16 Joint backing: Product as recommended by siding sealant manufacturer.

.17 Touch-up paint: as recommended by panel manufacturer.

.18 Isolation coating: Bituminous coating, acid and alkali resistant material.

2.3 FABRICATION

.1 Fabricate facings and concealed support members in a manner which will provide an installation free of exposed fastenings, with sufficient support and allowance for thermal movement to prevent facing distortion. Take site measurements before proceeding with production.

.2 Fabricate components of the system at factory, ready for field installation. Include full continuous joint reveals within system.

3. Fabricate facings flat, true, free of marks, without visible distortion and with edges straight and true. Make all planes true, and corners square and bend of minimum radius.

.4 Provide proprietary aluminum extrusions to manufacturer's standard profiles for a complete installation. Extrusions shall be full length around panel perimeter for panel reinforcement and alignment. Intermittent clips are unacceptable.

.5 Changes of plans, parallel or transverse to longitudinal axis shall be accomplished as detailed on shop drawings in the factory wherever practical and with a minimum of field fabrication.

.6 Form panels to dimensions indicated with tolerances to accommodate expansion and contraction between panels and structure members. Accurately form shaped panels.

.7 Fabricate panels with flanges on all sides.

.8 Factory fabricate accessory and trim components ready for installation.

.9 Polish smooth all exposed edges, corners and ends, free from sharp edges.

.10 Maximum allowable tolerances shall be as follows:
- .1 Panel bow: In a concave or convex direction to be 0.5% of panel dimension width and length.
- .2 Panel flatness: Rises and falls across the panel, (local bumps and depressions) will not be accepted.
- .3 Panel tolerance:
  - .1 Width: 2 mm.
  - .2 Length: 4 mm.
  - .3 Thickness: 0.2 mm.
  - .4 Squareness: 5 mm maximum.

3 Execution

3.1 **EXAMINATION**

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of work of this Section means acceptance of existing conditions.

.2 Verify that backup construction is aligned for proper installation of panels before commencing erection.

.3 Protect metal surfaces in contact with concrete, masonry mortar, plaster or other cementitious surface and aluminum to steel surfaces with isolation coating.

3.2 **SOFFIT AND SIDING INSTALLATION**

.1 Supply and install miscellaneous, additional structural framing members, required to complete aluminum panel system, where not indicated on Contract Drawings.

.2 Install seismic anchors, supports and accessories in accordance with reviewed shop drawings.

.3 Apply isolation coating to supporting structural framing to isolate airseal liner panel and to prevent galvanic corrosion.

.4 Install air/vapour retarder in accordance with Section 07 26 00.

.5 Install thermal spacer to substrate in accordance with manufacturer's written instructions.

6. Erect panels complete with girts, clips, and fasteners, to meet design criteria. Anchor each individual panel over solid backing. Ensure that all penetrations through air/vapour barrier are sealed.

.7 Install panels, support and anchoring system, fasteners, trim and related items to lines and elevations indicated and in strict accordance with reviewed shop/erection drawings and manufacturer's printed instructions. Carefully co-ordinate work with other Sections.

.8 Anchor component parts to transmit wind loading and other stresses to anchorage system.

.9 Install insulation in continuous contact with air/vapour retarder and neatly fitted between girts, supports, and anchoring system.

- .1 Install insulation by adhesive clip method in accordance with manufacturer's specifications.
- .2 Locate clips 100 mm from edges of panels where they abut other materials and at joints between panels otherwise, spaced throughout at 300 mm to 450 mm centres each way.
- .3 At clip locations clean supporting surfaces and apply 50 mm square film of adhesive; coat clips with adhesive and press firmly to wall, holding in place until adhesive exudes through clip base perforations; remove excess adhesive to permit curing; impale insulation panels on clips and secure.

10. Erect panel system in accordance with manufacturer's instructions and under direct supervision of the manufacturer.

.11 Repair all damages and all penetrations in the installed membrane air barrier, caused by work of this Section, using the same air barrier material.

.12 Installed panels shall not deviate from overall plane or alignment by more than 1:1000. Joints shall be hairline wherever possible or a maximum of 15 mm where indicated. Joints shall not be wavy, out of line or of different width from panel to panel.

.13 Install all exposed work of this Section with concealed clips and fasteners. Exposed fasteners not acceptable.

.14 Install all metal flashings within and at bottom of metal panel system.

.15 Ensure drainage of any moisture which may occur within the system to the exterior.

.16 Damaged panels, waviness, warp or distortion of finished work will not be accepted.

.17 Completed installation shall be free from rattles, wind whistles, noise due to thermal movement and other noises.

.18 Install metal materials during suitable weather conditions only.

.19 Openings:
- .1 Provide all openings required in preformed metal panel system.
- .2 Provide required metal flashings around penetrations through metal panels. Ensure complete watertight seal.

.20 Joint Backing and Sealant:
- .1 Prepare substrate surface and mask as recommended by sealant manufacturer.
- .2 Install joint backing and sealant at perimeter of aluminum panel system and where indicated on drawings for weathertight installation. Tool sealant to concave profile.
- .3 Seal around all openings and all other locations indicated or required to provide weathertight and watertight seal.

3.3 SCREEN INSTALLATION

.1 Install screen in accordance with reviewed shop drawings and manufacturer's written instructions.

.2 Attach aluminum panels directly mounted to framing using approved concealed fasteners and clips.

.3 Isolate aluminum from dissimilar metal to prevent galvanic action.

3.4 REPAIR

.1 Remove damaged, dented, defaced, defectively finished, or tool marked components and replace with new, unless minor blemishes are approved by Consultant.

.2 Only with approval of Consultant, refinish shop applied finishes in field with compatible materials to manufacturer’s written instructions.

3.5 CLEANING

.1 Remove all strippable protective film from the work as it is erected and prior to moving on to the next bay or grid.

.2 Wash down exposed exterior surfaces using solution of mild non-acidic detergent in warm water, applied with soft clean wiping cloths.

.3 As work progresses, remove excess sealant with recommended solvent and which will not affect metal, finished surfaces, or adjacent surfaces and materials.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Design, labour, Products, equipment and services necessary for metal siding work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 ANSI B18.6.4, Screws, Tapping and Metallic Drive, Inch Series, Thread Forming and Cutting.

.2 ASTM A653/A653M, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.

.3 ASTM C553, Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.4 ASTM C920, Specification for Elastomeric Joint Sealants.

.5 CISC/CPMA 1.73a, A Quick-Drying One-Coat Paint for Use on Structural Steel.

.6 CAN/CSA-G40.20/G40.21M, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels.

.7 CSA S136, Cold Formed Steel Structural Members.

.8 CSA S136.1, Commentary on CAN/CSA S136-M, Cold Formed Steel Structural Members.

1.3 **DESIGN REQUIREMENTS**

.1 Design metal siding system in accordance with CSA S136, S136.1, and to withstand live, dead, lateral, wind, seismic, handling, transportation, and erection loads.

.2 Design metal siding system in accordance with following Climatic Design Data for Brampton contained in Ontario Building Code.
.1 Design Temperature: January 1%, July 2 ½%.
.2 Wind (Hourly Wind Pressures): 1 in 50 year occurrence.
.3 Seismic design: Class “C”.

.3 Design metal siding system to limit deflection under design loads, to L/240.

.4 Design metal siding system to prevent restriction of thermal induced movement which would induce deformation such as warping, buckling, and failure of joint seals and fasteners. Design metal siding system to prevent vibration when subject to the effects of wind.

.5 Design miscellaneous, additional structural framing members and sag rods, required to complete metal siding system, where not indicated on Contract Drawings.

1.4 SUBMITTALS

.1 Product data:
- .1 Submit copies of manufacturer's Product data in accordance with Section 01 30 00 indicating:
  - .1 Performance criteria, compliance with appropriate reference standard, characteristics, limitations.
  - .2 Product transportation, storage, handling and installation requirements.

.2 Shop drawings:
- .1 Submit shop drawings in accordance with Section 01 30 00 indicating:
  - .1 Elevations, details, profiles, dimensions, thickness of materials, finishes, methods of joining, arrangement of sheets, joints, and seams, special shapes, methods of anchoring, anchor and clip details, types of sealants and gaskets, waterproof connections to adjoining work, details of other pertinent components of the work (i.e. windows, penetrations, membranes, etc), and compliance with design criteria and requirements of related work.
  - .2 Seismic anchors, supports and accessories for complete installation.

.3 Samples:
- .1 Submit samples in accordance with Section 01 30 00:
  - .1 600 x 600 mm samples of siding system showing fully assembled components including face sheets, sub-girts, insulation, liner panel, and concealed sealant. Sample to be fabricated using exact colour and gauges specified.

.4 Reports: Submit written field inspection and test report results after each inspection.

.5 Extended warranty: Submit extended warranties signed and registered by the manufacturer providing the warranties in the name of the Owner for the timeframe and coverage specified in this Section.

1.5 QUALITY ASSURANCE

.1 Retain a licensed Professional Engineer, registered in Province of Ontario, to perform following services for metal siding work:
- .1 Design of metal siding work.
- .2 Design of anchors, supports and accessories to meet seismic requirements.
- .3 Review, stamp, and sign shop drawings.
- .4 Conduct shop and field inspections and prepare and submit inspection reports.

.2 Mock-up:
- .1 Fabricate, deliver, and erect one full scale 3 m^2 high mock-up panel of metal siding construction, in location acceptable to Consultant.
- .2 Demonstrate finish, colours, and quality of workmanship.

.3 Mock-up may form part of final Work, if acceptable to Consultant. Remove and dispose of mock-ups which do not form part of Work.

.3 Pre-installation meeting: Arrange with manufacturer's representative, Contractor, and Consultant to inspect substrates, and to review installation procedures 48 hours in advance of installation.

1.6 **DELIVERY, STORAGE, AND HANDLING**

.1 Stockpile panels tilted to provide water run-off, free from ground contact on firm, level, non-staining supports extending full width of sheet and spaced not more than 450 mm apart. Cover components with opaque polyethylene sheet. Vent to allow air movement.

1.7 **EXTENDED WARRANTY**

.1 Submit an extended warranty for metal siding work in accordance with General Conditions, except that warranty period is extended to 2 years from date of Substantial Performance of the Work.
.1 Warrant against warping, twisting, joint, finish failure and water penetration.
.2 Coverage: Complete replacement including affected adjacent parts.

2 Products

2.1 **MATERIALS**

.1 All materials under work of this Section, including but not limited to, paints and sealants are to have low VOC content limits.

.2 Metal siding: ASTM A653/A653M, Z275 galvanized steel, 0.76 mm minimum base metal thickness.
.1 'AD275R' by VicWest Steel, nominal 39 mm deep.
.2 Or approved alternative by Agway Metals Inc., or Roll Form Group.

.3 Metal siding finish: Perspectra Series coating system by ArcelorMittal Dofasco, or WeatherX by Vicwest Steel. Colour as selected by Consultant.

.4 Airseal liner panel: ASTM A653/A653M; 0.70 mm minimum base metal, Z275, galvanized steel, with interlocked male and female edge lips, factory caulked with liner sealant.
.1 V-Rib Liner by Canadian Metal Rolling Mills.
.2 L-800FR by Flynn Canada Ltd.
.3 L-800 Liner by Vic West Steel.

.5 Structural shapes, plates, sag rods, and similar items: CAN/CSA-G40.20-G40.21-M, Grade 300W.

.6 Hollow structural sections: CAN/CSA-G40.20/G40.21-M Grade 350W, Class H.

.7 Liner sealant: Type as recommended by liner manufacturer.

.8 Airseal transition membrane: ‘Perm-a-Barrier Detail Membrane' by gcp applied technologies, ‘Blueskin SA’ by Henry Company Canada, or ‘Sopraseal Stick 1100T' by Soprema Inc. Membrane to come complete with applicable primer.

.9 Z-girts and C channels: CAN/CSA S136-M; Minimum 1.2 mm thick, Z275 galvanized. Depth as indicated on Contract Drawings. Z-girts to be thermally broken at mid-point of insulation thickness.

.10 Insulation: ASTM C553, 32 kg/m^3, Semi-rigid mineral fibre. Thickness as indicated on Contract Drawings. Temporary adhesive: Type as recommended by insulation manufacturer.
.1 ‘Rockwool Plus MB’ by Rockwool Inc.
.2 Or approved alternatives by Johns Manville or Owens-Corning.

.11 Fascia, trim, closures, and flashings: Material, finish, colour, and fasteners to match siding material, 0.76 mm minimum base metal thickness minimum.

.12 Screw fasteners: ANSI B18.6.4, stainless steel Type 304. Exposed locations: With coloured nylon heads to match metal siding.

.13 Seismic anchors, supports and accessories: In accordance with reviewed shop drawings.

.14 Primer paint: CISC/CPMA 1.73a

.15 Isolation coating: Black bituminous coating, acid and alkali resistant material.

.16 Joint backing: Product as recommended by siding sealant manufacturer.

.17 Siding sealant: ASTM C920, Type S, Grade NS; One-part, ultra-low modulus, moisture curing silicone sealant, ‘Dowsil 790' by Dow Consumer or Spectrem 1 by Tremco Ltd. Colour: As selected by Consultant.

.18 Thermal Separation: Continuous 3 mm thick x 38 mm wide self adhering cork.

3 Execution

3.1 EXAMINATION

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of work of this Section means acceptance of existing conditions.

3.2 **STRUCTURAL FRAMING**

.1 Supply and install miscellaneous, additional structural framing members, required to complete metal siding system, where not indicated on Contract Drawings.

3.3 **AIRSEAL LINER PANEL**

.1 Apply isolation coating to supporting structural framing to isolate airseal liner panel and to prevent galvanic corrosion.

.2 Apply continuous beads of liner sealant on face of top and bottom supports of siding liner sheet to provide a complete seal. Ensure a complete seal is obtained between all components from back of liner panel to face of supporting members.

.3 Install airseal liner panel to achieve continuous airseal, rigidly secured to resist design wind loading. Where possible, liner sheets to be one piece full height. Seal liner panel laps airtight with sealant.

.4 Coordinate airseal transition to adjacent parts of Work.

3.4 **AIRSEAL TRANSITION MEMBRANE**

.1 Install primer and airseal transition membrane with 150 mm overlap of metal airseal, continuously onto entire head, jamb, and sill surfaces of openings such as doors, windows, louvres and similar items, and metal siding system perimeter.

.2 Install additional layer of airseal transition membrane to serve as flashing over openings in, and at bottom side termination of metal siding panel system.

.3 Overlap airseal transition membrane 50 mm along sidelaps and 75 mm on end laps and lap in direction of waterflow.

.4 Coordinate airseal transition to adjacent parts of Work.

.5 Provide end-dams and terminations fabricated from same material as airseal transition membrane or material recommended by membrane manufacturer at sills, lintels, openings, and where horizontal surfaces intersect with vertical surfaces to ensure moisture is shed to exterior.

3.5 **GIRTS AND CHANNELS**

.1 Notch Z girts and C channels as required to accommodate airseal liner panel ribs and fins and to allow drainage of cavity.

.2 Provide thermal break between sub-girts and liner sheets. Direct metal-to-metal contact between liner sheet and exterior sheets will not be accepted.

.3 Install Z girts, fastened through airseal liner, and into structural framing beneath. Orient Z girts to drain water from cavity.

.4 Install C channels to frame openings such as doors, windows, and louvre openings, and orient channel webs to form heads, jambs and sills of openings.

3.6 SIDING INSULATION

.1 Install siding insulation in continuous contact with airseal liner and neatly fitted between Z girts and C channels. Adhere insulation with temporary adhesive.

3.7 FASCIA, TRIM, CLOSURES, AND FLASHINGS

.1 Install fascia and trim including inside and outside corners, flashing, edgings, cap strips, drips, under-sill trim, fillers, closure strips, starter strips, and window or door trim, carefully formed and profiled.

3.8 METAL SIDING

.1 Install metal siding in accordance with reviewed shop drawings and manufacturer's written instructions.

.2 Install seismic anchors, supports and accessories in accordance with reviewed shop drawings.

.3 Install metal siding in one piece, full height, except as indicated otherwise.

.4 Maintain joints in exterior siding, plumb, true to line, tight fitting, hairline joints.

.5 Attach metal siding system components to prevent warping, buckling, and deformation induced by restriction of thermal induced movement .

.6 Install corner pieces, closures, flashings, etc, where shown and where required. Provide formed steel closures around opening.

.7 Bed flashings, closures, and corner pieces in sealant to provide a weathertight installation.

3.9 JOINT BACKING AND SIDING SEALANT

.1 Prepare substrate surface and mask as recommended by sealant manufacturer.

.2 Install joint backing and sealant at siding system joints and perimeter for weathertight installation. Tool sealant to concave profile.

3.10 TOUCH UP

.1 Touch up marred surfaces with air dry formulation to match pre-finished siding if approved by Consultant, otherwise remove and replace damaged metal siding.

.2 Clean and touch up marred galvanized surfaces after installation, with zinc rich primer.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Labour, Products, equipment and services necessary for modified bituminous roofing work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 ASTM C1177/C1177M, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing

.2 ASTM D6162/D6162M, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements

.3 CSA A123.4-M, Bitumen for Use in Construction of Built-Up Roof Coverings and Dampproofing and Waterproofing Systems.

.4 CSA A123.21, Standard Test Method for the Dynamic Wind Uplift Resistance of Membrane-Roofing Systems.

.5 CSA A231.1/A231.2, Precast Concrete Paving Slabs/Precast Concrete Pavers.

.6 CGSB 37-GP-9Ma, Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing.

.7 CGSB 37-GP-15M, Application of Asphalt Primer for Asphalt Roofing, Dampproofing and Waterproofing.

.8 CAN/ULC S107, Fire Test For Roof Coverings.

.9 CAN/ULC S704, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Faced.

.10 CRCA Roofing Manual, Canadian Roofing Contractors Association.

.11 OIRCA, Ontario Industrial Roofing Contractors Association.

1.3 **SYSTEM DESCRIPTION**

.1 Roof assemblies specified herein are based on a two ply modified bituminous roofing system with two ply modified bituminous flashings. All plies of membrane and flashings will be torch applied. Roof assembly types referenced are as indicated on the Roof Plan;

.1 RF1 (Steel deck):

.1 Underlayment board

.2 Vapour retarder

.3 Rigid insulation (two layers, 65 mm thick each, adhered).

.4 Tapered insulation (adhered).
.5 Overlay board (adhered).
.6 Base and Cap membrane roofing (mopped/torched).
.7 Base and Cap flashing membranes (mopped/torched).

1.4 SUBMITTALS

.1 Product data:
  .1 Submit copies of manufacturer's Product data in accordance with Section 01 30 00 indicating:
    .1 Systems, materials, and methods of installation proposed for use, showing system and each component. Certify compliance of each component with applicable standards.
    .2 Submit cold weather construction procedures and methods of protection which will be initiated, installed and maintained when ambient temperature falls below 0^0C.

.2 Shop Drawings: Submit Shop Drawings in accordance with Section 01 30 00 indicating roof layout, sections, details, materials, flashings and membrane terminations, perimeter securement, vapour barrier terminations, insulation wrapping procedures, tapered insulation layout, membrane penetrations, control joints, and roof accessories.

.3 Samples:
  .1 Submit following samples in accordance with Section 01 30 00:
    .1 Substrate board and adhesive.
    .2 Vapour retarder and adhesive.
    .3 Insulation boards.
    .4 Tapered insulation.
    .5 Insulation overlay.
    .6 Roofing membranes.
    .7 Roof accessories.

.4 Reports and Certificates:
  .1 Submit copy of membership in good standing of OIRCA.
  .2 Submit certification from manufacturer that roof system has a minimum Class C classification in accordance with CAN/ULC-S107.
  .3 Submit Pre-Installation Notice (PIN): Copy to show that manufacturer's required Pre-Installation Notice (PIN) has been accepted and approved by the manufacturer.
  .4 Submit project specific report, issued by certified material testing laboratory, confirming that proposed roofing assembly conforms to CSA A123.21. As a minimum report shall indicate uplift pressures for field of roof, perimeter of roof and corners of roof.
  .5 Submit written inspection reports in duplicate from manufacturer, stating that materials proposed for use on this project meet criteria specified and are compatible with each other.

.5 Project close-out submittals:
.1 Submit close-out submittals in accordance with Section 01 78 00.
.2 Submit membrane manufacturer's certificate that membrane has been installed in accordance with Contract Documents.

.6 Extended warranties: Submit extended warranties signed and registered by the manufacturer providing the warranties in the name of the Owner for the timeframe and coverage specified in this Section.

1.5 QUALITY ASSURANCE

.1 Qualification: Perform work of this Section by a company that is a member in good standing of the Ontario Industrial Roofing Contractors Association (OIRCA) and has a minimum of 5 years proven acceptable roofing experience on installations of similar complexity and scope.

.2 Testing: Provide flood testing conducted by an independent testing agency of the specified roofing products.

.3 Perform roofing work in accordance with the CRCA Roofing Specifications Manual and in accordance with membrane manufacturer's printed installation instructions.

.4 Ensure roofing system has been tested and conforms to CAN/CSA A123.21 to ensure wind uplift resistant applicable to the Place of Work.

.5 Roof system shall have a minimum Class C classification in accordance with CAN/ULC-S107.

.6 Ensure torching is performed by skilled workers who have successfully completed and passed a course of instruction by membrane manufacturer in torch-applied-membrane techniques.

.7 Ensure membrane manufacturer's representative has full access to this work for proper inspection prior to and during membrane installation. Roof inspections shall be conducted when the roof is 10%, 50%, and 100% complete minimum. Membrane manufacturer to certify that roof installation was in conformance to manufacturer’s written requirements.

.8 Pre-installation meetings: Arrange meeting on Site to be attended by Consultant, Contractor, and roofing manufacturer's representative to inspect substrates, and to review installation procedures 48 hours in advance of installation.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle Products in accordance with the Conditions of the Contract and as specified herein.

.2 Deliver Products in original containers and keep in protective storage until used.

.3 Indicate on containers or wrappings of Products:
- .1 Manufacturer's name and brand.
- .2 Compliance with applicable standard.
- .3 Weight of material, where applicable.

.4 Handle and store Products to prevent damage. Keep manufacturer's labels and seals intact. Store roofing rolls on end to prevent flattening. Ensure that shelf life of Products has not expired.

.5 Protect Products from inclement weather. Keep insulation, insulation overlay, and roofing membranes absolutely dry. Remove from storage only as much Product as can be applied, made weathertight, and covered with roofing in same day. Do not install Products which are damp at time of installation or showing evidence of having been damp or exposed to moisture.

.6 Store roofing membranes for 24 hours minimum in area kept at 10^0C minimum and remove for application with minimum exposure to low temperatures. Keep membranes dry, stored off-the-ground, on end and well ventilated.

.7 Do not store more than one day's supply of Products on the roof at any time. Stack materials on pallets on roof. Cover Products with incombustible waterproof tarpaulin whenever work is interrupted, or when there is precipitation of any kind.

.8 Distribute Products stored on roof. Install bases under equipment and Products to distribute weight. Do not store Products on, or transport materials across, completed roof areas.

.9 Place 19 mm thick plywood runways over work to enable movement of Products and other traffic.

.10 Where hoisting or pumping occurs adjacent to construction, hang tarpaulins to protect walls and other surfaces. Locate kettle so smoke will not discolour adjacent building surfaces.

.11 Locate a 9 kg fire extinguisher fully charged and in operable condition at installation location, of proper type for Products being used and stored.

.12 Cover walls and adjacent work where Products are hoisted or used.

.13 Use warning signs and barriers and maintain in good order until completion of work.

.14 Clean off drips and smears of bituminous immediately.

.15 Dispose of rain water off roof and away from face of building until roof drainage system has been installed and connected.

.16 At end of each day's work or when stoppage occurs due to inclement weather, protect completed work and Products.

1.7 **SITE CONDITIONS**

.1 Install roofing on dry deck, free of snow and ice, use only dry Products and apply only during weather that will not introduce moisture into roofing system.

.2 Apply roofing only when air and surface temperatures are above 4^0C, have been so for at least 48 hours and are not likely to go below 4^0C, until work is completed.

.3 Proceed with work when temperatures are below 4^0C only with mutual documented agreement between Contractor and Consultant.

1.8 **EXTENDED WARRANTY**

.1 At completion of this work, provide a signed OIRCA warranty to the Owner covering defects of workmanship for a period of 2 years commencing from Contract Completion. Agree to make good promptly any defects which occur or become apparent within the warranty period in conjunction with the membrane manufacture's warranty. Defects shall include but not be limited to leakage, failure to stay in place, lifting, and deformation.

.2 At completion of this work, provide a signed warranty from the roofing system manufacturer to the Owner covering defects in workmanship and materials for a period of 5 years commencing from Contract Completion. Warranty shall include vapour retarder, membrane, roof insulation, sloped insulation, and all other products supplied by roofing system manufacturer. Scope of coverage: Repair and/or replace damaged roofing material caused by the ordinary wear and tear of the elements, manufacturing defect, and the workmanship used to install these materials.

2 Products

2.1 **MATERIALS**

.1 All materials under work of this Section, including but not limited to, adhesives and primers are to have low VOC content limits.

.2 Acceptable membrane manufacturers:
- .1 Henry Company Canada Inc.
- .2 IKO Industries Inc.
- .3 Soprema Waterproofing Inc.

.3 Deck Sheathing: ASTM C1177/C117M, 12.7 mm thick, unless otherwise indicated, 'Dens Deck' by G-P Products or 'Securock Gypsum Fiber Roof Board' by CGC.

.4 Sheathing and insulation adhesive: Single component polyurethane adhesive as recommended by roof system manufacturer.

.5 Asphalt primer: CGSB 37-GP-9Ma; Asphalt modified bitumen with thermoplastic polymers.

.6 Asphalt: CSA 123.4-M;
- .1 Type 2 for slopes up to 1:8.
- .2 Type 3 for slopes from 1:8 to 1:4.

.7 Vapour retarder: Minimum 0.8 mm thick self adhesive membrane consisting of SBS modified bitumen adhesive bottom and tri-laminated woven polyethylene top with silicone release film. 'Vapour Block SA' by Henry, 'M.V.P.' by IKO, or 'Sopravap'r by Soprema.

.8 Insulation:
- .1 Polyisocyanurate insulation: CAN/ULC S704, rigid, closed cell, polyisocyanurate foam insulation integrally laminated to perforated black glass reinforced felt facers, square edges, thickness as indicated on Drawings, use maximum size board possible. Insulation thickness under 50 mm use single layer board. Insulation thickness over 50 mm use two equal thickness boards.
- .2 Tapered Insulation: Factory pre-engineered tapered polyisocyanurate insulation in thickness sufficient for slopes indicated; manufactured by Accu-Plane Systems Inc. IKO, Posi-Slope Manufacturing Ltd. or Soprema.

.9 Overlay board:
- .1 Bituminous Board; Multi-ply, semi-rigid asphaltic roofing substrate board composed of a mineral fortified asphaltic core formed between two asphaltic saturated fibreglass liners. 1200 x 1500 x 8mm thick; 'IKO Protection Board' by IKO or 'Sopraboard' by Soprema or approved alternate.

.10 Base sheet membrane and flashing: ASTM D6162, Type 1, Grade S, Styrene-Butadiene-Styrene (SBS) elastomeric polymer, prefabricated sheet, non-woven polyester and glass fiber composite reinforcing, having the following minimum characteristics:
- .1 Thickness: 2.2 mm.
- .2 Reinforcing fabric weight: 200 g/m^2.
- .3 Cold flex: -18 deg. C.
- .4 Tensile strength: 13 kN/m.
- .5 Ultimate elongation: 26%.
- .6 Tensile-tear: 289 N.
- .7 Bottom and top surfaces: Sanded/Polyethylene.

.11 Cap sheet membrane and flashing: ASTM D6162, Type 1, Grade S, Styrene-Butadiene-Styrene (SBS) elastomeric polymer, prefabricated sheet, non-woven polyester and glass fiber composite reinforcing, having the following minimum characteristics:
- .1 Thickness: 4.0 mm.
- .2 Reinforcing fabric weight: 200 g/m^2.
- .3 Cold flex: -18 deg. C.
- .4 Tensile strength: 13 kN/m.
- .5 Ultimate elongation: 26%.
- .6 Tensile-tear: 289 N.
- .7 Granule loss: 2.0 g maximum.

.8 Bottom and top surfaces: Polyethylene/Granules.
.9 Top surface to providing a minimum SRI of 78.

.12 Expansion Joints: 2.2 mm thick mopped, waterproof expansion joint in width to suit expansion joint width. 'Redline' by Situra Inc. or approved alternative.

.13 Plastic cement: Trowel grade asphalt mastic.

.14 Roofing nails: Galvanized steel, minimum 19 mm head of length to penetrate wood nailer minimum 19 mm.

.15 Roof drains: In accordance with Division 22 - Mechanical

.16 Stack flashing units: In accordance with Division 22 - Mechanical

.17 Stack Jacks: to CSA-B272, insulated aluminum stack jacks complete with bitumen protection dam and screw-secured cover;
.1 SJ-26/SJ-27, by Thaler Metal Industries Ltd.
.2 Flash-Tite VSC-S Series, by Lexcor.

.18 Roof Penetration Flashings: to CSA-B272, insulated aluminum, complete with bitumen protection dam and screw-secured cover. Acceptable products and manufacturers by Thaler Metal Industries Ltd. or Flash-Tite by Lexcor as follows:
.1 Rigid Conduits: MEF-AE1.
.2 Flexible Conduits: MEF-2A.
.3 Gas Pipe Protrusion: MEF-9.
.4 Mechanical Unit Supply Piping & Tubing: MEF-AE2/AE4 series.

.19 Irregular Roof Protrusion Flashings: Pre-fabricated mastic sealer pockets; 127 mm high x appropriate diameter to exceed diameter or width of protrusion by 50 mm. Pockets to be sealed with pourable self-leveling sealant;
.1 Chemlink Advanced Construction Products.
.2 Hi-Tuff TPO Molded Sealant Pockets by Lexcan Limited.

.20 Gas Line supports: PPH Portable Pipe Hangers Ltd. Model PP10 with strut and Hanger.

.21 Precast Pavers: 610 X 610 x 45 mm thick non-interlocking roof slabs, less then 5% absorption, minimum 55MPa compressive strength, standard diamond finish, chamfered edges, patio quality, conforming to CSA A231.1/A231.2. 'Diamond' concrete roof slab by armtec Brooklin or approved alternative.

.22 Pedestals: Provide pedestals at each corner of paving slabs to product a level, smooth surface for pedestrian traffic; 'Pave-el' by Envirospec Inc. or approved alternative by Bison.

.23 Roof hatch: Preassembled 915 x 762 mm single leaf metal roof scuttle. EPDM rubber gasket adhered to hollow metal cover. Insulation 25 mm thick with metal liner protector. 305 mm high curb with integral flashing and full welded corners. Lifting mechanism will be compression spring operators enclosed in telescopic tubes. Slam latch with interior and exterior turn handles and padlock hasps. 'Type S' by Bilco or approved alternative.

.24 Roof hatch safety railing: Powder coated aluminum posts and rails in high visibility, safety yellow colour. Aluminum extrusion mounting brackets and cast aluminum locking mechanism. All fasteners and hinges are type 316 stainless steel. 'Bil-Guard 2.0' by Bilco or approved alternative.

.25 Roof hatch safety post: High strength square steel post with high visibility, powder coat finish in safety yellow colour. Design post to automatically lock into position when fully extended and to have release lever to disengage. All fasteners are type 316 stainless steel. 'LadderUp' by Bilco or approved alternative.

3 Execution

3.1 **EXAMINATION**

.1 Verify condition of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of work of this Section means acceptance of existing conditions.

3.2 **PREPARATION**

.1 Prior to commencement of work ensure:
- .1 Environmental and Site conditions are suitable for material installation in accordance with manufacturer's recommendations.
- .2 Decks are sound, straight, smooth, dry, free of oils, grease, snow, ice or frost, and swept clean of dust and debris.
- .3 Curbs have been built and plywood and lumber nailer plates have been installed.

.2 Supply to trades concerned in ample time, inserts, reglets and accessories to be built into Work. Assist in setting such items.

.3 Cooperate with respective trades to determine methods and procedures to ensure watertight junctions to items passing through roof.

.4 Locate kettles in a safe place outside of building. When locating kettles, give consideration to direction of prevailing winds, building fans and air handling units to minimize possibility of smoke and fumes entering surrounding occupied buildings. If wind direction causes smoke and fume problems, relocate kettles on a daily basis as directed by the Consultant.

.5 Maintain supervision while kettles are in operation and maintain metal covers for kettles to smother flames in case of fire. Supply suitable fire extinguishers.

.6 Maintain efficiency of equipment by frequent cleaning. Remove carbonized bitumen.

.7 Control heating of bitumen, prevent overheating. Maintain an accurate, easily read thermometer during heating. Comply with the following bitumen heating tolerances:
- .1 Maximum heating temperature: 240^0C.
- .2 Application temperature: Equiviscous Temperature (EVT).
- .3 Kettles: Holding time maximum 4 hours at maximum 177^0C.

.8 Use heating equipment equipped with thermometers which show temperature of asphalt at all times. During cold weather however, it may become necessary to heat bitumen beyond the normal temperatures specified herein, to obtain EVT temperature range at point of application on roof. If such conditions occur, implement cold weather procedures, and before proceeding with higher temperatures, obtain prior review from Consultant and inspection authorities approval, and take necessary safety precautions.

.9 In cold weather insulate hauling equipment and re-circulation lines to minimize heat loss.

3.3 DECK SHEATHING

.1 Over metal deck, Install sheathing in straight parallel rows, with long dimension perpendicular to metal roof deck rib direction, and with short dimension edges centred on and supported by ribs of metal deck in both directions.

.2 Place sheathing in moderately tight contact at joints between boards and abutting surfaces with gaps between boards not exceeding 3 mm. Under no circumstances shall the roofing membrane be left unsupported over a space greater than 3 mm.

.3 Adhesively fasten sheathing to metal deck with in accordance with sheathing manufacturer’s and adhesive manufacturer’s written instructions.

3.4 PRIMING

.1 Perform priming at rate and to surfaces recommended by the manufacturer in accordance with CGSB 37-GP-15M.

3.5 VAPOUR RETARDER

.1 Primer substrate to manufacturers recommendations.

.2 Install vapour retarder in accordance with manufacturers written instructions.

.3 Lap vapour retarder ends and edges 50 mm minimum. Roll vapour retarder and laps for continuous adhesion over entire substrate area; use manufacturer's recommended roller.

.4 Cut and fit vapour retarder as required for passage of protrusions, ensuring continuous adherence to substrate.

.5 At junction of deck to vertical surfaces and along perimeter of roof deck, extend vapour retarder, set in adhesive, beyond the point where insulation will terminate.

.6 Seal penetrations, end and side laps, and ends of vapour retarder to substrates and to wall system air/vapour retarder to maintain continuity of building air/vapour retarder system.

3.6 **INSULATION**

.1 Prior to installation of insulation, examine vapour retarder and make good damage.

.2 Use full size insulation boards wherever possible, and minimum half boards at abutting vertical surfaces.

.3 Install insulation promptly to avoid possibility of condensation beneath vapour retarder.

.4 Install insulation in straight parallel rows, with long dimension parallel to long dimension of roof. Stagger end joints of insulation boards in adjacent rows 50%.

.5 Place insulation boards in moderately tight contact at joints between boards and abutting surfaces with gaps between boards not exceeding 1.5 mm. Under no circumstances shall the roofing membrane be left unsupported over a space greater than 3 mm.

.6 When cutting insulation board cut completely through board thickness; do not break or tear insulation board to fit a detail. Any areas of insulation system having voids will be rejected.

.7 When installing multiple layers of insulation, all joints between layers shall be staggered at least 300 mm.

.8 Do not lay more insulation than can be completely covered as finished roofing system on the same day.

.9 Do not cut off insulation in straight lines at the end of a work period, allow stepped boards for toothing-in.

.10 Install polyisocyanurate insulation in a minimum of two layers.

.11 Install Polyisocyanurate insulation, in adhesive, in straight parallel rows, with long dimension parallel to long dimensions of roof.

.12 Install subsequent layers of insulation, in adhesive, in straight parallel rows, with long dimension parallel to previous layer of insulation with joints offset as recommended by insulation manufacturer.

.13 Install tapered insulation in accordance with manufacturer's details and instructions. Miter roof insulation edges at ridge, valley and other similar non-planar conditions.

.14 Install overlay board over tapered insulation in straight parallel rows, with long dimension parallel to long dimensions of insulation. Stagger side joints in adjacent rows minimum 50%.

3.7 MEMBRANE INSTALLATION

.1 Install materials in accordance with manufacturer's instructions.

.2 Install membrane free of blisters, wrinkles and fishmouths in accordance with membrane manufacturer's instructions. Avoid asphalt seepage at seams in cap sheet greater than 5 mm.

.3 Base sheet application:
- .1 Starting at low point of roof, perpendicular to slope, unroll base sheet dry over substrates, align and reroll for both ends.
- .2 Unroll and install membrane in full moppings of asphalt. Extend base sheet to base of cant.
- .3 Lap sheets 75 mm minimum for side and 150 mm minimum for end laps.

.4 Cap sheet application:
- .1 Starting at low point on roof, perpendicular to slope, unroll cap sheet, dry over base sheet, align and reroll from both ends.
- .2 Unroll and torch cap sheet onto base sheet extending to base of cant taking care not to burn membrane or its reinforcement.
- .3 Lap sheets 75 mm minimum for side laps and 150 mm minimum for end laps. Offset joints in cap sheet 300 mm minimum for those in base sheet.
- .4 Embed surface granules on end laps by heating and using a round-nosed roofing trowel, prior to installation of following sheet.

3.8 EXPANSION JOINT

.1 Roll out expansion joint and allow to relax prior to installation. Ensure joint is clean and packed with batt insulation. Install expansion joint in accordance with manufacturer's instructions to ensure joint is watertight.

.2 Apply flood coat of asphalt to roof and unroll expansion joint into it. Press expansion joint into hot asphalt with smoothing motion.

.3 Strip in joint by coating top side of polyester fleece with flood coat of asphalt and installing top ply of bitumen.

.4 Provide additional protection coarse over flashing by mopping a additional strip of modified bitumen membrane on one side of expansion joint to lay completely over joint.

3.9 FLASHING INSTALLATION

.1 Install flashing free of blisters, sags, wrinkles and fishmouths in accordance with the manufacturer's recommendations. Avoid asphalt seepage at seams greater than 5 mm.

.2 Base flashing:
- .1 Lay base flashings in vertical strips 1000 mm wide to curb surfaces as shown.
- .2 Extend on to flat roof surface minimum 100 mm from toe of cant.
- .3 Make 75 mm side laps and 100 mm end laps from laps in base sheet of roof membrane.
- .4 Install flashings in full moppings of asphalt directly to substrates, proceeding from bottom to top.
- .5 Nail top leading edge to nailer at 300 mm o.c.

.3 Cap flashing:
- .1 Lay cap flashing in vertical strips 1000 mm wide to curb surfaces as shown.
- .2 Extend on to flat roof surface minimum 150 mm from toe of cant.
- .3 Make 75 mm side laps and 100 mm end laps from cap sheet laps and base flashing laps.
- .4 Embed surface granules on laps over cap sheet roofing by heating and use of round-nosed roofing trowel.
- .5 Torch cap flashing directly to cap sheet roofing and to base sheet flashing proceeding from bottom to top
- .6 Soften underside of membrane by torching, without overheating, resulting in uniform adhesion over surface of base flashing.
- .7 Extend cap sheet as shown and nail leading edge to nailers 300 mm o.c.

3.10 ROOF ACCESSORIES

.1 Prior to application of membrane set stack flashing units, roof hatch, prefabricated equipment curbs, and other roof penetration accessory units in accordance with manufacturer's Product data. Install removable cap per accessory manufacturer's Product data as applicable.

.2 Seal joints at items projecting through membrane watertight to acceptance of Consultant.

3.11 FIELD QUALITY CONTROL

.1 Check completed membrane welds for continuity after cooling by use of screw driver run along welded seams and showing uninterrupted extrusion of melted asphalt material.

.2 Inspect completed membrane and flashings for punctures, tears and discontinuous weld seams. Apply additional layer of cap sheet membrane over punctures and tears, extending beyond damaged area or open seam in all directions, torch in-place.

3.12 **CLEANING**

.1 Clean roofing, metal, masonry, and similar items of dirt, cuttings, stains and foreign matter upon completion of the work.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Design, labour, Products, equipment and services necessary for metal roofing work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 ANSI B18.6.4, Screws, Tapping and Metallic Drive, Inch Series, Thread Forming and Cutting.

.2 ASTM A653/A653M, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.

.3 ASTM A792-M, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

.4 ASTM C612, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

.5 ASTM C1177M, Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

.6 ASTM E84, Test Method for Surface Burning Characteristics of Building Materials.

.7 CAN/CGSB-19.13-M, Sealing Compound, One Component, Elastomeric, Chemical Curing.

.8 CAN/CSA S136-M, Cold Formed Steel Structural Members.

.9 CAN/CSA S136.1-M, Commentary on CAN/CSA S136-M, Cold Formed Steel Structural Members.

1.3 **SYSTEM DESCRIPTION**

.1 Roof assemblies specified herein are based on a standing seam metal roof, complete with expansion clip system and drainage mat system. Roof assembly type referenced are as indicated on Drawings;

.1 RF2 (Steel deck):

.1 Underlayment board
.2 Vapour retarder (self-adhered).
.3 Rigid insulation (two layers, 65 mm thick each, adhered).
.4 Z-Grits
.5 Sheathing
.6 Self-adhered waterproof membrane (breathable)
.7 Standing seam metal roof complete with expansion clip and drainage mat system.

1.4 DESIGN REQUIREMENTS

.1 Design metal roofing elements in accordance with CAN/CSA S136-M, S136.1-M and to withstand live, dead, lateral, wind, seismic, handling, transportation and erection loads.

.2 Design metal roofing elements in accordance with following Climatic Design Data for Brampton contained in Ontario Building Code:
- .1 Design temperature: January 1%, July 2 1/2%.
- .2 Wind (Hourly wind pressures): 1 in 50 year occurrence.
- .3 Earthquake: Seismic Data as listed.

.3 Design metal roofing system to limit deflection under design loads to L/240.

.4 Design metal roofing system to prevent restriction of thermal induced movement which would induce deformation such as warping, buckling, and failure of joint seals and fasteners.

.5 Design metal roofing system to prevent the infiltration of water into the roof system and to prevent roofing system components from vibrating due to design wind loads.

1.5 SUBMITTALS

.1 Product data:
- .1 Submit copies of manufacturer's Product data in accordance with Section 01 30 00 indicating:
  - .1 Performance criteria, compliance with appropriate reference standard, characteristics, limitations.
  - .2 Product transportation, storage, handling and installation requirements.

.2 Shop drawings:
- .1 Submit shop drawings in accordance with Section 01 30 00 indicating:
  - .1 Arrangements of sheets and joints, materials, thicknesses, dimensions, layouts, types and locations of supports and fasteners and special shapes.
  - .2 Relationship of panels to structural frame.
  - .3 Details of waterproofing membrane, insulation, connections, and all other components in the system.

.3 Samples:
- .1 Submit following samples in accordance with Section 01 30 00.
  - .1 Submit 300 x 300 mm samples of each sheet metal material and finish.
  - .2 Waterproofing membrane.
  - .3 Insulation.

.4 Reports: Submit written field inspection and test report results within 3 days after each inspection.

.5 Extended warranty: Submit extended warranty signed and registered by the manufacturer providing the warranty in the name of the Owner for the timeframe and coverage specified in this Section.

1.6 QUALITY ASSURANCE

.1 Installers qualifications: Perform work of this Section by a company that has a minimum of five years proven experience in the installation of metal roofing of a similar size and nature and that is approved by manufacturer. Submit to Consultant, applicator's current certificate of approval by the material manufacturer as proof of compliance.

.2 Retain a Professional Engineer, licensed in Province of Ontario, with experience in metal roofing work of comparable complexity and scope to perform following services as part of work of this Section:
- .1 Design of metal roofing
- .2 Review, stamp, and sign shop drawings.
- .3 Conduct shop and on-Site inspections and prepare and submit inspection reports.

.3 Mock-up:
- .1 Construct one full scale 1200 mm wide x 1800 mm long mock-up panel of metal roofing construction, in location acceptable to Consultant.
- .2 Demonstrate installation of underlay board, insulation, metal roofing, finish, and quality of workmanship.
- .3 Mock-up may form part of final Work, if acceptable to Consultant. Remove and dispose of mock-ups which do not form part of Work.

.4 Pre-installation meeting: Arrange with manufacturer's representative, Contractor, and Consultant to inspect substrates, and to review installation procedures 48 hours in advance of installation.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Stockpile panels tilted to provide water run-off, free from ground contact on firm, level, non-staining supports extending full width of sheet and spaced not more than 450 mm apart. Cover components with opaque polyethylene sheet. Vent to allow air movement.

1.8 **EXTENDED WARRANTY**

.1 Submit an extended warranty for metal roofing work In accordance with the General Conditions, except that the warranty is extended to 2 years from date of Substantial Performance of the Work.
- .1 Warrant against panel warping, twisting, failure, jointing, finish failure, water penetration below waterproofing membrane and failure to drain water from rainscreen cavity and painting finishes.
- .2 Coverage: Complete replacement including affected adjacent parts.

2 Products

2.1 **MATERIALS**

.1 All materials under work of this Section, including but not limited to, sealants and coatings are to have low VOC content limits.

.2 Standing seam metal: ASTM A653M; 0.61 mm (24 Ga.) minimum base metal, Z275, galvanized steel. ‘Tradition 150’ by VicWest Steel or CRS-38 by CR Systems, or approved alternative by Agway Metals Inc., or Roll From Group.

.3 Metal roofing finish: Perspectra Series coating system by ArcelorMittal Dofasco, or WeatherX by Vicwest Steel or ‘SMP Prepainted Steel’ by Cascadia Metals Ltd. Colour as selected by Consultant.

.4 Galvalume: ASTM A792M, AZM165 coating designation, 0.61 mm thick minimum base metal.

.5 Steel deck: Refer to Structural Drawings and Specification for steel deck.

.6 Deck closures: ASTM A653/A653M, Z275 hot-dip galvanized steel, 0.61 mm thick base steel thickness.

.7 Deck reinforcements: ASTM A653/A653M, Z275 hot-dip galvanized steel, 2.0 mm thick base steel thickness.

.8 Underlay board: ASTM C1177; 6 mm thick, ‘Dens-Deck Roof Board’ by Georgia-Pacific Corp.; tested to ASTM E84, 0 flame spread, 0 smoke developed, glass fibre faced both sides, silicone treated gypsum core. 1200 mm wide sheets x maximum practical lengths to minimize end joints.

.9 Waterproof membrane: 1.0 mm thick composite sheet comprised of SBS modified bitumen with woven polyethylene reinforcement; ‘CCW 300 HT’ by Carlisle Coatings and Waterproofing, ‘Lastobond Shield HT’ by Soprema, ‘Platinum HT SA’ by FT Synthetics or approved alternative by Henry Company Canada. Primer recommended by membrane manufacturer.

.10 Drainage mat: 7.6 mm thick, ‘Viper CDR Vent’ by Keene or approved alternative.

.11 Z girts and C channels: CAN/CSA S136-M; Minimum 1.2 mm, Z275 galvanized Z girts and C channels. Depth: As indicated on Contract Drawings.

.12 Seam clips: ASTM A653M; Z275 galvanized steel, thermal clip system.

.13 Insulation: ASTM C612, 96 kg/m^3, Semi-rigid mineral fibre. Thickness as indicated on Contract Drawings. Temporary adhesive: As recommended by insulation manufacturer.
.1 'Rockboard 60' by Rockwool Inc.
.2 Or approved alternative by Owens Corning Canada Inc.

.14 Fascia, trim, closure, and flashings: Material, finish, colour, hidden fastener and thickness to match metal roofing material.

.15 Screw fasteners: Hot dipped galvanized steel fasteners. All fasteners to be concealed and hidden. Fasteners to be complete with coloured heads to match metal roofing.

.16 Sealant: CAN/CGSB-19.13-M. Primer as recommended by sealant manufacturer.

2.2 FABRICATION

.1 Fabricate roof components in accordance with reviewed shop drawings factory-ready for field installation.

.2 Fabricate individual metal roofing panels in maximum lengths.

.3 Fabricate metal roofing panels square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.4 Notch Z girts and C channels as required to allow for drainage of rainscreen cavity.

3 Execution

3.1 EXAMINATION

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of work of this Section means acceptance of existing conditions.

3.2 STEEL DECK

.1 Install steel deck in accordance with CSA S136 and manufacturers written instructions ensuring it is securely fastened with minimum bearing on structural support equal to depth of steel roof deck profile.

.2 Fasten steel roof deck to structural supports with a maximum fastener spacing along bearing supports of 400 mm or two flute spacings, whichever is less.

.3 Provide arc spot welds with a nominal 20 mm top diameter.

.4 Mechanically fasten side laps of adjacent units at maximum 900 mm. Provide closer spacing where required by design.

.5 Provide deck closures and reinforcing as required for design loads.

3.3 **UNDERLAY BOARD**

.1 Stagger underlay board joints at least 25% of full board length. Orient long side of boards perpendicular to metal deck flutes. Locate end joints over supporting ribs of metal deck.

.2 Do not install imperfect, damaged or damp boards. Butt boards together with no spaces between boards.

.3 Screw fasten underlay board to metal deck substrate at 600 mm o.c. and continuously around perimeter of each board at 300 mm o.c.. Maintain 15 mm minimum from edge of board to centre of screw.

3.4 **WATERPROOF/AIRSEAL MEMBRANE**

.1 Install primer and waterproof membrane continuously over underlay board, in accordance with manufacturer's instructions.

.2 Overlap waterproof membrane 50 mm along sidelaps and 75 mm on end laps and lap in direction of waterflow.

.3 Coordinate airseal transition to adjacent parts of work.

3.5 **GIRTS AND CHANNELS**

.1 Install Z girts, fastened through waterproof membrane and into structural framing beneath. Orient Z girts to drain water from rainscreen cavity.

.2 Frame roofing system edges, with C channels and orient channel webs to face outwards.

3.6 **METAL ROOF INSULATION**

.1 Prior to installation of insulation, examine waterproofing membrane and make good damage.

.2 Install metal roof insulation in continuous contact with waterproof membrane and fitted between Z girts and C channels. Butt boards together with no spaces between boards. Areas of insulation system having voids will be rejected.

.3 When cutting insulation board, cut completely though board thickness and trim to provide plain but joints. Do not break or tear insulation board to fit detail.

3.7 FASCIA, TRIM, CLOSURES, AND FLASHINGS

.1 Form and profile fascia and trim including inside and outside corners, flashing, edgings, cap strips, drips, fillers, closure strips, and starter strips in accordance with the drawings.

.2 Flashings to utilize a “S” locking joint for concealed fastening.

.3 Cut neat holes in metal roofing to accommodate roof penetrations and install flashing for a watertight installation.

3.8 METAL ROOFING (STANDING SEAM)

.1 Install metal roofing in accordance with reviewed shop drawings and manufacturer’s written instructions. Used concealed fasteners unless otherwise approved by the Consultant.

.2 Install seam clips spaced as indicated on reviewed shop drawings to comply with design criteria. Secure cleats with two fasteners each minimum, into Z girts or metal deck.

.3 Apply sheet metal roofing beginning at eaves. Loose lock pans to valley flashing and edge strips at eaves and gable rakes.

.4 Fold lower ends of seams at eaves over at 45° angle. Terminate standing seams at ridge and hips by turning down in tapered fold.

.5 Install metal roofing panels in one piece, for entire slope, except as indicated otherwise. In locations that roof panels cannot be installed in one piece, provide 100 mm starter strip to join the panels together. Provide a continuous sealant bead under starter strip.

.6 Metal roof panels terminating at eaves or valleys shall not have a raw metal edge or exposed fasteners. Fold panel ends and install in accordance with reviewed shop drawings.

.7 Insert metal roof panels terminating at hips or ridges into concealed metal closures. Metal closures shall allow for expansion of the metal roof panel and also act as a starter strip for hip or ridge flashings.

.8 Install valley sheets not exceeding 3 m in length. Shingle lap joints 150 mm in direction of flow. Extend valley sheet minimum 150 mm under roofing sheets. Double fold valley and roofing sheets and secure at 450 mm oc.

.9 Apply isolation coating to metal surfaces in contact with concrete or mortar.

.10 Remove and replace damaged metal roofing. Do not touch-up damaged panels.

3.9 **SEALANT**

.1 Seal where necessary to form weathertight seal between flashing and adjoining surfaces and between flashing and other work. Sealing work consists of bedding between members where possible. Dry tool sealant to concave profile where exposed.

3.10 **CLEANING AND TOUCH-UP**

.1 Clean exposed finished surfaces of complete installation free of dirt, grease and smudges.

.2 Touch-up scratches with air dry formulation of coating system to match original factory finish.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Labour, Products, equipment and services necessary for flashing and sheet metal Work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 ASTM A653/A653M, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.

.2 ASTM C920, Specification for Elastomeric Joint Sealants.

.3 CRCA Roofing Manual, Canadian Roofing Contractors Association.

.4 Canadian Steet Steel Building Institute (CSSBI) Bulletin No. 9, Core and Maintenance of Pre-finished Sheet Steel Building Products.

1.3 **SUBMITTALS**

.1 Shop drawings:
- .1 Submit shop drawings in accordance with Section 01 30 00 indicating:
  - .1 Proposed method of shaping, forming, jointing.
  - .2 Fastening, and application of flashing and sheet metal Work.

.2 Samples:
- .1 Submit following samples in accordance with Section 01 30 00:
  - .1 50 x 50 mm samples of sheet metal material, colour and finish.
  - .2 Representative sample section of prepainted metal flashing illustrating S locking jointing method, minimum 600 mm long.

1.4 **QUALITY ASSURANCE**

.1 Mock-Up:
- .1 Fabricate mock-up in minimum 2400 mm length with reviewed materials, approved methods including joints, seams, expansion joints, starter strips and fasteners.
- .2 Mock-up, if accepted, shall represent the minimum standard for Work. Mock-up may form part of finished Work.

.2 Flashing and Sheet Metal Work shall be executed in accordance with SMACNA Architectural Sheet Metal Manual - 1993 (Addendum No. 1 - October 31, 1997), by skilled trades having a minimum of five (5) years related experience.

1.5 **WARRANTY**

.1 Provide minimum two (2) year Warranty from date of Substantial Performance, as certified by Consultant. Warranty shall be submitted against defects in workmanship and materials.

.2 Contractor must extend the Warranty on replaced parts and workmanship for a period of two (2) years from date of acceptance of replacement parts and workmanship. Defects will include but will not be limited to leaking, failure to stay in place, lifting, deformation and breaking of weathertight seals.

.3 Provide all additional Warranties that may be available from manufacturer.

2 Products

2.1 **MATERIALS**

.1 All materials under Work of this Section, including but not limited to, sealants and paints are to have low VOC content limits.

.2 Prepainted sheet steel: ASTM A653/A653M; Classification LFQ, Grade A, Z275 zinc coating designation, minimum base metal thickness of 0.71 mm (24 gauge), commercial quality, prefinished with Perspectra Series coating system by U.S. Steel Canada, or WeatherX by Vicwest Steel. Colour as selected by Consultant.

.3 Plastic cement: Trowel grade asphalt mastic.

.4 Sealant: ASTM C920, Type S, Grade NS, Class 25; High-performance, medium-modulus, one-part, neutral-cure silicone sealant. 'CWS' by Dow Corning or approved alternative.

.5 Cleats and starter strips: Starter strips to be continuous, of same material as flashing used, 1.2 mm thick. Minimum 100 mm wide face or as detailed and to be continuous.

.6 Fasteners: Flat head roofing nails of length, type and thickness suitable for metal flashing application.

.7 Washers: of same material as sheet metal, 1 mm thick with rubber packings.

.8 Touch-up paint: Same colour and material as prepainted sheet steel, as recommended by prefinished coating manufacturer.

2.2 **FABRICATION**

.1 Shop fabricate flashing, sheet metal and trim in accordance with requirements of SMACNA, CRCA and the Contract Documents. Form sheet metal on bending brake, shaping, trimming and hand seaming on bench.

.2 Brake-form sections square, true, and accurate to size. Flashings shall be free from distortion, oil canning, twists, buckles, discolouration and other defects detrimental to appearance and performance.

.3 Hem exposed edges 13 mm minimum on underside for appearance and stiffness. Mitre and seal corners with sealant.

.4 Form joints with 'S-locks' and make allowances for movement. Mitre and form standing seams at all corners. Make allowance for movement at joints.

.5 Fabricate copings, cap flashings, counter flashings and starter strips, scuppers, fascia and miscellaneous flashings to details shown and where required.

.6 Fabricate metal in 2400 mm maximum lengths with an unbroken face less than 225 mm. Form flashings with an exposed unbroken face exceeding 225 mm and a girth greater than 610 mm in 1220 mm maximum lengths.

.7 Provide an 'S-Lock' joint at all end joints and at all horizontal joints between the cap flashing and the vertical flashing and between the vertical flashing and base counter flashing.

.8 Provide double locking standing seam at interior and exterior corners where flashings meet.

.9 Scuppers:
- .1 Form scuppers from prefinished steel sheet metal.
- .2 Sizes and profiles as indicated.
- .3 Provide necessary fastenings.
- .4 Provide Zurn Z198 cast metal parapet scupper sleeve with collar clamp where indicated on drawings.

.10 Sheet metal coming in contact with a metal of a different type must be back painted with two (2) coats of isolation coating.

3 Execution

3.1 EXAMINATION

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of Work means acceptance of existing conditions.

3.2 FLASHING INSTALLATION

.1 Install coping flashings, curb counter flashings, starter strips, scuppers, and miscellaneous flashings to details shown on the Contract Drawings and in accordance with CRCA.

.2 Use concealed fasteners. Exposed fasteners such as pop rivets are not allowed.

.3 Install continuous starter strips to present a true, non-waving, leading edge. Anchor to back-up for a rigid, secure installation.

.4 Counterflash bituminous flashings at intersections of roof with vertical surfaces and curbs. Flash joints using S-lock forming tight fit over hook strips.

.5 Make end joints using an S lock joint. Execute by inserting end coping length in 25 mm deep S lock formed in end of adjacent length. Extend concealed portion of S lock 25 mm outwards and nail to substrate. Face nailing of joints will not be permitted.

.6 Seal where necessary to form weathertight seal between flashing and adjoining surfaces and between flashing and other Work. Sealing Work consists of bedding between members where possible. Tool sealant to concave profile where exposed.

.7 Insert metal flashing under cap flashing to form weathertight junction.

.8 Caulk flashing at cap flashing with sealant.

.9 Install pans, where shown around items projecting through roof membrane.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Labour, Products, equipment and services necessary to protect spray applied foam insulation not otherwise concealed within masonry or gypsum clad wall assemblies with a spray applied thermal barrier in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 CAN4 S124, Standard Methods of Test for the Evaluation of Protective Coverings for Foamed Plastics.

1.3 **SUBMITTALS**

.1 Product data:
- .1 Submit copies of manufacturer's Product data in accordance with Section 01 30 00 indicating:
  - .1 Performance criteria, compliance with appropriate reference standard, characteristics, limitations.
  - .2 Product transportation, storage, handling and installation requirements.

.2 Certification:
- .1 Submit certified documentation for each worker performing Work of this Section, to substantiate 5 years minimum of experience in sprayed thermal barrier installation.
- .2 Submit installer's and Product manufacturer's certification verifying compliance with Contract Documents.
- .3 For assemblies not tested and rated in accordance with CAN4 S124, submit proposals based on related designs using accepted thermal barrier design criteria.

1.4 **QUALITY ASSURANCE**

.1 Qualifications: Execute Work of this Section by manufacturer-approved, skilled, qualified, and experienced workers, trained in installation of Work of this Section.

1.5 **SITE CONDITIONS**

.1 Maintain a 5^0C air and substrate temperature for 24 hours before, during, and 24 hours after application in accordance with manufacturer's instructions.

.2 Ventilate to dry thermal barrier. In enclosed areas circulate interior air and exhaust to the exterior.

.3 Protect adjacent surfaces and equipment around application areas from overspray, marring or damage. Clean, polish or replace materials damaged to acceptance of Engineer.

2 Products

2.1 **MATERIALS**

.1 All materials under Work of this Section, including but not limited to, primers are to have low VOC content limits.

.2 Primer/bonding agent: As recommended by spray thermal barrier manufacturer.

.3 Thermal Barrier: CAN4 S124, Spray applied, single component cementitious thermal barrier with a density of 370 to 380 kg/m3:
.1 'A/D Cementitious Thermal Barrier' by A/D Fire Protection Systems Inc.
.2 'Monokote Z-3306' by Grace Construction Products.

.4 Water: Clean, free from organic and mineral impurities which would be harmful to application.

2.2 **MIXING**

.1 Mix Products in accordance with manufacturer's instructions.

3 Execution

3.1 **EXAMINATION**

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Engineer. Commencement of Work means acceptance of existing conditions.

.2 Verify that substrates are compatible and have suitable bonding characteristics to receive thermal barrier.

.3 Ensure that items required to penetrate thermal barrier are placed before installation of thermal barrier.

.4 Ensure that ducts, piping, equipments, or other items which would interfere with application of thermal barrier are not positioned until thermal barrier is completed.

3.2 **APPLICATION**

.1 Use temporary enclosures to prevent spray from contaminating air beyond application area. Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of thermal barrier material. Protect walls, windows, floors and other surfaces around areas to be fireproofed, from marring or damage.

.2 Clean surfaces to be fireproofed of any foreign matter which would affect adhesion.

.3 Apply primer as recommended by thermal barrier manufacturer for the particular substrate to be fireproofed.

.4 Apply thermal barrier in separate coats in accordance with the manufacturer's instructions to total thickness required to achieve fire ratings shown on the Contract Drawings. Comply with accepted ULC or WHI design.

.5 Maintain continuity of thermal barrier without gaps or voids. Board tamp or trowel thermal barrier before curing.

.6 Repair thermal barrier damaged by other trades, to acceptance of Consultant.

3.3 **FIELD QUALITY CONTROL**

.1 Perform field tests required by authorities having jurisdiction.

3.4 **CLEANING UP**

.1 Clean exposed wall, ceiling or other surfaces of thermal barrier materials to the acceptance of Consultant.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Labour, Products, equipment and services necessary for intumescent fireproofing work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 ASTM D2240, Standard Test Method for Rubber Property - Durometer Hardness.

.2 ASTM D4541, Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.

.3 ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials.

.4 ASTM E761, Standard test method for Compressive Strength of Sprayed Fire-Resistive Materials Applied to Structural Members.

.5 AWCI, Association of the Wall and Ceiling Industries - International.

.6 AWCI Technical Manual 12-B, Standard Practice for the Testing and Inspection of Field Applied Thin-Film Intumescent Fire-Resistive Materials; an Annotated Guide.

.7 Technical Manual 12-B, 'Standard Practice for the Testing and Inspection of Field Applied Thin-Film Intumescent Fire-Resistive Materials by Association of the Wall and Ceiling Industry (AWCI)

.8 ULC, Underwriter's Laboratories of Canada.

1.3 **SYSTEM DESCRIPTION**

.1 Provide intumescent fireproofing to provide a fire resistance rating of 60 minutes for all columns and items indicated on drawings.

1.4 **SUBMITTALS**

.1 Product data:
  .1 Submit duplicate copies of manufacturer's Product data for each material used in accordance with Section 01 30 00 indicating:
    .1 Performance criteria, compliance with appropriate reference standard(s), characteristics, and limitations.
    .2 Product transportation, storage, handling and installation requirements.

.2 Samples:
  .1 Submit following samples in accordance with Section 01 30 00.
    .1 Two 150 x 300 mm samples of intumescent fireproofing applied to 3 mm steel plate cut back to show primer, intumescent coating and topcoat demonstrating colour and finish for Consultant approval.

.3 Certificates:
.1 Submit ULC certification for designs of fire resistive coating application to substrate materials required and test reports showing compliance with specified physical performance characteristics and physical properties.

1.5 QUALITY ASSURANCE

.1 Installers qualifications:
.1 Perform work of this Section by a company that has a minimum of five years proven experience in the installation of intumescent fireproof coatings on project of a similar size and nature and that is approved by manufacturer. Submit to Consultant, applicator's current certificate of approval by the material manufacturer as proof of compliance.

.2 Inspection and Testing:
.1 An independent testing laboratory/company may be selected by the Consultant to test random samples as applied, to verify thickness of thin-film intumescent fire-resistive coating in accordance with AWCI Technical Manual 12-B. Inspection shall be carried out prior to application of topcoat.
.2 Correct deficiencies and have such corrected work approved by Inspection/Testing Company before work is continued.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact. Ship, store and deliver at temperatures not less than 50°F (10°C); protect from freezing.

.2 Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

1.7 SITE CONDITIONS

.1 Do not install work of this Section outside of following environmental ranges without Consultant's and Product manufacturer's written acceptance:
.1 Ambient air and surface temperature: 10^0C minimum.
.2 Precipitation: None.
.3 Relative Humidity: 40-60%.

.2 Do not install work of this Section outside of environmental ranges as recommended by the intumescent coating manufacturer without the Consultant's and Product manufacturer's written acceptance.

.3 Supply and install temporary protection and facilities to maintain Product manufacturer's, and above specified environmental requirements for 24 hours before, during, and 24 hours after installation.

2 Products

2.1 **MATERIALS**

.1 All materials under work of this Section, including but not limited to, coatings are to have low VOC content limits.

.2 Intumescent fireproofing system: 'A/D Firefilm III System' by A/D Fire Protection Systems, 'Sprayfilm' by Cafco or approved alternative by StonCor, consisting of the following components.
- .1 Primer: Recommended by manufacturer for substrate being fireproofed.
- .2 Intumescent coating: A/D Firefilm III, conforming to:
  - .1 Hardness (Shore "D"): Durometer D65-70 in accordance with ASTM D2240.
  - .2 Surface Burning Characteristics: Class "A", in accordance with ASTM E84.
  - .3 Density 1425 kg/m^2.
  - .4 Bond strength: 861 kPa in accordance with ASTM D4541.
  - .5 Compressive strength: 5.2 MPa at 10 % deformation, in accordance with ASTM E761.
- .3 Top coat: A/D TC-55 Sealer. Colour: Clear.

.3 Intumescent fireproofing system: Two component, epoxy based, thermally activated, subliming coating. Intumescent coating system to include primer, intumescent coating, and top coat as indicated below.
- .1 'Thermo-Lag 3000-SA' by A/D Fire Protection Systems or approved alternative by Cafco or approved alternative manufacturer that meets or exceeds the specifications.
- .2 Primer: Recommended by manufacturer for substrate being fireproofed.
- .3 Intumescent coating: Provide first and final coat of 'Thermo-Lag 3000-SA' by A/D Fire Protection Systems, meeting the following criteria:
  - .1 VOC content: 0.53 lbs/gal.
  - .2 Density: 1313 kg/cm. (82 pcf) conforming to ASTM E605.
  - .3 Hardness (Shore "D"): Durometer of 55 in accordance with ASTM D2240.
  - .4 Surface Burning Characteristics: Flame Spread: 0, Smoke Development: 0-20, Class "A", in accordance with ASTM E84.
  - .5 Bond Strength: 2.73 MPa (57,000 psf) in accordance with ASTM E736.
  - .6 Compressive strength: 19.65 MPa (2,850 psi) in accordance with ASTM E761.
- .4 Top coat: Top coat as approved by intumescent film manufacturer for intended application. Colour to be selected by Consultant.

2.2 **MIXES**

.1 Mix intumescent fireproof coating components in accordance with manufacturer's written instructions.

3 Execution

3.1 **EXAMINATION**

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Verify that all clips, hangers, sleeves and similar devices have been attached. Report defects to Consultant. Commencement of work of this Section means acceptance of existing conditions.

3.2 **PREPARATION**

.1 Protect work of other trades against overspray and make good at own expense any such damage. Provide adequate covering by drop cloths, masting or tarpaulins to surfaces, or on fitments in contact with, or adjacent to, surfaces to be fireproofed.

.2 Clean surfaces, to be fireproofed, free of dust, grease, oils, etc. in accordance with manufacturer's recommendations. Ensure surfaces are free of any extraneous matter which could be detrimental to a satisfactory and acceptable finish.

.3 Verify substrate surfaces are solid, free from surface water, frozen matter, dust, oil, grease, scaling or laitance, projections and any other foreign matter detrimental to performance. Obtain manufacturer's approval of substrate in writing, submit copy to Consultant.

.4 Prime surfaces to be fireproofed with specified primer in accordance with manufacturer's recommendations.

.5 Inspect primed surfaces to be fireproofed for gouges, marks, pinholes, nibs, etc. Properly prepare same by patching, filling, smoothing or any other surface preparation necessary to ensure a satisfactory surface finish.

.6 Ensure written confirmation is received from steel fabricators of the specific surface preparation procedures and primers used for the application of fireproofing materials to ascertain compatibility with work of this Section:

.1 Verify that substrate surfaces are ready to receive work. Commercial blast cleaning (SSPC SP6) is required for minimum surface preparation. Weld flashes should be ground smooth prior to commencement of application. Select primer from manufacturer's list of approved primers.

3.3 **APPLICATION**

.1 Install intumescent fireproofing in accordance with manufacturer's written instructions.

.2 Install intumescent fireproofing at the proper consistency to ensure a satisfactory surface finish.

.3 Use-up materials within shelf life period recommended by manufacturer.

.4 Ensure finished work is uniform as to sheen, gloss, colour, and texture.

.5 Patching: Patch and repair any fire resistive coating that has been damaged in accordance with patching recommendations of material manufacturer. If coating becomes damaged, rebuild thickness by spray or brush. Fill small areas with trowel. When dry, smooth and finish to match adjacent surfaces.

3.4 FIELD QUALITY CONTROL

.1 Perform field tests as required by Authorities having Jurisdiction. Tests to be carried out as outlined in Technical Manual 12-B by AWCI.

3.5 CLEANING

.1 Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions. Remove and legally dispose of construction debris.

.2 Work will not be considered complete until all spatters, drippings, smears and overspray have been cleaned and removed to the satisfaction of Consultant.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Labour, Products, equipment and services necessary for firestopping and smoke seals work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 ASTM C303, Standard Test Method for Dimensions and Density of Preformed Block and Board–Type Thermal Insulation.

.2 ASTM C920, Standard Specification for Elastomeric Joint Sealants.

.3 ASTM C1104, Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.

.4 ASTM E814, Test Method for Fire Tests of Through-Penetration Fire Stops.

.5 ASTM E2174, Standard Practice for On-Site Inspection of Installed Fire Stops.

.6 CAN/ULC S102, Surface Burning Characteristics of Building Materials and Assemblies.

.7 CAN/ULC S114, Standard Method of Test for Determination of Non-Combustibility in Building Materials.

.8 CAN/ULC S115, Standard Method of Fire Tests of Firestop Systems.

.9 CAN/ULC S129, Standard Method Of Test For Smoulder Resistance Of Insulation (Basket Method).

.10 CAN/ULC S702, Thermal Insulation, Mineral Fibre for Buildings.

1.3 **DEFINITIONS**

.1 Fire Separation: A construction assembly, plane or device, either vertical or horizontal, which is required to prevent the passage of fire and smoke for a prescribed period of time. Proof of compliance to required time rating shall be by ULC, Warnock Hersey (or similar approved) certification or shall be as listed in the Ontario Building Code Supplementary Standard SB-2.

.2 Smoke Separation: A construction assembly, plane or device, either vertical or horizontal, which is not required to prevent the passage of fire for a prescribed period of time but is required to prevent the passage of smoke. A "Smoke Separation" is also known as a "Fire Separation with No Rating" or a "Zero Hour Rated Separation".

.3 Non-Rated Separation: A construction assembly, plane or device, either vertical or horizontal, which is not required to prevent the passage of fire for a prescribed period of time and is not required to prevent the passage of smoke.

1.4 SYSTEM DESCRIPTION

.1 Firestopping and smoke seals: ULC or Intertek Testing Services listed Products and systems in accordance with CAN/ULC S115 suitable to actual application and installation conditions.

.2 Firestop applications that exist for which no ULC or cUL tested system is available through a manufacturer, a manufacturer's engineering judgment derived from similar ULC or cUL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineer judgment drawings must follow requirements set forth by the International Firestop Council.

.3 Firestop and smoke seal system shall achieve a fire resistance rating and smoke seal rating equal to that of assemblies into which they are installed.

.4 Provide smoke sealants over firestopping materials or combination smoke seal/firestop seal material to form air tight barriers to retard the passage of gas and smoke.

.5 Firestopping and smoke seals located at movement joints shall be designed with movement capability.

.6 Firestopping and smoke seals within mechanical and electrical assemblies shall be provided as part of the work of Divisions 21, 22, 23, 26, 27, and 28 respectively.

1.5 SUBMITTALS

.1 Product data:
- .1 Submit copies of manufacturer's Product data in accordance with Section 01 30 00 indicating:
  - .1 Performance criteria, compliance with appropriate cUL or ULC reference standard, characteristics, limitations.
  - .2 Product transportation, storage, handling and installation requirements.
  - .3 Submit firestop and smoke seal manufacturer's Product data for materials and prefabricated devices, including manufacturer's printed installation instructions.

.2 Shop drawings:
- .1 Submit shop drawings in accordance with Section 01 30 00 indicating:
  - .1 Fire rated and smoke sealed systems for each typical application.
  - .2 Construction details, accurately reflecting actual job conditions.
  - .3 ULC or Intertek Testing assembly listing.
  - .4 Each floor and wall assembly requiring firestop system with each corresponding ULC firestop system.

.3 Certification:
.1 Submit certified documentation from manufacturer for each worker performing work of this Section.
.2 Submit installer's and Product manufacturer's certification verifying compliance with the Contract Documents and conformance with ASTM E814 and CAN/ULC S115.

1.6 **QUALITY ASSURANCE**

.1 Installers qualifications: Perform work of this Section by a company that has a minimum of five years proven experience in the installation of firestopping and smoke seal work of a similar size and nature and that is approved by manufacturer. Submit to Consultant, applicator's current certificate of approval by the material manufacturer as proof of compliance.

.2 Manufacturer's direct representative and/or fire protection specialist shall be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures conforming to manufacturer's written recommendations published in their literature and drawing details.

.3 Pre-construction meetings: Arrange with manufacturer's representative, Contractor, Consultant and Field Engineer to determine responsibility for handling such issues as FT rated partitions, firestop custom details, compatibility, mixed penetrations, and to review installation procedures 48 hours in advance of installation.

1.7 **DELIVERY STORAGE AND HANDLING**

.1 Deliver materials to Place of Work in manufacturer's unopened containers, containing classification label with labels intact and legible at time of use.

.2 Do not use damaged or adulterated materials exceeding their expiry date.

1.8 **SITE CONDITIONS**

.1 Conform to manufacturer's requirements and maintain a minimum temperature of 5^0 C for a minimum period of 24 h before application, during, and until application is fully cured.

.2 Maintain sealant at a minimum 18° C for best workability.

2 Products

2.1 **ACCEPTABLE MANUFACTURERS**

.1 Acceptable manufacturers of rated systems include:
.1 3M
.2 Hilti Canada Corporation.
.3 Specified Technologies Inc. (STI Firestop)
.4 Tremco Ltd.

2.2 GENERAL SYSTEM REQUIREMENTS

.1 All materials under work of this Section, including but not limited to, primers and sealants are to have low VOC content limits.

.2 Do not use Products containing asbestos.

.3 Firestopping components shall not contain volatile solvents or require special application to protect plastic pipe from firestopping compound.

.4 Provide smoke seal sealant in following colours:
- .1 Grey or white in finished areas.
- .2 Red in unfinished areas.

.5 Smoke sealant for overhead and vertical joints for floor to be self-levelling and non-sagging sealant.

.6 Smoke sealant at vertical through penetrations in areas with floor drains shall be waterproof type.

2.3 MATERIALS

.1 Following materials have been provided for convenience. Contractor shall provide complete system with all components and accessories as required for fire resistant and smoke seal installation.

.2 Firestop sealant: single component, low modulus, silicone rubber, moisture curing sealant to ASTM C920, ULC labelled to CAN/ULC S115.

.3 Pre-Installed firestop devices for use with non-combustible and combustible pipes, conduit and/or cable bundles penetrating concrete floors and walls.
- .1 Cast-in place firestop device complete with aerator adaptor when used in conjunction with aerator system. Model CP 680-P by Hilti or approved alternative.
- .2 Cast-in place firestop device for use with noncombustible penetrants. Model CP 680-M by Hilti or approved alternative.
- .3 Speed sleeve for use with cable penetrations. Model CP 653 by Hilti or approved alternative.
- .4 Firestop block. Model CFS-BL by Hilti or approved alternative.

.4 Re-penetrable, round cable management devices for use with new or existing cable bundles penetrating walls:
- .1 Speed sleeve with integrated smoke seal fabric membrane. Model CP 653 by Hilti or approved alternative.
- .2 Firestop Sleeve. Model CFS-SL SK by Hilti or approved alternative.
- .3 Retrofit sleeve for use with existing cable bundles. Model CFS-SL RK by Hilti or approved alternative.
- .4 Gangplate for use with multiple cable management devices. Model CFS-SL GP by Hilti or approved alternative.

.5 Gangplate Cap for use at blank openings in gangplate for future penetrations. Model CFS-SL GP CAP by Hilti or approved alternative.

.5 Firestop insulation: to CAN/ULC S702, Type 2; mineral fibre manufactured from rock or slag, suitable for manual application.
- .1 Density: Minimum 64 kg/m^3 when tested to ASTM C303.
- .2 Combustibility: Noncombustible to CAN/ULC S114.
- .3 Melt temperature: >1175 degrees C.
- .4 Surface burning characteristics: to CAN/ULC S102, maximum flame spread of 0, smoke developed of 0.
- .5 Moisture Absorption: 0.04 percent when tested to ASTM C1104.
- .6 Smoulder Resistance: 0.01 percent when tested to CAN/ULC S129.

.6 Damming, back-up, supports, and anchorage: In accordance with manufacturer's fire rated systems and to acceptance of authorities having jurisdiction.

.7 Primer: As recommended by firestopping sealant manufacturer.

3 Execution

3.1 EXAMINATION

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of work of this Section means acceptance of existing conditions.

.2 Verify that substrates and surfaces to receive firestopping and smoke seals are clean, dry, and frost free.

3.2 PREPARATION

.1 Prepare, modify, and adjust void sizes, proportions, and conditions to conform to fire rated and smoke sealed assembly requirements such as assembly opening size and dimensional restrictions.

.2 Clean surfaces to remove material detrimental to bond including dust, paint, rust, oil, grease, moisture, frost and other foreign matter to manufacturers recommendations.

.3 Mask adjacent surfaces to avoid spillage and over-coating of adjacent surfaces. Remove stains from adjacent surfaces.

3.3 INSTALLATION

.1 Install firestopping and smoke seal systems in accordance with reviewed Shop Drawings, manufacturer's instructions and fire rated assembly to establish continuity and integrity of fire separations.

.2 Install firestop insulation in compacted thicknesses required by ULC design. Compress insulation approximately 50 percent.

.3 Install primers as recommended by firestop and smoke seal Product manufacturers.

.4 Install temporary forming, damming, back-up as required, remove after materials have achieved initial cure and will resist displacement.

.5 Install firestop and smoke seal filler in horizontal joints providing 25% compression fit.

.6 Use resilient, elastomeric firestopping and smoke seal systems in following locations:
- .1 Openings and sleeves for future use.
- .2 Penetration systems subject to vibration or thermal movement.
- .3 Penetration systems in acoustical containment enclosures.

.7 Trowel and tool exposed firestop and smoke seal. Product surfaces to uniform, smooth finish.

.8 Seal joints to ensure an air and water resistant seal capable of withstanding compressions and extensions due to thermal wind or seismic joint movement.

.9 Taped joints will not be acceptable.

.10 Repair damaged firestopped and smoke sealed surfaces to acceptance of Consultant.

.11 Identify each firestop and smoke seal penetration assembly with permanent label listing following:
- .1 Assembly and rating in hours.
- .2 Date of installation.
- .3 Installing company's name and telephone number.

.12 Do not cover materials until full cure has taken place.

3.4 INSPECTION AND TESTING

.1 Inspection of through-penetration firestopping shall be performed in accordance with ASTM E2174 to ensure that firestopping and smoke seals have been installed in accordance with Contract documents and to tested and listed firestop system.

3.5 CLEAN-UP

.1 Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

.2 Remove excess materials and debris immediately after application.

3.6 SCHEDULE OF FIRESTOP AND SMOKE SEAL LOCATIONS

.1 Following firestop and smoke seal location schedule is included for convenience and may not be complete. Examine Contract Drawings and other specification sections and determine entire extent of work of this Section. Generally provide systems with required fire and smoke ratings at following locations:

- .1 Gaps at intersections of fire-resistance rated walls and partitions.
- .2 Control and sway joints in fire-resistance rated walls and partitions.
- .3 Gaps at top of fire-resistance rated partitions and walls.
- .4 Penetrations through fire-resistance rated walls and partitions including but not limited to mechanical and electrical services and openings and sleeves for future use.
- .5 Penetrations through fire-resistance rated floor slabs, ceilings, and roofs.
- .6 Gaps at edge of floor slabs at exterior walls.
- .7 Perimeter of retaining angles on rigid ducts greater than 0.012 m^2, firestopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.
- .8 Where indicated on drawings.
- .9 At non-rated assemblies that require a smoke seal.
- .10 Where required by Ontario Building Code.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Labour, Products, equipment and services necessary for sealant Work in accordance with the Contract Documents.

.2 Work of this Section does not include sealants in firestopping and smoke sealed assemblies.

.3 Work of this Section does not include sealant work identified in individual specification sections.

1.2 **REFERENCES**

.1 ASTM C834, Specification for Latex Sealants.

.2 ASTM C920, Specification for Elastomeric Joint Sealants.

.3 ASTM C1330, Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.

1.3 **SUBMITTALS**

.1 Product data: Submit copies of Product data in accordance with Section 01 30 00 describing type, composition and recommendations or directions for surface preparation, material preparation and material installation.

.2 Samples:
.1 Submit following samples in accordance with Section 01 30 00.
.1 Two samples of sealant/caulking, for colour selection.
.2 Two samples of back-up material and primer for physical characteristics.

1.4 **QUALITY ASSURANCE**

.1 Qualifications: Work of this Section shall be executed by trained applicators approved by sealant manufacturer and having a minimum of 5 years proven experience.

1.5 **SITE CONDITIONS**

.1 Do not install materials when ambient air temperature is less than 5 °C, when recesses are wet or damp, or to manufacturer's recommendations.

1.6 **DELIVERY, STORAGE AND HANDLING**

.1 Arrange delivery of materials in original, unopened packages with labels intact, including batch number, and ensure that on-site storage is kept to a minimum. Do

not store materials on site where there exists any danger of damage from moisture, direct sunlight, freezing and other contaminants.

1.7 **EXTENDED WARRANTY**

.1 Submit a extended warranty for Sealant Work in accordance with General Conditions, except that warranty period is extended to 2 years. Warrant against leakage, cracking, crumbling, melting, shrinkage, running, loss of adhesion and staining adjacent surfaces. Warranty shall be for complete replacement including affected adjacent Work.

2 Products

2.1 **MATERIALS**

.1 General:
- .1 All materials under Work of this Section, including but not limited to, primers and sealants are to have low VOC content limits.
- .2 Use materials as received from manufacturers, without additives or adulterations. Use one manufacturer's Product for each kind of Product specified.

.2 Sealant **Type 1**: ASTM C920, Type M, Grade NS, Class 50; Multi-Component, polyurethane sealant, in standard colours selected.
- .1 'DC CWS' by Dow Corning Inc.
- .2 'Dymeric 240' by Tremco.

.3 Sealant **Type 2**: ASTM C920, Type S, Grade NS, Class 25; One-Component, polyurethane sealant, in standard colours selected.
- .1 'DC CWS' by Dow Corning Inc.
- .2 'Dymonic' by Tremco.
- .3 'Novalink' by Chemlink Advanced Architectural Products.

.4 Sealant **Type 3**: ASTM C834; Pure acrylic siliconized sealant; in standard white colour (paintable).
- .1 'Tremflex 834 Silconized Sealant' by Tremco Ltd.

.5 Sealant **Type 4**: ASTM C920, Type S, Grade NS; One-part mildew-resistant silicone, in standard colours selected.
- .1 '786 Mildew Resistant Silicone Sealant' by Dow Corning Inc.
- .2 'Tremsil 200 Silicone Sealant' by Tremco Ltd.

.6 Sealant **Type 5**: ASTM C920, Type S, Grade NS, Class 50; One-part neutral-cure silicone, in standard colours selected.
- .1 '795 Weather Sealant' by Dow Corning Inc.
- .2 'Spectrum 2' by Tremco Ltd.

.7 Sealant **Type 6**: Acoustical sealant in accordance with Section 09 21 16.

.8 Sealant **Type 7**: ASTM C920, Type S, Grade NS, Class 50; One-part neutral-cure, low modulus silicone, in standard colours selected.
- .1 '791 Sealant' by Dow Corning Inc.
- .2 'Spectrum 3' by Tremco Ltd.

2.2 **ACCESSORIES**

.1 Primers: Type recommended by material manufacturers for various substrates, primers to prevent staining of adjacent surfaces encountered on project.

.2 Joint backing: ASTM C1330; Round, solid section, closed cell, skinned surface, soft polyethylene foam gasket stock, compatible with primer and sealant materials, 30 to 50% oversized, Shore A hardness of 20, tensile strength 140 to 200 kPa. Bond breaker type surface.

.3 Bond breaker: Type recommended by material manufacturers.

.4 Void filler around the window frames to be one part expanding polyurethane foam.

.5 Cleaning agents: As recommended by material manufacturer, non-staining, harmless to substrates and adjacent finished surfaces.

2.3 **MIXING**

.1 Follow manufacturers instructions on mixing, shelf and pot life.

3 Execution

3.1 **PREPARATION**

.1 Prepare joints to receive sealants to manufacturer's instructions. Ensure that joints are clean and dry and ferrous surfaces are free from rust and oil.

.2 Clean recesses to receive sealant, to be free of dirt, dust, loose material, oil, grease, form release agents and other substances detrimental to sealant's performance.
- .1 Remove lacquer or other protective coatings from metal surfaces, without damaging metal finish, using oil-free solvents. Remove rust, mill scale and coatings from ferrous metals by wire brush, grinding or sand blasting.
- .2 Ensure recess is dry.
- .3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings. Remove incompatible coatings as required.

.3 Ensure that all materials in contact with sealant are compatible. Test substrate for adhesion.

.4 Depth of recess: Maintain depth to ½ joint width up to a maximum of 13 mm and not less than 6 mm at centre of joint. For greater depth, use joint backing under. Where

recess is less than specified depth, cut back surface of recess to specified recess depth.

.5 Install polyethylene backing rod in joints 6 mm or more in width. Roll backing rod into joint. Do not stretch or bend backing rod. Install bond breaker to back of recess.

.6 Prime sides of recess, in accordance with sealant manufacturer's instructions.

.7 Condition products for use in accordance with manufacturer’s recommendations.

3.2 INSTALLATION

.1 Apply sealant immediately after adjoining Work is in condition to receive such Work. Apply sealant in continuous bead using gun with correctly sized nozzle. Use sufficient pressure to evenly fill joint.

.2 Ensure sealant has full uniform contact with, and adhesion to, side surfaces of recess. Superficial painting with skin bead is not acceptable. Tool sealant to smooth surface, free from ridges, wrinkles, sags, air pockets, embedded impurities, dirt, stains or other defects.
- .1 At recesses in angular surfaces, finish sealant with flat profile, flush with face of material at each side.
- .2 At recesses in flush surfaces, finish compound with concave face, flush with face of material at each side.

.3 Make sealant bead uniform in colour.

.4 Cure sealants in accordance with sealant manufacturer's instructions. Do not cover up sealants until proper curing has taken place.

.5 Immediately remove excess compound or droppings which would set up or become difficult to remove from adjacent finished surfaces, using recommended cleaners, as work progresses. Do not use scrapers, chemicals or other tools which could damage finished surfaces. Remove defective sealant.

.6 Clean recesses and re-apply sealant.

.7 Remove masking tape immediately after joints have been sealed and tooled.

3.3 CLEANING

.1 Clean surfaces adjacent to joints, remove sealant smears or other soiling resulting from application of sealants. At metal surfaces, remove residue. Do not mar or damage finishes on materials adjacent to joints. Repair or replace marred or damaged materials.

3.4 SCHEDULE OF LOCATIONS

.1 Following sealant location schedule is included for convenience and may not be complete. Examine Contract Drawings and other specification sections and determine entire extent of Work of this Section. Generally seal following locations:
- .1 Concrete, masonry, wood and stone to metal.
- .2 Wood to masonry, concrete and stone.
- .3 Metal to metal.
- .4 All dissimilar materials.

.2 Sealant **Type 1 or Type 2**:
- .1 Interior joints between dissimilar materials.
- .2 Interior joints at perimeter of all built-in equipment.
- .3 Interior joints at perimeter of metal door and window frames.

.3 Sealant **Type 3**:
- .1 Interior non-movement joints 6mm or less for painting (painter's caulk).

.4 Sealant **Type 4**:
- .1 Interior joints where mildew resistance is required.
- .2 Interior joints at perimeter of all plumbing fixtures.
- .3 Interior joints between counter backsplash and wall surfaces.

.5 Sealant **Type 5:**
- .1 Glass to glass joints.
- .2 Glass to metal joints.
- .3 Metal to metal curtain wall joints.
- .4 Interior face of metal panel joints.

.6 Sealant **Type 6:**
- .1 Perimeter of all gypsum board partitions where sound insulation is indicated.
- .2 All vapour barrier seams and seals.

.7 Sealant **Type 7:**
- .1 Exterior joints between dissimilar building veneer materials.
- .2 Exterior control joints in building veneers.
- .3 Exterior joints at perimeter of all door and window frames.
- .4 Exterior joints in metal panel systems.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Labour, Products, equipment and services necessary for metal door and frame work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 ASTM A653/A653M, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.

.2 ASTM A924/A924M, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

.3 ASTM E90, Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.4 CAN4/ULC-S104M, Standard Method for Fire Test of Door Assemblies.

.5 CAN4/ULC-S105M, Standard Specification for Fire Door Frames, Meeting the Performance Required by CAN4/ULC-S104M.

.6 CAN/CGSB-1.198, Cementitious Primer, (for Galvanized Surfaces).

.7 CGSB 41-GP-19Ma, Rigid Vinyl Extrusions for Windows and Doors.

.8 CAN/ULC-S702, Thermal Insulation, Mineral Fibre for Buildings.

.9 CSA W47.1, Certification of Companies for Fusion Welding of Steel Structures.

.10 CSA W59-M, Welded Steel Construction (Metal Arc Welding).

.11 CSDMA, Canadian Steel Door Manufacturer’s Association.

.12 NFPA 80, Standard for Fire Doors and Other Opening Protectives.

.13 NFPA 252, Standard Methods of Fire Tests of Door Assemblies.

1.3 **DESIGN REQUIREMENTS**

.1 Design exterior frame assemblies to accommodate expansion and contraction when subjected to minimum and maximum surface temperature of -35°C to 35°C.

.2 Maximum deflection for exterior metal doors under wind load of 1.2 kPa not to exceed 1/175th of span.

1.4 **SUBMITTALS**

.1 Product data: Submit manufacturer's Product data in accordance with Section 01 30 00 indicating door and frame construction.

.2 Shop drawings:
- .1 Submit shop drawings in accordance with Section 01 30 00 for each type of door and frame indicating:
  - .1 Thickness and type of steel.
  - .2 Thickness and type of core.
  - .3 Thickness and type of steel stiffeners and location of them within the door.
  - .4 Thickness and type of metal facing on edges of door and method of fastening.
  - .5 Location of mortises, reinforcement, anchorages, joining, welding, sleeving, exposed fasteners, openings and arrangement for hardware.
- .2 Include schedule identifying each unit with door marks and numbers relating to numbering on Contract Drawings and in door schedule. Indicate doors and frames to be fire rated.

1.5 **QUALITY ASSURANCE**

.1 Perform work in accordance with requirements by a member of the Canadian Steel Door Manufacturer's Association (CSDMA).

.2 Label and list fire rated doors and frames by an organization acceptable to authorities having jurisdiction and accredited by the Standards Council of Canada in conformance with CAN4/ULC-S104M and CAN4/ULC-S105M for ratings indicated, Labelling shall be in accordance with NFPA 80.

2 Products

2.1 **ACCEPTABLE MANUFACTURERS**

.1 Baron Metal Industries Inc.

.2 Daybar Industries Limited

.3 Fleming Doors Products.

.4 Steelcraft.

.5 Vision Hollow Metal Limited.

2.2 **MATERIALS**

.1 General: All materials under work of this Section, including but not limited to, primers are to have low VOC content limits.

.2 Steel: ASTM A924/A924M, Class 1; Commercial grade steel, hot dip galvanized to ASTM A653/A653M, ZF120 galvanized coating.

.3 Minimum base steel thickness:

.1	Frames	1.6 mm
.2	Typical doors	1.6 mm
.3	Interior stiffeners	0.9 mm
.4	Lock/strike reinforcements	1.6 mm
.5	Hinge reinforcements	2.7 mm
.6	All other reinforcement	1.6 mm
.7	Top and bottom channels	1.2 mm
.8	Glazing stops	0.9 mm
.9	Guard boxes	0.9 mm
.10	Jamb spreaders	0.9 mm

.4 Top caps and thermal breaks: CGSB 41-GP-19Ma; Rigid PVC extrusions.

.5 Primer: CAN/CGSB 1.198.

.6 Core material:
- .1 Interior doors: Mineral fibre insulation with a minimum face density of 24 kg/m^3 (1.5 lbs/ft^3).
- .2 Exterior doors: Rigid poly/isocyanurate, closed cell insulation, 32 kg/m^3 (2.0 lbs/ft^3) , thermal value: RSI 1.9.
- .3 Fire rated doors: Mineral fibre insulation to CAN/ULC S702, Type 1A; 24 kg/m^3 (1.5 lbs/ft^3).

.7 Screws: Stainless steel screws with countersunk flat head.

.8 Door silencers: Type 6-180, black neoprene.

.9 Frame anchors:
- .1 Frames in masonry: 1.2 mm minimum, adjustable T-strap jamb anchors.
- .2 Frames in steel stud partitions: 0.9 mm minimum steel anchors of suitable design securely welded inside each jamb.
- .3 Labeled frames: In accordance with ULC requirements.

.10 Floor anchors: 1.6 mm minimum adjustable floor clip angles with 2 holes for anchorage to floor.

.11 Labels for fire doors and door frame: Brass plate, riveted to door and door frame.

.12 Glass and glazing: In accordance with Section 08 80 00.

2.3 FABRICATION

.1 General
- .1 Fabricate doors and frames in accordance with reviewed shop drawings.

.2 Welding: CSA W59-M to produce a finished unit with no visible seams or joints, square, true and free of distortion.
.3 Welding: Continuous unless specified otherwise. Execute welding by a firm fully acceptable to the Canadian Welding Bureau to requirements of CSA W47.1.
.4 Form profiles accurately to details shown on Contract Drawings.
.5 Ream and remove burrs from drilled and punched holes.
.6 Grind welded corners and joints to a flat plane and fill with metallic filler and sand to a uniform smooth finish. Apply one coat of primer.
.7 Provide weather strip for exterior doors in accordance with Section 08 70 00 and door manufacturer.

.2 Frames, windows, and screens:
.1 Fabricate frames of welded construction. Cut mitres and joints accurately and weld continuously on inside of frame profile. Exterior frames to be thermally broken.
.2 Construct large frame sections with provision for on Site assembly to suit Site conditions.
.3 Blank, reinforce, drill and tap frames for mortised, templated hardware. Protect mortised cut-outs with guard boxes.
.4 Reinforce frames where required for surface mounted hardware.
.5 Reinforce frames over 1200 mm wide with roll formed steel channels or hollow structural sections specified in Section 05 50 00 and as indicated on drawings.
.6 Furnish exterior door frames with a continuously welded integral steel weather drip at head of frame.
.7 Prepare each door opening for single stud rubber door silencers, 3 for single door openings located in strike jamb, and 2 for double door openings located in head.
.8 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.
.9 Form channel glazing stops minimum 16 mm height, accurately cut, mitred, fitted and fastened to frame sections with stainless steel counter-sunk, flat head screws spaced at maximum 450 mm throughout and 50 mm from each end.
.10 Provide the following requirements for electrified frame applications:
.1 Low voltage wire conduit for required electrified hardware devices.
.2 Junction boxes for all frame mounted electrified hardware devices, complete with required connectors to in frame low voltage wire conduit.

.3 Anchorage:
.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:
.1 Frames up to 2285 mm 3 anchors.
.2 Frames from 2285 mm to 2440 mm 4 anchors.

.2 Where frames are to be set in masonry or concrete, supply adjustable anchors to trade installing frame.

.3 Fabricate frames for installation in steel stud partitions with steel anchors of suitable design, minimum number of anchors for each jamb :

.1	Frames up to 2285 mm height	4 anchors.
.2	Frames 2285 mm to 2440 mm	5 anchors.

.4 General Door Requirements:

.1 Hollow steel construction, flush swing type, of sizes to conform to details, schedules and reviewed shop drawings with provisions for cut-outs for glass and grilles and reinforced to receive hardware fastenings.

.2 Blank, reinforce, drill and tap doors for mortised, templated hardware. Where required, reinforce doors for surface mounted hardware and door closers.

.3 Reinforce oversized doors with steel channels and plates specified in Section 05 50 00 and as indicated on drawings.

.4 Where openings are required, form integral cut-outs with framing, glass stop moldings and division bars.

.5 Install grilles to fit tight and secure into openings.

.6 Bevel both stiles of single doors 1 in 16.

.7 Provide the following requirements for electrified door applications:

.1 In door low voltage wire raceways.

.2 Steel astragals for hollow metal doors.

.3 Reinforcement for all door mounted electrified hardware devices as required and as indicated on Contract Drawings.

.5 Interior Doors:

.1 Supply and install inverted, recessed, mechanically interlocked with tack welded channels at top and bottom of doors.

.2 Fabricate doors with joints between front and back panels meeting on stile edges. Make joints mechanically interlocked and tack welded for entire height of door. After welding has been completed, grind joints smooth to match metal. Ensure that no filler is used in joints.

.3 Fill hollow space within door and vertical stiffeners from top to bottom with mineral fibre batt insulation.

.6 Exterior Doors:

.1 Supply and install inverted, recessed, mechanically interlocked with tack welded channels at top and bottom of doors.

.2 Fabricate doors with joints between front and back panels meeting on stile edges. Make joints mechanically interlocked and tack welded for entire height of door. After welding has been completed, grind joints smooth to match metal. Ensure no filler is used in joints.

.3 Fill void between door faces with polyisocyanurate insulation as specified, thermally bonded to door skins.

.7 Fire Rated Doors:

.1 Supply and install inverted, recessed, spot welded channels at top and bottom of doors. Supply and install steel flush top caps on exterior doors.

.2 Fabricate doors with joints between front and back panels meeting on stile edges. Make joints mechanically interlocked and tack welded for entire height of door. After welding has been completed, grind joints smooth to match metal. Ensure that no filler is used in joints.

.3 Fabricate doors to achieve fire rating as indicated on drawings and in accordance with ULC. Provide ULC label on door at hinged edge midway between top hinge and head of door.

3 Execution

3.1 **EXAMINATION**

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of work of this Section means acceptance of existing conditions.

3.2 **HOLLOW METAL DOOR, AND FRAME INSTALLATION**

.1 Install hollow metal doors, frames, windows, and screens in accordance with reviewed shop drawings, manufacturer's written instructions and to meet CSDMA requirements.

.2 Install hollow metal doors, frames, windows, and screens plumb, square, level, secure, and at correct elevation.

.3 Install doors clear of floor finishes, and with the correct rebate opening for the door installation. Install door silencers.

.4 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 supports as indicated on drawings for openings over 1200 mm in width. Remove wood spreaders after frames have been built-in.

.5 Allow for structural deflection and prevent structural loads from being transmitted to hollow metal frames.

.6 Touch-up areas where galvanized coating has been removed or damaged with primer.

.7 Fire rated doors: Install fire rated doors and frames in accordance with requirements of NFPA 80.

3.3 **ADJUSTING AND CLEANING**

.1 Adjust doors for smooth and balanced door movement.

.2 Clean doors, frames, windows and screens.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Labour, Products, equipment and services necessary for four fold doors Work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 ASTM A36/A36M, Specification for Carbon Structural Steel.

1.3 **DESIGN REQUIREMENTS**

.1 Design folding door to withstand a windload condition of 20 lbs./sq. ft. (88 mph) at standard pressure and temperature.

.2 Folding door shall not exceed a maximum allowable deflection of 1/120 of the span.

1.4 **SUBMITTALS**

.1 Product data:
- .1 Submit duplicate copies of manufacturer's Product data in accordance with Section 01 30 00 indicating:
  - .1 Performance criteria, compliance with appropriate reference standard(s), Product characteristics, and limitations.
  - .2 Product transportation, storage, handling and installation requirements.

.2 Shop drawings: Submit shop drawings in accordance with Section 01 30 00 indicating elevations, sections, details, required clearances, materials, operating components, dimensions, gauges, and finishes.

.3 Closeout submittals: Submit operation, maintenance, cleaning instructions for incorporation into Operations and Maintenance Manuals in accordance with Section 01 78 00.

1.5 **QUALITY ASSURANCE**

.1 Furnish each folding door as a complete unit produced by one manufacturer, including hardware, accessories, mounting and installation components. Furnish folding doors by one manufacturer for the entire project.

.2 Inserts and Anchorages: Furnish fasteners and spacers as required to facilitate installation. If special requirements are necessary, coordinate those requirements with the general Contractor.

1.6 **WARRANTY**

.1 Manufacturer shall warrant all folding doors against defects in material and workmanship for 3 years from date of acceptance.

2 Products

2.1 **ACCEPTABLE PRODUCTS AND MANUFACTURERS**

.1 'Model FF300 Glazed Four-Fold Doors' by Door Engineering.

2.2 **MATERIALS**

.1 Structural Steel: ASTM A36/A36M.

.2 Steel Sheets: Steel sheets of commercial quality, complying with ASTM A366/A366M cold-rolled steel sheet, or A569/A569M hot-rolled steel sheet.

.3 Hardware: Manufacturer's standard components.

.4 Fasteners: As recommended by door manufacturer.

.5 Door panels and framing: Provide minimum 14-gauge structural steel tube framing with minimum 14-gauge steel sheet on exterior and interior faces. Sheeting shall be formed on vertical edges with no visible welds on panel faces. All frames and framing members shall be true to dimension and square in all directions, no door shall be bowed or warped. Door shall not be out of line, vertically or horizontally. Exposed welds shall be ground smooth and flush. Fabricate door size as indicated on drawings.

.6 Door finish:
- .1 Fire Station Apparatus Bay: Custom powder coated to match PPG Duranar Sunstorm Coating 'Silverstorm - UC106685F'.
- .2 Training Apparatus Bay: Satin nickel finish.

.7 Surface Mounted Tube Frame: Supply pre-hung tube frame system designed to anchor to masonry wall construction or weld to steel structure. All hinges, track supports and operator supports shall be factory attached.

.8 Operating Hardware: Hardware shall include guide tracks and brackets, trolleys, center guides, not less than three pairs of jamb and fold hinges per opening and all bolts, nuts, fasteners, etc. necessary for complete installation and operation. Jamb hinges shall be dual shear and have two thrust bearings and two needle bearings. Jamb hinges shall be gusseted. Fold hinges shall be dual shear with two thrust bearings. All bearings shall be completely concealed within the hinge barrel. All hinge pins shall be minimum 19 mm diameter hardened steel.

.9 Weather stripping: Cloth-inserted neoprene bulb installed weather-tight. Weather stripping shall be retained continuously.

.10 Vision Panels: 6 mm clear tempered glazing; ' Energy Advantage' by Pilkington with low emissivity coating on surface #2, of the size, shape and location as noted on the drawings. 25 mm total insulated glass unit thickness.

2.3 **OPERATORS**

.1 Each Four-Fold door shall be operated by an overhead mounted electro-mechanical drive unit designed for high cycle operation. Operator consists of an electric motor, gear reducer, and rotating drive arm. Door shall be operated in accordance with Manufacturer's written instructions.

.2 Electric Controls: Controls shall be furnished by the door manufacturer and shall be complete for each door and built in accordance with the latest NEMA standards.

.3 Operation (interior): Remote pushbutton stations, surface mounted, in location shown, with "OPEN-STOP-CLOSE" designations on pushbuttons in English.

.4 Radio Control: Portable transmitter to signal operator to open, close or stop door.

.5 Photo sensors and timer: UL approved, self monitoring operator to open door when object is sensed and a timer-to-close function to close door at a programmable time from 5 seconds to 1 hour.

3 Execution

3.1 **EXAMINATION**

.1 Verify condition and dimensions of steel hanger system, installed by Section 05 50 00, and other Work upon which this Section depends. Report defects to Consultant. Commencement of Work means acceptance of existing conditions.

3.2 **INSTALLATION**

.1 Install door and operating equipment complete with necessary hardware, jamb and head mould strips, anchors, inserts, hangers and equipment supports in accordance with final shop drawings, manufacturer's product data and as specified herein.
   .1 Secure guides to walls, plumb, level and true to line. Anchor guides at spacings indicated on approved shop drawings.
   .2 Provide additional support as necessary for attachment of guides, brackets and door and operator mechanisms to interfacing surfaces.

.2 Connect and adjust electrical components and operating hardware accordingly.

.3 Touch-up paint on frame and other painted surfaces in accordance with painting Section 09 91 00.

.4 Upon completion of installation, including work by other trades, lubricate, test and adjust doors to operate in accordance with manufacturer's product data. Final adjustments shall be made by manufacturer's authorized representative.

.5 Protect finished installations until date of Substantial Completion. Repair damage to door panel, hardware and operators.

3.3 **CLEANING**

.1 Upon completion of work of this section, remove strippable coatings, clean, materials, adjust operations and lubricate as required to obtain optimum performance.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Design, labour, Products, equipment and services necessary for electrically operated glazed sectional overhead door Work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 AAMA 2605, Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

.2 ANSI, H35.1M Alloy and Temper Designation Systems for Aluminum (Metric).

.3 ASTM A653/A653M, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.

.4 ASTM B209M, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.5 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standards for Electrical Installations.

.6 CAN/CSA-G40.20/G40.21-M, General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steels.

.7 CAN/CSA G164-M, Hot Dip Galvanizing of Irregularly Shaped Articles.

.8 CSA S136.1-M, Commentary on CAN/CSA S136-M, Cold Formed Steel Structural Members.

1.3 **DESIGN REQUIREMENTS**

.1 Design door assembly for climatic design data for location of work and to withstand wind loads in closed position of 1 kPa positive and 0.6 kPa negative. Maximum deflection under full design load to be 1/240 of opening width.

.2 Calculate properties of steel sections and allowable stresses used in determination of structural performance in accordance with CSA S136.1-M.

.3 Design door assembly to withstand minimum 100,000 cycles per annum, and 20 years total life cycle.

.4 Design electrical components for doors in accordance with CSA C22.1 and the Ontario Hydro Electrical Safety Code.

1.4 SUBMITTALS

.1 Product data:
- .1 Submit duplicate copies of manufacturer's Product data in accordance with Section 01 30 00 indicating:
  - .1 Performance criteria, compliance with appropriate reference standards, characteristics, limitations, and trouble-shooting protocol.
  - .2 Product transportation, storage, handling and installation requirements.

.2 Shop drawings:
- .1 Submit shop drawings in accordance with Section 01 30 00 indicating:
  - .1 Elevations, materials, sections and details, operating components, dimensions, gauges, glazing, hardware, accessories, finishes, and service rating.
  - .2 Complete electrical wiring diagrams including electrical schematics and sequence of operation.
  - .3 Complete engineering design data to confirm that door meets design criteria specified.

.3 Closeout submittals:
- .1 Submit following for each Product for incorporation into Operations and Maintenance Manuals in accordance with Section 01 78 00:
  - .1 Identification: Manufacturing name, type, year, and serial number.
  - .2 Performance criteria and maintenance data.
  - .3 Operating instructions and precautions.
  - .4 Safety precautions.
  - .5 Component parts availability including names and addresses of spare part suppliers.
  - .6 Lubrication schedule indicating lubrication points and type of lubricant recommended.

1.5 QUALITY ASSURANCE

.1 Retain a Professional Engineer, licensed in the Province of Ontario, with experience in Work of comparable complexity and scope, to perform the following services as part of the Work of this Section :
- .1 Design overhead doors to resist live, dead, lateral, wind, or seismic loads.
- .2 Review, stamp, and sign shop drawings.

1.6 EXTENDED WARRANTY

.1 Submit a extended warranty for Work of this Section in accordance with the Conditions of the Contract, except that warranty period is extended to 3 years.
- .1 Warrant against failure to meet design criteria and specified requirements.
- .2 Coverage: Complete replacement including affected adjacent Work.

2 Products

2.1 **ACCEPTABLE PRODUCTS AND MANUFACTURERS**

.1 Model Insulated (C175) Sectional Overhead Doors with Aluminum framed Full View Panels by Service Door Industries.

2.2 **MATERIALS**

.1 Aluminum extrusions: ASTM B211 and ANSI H35.1 AA6063 alloy, T6 temper.

.2 Aluminum sheet: ASTM B209 and ANSI H35.1 AA1100 aluminum alloy, H14 temper, minimum 1.0 mm aluminum sheet.

.3 Steel angles, shapes, plates, and similar items: CAN/CSA-G40.20/G40.21-M, Grade 350W.

.4 Galvanized steel sheet: commercial quality to ASTM A653/A653M with Z275 zinc coating.

.5 Insulated sections: Structural quality hot-dipped galvanized steel with polyurethane core sandwich type construction, thermal break and to incorporate the use of two continuous replaceable factory installed gaskets. Sections shall have a minimum thermal insulating value of R16 (RSI 2.81).

.6 Insulation: Cavity shall be filled with continuous process, formed-in-place, CFC and HCFC free rigid polyurethane core, interior and exterior skins shall feature thermal break.

.7 Glazing: 12.7 mm thick insulated glass unit consisting of two panes of 3 mm thick tempered glass with 6.7 mm thick air space, warm edge spacers and Low E coating to 2nd surface.

.8 Weather stripping: Heavy duty, factory installed continuous top seal to seal against header, continuous co-polymer joint bulb seal between sections and vinyl bulb shaped astragal on the bottom edge of the door. Dual durometer vinyl jamb weather seal, bolted to the continuous adjustable mounting angle (ADCA).

.9 Trusses: Provide adequate number of galvanized steel reinforcing trusses to meet the wind loading.

2.3 **STANDARD OPERATING HARDWARE**

.1 Track: Lift hardware as indicated on drawings with 75 mm size minimum 2.3 mm core thickness galvanized steel track.

.2 Track Supports: 2.3 mm core thickness continuous galvanized steel angle track supports.

.3 Spring counter balance: Heavy duty oil tempered torsion spring with manufacturers standard brackets.
- .1 Drum: 133 mm diameter die cast aluminum.
- .2 Shaft: 40 mm diameter solid steel.

.4 Top roller carrier: Galvanized steel minimum 2.3 mm thick, adjustable.

.5 Rollers: Full floating, grease packed hardened steel, ball bearing minimum 75 mm diameter, stamped tire.

.6 Roller brackets: Adjustable, galvanized steel, minimum 2.5 mm thick.

.7 Hinges: standard duty industrial 2.3 mm thick galvanized steel.

.8 Cable: minimum 4 mm diameter multi-strand galvanized steel aircraft cable with a safety factor of 8:1.

.9 Lock: manufacturer's standard interior mounted slide lock.

2.4 SPRINGLESS SAFE-DRIVE OPERATING SYSTEM

.1 Track: Lift hardware as indicated on drawings with 80 mm size minimum 2.75 mm core thickness galvanized steel track.

.2 Track Hangers: 32 mm x 32 mm x 2 mm galvanized steel angles.

.3 Vertical track mounting: Adjustable Continuous Track Angle (ADCA) bolted type, field adjustable, sloped to ensure weather tight seal, shall be fabricated from 2.4 mm commercially galvanized steel,

.4 Rollers: UHMW nylon rollers, 76 mm diameter, with sealed ball bearings, 11 mm diameter roller axles and both inner and outer ball races of hardened steel..

.5 Roller brackets: Fabricated from 3.1 mm zinc plated steel.

.6 Hinges: standard duty industrial 2.75 mm thick zinc plated steel.

.7 Track Guards: Continuous 4.5 mm x 1524 mm high, chamfered 45 degree at top, gray prime finish.

.8 Bumper springs shall be installed at the end of each horizontal track to stop door over travel.

2.5 ELECTRICAL

.1 Electrical jack shaft side mounted type operator for standard operating doors and direct drive type electric operator, shaft mounted for springless safe-drive operating doors. Operator to include motors, speed reducers with all gears running in oil, sheaves, racks, levers, cables and brake, disconnect switches, reversing starters, controls, and all conduit and wiring to make all connections required to complete the Work.

.2 Provide operator with floor level disconnect device to allow for manual operation in event of power failure. Equip operator with electrical interlock switch to disconnect power to operator when in manual operation and Built-in chain hoist for manual operation in event of power failure.

.3 Electrical motors, controller units, remote pushbutton stations, relays and other electrical components: to CSA approval with CSA enclosure type 1.

.4 Power supply: 120 V, 3 phase, 60 Hz.

.5 Motor: Minimum 0.375 kW to maximum 0.560 kW to suite design.

.6 Operation: Remote pushbutton stations, surface mounted, in location shown, with "OPEN-STOP-CLOSE" designations on pushbuttons in English.

.7 Exterior push buttons: Mushroom style exterior button to close door, interlinked with card reading system. Provide one per door, surface mounted, in location shown.

.8 Radio Control: Portable transmitter to signal operator to open, close or stop door.

.9 Vehicle Detection and Sensing Unit

- .1 System to consist of detector unit working in conjunction with sensing loop to activate door when vehicle enters or exits.
- .2 Vehicle detector: Manufacturers standard unit for use in temperature range of -40°C to 71°C.
- .3 System to automatically self-tune after initial setting.
- .4 Include protection against interference or damage by lightning or other electrical influence. Minimum protection to include loop fuse, zener diode over-voltage protection, neon flash over protection and line filter.

.10 Safety switch: combination roll rubber with limit switches for full length of bottom rail of bottom section of door, to reverse door to open position when coming in contact with object on closing cycle.

.11 Door speed: Minimum 300 mm per second.

.12 Control transformer: for 24 V AC control voltage.

2.6 FABRICATION

.1 Verify dimensions of existing Work before commencing fabrications and report discrepancies to Consultant.

.2 Fabricate Work in accordance with Contract Drawings and reviewed shop drawings. Fabricate, fit and assemble Work in shop where possible.

.3 Fabricate Work free from defects impairing function, appearance, strength and durability.

.4 Join stiles and rails with self tapping screws. Reinforce doors as required to meet design criteria.

.5 Panels and glazing to be encased in vinyl channels and held in place with a snap in retainer.

2.7 **FINISHES**

.1 Extrusion and sheet finish:
- .1 Fire Station Apparatus Bay: Custom powder coated to match PPG Duranar Sunstorm Coating ‘Silverstorm - UC106685F’.
- .2 Training Apparatus Bay: Satin nickel finish.

.2 Steel: Hot dip galvanized in accordance with CAN/CSA G164-M.

3 Execution

3.1 **INSTALLATION**

.1 Install doors in accordance with reviewed shop drawings and manufacturer's written instructions.

.2 Use anchorage devices to securely fasten unit assembly to wall construction and building and building framing without distortion or stress.

.3 Fit and align assembly including hardware; level and plumb, to provide smooth operation. Install door to fit tight at all edges of jambs and heads of frames.

.4 Install operator including electrical motors, controller units, pushbutton stations, vehicle sensing unit, remote operators, relays and other electrical equipment required for door operation in accordance with CSA C22.1 and Ontario Hydro Electrical Safety Code.

.5 Coordinate the installation of a magnetic loop with Division 26.

.6 Lubricate and adjust door operating components to ensure smooth opening and closing of doors.

.7 Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07 92 00.

.8 Touch-up doors and hardware after installation to the satisfaction of the Consultant.

.9 Adjust weatherstripping to form a weathertight seal.

.10 Apply isolation coating at 0.8 mm dry film thickness to prevent corrosive or electrolytic action between dissimilar materials.

3.2 ERECTION TOLERANCES

.1 Maintain dimensional tolerances and alignment with adjacent work and as follows:
- .1 Maximum variation and alignment from plum: 1.5 mm.
- .2 Maximum variation from level: 1.5 mm.
- .3 Longitudinal or diagonal warp: Plus or minus 3 mm per 3 m straight edge.

3.3 FIELD QUALITY CONTROL

.1 Testing: Test operate door and demonstrate the operation of same to the satisfaction of the Consultant.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Design, labour, Products, equipment and services necessary for sliding automatic door work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 AAMA 611, Voluntary Standards for Anodized Architectural Aluminum.

.2 ANSI H35.1M Alloy and Temper Designation Systems for Aluminum (Metric).

.3 ASTM C920, Specification for Elastomeric Joint Sealants.

.4 ASTM E283, Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

.5 ASTM E331, Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.

.6 CAN/CGSB-1.108-M, Bituminous Solvent Type Paint.

.7 CAN/CGSB-12.1-M, Tempered or Laminated Safety Glass.

.8 CAN/CGSB-12.8-M, Insulating Glass Units.

.9 CAN/CGSB-69.26, Power-Operated Pedestrian Doors.

1.3 **DESIGN REQUIREMENTS**

.1 Design sliding door system in accordance with following Climatic Design Data for Brampton contained in Ontario Building Code (OBC):
  .1 Design Temperature: January 1%, July 2 1/2% .
  .2 Wind (Hourly Wind Pressures): 1 in 50 year occurrence.
  .3 Earthquake: Seismic Data as listed.

.2 Design complete aluminum entrance door system, including glazing, to meet the following performance criteria:
  .1 U-factor: Maximum to follow.
  .2 SHGC: Maximum to follow.

.3 Restrict air infiltration/exfiltration, through sliding door system to 3.05×10^{-4} $m^3/s/m^2$ at reference pressure differential of 75 Pa, when measured in accordance with ASTM E283.

.4 Design and detail controlled drainage path to actively discharge water, which enters into, or forms within, sliding door system to exterior; design to prevent accumulation or storage of water within sliding door system, and to prevent water from entering interior. No water leakage permitted when tested in accordance with ASTM E331.

.5 Design and detail air and vapour retarder, insulation and rainscreen Products and assemblies into a continuous and integrated envelope. Optimize design to align envelope layers and to minimize thermal bridges.

.6 Design sliding door system to accommodate following without producing detrimental effect on sliding door system or its components:
- .1 40 degrees C range of cyclic, daily thermal swing for component expansion and contraction.
- .2 Dynamic, cyclic loading and release of loads such as wind loads.
- .3 Movement of supporting structure such as live, dead load, and creep deflections, seismic load and sway displacement and similar items.

.7 Design to prevent excessive deflection and permanent or progressive glazing displacement. Restrict horizontal and vertical mullion deflection to L/175 maximum (under uniformly distributed positive load), and do not exceed 10 mm total, regardless of span.

.8 Design, fabricate, and supply anchorage inserts for installation as part of other parts of the work. Design anchorage assemblies to accommodate construction and installation tolerances.

.9 Design sliding door system to accommodate 19 mm vertical deflection in supporting structure.

.10 Design automatic door equipment to accommodate traffic loading of 100,000 cycles.

.11 Design sliding automatic doors system with power and control voltage electrical requirements of single phase, 120V, 60Hz.

.12 Safety design criteria:
- .1 Design to prevent initiation of close cycle when failure of threshold presence detectors occurs.
- .2 Maximum closing force: 133 N factory set.

.13 System safety features:
- .1 Emergency exit break-away: Design sliding door break-away hardware on active leafs only, in direction of egress, under 90 N factory set, horizontal force field adjustable.
- .2 Motion/presence detectors: Design to detect moving (approaching or departing) and motionless people, and moving objects, both sides of sliding automatic door.
- .3 Threshold presence detector: Design to prevent sliding doors from closing when door opening is occupied.
- .4 Back-up system: 3 photocell detectors across doorway opening.

.5 Detection systems failure defaults: Default to hold-open position in case of system's failure.

.14 Sequence of operation (normal): Program following operating sequences for On key switch position.
- .1 Motion detector activation initiates door opening cycle, threshold presence detectors are activated, and timer is re-set.
- .2 After preset time has elapsed, door close cycle is initiated, threshold detectors remain activated till fully closed, and motion detectors, (both sides), continue to monitor for movement toward door.
- .3 If sliding door encounters resistance or obstruction while closing, door returns to fully open position and re-activates timer leading to closing cycle.
- .4 Door security system remains inactive

.15 Program following operating sequences for Exit Only key switch position:
- .1 Sequences identical to On position, except pedestrian entrancing is disallowed.

.16 Program following operating sequences for Maintenance key switch position:
- .1 Sliding door becomes inoperative (activation is not possible) and sliding door leaves can slide freely.
- .2 Door security system remains inactive.

.17 Program following operating sequences for Off key switch position:
- .1 Sliding door panels close when the motion and threshold detectors report door is clear, and remain in closed position to facilitate manual locking. Detectors are de-energized.
- .2 Door security system includes sliding automatic door.

1.4 SUBMITTALS

.1 Shop drawings:
- .1 Submit shop drawings in accordance with Section 01 30 00 indicating:
  - .1 Plans, sections, and details.
  - .2 Products and glazing types.
  - .3 Finishes.
  - .4 Anchorage inserts, system installation tolerances
  - .5 Section and hardware reinforcement, anchorage, assembly fixings
  - .6 Detailing, locations, and allowances for movement, expansion, contraction.
  - .7 Path of cavity drainage and air pressure equalization.
  - .8 Relationship of doors, frames, track, hardware and operating components to adjacent construction. Include detailed descriptions and catalogue cuts of specified door controls.
- .2 Submit complete electrical wiring diagrams including electrical schematics and sequence of operation for doors.
- .3 Submit complete design calculations for the doors to demonstrate conformance with design requirements.
- .4 Calculations or modelling confirming sliding automatic doors conform to specified performance and energy requirements.

.2 Samples:
.1 Submit following samples in accordance with Section 01 30 00:
.1 Two 300 mm long sliding door extrusion .
.2 Two 300 mm square insulating glass unit.
.3 Two 300 mm square corner samples of each type door and frame.

.3 Certificates:
.1 Submit CSA, ULC, or Ontario Hydro approvals for sliding automatic door systems.

.4 Close-out submittals:
.1 Submit following for each Product, incorporated into Operations and Maintenance Manual in accordance with Section 01 78 00.
.1 Printed operation instructions and maintenance data for doors with as-built straight line wiring diagrams illustrating electrical connections and control wiring.
.2 Submit lubrication chart indicating lubrication points and type of lubricant recommended for equipment.

.5 Extended warranty: Submit extended warranty signed and registered by the manufacturer providing the warranty in the name of the Owner for the timeframe and coverage specified in this Section.

1.5 **QUALITY ASSURANCE**

.1 Perform work of this Section by a company which supplies and installs work of this Section. Execute installation by manufacturer's trained and certified installation specialists.

1.6 **EXTENDED WARRANTY**

.1 Submit an extended warranty for sliding automatic door work In accordance with General Conditions, except that warranty period is extended to 5 years.
.1 Warrant that sliding automatic door systems will remain fully operational and functional, assuming normal wear and tear and maintenance.
.2 Coverage: complete replacement including affected adjacent work.

2 Products

2.1 **ACCEPTABLE MANUFACTURERS AND SYSTEMS:**

.1 All materials under work of this Section, including but not limited to, sealants and coatings are to have low VOC content limits.

.2 Acceptable manufacturers and systems include:
.1 OHC Unislide by Besam.
.2 Series 2000 by Horton Automatics.
.3 Dura-Glide, Series 2000 by Stanley Ltd.

.3 Hardware:
- .1 Complete perimeter weather stripping system.
- .2 Back-to-back cylinder cam lock between meeting stiles of sliding doors.
- .3 On - Exit only - Maintenance - Off, four position, key switch located on the door stile of each door.

.4 Aluminum extrusions: ANSI H35.1 AA6063, T5 temper alloy.
- .1 Finish: Clear anodized to AAMA 611 per Aluminum Association Designation System for Aluminum Finishes. AA-M12C23A41.

.5 Tempered/laminated, safety glass: CAN/CGSB-12.1-M, Type 1, Class B.; Laminated glass consisting of two 3 mm thick tempered glass panes laminated together, laminating film thickness: 1.52 mm.

.6 Insulating glass units: CAN/CGSB-12.8-M; 25 mm overall thickness. Tempered/laminated inside, tempered/laminated outside .

.7 Temporary glass presence markers: Easily removable, non-residue depositing.

.8 Permanent warning decal: 150 mm diameter, self adhesive vinyl, red colour decal with white lettering reading CAUTION SLIDING DOOR.

.9 Glazing tape: Preformed and pre-shimmed tape, paper release, colour as selected by Consultant.

.10 Setting blocks: Neoprene, 80-90 Shore A Durometer hardness, 100 mm long x 6 mm high x rebate width.

.11 Motion/presence detector:
- .1 K-band microwave, for two way traffic, motion detectors and active infrared presence sensors, designed to control the opening, hold open, and closing cycles of sliding automatic doors, with fully adjustable detection pattern and sensitivity adjustments in accordance with CAN/CGSB-69.26, in high impact, weather tight housing:
  - .1 Eye-Cue Besam by Enex Door Automation Inc.
  - .2 Apex by Horton Automatics
  - .3 Stan-Guard Threshold Sensor by Stanley Ltd.
- .2 Fabricate detectors which are capable of distinguishing false impulse events, including rain, snow, and which are unaffected by temperature changes, ambient light, or excessive traffic flow.

.12 Back-up system: Three photocell presence detectors concealed in sidelight stiles and located at 150 mm, 610 mm, and 1500 mm A.F.F across threshold.

.13 Anchors, clips, blocking, and angles: AISI Type 304 stainless steel, 2B mill finish.

.14 Screws, bolts and other fasteners: AISI Stainless Steel Type 304.

.15 Isolation coating: CAN/CGSB-1.108-M; Bitumastic coating, acid and alkali resistant material.

.16 Foam insulation: One component polyurethane foam for installation within closures and fillers; Enerfoam by DuPont de Nemours Inc.

.17 Frame sealant: Type as recommended by the sliding automatic door manufacturer.

.18 Lubricant: Type as recommended by manufacturer.

.19 Conduit: In accordance with Division 26 for rigid and flexible conduit and accessories.

.20 Wiring: In accordance with Division 26 .

.21 Airseal transition membrane: 'Blueskin SA' by Bakor, 'Sopraseal Stick 1100' by Soprema Inc. or 'Air-Shield by W. R. Meadows. Membrane to come complete with applicable primer.

.22 Joint backing: Product as recommended by sealant manufacturer.

.23 Sliding door sealant: ASTM C920, Type S, Grade NS, Class 35; One part silicone, neutral cure sealant, medium modulus; 'Dowsil Contractors Weatherproofing Sealant (CWS)' by Dow Consumer Solutions or 'Tremsil 400' by Tremco. Colour as later selected by Consultant. Primer as recommended by manufacturer.

2.2 **FABRICATION**

.1 Verify dimensions of existing work before commencing fabrication and report discrepancies to Consultant. Commencement of work means acceptance of existing conditions.

.2 Fabricate sections true to detail, free from defects impairing appearance, strength and durability. Fabricate extrusions with sharp, well defined corners.

.3 Fabricate, fit, and secure framing joints and corners accurately, with flush surfaces, and hairline joints. Fabricate frame sealant at joints for weatherproof seams.

.4 Fabricate to conceal anchors and attachments from view. Fabricate concealed reinforcement in accordance with design requirements.

.5 Do not expose manufacturer's identification labels on sliding automatic door assemblies.

.6 Fit and mitre corners and joints accurately fitted and securely jointed together. Apply back-up sealants on the inside of aluminum frame joints.

.7 Fabricate doors and frames complete with internal reinforcements, cutouts, recesses.

.8 Supply and install transom framing complete with glazing.

.9 After fabrication, apply protective strippable coating to prefinished aluminum surfaces. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather. Do not remove before final cleaning of building.

3 Execution

3.1 **EXAMINATION**

.1 Verify conditions and dimensions of previously installed Work upon which work of this Section depends. Report defects to Consultant. Commencement of work of this Section means acceptance of existing conditions.

3.2 **INSTALLATION**

.1 Install sliding door system in accordance with reviewed shop drawings and manufacturer's instructions.

.2 Install work of this Section securely, in correct location, level, square, plumb, at correct elevations, free of warp or twist.

.3 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.

.4 Install flashings, closures, and trim pieces.

.5 Fill voids between aluminum framing and adjacent construction with foam insulation.

.6 Supply and install sliding automatic door systems complete with glazing and accessories.

.7 Install glass presence markers, in two cross stripes extending from diagonal corners. Maintain markers until final clean-up.

.8 Install manufacturer's standard weatherstripping at door frame perimeter. Install weatherstripping throughout the full length and width of the doors at jambs and heads.

.9 Adjust operable parts for correct function.

.10 Remove damaged or unacceptable Products and assemblies from Site and replace to acceptance of Consultant.

.11 Install permanent warning decal onto upper lites of both sliding doors and fixed sidelights.

3.3 **ERECTION TOLERANCES**

.1 Maximum variation from plumb: 1.5 mm/3 m non-cumulative.

.2 Maximum misalignment of two adjoining members abutting in plane: 0.4 mm.

.3 Maximum perimeter sealant joint between sliding door system and adjacent construction: 13 mm.

3.4 GLAZING PERIMETER AIRSEAL

.1 Install glazing perimeter airseal at perimeter of each insulating glass unit to achieve an airseal from IG unit to sliding door frame. Do not obstruct path of cavity drainage and air pressure equalization.

3.5 AIRSEAL TRANSITION MEMBRANE

.1 Install primer and airseal transition membrane in accordance with manufacturer's instructions.

.2 Overlap airseal transition membrane 75 mm minimum and lap in direction of waterflow.

.3 Coordinate airseal transition to adjacent parts of Work.

3.6 ELECTRICAL WORK

.1 Install rigid steel conduit and wiring:
- .1 To nearest power supply junction boxes and make the connection.
- .2 For control and activation devices

.2 Install approach motion/presence detectors and adjust in accordance with sliding automatic door manufacturer's instructions.

3.7 JOINT BACKING AND SLIDING DOOR SEALANT

.1 Install joint backing and sliding door sealant at both sides of sliding automatic door frame perimeter for an air and weather tight installation.

3.8 FIELD QUALITY CONTROL

.1 Lubricate moving parts before test operations, include greasing/lubrication of sprockets, bearings, cables, and guides.

.2 Test operate sliding automatic doors and demonstrate operation to acceptance of Consultant.

3.9 CLEANING

.1 Remove strippable, protective coatings, temporary labels, and glass presence markers, clean frames and glazing free of residue.

.2 Clean and polish glass and metal surfaces, both interior and exterior.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Design, labour, Products, tool, equipment and services necessary for Aluminum work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 AAMA 501, Methods of Test for Exterior Walls.

.2 AAMA 2605, Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels - Series: Components, Coatings and Finishes.

.3 AAMA CW-10, Care and Handling of Architectural Aluminum from Shop to Site.

.4 AAMA CW-DG-1, Aluminum Curtain Wall Design Guide Manual.

.5 AAMA/WDMA/CSA 101/I.S.2/A440, Standard Specification for Windows, Doors, and Unit Skylights.

.6 ANSI H35.1M, Alloy and Temper Designation Systems for Aluminum (Metric).

.7 ASTM A167, Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.

.8 ASTM B209M, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.9 ASTM B221M, Specification for Aluminum-Alloy Extruded Bars, Rods, Wires, Profiles and Tubes.

.10 ASTM C920, Specification for Elastomeric Joint Sealants.

.11 ASTM E283, Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

.12 ASTM E330, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

.13 ASTM E331, Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.

.14 ASTM E783, Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.

.15 ASTM E1105, Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.

.16 ASTM F738M, Specification for Stainless Steel Metric Bolts, Screws, and Studs.

.17 CAN/CGSB 1.108-M, Bituminous Solvent Type Paint.

.18 CAN/ULC S702, Thermal Insulation, Mineral Fibre, for Buildings.

.19 CAN/ULC S705.1, Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density - Material Third Edition.

.20 NFRC 100, Procedure for Determining Fenestration Product U-factors.

.21 NFRC 200, Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.

1.3 **DEFINITION(S)**

.1 Aluminum work: Shall mean aluminum curtainwall, windows, entrances, vestibules, doors, and framing mentioned in Part 2 of this Specification Section.

1.4 **DESIGN REQUIREMENTS**

.1 Design Aluminum work to meet requirements of AAMA/WDMA/CSA 101/I.S.2/A440, AAMA CW-DG-1, ASTM E283, ASTM E330, ASTM E331, NFRC 100, NFRC 200 and to meet performance and energy requirements specified herein and as required by authorities having jurisdiction.

.2 Design Aluminum work in accordance with following Climatic Design Data for Brampton contained in the Ontario Building Code:
- .1 Design temperature: January 1%, July 2 1/2% .
- .2 Hourly wind pressures: 1 in 50 year occurrence.
- .3 Seismic design: Class “C”.

.3 Design complete aluminum window systems, including glazing, to meet the following performance criteria:
- .1 U-factor: Maximum to follow.
- .2 SHGC: Maximum to follow.

.4 Design complete aluminum entrance door systems, including glazing, to meet the following performance criteria:
- .1 U-factor: Maximum to follow.
- .2 SHGC: Maximum to follow.

.5 Design Aluminum work to accommodate following without producing detrimental effect:
- .1 Cyclic 40°C daily thermal swing of components.

.2 Cyclic, dynamic loading and release of loads such as wind loads.
.3 13 mm vertical deflection in supporting structure and movement of supporting structure due to live, dead load, and creep or deflections, seismic load, sway displacement and similar items.

.6 Design to prevent accumulation of condensate on interior side of Aluminum work framing under the following service conditions:
.1 Interior summer temperature: 21°C.
.2 Interior winter temperature: 21°C.
.3 Exterior temperature: -20°C.
.4 Interior RH: 35%.

.7 Restrict air infiltration/exfiltration, through Aluminum work in accordance with ASTM E283 at pressure differential as indicated:
.1 Curtainwalls and entrance assemblies: 0.003 L/s m^2 at differential of 300 Pa.
.2 Doors (per door): 2.78 m^3/h m per linear metre of crack at differential of 75 Pa.

.8 Design and detail controlled drainage path to actively discharge water, which enters into or forms within Aluminum work, to exterior; prevent accumulation or storage of water within Aluminum work. Prevent water from entering interior when tested in accordance with ASTM E331 at a pressure differential of 700 Pa..

.9 Design and detail air barrier, vapour retarder, and rainscreen products and assemblies into continuous and integrated Aluminum work envelope. Optimize Aluminum work design to align envelope layers and to minimize thermal bridges.

.10 Prevent deflection and permanent or progressive glazing displacement. Restrict horizontal and vertical mullion deflection to less than L/175 and 19 mm maximum for heights under 4115 mm and L/240 and 25 mm maximum for heights over 4115 mm.

.11 When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span in accordance with ASTM E330.

.12 Design anchorage inserts for installation as part of other Sections of work. Design anchorage assemblies to accommodate construction and installation tolerances.

.13 Provide all reinforcing within aluminum members as required by design and OBC to provide structurally sound assembly. In any case, mullion size shall not be increased due to provision of reinforcing.

.14 Design Aluminum work and connections to substrate where the bottom of the Aluminum work extends to a point below 1070 mm above finished floor level and separates a floor level from an adjacent interconnected space to withstand the required guard and handrail loads in accordance with the OBC and applicable local regulations. When requested by Consultant, provide a letter signed and sealed by a Professional Engineer certifying that the Aluminum work conforms to the OBC requirements.

.15 Design operable windows within reach of occupants with limiting stops conforming to requirements of OBC.

1.5 SUBMITTALS

.1 Shop drawings:
- .1 Submit shop drawings for mock-ups and Aluminum Work in accordance with Section 01 30 00 indicating:
  - .1 Plans, sections, details, type of extrusions, profiles, finishes, panels, spandrels, operating components, doors, related flashings, closures, fillers, and end caps, and sealants.
  - .2 Products and glazing types.
  - .3 Calculations or modelling confirming Aluminum work conforms to specified performance and energy requirements.
  - .4 Structural integrity of Aluminum work, anchorage inserts, and system installation tolerances.
  - .5 Section and hardware reinforcement, anchorage, assembly fixings.
  - .6 Detailing, locations, and allowances for movement, expansion, contraction
  - .7 Air barrier and vapour retarder continuity and path of cavity drainage and air pressure equalization.
  - .8 Seismic anchors, supports and accessories for complete installation.

.2 Samples:
- .1 Submit two samples of following in accordance with Section 01 30 00.
  - .1 250 mm long samples of each type of extrusion and finish.
  - .2 250 x 200 mm samples of insulating glass unit.
  - .3 One complete corner detail of door frame, glazing, and finish for each door type.
  - .4 Each door hardware item for Consultant’s approval.
  - .5 250 x 200 mm sample of aluminum panel.
  - .6 200 x 200 mm sample of insect screen for operable windows for Consultant’s approval of fibreglass mesh.

.3 Reports:
- .1 Submit substantiating engineering data, and independent test results of pre-tested, Aluminum work to substantiate compliance with the design criteria including air leakage and water penetration conforming to ASTM E283 and ASTM E331.

.2 Engineering data demonstrating compliance with test procedures outlined in AAMA 501 including as a minimum air leakage resistance, static pressure water penetration resistance, dynamic pressure water penetration resistance, wind load resistance, vertical live load deflection movement and lateral (horizontal) movement, and condensation resistance.

.3 Submit documentation to substantiate ten years of experience in Aluminum work manufacture and installation of similar size and nature.

.4 Close-out submittals: Submit Aluminum work data for incorporation into the Operations and Maintenance Manual as part of Section 01 78 00.

.5 Extended warranties: Submit extended warranty signed and registered by the manufacturer providing the warranty in the name of the Owner for the timeframe and coverage specified in this Section.

1.6 **QUALITY ASSURANCE**

.1 Retain a Professional Engineer, licensed in Province of Ontario, with experience in Aluminum work of comparable complexity and scope to perform the following services as part of the work of this Section:

.1 Design of Aluminum work.

.2 Design of anchors, supports and accessories to meet seismic requirements.

.3 Review, stamp, and sign shop drawings.

.4 Conduct on-Site inspections and prepare and submit inspection reports. Number and frequency of inspection to be sufficient to satisfy Engineer that Window Wall Work is being fabricated and installed in accordance with reviewed shop drawings and design intent.

.2 Shop mock-up:

.1 Provide one, full scale mock-up in shop of Aluminum work for shop testing, including air leakage, water penetration, and deflection in accordance with AAMA/WDMA/CSA 101/I.S.2/A440,, AAMA 501, ASTM E283, ASTM E330, and ASTM E331. If a test fails, additional testing may be required by Consultant to ensure performance of Aluminum Work at no additional cost to Owner.

.2 Demonstrate conformance to specified design requirements.

.3 Mock-up shall show full range of Products, finishes, textures, quality of fabrication, and workmanship including, but not limited to, framing members, glazing units, anchorage, opening units, doors and transitions to adjoining assemblies and materials.

.3 Site mock-up:

.1 Provide one full scale in-situ mock-up for testing of air and water infiltration to AAMA 501, ASTM E783 and ASTM E1105 to the satisfaction of an Consultant. If a test fails, additional testing may be required by Consultant to ensure performance of Aluminum Work at no additional cost to Owner.

.2 Deliver and erect one, full scale mock-up of Aluminum work assembly, in location acceptable to Consultant.

.3 Demonstrate conformance to specified design requirements.

.4 Demonstrate installation procedures, finished look and quality of workmanship including, but not limited to, framing members, glazing units, anchorage, opening units, doors and transitions to adjoining assemblies and materials.

.5 Mock-up may form part of final Work, if acceptable to Consultant. Remove and dispose of mock-ups which do not form part of Work.

.4 Pre-installation meetings:

.1 Mock-ups: Prior to installation of mock-ups, arrange meeting at the shop and on Site to be attended by Consultant, Contractor, and window wall Engineer and site superintendent to inspect substrates, and to review installation procedures 48 hours in advance of installation.

.2 Site: Prior to installation of window wall, arrange meeting at the Site to be attended by Consultant, Contractor, and window wall Engineer and site superintendent to inspect substrates, and to review installation procedures 2 weeks in advance of installation.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, and handle Aluminum Work in accordance with AAMA CW-10 and manufacturer's written recommendations.

.2 Protect aluminum surfaces with strippable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather. Do not remove before final cleaning of building.

1.8 EXTENDED WARRANTY

.1 Aluminum work: Submit an extended warranty for Aluminum work in accordance with General Conditions, except that warranty period is extended to 5 years.

.1 Warrant against failure to meet the design criteria and requirements such as interior leakage, frame condensation.

.2 Coverage: Labour and materials to repair or replace Aluminum Work as required to correct deficient work and meet specified requirements including affected adjacent work.

.2 Glazing:

.1 Provide a 10 year warranty, commencing from date of Substantial Performance, against defects in the insulating glass units and warrant them to be free from material obstruction of vision as a result of dust or film formation on the internal glass surfaces by any cause, under normal design conditions. Warrant the following:

.1 The insulating glass units shall be free from condensation, fogging material obstruction of vision as a result of dust or film formation on the internal glass surfaces by any cause under design conditions.

.2 The insulating glass units shall not change their mechanical design properties and shall not in any way deteriorate, degrade, delaminate or change their visual appearance.

.3 The glass units will not break due to thermal shock and temperature differential due to inherent glass faults, other than extrinsic glass breakage.

.4 Internal fogging shall be deemed to occur when light transmission of the glass is reduced by 5% in any 50 mm x 50 mm area.

.5 Failure will be deemed to occur when the internal dew point exceeds -40oC in a 21oC ambient temperature (when tested in accordance with ASTM E576).

.2 Warrant that glazing work is water and weather tight and free from distortion; that glazing materials will not deteriorate from exposure to the atmosphere and weather, will not be displaced, and will be free from permanent deformation under load; and that glass and insulating glass units will not be broken, cracked or scratched by causes resulting from defects in material, workmanship or design of glazing installation.

.3 Cracked or scratched glass, shrinking, cracking, staining, hardening, sagging of glazing materials; loosening or rattling of glass; and leaking of glazed joints will be considered defective work.

.4 Warranty shall provide for the removal of defective Products, replacement with new Products conforming to the specifications, and restoration of work damaged by removal and replacement including labour and installation costs.

3. Manufacturer's finish Warranty: Provide manufacturer's written warranty naming Owner as beneficiary and covering finish degradation or failure of factory-applied exterior fluoropolymer finish on Aluminum work within the warranty period; warrant finish per AAMA 2605 for colour fade less than 5 units, maximum chalk rating of 8, and greater than 30% gloss retention. Warranty period for finish: 5 years from date Work is certified as substantially performed.

2 Products

2.1 ACCEPTABLE MANUFACTURER(S) AND SYSTEM(S)

.1 All Aluminum work systems and components are to be provided by a single manufacturer to ensure a single source of responsibility for the Work of this Section.

.2 Curtain wall: ‘HP3252 Series’ by CRL / U.S. Aluminum or approved alternative Oldcastle Building Envelope. Reinforcing in curtain wall mullions as required to maintain mullion size as detailed.

.3 Exterior entrance system:

.1 Aluminum entrance framing: In accordance with 2.1.1, Curtainwall.

.2 Aluminum doors: ‘ThermaPorte 7700’ by Alumicor Limited, ‘Insulclad Doors' by Kawneer Company Canada Limited or approved alternative by US Aluminum (C.R. Lawrence).

.4 Interior vestibule framing:
- .1 Aluminum entrance framing: '1800 Series' by Alumicor Limited or 'Trifab VG 451' by Kawneer Company Canada Limited or approved alternative by US Aluminum (C.R. Lawrence).
- .2 Aluminum doors: 'Canadiana' by Alumicor Limited, 'Standard Entrances' by Kawneer Company Canada Limited or approved alternative by US Aluminum (C.R. Lawrence).

2.2 MATERIALS

.1 All materials under work of this Section, including but not limited to, sealants are to have low VOC content limits.

.2 Aluminum extrusions and channels: ASTM B221 and ANSI H35.1 AA6063 alloy, T6 temper.
- .1 Profile and dimensions: Refer to Contract Drawings.
- .2 Thermal breaks in frame members: Vertically aligned with glazing.

.3 Aluminum sheet: ASTM B209 and ANSI H35.1 AA1100 aluminum alloy, H14 temper, minimum 2.38 mm thickness for all sheet widths.

.4 Reinforcements and anchors: ASTM A167, Type 304 to AISI No. 2B finish. Size as shown.

.5 Glass and glazing materials: As specified in Section 08 80 00.

.6 Spandrel panel, airseal backpan: ASTM A653/A653M; 0.9 mm thick, Z275 galvanized steel sheet.

.7 Airseal and Aluminum Work sealant: ASTM C920, Type S, Grade NS, Class 100/50; One-part, low-modulus, moisture-curing, silicone. 'Dow Corning 790' by Dow Corning; 'Spectrem 1' by Tremco. Verify compatibility with insulating glass unit manufacturer's secondary sealant. Colour as selected by Consultant. Primer as recommended by manufacturer.

.8 Frame sealant: Type as recommended by the Aluminum work manufacturer.

.9 Joint backing: Closed cell foam polyethylene rod, outsized minimum 30-50% larger than joint width and compatible with joint sealant. Product as recommended by sealant manufacturer.

.10 Airseal transition membrane: To match products provided under Section 07 26 00 - Air/Vapour Barriers.

.11 Anchors, clips, and angles: Extruded aluminum or stainless steel.

.12 Shims and blocking for frame: Rigid plastic, wood is not permitted.

.13 Flashings, closures and trim: 1.0 mm minimum aluminum sheet, finish to match Aluminum Work extrusion finish.

.14 Screws, bolts and other fasteners: ASTM F738M; Stainless Steel Type 304.

.15 Seismic anchors, supports and accessories: In accordance with reviewed shop drawings.

.16 Isolation coating: CAN/CGSB-1.108-M; Bitumastic coating, acid and alkali resistant material.

.17 Spandrel panel insulation: CAN/ULC S702; minimum 56 kg/m^3, unfaced, semi-rigid mineral wool.
- .1 'Thermafiber FireSpan' by Owens-Corning.
- .2 'CurtainRock' by Rockwool Inc.
- .3 Thickness: As required to fill void.
- .4 Insulation fasteners: Stik-Clip with retaining washer.

.18 Foam Insulation: One component polyurethane foam-in-place moisture cured caulking sealant insulation, 16 kg per m3 to 32 kg per m3 density; injected from prepackaged pressurized containers for installation within closures and fillers; foam shall be CFC free. Enerfoam by Dow Chemical Canada Inc. or approved alternative.

.19 Window hardware: Manufacturer's standard heavy duty corrosion resistant hardware.

.20 Door hardware: Supplied by others, installed by this Section.

.21 Weatherstripping: Durable, non-absorbing material resistant to deterioration by aging and weathering. Weather stripping shall provide complete air-tight seal at jambs and head of opening. Adapt weatherstripping as required to maintain required performance and provide any/all necessary accessories.

2.3 FABRICATION

.1 Fabricate sections true to detail, free from defects impairing appearance, strength and durability. Fabricate extrusions with sharp, well defined corners.

.2 Fabricate Aluminum work in accordance with reviewed shop drawings and manufacturer's written instructions.

.3 Fabricate, fit, and secure framing joints and corners accurately, with flush surfaces, and hairline joints. Apply frame sealant at joints to provide continuity of water and air barrier.

.4 Conceal anchors, reinforcement and attachments from view. Fabricate reinforcement in accordance with design requirements.

.5 Do not expose manufacturer's identification labels on aluminum assemblies.

.6 Fabricate continuous sill flashings with intermediate anchor clips, and joint reinforcing, form to profile shown. Fabricate filler and closure pieces as necessary for a complete and weather tight installation.

.7 Certify aluminum windows as complying with the AAMA/WDMA/CSA 101/I.S.2/A440 design criteria and requirements using an easily removable label located on the inside face of glazing.

.8 Fabricate doors and frames complete with internal reinforcements, cut-outs, and recesses to accommodate finish hardware. Reinforce cut-outs to assure adequate strength.

.9 Fabricate Aluminum work closures and trim from aluminum sheet. Form to profile shown. Make weathertight.

.10 Double weatherstrip windows and doors. Install weatherstripping in specially extruded ports and secure to prevent shrinkage or movement.

.11 Fabricate glazing recess with drainage to exterior.

2.4 ALUMINUM DOORS

.1 Fabricate doors of welded construction.

.2 Glazing stop: Aluminum, square, snap-on type, designed for glazing system.

2.5 INSULATED PANELS AND SPANDREL PANELS

.1 Fabricate insulated panel and spandrel panel inner facing of galvanized sheet to form an airseal backpan. Wrap edges with galvanized sheet, enabling installation and minor movement of perimeter seal.

.2 Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.

.3 Provide integral reinforcing and stiffeners as required to reinforce panel against deflection caused by wind and suction loads.

.4 Place continuous layer of insulation to airseal backpan with adhesive and impale clips and fasteners. Ensure there are not gaps between the insulation and airseal backpan.

.5 Provide spacers as necessary to separate dissimilar metals.

.6 Ventilate and pressure equalize the air space outside the exterior surface of the insulation, to the exterior.

.7 Arrange fasteners and attachments to ensure concealment from view.

.8 Glass panels: Consists of 6 mm thick spandrel glass to the exterior with insulated backpan to the inside. Insulation shall be in thickness as indicated on Contract Drawings thick, retained with stick clips. Seal all joints in shop with high grade butyl sealant, including perimeter seal at backpan. Colour to later selection by Consultant.

.9 Metal panels: Consists of an exterior prefinished flush aluminum panel with panel stiffeners as required, to match colour of window framing, with insulation core in thickness as indicated on Contract Drawings and galvanized sheet back-pan.

2.6 **FINISH**

.1 Extrusion finish: Four coat finish with barrier coat 'Duranar XL' by PPG in accordance with AAMA 2605. Colour:‘Silverstorm - UC106685F’.

.2 Mullion cap finish: Four coat finish with barrier coat 'Duranar XL' by PPG in accordance with AAMA 2605. Colour: ‘Silverstorm - UC106685F’.

.3 Doors: Four coat finish with barrier coat 'Duranar XL' by PPG in accordance with AAMA 2605. Colour:‘Silverstorm - UC106685F’.

.4 Panel and sheet finish: As indicated on drawings to match adjacent extrusion finish.

3 Execution

3.1 **EXAMINATION**

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of Work means acceptance of existing conditions.

3.2 **INSTALLATION**

.1 Install Aluminum Work in accordance with reviewed shop drawings, manufacturer's written instructions, and CAN/CSA-A440-M/A440.1-M.

.2 Install Work of this Section securely, in correct location, level, square, plumb, at proper elevations, free of warp or twist.

.3 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.

.4 Install flashings, closures, and trim pieces.

.5 Fill voids between aluminum framing and adjacent construction with foam insulation.

.6 Install sills in maximum lengths possible. For sills over 1200 mm in length, maintain 3 mm to 6 mm space at each end.

.7 Refer to Contract Drawings for glazing type locations. Install glazing in accordance with Section 08 80 00.

.8 Spandrel panels:
- .1 Set back pans to framing, apply sealant to cover screw heads to maintain air tight seal between back pans and framing.
- .2 Adhere stick clips to metal back pans at 300 mm o.c. both ways. Apply insulation adhesive over entire surface of barrier and around clips held with adhesive.
- .3 Cut insulation slightly over-size and press insulation boards firmly to barrier impaling them on clips without bending clips. Butt insulation boards tightly. install retainers to clips.

.9 Install aluminum door weatherstripping at door frame perimeter. Install weatherstripping throughout entire length and width of doors at jambs and heads.

.10 Install doors and hardware to manufacturers' written instructions. Clean and adjust hardware for correct performance.

.11 Install hardware in accordance with hardware templates.

.12 Adjust fixed and operable hardware for correct clearances and function.

.13 Remove damaged or unacceptable Products and assemblies from Site and replace to Consultant's acceptance.

.14 Install glass presence markers, in two cross stripes extending from diagonal corners. Maintain markers until final clean-up.

3.3 ERECTION TOLERANCES

.1 Tolerances: Non-cumulative.
- .1 Maximum variation from plumb: 1.5 mm/3 m non-cumulative or 12 mm/30 m, whichever is less.
- .2 Maximum misalignment of two adjoining members abutting in plane: 0.8 mm.
- .3 Vertical and horizontal positions: +/- 3 mm.
- .4 Racking of face: 6 mm, nil in elevation.
- .5 Operable components: Consistent with smooth operation and weatherproof performance.
- .6 Maximum perimeter sealant joint between Aluminum Work and adjacent construction: 13 mm.

3.4 GLAZING PERIMETER AIRSEAL

.1 Install glazing perimeter airseal at entire perimeter of each insulating glass unit to achieve an airseal from insulating glass unit to curtain wall frame. Do not obstruct path of cavity drainage and air pressure equalization.

.2 Perform sealant work in accordance with manufacturer’s written requirements.

3.5 AIRSEAL TRANSITION MEMBRANE

.1 Install primer and airseal transition membrane in accordance with manufacturer's instructions. Install airseal transition membrane into extrusion reglet as indicated on drawings. If there is no extrusion reglet, mechanically fasten airseal transition membrane to frame with batten bar fastened at 150 mm o.c.

.2 Overlap airseal transition membrane 75 mm minimum and lap in direction of waterflow.

.3 Coordinate airseal transition to adjacent parts of Work.

3.6 JOINT BACKING AND ALUMINUM WORK SEALANT

.1 Prepare substrate surface and mask as recommended by sealant manufacturer.

.2 Install joint backing and sealant at Aluminum Work and perimeter joints for weather tight installation in accordance with sealant manufacturer's instructions. Tool sealant. Remove excess sealant.

.3 Seal joints between windows and window sills with sealant. Bed sill expansion joint cover plates and drip deflectors in sealant. Seal between sill upstand and window-frame. Seal butt joints in continuous sills.

3.7 ADJUSTING

.1 Adjust operable units to move smoothly, with proper tension, throughout their full range of motion and to fit tightly when closed and locked.

.2 Lubricate hardware in accordance with manufacturer's instructions.

.3 Ensure that weatherstripping makes weathertight contact and does not cause binding to affect closing and locking.

3.8 CLEANING

.1 Maintain Aluminum Work, inside and outside, in clean condition throughout construction period.

.2 Remove labels, protective material, and glass presence markers from prefinished surfaces.

.3 Remove CAN/CSA-A440-M/A440.1-M certification labeling when directed by Consultant, in writing.

.4 Wash Aluminum Work with solution of mild detergent in warm water, with particular attention to recesses and corners. Wipe surfaces clean and dry.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Labour, Products, equipment and services necessary for finish hardware work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 BHMA, Builders Hardware Manufacturing Association.

.2 NFPA 80, Standard for Fire Doors and Other Opening Protectives.

1.3 **SUBMITTALS**

.1 Product data: Submit manufacturer's Product data in accordance with Section 01 30 00 indicating compliance with reference standards, transportation, storage, handling and installation requirements.

.2 Shop Drawings:
- .1 Submit Shop Drawings and 3 complete hardware lists in accordance with Section 01 30 00 indicating:
  - .1 Door locations, sizes, hardware manufacturer's catalogue numbers, finish symbols and quantities required.
  - .2 Locations and mounting heights of each type of hardware.
- .2 Supply templates and required information to door and frame manufacturer to enable accurate sizes, locations of cut-outs and reinforcement for hardware.
- .3 Submit templates to required trade to arrange for provisions for accurate setting and fitting of hardware.

.3 Samples:
- .1 Submit 2 samples in accordance with Section 01 30 00 of each item that is different from hardware specified and include manufacturer's parts lists and installation instructions.
- .2 Submit hardware component samples illustrating style, colour and finish. Tag samples identifying applicable Specification article number, brand name and number, finish, building location, date and catalogue number.
- .3 Do not order hardware until samples have been accepted. Submit new samples to replace rejected samples. Supply hardware and finishes identical to each accepted sample.

.4 Closeout submittals:
- .1 Submit the following in accordance with Section 01 78 00 for each Product for incorporation into Operation and Maintenance Manual:
  - .1 Maintenance data.
  - .2 Operating instructions and safety precautions.
  - .3 Parts list with name and address of supplier.
  - .4 Lubrication schedule and type of lubricant recommended.
  - .5 Keys, tools and special devices.
  - .6 Inspection procedures related to preventive maintenance.

1.4 **QUALITY ASSURANCE**

.1 General:
- .1 Manufacturers: Companies specializing in manufacturing door hardware and registered with BHMA.
- .2 Hardware supplier: Company specializing in supplying commercial door hardware and acceptable to manufacturer.

.2 Certifications:
- .1 Employ an Architectural Hardware Consultant to prepare hardware schedule and inspect completed installation and certify that hardware has been installed in accordance with manufacturer's printed instructions, Authorities having Jurisdiction and as specified.
- .2 Submit manufacturer's certificate that finish hardware and fire rated hardware meets specified requirements.

1.5 **DELIVERY, STORAGE, AND HANDLING**

.1 Be responsible for packaging of hardware, on a set by set basis. As material is received from various manufacturers identify it to correspond to Hardware List symbols.

.2 Label packages legibly, indicating manufacturer's number, types, sizes, opening number and Hardware List reference number. Wrap hardware and include in package, screws, bolts and fastening necessary for correct installation. If hardware package is not complete, pay additional charges incurred by installer.

.3 Deliver hardware to Site packaged, labelled and cross-referenced to hardware list for each item and its scheduled installation location.

.4 Accept Products of this Section on Site and ensure that each item is undamaged.

.5 Catalogue and store hardware in secure area.

2 Products

2.1 **GENERAL**

.1 Aluminum door hardware: Supplied and installed under the work of Section 08 44 00.

.2 Carefully check and verify Hardware List against Contract Drawings to ensure that hardware listed can be used as specified. Inform Consultant of concerns regarding quality, quantity, operation or function of hardware selected:
- .1 Verify hand of doors, examine details on Contract Drawings and at Site to ensure hardware supplied can be correctly installed and is correct for work as constructed.

.2 Select hardware in accordance with applicable codes and regulations and to approval of local Fire Marshal.

.3 Replace and pay for defective hardware including hardware which was incorrectly selected, and remedial and installation costs.

.3 Ensure that hardware selected will function correctly, meets Contract requirements and Ontario Building Code and authorities having jurisdiction.

.4 Ensure that each hardware item is of same type, design and by same manufacturer.

.5 Manufacturer's names or trade marks are not permitted on exposed surfaces of hardware.

.6 Include in packing slip a list of parts, name of supplier and door number in which lock is to be installed.

.7 Hardware for fire rated and labelled door and frame assemblies: ULC listed or as accepted by authorities having jurisdiction.

.8 Fire rated assemblies:

.1 Hardware: Selected and installed in accordance with applicable codes and regulations, NFPA-80 and to approval of Ontario Fire Marshal.

.2 Fire rated doors: ULC labelled hardware. Submit written certification of conformance to ULC requirements for each type of hardware prior to delivery.

.3 Locksets and latchsets on fire rated doors: 19 mm throw minimum.

2.2 ACCESSORIES

.1 Items to be attached to masonry or concrete with expandable shields, lag screws, bolts or other fastening devices as required. Exposed screws: Stainless steel, Phillips or Robertson heads.

2.3 FINISHES

.1 Metal finishes: Free from defects, clean, unstained and of a uniform colour for each type of finish required. Exposed surfaces and anchors: Specified finish symbol of item.

3 Execution

3.1 EXAMINATION

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of work of this Section means acceptance of existing conditions.

3.2 INSTALLATION

.1 Install hardware in accordance with reviewed Shop Drawings, manufacturer's installation instructions, and applicable Codes and regulations.

.2 Install hardware in accordance with hardware templates.

.3 Adjust fixed and operable hardware for correct clearances and function.

.4 Mount hardware measured from finished floor to centre of hardware, unless indicated otherwise or required by Code:

- .1 Top hinge: 250 mm from head of door to top.
- .2 Bottom hinge: 265 mm from finished floor to bottom of hinge.
- .3 Intermediate hinge: Equal distance between top and bottom hinge.
- .4 Locksets, latchsets: 1000 mm.
- .5 Panic device crossbar: 1000 mm.
- .6 Push plates: 1100 mm to bottom of plates.
- .7 Guard bars: 1100 mm.
- .8 Door pulls: 1100 mm to bottom of pulls.
- .9 Blank strike: 1450 mm.
- .10 Blank fronts: 1450 mm.

.5 Include for supply and installation of wiring for electric strikes from electrical junction box to electric strike hardware.

.6 Locate door stops to contact doors 75 mm from latch edge.

.7 Install hardware and trim square and plumb to doors.

.8 Replace wrappings for hardware provided by manufacturer after installation.

.9 Safeguard keys to keep them out of unauthorized hands, tag them with door number, and deliver them to person designated by Consultant at building completion.

3.3 FIELD QUALITY CONTROL

.1 Have hardware inspected after installation by hardware supplier's representative, obtain certification in writing that hardware has been supplied and installed in accordance with Specifications and hardware manufacturer's instructions and is functioning correctly.

.2 Inspect fire rated openings to ensure they are installed in compliance with NFPA 80 requirements and Authorities having Jurisdiction.

.3 Test access control system and electrified hardware devices for proper operation. Verify electric door release hardware operates properly upon activation of fire alarm system.

3.4 ADJUSTING

.1 Verify under work of this Section, that installed hardware functions properly.

.2 Adjust hardware so that latches and locks operate smoothly and without binding, and closers act positively with the least possible resistance in use. Lubricate hardware if required by manufacturer's instructions.

.3 Adjust doors with self closing devices or automatic closing devices for proper operation after the HVAC system is balanced and adjusted. Verify spring power of non sized door closers is properly adjusted.

3.5 CLEANING

.1 Remove wrappings at completion of the Project and clean hardware in accordance with manufacturer's instructions.

3.6 HARDWARE GROUPS/SCHEDULE

.1 Hardware groups/schedule: Refer to hardware groups/schedule appended to this Section.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Design, labour, Products, tool, equipment and services necessary for automatic door equipment work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 ANSI/BHMA A156.19, Power Assist and Low-Energy Power-Operated Doors.

1.3 **DESIGN REQUIREMENTS**

.1 Design handicap door system comprising of low energy power operator with optional push and go door system as defined in ANSI/BHMA A156.19.

.2 Design system operator to activate if one push button from either side of door is pushed. Actuated door shall open slowly to back check (80°) in 3 to 6 seconds and to full open position in 4 to 7 seconds. Door shall remain open for period set to suit requirements (period of 5 to 30 seconds). After time delay door shall close by spring in door operator from 90° to 10° in 3 to 6 seconds from 10° to fully closed in 1-1/2 to 2 seconds.

1.4 **SUBMITTALS**

.1 Product data: Submit duplicate copies of manufacturer's Product data in accordance with Section 01 30 00 indicating performance criteria, compliance with appropriate reference standard(s), characteristics, limitations, trouble-shooting protocol, transportation, storage, handling and installation requirements.

.2 Shop drawings: Submit shop drawings in accordance with Section 01 30 00 indicating all connections, attachments, reinforcing, anchorage and location of exposed fastenings.

.3 Extended warranty: Submit extended warranty signed and registered by the manufacturer providing the warranty in the name of the Owner for the timeframe and coverage specified in this Section.

1.5 **EXTENDED WARRANTY**

.1 Submit a extended warranty for automatic door equipment in accordance with General Conditions, except that warranty period is extended to 2 years.
  .1 Warrant against failure to meet design criteria and requirements.
  .2 Coverage: Complete replacement including affected adjacent Work.

2 Products

2.1 **ACCEPTABLE MANUFACTURER(S) AND SYSTEM(S)**

.1 Heavy Duty Door Operator: Design is based on self contained, low pressure electro-hydraulic power. Operator to be as manufactured by one of the following:
- .1 PowerSwing by Assa Abloy Entrance Systems Canada (Besam).
- .2 Magic Force by Stanley Canada Inc.
- .3 Or approved alternative by Allegion.

.2 Door operating equipment shall be complete with electro mechanical motor gear box. Provide 3 position (off-on) switch. System shall operate between -30 deg C and 50 deg C.

2.2 **REQUIREMENTS**

.1 Functional Requirements:
- .1 Equipment shall be designed to operate swing doors up to weight of 100 kg.
- .2 Opening Speed:
  - .1 Door shall be field adjusted to back check as required in Table 1 of ANSI/BHMA A156.19.
  - .2 Opening speed to fully open shall be 4 seconds or longer.

.2 Hold Open: Door shall be field adjusted to remain fully open for not less then 5 seconds or more than 30 seconds.

.3 Closing Speed:
- .1 Doors shall be field adjusted to close 90° to 10° in 3 seconds or longer as required in Table 1 of ANSI/BHMA A156.19.
- .2 Doors shall close from 10° to fully closed in not less than 1.5 seconds.
- .3 Force required to prevent door from opening or closing shall not exceed 7 kg applied 25 mm from latch edge of door at any point in opening or closing cycle.
- .4 During power failure, doors shall open with manual pressure not exceeding 11.3 kg at point 25 mm from latch edge of door.
- .5 Doors shall be equipped with signs visible from either side, instructing user as to operation and function of door.

.4 Requirements:
- .1 Provide header complete with full housing, finish shall match door frame finish.
- .2 Locations of automatic door operators to conform to requirements of the Ontario Building Code (OBC).
- .3 Operator shall be activated by 150 mm diameter stainless steel push button switches on either sides as indicated.
- .4 Switches shall bear universal handicap logo visible to all types of traffic.

3 Execution

3.1 **EXAMINATION**

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of Work means acceptance of existing conditions.

3.2 **INSTALLATION**

.1 Install automatic door operators, controls and accessories for doors indicated in accordance with reviewed shop drawings and manufacturer written instructions.

.2 Installation of automatic door operators to be in accordance with requirements of the Ontario Building Code (OBC).

.3 Doors shall operate manually as though equipped with manual door closers, without damage to automatic door components, in event of power failure or in event of power termination.

.4 Co-ordinate this work with Section 08 44 00.

.5 Power supply to each door operator and wiring shall be provided by Division 26 - Electrical. Make connections at operators and at control panel and supply and install each electrical work between operators and activating controls. Comply with requirements of Division 26 - Electrical. All wiring shall be concealed and where exposed shall be run in conduit. Location of exposed wiring shall be subject to Consultant's approval.

3.3 **ADJUSTMENT AND CLEANING**

.1 Test and adjust operators and controls smooth and proper operation.

.2 Upon completion of Work of this Section, remove from Site all debris, equipment and excess material resulting from Work of this Section.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Design, labour, Products, equipment, tools, and services necessary for glass and glazing work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 ASTM C1048, Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.

.2 ASTM C1376, Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass.

.3 ASTM C1503, Standard Specification for Silvered Flat Glass Mirror.

.4 ASTM D2240, Test Method for Rubber Property - Durometer Hardness.

.5 ASTM E2190, Standard Specification for Insulating Glass Unit Performance and Evaluation.

.6 CAN/CGSB-12.1-M, Tempered or Laminated Safety Glass.

.7 CAN/CGSB-12.8, Insulating Glass Units.

.8 Glass Association of North America (GANA) Glazing Manual.

.9 NFPA 80, Standard for Fire Doors and Other Opening Protectives.

1.3 **DESIGN REQUIREMENTS**

.1 Glass design:
- .1 Design glass using a probability of breakage of 8 lites per 1000 at the first application of design load.
- .2 Perform stress analysis. Design units to accommodate live, dead, lateral, wind, seismic, handling, transportation, and erection loads.
- .3 Perform a thermal stress analysis on each glass unit with Low-E coating and provide heat strengthening and/or tempered units as necessary to prevent thermal breakage.
- .4 Perform a thermal stress analysis on each insulating thermal unit and provide heat strengthening and/or tempered units as necessary to prevent thermal breakage.
- .5 Where required, design glazing units so as not to allow thermal stress fracture due to heat build-up behind insulating units.
- .6 Roller wave:
  - .1 Heat treated flat glass to be by horizontal (roller hearth) process with inherent roller wave distortion parallel to the bottom edge of the glass as installed.

.2 Maximum peak to valley roller wave 0.08 mm in the central area and 0.20 mm within 267 mm of the leading and trailing edge or 100 millidiopter over 95% of the glass surface.
.3 Maximum bow and warp 0.79 mm per 300 mm.
.4 Roll distortion is to run parallel to the width dimension when installed in the building.

.7 Coordinate with applicable Sections as required to meet intended energy and performance requirements for insulating glass units.

.2 Limit glass deflection to flexural limit of glass with full recovery of glazing materials.

.3 Utilize inner light of multiple light sealed units for continuity of air and vapour seal.

1.4 SUBMITTALS

.1 Shop drawings:
.1 Submit shop drawings in accordance with Section 01 30 00 indicating as a minimum:
.1 Fabrication and erection of glazing elements indicating materials, thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

.2 Samples:
.1 Submit following samples in accordance with Section 01 30 00.
.2 Submit one sample of each type of glass.
.1 300 x 300 mm of each type of insulating glass unit, complete with each different Low-E coating.
.2 300 x 300 mm of tempered glass.
.3 300 x 300 mm of laminated glass.
.4 300 x 300 mm of each colour of spandrel glass.
.5 300 x 300 mm of mirror.
.6 300 x 300 mm of glass film.

.3 Certificates:
.1 Submit manufacturer's certification that glass and glazing materials are compatible.

.4 IGMAC Compliance Audit: Submit in accordance with Section 01 30 00, a written certification of successful completion of a Compliance Audit within the last six months.

.5 Extended warranty: Submit extended warranty signed and registered by the manufacturer providing the warranty in the name of the Owner for the timeframe and coverage specified in this Section.

1.5 **QUALITY ASSURANCE**

.1 Insulating glass unit fabricators shall be a certified member of the Fenestration and Glazing Industry Alliance (FGIA). FGIA members must participate in the certification program and shall have successfully passed a Compliance Audit within the last six months.

.2 Installers qualifications: Perform work of this Section by a company that has a minimum of five years proven experience in the installation of glazing units of a similar size and nature.

1.6 **SITE CONDITIONS**

.1 Glaze with compounds, sealants, or tapes only when glazing surfaces are at temperatures over 4°C, and when positive that no moisture is accumulating on them from rain, mist, or condensation.

.2 When temperature of glazing surfaces is below 4°C, obtain from Consultant and material manufacturer approval of glazing methods and protective measures which will be used during glazing operations.

1.7 **EXTENDED WARRANTY**

.1 In accordance with Section 08 44 00.

2 Products

2.1 **ACCEPTABLE MANUFACTURERS**

.1 Glass manufacturers:
- .1 AGC Flat Glass.
- .2 Cardinal Glass Industries.
- .3 Guardian Industries.
- .4 Viracon Inc.
- .5 Vitro Architectural Glass (formerly PPG Industries Ltd.)

2.2 **MATERIALS**

.1 General:
- .1 All materials under work of this Section, including but not limited to, primers, coatings, sealers, sealants, adhesives and cleaners are to have low VOC content limits.
- .2 All coatings of a similar type shall be applied in a single production run to ensure colour match.
- .3 Edges of glass shall be free from spalls, flake chips or rough chips which would be either visible or compromise the adhesion of the exterior weather seal or reduce the strength of glass when subjected to temperature differentials.

.2 Tempered glass **(TGL)**: CAN/CGSB-12.1-M, Type 2, Class B, Category II, clear, minimum 6 mm thick.

.3 Fire rated glass **(FRGL)**: 20 min. to 3 hr. fire rating tested to ULC CAN4 S104-M and ULC CAN4 S106-M, 5 mm thick or as otherwise noted on Door Schedule with appropriate labelling stating fire rating and approval, clear polished glass. Firelite Plus by Nippon Electric Glass Company Ltd. or approved alternative.

.4 Laminated glass **(LGL)**: to CAN/CGSB-12.1, Category II, consisting of top layer of 3 mm thick clear tempered glass, 0.8 mm thick clear PVB interlayer, and bottom layer of 3 mm thick clear tempered glass. Heat strengthening and/or tempered laminated glass as necessary to prevent thermal breakage.

.5 Spandrel glass **(SGL)**: ASTM C1048, Condition B, 6 mm thick tempered glass, with water-based silicone emulsion coating applied to backside, 'Opaci-Coat 300' by ICD High Performance Coatings or approved alternative. Colour: To the later selection of the Consultant.

.6 Heat strengthened glass **(HSGL)**: CAN/CGSB-12.3-M; clear float glass, glazing quality, heat strengthened in accordance with ASTM C 1048, Kind HS, 17.5 mm thick unless indicated otherwise.

.7 Silvered mirror glass **(MGL)**:
- .1 to ASTM C1503, 6 mm thick, laminated safety mirror glass fabricated with polished plate or float glass. Mirror backing shall be resistant to sulphur and hydrogen sulphide fumes. Polish and round all corners of mirrors.
- .2 Mirror attachment accessories:
  - .1 Mirror adhesive: Chemically compatible with mirror coating and wall substrate.
  - .2 Mirror frames: Stainless steel.
  - .3 Stainless steel clips.

.8 Insulating glass units:
- .1 To CAN/CGSB-12.8-M, ASTM E2190 and IGMA requirements utilizing approved stainless steel edge spacer. Dual seal with a PIB primary seal and silicone secondary seal.
- .2 To comply with IGMA labelling requirements to be considered certified. Materials, excluding the glass, shall be from the same manufacturer as those employed for the certification of the insulating glass units.

.9 Argon gas: 100% pure. Argon gas to be used to fill air space at all insulated glass units.

.10 Low-E coating (Soft coat): ASTM C1376, high performance sputtered low-E coating. Provide insulating glass units with low-E coating edge deletion and low-E coating. Apply low-E coating to second surface unless otherwise indicated. 'EnergySelect 36' by AGC Flat Glass, 'Cardinal LoE-272' by Cardinal Glass Industries or 'SN 68' by Guardian Industries.

.11 Glazing and rebate primers, sealants, sealers, and cleaners: Compatible with each other. Type as recommended by sealant, spline, and glass manufacturer.

.12 Glazing sealant: Silicone sealant as recommended by glazing manufacturer. Verify compatibility with insulating glass unit secondary sealant.

.13 Heel & toe bead: Silicone sealant as recommended by glazing manufacturer.

.14 Glazing gasket: 'Visionstrip' or Polyshim II' by Tremco Ltd., glazing seal, size as recommended by manufacturer.

.15 Glazing tape: 'Polyshim II' glazing tape EPDM shim.

.16 Glazing splines: EPDM or neoprene, extruded shape to suit glazing channel retaining slot, colour as selected.

.17 Setting blocks (regular): EPDM, 80 - 90 Shore A durometer hardness to ASTM D2240, sized to suit glazing method, glass unit weight and area.

.18 Edge blocks: EPDM, 60-70 Shore A Durometer hardness, self adhesive on face, sized with 3 mm clearance from glass edge and spanning glass thickness(es).

.19 Glass presence markers: Easily removable, non-residue depositing.

.20 Screws, bolts and fasteners: Type 304 stainless steel.

2.3 GLAZING AND FILM SCHEDULE

.1 General: Glass types shall be as indicated on Drawings and below unless otherwise required due to thermal stress analysis.

.2 GL-1 (IG units): 6 mm clear tempered glass interior lite, argon filled air space, 6 mm clear tempered glass exterior lite with low-E coating on surface #2. Standard throughout unless noted otherwise. 25 mm overall thickness.

.3 GL-2: 7 mm clear laminated safety glass interior lite, argon filled air space, 6 mm clear tempered glass exterior lite with low-E coating on surface #2. Standard throughout unless noted otherwise. 25 mm overall thickness.

.4 GL-3: 6 mm thick spandrel glass with galvanized metal back-pan filled with semi-rigid insulation.

.5 GL-4: 6 mm clear tempered glass.

2.4 FABRICATION

.1 Verify glazing dimensions on Site.

.2 Clearly label each glass lite with maker's name and glass type. Ensure labels are easily removable, non-residue depositing type. Do not remove labels until after Work is accepted by Consultant.

.3 Fabricate glazing not less than 3 mm smaller than rebate size in either dimension; allow for edge spacers, shims, and setting blocks as necessary.

.4 Work shall have smooth finished surfaces free from distortion and defects detrimental to appearance and performance.

.5 Carefully make and fit details. Take special care with exposed finished work to produce a neat and correct appearance to the Consultant's acceptance.

.6 Grind and polish a 1.5 mm arris to both edges of exposed glazing at locations where glazing is not encapsulated in framing and where edges are exposed to occupants.

.7 Fabricate argon filled thermal units with air space filled minimum 90% with argon gas.

3 Execution

3.1 EXAMINATION

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of work of this Section means acceptance of existing conditions.

.2 Verify that openings for glazing are correctly sized and within tolerance.

.3 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.

.4 Laminated glass edges shall be completely covered by tape to protect against sealants and water if required by manufacturer.

3.2 PREPARATION

.1 Clean contact surfaces with solvent and wipe dry.

.2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.

.3 Prime surfaces scheduled to receive sealant.

3.3 INSTALLATION

.1 Provide glazing in accordance with FGIA recommendations. Provide continuous contact between glazing tapes and gasket to the glazing.

.2 Install glazing to the work of Sections 05 50 00, 06 20 00, 08 11 13, 08 35 00, 08 39 18, 08 42 29 and 08 44 00.

.3 Provide neat, straight sight lines. Trim excess glazing tape flush with top of stops and fixed leg of frames.

.4 Remove protective coatings, glazing stops, clean rebate and glass contact surfaces with solvent, wipe dry.

.5 Apply primer/sealer to contact surfaces, prior to glazing.

.6 Apply glazing tape as per manufacturer's instructions including recommended corner sealant.

.7 Use setting blocks at 1/4 points and spacers to centre glass unit in frame.

.8 Install glazing in accordance with reviewed shop drawings and manufacturer's written instructions. Install glazing with full contact and adhesion at perimeter. Maintain edge clearance recommended by glass manufacturer.

.9 Apply a continuous heel bead of sealant around perimeter of inboard lite of the sealed unit and the metal framing.

.10 Re-install glazing stops ensuring continuous contact and rattle-free installation. Do not distort glass. Trim tape protruding more than 2 mm above stop.

.11 Install glazing gasket in accordance with manufacturer's recommendations.

.12 Do not cut or abrade tempered, heat treated, or coated glass.

.13 Install glass presence markers in two cross stripes extending from diagonal corners. Maintain markers until final clean-up.

.14 Remove, dispose of, and replace broken, cut, abraded glass, and defective glass including but not limited to production dimples, roller wave or marks, tong marks, chips, cracks, etc.

.15 Exterior glass: Glaze units with gasket on exterior side and glazing tape on interior side. Seal gap between glazing and stop with sealant to depth equal to bite of frame. Apply cap head of sealant along void between stop and glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

.16 Interior glass: Glaze interior glass using glazing gasket glazing tape.

.17 Glass film
- .1 Install glass film with adhesive, applied in accordance with film manufacturer's instructions.
- .2 Place without air bubbles, creases or visible distortion.
- .3 Fit tight to glass perimeter with razor cut edge.

.18 Mirrors:

.1 Install mirrors in one single piece in sizes indicated without joints.

.2 Set mirrors with adhesive and clips, applied in accordance with manufacturer's instructions.

.3 Where indicated, provide continuous metal trim along all mirror edges, with mitred corners and concealed fastenings.

3.4 CLEANING

.1 Immediately remove sealant and compound droppings from finished surfaces.

.2 Remove labels, protective material, and glass presence markers from prefinished surfaces.

.3 Clean glass surfaces with cleaning agents and methods in accordance with Manufacturer’s written instructions.

.4 Do not wash glass film for 30 days after installation.

.5 Do not use bristle brushes on glass film.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Design, labour, Products, equipment and services necessary for gypsum board work.

1.2 **REFERENCES**

.1 ASTM A653/A653M, Specification for Steel Sheet, Zinc-coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.

.2 ASTM C475, Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

.3 ASTM C645, Specification for Nonstructural Steel Framing Members.

.4 ASTM C754, Specification for Steel Framing Members to Receive Screw-Attached Gypsum Board.

.5 ASTM C834, Standard Specification for Latex Sealants.

.6 ASTM C840, Specification for Application and Finishing of Gypsum Board.

.7 ASTM C1002, Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

.8 ASTM C1396, Specification for Gypsum Board.

.9 ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 **DESIGN REQUIREMENTS**

.1 Design gypsum board wall and ceiling systems with a maximum deflection of l/360.

.2 Design ceiling suspension system in accordance with manufacturer's printed directions and ASTM C754.

.3 Design ceiling system for adequate support of electrical fixtures as required by the current bulletin of the Electrical Safety Authority.

.4 Design hanger anchor and entire suspension system static loading not to exceed 25% of their ultimate capacity including lighting fixture dead loads.

.5 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.

.6 Design subframing as necessary to accommodate, and to circumvent, conflicts and interferences where ducts or other equipment prevent the regular spacing of hangers.

.7 Design wall framing system and reinforce as necessary to accommodate and support items attached to and supported by wall framing system.

.8 Design wall framing system for wall assemblies with a height greater than 3000 mm and those assemblies incorporating non-standard gypsum board assemblies including, but not limited to, abuse resistant gypsum board, and large format tile. applications.

1.4 REGULATORY REQUIREMENTS

.1 Provide fire separations and fire protection exactly as specified in test design specification that validates the specified rating. Verify that work specified in other Sections, as a part of the entire assembly, meets applicable validating test design specification.

1.5 SUBMITTALS

.1 Product data:
- .1 Submit copies of manufacturer's Product data in accordance with Section 01 30 00 indicating:
  - .1 Performance criteria, compliance with appropriate reference standard, characteristics, and limitations.
  - .2 Product transportation, storage, handling and installation requirements.

.2 Shop Drawings:
- .1 Submit Shop Drawings in accordance with Section 01 30 00 indicating:
  - .1 Wall assemblies, suspension systems, adjacent construction, elevations, sections and details, dimensions, thickness, finishes and relationship to adjacent construction.
  - .2 Framing and blocking for items being supported of wall systems.
  - .3 Fire rated designs.

.3 Certifications: Submit written certification stating that suspended ceiling system is designed for adequate support of electrical fixtures as required by the current bulletin of the Electrical Safety Authority.

1.6 QUALITY ASSURANCE

.1 Qualifications: Execute the work of this Section by skilled, qualified, and experienced workers trained in the installation of the work of this Section.

.2 Retain a Professional Engineer, licensed in Province of Ontario, with experience in work of comparable complexity and scope, to perform following services as part of work of this Section:

.1 Design of wall systems with height greater than 3000 mm and at non-standard gypsum board assemblies including, but not limited to, assemblies incorporating abuse resistant gypsum board, and large format tile applications.
.2 Design of suspended gypsum board assemblies.
.3 Review, stamp, and sign Shop Drawings and design calculations.
.4 Conduct shop and on-site inspections, prepare and submit written inspection reports verifying that this part of Work is in accordance with Contract Documents and reviewed Shop Drawings.

1.7 **SITE CONDITIONS**

.1 Do not begin work of this Section until:
.1 Mechanical and electrical work above the ceiling is complete.
.2 Substrate and ambient temperature is above 15°C.
.3 Relative humidity is below 80 %.
.4 Ventilation is adequate to remove excess moisture.

.2 Install temporary protection and facilities to maintain Product manufacturer's, and above specification, environmental requirements 24 h before, during, and 24 h after installation.

2 Products

2.1 **MATERIALS**

.1 General: All materials under work of this Section, including but not limited to, sealants, adhesives, and primers are to have low VOC content limits.

.2 Steel framing: ASTM C754; ASTM A653/A653-M, Z275; cold rolled, galvanized steel sheet.
.1 Bailey Metal Products Limited
.2 Corus Metal Profiles

.3 Steel studs and track runners: ASTM C645; Galvanized steel studs and runners, 32 mm wide x depth as indicated on Contract Drawings. Formed from galvanized steel sheet, thicknesses as follows:
.1 Studs less than 3000 mm: Minimum 0.53 mm (25 ga.).
.2 Studs greater than 3000 mm and non-standard assemblies: Minimum 0.91 mm (20 ga.), unless stud thickness of greater thickness is required to accommodate intended loading, spans, or conditions.
.3 Track runners and ancillary components to match stud thickness.

.4 Main carrying channels: ASTM C645; Formed from galvanized steel sheet, 38 x 19 mm cold rolled, channels.

.5 Resilient channel: ASTM C645; 0.5 mm thick galvanized metal, 57 mm wide x 12 mm deep for walls and ceiling to reduce sound transmission.

.6 Furring channels: ASTM C645; Formed from galvanized steel sheet, 22 mm winged flange type, cold rolled.

.7 Furring channels (hat type): ASTM C645; 0.5 mm base steel thickness, galvanized. 70 mm wide x 22 mm deep hat shaped channel.

.8 Heavy duty furring channels: ASTM C645; 0.9 mm steel thickness, galvanized hat shaped channel with a wider and deeper size as required by manufacturers.

.9 Hanger wires: 4.1 mm minimum diameter galvanized pencil rod.

.10 Tie wire: 1.6 mm thick minimum diameter, soft annealed, galvanized steel wire.

.11 Corner bead, casing bead, and special shapes: Formed from 0.6 mm thick minimum, galvanized steel sheet, designed to be concealed by joint compound.

.12 Deflection track: ASTM C 645 top runner with 50.8-mm- deep flanges, in thickness indicated for studs and in width to accommodate depth of studs.

.13 Deflection track (fire rated): Provide 25 mm deep leg deflection track where indicated on rated walls. 'Fire Trak Shadowline' by Fire Trak Corporation or approved alternative.

.14 Ceiling clips: Hot dip galvanized partition attachment clips, in square and reveal edge; 'PAC 15 Series' to match grid system by CGC Inc. or approved alternative.

.15 Gaskets (acoustic partitions): Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 3.2 mm thick, in width to suit steel stud size.

.16 Control joint strip: Roll formed from galvanized steel sheet, with a tape protected recess, 6 mm wide x 11 mm deep.

.17 Screw fasteners: ASTM C1002 Type S; Corrosion resistant.

.18 Concrete anchors: tie wire sleeve anchors, 'Redi-Drive Anchors' by ITW Red Head or approved alternative.

.19 Insulation: In accordance with Section 07 21 00.

.20 Standard sealants:

- .1 Acoustic sealant (non-rated): Non-hardening acoustic sealant for use at non-rated assemblies, ASTM C834; Acrylic, mould resistant sealant, paintable. 'Smoke and Acoustic Sealant CP506' by Hilti or approved alternative.
- .2 Standard sealants: In accordance with Section 07 92 00.

.21 Fire rated seal: Provide one of the following for use at fire rated assemblies:
- .1 Fire-rated sealant: Non-hardening sealant for use at fire-rated assemblies: ASTM E84; Acrylic based firestop sealant, colour: red or white as selected by Consultant. 'Flexible Firestop Sealant CP606' by Hilti or approved alternative.
- .2 Fire-rated seal: Non-hardening seal for use at fire-rated assemblies: ASTM E84; Flexible seal for installation between top track and substrate. 'Firestop Top Track Seal CFS-TTS' by Hilti or approved alternative.

.22 Polyethylene vapour retarder: In accordance with Section 07 26 00.

.23 Vibration isolation ceiling hangers: unit shall consist of a steel spring in series with a neoprene isolating element. Model W30N manufactured by Mason Industries Inc., or approved alternative by PAC International. Provide hangers to ensure that working load does not exceed 2/3 of solid load. Design hangers to tolerate 30 deg. misalignment.

.24 Fire rated gypsum board: ASTM C1396; gypsum board 15.9 mm thick of maximum practical lengths to minimize end joints, unless indicated otherwise. Furnish Type X Board by Certainteed Gypsum Canada, CGC Inc., or Georgia-Pacific Canada LP.

.25 Abuse Resistant Panels: ASTM C1396; 15.9 mm thick unless indicated otherwise on drawings; 'Abuse Resistant' by Certainteed Gypsum Canada, 'Sheetrock AR' by CGC Inc. or 'ToughRock' by Georgia-Pacific Canada LP.

.26 Moisture, mould, and abuse resistant panels: 15.9 mm thick unless indicated otherwise on drawings; 'AirRenew Extreme Impact Resistant with M2Tech' by Certainteed Gypsum Canada, 'Sheetrock Mold Tough AR' by CGC Inc. or 'DensArmor Plus Abuse-Resistant Interior Panel' by Georgia-Pacific Canada LP.

.27 Tile Backer: Water resistant tile backer board meeting ASTM C1178 or ASTM C1278, thickness as indicated. 'Diamondback Tile Backer' by Certainteed Gypsum Canada, 'Fiberock Aqua-Tough Underlayment' by CGC Inc. or 'Dens Shield' by Georgia-Pacific Canada LP.

.28 Primer: Where indicated by board manufacturer, provide primer as required to achieve finishes as defined in ASTM C840.

.29 Joint reinforcing tape:
- .1 Standard gypsum board: ASTM C475; 50 mm wide x 0.25 mm thick, perforated paper, with chamfered edges.
- .2 Moisture resistant and tile backer boards: ASTM C475; fibreglass mat joint tape as recommended by board manufacturer to suit location.

.30 Bonding adhesive: Type for purpose intended and as recommended and approved by manufacturer.

.31 Joint and patching compound: ASTM C475; Asbestos-free, supplied by manufacturer of gypsum board used.

.32 Fast setting patching compound: ASTM C475; Asbestos-free, Sheetrock or Durabond by CGC Inc., 'Moisture and Mold Resistant Setting Compound with M2Tech' by Certainteed Gypsum Canada or approved alternative.

.33 Access doors: Supplied by other Sections for installation as part of the work of this Section.

3 Execution

3.1 **EXAMINATION**

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of work of this Section means acceptance of existing conditions.

3.2 **SUSPENSION FRAMING**

.1 Install ceiling systems in accordance with reviewed Shop Drawings and manufacturer's written instructions.

.2 Install hanger wires plumb and securely anchored to the building structural framing, independent of walls, pipes, ducts, and metal deck; install additional framing and hangers to bridge interference items.

.3 Install vibration isolation hangers at all locations where indicated in strict accordance with manufacturer's printed instructions.

.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.

.5 Install additional hangers at lighting fixture and ductwork locations. Do not attach hanger wires to mechanical or electrical equipment. Do not support mechanical and electrical fixtures and fitting on ceiling without the ceiling manufacturer's written acceptance.

.6 Install main carrying channels transverse to structural framing members. Lap main carrying channels 200 mm minimum at splices and wire each end with two loops and prevent clustering or lining-up of splices.

.7 Install furring channels at 400 mm o.c., not less than 25 mm, and not more than 150 mm from perimeter walls, at openings, at interruptions in ceiling continuity, and at change in plane. Install furring channels to a tolerance of 3 mm maximum in 3600 mm.

.8 Install additional main carrying and furring channels to frame and to reinforce openings such as recessed lighting fixtures, access hatches, ceiling grilles, outlet boxes, ventilating outlets and similar items.

3.3 STEEL STUDS AND FURRING

.1 Install steel studs and furring in accordance with reviewed Shop Drawings and manufacturer's written instructions.

.2 Install steel stud partitions to underside of structure unless indicated otherwise.

.3 Install track runners at floors, ceilings, and underside of structure; align track runners accurately and secure to structure at 600 mm centres maximum.

.4 Install double top track runner assembly to prevent the transmission of structural loads to steel studs.

.5 Install steel studs vertically at 400 mm o.c., unless otherwise indicated, and not more than 50 mm from abutting walls, at openings, and at each side of corners. Install studs securely to track runners.

.6 Schedule and coordinate steel framing installation with mechanical and electrical services installation.

.7 Install full height, double studs at door and service openings, fastened together and stiffened back to the structure to prevent vibration when doors close.

.8 Provide double studs boxed together at all openings, sill, head and jambs and at door jambs, fastened together and stiffened back to the structure to prevent vibration. At each opening exceeding 900 mm in width double studs shall be 20 ga. extending to structure above, and adequately anchored at each end. Provide steel studs above and below openings spaced at 400 mm oc maximum. All metal stud partitions above doors and screens over 1220 mm wide shall be secured to structure over and reinforced with sway bracing to stabilize walls to prevent lateral movement.

.9 Erect three studs at corner and intermediate intersections of partitions. Space 50 mm apart and brace together with wired 19 mm channels.

.10 Stiffen partitions over 2440 mm high or 3000 mm long, or both, with horizontal bracing extended for full length of partitions. Provide one line of bracing in partitions. Space lines to provide equal unbraced panels. Provide bracing for portions of partitions over door openings in partitions over 3000 mm high, and bracing both above and below openings in partitions located no greater than 150 mm from top and bottom of opening, and extending two stud spaces beyond each edge of opening for both doors and windows. Wire tie or weld bracing to studs.

.11 Frame control joints using back to back double studs at abutting structural elements, at dissimilar backup interface, at dissimilar walls and ceilings, at structural expansion and control joints, at door and other openings, and at 9000 mm maximum spacing in continuous runs. Install control joint strips and secure in place.

.12 Install additional support framing at openings and cutouts for built-in equipment, upper cabinet support, access panels and similar items.

.13 Attach to framing adequate steel reinforcing members or an 18 ga. steel stud mounted horizontally and notched around furring members to support the load of, and to withstand the withdrawal and shear forces imposed by, items installed upon the work of this Section. Such items include, but are not restricted to, coat hooks, washroom accessories, handrail anchors, rub rails, grab bars, guards, wall-hung cabinets and fitments, shelving, curtain and drape tracks; Owner supplied equipment; and minor mechanical and electrical work. Heavy mechanical and electrical equipment shall be self-supporting in Divisions 21, 22, 23 and 26.

.14 Provide for support and incorporation of flush-mounted and recessed mechanical and electrical equipment and fixtures only after consultation and verification of methods with those performing the work of Divisions 21, 22, 23 and 26.

.15 Install cross bracing in accordance with the steel stud manufacturer's recommendations.

3.4 FIRE RATED ASSEMBLIES

.1 Install Products in fire rated assemblies in strict accordance with reviewed Shop Drawings and applicable tested and approved designs required by Authorities Having Jurisdiction.

.2 Install firestop fill material behind fire rated acoustical sealant and provide firestop identification tag.

.3 Stiffen fire rated walls over 3.66 m high, where linear length of wall is greater than 2.44 m between perpendicular wall supports, with diagonal bracing above the ceiling extending perpendicular to wall at a 45° angle to structure above. Locate diagonal bracing at maximum 2.44 m o.c.

.4 Where double layers of gypsum board are shown, and required for fire rating, screw first layer to studs and furring and laminate the second layer to the first using joint filler as an adhesive. Stagger joints between first and second layers.

3.5 INSULATION

.1 Install non-rated and fire-rated/acoustic insulation as required for Work of this Project in accordance with Section 07 21 00.

3.6 ACOUSTICAL SEALANT

.1 Install acoustical sealant to acoustically insulated partitions in accordance with the manufacturer's instructions and Contract Drawings.

.2 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 Smooth acoustical sealant with trowel prior to skin forming.

3.7 GYPSUM BOARD

.1 Comply with ASTM C840. Install gypsum board in accordance with reviewed Shop Drawings and manufacturer's written instructions.

.2 Install gypsum board vertically or horizontally, whichever results in fewer end joints. Locate end joints over supporting members.

.3 Install gypsum board in lightly butted contact at edges and ends and with 1.6 mm maximum open space between boards; do not force gypsum board into place. Do not install imperfect, damaged or damp boards.

.4 Install gypsum board butting paired tapered edge joints, and mill-cut or field-cut end joints; do not place tapered edges against cut edges or ends.

.5 Install vertical joints minimum 300 mm from the jamb lines of openings and stagger vertical joints over different studs on opposite sides of partitions.

.6 Do not locate joints within 200 mm of corners or openings, except where control joints occur at jamb lines or where openings occur adjacent to corners. Where necessary, place a single vertical joint over the centre of wide openings.

.7 Install gypsum board over concrete and concrete masonry units with adhesive as recommended by gypsum board manufacturer where indicated on Drawings.

.8 Cut, drill and patch gypsum board as may be necessary to accommodate the work of other trades.

9. Fire Separations:
   .1 Construct gypsum board assemblies, where located, in accordance with tested assemblies to obtain required or indicated fire rated assemblies. As a minimum fire separations shall consist of metal framing covered on both sides by fire-rated gypsum board.
   .2 Install assemblies tightly to enclosing constructions to maintain integrity of the separations. Install casing beads at all perimeter edges.

3.8 CORNER, CASING BEADS AND TRIM

.1 Corner reinforcing bead: Install along all external angles, erect plumb, level and with a minimum of joints. Secure with screws at 225 mm o.c. apply filler over flanges flush with nose of the bead and extending at least 75 mm onto surface of board each side of corner. When filler dries, apply a thin coat of topping cement and blend onto adjoining surfaces.

.2 Casing bead: Install where wallboard butts against a surface having no trim concealing the juncture and where shown on drawings. Erect casing beads plumb or level, with minimum joints, and secure with screws at 300 mm o.c. apply filler over flange flush with bead and extending at least 75 mm onto surface of board. When dry, apply a thin coat of topping cement and blend onto adjoining surfaces.

.3 Recess channels and trim: Install recess channels and special metal trim where shown. Secure to substrate. Provide casing beads full height on wallboard edges at recess channels and metal trim.

3.9 JOINT TAPING AND FINISHING

.1 Install reinforcing tape and a minimum of 3 coats of joint compound over gypsum board joints, metal trim and accessories, and screw fasteners in accordance with the gypsum board manufacturer's instructions.

.2 Fill gaps between ,and any imperfections in, gypsum boards with joint compound, allow to dry, and sand smooth ready for painting.

.3 Install finished gypsum board work smooth, seamless, plumb, true, flush, and with square, plumb, and neat corners.

.4 Finish gypsum board in accordance with ASTM C840 to the following grades:

- .1 Level 0: No taping, finishing, or accessories required. Use above suspended ceilings and within other concealed spaces, unless the assembly is fire rated, sound rated, sound or smoke controlled, or unless the space serves as an air plenum.
- .2 Level 1: At joints and interior angles embed tape in joint compound. Leave surface free of excess joint compound. Tool marks and ridges are acceptable. Use above suspended ceilings and within other concealed spaces if the gypsum board assembly is fire rated, sound rated, sound or smoke controlled, or the space serves as an air plenum.
- .3 Level 2: At joints and interior angles embed tape in joint compound with one separate coat of joint compound applied over joints, angles, fastener heads, and accessories. Use for water resistant gypsum board indicated for use as a substrate for ceramic tile.
- .4 Level 3: At joints and interior angles embed tape in joint compound with two separate coats of joint compound applied over all joints, angles, fastener heads, and accessories. Apply joint compound smooth and free of tool marks and ridges. Use where heavy grade wall coverings are the final decoration.
- .5 Level 4: At joints and interior angles embed tape in joint compound with three separate coats of joint compound applied over all joints, angles, fastener heads, and accessories. Apply joint compound smooth and free of tool marks and ridges. Use for all locations except those indicated for other finish levels.
- .6 Level 5: At joints and interior angles embed tape in joint compound with three separate coats of joint compound applied over all joints, angles, fastener heads, and accessories. Apply a thin skim coat of joint compound, or a material manufactured especially for this purpose, to the entire surface. Leave surface smooth and free of tool marks and ridges. Use where semi-gloss or gloss finish coatings are the final decoration.

3.10 ACCESS DOORS

.1 Install access doors, supplied as part of other parts of the work, in accordance with manufacturer’s written instructions.

3.11 **SITE TOLERANCES**

.1 Install metal support systems to ensure that, within a tolerance of +3 mm and -1.5 mm for plaster thickness, finish surfaces will be flat within 3 mm under a 3 m straightedge, and with no variation greater than 1.5 mm in any running 300 mm, and that surface planes shall be within 3 mm of dimensioned location.

3.12 **REPAIR**

.1 Make good cut-outs for services and other work, fill in defective joints, holes and other depressions with joint compound.

.2 Make good defective work, and ensure that surfaces are smooth, evenly textured and within specified tolerances to receive finish treatments.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Labour, Products, equipment and services necessary for tile work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 ANSI A108/A118/A136.1, Installation of Ceramic Tile.

.2 ANSI A137.1, Specifications for Ceramic Tile.

.3 ASTM C144, Specification for Aggregate for Masonry Mortar.

.4 ASTM C920, Specification for Elastomeric Joint Sealants.

.5 CAN/CSA A3000, Cementitious Materials Compendium.

.6 TTMAC Specification Guide 09 30 00 Tile Installation Manual.

.7 TTMAC, Maintenance Guide.

1.3 **SUBMITTALS**

.1 Product data:
- .1 Submit copies of manufacturer's Product data in accordance with Section 01 30 00 indicating:
  - .1 Performance criteria, compliance with appropriate reference standard, characteristics, limitations and warranties.
  - .2 Product transportation, storage, handling and installation requirements.

.2 Shop drawings:
- .1 Submit shop drawings in accordance with Section 01 30 00 indicating:
  - .1 Tile layout, patterns, and colour arrangement.
  - .2 Perimeter conditions, junctions with dissimilar materials.
  - .3 Setting details.

.3 Samples:
- .1 Submit following sample panels in accordance with Section 01 30 00.
  - .1 Each colour, texture, size, and pattern of tile.
  - .2 Adhere tile samples to 400 x 400 x 12.5 mm thick cement board complete with selected grout colour in joints.

.4 Certificates: Submit manufacturer's certificates stating that materials supplied are in accordance with this specification.

.5 Extended warranty: Submit extended warranty signed and registered by the manufacturer providing the warranty in the name of the Owner for the timeframe and coverage specified in this Section.

.6 Closeout submittals: Submit recommended maintenance instructions and listing of recommended maintenance Products for incorporation into Operations and Maintenance Manuals in accordance with Section 01 78 00.

1.4 QUALITY ASSURANCE

.1 Perform work of this Section by a company that is a member in good standing of the Terrazzo Tile and Marble Association of Canada with proven, acceptable experience on installations of similar complexity and scope.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials in adequate crates or containers with manufacturer’s name and product description clearly marked.

.2 Handle and store tiles in a manner to avoid chipping, breakage or the instruction of foreign matter. Take precautions to protect the mortar and grout admixtures from freezing or from excessive heat.

1.6 SITE CONDITIONS

.1 Do not install work of this Section outside of the following environmental ranges without the Consultant's and Product manufacturer's written acceptance:
.1 Ambient air and surface temperature: 15^0C to 45^0C.
.2 Precipitation: None.

.2 Install temporary protection and facilities to maintain the Product manufacturer's, and specified, environmental requirements for 7 Days before, during, and 7 Days after installation.

1.7 MAINTENANCE

.1 Submit extra tile amounting to 3% of gross area covered, allowing proportionately for each pattern and type specified and which are part of the same Production run as installed Products. Store maintenance Products as directed by the Consultant.

2 Products

2.1 **MATERIALS**

.1 General: All materials under work of this Section, including but not limited to, sealants, adhesives, and sealers are to have low VOC content limits.

.2 Tile (PT-#):
- .1 To CAN/CGSB-75.1-M.
- .2 Supply coves, caps, inside and outside corners and bullnose tile as required.
- .3 Where unfinished tile edge is exposed, supply cap to Consultant's selection.
- .4 Colours and styles as indicated on Colour and Material Schedule.

.3 Tile Base: Cove base tile to match floor tile.

2.2 **ACCESSORIES**

.1 Metal trims and caps (TT-#): Metal trims with trapezoid anchoring leg by Schluter or approved alternative. Profiles, materials and finish as indicated on Colour and Material Schedule.

.2 Cement: CAN/CSA A3000, Type GU.

.3 Sand: ASTM C144.

.4 Water: Potable and free of minerals and other contaminants which are detrimental to mortar and grout mixes.

.5 Flexible thin-set mortar: ANSI A108/A118/A136.1; ServoStar 3000 Flex White by Kiesel.

.6 Medium bed mortar: to ANSI A118.4; Servoflex-Trio-schnell SuperTec by Kiesel.

.7 Thick bed sloped topping: Factory mixed blend of portland cement and aggregates with latex admix. as manufactured by Kiesel.

.8 Primer: To meet specified requirements of adhesive manufacturer.

.9 Cleaner: In accordance with TTMAC's requirements and as recommended by tile manufacturer.

.10 Grout:
- .1 Joint widths 1 mm - 10 mm for walls and floors: Fast-setting, flexible, water and dirt repellant grout; Servoperl Royal Schnell by Kiesel.
- .2 Joint widths 3 mm - 25 mm for walls and floors: Universal flexible sanded grout; Servoflex F by Kiesel.
- .3 Grout colour: To be selected by the Consultant from the manufacturer's full colour range.

.11 Joint backing: Round, closed cell, foam rod, oversized by 30% to 50%, Shore A hardness of 20, tensile strength 140 to 200 kPa.

.12 Sealer: CAN/CGSB-25.20, penetrating, type as recommended by tile manufacturer.

.13 Tile sealant: In accordance with Section 07 92 00.

2.3 **MIXES**

.1 Levelling bed mix:
- .1 1 part Portland cement.
- .2 4 parts sand.
- .3 1 part water (including polymer additive), adjusted for water content of sand.
- .4 1/10 part polymer additive.

3 Execution

3.1 **SURFACE PREPARATION**

.1 Clean and dry surfaces thoroughly. Remove oil, wax, grease, dust, dirt, paint, tar, primers, form release agents, curing compound, and other foreign material from substrate surfaces which may prevent or reduce adhesion.

.2 Neutralize any trace of strong acids or alkali from the substrate.

3.2 **CONTROL JOINTS**

.1 Provide control, expansion and isolation joints in accordance with TTMAC specification 301MJ and as indicated on drawings. Install in locations indicated on drawings and specified herein.

.2 Continue control, construction, and cold joints in the structural substrate up through the tile finish, and align with mortar joints where possible. Review joint locations on Site with the Consultant.

.3 Install joint widths to match grout joint widths, except where a minimum width is indicated.

.4 Install control joints in the following typical locations:
- .1 Aligned over changes in type of substrate.
- .2 At the restraining perimeters such as walls and columns.
- .3 Interior areas (not subject to sunlight): 6 mm minimum width, at 7320 mm o.c. maximum.
- .4 Interior areas (subject to sunlight): 6 mm minimum width, at 3660 mm o.c maximum.
- .5 As indicated on the Contract Drawings.

.5 Seal control joints in accordance with Section 07 92 00.

3.3 LEVELLING BED

.1 Install a levelling bed on uneven substrate surfaces, level and plumb substrates in accordance with the following tolerances:
- .1 Vertical surfaces: 3 mm in 2.4 m maximum .
- .2 Horizontal surfaces: 6 mm in 3 m from finished levels of the surface, or better.

.2 Clean structural substrate control joints and blow-clean with compressed air. Grout fill control joints flush to slab with levelling bed.

.3 Provide slopes to drains in washrooms and as indicated on drawings.

3.4 GENERAL INSTALLATION REQUIREMENTS

.1 Install tiles in accordance with manufacturer's instructions and TTMAC Specification Guide 09300 Tile Installation Manual. Manufacturer's installation instructions govern over TTMAC Installation Manual.

.2 Lay out Work to produce a symmetrical pattern with minimum amount of cutting. Ensure cut tile at room perimeter and at joints is not less than ½ full size.

.3 Install trim to be placed under tile in locations indicated on Drawings.

.4 Set tiles in place and rap or beat with a beating block as necessary to ensure a proper bond and to level surface. Align tile for uniform joints and allow to set until firm. Clean excess mortar from surface of tile with a wet cloth or sponge while mortar is fresh.

.5 Ensure following minimum mortar contact coverage to back of tiles. Contact must be evenly distributed to give full support of the tile.
- .1 90% for interior applications.

.6 Adjust joints between units uniform, plumb, straight, even, and true, with adjacent tile flush. Align grout joints in both directions unless indicated otherwise.

.7 Align floor and base grout joints.

.8 Install tile accessory fittings for a complete and fully coordinated tile assembly.

.9 Do not place tile, trim, and accessories over control, expansion, or isolation joints. Stop materials in either side on joints and provide control, expansion and isolation joints as specified.

.10 Cut and fit tile neatly around piping, fittings, joints, projections and around recesses items e.g. washroom accessories. Where surface mounted equipment and accessories are installed on tile surfaces, extend tile over surfaces. Cut edges smooth, even, and free from chipping; chipped and broken edges are not acceptable.

.11 Do not proceed with grouting until minimum 48 hours after tile has set, to prevent displacement of tiles.

.12 Apply grout in accordance with grout manufacturer's directions to produce watertight, filled joints without voids, cracks and excess grout. Thoroughly compact and tool floor grout. Finish grout flush to edge thickness of tile and remove excess grout with soft burlap or sponge moistened with clean water.

3.5 CLEANING

.1 Clean off excess grout with soft burlap or sponge moistened with clean water.

.2 Polish tile after grout has cured in accordance with TTMAC recommendations in the Maintenance Guide; do not use acid for cleaning.

.3 Apply 2 coats of sealer to unglazed floor tile in accordance with sealer manufacturer’s printed directions.

.4 Re-point joints after cleaning as required to eliminate imperfections, then re-clean as necessary. Avoid scratching tile surfaces.

3.6 JOINT BACKING AND TILE SEALANT

.1 Install joint backing under sealant as necessary.

.2 Install tile sealant around piping and fittings extending through tiled surfaces.

.3 Seal tile control joints.

.4 Seal internal tile to tile junctions. Tool to a smooth, flush surface, free from air bubbles and contamination.

3.7 PROTECTION

.1 Prevent traffic over tiled areas, and protect tiled assemblies from weather, freezing, and water immersion, for 72 hours minimum, after final installation.

.2 Prevent direct impact, vibration and heavy hammering on adjacent and opposite walls for 24 hours minimum, after final installation.

.3 Cover work temporarily with building paper properly lapped and taped at joints until work has been approved by Consultant.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Design, labour, Products, equipment and services necessary for acoustical ceilings work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 ASTM A653/A653M, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.

.2 ASTM C635, Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

.3 ASTM C636, Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.

.4 ASTM C645, Specification for Non-Load Bearing (Axial) Steel Studs, Runners (Tracks), and Rigid Furring Channels for Screw Application of Gypsum Board.

.5 ASTM E1264, Classification for Acoustical Ceiling Products.

1.3 **DESIGN REQUIREMENTS**

.1 Design acoustical ceiling system in accordance with following Climatic Design Data for Brampton contained in the Ontario Building Code:
  .1 Design temperature: January 1%, July 2 1/2%.
  .2 Hourly wind pressures: 1 in 50 year occurrence.
  .3 Seismic design: Class “C”.

.2 Design acoustical ceiling suspension system and anchors in accordance with specified Seismic Design requirements.

.3 Design ceiling suspension systems in accordance with ASTM C636 and manufacturer's printed directions.

.4 Design tile ceiling system for adequate support of electrical fixtures as required by the current bulletin of the Electrical Safety Authority. Acoustic panel system is not designed to carry the weight of electrical equipment.

.5 Design hanger anchor and entire suspension system static loading not to exceed 25% of their ultimate capacity including lighting fixture dead loads.

.6 Design tile 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. Acoustic panel system is not designed to carry the weight of mechanical and electrical equipment.

.7 Design subframing as necessary to accommodate, to avoid conflicts and interferences where ducts or equipment prevent regular spacing of hangers.

1.4 SUBMITTALS

.1 Shop drawings:
- .1 Submit shop drawings in accordance with Section 01 30 00 indicating:
  - .1 Suspension system layout including hangers and supports for acoustic tile system.
  - .2 Acoustic panel system including suspension system, hangers, supports and panel sizes and locations.
  - .3 Conditions at abutting, intersecting, and penetrating construction.
  - .4 Dimensioned locations of lighting fixtures, diffusers, sprinkler heads and other items that pierce the ceiling plane.
  - .5 Seismic anchors, supports and accessories for complete installation.

.2 Samples:
- .1 Submit following samples in accordance with Section 01 30 00:
  - .1 One full-size sample of each type of tile panels to be used.
  - .2 One of each type of suspension system members.

.3 Certificates: Submit written certification stating that suspended ceiling system is designed for adequate support of electrical fixtures as required by the current bulletin of the Electrical Safety Authority.

1.5 QUALITY ASSURANCE

.1 Mock-up:
- .1 Construct one 3 m^2 mock-up for each type of ceiling system incorporating typical light fixture and other typical mechanical and electrical fixtures.
- .2 Test the adequacy of the suspension system to support the fixtures without deflection of ceiling or failure of hanging wire anchorage. Supply copy of Test Results to Consultant.
- .3 Change materials and installation methods if tests indicate proposed system is inadequate and re-test as necessary until system approved.
- .4 Give early notice to Consultant and Mechanical and Electrical Trades and co-operate with them in selecting suitable location for sample ceiling and timing of installation and test.
- .5 Do not commence general installation work until sample ceiling approved, then install ceiling to conform with approved samples.
- .6 Mock-up may form part of final Work, if acceptable to Consultant. Remove and dispose of mock-ups which do not form part of Work.

1.6 SITE CONDITIONS

.1 Do not install the work of this Section until:
- .1 Mechanical and electrical work above the ceiling is complete.
- .2 Relative humidity is below 80 %.
- .3 Ventilation is adequate to remove excess moisture.

.4 Areas are closed and protected against weather, and maintained at no less than 10°C.

.2 Install temporary protection and facilities to maintain Product manufacturer's, and above specification, environmental requirements 24 h before, during, and after installation.

1.7 **MAINTENANCE**

.1 Submit extra acoustic ceilings amounting to 2% of gross ceiling area, allowing proportionately for each pattern and type specified to nearest full carton. Submit Products which are part of same production run as installed Products. Store maintenance Products as directed by Consultant.

1.8 **DELIVERY, STORAGE AND HANDLING**

.1 Transport, handle and store material in manner to prevent warp, twist, damage to panel edges and surfaces in accordance with Manufacturer's recommendations.

.2 Any warped and/or damaged panels and trim shall be rejected and be replaced by new, straight, undamaged and acceptable material at no cost to Owner.

.3 Bent, twisted or otherwise damaged Tee grid suspension components shall not be used under any circumstances. Replace such damaged items with new undamaged material at no additional cost to Owner.

.4 Store material in warm, dry place away from water and the elements. Protect against undue loading stresses and shock.

.5 All packaged material shall be delivered in original manufacturers wrappers and containers with labels and seals intact. All cartons shall bear U.L. label.

2 Products

2.1 **MATERIALS**

.1 Galvanized steel sheet: ASTM A653/A653-M, Z275; cold rolled, galvanized steel sheet.

.2 Main carrying channels: ASTM C645; Channels formed from galvanized steel sheet, 38 x 19 mm cold rolled.

.3 Subframing: ASTM C645; Channels formed from galvanized steel sheet, dimensions and spans as required.

.4 Hangers: 2.6 mm minimum diameter, galvanized steel wire.

.5 Tie wire: 1.6 mm minimum diameter, soft annealed galvanized steel wire.

.6 Concrete anchors: tie wire sleeve anchors, ‘Redi-Drive Anchors' by ITW Red Head or approved alternative.

.7 Seismic anchors and supports: Provide wall moulding, seismic clips and perimeter hanger wires as required and in accordance with reviewed shop drawings.

.8 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.

.9 Exposed main, cross tees, and relocatable cross tees: ASTM C635, 38 mm high steel, bulb tee design double steel web, rectangular single spans without exceeding a deflection of 1/360 of the span. Splices to be integral and reversible; cross tee interlocking into main tee. Colour and finish: Manufacturer's standard white.

.1 Suspension system:

.1 Armstrong World Industries Inc.
.2 CGC Inc.
.3 Certainteed Ceilings Canada.
.4 Rockfon/Chicago Metallic.

.10 Acoustic tiles for suspended ceiling system (ACT-1): Refer to Colour and Material Schedule for acoustical tile types.

.11 Wall mouldings: To match acoustical ceiling suspension system.

3 Execution

3.1 EXAMINATION

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of work of this Section means acceptance of existing conditions.

3.2 SUSPENSION SYSTEM

.1 Coordinate locations and openings of mechanical and electrical services support, and penetration through the acoustical ceilings. Coordinate field conditions, clearances, measurements, and mechanical and electrical services testing and commissioning, above the acoustical ceilings.

.2 Install hanger wires plumb and securely anchored to the building structural framing, independent of walls, pipes, ducts, and metal deck; install additional framing and hangers to bridge interference items.

.3 Install acoustical ceiling systems in accordance with manufacturer's written instructions, reviewed shop drawings, and ASTM C636, listed in order of precedence.

.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.

.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 the ceiling manufacturer's written acceptance.

.6 Install acoustical ceiling suspension system to a tolerance of 1:1200 of span and 0.4 mm maximum between adjacent metal members. Tolerances are not cumulative. Refer to Electrical Contract Drawings for fixture layout.

.7 Do not bend or twist hangers as a means of levelling. Form double loops tightly and lock to prevent vertical movement or rotation within the loop.

.8 Install edge moulding at intersection of ceiling and vertical surfaces.

.9 Centre acoustical ceiling suspension systems on room axis; install equal border pieces. Install hangers onto the ends of main tee runners at not more than 150 mm from ends of runners, adjacent and perpendicular to walls.

.10 Support the suspension system independently of walls, columns, ducts, pipes and conduits.

.11 Install main runners in maximum available lengths. Layout joints in suspension members to avoid the perimeters of recessed fixtures. Lock grid members to form a rigid assembly. Install additional tee, suspension system framing around recessed fixtures, diffusers, grilles and other items for a complete assembly.

.12 Install seismic anchors, supports and accessories in accordance with reviewed shop drawings.

3.3 ACOUSTIC LAY-IN TILES

.1 Install acoustic tile in grid system openings supported by bottom flanges of members. Provide special shapes and sizes to provide a complete installation by cutting tile to fit into openings. Fit tile moderately tight between upright legs of members.

.2 Carefully cut and trim acoustic tiles to accommodate items piercing the finished ceiling plane.

.3 Remove and replace acoustic tiles with broken edges, or damaged, marked, discoloured, soiled, or stained faces.

3.4 ADJUSTMENTS AND CLEANING

.1 Clean soiled or discoloured surfaces of exposed work on completion of work.

.2 Replace components which are visibly damaged, marred or uncleanable.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Labour, Products, equipment and services necessary for resilient base work and accessories in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 ASTM F1861, Specification for Resilient Wall Base.

1.3 **SUBMITTALS**

.1 Product data:
  .1 Submit copies of manufacturer's Product data in accordance with Section 01 30 00 indicating:
    .1 Performance criteria, compliance with appropriate reference standard, characteristics, limitations.
    .2 Product transportation, storage, handling and installation requirements.

.2 Samples: Submit two 250 mm long samples of resilient base in accordance with Section 01 30 00.

.3 Closeout submittals: Submit maintenance and cleaning data for incorporation into Operations and Maintenance Manuals in accordance with Section 01 78 00.

1.4 **SITE CONDITIONS**

.1 Maintain air temperature and structural base temperature at installation area above 20°C for 48 hr before, during and 48 hr after installation.

.2 Store materials for 2 days prior to installation in area of work to achieve temperature stability.

.3 Do not install base in conditions of high humidity or where exposed to cold drafts. In hot weather, protect from direct sunlight.

.4 Provide adequate ventilation during installation.

1.5 **MAINTENANCE**

.1 Submit extra 5% or to nearest full roll of each colour, pattern and type of base required for maintenance use. Identify each carton. Store where directed.

2 Products

2.1 **MATERIALS**

.1 All materials under work of this Section, including but not limited to, primers, and adhesives are to have low VOC content limits.

.2 Rubber base (RB-#): ASTM F1861, Refer to Colour and Material Schedule for rubber base colours and types.

.3 Reducing edge strips, transition strips, thresholds and accessories: Refer to Colour and Material Schedule.

.4 Primers and adhesives: Low VOC, waterproof, recommended by base manufacturer for specific material on applicable substrate, above, at or below grade.

3 Execution

3.1 **EXAMINATION**

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of work of this Section means acceptance of existing conditions.

.2 Defective work resulting from application to unsatisfactory surfaces will be considered the responsibility of those performing the work of this Section.

3.2 **RESILIENT BASE APPLICATION**

.1 Install resilient base in accordance with manufacturer’s written instructions.

.2 Lay out base to keep number of joints at minimum.

.3 Prior to installing base, fill cracks and irregularities with a filler recommended by base manufacturer.

.4 Set base in adhesive using a 3 kg hand roller, against wall and floor surfaces.

.5 Install straight and level to variation of 1:1000.

.6 Scribe and fit to door frames and other obstructions.

.7 Cope internal corners.

3.3 **CLEANING**

.1 Forty-eight hours after installation, clean resilient base surfaces with a mild soap solution approved by finish manufacturer.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Labour, Products, equipment and services necessary for resilient sheet flooring work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 ASTM D2047, Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine.

.2 ASTM F710, Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

.3 ASTM F970, Standard Test Method for Static Load Limit.

.4 ASTM F1516, Standard Practice for Sealing Seams of Resilient Floor Products by the Heat Weld Method.

.5 ASTM F1869, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Cloride.

.6 ASTM F2170, Standard Test Method for Determining Relative Humidity in Concrete Slabs Using in-situ Probes.

.7 ASTM F2034, Standard Specification for Sheet Linoleum Floor Covering.

.8 CAN/ULC-S102.2-M, Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.

.9 ISO 717-2, Acoustics - Rating of Sound Insulation in Buildings and of Building Elements - Part 2: Impact Sound Insulation.

1.3 **SUBMITTALS**

.1 Product data:
  .1 Submit copies of manufacturer's Product data in accordance with Section 01 30 00 indicating:
    .1 Performance criteria, compliance with appropriate reference standard, characteristics, and limitations.
    .2 Product transportation, storage, handling and installation requirements.

.2 Shop drawings: Submit shop drawings indicating seam layout and welding procedures in accordance with Section 01 30 00.

.3 Samples:
.1 Submit samples in accordance with Section 01 30 00:
.1 Two 250 x 200 mm samples of each type of sheet material and colour.
.2 Two 250 mm long samples of each accessory and colour.

.4 Extended warranties: Submit extended warranties signed and registered by the manufacturer providing the warranties in the name of the Owner for the timeframe and coverage specified in this Section.

.5 Closeout submittals: Submit maintenance and cleaning data for incorporating into Operations and Maintenance Manuals in accordance with Section 01 78 00.

1.4 SITE CONDITIONS

.1 Maintain air temperature and structural base temperature at flooring installation area above 20°C for 48 hr before, during and 48 hr after installation.

.2 Store materials for 2 days prior to installation in area of Work to achieve temperature stability.

.3 Do not lay flooring in conditions of high humidity or where exposed to cold drafts. In hot weather, protect from direct sunlight.

.4 Provide adequate ventilation during installation.

1.5 EXTENDED WARRANTY

.1 Manufacturer's warranty:
.1 Resilient flooring: Provide flooring manufacturer's warranty naming Owner as beneficiary, covering excessive wear for a period of 5 years from the date Work is certified as Substantially Performed.

1.6 MAINTENANCE

.1 Submit extra 5% or to nearest full roll of each colour, pattern and type of flooring material required for maintenance use. Identify each roll. Store where directed. Submit maintenance material in one piece and of same production run as installed materials.

2 Products

2.1 MATERIALS

.1 All materials under work of this Section, including but not limited to, primers and adhesives are to have low VOC content limits.

.2 Linoleum sheet flooring (LINO-1):
- .1 Conforming to ASTM F2034, Type 1, 2.5 mm thick, homogeneous resilient flooring, made from natural ingredients, mixed and calendared onto a natural jute backing.
- .2 Flame spread: 150 to CAN/ULC-S102.2-M.
- .3 Smoke developed: 160 to CAN/ULC-S102.2-M.
- .4 Impact sound reduction: when tested to ISO 717/2, 6 dB.
- .5 Slip resistance: Static coefficient of slip resistance meets or exceeds 0.6 when tested in accordance with ASTM D2047.
- .6 Static load limit: 450 pounds per square inch when tested in accordance with ASTM F970.
- .7 Colour: Refer to Colour and Material Schedule.
- .8 Acceptable products and manufacturers: 'Marmoleum' by Forbo Flooring or approved alternative.

.3 Base and accessories: In accordance with Section 09 65 00.

.4 Welding rod: type recommended by flooring manufacturer to complement flooring.

.5 Primers and adhesives: Low VOC, waterproof, of types recommended by flooring manufacturer for specific material on applicable substrate, above, on or below grade.

.6 Reducing edge strips, thresholds: Nitrile rubber plasticized vinyl, 80-95 Shore A Durometer, adhesive as recommended by manufacturer.

.7 Concrete skim coat compound: High-performance, rapid-setting cement based skim coating compound. 'Ultra SkimCoat' by Mapei or approved alternative for filling minor voids and leveling existing substrate.

.8 Stain sealer and polish: Type recommended by flooring manufacturer.

3 Execution

3.1 EXAMINATION

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of work of this Section means acceptance of existing conditions.

.2 Ensure concrete floors meet the following minimum requirements and requirements of the flooring manufacturer. If there is a conflict between these requirements and those of the flooring manufacturer, the more stringent shall apply.
- .1 Internal Relative Humidity Test: Perform internal relative humidity testing in accordance with ASTM F2170. Results shall not exceed 80% RH.
- .2 Moisture Test: Moisture emissions from concrete subfloors (cured for a minimum of 28 days) must not exceed 3 lbs per 1000sf per 24 hours (1.4 kg H2O/24 hr/93 m2) for acrylic adhesive and 5lbs for polyurethane adhesive via the Calcium Chloride Test Method (ASTM F1869).
- .3 The pH level of the subfloor surface shall not be higher than 9.9. If higher, subfloor must be neutralized.

.3 Ensure that sub-floors have been provided as specified without holes, protrusions, cracks, depressions or other major defects.

.4 Ensure that control joints have been filled and levelled.

.5 Defective work resulting from application to unsatisfactory surfaces will be considered the responsibility of those performing the work of this Section.

3.2 SUBFLOOR TREATMENT

.1 Flooring shall be installed over subfloors conforming to ASTM F710 for concrete.

.2 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.

.3 Apply sub-floor filler to low spots and cracks to achieve floor level to a tolerance of 1:1000, allow to cure.

.4 Meet ASTM F710 Standard for Concrete or other monolithic floors.

.5 Clean and remove all deleterious materials from surfaces to receive this work in accordance with the adhesive manufacturer's recommendations.

.6 Prime concrete to flooring manufacturer's printed instructions.

3.3 RESILIENT SHEET FLOORING APPLICATION

.1 Install resilient sheet flooring in accordance with manufacturer’s written instructions.

.2 Apply adhesive uniformly using recommended trowel in accordance with flooring manufacturers instructions. Do not spread more adhesive that can be covered by flooring before initial set takes place.

.3 Run sheets in direction of traffic. Double cut sheet joints and continuously seal according to manufacturer's printed instructions. Remove adhesive seepage of seams or surface while adhesive is still wet.

.4 Heat weld seams in accordance with ASTM F1516 and manufacturer's printed instructions.

.5 As installation progresses and after installation, roll flooring with minimum 45 kg roller to ensure full adhesion.

.6 Cut flooring neatly around fixed objects.

.7 Terminate flooring at centreline of door in openings where adjacent floor finish or colour is dissimilar.

.8 Install reducing edge strips at unprotected or exposed edges where flooring terminates or where there are two finishes of different thicknesses.

3.4 RESILIENT BASE APPLICATION

.1 Resilient base: In accordance with Section 09 65 00. Coordinate with noted Section as required for installation of resilient base with resilient sheet flooring.

3.5 CLEANING AND SEALING

.1 Forty-eight hours after installation, clean sheet flooring surfaces with a mild soap solution approved by finish manufacturer. Rinse clean and allow to dry.

3.6 PROTECTION OF FINISHED WORK

.1 Protect floors and bases from time of final set of adhesive until accepted by Consultant.

.2 Prohibit traffic on floor for 48 hours after installation.

.3 Cover cleaned surfaces with fibre reinforced, clean, non-staining clean, kraft paper. Secure in position with gummed tape to prevent drifting. Remove covering when directed by Consultant.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Labour, Products, equipment and services necessary for resilient tile flooring Work and accessories in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 ASTM F710, Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

.2 ASTM F1066, Specification for Vinyl Composition Floor Tile.

.3 ASTM F1869, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Cloride.

.4 ASTM F 2170, Standard Test Method for Determining Relative Humidity in Concrete Slabs Using in-situ Probes.

1.3 **SUBMITTALS**

.1 Product data:
  .1 Submit copies of manufacturer's Product data in accordance with Section 01 30 00 indicating:
    .1 Performance criteria, compliance with appropriate reference standard, characteristics, limitations.
    .2 Product transportation, storage, handling and installation requirements.

.2 Samples:
  .1 Submit following samples in accordance with Section 01 30 00:
    .1 Two 250 x 200 mm samples of each type of tile material and colour.
    .2 Two 250 mm long samples of each accessory and colour.

.3 Closeout submittals: Submit maintenance and cleaning data for incorporation into Operations and Maintenance Manuals in accordance with Section 01 78 00.

1.4 **SITE CONDITIONS**

.1 Maintain air temperature and structural base temperature at flooring installation area above 20°C for 48 hr before, during and 48 hr after installation.

.2 Store materials for 2 days prior to installation in area of Work to achieve temperature stability.

.3 Do not lay flooring in conditions of high humidity or where exposed to cold drafts. In hot weather, protect from direct sunlight.

.4 Provide adequate ventilation during installation.

1.5 **MAINTENANCE**

.1 Submit extra 5% or to nearest full carton of each colour, pattern and type of flooring material required for maintenance use. Identify each carton. Store where directed.

2 Products

2.1 **MATERIALS**

.1 All materials under Work of this Section, including but not limited to, primers, adhesives, sealers, and waxes are to have low VOC content limits.

.2 Static dissipative vinyl tile (SDT-1): CSA A126.2-M, Type A, mottled, asbestos free, 305 x 305 x 3.178 mm, meeting the following requirements:
- .1 Static Propensity: less than 2 kV with conductive footwear per AATCC-134 at 20% relative humidity.
- .2 Static Decay: 5,000 volts to zero in less than 0.01 seconds per US Federal Test Method 101B, Method 4048 at 15% relative humidity.
- .3 Flame Spread: 25 to CAN/ULC S102.2-M.
- .4 Smoke Developed: 50 to CAN/ULC S102.2-M.
- .5 Colour: Refer to Colour and Material Schedule.
- .6 Acceptable products and manufacturers:
  - .1 ‘Excelon SDT’ by Armstrong.
  - .2 Or approved alternative.

.3 Reducing edge strips, transition strips, thresholds, etc.: Nitrile rubber plasticized vinyl, 80-95 Shore A Durometer, adhesive recommended by flooring manufacturer.
- .1 ‘Finishing Accessories’ Johnsonite or approved alternative.

.4 Primers and adhesives: Low VOC, waterproof, recommended by flooring manufacturer for specific material on applicable substrate, above, at or below grade.

.5 Concrete skim coat compound: High-performance, rapid-setting cement based skim coating compound. 'Ultra SkimCoat' by Mapei or approved alternative for filling minor voids and leveling existing substrate.

3 Execution

3.1 **EXAMINATION**

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of Work means acceptance of existing conditions.

.2 Ensure concrete floors meet the following minimum requirements and requirements of the flooring manufacturer. If there is a conflict between these requirements and those of the flooring manufacturer, the more stringent shall apply.

.1 Internal Relative Humidity Test: Perform internal relative humidity testing in accordance with ASTM F2170. Results shall not exceed 80% RH.

.2 Moisture Test: Moisture emissions from concrete subfloors (cured for a minimum of 28 days) must not exceed 3 lbs per 1000sf per 24 hours (1.4 kg H2O/24 hr/93 m2) for acrylic adhesive and 5lbs for polyurethane adhesive via the Calcium Chloride Test Method (ASTM F1869).

.3 The pH level of the subfloor surface shall not be higher than 9.9. If higher, subfloor must be neutralized.

.3 Ensure that sub-floors have been provided as specified without holes, protrusions, cracks, depressions or other major defects.

.4 Ensure that control joints have been filled and levelled.

.5 Defective Work resulting from application to unsatisfactory surfaces will be considered the responsibility of those performing the Work of this Section.

3.2 SUBFLOOR TREATMENT

.1 Flooring shall be installed over subfloors conforming to ASTM F710 for concrete.

.2 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.

.3 Apply sub-floor filler to low spots and cracks to achieve floor level to a tolerance of 1:1000, allow to cure.

.4 Sub-floor shall be feathered up to meet adjacent floor finishes to ensure a smooth, flush transition.

.5 Meet ASTM F710 Standard for Concrete or other monolithic floors.

.6 Clean and remove all deleterious materials from surfaces to receive this Work in accordance with the adhesive manufacturer's recommendations.

.7 Prime concrete to flooring manufacturer's printed instructions.

3.3 TILE APPLICATION

.1 Install resilient tile flooring in accordance with manufacturer’s written instructions.

.2 Install flooring wall to wall before installation of floor-set cabinets, casework, furniture, equipment, etc. Extend flooring into toe spaces, door recesses, closets and similar openings.

.3 Apply adhesive uniformly using recommended trowel in accordance with flooring manufacturer's instructions. Do not spread more adhesive that can be covered by flooring before initial set takes place.

.4 Make tile joints flush, uniform, in moderate contact, in straight lines and as inconspicuous as possible. Lay tile patterns of adjacent tiles parallel to each other. In general, grain pattern and continuous joints will run in one direction of room, staggered joints will run in opposite direction. Verify with Consultant on site which way grain pattern and joints will run in each room.

.5 As installation progresses, and after installation, roll flooring in 2 directions with minimum 45 kg minimum roller to ensure full adhesion.

.6 Remove adhesive seepage at seams or surface while adhesive is still wet, in accordance with manufacturer's recommendation.

.7 Cut tile and fit neatly around fixed objects.

.8 Install feature strips and floor markings where indicated. Fit joints tightly.

.9 Terminate flooring at centerline of door in openings where adjacent floor finish or colour is dissimilar.

.10 Install resilient tactile warning edge in accordance with manufacturer’s written instructions.

.11 Install reducing edge strips at unprotected or exposed edges where flooring terminates and at edges where there are two finishes of different thicknesses.

3.4 ACCESSORIES AND WHEELED TRANSITION APPLICATION

.1 Install accepted adaptors between different flooring materials in accordance with manufacturer’s instructions.

.2 Ensure that adaptors have been clipped into place properly to provide a smooth, gradual transition between floors of different height.

.3 Install accessories in accordance with manufacturer’s written instructions.

3.5 PROTECTION OF FINISHED WORK

.1 Protect floors from time of final set of adhesive until final waxing.

.2 Prohibit traffic on floor for 48 hours after installation.

.3 Cover polished surfaces with fibre reinforced, clean, non-staining kraft paper. Secure in position with gummed tape to prevent drifting. Remove covering when directed by Consultant.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Labour, Products, equipment and services necessary for athletic flooring work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 ASTM F1861, Standard Specification for Resilient Wall Base.

.2 CPSC FF 1-70, Flammability of finished textile floor covering material.

1.3 **SUBMITTALS**

.1 Shop drawings: Submit shop drawings indicating seam layout and welding procedures in accordance with Section 01 30 00.

.2 Extended warranty: Submit extended warranty signed and registered by the manufacturer providing the warranty in the name of the Owner for the timeframe and coverage specified in this Section.

.3 Closeout submittals: Submit maintenance and cleaning data for incorporating into Operations and Maintenance Manuals in accordance with Section 01 78 00.

1.4 **SITE CONDITIONS**

.1 Maintain air temperature and structural base temperature at flooring installation area above 20°C for 48 hr before, during and 48 hr after installation.

.2 Store materials for 2 days prior to installation in area of Work to achieve temperature stability.

.3 Do not lay flooring in conditions of high humidity or where exposed to cold drafts. In hot weather, protect from direct sunlight.

.4 Do not install floor system until concrete has been cured sixty (60) days.

1.5 **MAINTENANCE**

.1 Submit extra 5% or to nearest full roll of each colour, pattern and type of flooring material required for maintenance use. Identify each roll. Store where directed. Submit maintenance material in one piece and of same production run as installed materials.

1.6 **EXTENDED WARRANTY**

.1 Submit manufacturer's extended warranty for flooring extended to 3 years covering the full replacement of system due to defects in materials.

2 Products

2.1 **MATERIALS**

.1 All materials under work of this Section, including but not limited to, coatings and adhesives are to have low VOC content limits.

.2 Rubber athletic flooring (RSF-1): 610 mm x 610 mm x 25 mm thick rubber floor tile, high-density wear layer with shock absorption. 'Everlast UltraTile' as manufactured by Ecore Athletic or approved alternative. Colour: Refer to Colour and Material Schedule.

.3 Adhesive: Polyurethane or epoxy adhesive as recommended by flooring manufacturer.

.4 Wall base: 100 mm high, 3 mm thick, conforming to ASTM 1861, Type TV, Group 1; 'Duracove Rubber Wall Base' by Johnsonite or approved alternative.

.5 Sub-floor filler and leveller: White premix latex requiring water only to produce cementitious paste as recommended by flooring manufacturer

.6 Reducing edge strips, thresholds: Nitrile rubber plasticized vinyl, 80-95 Shore A Durometer, adhesive as recommended by manufacturer.

3 Execution

3.1 **EXAMINATION**

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of work of this Section means acceptance of existing conditions.

3.2 **SUBFLOOR TREATMENT**

.1 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.

.2 Trowel and float sub-floor filler to leave smooth, flat hard surface. Prohibit traffic until filler is cured and dry.

.3 Clean and remove all deleterious materials from surfaces to receive this work in accordance with the adhesive manufacturer's recommendations.

.4 Prime concrete to flooring manufacturer's printed instructions.

3.3 **FLOORING APPLICATION**

.1 Apply adhesive uniformly using recommended trowel in accordance with flooring manufacturers instructions. Do not spread more adhesive that can be covered by flooring before initial set takes place.

.2 Unroll flooring into freshly applied adhesive ensuring that all seams are in contact without compression.

.3 Cut flooring neatly around fixed objects.

.4 Terminate flooring at centreline of door in openings where adjacent floor finish or colour is dissimilar.

.5 Roll flooring in both directions when complete.

.6 Install reducing edge strips at unprotected or exposed edges where flooring terminates or where there are two finishes of different thicknesses.

3.4 **BASE APPLICATION**

.1 Lay out base to keep number of joints at minimum.

.2 Prior to installing base, fill cracks and irregularities with a filler recommended by base manufacturer.

.3 Set base in adhesive using a 3 kg hand roller, against wall and floor surfaces.

.4 Install straight and level to variation of 1:1000.

.5 Scribe and fit to door frames and other obstructions.

.6 Cope internal corners.

3.5 **CLEANING**

.1 Clean up all unused materials and debris and remove from the premises. Dispose of empty containers in accordance with federal and local statutes.

.2 72 hours after installation, clean rubber mat by vacuuming then damp mopping. Rinse clean and let dry.

3.6 **PROTECTION OF FINISHED WORK**.

.1 Protect floors from time of final set of adhesive until accepted by Consultant.

.2 Prohibit traffic on floor for 72 hours after installation.

.3 Cover cleaned surfaces with fibre reinforced, clean, non-staining clean, kraft paper. Secure in position with gummed tape to prevent drifting. Remove covering when directed by Consultant.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Labour, Products, equipment and services necessary for epoxy flooring work in accordance with the Contract Drawings.

1.2 **SUBMITTALS**

.1 Product data: Submit manufacturer's Product data in accordance with Section 01 30 00 indicating:
- .1 Two copies of manufacturer's Product data on characteristics, performance criteria, and limitations.
- .2 Preparation, installation requirements and techniques, Product storage, and handling criteria.

.2 Samples: Submit duplicate samples of each type and colour of epoxy flooring mounted on 250 x 200 mm hardboard in accordance with Section 01 30 00.

.3 Reports: Submit manufacturer's acceptance of substrate prior to installation in writing. Submit verification of moisture content of floor prior to installation.

.4 Close-out submittals: Submit maintenance data for incorporation into Operations and Maintenance manuals in accordance with Section 01 78 00.

1.3 **QUALITY ASSURANCE**

.1 Perform work of this Section by a company that has a minimum of five years proven experience in installations of a similar size and nature and that is approved by manufacturer. Submit to Consultant, applicator’s current certificate of approval by the material manufacturer as proof of compliance.

.2 Mock-up:
- .1 Construct one 3 m^2 mock-up of each type and colour of epoxy flooring in location acceptable to Consultant.
- .2 Arrange for Consultant's review and acceptance, allow 48 hours after acceptance before proceeding with work.
- .3 Mock-up may remain as part of Work if accepted by Consultant. Remove and dispose of mock-ups which do not form part of Work.
- .4 Upon acceptance, mock-up shall serve as a minimum standard of quality for the balance of the work of this Section.

.3 Pre-installation meetings: Arrange with manufacturer's representative and Consultant to inspect substrates, and to review installation procedures 48 hours in advance of installation.

1.4 **SITE CONDITIONS**

.1 Do not install the work of this Section outside of the following environmental ranges without Product manufacturer's written acceptance:
- .1 Ambient air and surface temperature: 15^0C to 30^0C.
- .2 Relative Humidity: In accordance with manufacturers' requirements.
- .3 When no dust is being raised.
- .4 In well-ventilated and broom clean areas.

.2 Do not apply epoxy flooring over materials that contain over 4% moisture.

.3 Install temporary protection and facilities to maintain the Product manufacturer's, and the above specification, environmental requirements for 24 hours before, during, and 24 h after installation.

.4 Post do not enter and appropriate warning signs at conspicuous locations.

1.5 **DELIVERY, STORAGE, AND HANDLING**

.1 Package, seal and label each epoxy flooring material to show manufacturer's and product name, and colour.

.2 Store materials at site in an area specifically set aside for purpose that is locked, ventilated, and maintained at a minimum temperature of 16°C.

.3 Ensure that health and fire regulations are complied with in storage area, and during handling and application.

2 Products

2.1 **MATERIALS**

.1 General:
- .1 All materials under work of this Section, including but not limited to, primers and epoxy flooring are to have low VOC content limits.
- .2 Each material used in the application of each flooring system shall be as recommended or manufactured by the supplier of the flooring system.

.2 Epoxy flooring and base (EXP-1): Nominal 2 to 3 mm thick, two component, 100% solids, decorative, quartz aggregate broadcast flooring system. ‘Stonshield SLT’ by Stonhard or approved alternative. Refer to Colour and Material Schedule for colour and texture types.

.3 Primer: As recommended by manufacturer.

3 Execution

3.1 **EXAMINATION**

.1 Verify condition of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of work of this Section means acceptance of existing conditions.

.2 Verify that concrete floor has cured 28 days minimum and that substrate is acceptable to epoxy manufacturer.

.3 Test surfaces for moisture content to ensure that they are suitable for application.

3.2 **PREPARATION**

.1 Prepare substrate using steel aggregate blast method and vacuum substrate free of debris and dust.

.2 Fill minor cracks and voids and prime surfaces in accordance with manufacturer's recommendations.

.3 Project adjacent surfaces from damage resulting from this work. Mask and/or cover adjacent surfaces, fixtures, and equipment as necessary.

.4 Fill open control joints, and other cracks and voids with material compatible with epoxy materials.

.5 Clean prime and seal surfaces as recommended by epoxy manufacturer.

3.3 **APPLICATION**

.1 Apply epoxy flooring in accordance with manufacturer’s printed instructions. Epoxy manufacturer shall supervise application.

.2 General: Apply each component of resinous flooring system in compliance with manufacturer's directions to produce a uniform monolithic surface of thickness indicated, uninterrupted except at expansion joints or other types of joints (if any), indicated or required.

.1 Mix and apply primer over properly prepared substrate with strict adherence to manufacturer's installation procedures and coverage rates. Coloured, quartz aggregate shall be broadcast into the wet primer until refusal. Excess aggregate shall be removed following appropriate cure time. Coordinate timing of primer application with application of flooring system to ensure optimum inter-coat adhesion.

.2 Apply cove base material immediately after mixing using preformed cove trowels to a height of 100 mm where indicated on the room finish schedule in accordance with manufacturer's recommended procedures. Cove base shall be finished smooth and free of all possible waves, undulations, and other surface defects. Minor imperfections shall be mechanically removed prior to application of topcoat.

.3 Apply undercoat material immediately after mixing using squeegees or premium nap rollers in accordance with manufacturer's recommended procedures. Coloured, quartz aggregate shall be broadcast into the wet undercoat until refusal. Excess aggregate shall be removed following appropriate cure time. Strict adherence to manufacturer's coverage rates shall be maintained.

.4 Topcoat material shall be applied in one coat at 6-8 mils per coat immediately after mixing using high quality medium nap rollers in accordance with manufacturer's recommended procedures. Strict adherence to manufacturer's coverage rates shall be maintained.

.5 Chase edges to "lock" the flooring system into the concrete substrate along lines of termination.

.3 Stop epoxy in a straight line on each side of control joints; fill space over expansion joint with a self-levelling, non-sag polyurethane sealant.

.4 Apply epoxy with care to ensure that no laps, voids, or other marks or irregularities are visible, and with an appearance of uniform colour, sheen and texture, all within limitations of materials and areas concerned.

.5 Match colours and textures of approved samples.

.6 Make clean true junctions with no visible overlap between adjoining applications of epoxy.

.7 Chase edge of adjacent floor systems so that epoxy finishes flush with adjacent floor systems.

3.4 SITE TOLERANCES

.1 Finish surfaces shall be level, or straight where sloped to drains, within a tolerance of 1.5 mm in 3 m, and shall not vary more than 0.8 mm in any running 300 mm.

3.5 REPAIR

.1 Touch-up and refinish minor defective work. Refinish entire coated surface areas where finish is damaged or otherwise unacceptable.

3.6 CLEANING

.1 Remove promptly as work progresses spilled or spattered materials from surfaces of work performed under other Sections. Clean floors on completion of work. Do not mar surfaces while removing.

.2 Leave storage and mixing areas in same condition as equivalent spaces in project.

3.7 PROTECTION

.1 Erect barriers to prevent the entry and presence of personnel not performing work of this Section during application of epoxy flooring, and for 48 hours following completion of application.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Design, labour, Products, equipment and services necessary for waterproof flooring Work in accordance with the Contract Documents.

1.2 **SUBMITTALS**

.1 Product data:
- .1 Submit manufacturer's Product data in accordance with Section 01 30 00 indicating:
  - .1 Performance criteria, characteristics, limitations, preparation, and installation requirements and techniques.
  - .2 Product transportation, storage, handling and installation requirements.

.2 Shop drawings:
- .1 Submit shop drawings in accordance with Section 01 30 00 indicating:
  - .1 Sections, details, materials, thicknesses, finishes, joint layout and locations, and coating terminations.

.3 Samples: Submit two 300 x 300 mm samples, on cement board, of waterproof flooring in accordance with Section 01 30 00.

.4 Reports/Certificates:
- .1 Submit manufacturer's written acceptance of substrate prior to installation. Submit verification of moisture content of floor prior to installation.
- .2 Submit applicator’s current certificate of approval, for installation of waterproof flooring, by the material manufacturer as proof of compliance.
- .3 Submit letter certifying that materials proposed for use on this project meet criteria specified, are compatible with each other, and that the manufacturer recommended the product for it’s intended end use.
- .4 Submit certification from waterproofing flooring manufacturer that installation meets specified and manufacturer’s requirements.

.5 Closeout submittals: Submit maintenance data for incorporation into Operations and Maintenance Manuals in accordance with Section 01 30 00.

1.3 **QUALITY ASSURANCE**

.1 Installers qualifications: Perform Work of this Section by a company that has a minimum of five years proven experience in waterproof flooring installations of a similar size and nature and that is approved by manufacturer.

.2 Mock-up:
- .1 Construct 10 m^2 mock-up of waterproof flooring in location acceptable to Consultant.

.2 Mock-up shall demonstrate the minimum standard for workmanship, material thicknesses, surface profile, flashing, and juncture details, slip resistance, and finished appearance.

.3 Arrange for Consultant's review and acceptance, allow 48 hours after acceptance before proceeding with Work.

.4 Mock-up may remain as part of Work if accepted by Consultant. Remove and dispose of mock-ups which do not form part of Work.

.5 Upon acceptance, mock-up shall serve as a minimum standard of quality for the balance of the work of this Section.

.3 Pre-installation meetings: Arrange with Consultant, manufacturer's representative, and waterproof flooring applicator to inspect substrates, and to review installation procedures 48 hours in advance of installation.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Deliver products in original factory packaging bearing identification of product, manufacturer, and batch number. Provide Material Safety Data Sheets for each product.

.2 Store product in location protected from freezing, damage, construction activity, precipitation, and direct sunlight, in strict accordance with manufacturer's recommendations.

.3 Prior to application, condition products in accordance with manufacturer's recommendations.

.4 Handle all products with appropriate precautions and care as stated on Material Safety Data Sheet.

1.5 SITE CONDITIONS

.1 Do not install Work of this Section outside of following environmental ranges without Consultant's and Product manufacturer's written acceptance:

.1 Ambient air and surface temperature: 10^0C to 32^0C.

.2 Relative Humidity: 80%.

.3 Moisture content of concrete is above 4% by weight of concrete.

.2 Supply and install temporary protection and facilities to maintain Product manufacturer's, and above specified environmental requirements for 48 hours before, during, and 72 hours after installation.

1.6 EXTENDED WARRANTY

.1 Submit a extended warranty for Work of this Section in accordance with General Conditions, except that warranty period is extended to 2 years for the following:

.1 Warrant against leaking, failure to stay in place, deformation, and breaking of watertight seals.

.2 Coverage: Complete replacement including affected adjacent Work at no cost to Owner.

2 Products

2.1 **MATERIALS**

.1 Waterproof Flooring: Combining primer, membrane and slip resistant wearing surface with non-slip surface texture. Minimum 0.762 mm (30 mils) thick, Class A fire resistance or better; 'Sikafloor Resoclad MRW Type III' by Sika Canada Inc.or approved alternative. Colour: Refer to Room Finish and Colour Schedule for colour type.

3 Execution

3.1 **EXAMINATION**

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of Work means acceptance of existing conditions.

.2 Verify substrate surfaces are solid, free from surface water, frozen matter, dust, oil, grease, scaling or laitance, projections and any other foreign matter detrimental to performance.

.3 Verify that specified environmental conditions are ensured before commencing work.

.4 Test substrate surfaces to ensure that moisture level and acid-alkali balance does not exceed limits recommended manufacturer. Provide one copy of tests results to Consultant prior to installation.

3.2 **PREPARATION**

.1 Supply and install temporary protection to adjacent surfaces to prevent damage resulting from Work of this Section.

.2 Thoroughly clean all surfaces to receive coating by steel shotblasting or other method in accordance with manufacturer's written instructions.

.3 Remove projections and other conditions that may affect the installation of the coating.

.4 Fill open control joints, and other cracks and voids with material compatible with waterproof floor treatment materials.

.5 Clean prime and seal surfaces as recommended by waterproof flooring manufacturer.

3.3 **INSTALLATION**

.1 Install waterproof flooring in accordance with reviewed shop drawings and manufacturer's written instructions.

.2 Stop waterproofing flooring in a straight line on each side of control/expansion joints.

.3 Apply waterproof flooring with care to ensure that no laps, voids, or other marks or irregularities are visible, and with an appearance of uniform colour, sheen and texture, all within limitations of materials and areas concerned.

.4 Make clean true junctions with no visible overlap between adjoining applications of waterproof flooring.

.5 Chase edge of adjacent floor systems so that waterproof flooring finishes flush with adjacent floor systems.

.6 At projections through floor post, pipes, vents and similar locations of potential movement, install a sealant bead and tool to form a cove and allow to cure prior to application of waterproof flooring.

.7 Apply waterproof flooring over entire floor areas and extend up vertical surfaces such as walls, columns and curbs to a height of 100 mm.

3.4 **REPAIR**

.1 Touch-up and refinish minor defective work. Refinish entire coated surface areas where finish is damaged or otherwise unacceptable.

3.5 **PROTECTION**

.1 Erect barriers to prevent the entry and presence of personnel not performing work of this Section during application of waterproof flooring, and for 48 hours following completion of application.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Labour, Products, equipment and services necessary for concrete floor sealer work in accordance with the Contract Drawings.

1.2 **SUBMITTALS**

.1 Product data: Submit manufacturer's Product data in accordance with Section 01 30 00 indicating:
- .1 Two copies of manufacturer's Product data on characteristics, performance criteria, and limitations.
- .2 Preparation, installation requirements and techniques, Product storage, and handling criteria.

.2 Samples: Submit samples in accordance with Section 01 30 00 indicating coating and final concrete finish.

.3 Reports: Submit manufacturer's acceptance of substrate prior to installation in writing. Submit verification of moisture content of floor prior to installation.

.4 Close-out submittals: Submit maintenance data for incorporation into Operations and Maintenance manuals in accordance with Section 01 78 00.

1.3 **QUALITY ASSURANCE**

.1 Perform work of this Section by a company that has a minimum of five years proven experience in installations of a similar size and nature and that is approved by manufacturer. Submit to Consultant, applicator’s current certificate of approval by the material manufacturer as proof of compliance.

.2 Mock-up:
- .1 Construct one 2 m^2 mock-up of floor sealer in location acceptable to Consultant.
- .2 Arrange for Consultant's review and acceptance, allow 48 hours after acceptance before proceeding with Work.
- .3 Mock-up may remain as part of Work if accepted by Consultant. If sealer application is unacceptable to Consultant, rework sealer in accordance with manufacturer’s recommendations to provide a sealed concrete surface acceptable to Consultant.
- .4 Upon acceptance, mock-up shall serve as a minimum standard of quality for the balance of the work of this Section.

.3 Pre-installation meetings: Arrange with manufacturer's representative and Consultant to inspect substrates, and to review mock-up and installation procedures 48 hours in advance of installation.

1.4 **SITE CONDITIONS**

.1 Do not install the work of this Section outside of environmental ranges as recommended by the manufacturer without Product manufacturer's written acceptance and as follows:
- .1 Relative Humidity: In accordance with manufacturers' requirements.
- .2 When no dust is being raised.
- .3 In well-ventilated and broom clean areas.

.2 Install temporary protection and facilities to maintain the Product manufacturer's, and the above specification, environmental requirements for 24 hours before, during, and 24 h after installation.

.3 Post do not enter and appropriate warning signs at conspicuous locations.

1.5 **DELIVERY, STORAGE, AND HANDLING**

.1 Store materials at site in an area specifically set aside for purpose that is locked, ventilated, and maintained at a minimum temperature of 16°C.

.2 Ensure that health and fire regulations are complied with in storage area, and during handling and application.

2 Products

2.1 **MATERIALS**

.1 All materials under work of this Section, including but not limited to, sealers and coatings are to have low VOC content limits.

2. Each material used in the application of each flooring system shall be as recommended or manufactured by the supplier of the flooring system.

.3 Concrete floor sealer: Alkali-silicate, water-soluble, inorganic concrete hardener and dustproofer; ‘MasterKure HD 200WB’ by Master Builders Solutions or ‘Sikafloor 3S’ by Sika Canada Inc.

3 Execution

3.1 **EXAMINATION**

.1 Verify condition of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of work of this Section means acceptance of existing conditions.

.2 Verify that concrete floor has cured 28 days minimum and that substrate is acceptable to sealer manufacturer.

.3 Test surfaces for moisture content to ensure that they are suitable for application.

3.2 **PREPARATION**

.1 Prepare substrate in accordance with manufacturer's written instructions. [Diamond grind and vacuum substrate free of debris and dust.

.2 Project adjacent surfaces from damage resulting from work of this Section. Mask and/or cover adjacent surfaces, fixtures, and equipment as necessary.

.3 Clean surfaces to be sealed as recommended by sealer manufacturer.

3.3 **APPLICATION**

.1 Apply concrete floor sealer in accordance with manufacturer's written instructions. Sealer manufacturer shall supervise application.

.2 Spray apply concrete sealer to entire surface and keep from drying for 30 minutes as recommended by manufacturer.

.3 Sprinkle surface with water as sealer begins to penetrate (after 30 minutes).

.4 Flush surface with water and drying begins to remove excess material. Allow to harden for 24 hours.

.5 Lightly buff floor with a commercial floor buffer and non-aggressive pad to bring up required sheen.

3.4 **CLEANING**

.1 Remove promptly as work progresses spilled or spattered materials from surfaces of work performed under other Sections. Clean floors on completion of work. Do not mar surfaces while removing.

3.5 **PROTECTION**

.1 Erect barriers to prevent the entry and presence of personnel not performing work of this Section during application of floor sealer, and for 48 hours following completion of application.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Labour, Products, equipment and services necessary for fibreglass reinforced plastic cladding work in accordance with the Contract Documents.

1.2 **SUBMITTALS**

.1 Product data:
- .1 Submit duplicate copies of manufacturer's Product data in accordance with Section 01 30 00 indicating:
  - .1 Performance criteria, characteristics, and limitations.
  - .2 Product transportation, storage, handling and installation requirements.

.2 Shop drawings:
- .1 Submit shop drawings in accordance with Section 01 30 00 indicating:
  - .1 Elevations, sections, details, materials, dimensions, thicknesses, trim and accessory pieces, and interfacing with adjacent construction.

.3 Samples:
- .1 Submit following samples in accordance with Section 01 30 00.
  - .1 Two 300 x 300 mm samples of wall cladding.
  - .2 Two 300 mm samples of each trim and accessory proposed for use.

.4 Certificates: Submit certification from material manufacturer that installation is in accordance with manufacturer’s instructions.

.5 Closeout submittals: Submit maintenance and cleaning instructions for incorporation into Operations and Maintenance Manuals in accordance with Section 01 78 00.

1.3 **QUALITY ASSURANCE**

.1 Installers qualifications: Perform work of this Section by a company that has a minimum of three years proven experience in the installation of wall cladding on projects of a similar size and nature and that is approved by manufacturer. Submit to Consultant, installer’s current certificate of approval by the cladding manufacturer as proof of compliance.

.2 Mock-up:
- .1 Construct one 2 m^2 mock-up of wall cladding system in location acceptable to Consultant.
- .2 Arrange for Consultant's and manufacturer’s review and acceptance prior to start of installation.
- .3 Mock-up may remain as part of Work if accepted by Consultant. Remove and dispose of mock-ups which do not form part of Work.
- .4 Upon acceptance, mock-up shall serve as a minimum standard of quality for the balance of the work of this Section.

1.4 **SITE CONDITIONS**

.1 Do not install work of this Section outside of following environmental ranges without Consultant's and Product manufacturer's written acceptance:
- .1 Ambient air and surface temperature: 15^0C to 30^0C.
- .2 Relative Humidity: 45%.

.2 Supply and install temporary protection and facilities to maintain Product manufacturer's, and above specified environmental requirements for 24 hours before, during, and 24 hours after installation.

2 Products

2.1 **MATERIALS**

.1 All materials under work of this Section, including but not limited to, sealants and adhesives are to have low VOC content limits.

.2 Fibreglass reinforced plastic cladding:
- .1 Extruded rigid FRP sheets, coloured throughout, smooth finish backside with smooth front texture, Agriculture and Agri-Food Canada Approved, 2440 mm x 1220 mm x 1.9 mm thick. ‘Glasbord FRP’ by Crane Composites, ‘Panolam FRP’ by Panolam Industries, or ‘Glasliner FRP Panels’ by Stabilit.
- .2 Wall cladding to come complete with thermoformed corners and all accessories required to provide a complete system.

.3 Adhesive and sealant: Types as recommended by cladding manufacturer to suit intended application.

3 Execution

3.1 **EXAMINATION**

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of work of this Section means acceptance of existing conditions.

3.2 **PREPARATION**

.1 Verify substrate surfaces are solid, free of moisture, dust, oil, grease, scaling or laitance, projections and any other foreign matter detrimental to performance. Obtain manufacturer's approval of substrate in writing, submit copy to Consultant.

3.3 **INSTALLATION**

.1 Install wall cladding in accordance with reviewed shop drawings and manufacturer's written instructions.

.2 Dry-fit sheet prior to fixing.

.3 Bevel leading edges of sheet prior to fitting joint and cap strips.

.4 Apply adhesive to back of sheet uniformly using a 4.5 mm ‘V’ notched trowel. Allow adhesive to dry tacky to the touch.

.5 Offer sheet to wall substrate. Roll sheet thoroughly with a wall roller to ensure full adhesion.

.6 Cut sheet neatly to accommodate pipes, electrical boxes, etc., providing a 3 mm gap for expansion.

.7 Fit sheets neatly at door and window trim providing a 3 mm gap for expansion.

.8 Thermoform all inside and outside corners and specific shapes to fit building contours.

.9 Install joint strips to each sheet as installation progresses.

.10 Provide water tight seal to all pipes, projections, door and window trims with sealant.

3.4 CLEANING

.1 Upon completion of installation, remove the protective film and wash with a dilute soap/detergent solution and rinse with clean water.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Labour, Products, equipment and services necessary for painting work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 Master Painters Institute (MPI), Painting Specification Manual.

.2 SSPC Steel Structures Painting Council, Standards.

1.3 **SUBMITTALS**

.1 Product data:
- .1 Submit copies of manufacturer's Product data in accordance with Section 01 30 00 indicating:
  - .1 Performance criteria, compliance with appropriate reference standard, characteristics, limitations.
  - .2 Product transportation, storage, handling and installation requirements.
- .2 Submit listing of manufacturer's Product types, Product codes, and Product names, number of coats, and dry film thicknesses, corresponding to each Painting Schedule code; submit listing minimum of 8 weeks before materials are required.

.2 Samples:
- .1 Submit following samples in accordance with Section 01 30 00.
  - .1 Three 300 x 150 mm draw downs of each colour minimum 4 weeks before paints are required.
  - .2 Identify each sample with Contract number and title, colour reference, sheen, date, and name of applicator.

.3 Certificates:
- .1 Submit certification from paint manufacturer, on company letterhead, indicating each product proposed for use is Manufacture's premium grade, first line Product.
- .2 Submit certified documentation to confirm each airless spray painter has minimum of 5 years experience on applications of similar complexity and scope.
- .3 Submit certified documentation to confirm each worker has Provincial Tradesman Qualification certificate of proficiency.

.4 Reports:
- .1 Submit written field inspection and test report results after each inspection.
- .2 Submit Field Quality Control test result reports for alkali content, substrate moisture, and dry film thickness.
- .3 Submit electronic moisture meter manufacturer's specifications including tolerances. Submit record of latest meter calibration to meet manufacturer's recommendations.

1.4 QUALITY ASSURANCE

.1 Finishing work: Perform work to MPI requirements for premium grade.

.2 Supervision: Have work supervised by a full-time qualified foreperson who has 10 years minimum experience on Contracts of similar complexity and scope.

.3 Mock-up:
- .1 Construct three 3 m^2 mock-ups of different Paint Schedule code systems, selected by Consultant, in locations acceptable to Consultant to demonstrate installation workmanship, colour, and hiding power of Products.
- .2 Obtain Consultant's acceptance in writing before proceeding with the work of this Section.
- .3 Mock-ups may remain as part of the Work if acceptable to Consultant and will serve as a standard for similar code systems.
- .4 Repaint over mock-ups which do not form part of the Work.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Install correct, safe temporary storage for paint, thinner, solvents, and other volatile, corrosive, hazardous, and explosive materials in accordance with requirements of authorities having jurisdiction.

.2 Post hazard warning signage in areas of storage and mixing. Install and maintain sufficient CO_2 fire extinguishers of minimum 9 kg capacity, accessible in each storage mixing and storage areas.

.3 Maintain storage enclosures at minimum 10°C ambient temperature and to manufacturer's instructions.

1.6 SITE CONDITIONS

.1 Apply coatings under the following conditions:
- .1 Exterior coatings (except Latex): 5° C minimum.
- .2 Exterior latex coatings: 10°C minimum.
- .3 24 hours minimum after rain, frost, condensation, or dew.
- .4 When no condensation is possible (unless specifically formulated against condensation).
- .5 Interior coatings: 7°C minimum.
- .6 Relative humidity: 85% maximum.
- .7 Not in direct exposure to sun light.

.2 Maintain temperature conditions indicated above for 24 hours before, during and 24 hours after painting.

.3 Install clean plywood sheets to protect floors and walls in storage and mixing areas, from paint drips, spatters, and spills.

.4 Apply sufficient masking, clean drop cloths, and protective coverings for full protection of work not being painted including, but not limited to, the following:
- .1 Light fixtures, fire and smoke detectors.
- .2 Data cabling and data infrastructure.
- .3 Sprinkler heads.
- .4 Prepainted diffusers and registers.
- .5 Prepainted equipment.
- .6 Fire rating labels and equipment specification plates.
- .7 Finished surfaces.

1.7 ENVIRONMENTAL PERFORMANCE REQUIREMENTS

1. Provide paint products meeting MPI "Green Performance Standard GPS-1-12.

1.8 MAINTENANCE

1. Deliver to Owner's place of storage on completion of work, sealed containers of each finish painting material applied, and in each colour. Label each container as for original, including mixing formula. Provide the following:
   - .1 1 L of extra materials when less than 50 L are used for Project;
   - .2 3.78 L of extra stock when 50 to 200 L are used;
   - .3 7.57 L of extra stock when over 200 L are used.

2 Products

2.1 MATERIALS

.1 Paint:
- .1 All materials under work of this Section, including but not limited to, primers, stains, and paints are to have low VOC content limits.
- .2 Products in accordance with the MPI Painting Specification Manual, Exterior and Interior Systems;
  - .1 For each MPI paint code, manufacture's premium grade, first line Products is to be use.
  - .2 Uniform dispersion of pigment in a homogeneous mixture.
  - .3 Ready-mixed and tinted whenever possible.
- .3 Products within each MPI paint system code: From single manufacturer.
- .4 Acceptable manufacturers:
  - .1 AkzoNobel.
  - .2 Benjamin Moore.
  - .3 PPG Industries Inc.
  - .4 Sherwin Williams.

.2 Wood sealer: Three coat wood sealer system as manufactured by Sikkens or approved alternative.
- .1 Wood basecoat: One coat of translucent oil alkyd basecoat ‘Cetol 1RE’ by Sikkens.

.2 Wood topcoat: Two coats of 'Cetol 23RE' by Sikkens topcoat consisting of translucent alkyd resin and UV absorbers, in colour as selected by the Consultant.

2.2 COLOUR SCHEDULE

.1 Refer to Colour and Material Schedule for selected colour references.

.2 Conform to gloss reflectance definitions listed in MPI Specification Manual.

2.3 PAINTING AND FINISHING SCHEDULE

.1 Refer to Table 1, MPI Painting and Finishing Schedule coded systems, comply with MPI Painting Specification Manual.

Table 1: Painting and Finishing Schedule

EXTERIOR SUBSTRATES	Typical substrates (Including but not limited to)	MPI Manual Ref.	MPI Finish System Code	Sheen	Topcoat
Galvanized steel	HM doors & frames, handrails	EXT 5.3	EXT 5.3L		Pigmented polyurethane
Galvanized steel (structural steel)	Structural steel components with galvanized finish	EXT 5.3	EXT 5.3L		Pigmented polyurethane
Wood	Wood screen	N/A	N/A		See Note 6
INTERIOR SUBSTRATES	Typical substrates (Including but not limited to)	MPI Manual Ref.	MPI Finish System		Topcoat
Concrete walls and ceilings		INT 3.1	INT 3.1A		Latex
Concrete floors		INT 3.2	INT 3.2C		Epoxy
Concrete block masonry		INT 4.2	INT 4.2A		Latex

Table 1: Painting and Finishing Schedule					
Metal Fabrications (Factory primed)	Steel stairs, ladders	INT 5.1	INT 5.1R		High performance latex
Galvanized metal	HM doors & door frames, handrails	INT 5.3	INT 5.3B	Semi-Gloss	WB light industrial coating
Wood Millwork	Benches	INT 6.4	INT 6.4C	Satin	Semi-transparent stain
Wood paneling & casework	Millwork, partitions	INT 6.4	INT 6.4E	Satin	Poly-urethane
Gypsum board	Drywall, walls, ceilings	INT 9.2	INT 9.2A	Eggshell	Latex
Gypsum board	Wet areas	INT 9.2 .	INT 9.2F	Semi-Gloss	Epoxy-modified latex
Gypsum Board	Ceilings	INT 9.2	INT 9.2A	Flat	Latex

.2 Notes:

.1 Provide three coat wood sealer system consisting of one coat of the basecoat and two coats of topcoat specified herein in accordance with this specification and the manufacturers directions.

3 Execution

3.1 **EXAMINATION**

.1 Verify condition of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of work of this Section means acceptance of existing conditions.

3.2 **PREPARATION**

.1 General:

.1 Clean substrate surfaces free from, dust, grease, soiling, or extraneous matter, which are detrimental to finish.

.2 Patch, repair, and smoothen minor substrate defects and deficiencies e.g. machine, tool and sand paper marks, shallow gouges, marks, and nibs.
.3 Clean, sweep, and vacuum floors and surfaces to be painted, debris and dust-free prior to painting.
.4 Refer to MPI Painting Specification Manual for surface preparation requirements of substrates not listed here.

.2 Where finish hardware has been installed remove, store, re-install finish hardware, to accommodate painting. Do not clean hardware with solvent that will remove permanent lacquer finishes.

.3 Alkali Content tests and neutralization:
.1 Test for ph level using litmus paper on dampened substrate.
.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 Brush-off any residual Zinc Sulphate crystals.
.4 Coordinate paint system primer / sealer to be alkali-resistant.

.4 Substrate moisture tests:
.1 Test for moisture content over entire surface to be painted, minimum one test/ 2 m^2 in field areas and one test/600 mm along inside corners including at ceiling to wall juncture.
.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 Re-test employing same criteria.

.5 Mildew removal: Scrub with solution of trisodium phosphate and sodium hypochlorite (Javex) bleach, rinse with water, and allow to dry completely.

.6 Cementitious and masonry (Concrete, block, brick, stucco, cement rendering):
.1 Allow 28 days cure before painting.
.2 Coordinate repair of protrusion-chipping and grinding, and honeycomb filling with responsible trades.
.3 Remove dirt, loose mortar, scale, powder, efflorescence, and other foreign matter.
.4 Remove form oil and grease with trisodium phosphate, rinse, and allow to dry thoroughly.
.5 Remove rust stains with solution of sodium metasilicate after thorough wetting; allow to dry thoroughly.

.7 Concrete floors (new):
.1 Allow 28 days cure before painting.
.2 Remove contamination, acid etch, rinse with water, and allow to dry completely. Test and adjust for neutral ph.

.8 Galvanized steel sheet:
.1 Z275 (Satin & Spangled Sheet): SSPC SP7 brush blast.
.2 ZF075 (Wiped Coat): Remove contamination, wash with Xylene solvent.

.3 Touch-up damaged galvanized areas with organic zinc rich primer.

.9 Galvanized iron and steel: Prepare galvanized and ungalvanized metal surfaces as follows:
- .1 Unpassivated, unweathered and weathered: Remove contamination, wash with Xylene or Toluol solvent, allow to dry thoroughly. Make paint system primer/sealer an etching type primer.
- .2 Manufacturer pre-treated (including passivated): SSPC SP7.
- .3 Touch-up damaged galvanized areas with organic zinc rich primer.

.10 Structural steel and miscellaneous metal fabrications:
- .1 Coordinate the following with the responsible trades:
  - .1 Rust, mars, mill scale, and weld-burn touch-ups.
  - .2 Oil, grease, weld flux and other residue removal.
- .2 Prime paint items, not otherwise indicated to be primed as part of another Section.
- .3 Touch-up damaged galvanized areas with organic zinc rich primer.

.11 Wood and Millwork:
- .1 Wood surfaces to be clean and dry with a moisture content of less than 15%.
- .2 Remove foreign matter prior to prime coat; spot coat knots, pitch streaks and sappy sections with sealer.
- .3 Fill nail holes and fine cracks after primer has dried.
- .4 Backprime interior and exterior woodwork.

.12 Factory primed surfaces:
- .1 Touch up damaged areas.
- .2 Clean as required for top coat.

.13 Gypsum board:
- .1 Apply primer/sealer paint to reveal defects and deficiencies and to equalize absorption areas.
- .2 Coordinate repairs and touch-ups with the responsible trade.
- .3 Re-prime repairs.

.14 Coordinate with other trades to prevent:
- .1 Damage, and inadvertent activation of fire and smoke detectors.
- .2 Odour and dust distribution by permanent HVAC systems including fouling of ducts and filters.

.15 Field-mix Products in accordance with manufacturer's written instructions.

3.3 APPLICATION

.1 Apply painting systems in accordance with the MPI Painting Specification Manual. Apply each Product to manufacturer's recommended dry film thickness.

.2 Painting systems listed are required minima, apply additional coats if necessary to obtain substrate hiding acceptable to the Consultant.

.3 Tint intermediate coats lighter than final top coats for identification of each succeeding coat and to facilitate inspections. Include only manufacturer's recommended reducing and tinting accessories. Do not add adulterants.

.4 Primer to be specialized primer coating system as required by manufacturer for selected colour. Standard primer being tinted shall be tinted to a maximum of 1.5% by volume.

.5 Sand lightly between coats to achieve a tooth or anchor for subsequent coats.

.6 Apply paint uniformly in thickness, colour, texture, and gloss, as determined by the Consultant 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 the Consultant, affect appearance and performance. Defects include, but are not limited to:
- .1 Improper cleaning and preparation of surfaces.
- .2 Entrapped dust, dirt, rust.
- .3 Alligatoring, blisters, peeling.
- .4 Scratches, blemishes.
- .5 Uneven coverage, misses, drips, runs, and poor cutting in.

.7 Do not apply coatings on substrates which are not sufficiently dry. Unless indicated otherwise, allow each painting system coat to cure dry and hard before following coats are applied.

.8 Repaint entire areas of damaged or incompletely covered surfaces, to the nearest inside or outside corner; patching will not be permitted.

.9 Miscellaneous painting requirements:
- .1 Paint projecting ledges, and tops, bottoms and sides of doors both above and below sight lines to match adjacent surfaces.
- .2 Paint door frames, access doors and frames, door grilles, prime coated butts, and prime coated door closers to match surface in which they occur.
- .3 Finish closets and alcoves as specified for adjoining rooms.
- .4 Paint light coves white whether a light lense is installed or not, unless otherwise indicated.
- .5 Paint interior columns to match walls of room.
- .6 Allow for:
  - .1 2 wall colours per room, one ceiling colour per room.
  - .2 Different door colours in each functionally different area.
  - .3 Different colours on both sides of same door.

.10 Mechanical, electrical and other painting coordination:
- .1 Paint following items unless specified or indicated on drawings not to be painted.
- .2 Paint mechanical services in accordance with Mechanical Identification Division 21, 22 and 23.
- .3 Coordinate painting of pipes, ducts, and coverings with the work of Division 21, 22 and 23 to precede pipe colour banding, flow arrows, and other pipe identification labeling installation.

.4 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.

.5 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.

.6 Remove the following to accommodate painting, carefully store, clean, then re-install on completion of each area and when dry:

.1 Switch and receptacle plates, fittings and fastenings, grilles, gratings, louvres, access panels, convector covers, and enclosures .

3.4 FIELD QUALITY CONTROL

.1 Dry film thickness tests:

.1 Test for film thickness over entire surface to be painted, minimum one test/2 m^2 in field areas and one test/600 mm along inside corners including at ceiling to wall juncture.

.2 If any test registers below specified thickness, re-apply paint to entire surface to nearest inside and outside corners.

.3 If test registers more than 50% above specified thickness, consult with paint manufacturer, determine if problem exists, offer solutions to Consultant, and repair as directed.

.4 Re-test employing same criteria after repair.

3.5 CLEANING

.1 Remove spilled, splashed, and spattered paint promptly as work proceeds and on completion of work. Clean surfaces soiled by paint spillage and paint spatters. Repair or replace damaged work, as directed by Consultant.

3.6 PROTECTION

.1 Post Wet Paint signs during drying and restrict or prevent traffic where necessary.

.2 Post sign, after Consultant's inspection and acceptance of each room, reading: PAINTING COMPLETE - NO ADMITTANCE WITHOUT CONTRACTOR'S PERMISSION.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Labour, Products, equipment and services necessary for signage Work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 CSA-A23.1; Concrete Materials and Methods of Concrete Construction.

.2 CAN/CSA-G40.20/G40.21; General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steels.

.3 CAN/CSA-G164; Hot Dip Galvanizing of Irregular Shaped Articles.

1.3 **SUBMITTALS**

.1 Shop drawings:
- .1 Submit shop drawings in accordance with Section 01 30 00 indicating:
  - .1 Provide full scale sign layouts for all signs specified, for review by the Consultant. Layouts shall include correct symbols, lettering, lettering styles, and shall indicate colours.
  - .2 All signs shall be bilingual (English/French).

2 Products

2.1 **MATERIALS**

.1 Sign Posts:
- .1 One piece, cold-rolled channel sign posts, 64 mm wide x 32 mm deep, hot-dip galvanized steel, 4.2 mm base metal thickness, minimum 340 MPa yield, perforated for sign attachment, as manufactured by Armtec Limited, or an approved alternative. Provide mounting hardware.
- .2 Post Lengths: As per drawings.

.2 Signs: 1.63 aluminum with MTO standard traffic colours and graphics.

.3 Concrete:
- .1 Proportion normal density concrete in accordance with CSA-A23.1, and as follows:
- .2 Cement: Type 10 Portland Cement.
- .3 Minimum compressive strength at 28 days: 25Mpa.
- .4 Exposure Classification: C-2.
- .5 Coarse Aggregate Size: 16mm, crushed (smooth aggregate not acceptable).
- .6 Slump at time and point of discharge: 80mm ± 20mm.

3 Execution

3.1 **INSTALLATION**

.1 Place concrete in post holes then embed posts into concrete to minimum 914mm depth. Extend concrete 25mm above ground level and slope to drain away from posts.

.2 Brace posts in plumb position and true to alignment and elevation until concrete has set.

.3 Bolt signs to top of posts with tamper-proof galvanized steel bolts and nuts.

3.2 **SCHEDULE**

.1 Refer to Drawings for sign types and locations.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Labour, Products, equipment and services for washroom accessories work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 ASTM A167, Specification for Stainless Steel and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

.2 ASTM A312, Specification for Seamless and Welded Austenitic Stainless Steel Pipes.

.3 ASTM A653/A653M, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.

.4 ASTM F2285, Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use.

.5 CAN/CSA B651-M, Accessible Design for the Built Environment.

1.3 **SUBMITTALS**

.1 Product data: Submit Product data to requirements of Section 01 30 00 indicating each washroom accessory describing size, finish, details of function, attachment methods, hardware and locks, description of rough-in frame, and building-in details of anchors for grab bars.

.2 Closeout submittals:

.1 Submit for each Product operation and maintenance instructions for incorporating into the Operations and Maintenance Manuals in accordance with Section 01 78 00.

.1 Supply 2 keys for each lockable washroom accessory to Consultant.

.2 Master key washroom accessories which are keyed..

.3 Extended warranty: Submit extended warranty signed and registered by the manufacturer providing the warranty in the name of the Owner for the timeframe and coverage specified in this Section.

1.4 **DELIVERY, STORAGE AND HANDLING**

.1 Deliver materials in sealed cartons and containers with manufacturer’s name and product description clearly marked.

1.5 **EXTENDED WARRANTY**

.1 Submit an extended warranty for washroom accessories work in accordance with the General Conditions, except that the warranty period is extended to 10 years.
- .1 Against cracked or scratched mirrors, spoiling or deterioration of silvering or backing, loosening of fastenings or adhesive
- .2 Coverage: complete replacement including effected adjacent work.

1.6 **MAINTENANCE**

1. Maintenance Tools: Provide special tools necessary for accessing, assembly/disassembly or removal of toilet, bath and cleaning accessories in accordance with Section 01 78 00.

2 Products

2.1 **MATERIALS**

.1 Stainless steel:
- .1 Sheet metal: ASTM A167, Type 304.
- .2 Tubing: ASTM A312, Type 304.

.2 Sheet steel: ASTM A653M, Z275; Cold rolled, commercial quality, surface preparation and pretreatment as required for applied finish.

.3 Fasteners, screws and bolts: ASTM A167, Type 304 stainless steel, tamper-proof.

2.2 **ACCESSORIES**

.1 The following Products are by Bobrick Washroom Equipment of Canada Ltd. except where noted. Quantity and location of accessories as shown on Contract Drawings. Equivalent Products from ASI/Watrous and Bradley are acceptable.

.2 All washroom accessories shall be mounted in strict conformance to meet all requirements of the Ontario Building Code 2012 and all amendments. Confirm mounting configurations and heights with Consultant prior to installing at all washroom accessories.

.3 Toilet tissue dispenser: Owner supplied, Contractor installed.

.4 Soap dispenser: Owner supplied, Contractor installed.

.5 Paper towel dispenser/disposal: Owner supplied, Contractor installed.

.6 Soap dish:
- .1 #B4380; Recessed mounted 185 mm W x 125 mm H x 90 mm deep, drawn and beveled, one piece seamless with countersunk mounting holes.
- .2 Finish: Type 304 stainless steel with matte polish.

.7 Mirror: 6 mm thick, mirror quality tempered glass with type 304 stainless steel frame in satin finish. Corners to be heliarc welded, ground and polished smooth.
- .1 Standard frame (M): #B-290 Series; 610 mm x 914 mm.

.8 Grab Bars: 38mm diameter, 1.2mm thick, concealed mounting with snap flange, complete with escutcheons, type 304 stainless steel with a satin finish and peened grip in the following configurations:
- .1 GB1: 762 mm long horizontal and vertical legged "L" shaped grab bar beside watercloset: Series 6806.99-L30x30 by Bobrick Washroom Equipment of Canada or approved alternative.
- .2 GB2: 610 mm long straight grab bar to be located behind watercloset table of : Series B-6806.99 by Bobrick Washroom Equipment of Canada or approved alternative.
- .3 GB3: 305 mm long straight grab bar for use at urinals: Series B-6806.99 by Bobrick Washroom Equipment of Canada or approved alternative.
- .4 GB4: 1000 mm long straight grab bar beside showerseat: Series B-6806.99 by Bobrick Washroom Equipment of Canada or approved alternative.

.9 Coat hook:
- .1 Model 1150-SS by Frost Product Inc. or approved alternative; collapsible single spring loaded coat hook, maximum weight capacity 11 kg.
- .2 Finish: Type 304 stainless steel, #4 Finish.

.10 Stainless steel shelf:
- .1 #0692 Series by ASI Group Canada or approved alternative; shelf fabricated from 1.2 mm thick stainless steel with 13 mm return edge and front edge hemmed for safety.
- .2 Shelf complete with brackets fabricated from 1.2 mm thick stainless steel.
- .3 Size: 100 mm wide x 450 mm length.
- .4 Finish: Type 304 stainless steel, satin finish.

.11 Folding Shower seat:
- .1 #B-5191; surface wall mounted seat with 8 mm thick water-resistant, ivory coloured solid phenolic.
- .2 Dimensions: 405 mm deep x 460 mm wide.
- .3 Finish: Type 304 stainless steel frame.

.12 Hand Dryer:
- .1 Surface mounted on pressed anti-rust steel back plate, polycarbonate ABS casing with anti-microbial scuff resistant coating on exterior surfaces in colour to be selected by Consultant with touch-free infra-red activation, 10-15 second drying time and HEPA filter.
- .2 Electrical supply: 120V, 1HP, 350-700 W, 50/60 Hz.
- .3 Canadian model ‘Ultra Series - iStorm 2 Electric Hand Dryer' by Palmer Fixture or approved alternative.

13. Shower curtain rod:
    .1 #B6047; 32 mm diameter, 1.0 mm thick tube, complete with 81 mm diameter flanges, #B204-1 by Bobrick or #1200-SHU by ASI Group Canada stainless steel curtain hooks. Length as indicated on drawings.
    .2 Finish: Type 304 stainless steel satin finish.

14. Shower curtain:
    .1 #B204-2; 0.2 mm thick matte white vinyl, anti-bacterial treated, bottom and sides hemmed, complete with nickel plated brass grommets at 150 mm o.c.
    .2 Size: 1065 mm wide x 1830 mm high.

3 Execution

3.1 **EXAMINATION**

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of work of this Section means acceptance of existing conditions.

3.2 **INSTALLATION**

.1 Verify and coordinate templates, inserts, and rough-in frames and verify exact location of washroom accessories for installation.

.2 Verify there is adequate supports and/or blocking in gypsum wall assemblies prior to installation of washroom accessories.

.3 Provide fastening and mounting kits for washroom accessories.

.4 Locate washroom accessories where indicated on Drawings and where directed by Consultant.

.5 Install washroom accessory fixtures, accessories, and items in accordance with manufacturer's instructions and CAN/CSA B651-M. Provide exposed tamper-proof screws of stainless steel to match units.

.6 Install washroom accessories plumb, level, and securely and rigidly anchored to substrate surfaces and framing. Adjust accessories for proper operation and verify mechanisms function smoothly.

.7 Install grab bars to withstand minimum load of 1.3 kN applied vertically or horizontally. Provide necessary reinforcements as required.

.8 Clean and polish exposed surfaces and fill accessories with necessary supplies prior to acceptance by Consultant.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Labour, Products, equipment and services necessary for lockers Work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 CAN/CGSB-44.40, Steel Clothing Locker.

1.3 **SUBMITTALS**

.1 Product data:
  .1 Submit duplicate copies of manufacturer's Product data in accordance with Section 01 30 00 indicating:
    .1 Performance criteria, compliance with appropriate reference standard(s), characteristics, and limitations.
    .2 Product transportation, storage, handling and installation requirements.

.2 Shop drawings: Submit shop drawings in accordance with Section 01 30 00 indicating type and class of lockers, elevations, sections, dimensions, gauges, tops, bases, hooks, shelves, trim, numbering, doors, handles, anchorage and hardware, and finishes.

.3 Samples:
  .1 Submit following samples in accordance with Section 01 30 00.
    .1 Two 50 mm x 50 mm samples of colour and finish on actual base metal.

.4 Closeout submittals: Submit maintenance and cleaning instruction for incorporation into Operations and Maintenance Manuals in accordance with Section 01 78 00.

2 Products

2.1 **MANUFACTURED UNITS**

.1 Tactical Gear Locker (Type 1): Welded steel lockers in colour shown on Colour and Material Schedule, 533 mm x 533 mm x 1981 mm; Model TA-1-212178 by Lincora or approved alternative complete with the following options:
  .1 Hat Shelf;
  .2 Bottom Drawer;
  .3 Boot Tray;
  .4 Coat Bar.

.2 Lockers (Bunker Gear Locker Room): Custom sized as indicated on drawings, open style locker; Freestanding Racks and Wall Mounted Racks by Ready Rack Lockers or approved alternative. Locker Construction:
  .1 Frames: Tubular steel frames.
  .2 Walls and backs: Large open steel mesh.
  .3 Equipment: Manufacturer's standard hooks and shelves.

.4 Numbering: Each locker to have number plate with non-removable numerals, one number designation for each locker space.

.5 Finish: High performance baked on epoxy powder coating. Colours: Refer to Colour and Material Schedule.

3 Execution

3.1 **INSTALLATION**

.1 Assemble and Install lockers in accordance with reviewed shop drawings and manufacturer's written instructions.

.2 Securely fasten lockers to bases and grounds and nailing strips and to each other when in locker banks.

.3 Install trim and closures where indicated and where obstructions occur.

.4 Install locker numbers.

.5 Upon completion, test doors and adjust for ease of operation.

3.2 **CLEANING**

.1 Touch up scratches and abrasions to match original finish. Clean and polish lockers prior to final acceptance by Consultant.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Labour, Products, equipment and services necessary for miscellaneous specialties Work as listed below in accordance with the Contract Documents.

.1 Foot grilles.
.2 Janitor shelf.
.3 Corner guard.
.4 Tackboard.
.5 Whiteboard.
.6 Flag pole.
.7 Work Stations

1.2 **SUBMITTALS**

.1 Product data:
.1 Submit duplicate copies of manufacturer's Product data for each Product specified in accordance with Section 01 30 00 indicating:
.1 Performance criteria, compliance with appropriate reference standard(s), characteristics, and limitations.
.2 Product transportation, storage, handling and installation requirements.

.2 Shop drawings: Submit shop drawings in accordance with Section 01 30 00 indicating elevations, sections, details, dimensions, materials, gauges, and finishes.

.3 Closeout submittals: Submit cleaning and maintenance instructions for miscellaneous specialties for incorporation into Operations and Maintenance Manuals in accordance with Section 01 78 00.

1.3 **DELIVERY, STORAGE, AND HANDLING**

.1 Package or crate, and brace products to prevent distortion in shipment and handling. Label packages and crates, and protect finish surfaces by sturdy wrappings.

2 Products

2.1 **MANUFACTURED UNITS**

.1 Foot Grilles (with drain pan):
.1 Frame and Grid: Level base frame with drain pan, minimum 46 mm deep by area shown on drawings, Recessed type, extruded 6105-T5 aluminum alloy tread rails joined mechanically by extruded 6061-T6 aluminum alloy key lock bars. Tread rails to incorporate vinyl cushion unless indicated other wise. Furnish anchors for attachment to, or for casting in, concrete.
.2 Evaporator Pan: 1.5 mm aluminum waterproof pan.
.3 Finish: Clear anodized.
.4 Tread insert: Serrated aluminum.

.5 Floor grilles size: As indicated on Drawings.
.6 Acceptable Manufacturer: To be selected by Consultant.

.2 Janitor's shelf with mop and broom holders and hooks:
.1 #B-239 x 34 by Bobrick Washroom Equipment of Canada or approved alternative.
.2 330 mm H by 205 mm deep. Shelf constructed of minimum 1.2 mm stainless steel, mop and broom holders to have spring loaded rubber cam to grip handles up to 30 mm in diameter, and stainless steel hooks positioned below shelf.
.3 Finish: Type 304 stainless steel with satin finish.

.3 Stainless steel corner guard (CG-1): 89 mm x 89 mm x 90°, stainless steel corner guard. Surface mounted 'CO-0' by C/S Group or approved alternative by McGill Architectural Products. Finish: #4 Satin Finish

.4 Tackboard: "Tackboards" by ASI Visual Display Products or approved alternative consisting of 6 mm natural cork laminated under heat and pressure to 6 mm hardboard, clear aluminum frame; wall mounted with concealed wall hanger.

.5 Whiteboard:
.1 Porcelain on steel laminated to 8 mm impregnated core with zinc coated backing sheet, with recessed tray and clear anodized aluminum perimeter trim with squared corners.
.2 Colour and finish: High gloss finish in white, 'Porcelain Surface' by ASI Visual Display Products or approved alternative.
.3 Sizes and layout: As shown on Contract Drawings.

.6 Flagpole: Tapered aluminum 6063 T-6 flag pole 30 ft exposed height of wall thickness between minimum 4.0 mm, designed to withstand 93 Mph winds. 14 gauge clear anodized aluminum ball with flush seams. Supply all trucks, halyards, cleats, collar, anchor base and accessories. 'Ground set architectural cone tapered aluminum' as manufactured by Ewing or approved alternative by Holards International.

.7 Work Stations: Adjustable height and flip-down work surface. 710 mm H x 1030 mm D x 550 mm with surface raised work station; Colour to be Selected by Consultant from manufacturer standard colour finish. Capacity: maximum 18.2 kg. Manufactured to be 'WorkFit Elevate' by Ergotron or approved alternative.

3 Execution

3.1 EXAMINATION

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of work of this Section means acceptance of existing conditions.

3.2 PREPARATION

.1 Verify substrate surfaces are solid, free from surface water, dust, oil, grease, projections and other foreign matter detrimental to performance.

.2 Items to be built-in: Provide information and templates required for installation of work of this Section, and assist or supervise, or both, the setting of anchorage devices, and construction of other work incorporated with products specified in this Section in order that they function as intended.

.3 Verify there is adequate supports and/or blocking in gypsum wall assemblies prior to installation of miscellaneous specialty items as required and janitors shelf.

3.3 INSTALLATION

.1 Install miscellaneous specialties level and securely and rigidly anchored to substrate in accordance with authorities having jurisdiction, reviewed shop drawings, and manufacturer's written instructions.

.2 After installation, adjust miscellaneous specialties in accordance with manufacturer’s written instructions.

3.4 CLEANING

.1 Clean and polish exposed surfaces prior to acceptance by Consultant.

END OF SECTION

1 General

1.1 **SECTION INCLUDES**

.1 Labour, Products, equipment and services necessary for manually operated window coverings Work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 AAMA 611, Voluntary Standards for Anodized Architectural Aluminum.

.2 ANSI, H35.1M, Alloy and Temper Designation Systems for Aluminum (Metric).

1.3 **SUBMITTALS**

.1 Product data:
- .1 Submit duplicate copies of manufacturer's Product data in accordance with Section 01 30 00 indicating:
  - .1 Performance criteria, compliance with appropriate reference standard(s), characteristics, limitations, and finishes.
  - .2 Product transportation, storage, handling and installation requirements.

.2 Shop drawings:
- .1 Submit shop drawings in accordance with Section 01 30 00 indicating:
  - .1 Elevations, sections and details of opening size, clearances, handling of operating components, anchorage, dimensions, gauges, materials, and finishes.

.3 Samples:
- .1 Submit following samples in accordance with Section 01 30 00.
  - .1 Two 300 x 300 mm samples of fabric type.

.4 Closeout submittals:
- .1 Submit following for each Product for incorporation into Operations and Maintenance Manuals in accordance with Section 01 78 00:
  - .1 Functional description detailing operation and control of components.
  - .2 Performance criteria and maintenance data.
  - .3 Operating instructions and precautions.
  - .4 Safety precautions.

1.4 **EXTENDED WARRANTY**

.1 Manufacturer shall provide warranty that all components are free of manufacturing defects for two years from date of installation. This warranty is void if the product has been improperly installed or subjected to improper care.

2 Products

2.1 **ACCEPTABLE PRODUCTS AND MANUFACTURERS**

.1 Manual Roller Shade: Factory assembled, manual chain operated, roller type fabric shades with “snap-in” mounting, end brackets, shade tube, aluminum fascia, hembar and fabric as indicated on drawings and as specified herein. ‘Teleshade’ by Solarfective or approved alternative by Sun Glow, Sun Project or Urban Edge Shading.

2.2 **SHADING FABRIC (3% OPENNESS)**

.1 Yarn: Vinyl coated polyester, 0.46 mm thick, basket weave design.

Openness factor	3 %
Weight (g/sq.m)	21(oz./sq.yd.)
Warp ends per 25.4 mm (1") approx.	42
Fill ends per 25.4 mm (1") approx.	31
Grab tensile strength	Warp - 1180 N Fill - 667 N
Stretch (% at 12.2 kg.wt.)	Warp - 2% Fill - 3%
Set %	Warp - 1.5% Fill - 1.5%
Abrasion resistance (500 Taber cycles)	- Yarn rupture none
Wear	- trace
U.V. Deterioration(200 Sun Fade hours)	- Fade none
Tensile retention	- 96%

.2 Flame Retardance: Fabric shall be certified by an independent laboratory to pass CAN/ULC-S109.

.3 Fabric colour: Selected by Consultant from full colour range of any of the specified manufacturers. Shade fabric on any one floor shall be from the same dye lot.

.4 Fabric shall be sealed under heat and pressure to retain weave pattern, with additional heat seal at sides, to prevent fraying and to eliminate rough edges.

2.3 **FABRICATION**

.1 Extruded Aluminum Shade Tube: 1.52 mm thick, 38 mm diameter with three internal, continuous fins 4.82 mm high for strength and drive capabilities when attached to the nylon sprocket. The fins shall be spaced 120 degrees apart.

.2 Fascia: 1.7 mm thick, extruded aluminum cover, complete with three continuous screw flutes which accept end brackets to form unitized unit (totally assembled). To cover front of shade and return at underside to conceal roller and hardware, notched for chain clearance.

.3 Drive Assemblies:
- .1 Factory set, spring clutch type drive assembly to suit size and travel of fabric shades, complete with built-in shock absorber system to prevent chain breakage under normal conditions, and balancing spring or lift assist mechanism.
- .2 Capable of being field adjusted from exterior of shade without having to disassemble shades.

.4 Exterior Hembar: Extruded aluminum in clear anodized finish with plastic end finials.

.5 Drive Chain:
- .1 No. 10 “bright” finished series 300 stainless steel bead type chain forming continuous loops and capable of withstanding 400 N pull test.
- .2 Provide drive chains with upper and lower stops to prevent overwinding or underwinding.

.6 Dynamic Hembar: At sill locations, in lieu of bottom channel, provide aluminum Dynamic Hembar with same finish as side channels. Upon contact with sill, it shall provide a light seal even if the sill is slightly out of level.

.7 End Bracket: Two piece moulded ABS construction with a nylon drive sprocket. Incorporate snap-in clip on each end bracket to engage snap-in mounting hardware. Bracket colour shall coordinate with the fascia colour.

.8 Colour: Exposed surfaces (excluding fabric) shall be colour selected by Consultant, and not necessarily from manufacturer's full colour range. Metal components shall be pretreated and finished with an acceptable baked enamel finish.

.9 Fasteners: Non-corrosive metal screws for attachment to windows or curtain wall framing, concealed in completed installation.

.10 Mounting System: Snap-in brackets which allow the shade to be removed without disassembling the shade unit.

.11 Shade and mounting system to be designed to allow air between shade and glass.

.12 Fabric shall hang flat, without buckling or distortion. Trimmed edges shall hang straight without curling or raveling.

.13 Unguided vertical shades shall not drift sideways more than 3 mm in total run.

.14 Provide stops at highest and lowest shade positions to prevent over winding and unrolling.

.15 Design and fabricate shades so that there is a maximum 12 mm gap both sides of fabric.

.16 Shades shall be Fully Factory Assembled Units of unitized construction consisting of end brackets, shade tube, extruded aluminum fascia, Hembar and specified fabric.

3 Execution

3.1 **EXAMINATION**

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of Work means acceptance of existing conditions.

3.2 **INSTALLATION**

.1 Install shade in accordance with accepted shop drawings and manufacturer's written instructions.

.2 Install shades in locations shown using specified fasteners, plumb, true, square, straight, and level in proper planes, complete with all fascias/soffits, trims and accessories.

3.3 **ADJUSTMENT AND CLEANING**

.1 The shade cloth fabric shall hang flat, without buckling or distortion. The edge, when trimmed, shall hang straight without ravelling. An unguided roller shade cloth shall roll true and straight, without shifting sideways more than 3 mm in either direction due to warp distortion, or weave design.

.2 Adjust, correct and lubricate fabric shade as required, to provide smooth and efficient operation without binding.

.3 Clean shade surfaces and remove all finger marks and smudges from fascia, soffits, and trim surfaces. Remove all protective films.

.4 Leave fabric shade in raised position and in first-class condition upon completion of the Work of this Section.

END OF SECTION