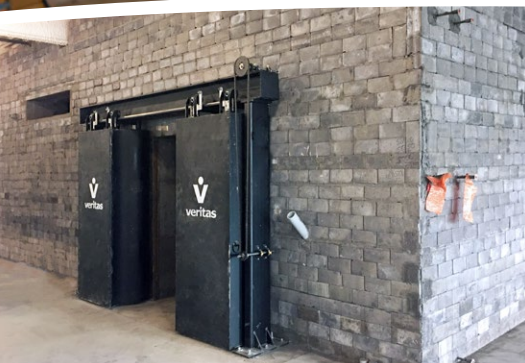


Designers' Desk Reference



Cancer Centers Of Excellence Start Here

veritas
Medical Solutions



Introduction to the Veritas Designers' Desk Reference (DDR)

Printed Designers' Desk Reference or Digital Designers' Desk Reference (Adobe® Acrobat .PDF format)

For optimal printing results, this Designers' Desk Reference is formatted to require double-sided capabilities in both 8-1/2" x 11" and 11" x 17" sizes or their metric equivalents. If your printer does not have these capabilities, a printed version will gladly be supplied. To obtain a printed copy of the Veritas DDR, contact the Veritas Design Department at the address below.

Digital Drawing Files

AutoCAD DWG files for all sections within this DDR are available. These files contain details that can be useful for incorporating into the Architect's contract documents.

Limitation of Liability

Every effort has been made to keep the digital drawing files consistent with the documents in the DDR. These files are provided "as-is" without warranty of any kind, either express or implied. The Architects and Engineers of Record shall modify these files to reflect any and all site-specific conditions and regional regulatory agency requirements. Veritas Medical Solutions, Inc., its agents, or any subsidiaries shall not be liable for the accuracy or completeness of the files, any documents that include portions of them or any damages, direct, indirect, incidental or consequential, including damages for any lost profits or project delays that result from the use of the files included herein.

Contact Veritas Design Department at:

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<http://www.veritas-medicalsolutions.com>



Advancing The Science Of Radiation Shielding

Veritas was founded on one simple truth: there is a way to provide better radiation shielding solutions. In our exploration of that truth, we engineered the industry's most effective shielding system, developed the world's fastest shielded doors and designed pre-manufactured radiotherapy facilities to give customers a start to finish room solution.

Today, Veritas offers complete pre-manufactured radiotherapy facilities based on an unparalleled system of physics, engineering, installation, and project management. Whether you need a single pre-engineered room, full oncology center, pre-certified radiotherapy center, or a comprehensive medical campus, Veritas offers the quickest, most cost-effective solution with a 100% shielding guarantee.

Faster - Better - 100% Veritas

From the start, the primary goal of Veritas was getting our clients into a state-of-the-art therapy center as quickly as possible—without having to coordinate a multitude of service providers. We do it faster because we rely on a system of pre-engineered components ranging from walls and room shells to complete pre-manufactured oncology centers. We do it better because we've developed the world's most advanced shielding materials, entry systems, and construction methods. Whether you need to upgrade, expand, or build from the ground up, Veritas can handle every aspect of design, engineering, testing, and assembly - in a fraction of the time needed with traditional construction methods.

Pre-Engineered Package Approach

Concept

We help you determine the facility configuration that will work best for you. Pre-engineered room layouts for virtually every modality and machine energy simplify the work of the architect. Customized room designs, along with all required details, can be engineered should standard design modules not be entirely suited to specific project requirements.

Physics

Our on-staff physicists make sure that your facility is properly shielded and meets all regulatory requirements. In-house physics capabilities provide the assurance of optimum shielding functionality. We can reduce overall costs by tailoring the best shielding solution to every application. We work to your physicist's performance criteria and provide a 100% guarantee of shielding effectiveness and integrity.

Design

We're involved every step of the way, ensuring that design, configuration, equipment, and other components satisfy your requirements.

Project Management

We work with you to develop a plan that meets your needs and will get you treatment-ready as quickly as possible. Acting as a single point of contact, your Project Manager will liaise with all members of the project team to ensure that everything runs smoothly and on schedule.

Manufacturing

Veritas VeriShield™ Modules, VPAC™ shielding packs, SmartDoor™ Shielded doors and SmartSuite™ deliverable therapy rooms are manufactured under factory controlled conditions, ensuring the highest quality and fast, trouble-free onsite installation.

Installation

Veritas manages the entire process, monitoring the jobsite until your project is properly completed.



Veritas Shielding Solution Package

VeriShield® Radiation Shielding

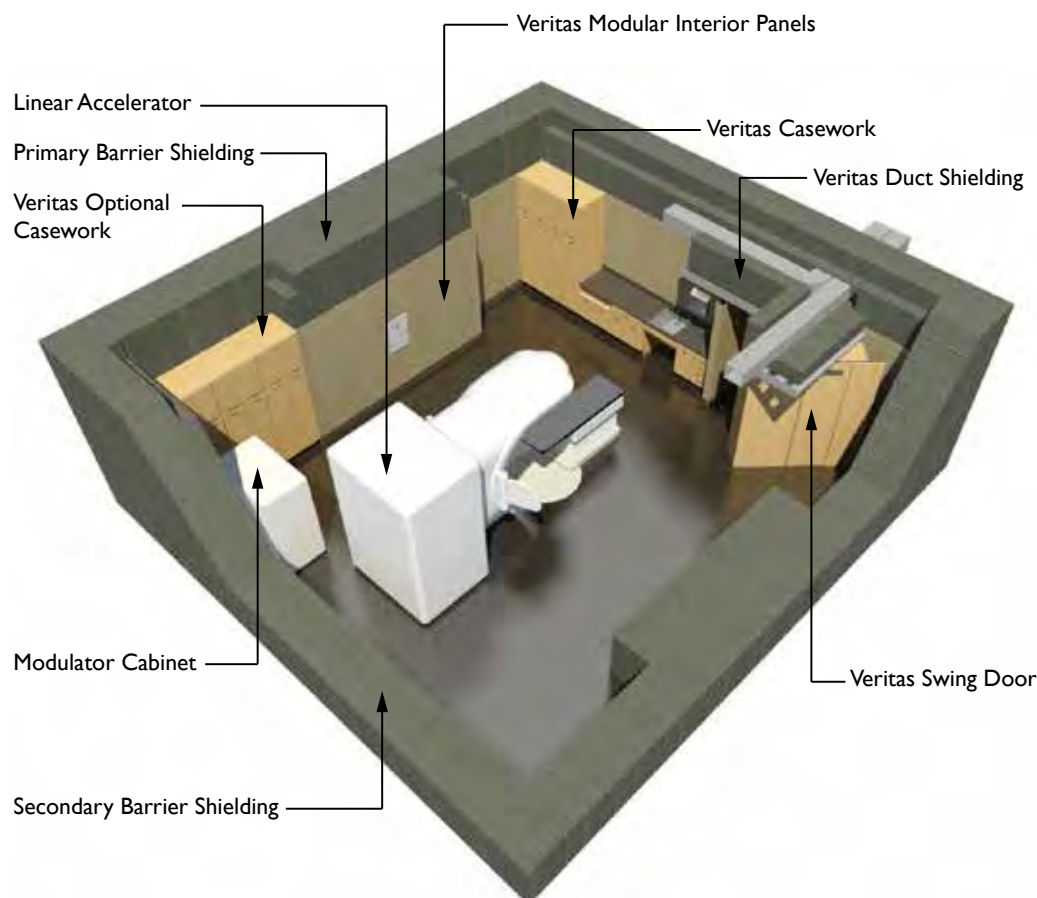
The core of the Veritas shielding solution is VeriShield, a groundbreaking system of high-density stacked modules that provide superior attenuation while delivering the added benefits of significant space and time savings. Incorporating a unique patented “sine wave” design that prevents radiation streaming, VeriShield is the building block that allows Veritas to engineer shielding solutions that outperform concrete from start to finish. Ideal for all machine energies and therapies, VeriShield provides superior attenuation by a factor of more than two times at the joints. This greatly reduces the amount of shielding needed to attain desired protection levels - one of many significant advantages over concrete and other shielding materials.

Shielded Doors

Veritas SmartDoor™ Radiation Shielded Doors have taken shielded door technology to a whole new level - outperforming the competition in speed, protection, and versatility. By combining cutting-edge technology with patient-friendly operation and appearance, Veritas offers a series of door systems that are rapidly setting the worldwide standard for performance and reliability and are fast becoming the industry choice for shielded doors. All Veritas doors are controlled by Veritas' SmartDoor operating system, which provides complete system control and electronic monitoring via a single interface touchscreen.

High Quality Modular Interiors

Veritas has developed a unique modular “plug and play” system to create a beautiful and fully modular room fit-out for linear accelerator and particle facilities. The system includes high end modular wall panels and casework, along with MEP services, allowing facilities to be rapidly finished.





Planning and Design

Gathering information about your project will assist all parties in the preliminary design and cost estimates required for project feasibility studies. The Veritas Prospectus (located in the Appendix) will help consolidate whatever information you may have and will help identify information which needs to be gathered. There are a wide variety of factors to consider when planning an installation. When taken in combination, these factors will govern the size and layout of the finished treatment room. It is important to provide as much detail as possible about all aspects of the project in order to ensure an accurate proposal and subsequent project performance.

Project Description

Project Identification

This includes Name of facility, Location of the project, etc.

Facility Details

Is the facility a Hospital, Clinic, Private - proposed or existing structure?

Professionals Involved

List details for all involved professionals including Owner or Owners Representative, Architect, Physicist, Contractor, etc.

Projected Schedules

Anticipated start of treatment - critical dates such as start date, finish date and any other critical milestone dates such as footing completion, equipment deliveries, and operating license obtained)

Project Parameters

Your project and our estimates and planning are based on information and parameters you select. These deal primarily with the types of services you wish to provide your patients and will have an impact on the planning and costing of the project. The following parameters should be addressed and detailed when planning the project.

Number and types of rooms

How many rooms of each type will be required?

- High Energy Linear Accelerators Above 10MV w/ Neutron Production
- Low Energy Linear Accelerators 10MV and below
- High Dose Rate (HDR) Rooms

Treatment Dose per Week

How many patients per day?

Type of Procedures

What types of treatment will be provided?

- Conventional Radiotherapy
- IMRT Procedures (Intensity Modulated Radiation Therapy)
- Stereotactic Procedures
- Total Body Irradiation (TBI)

Applicable Regulations

A listing of any regulations governing permissible exposure levels

Location and type of treatment rooms

- Is the room new, or an upgrade of an exiting treatment room?
- Is the location of the installation inside new construction, inside an existing structure, or inside a shell space attached to an existing building?
- Is the installation supplemental to a planned treatment room?

Desired Entry

- What type of entry will be required?
- Direct Entry, Maze Entry, Door or Doorless, etc.

Manufacturer and Model of Planned Linear Accelerator Equipment

- Specific information on the type of equipment being installed

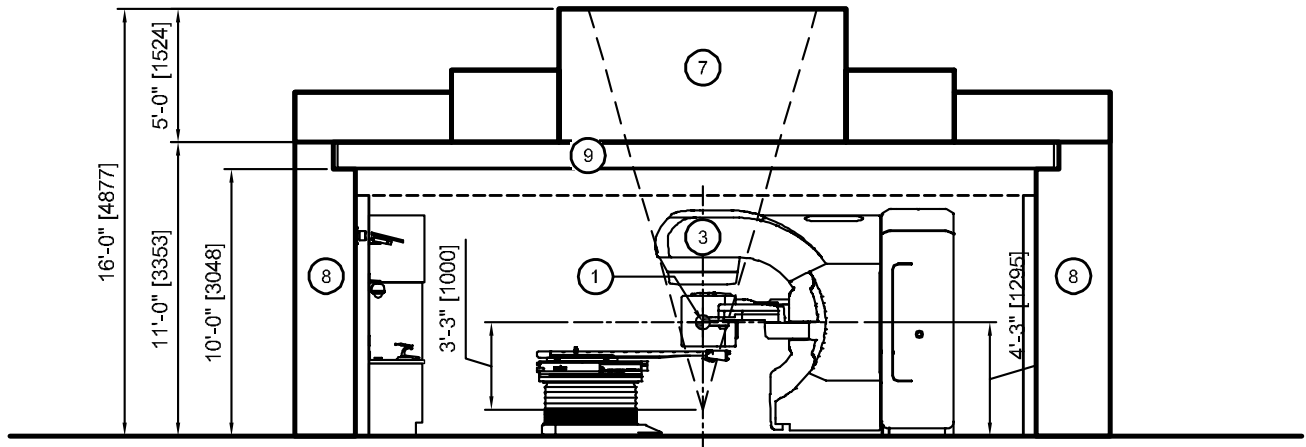
The client should provide as many drawings and plans as possible including the following:

- Floor plan of proposed room(s)
- Floor plan of all adjacent rooms and spaces
- Section plan through treatment room and adjacent area
- Plan view of area above and below treatment area
- Plan showing access to construction area
- Physicist's calculations or report
- Use and occupancy of all adjacent areas

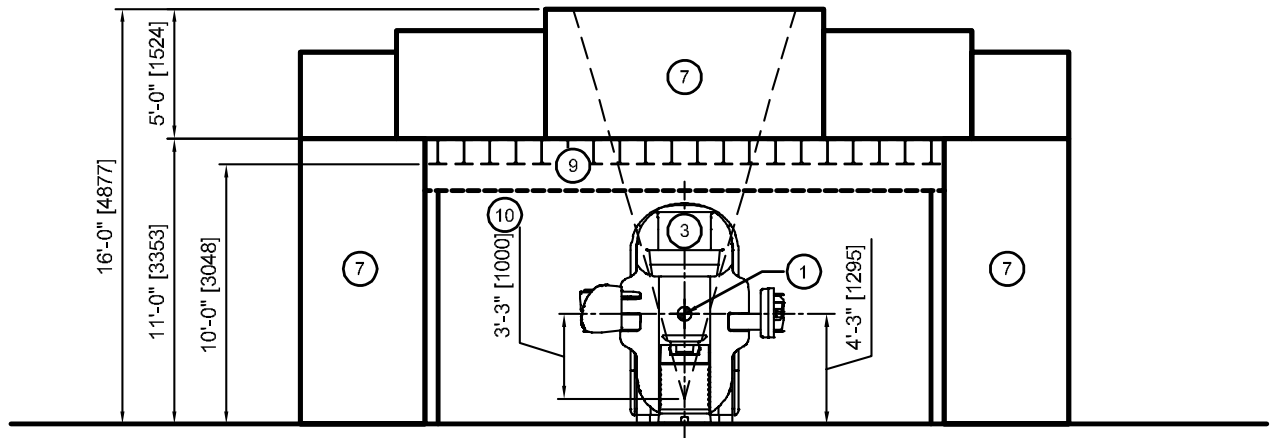


Plan View

6



Section View A



Section View B



Deciding on the Type of Room

Veritas accelerator rooms can be built as free-standing exterior buildings or constructed within a new or existing building shell. Efficiency in space utilization is a key benefit of the VeriShield system. Veritas rooms can be configured to any size or shape, but the most common types are: Direct Entry, Maze Entry and Doorless Entry.

Direct Entry

840 ft² - 78 m² - Overall footprint

20" - 508mm Thick Door

Direct Entry Rooms offer significant space savings over the other room types. The doors to the DE rooms are generally much heavier and thicker than the maze entry doors.

DE rooms are the most compact design but require thick doors.

Maze Entry

1,083 ft² - 100 m² - Overall footprint

10" - 254mm - Thick Door

Maze entry rooms eliminate the necessity of thick entry doors but at the expense of more floorspace. Cost is approximately equivalent to direct entry rooms.

ME rooms incorporate thinner, less expensive doors but require more shielding to construct the maze.

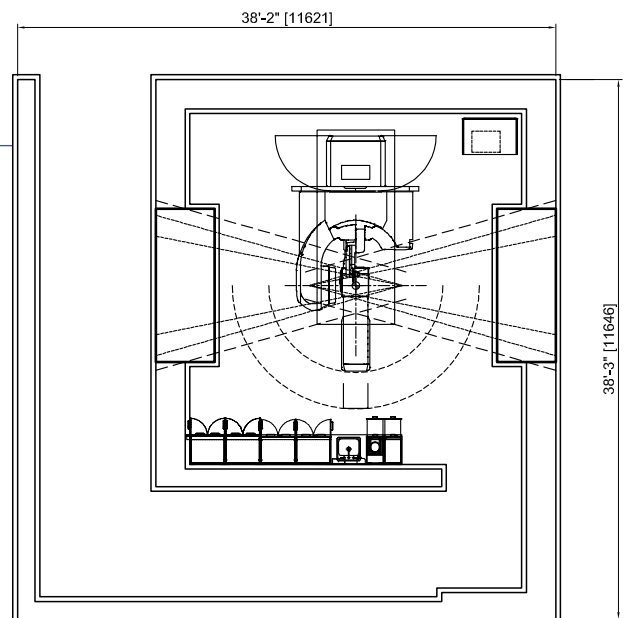
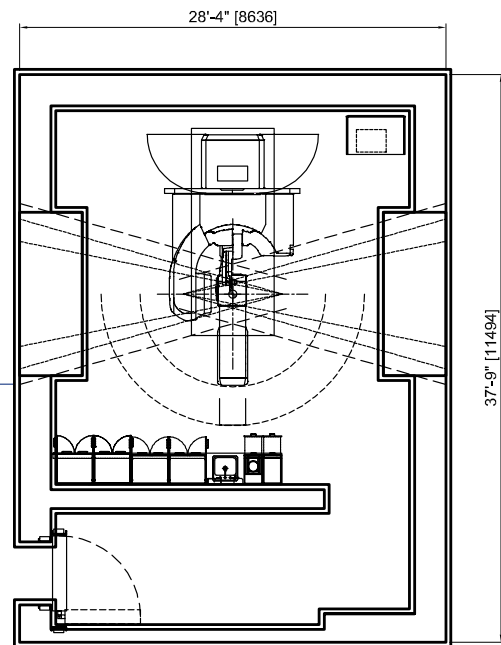
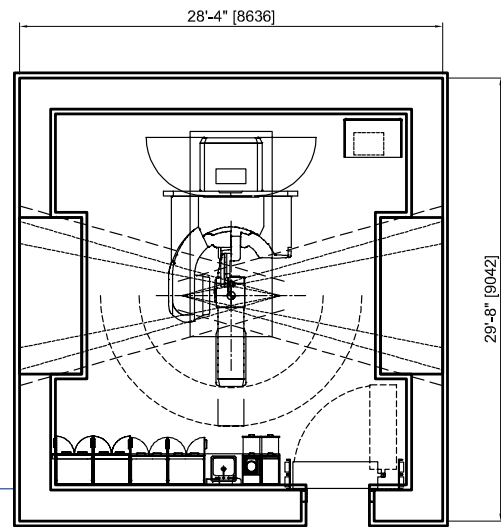
Doorless Entry

1,457 ft² - 135 m² - Overall footprint

No Door

Doorless Entry designs completely eliminate the need for an entry door but require significantly more space than other room designs.

Doorless rooms save on the cost of doors, but require much more shielding and floorspace, so are more expensive than DE and ME rooms.





Sizing Room Interior Dimensions

As a starting point, treatment rooms should be sized to accommodate the planned treatment modality and the linear accelerator machine type as well as other factors such as the couch rotation, cabinetry requirements, vertical height and service requirements

Effect of Treatment Modality on Interior Room Dimensions

The Treatment Modality will assist in determining the interior dimension of a treatment room. Additionally, the modality will affect the thickness of the barrier shielding

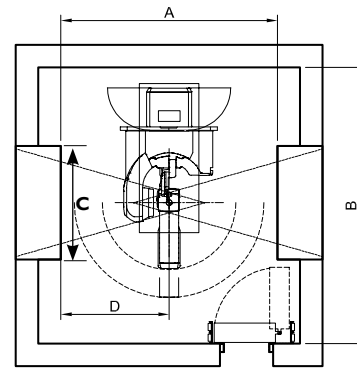
IMRT for example will increase the thickness of the secondary barrier. These issues are discussed in the shielding thickness section. The overall size of a treatment room will be the result of the interior room dimensions and the subsequent required barrier thickness.

Typical Room Dimensions by Modality				
Treatment Modality	A	B	C	*D
Conventional	20'-0" (6096)	25'-6" (7772)	10'-0" (3048)	10'-0" (3048)
TBI	25'-0" (7620)	25'-6" (7772)	14'-0" (4267)	15'-0" (4572)
IMRT	20'-0" (6096)	25'-6" (7772)	10'-0" (3048)	10'-0" (3048)

* Determined by vendors couch rotation requirements and desired finishes.

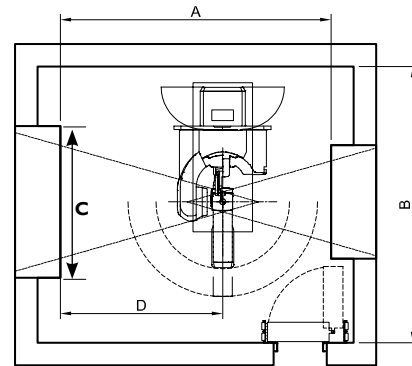
These dimensions are approximate. Actual room size will be based on available space, budget and client preference.

Conventional Therapy



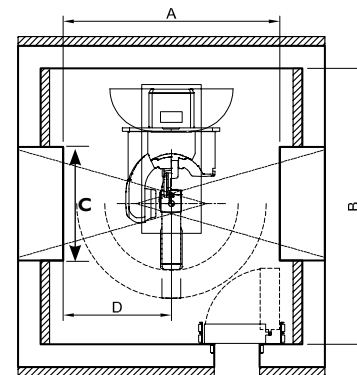
Conventional rooms require the minimum interior space and generally minimal wall thicknesses.

Total Body Irradiation Therapy



To accommodate TBI procedures, the treatment room needs to be approximately 5'-0" (1.5 m) larger between primary barriers, with a wider primary barrier on the wall farthest from isocenter.

Intensity Modulated Radiation Therapy



If IMRT procedures are planned, then the secondary wall barriers are generally 25% to 30% thicker than conventional walls. Extra protection may be applied either on the exterior or interior sides of the walls.



Machine Make and Model

Room size is determined by the machine make and model. Veritas is familiar with all major machine makes and will typically design to the manufacturers recommended interior dimensions, unless otherwise instructed.

A typical linac room is 20'-0" (6.09/m) between primary walls and 25'-6" (7.77/m) between front and back walls.

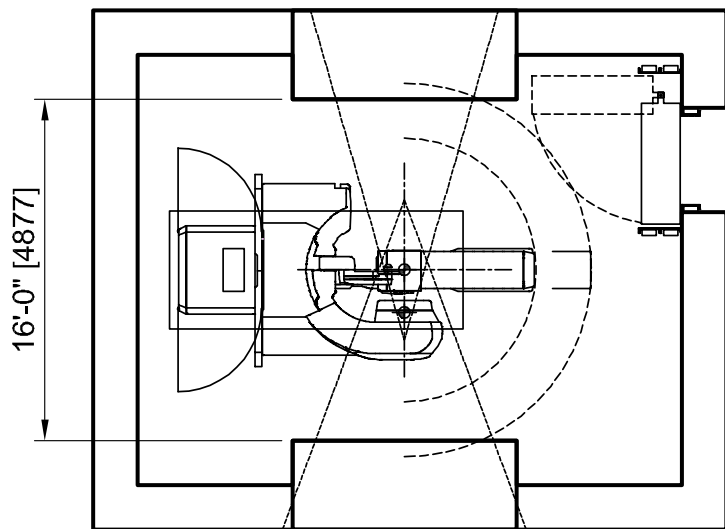
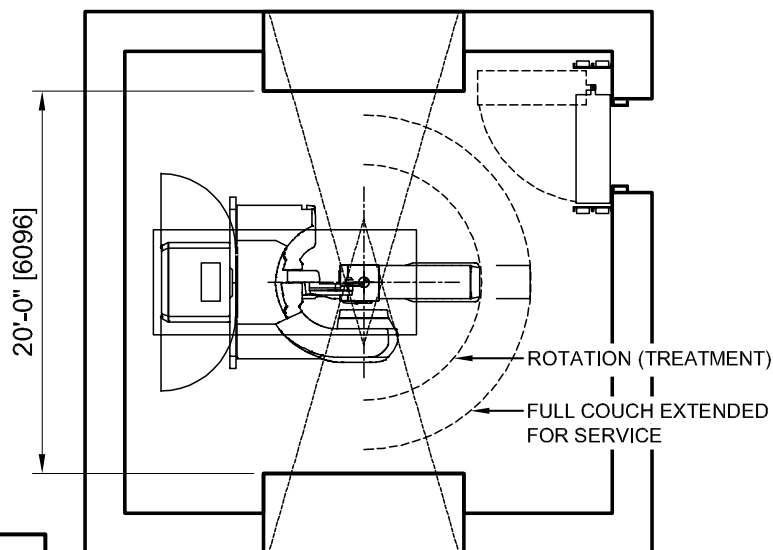
Actual requirements should be verified based on the make and model of machine being used. It should also be noted that each accelerator vendor has specific planning criteria such as head room requirements, turning radius and door width requirements for rigging equipment into place.

Treatment Couch Rotation

Most accelerators have treatment couches that require an approximate 6 foot radius for normal couch rotation under clinical treatment conditions. For servicing the couch or other special needs there is usually an extended radius specified. Where facilities are tight on space, it is possible to design the room to the clinical couch rotation requirement, with a designated area for full extension couch for service. This enables a facility to reduce the primary wall distances to less than the standard 20 foot. Pursuing these limited space options affords the ability to provide clinical treatment within extremely confined spaces. Care should be taken to consult with the equipment vendor and department staff when planning these types of rooms.

Conventional Layout

with full treatment and service rotation



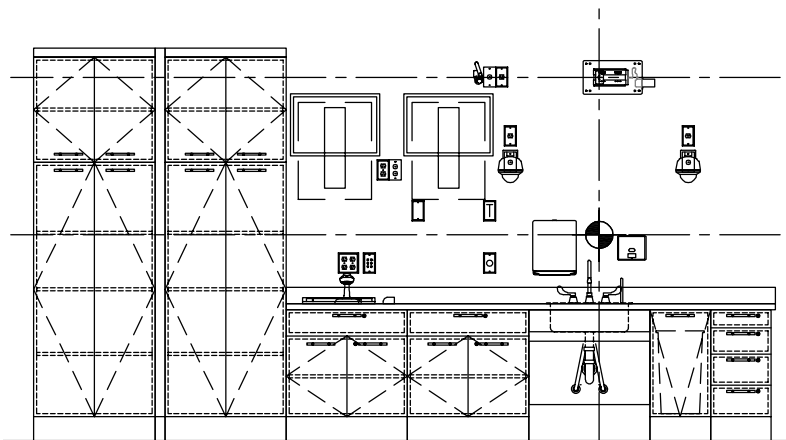
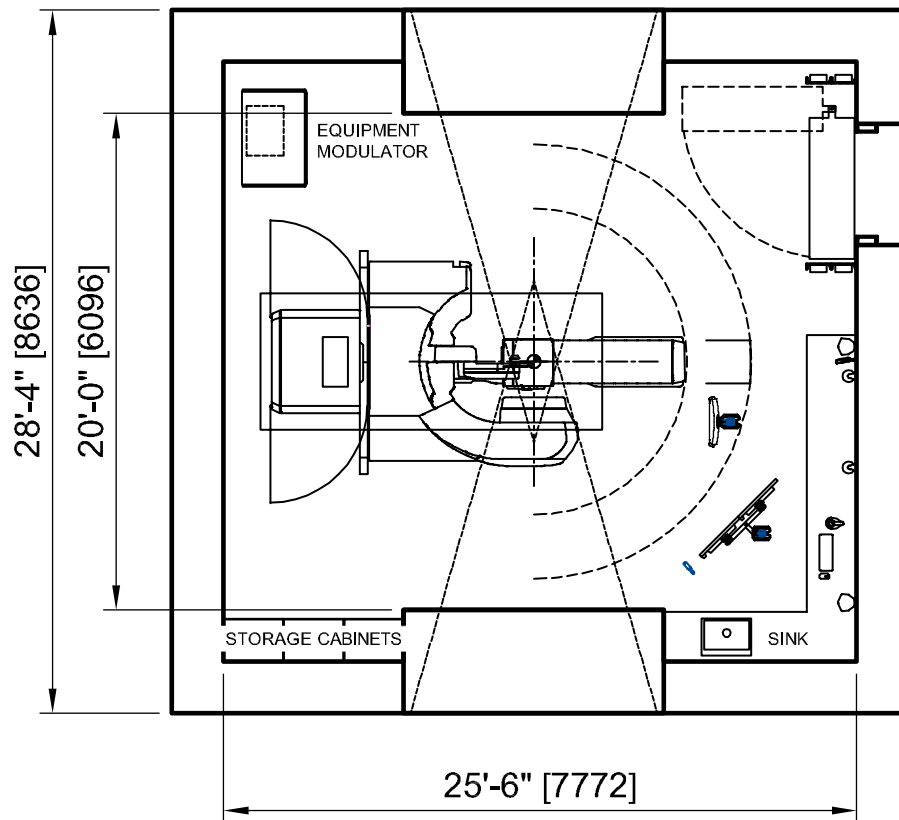
Restricted Space Layout

with full treatment rotation and partial service rotation

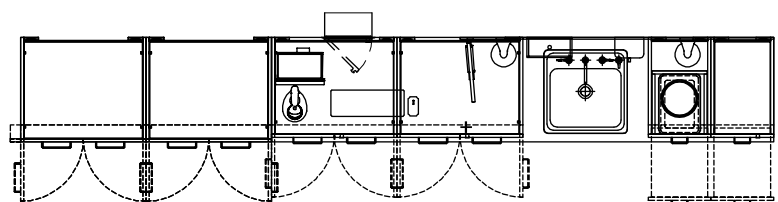


Cabinetry and Equipment Components

Accelerator rooms can be fitted with a wide variety of cabinetry/casework. Storage cabinets, sinks and splashguards, garment racks, etc. can be worked into the design. An efficient use of space is the incorporation of storage or workspace into the area between the primary barrier and the secondary side walls.



The amount, type and configuration of the casework designed into the room will greatly influence the total space requirement of the treatment area.





Vertical Height Requirements

Finish Height ($M + MC = A$)

The standard floor to underside of finished ceiling height for most of the common Varian and Elekta accelerators is recommended to be 9'-0" [2.44m]. This height requirement is typically only necessary directly above the accelerator head to allow for proper gantry rotation. The finished ceiling can be lowered around the room perimeter.

Maintenance Requirements

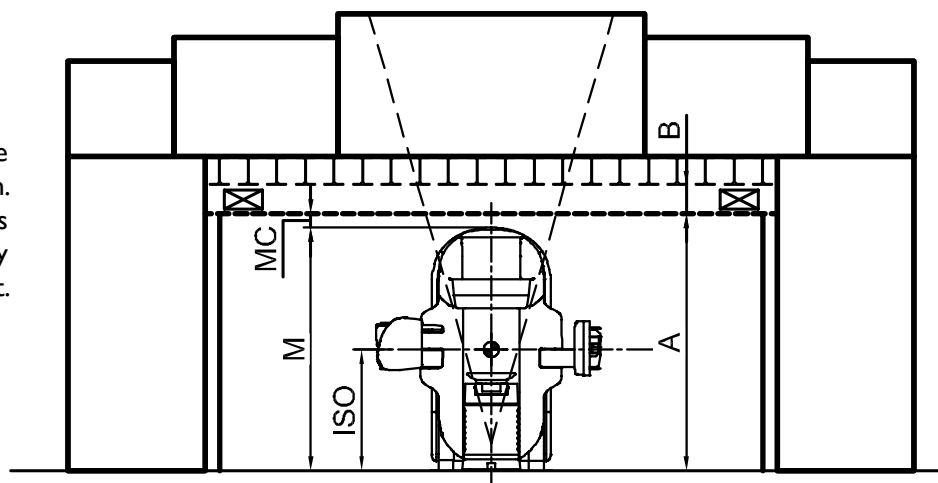
For servicing the accelerators it is some-times necessary to lift the head of the accelerator off of the machine. Consult with the particular machine vendors for their requirements. Typically a zone above the suspended ceiling is required for

a gantry crane to pass over or a fixture to mount to the structure above to lift the accelerator head. For planning purposes a one foot distance from structure to finished ceiling should be provided.

HVAC and other services (Mechanical Soffitt)

There should also be provision made for electrical conduits, HVAC duct work and other services above the suspended ceiling where there are tight vertical constraints, the one foot clearance zone from suspended ceiling to underside of structure is generally adequate to accommodate HVAC services, recessed lighting etc. At the room perimeters, soffitting can be used to accommodate larger duct runs and services.

A variety of factors affect the overall height of each room. VeriShield construction allows for the accomodation of virtually any height requirement.



Vertical Height Requirement						
Machine Vendor	Isocenter	M Height of Machine	+ MC Machine Clearance	= A Recommended Finished Height	+ B Mechanical Plenum	= To Bottom of Shielding System
Varian	4'-3" (1295)	8'-6" (2591)	2'-6" (762)	9'-0" (2743)	4" (102) - 12" (305)	9'-4" (2845) - 12'-0" (3658)
Elekta	4'-0 13/16" (1240)			9'-0" (2743)	12" (305)	10'-0" (3048)



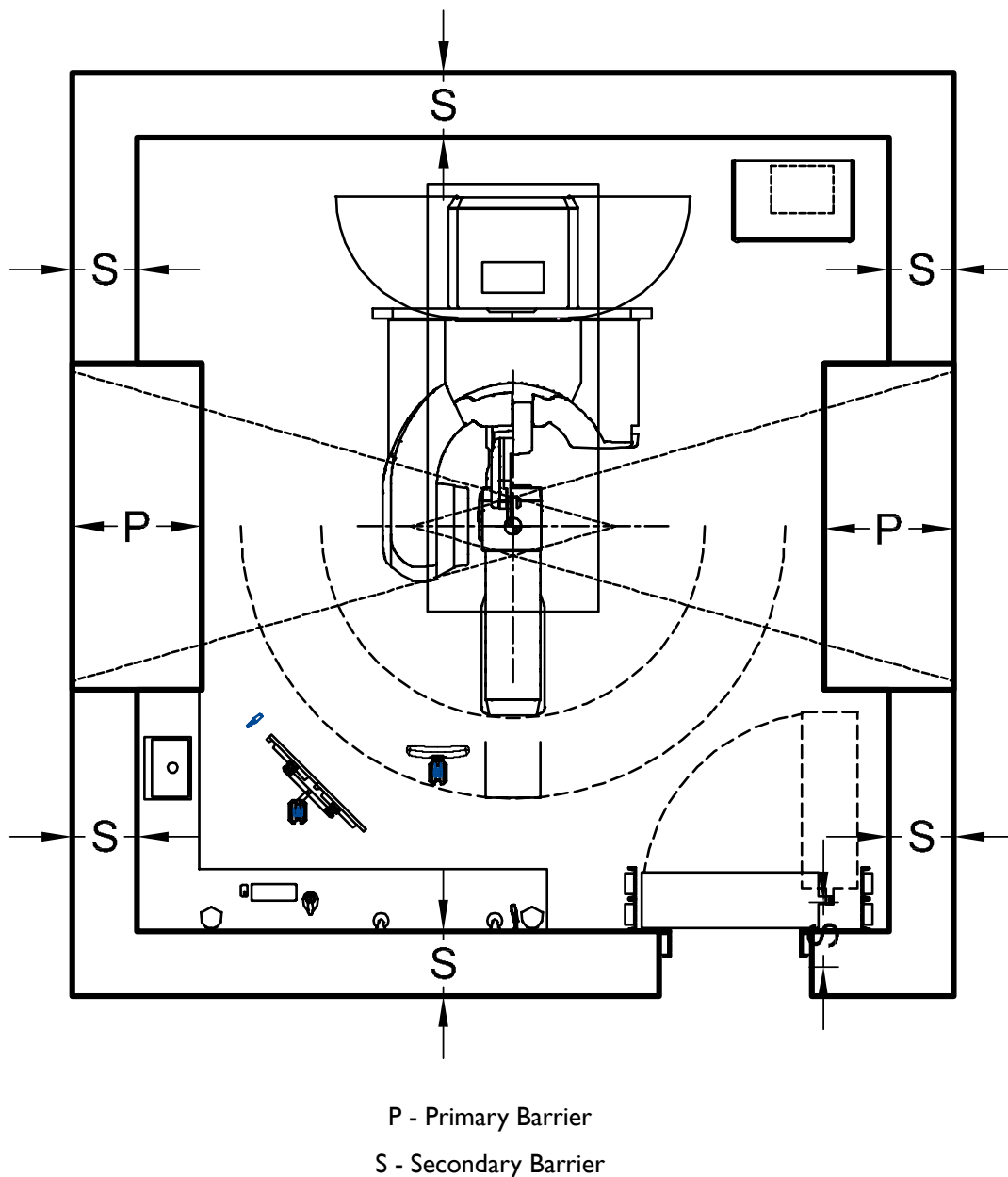
Determining Shielding Thickness

Shielding thicknesses are determined by calculations based on many parameters including machine energy, workload, treatment modality, and permissible exposure levels outside the treatment room. Occupancies in the adjacent spaces may also factor into the barrier thickness.

Typically the primary barrier areas in both the walls and the ceiling will receive direct beam radiation and will

require the highest level of attenuation, which is afforded by the greatest thickness of VeriShield shielding. Secondary barriers will be subjected to indirect radiation and will not be as thick as the primary barriers.

See tables for approximate barrier thicknesses. These values can be used for preliminary planning design but final physics calculations must be provided for the specific site.





Primary Barriers

Most linear accelerator rooms require a primary barrier which shields against direct beam radiation. Primaries are located on both the walls and the ceiling areas where the machine head rotates around the isocenter directing the beam directly at the shielding.

Secondary Barriers

The remainder of the walls are secondary barriers and typically require much less shielding than the primary.

Rounding Up

After calculating the barrier thickness requirement, the actual wall thickness must be calculated by allowing for

tolerance requirements. VeriShield block are manufactured in 5" [12.7cm] and 2 1/2" (6.35 cm) modular thicknesses. If the physics calculations determine that a wall should be 34" thick, then the actual installed thickness should be rounded up to the nearest 5" [12.7cm] or 2 1/2" (6.35 cm) increment. Thus a 34" calculated thickness would result in 35" of VeriShield protection which is equivalent to 7 layers of block.

Include Air Gaps

When calculating the total thickness of the shielding barrier, air gaps between each wythe of VeriShield block should be included, allowing for approximately 1/8" [3mm] for each wythe of block.

Approximate Barrier Thicknesses

As a guide, the following thickness will be useful in preparing preliminary schematics for physics review. These are general representations only.

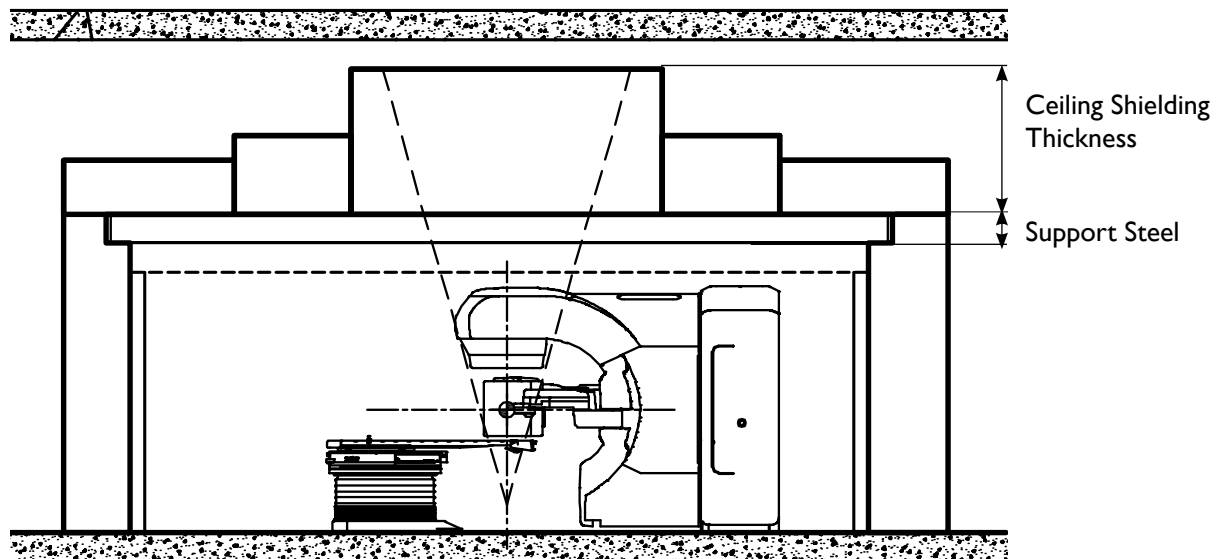
Wall			6MV	6/10MV	6/15MV	6/18MV
Occupancy	Occupancy Factor	Barrier Type	Thickness	Thickness	Thickness	Thickness
High	I	P	50 [1270]	52.5 [1334]	57.5 [1461]	60 [1524]
High	I	S	30 [762]	32.5 [826]	35 [889]	35 [889]
Medium	0.2	P	42.5 [1080]	47.5 [1207]	50 [1270]	52.5 [1334]
Medium	0.2	S	25 [635]	27.5 [699]	30 [762]	30 [762]
Low	0.025	P	35 [889]	37.5 [953]	42.5 [1080]	42.5 [1080]
Low	0.025	S	20 [508]	22.5 [572]	22.5 [572]	22.5 [572]

Table X Example barrier thicknesses in VeriShield V250 : inches [mm]



Determining Ceiling Shielding Thickness

Room ceiling thickness is directly affected by the machine energy, which dictates the amount of shielding required. In turn, the weight of this shielding then dictates the size and height of the steel support beams.



Ceiling Shielding Thicknesses						
Ceiling			6MV	6/10MV	6/15MV	6/18MV
Occupancy	Occupancy Factor	Barrier Type	Thickness	Thickness	Thickness	Thickness
High	1	P	50 [1270]	55 [1397]	60 [1524]	62.5 [1537]
High	1	S	30 [762]	32.5 [826]	35 [889]	35 [889]
Medium	0.2	P	45 [1143]	47.5 [1207]	55 [1397]	55 [1397]
Medium	0.2	S	25 [635]	27.5 [699]	30 [762]	30 [762]
Low	0.025	P	37.5 [953]	40 [1016]	42.5 [1080]	45 [1080]
Low	0.025	S	20 [508]	22.5 [572]	25 [635]	25 [635]

Structural Beams

The size of the beams that support the ceiling shielding are designed based on the weight of shielding, the transmitted loads and length of beam span. Generally W8, W10 or W12 beams are used. Low energy rooms that require shorter spans and require less protection can often use W8-W10 beams. High energy rooms usually require W10 or W12 beams.

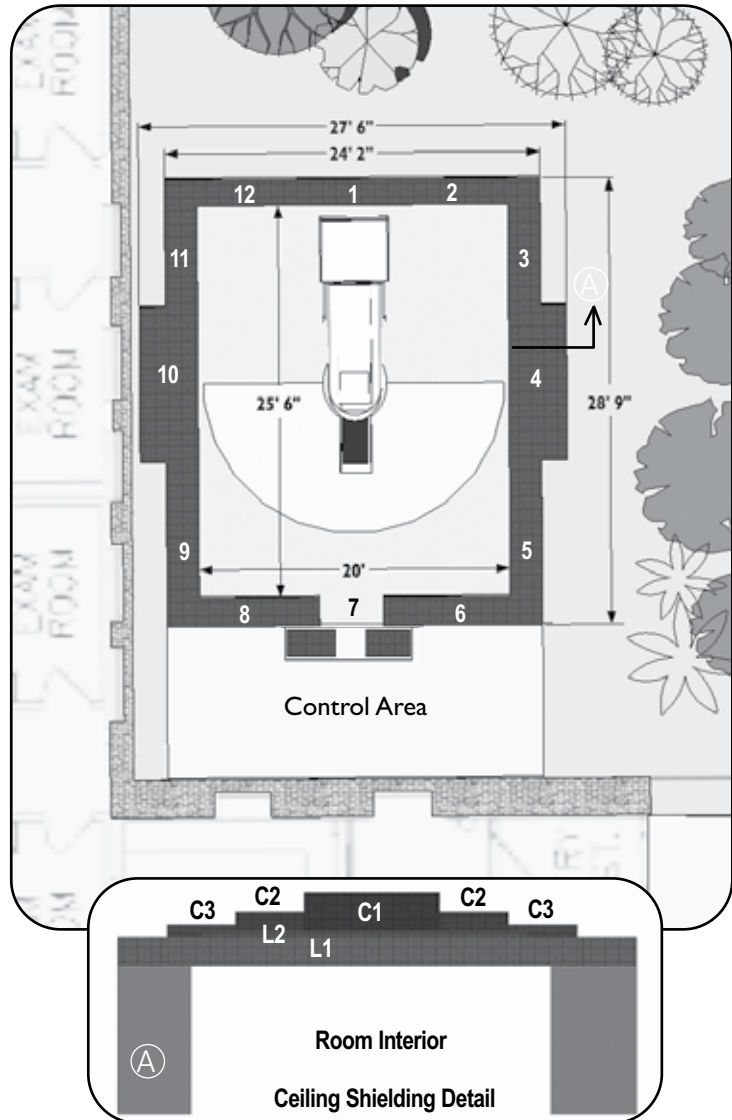


Shielding Thicknesses for Typical Linac Treatment Room Adjacent to Occupied Areas

Typical shielding thicknesses of a Veritas VeriShield installation based on varying energy levels and positioned next to an existing multi-story structure.

Parameters: Varian Truebeam - 40 patients/day
45000 cGy/wk@1m - Leakage 165 cGy/wk@1m
Occupancy T=1 for outdoor space
T=.025 for ceiling - Near adjacent building

Shielding Thickness			
Survey Point	6/10 Mv	15 Mv	18 Mv
12,1,2	27.5"	27.5"	27.5"
3	25"	25"	25"
4	50"	55"	57.5"
5	25"	25"	25"
6	22.5"	22.5"	22.5"
7	22.5"	22.5"	22.5"
8	22.5"	22.5"	22.5"
9	25"	25"	25"
10	50"	55"	57.5"
11	25"	25"	25"
C1	37.5"	42.5"	42.5"
C2	32.5"	35"	37.5"
C3	25"	30"	30"
L1	17.5"	17.5"	17.5"
L2	12.5"	12.5"	12.5"



Note: Room layout, shielding thicknesses and machine shown are included only as a general reference of the Veritas VeriShield Package. Actual shielding thicknesses will vary based upon client specifications and applicable physics/regulatory parameters.



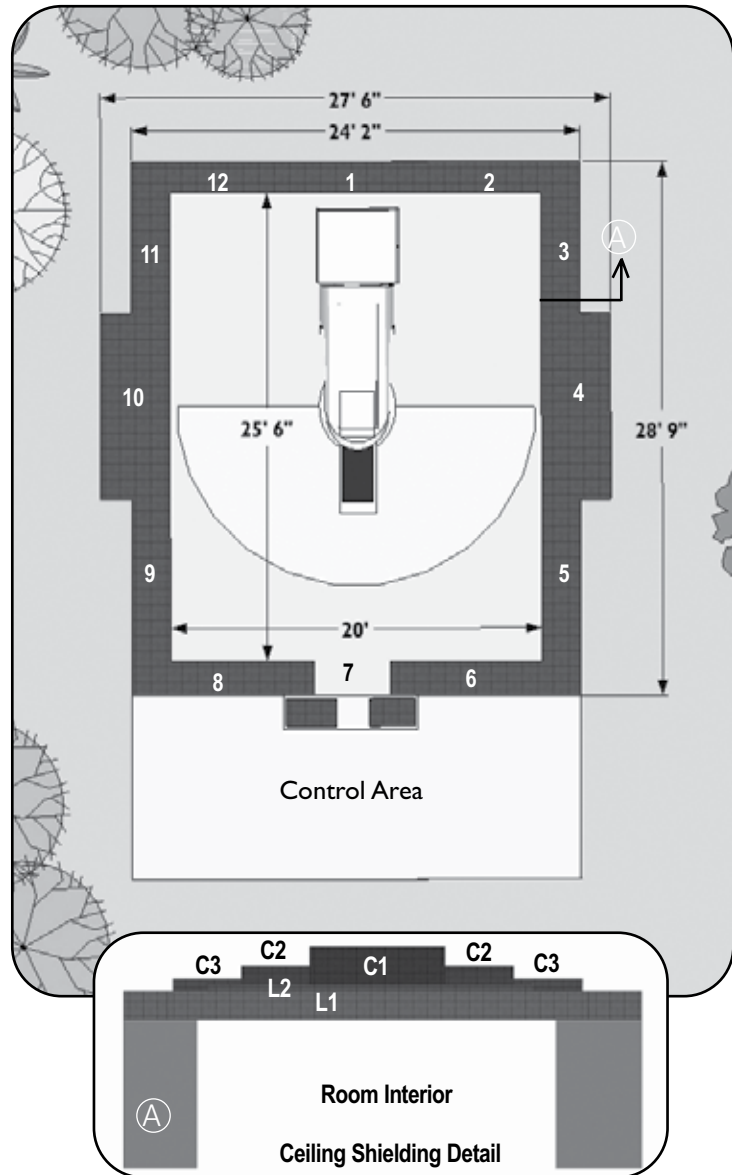
Shielding Thicknesses for Typical Linac Treatment Room Greenfield Conditions

Typical shielding thicknesses of a Veritas VeriShield installation based on varying energy levels and positioned in an open space with no surrounding structures.

Parameters: Varian Truebeam - 40 patients/day
45000 cGy/wk@1m - Leakage 1.65 cGy/wk@1m
Occupancy T=.05 for outdoor space
T=.025 for ceiling - Near adjacent building

Shielding Thickness			
Survey Point	6/10 _{Mv}	15 _{Mv}	18 _{Mv}
12,1,2	17.5"	17.5"	17.5"
3	17.5"	17.5"	17.5"
4	37.5"	42.5"	42.5"
5	17.5"	17.5"	17.5"
6	20"	20"	20"
7	22.5"	22.5"	22.5"
8	22.5"	22.5"	22.5"
9	17.5"	17.5"	17.5"
10	37.5"	42.5"	45"
11	17.5"	17.5"	17.5"
C1	37.5"	42.5"	45"
C2	32.5"	35"	37.5"
C3	25"	30"	30"
L1	17.5"	17.5"	17.5"
L2	12.5"	12.5"	12.5"

Note: Room layout, shielding thicknesses and machine shown are included only as a general reference of the Veritas VeriShield Package. Actual shielding thicknesses will vary based upon client specifications and applicable physics/regulatory parameters.





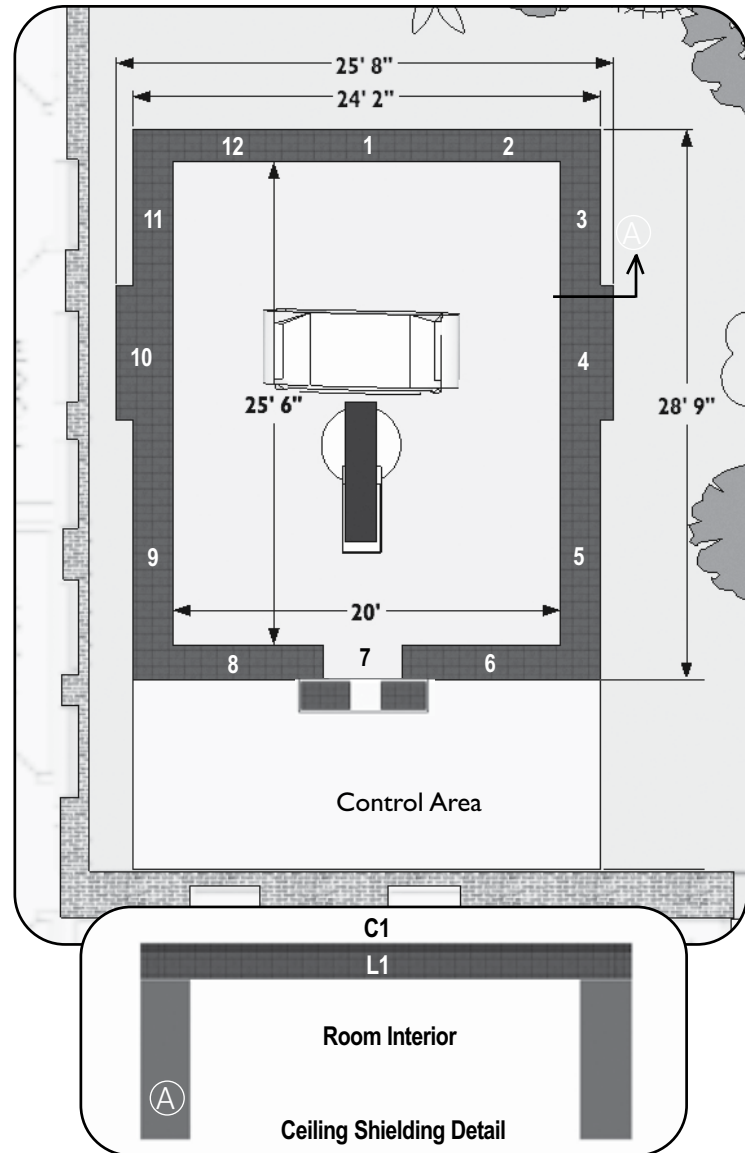
Shielding Thicknesses for Typical Tomotherapy® Treatment Room Adjacent to Occupied Areas

Typical shielding thicknesses of a Veritas VeriShield installation based on varying energy levels and positioned next to an existing multi-story structure.

Parameters: Tomotherapy - 35 patients/day
52500 cGy/wk@1m - Leakage 840 cGy/wk@1m
Occupancy T=.05 for outdoor space
T=.025 for ceiling - Near adjacent building

Shielding Thickness	
Survey Point	6 Mv
12,1,2	30"
3	30"
4	30"
5	32.5"
6	30"
7	20"
8	30"
9	32.5"
10	27.5"
11	27.5"
C1	22.5"
L1	22.5"

Note: Room layout, shielding thicknesses and machine shown are included only as a general reference of the Veritas VeriShield Package. Actual shielding thicknesses will vary based upon client specifications and applicable physics/regulatory parameters.





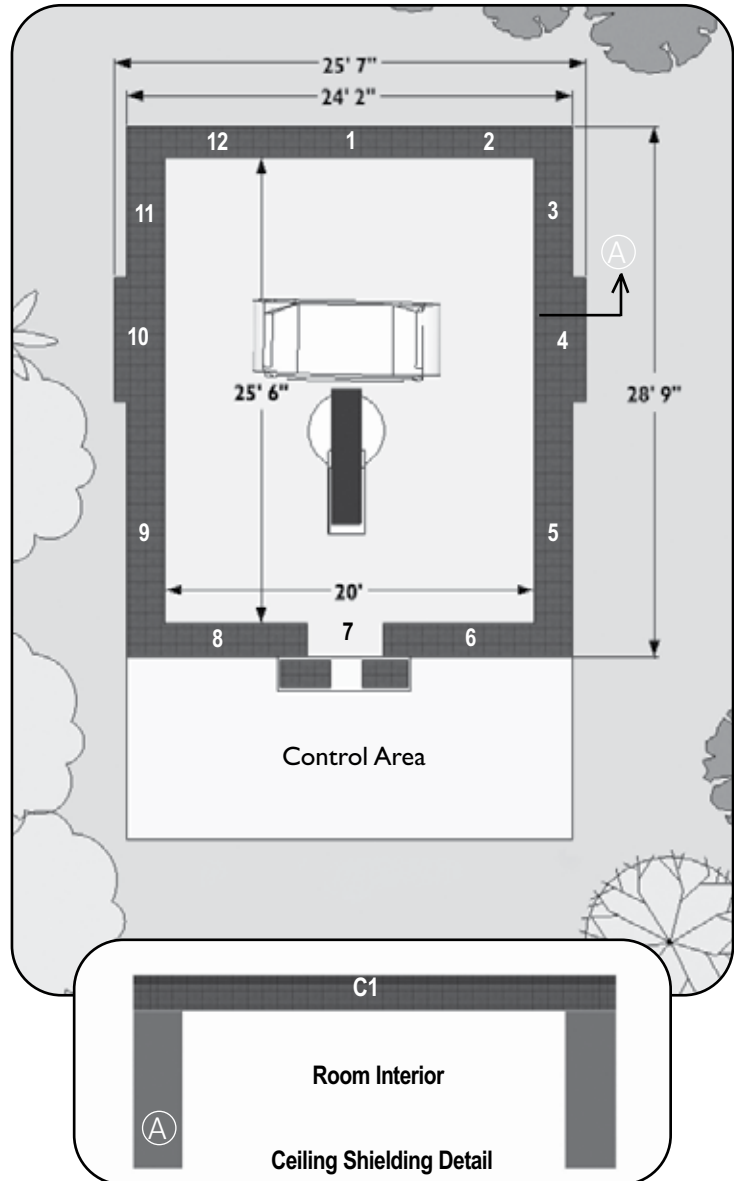
Shielding Thicknesses for Typical Tomotherapy® Treatment Room Greenfield Conditions

Typical shielding thicknesses of a Veritas VeriShield installation based on varying energy levels and positioned in an open space with no surrounding structures.

Parameters: Tomotherapy - 35 patients/day
52500 cGy/wk@1m - Leakage 840 cGy/wk@1m
Occupancy T=.05 for outdoor space
T=.025 for ceiling - Near adjacent building

Shielding Thickness	
Survey Point	6 Mv
12,1,2	17.5"
3	17.5"
4	20"
5	22.5"
6	30"
7	20"
8	30"
9	22.5"
10	20"
11	20"
C1	7.5"

Note: Room layout, shielding thicknesses and machine shown are included only as a general reference of the Veritas VeriShield Package. Actual shielding thicknesses will vary based upon client specifications and applicable physics/regulatory parameters.





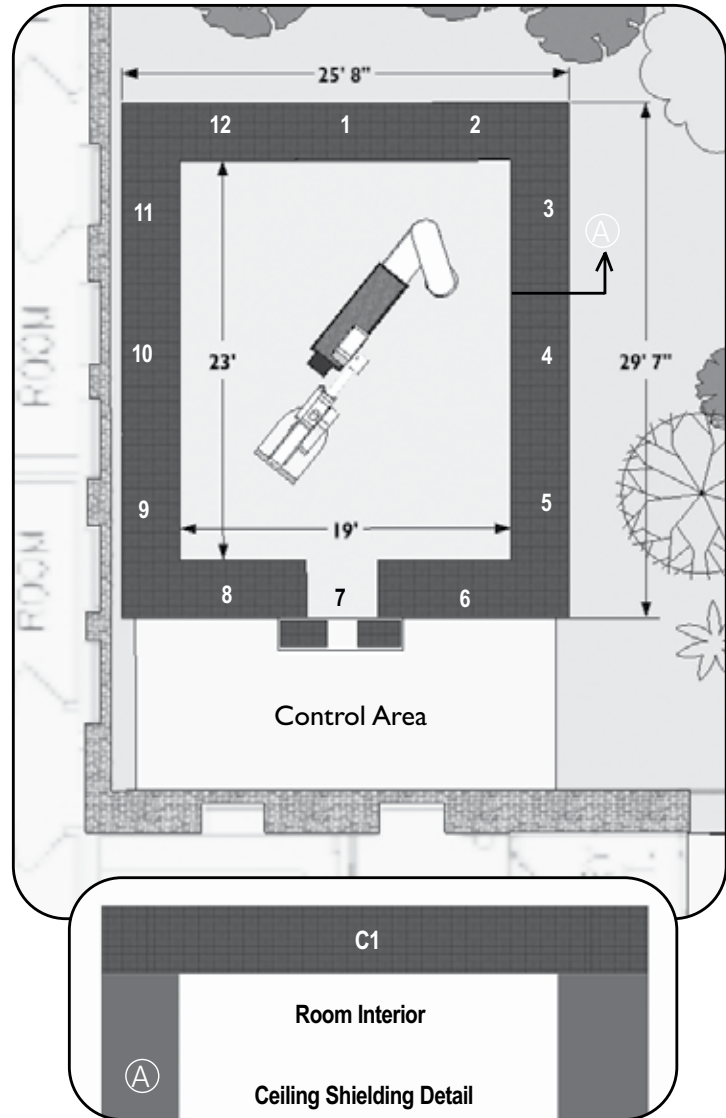
Shielding Thicknesses for Typical Cyberknife® Treatment Room Adjacent to Occupied Areas

Typical shielding thicknesses of a Veritas VeriShield installation based on varying energy levels and positioned next to an existing multi-story structure.

Parameters: Cyberknife - 8 patients/day
32000 cGy/wk@1m - Leakage 480 cGy/wk@1m
Occupancy T=1 for outdoor space
T=.025 for ceiling - Near adjacent building

Shielding Thickness	
Survey Point	6 Mv
12,1,2	40"
3	35"
4	40"
5	35"
6	35"
7	35"
8	35"
9	35"
10	40"
11	35"
C1	22.5"

Note: Room layout, shielding thicknesses and machine shown are included only as a general reference of the Veritas VeriShield Package. Actual shielding thicknesses will vary based upon client specifications and applicable physics/regulatory parameters.





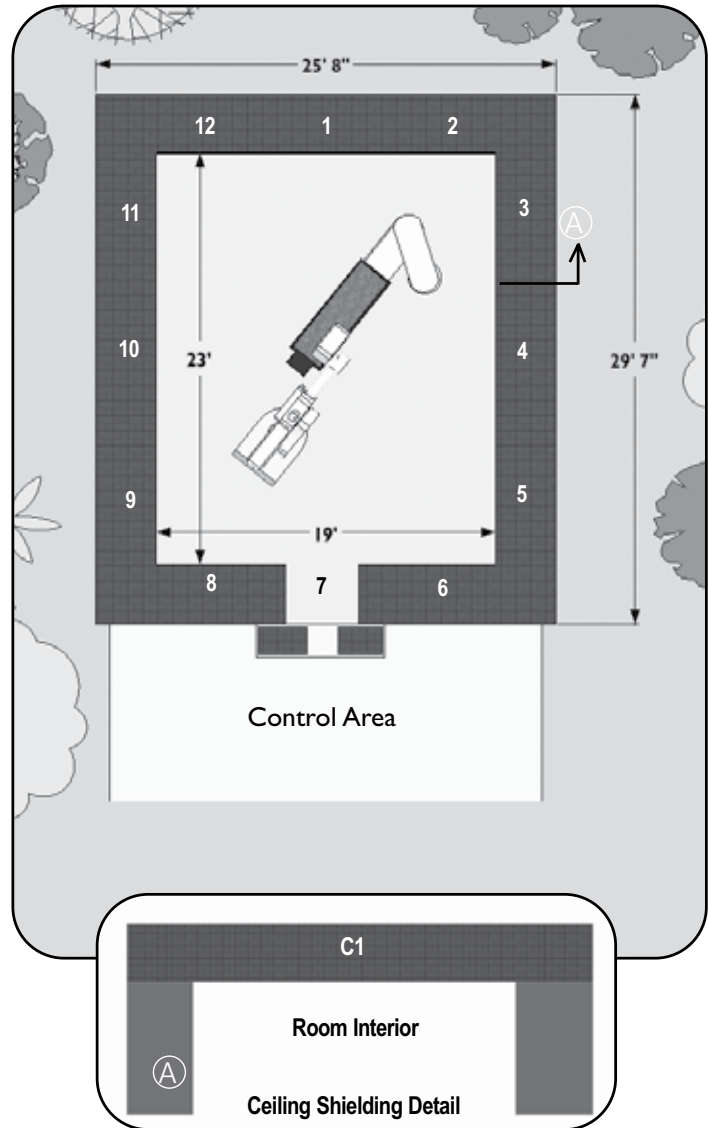
Shielding Thicknesses for Typical Cyberknife® Treatment Room Greenfield Conditions

Typical shielding thicknesses of a Veritas VeriShield installation based on varying energy levels and positioned in an open space with no surrounding structures.

Parameters: Cyberknife - 8 patients/day
32000 cGy/wk@1m - Leakage 480 cGy/wk@1m
Occupancy T=1 for outdoor space
T=.025 for ceiling - Near adjacent building

Shielding Thickness	
Survey Point	6 Mv
12,1,2	27.5"
3	22.5"
4	27.5"
5	22.5"
6	35"
7	35"
8	35"
9	22.5"
10	27.5"
11	22.5"
C1	5"

Note: Room layout, shielding thicknesses and machine shown are included only as a general reference of the Veritas VeriShield Package. Actual shielding thicknesses will vary based upon client specifications and applicable physics/regulatory parameters.





Designs To Minimize Ceiling Height

Where the overall height of the VeriShield Accelerator Room [floor to finished ceiling + service zone + beam height + shielding thickness] exceeds the available space, there are several options available to reduce the overall bunker height.

Shielding Substitution

Thickness can be reduced by substituting some of the VeriShield 250 Shielding Block with more efficient photon attenuating materials such as VeriShield V300 (a higher density block), lead or steel. A typical room might have a 25" thick V250 secondary ceiling with a 50" thick V250 primary band. This 50" primary band could be reduced by adding V300, lead, steel or a combination of all three. The shielding components can be combined to provide the desired thickness and attenuation levels in the most economical design. Physics calculations specific to the project would provide the actual ratios for substituting.

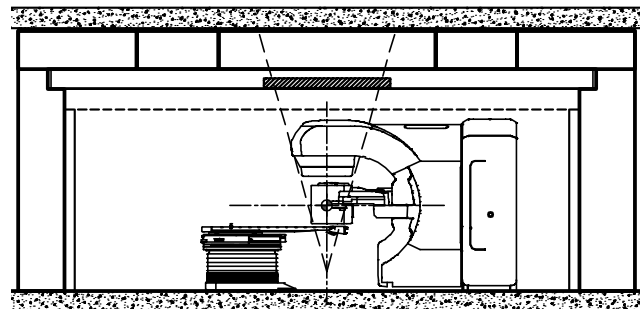
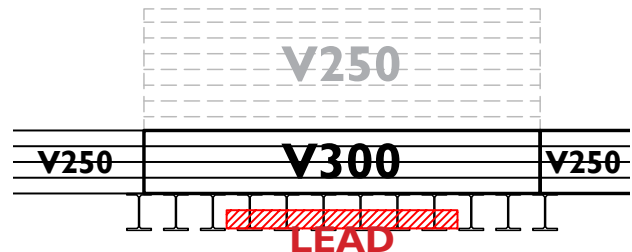
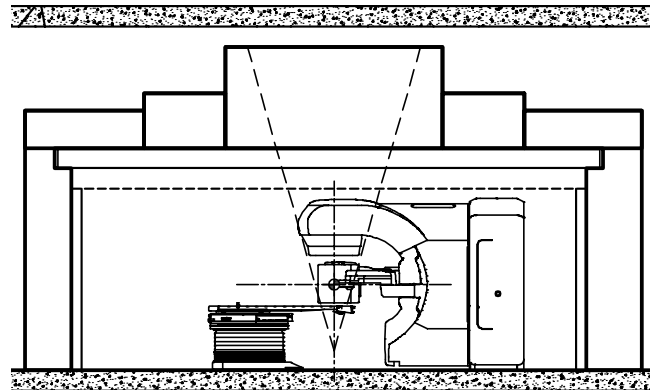
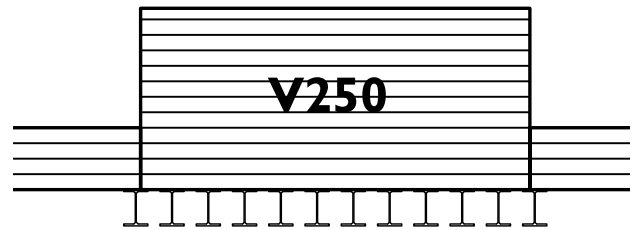
Shielding Within the Beam Webs

The space within the support steel beam webs can be utilized for shielding and be filled with shielding (V250, V300, lead or steel). This shielding must be properly sized and placed by hand, which makes this design more complex and therefore more time-consuming to construct, than typical hand-laid block.

When utilizing lead or steel, these materials should be placed below the VeriShield, as these high "Z" materials may become a source of neutron radiation when subjected to a high energy photon beam. Therefore, VeriShield or some other neutron moderating material such as borated polyethylene must be placed above the lead or steel. A commonly used design is to place the lead or steel between the steel beam webs or to lay it on the top flanges of the steel beams, and then place the VeriShield shielding protection above it.

Excavation

Another option to gain vertical height is to dig the foundations of the room below ground level and provide a ramp into the accelerator area. This is generally not a desirable option and care should be taken to keep the ramp slope to a minimum.

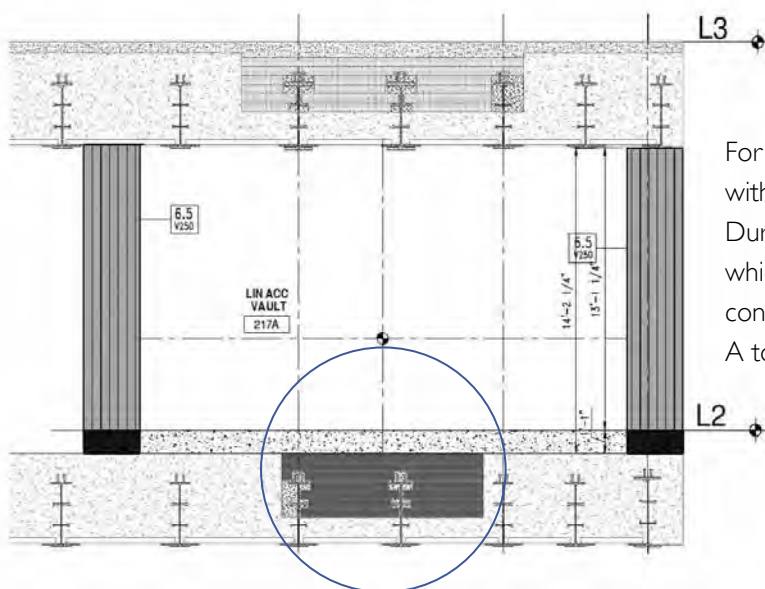
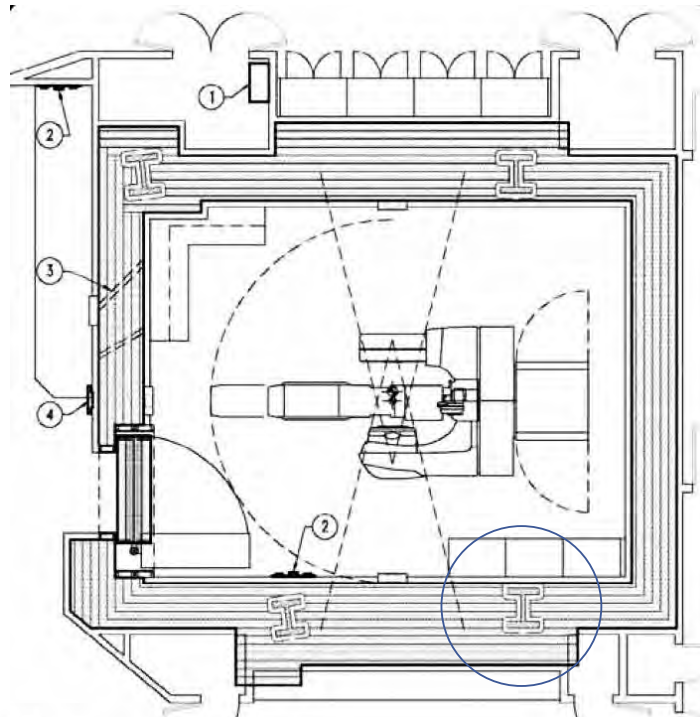




Special Circumstances

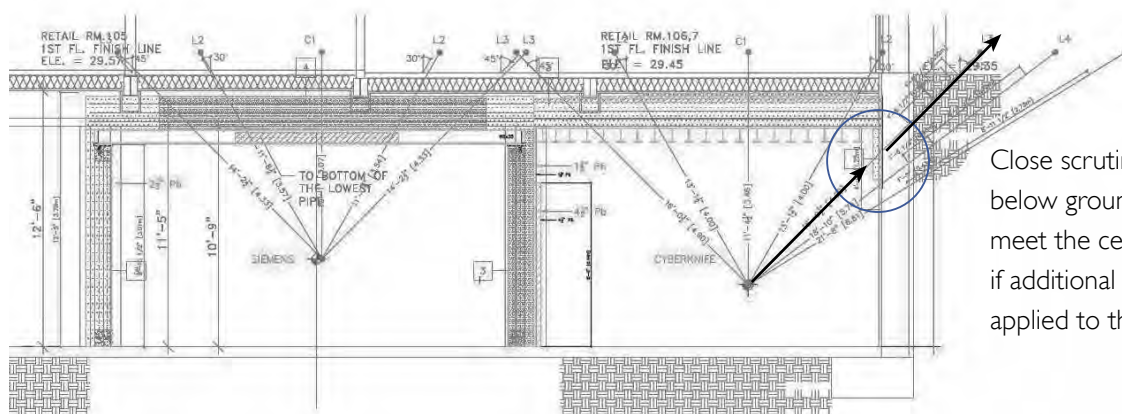
VeriShield modular shielding is especially adaptable to installations where existing conditions do not allow for expansive working space.

For installations within an existing structure, VeriShield can be constructed around structural columns, and when circumstances dictate, the columns can be encased within the shielded walls.



For upper floor installations, VeriShield can be encased within the upper and lower concrete floor structure. During construction, a void is left in the cast concrete, which is then filled with VeriShield. Shielding can be configured around structural support steel as required. A topping layer of concrete provides the finished floor.

Tight basement conditions require utilizing all available vertical space as well as intermixing shielding materials.



Close scrutiny should be given to areas below ground where earth-backed walls meet the ceiling shielding, to determine if additional shielding may need to be applied to the wall.



Typical Veritas Project Process

A typical shielding project for Veritas follows the standard process outlined below. If the project is complex or has unusual features then the process may be slightly different.

SALES PHASE

1) Client-Information Gathering

The client completes the Veritas Project Prospectus. This form details the design parameters to use by the Veritas physicists and designers when laying out the rooms.

The client supplies Veritas with the Prospectus, together with as much detailed information as possible, including:

- Plan drawings
- Section drawings
- Site Plans
- Schedules
- Client Physics Report (if one has been prepared)

If there is a space constraint (e.g. we are trying to build a room inside an existing structure with a limited height above) then details of this constraint (e.g. detailed drawings of existing conditions and clearances) are important.

If we are using existing shielding (e.g. we're sharing a wall with an existing vault) then details of the existing shielding are important.

Clear instructions in an email from the client are important if there are specific things Veritas should be aware of, e.g:

- "There are plans to build one room now, one room later."
- "This is going to house a 6MV linac but should be shielded for a 18MV linac in the future."
- "All work should be completed off hours at night."

Veritas is happy to calculate the shielding design based on the client-supplied information. However, if the client wants to complete a shielding design using VeriShield then we are happy to provide the necessary attenuation data and other information to assist.

2) Veritas Design and Pricing

The Veritas team takes the information and instructions from the client and produces shielding calculations and architectural drawings for some initial designs. Often this involves multiple options (e.g. maze-entry vs direct-entry etc) to help the client assess the best solution for their site.

These designs are priced up and a Proposal document is prepared detailing the various options and their prices. If only preliminary pricing is requested or only rough information is provided then the pricing may be presented in a Budget Estimate with an indicative range price.

3) Client Review and Coordination

The Proposal document is sent to the client for their review. Often the client will have further feedback on the design as they review it within their team. Further information may be requested from Veritas including loading information, further pricing options etc.

The steps 1, 2 and 3 are repeated until agreement is reached between the client and Veritas over the layout, room sizes, entry type, physics parameters etc.

4) Contracting

The client and Veritas sign a contract agreeing to build the project.

PROJECT PHASE

5) Invoicing and Project Manager Assignment

A Veritas Project Manager is assigned who is then the primary point-of-contact for the client.

The client is invoiced the initial payments for the project. Regular payments are continued through the design and build phase. Client's materials are allocated as the project is invoiced.

6) Detailed Design

The Project Phase progresses with the Veritas team working closely with the client team to prepare detailed architectural drawings and shielding analysis.

The Veritas designer prepares progress issue drawings which are reviewed by the client.

The Veritas physicist prepares a detailed shielding report to be reviewed by the client.



Any feedback from the client's team is incorporated into the design until the design is approved by the client and acceptable to Veritas.

A number of coordination issues are usually left until this phase. These typically include:

- HVAC/MEP services for the rooms - sizing, routing and location. This affects the shielding as the services typically enter the room through a penetration in the wall or ceiling. The coordination of this is something that typically gets finalized near the end of the design phase.
- Logistics. This is typically coordinated between the Veritas Project Manager and the client. Details include locations for staging of material, delivery routes, schedules etc.
- Door control locations (e.g. position of touch-screen HMI etc)
- Door finishes

If there are unexpected developments (e.g. layout changes, room dimension changes etc) then these may delay the detailed design. If major changes are made then there may also be a change order issued to the client to cover increased cost. If minor changes are made then these will be handled gratis.

When the final design is complete a Construction Issue set of drawings is produced. This is given a final check by the Veritas Physicist who stamps their approval of the drawings.

7) Client Site Preparation

As the shielding design progresses the client's team simultaneously designs the room foundation, fit out (unless provided by Veritas), MEP, electrical etc.

8) Shipping and Construction

Once the design is finalized and the site is ready Veritas ships the necessary materials to the site.

A Veritas Project Manager and a subcontracted labor crew arrive to build the project. This includes mechanical installation and loading of the doors.

9) Door Power Up

After the heavy construction is complete and power is available at the site a Veritas Door Technician arrives to complete the electrical power up of the door.

After this Veritas is largely complete with the project.

10) Interior Fit Out and Machine Delivery

If Veritas is not providing the room interiors then the client's team fits out the interiors of the rooms.

Once the rooms are ready for the machine delivery the equipment manufacturer delivers, installs and calibrates the machines.

11) Radiation Survey

After the construction is complete and the machine is installed each room undergoes a radiation survey. This tests the shielding to ensure it is performing as designed. The radiation survey is typically performed by the client physicist with Veritas being notified ahead of time. A Veritas physicist may attend the survey if possible.

In the unlikely event that there are shielding problems these will be remediated by Veritas under our shielding guarantee.

At the successful completion of the radiation survey a copy of the radiation survey should be sent to Veritas.



Typical Material Handling

Packaging

VeriShield block is shipped on wood pallets. The weight of a pallet of block is approximately 4,500 pounds. Up to ten (10) pallets of block are shipped per truck/container. The trucks are closed van-type tractor-trailer vehicles.

Steel beams are shipped in bundles weighing approximately 4,000 lbs. each. Beams are generally between 20' and 28' long (see arch drawings for site specific information). Beams typically weigh in excess of 1,000 lbs. each. Note: Where special rigging problems are encountered, it may be possible to cut beams in half and a structurally certified splice joint factory prepared at additional cost.

Shipping

Advance notification of date of shipment arrival will be provided by Veritas Medical Solutions. Customer will receive copies of Bills of Lading from Veritas.

Products are typically shipped in closed 20' or 40' shipping containers. Any special shipping/handling requests must be sent in writing to Veritas at least four (4) weeks prior to shipment. A rate quotation for special shipping conditions will be quoted at time of notice.

The majority of the materials used for the installation will be shipped from the USA. Twenty foot (20') shipping containers, each containing approximately ten (10) pallets of block, will be off-loaded at the port awaiting inland transport to the project site. The parties responsible for arranging and collecting materials at the port will deliver containers of block as scheduled, and as needed, to supply the project with materials. Material deliveries are to be closely coordinated between Veritas, the subcontracted installation crew, and the General Contractor.

Prior to unloading the installation material, the driver should be requested to provide the shipment Bill of Lading. The Bill of Lading should be signed and dated by the installation subcontractor after the material inside the cargo area has been checked against the material listed on the Bill of Lading to ensure that all material listed on the paperwork is present. Any discrepancies between the Bill of Lading and the actual delivery material or quantity is to be noted on the Bill of Lading, acknowledged by the signature of the driver of the delivery, and reported to Veritas immediately. A copy of each signed and dated Bill of Lading should be retained by the installation subcontractor and faxed to Veritas with the Daily Progress Report each night after the end of the workday.

Site manager is responsible for all customs clearances and the payment of all duties and taxes.

Deliveries will be made during normal work hours 7:00 am through 5:00 pm unless special conditions mandate other delivery times. Additional cost for deliveries during off-hours will be quoted separately. Customer must request special delivery times and/or notify Veritas of special storage/off loading conditions (in writing - 4 weeks prior to delivery).

Customer is responsible for properly conducting the delivery of all materials to the jobsite and for providing adequate on-site storage.

Receiving/Unloading

If a shipping dock is used for unloading the material, block may be unloaded directly from the delivery vehicle with pallet jacks possessing a weight capacity of at least 4,600 pounds. If other means of unloading the delivery vehicle are utilized, pallet jacks possessing a weight capacity of at least 4,600 pounds may be used to move the pallets to the end of the delivery vehicle for unloading. If an appropriate loading dock is not available for unloading, a forklift possessing an safe and appropriate weight capacity may be required to unload the pallets of block from the end of the truck. It takes approximately 20 minutes for two to four workers to unload a truck once a routine has been developed. All appropriate safety precautions shall be taken at all times by the installer to ensure the safety of both his installation personnel and the public. This includes, but is not limited to, pedestrian and vehicular traffic safety and flow, movement and stability of the pallets of block on paved and unpaved areas, appropriate signage, cordoning off material storage and material transport areas from all pedestrian and vehicular traffic, etc.

Steel beams, bearing plates and steel plate shielding may be delivered in closed van-type tractor-trailers or on flatbed tractor-trailers. Steel is usually bundled in 4,000-pound units. However, if the steel beams are delivered on a flatbed, it may be necessary to unload the steel beams one at a time. Veritas requires that appropriate safety, precautions and equipment be utilized at all times. Beams are generally between 20' and 28' long (see architectural drawings for site specific information). Beams typically weigh in excess of 1,000 lbs. each. Note: Where special rigging problems are encountered, it may be possible to cut beams in half and a structurally certified splice joint factory prepared at additional cost.



The installer should take all appropriate care when receiving and unloading Veritas's installation materials. Any material arriving to the project in damaged condition must be brought to the attention of Veritas's representative prior to moving or unloading any damaged material. This includes, but is not limited to, door sub-frame(s), door(s), door operator(s), duct shielding components, structural steel, steel plates, lead shielding, and bearing plates.

Storage

Storage and staging area at the site location is required. Materials may not be stored off-site unless provisions are made by customer to have materials brought to the actual site area at time of installation.

VeriShield may be stored outdoors temporarily as necessary, provided there is adequate space, security, etc. Where storage space is limited, arrangement can possibly be made with Veritas to store material at their facility and stagger truckload shipments to supply installation crew as required.

Pallets will be stored according to their type and anticipated use/need. Pallets may be double or triple stacked provided there is adequate support beneath the bottom most pallet and proper wood planking is placed at each subsequent level in order to evenly distribute the load. Pallets can be stacked 3 or even 4 high if you bridge between pallets with 4" x 4" beams over each pallet. Otherwise, Veritas recommends that the pallets only be stacked 2 high.

Materials needed for the first two weeks of installation must be located on site in close proximity to the vault construction area. Pallets will be shuttled from the storage area to the respective room footprints as needed. Palletized block will be moved via fork-lift or other appropriate material handling equipment. Single pallets of block may be set at ground level, or at each staged scaffolded area as needed. Each pallet of block weighs approximately two (2) tons, and care should be taken to ensure that block are only stored on raised scaffold platforms at designated areas. Scaffolding must be designed and constructed to support the shielding loads.

Materials for the first several weeks of installation will be located on-site prior to installation works commencing. Materials will thereafter be called off to suit the speed of installation.

At no time shall anyone be permitted by the installer to be within a proximity where injury could be sustained should the block pallet construction fail.

Upon delivery of the door, it is to be stored hinge-side up (if swing-style) and in an interior location not exposed to the elements. It is also to be stored in such a location

as to be protected from individuals walking on the door. The door should be covered securely with heavy plastic sheeting.

All door/mechanical shielding (duct shielding) material is to be stored on a flat surface only. At no time may any other material be placed upon the shielding materials. Shielding doors, motor drives, electrical components, cement and other like products should not be stored outdoors. Adequate protection from weather must be provided (indoors) for such products and materials.

Material lost, stolen, or damaged after being received by the installer is the responsibility of the installer.

If a safe and level storage area with stable soil conditions is available, one pallet of block may be stacked so as to straddle two pallets of block.

Customer is responsible for the protection and security of all materials upon arrival.

Delivery Onsite

Reasonable access to the site must be provided, which assumes palletized VeriShield block material weighing approximately 4,000 lbs. each, with skid dimensions of 42" x 36" x 30" - H, may be transported through corridors, doorways, elevators, etc. using conventional material handling (carts, electric pallet lift, forklift etc.) equipment as necessary.

Access routing may require pallets be transported through hospital corridors utilizing propane or electric powered handling equipment. Protection of floors, carpets, tile, etc. is the responsibility of owner/general contractor.

Pallets will be shuttled from the storage area to the respective room footprints as needed. Palletized block will be moved via fork-lift or other appropriate material handling equipment. Single pallets of block may be set at ground level, or at each staged scaffolded area as needed.

A 10' area (minimum) around the accelerator room footprint must be maintained throughout the course of installation. This area is used for pallet storage, scaffold setup, etc.

If possible and practical, all materials will be mechanically handled to the work area, and placed as close as practical to their final position. The installation of the blocks will be by mechanical or manual handling with operatives using block / kerb lifters where this is not possible. It is estimated that the carry distance for any block will be no more than 3 m, hence manual handling although unavoidable, is minimized.



Safety Issues

Personal Protective Equipment (PPE)

Operatives will wear hard hats. Hi-visibility vests or jackets and safety footwear shall be standard for all works onsite. Other PPE, e.g. safety goggles, masks, ear defenders, gloves, etc., will be worn as required for specific activities (e.g. welding, grouting, disc cutting). All PPE will be maintained in good order.

Safety glasses and dust masks should be worn at all times since it may be necessary, at the end of a row, to split block using a hydraulic block splitter. The splitting of the block may result in minimal dust and particles. Block composition materials are listed in the VeriShield Material Safety Data Sheets and referenced in Veritas Control of Substances Hazardous to Health documents (available upon request).

Ear plugs and other ear protection is recommended for all individuals to reduce the noise associated with cement mixers, forklifts, and material handling equipment.

First Aid Arrangements

Onsite with the project's General Contractor.

Unforeseen Hazards and Change in Working Methods

If necessary, any onsite unforeseen hazards will be reported by the designated Installer to Veritas Medical Solutions. Veritas will then notify owner/general contractor of same. If a change in work method is required, a Veritas representative will notify the owner/general contractor accordingly.

Site Induction and Method Statement Briefing

All operatives will attend a site-specific induction meeting performed by the General Contractor and be method statement briefed by Veritas prior to commencing any works on-site. Toolbox talks will be held with operatives in respect of site lifting operations.

Access and Egress/Work Area

Clear access will be maintained at all times by other trades, including personnel and materials not associated with the specific VeriShield installation, to the bunker areas, unless contractor operatives are providing attendances to the Veritas works (e.g. ramp) necessary at that particular sequence of the installation. No other works or workers will be permitted within the bunker areas during the bunker construction. All operatives on-site will receive a toolbox talk on designated working areas and the importance of maintaining of pedestrian walkways.

Plant/Work Equipment

All plant/work equipment will have required certification/ testing, and will be maintained in good working order.

Scaffolding

Scaffolding to footprint of each bunker shall be designed for loads and site specific requirements. Scaffold will be raised in approximate 1200 mm lifts to assist manual laying of blocks. All scaffolding to be arranged by the subcontractor and approved by the General Contractor. It is the responsibility of the scaffolding subcontractor to coordinate the design and erection of scaffolding as needed to accommodate the sequencing of the Veritas crew. The costs for these attendances (materials & labor) are by Veritas's installation subcontractor.

Scaffold will be designed by specialist subcontractor with design being checked by General Contractor. Scaffolding will only be used, once design details have been thoroughly checked and verified.

Manual Handling

If possible and practical, all materials will be mechanically handled to the work area, and placed as close as practical to their final position. The installation of the blocks will be by mechanical or manual handling with operatives using block/ kerb lifters where this is not possible. It is estimated that the carry distance for any block will be no more than 3 m, hence manual handling although unavoidable, is minimized.

Control of Substances Hazardous to Health

Material Safety Data Sheets (MSDS) will be provided by Veritas for the VeriShield block and high density grout. The block and grout are cement and aggregate based products. The hazards being dust and cement particles. It is proposed that wherever possible, block will be cut by guillotine cutter; or if not, will be wet disc cut to minimize dust. When using grout, operatives will wear gloves and overalls to prevent contact with skin.

Hot Works - Welding

The only hot works typically associated with the bunker construction is the tack welding of steel beams and steel plates to bunker roofs or the setting of door assemblies.

Welding will have its own dedicated generator (at no time will the main electrical supply be used for welding). Welding will be in open air with no combustible materials in the



vicinity. Operatives carrying out welding will 'screen off' the work area, have a fire extinguisher adjacent the work area, and will wear facemask, gloves and overalls in addition to standard PPE.

Welding location(s) will be advised to the General Contractor and a 'hot works' permit obtained by the General Contractor, who will issue a daily permit for any 'hot works'.

Environmental/Waste Disposal/Washing Out

Veritas presents that all waste is inert and no special disposal procedures are required. Waste block and grout is to be cleared to general waste skips daily. Pallets shall be stacked within crane radius and removed from site on a 1-2 week basis.

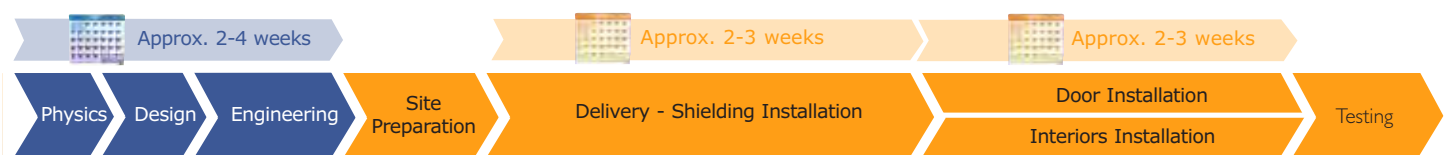
All cleaning of mixers/tools, etc. will be performed in a designated 'wash out area' only. The works are not anticipated to omit any excessive noise, vibration or dust.

It is expressly understood that alcohol and drugs are prohibited on the jobsite. Additionally, it is expressly understood that no subcontractor installation personnel may be on the jobsite if they have partaken of any alcohol or drugs within eight hours prior to the start of the workday or during the workday. It shall be the sole responsibility of the installation subcontractor to determine whether any subcontractor personnel taking legally prescribed medications shall be permitted to be on the jobsite and to determine what, if any, tasks the individual may undertake.

Typical VeriShield Timeline - Single Radiotherapy Room

The following details represent the typical production timeline for a standard Veritas VeriShield Linac Treatment Room facility from completion of the Project Prospectus to the point of door installation. At many points of the timeline, services may overlap and run concurrently.

Receipt of Completed Project Prospectus by Veritas	
Physics evaluation, Shielding estimate and Quote development	
Receipt of Authorization to Proceed/Signed Contract with downpayment	
Physics review and Engineering - start upon receipt of downpayment	
Design services – (may run concurrently)	
Physics Planning –	1 Week
Architectural Planning –	1-2 Weeks
Engineering/Unit Design creation of Permit Set –	2-3 Weeks
Following final design approval by client: (some items run concurrently)	
Manufacturing Services	
Materials Procurement – Shielding Construction –	2-3 Weeks
Door System Fabrication and Mock Up	8-12 Weeks
Shipment to Jobsite	1-2 Weeks
Installation –	
Placement of VeriShield or VPAC modules	1-2 Weeks
Structural Steel placement	2-3 Days
Door frame installation	1 Day
SmartDoor installation, shielding load out	2-3 Days
Exterior door finishes and door powerup	1-2 Days



There are also scheduled requirements that are not the responsibility of Veritas and must be handled by the client (permits, sitework, Utilities, etc.). These should be factored into the overall timeline as they may significantly impact the schedule.



Typical Veritas Scope of Work - Single Radiotherapy Room

PHYSICS	To be provided by Client	To be provided by Veritas
Establish primary workload	✓	
Determine ratio of conformal IMRT TBI	✓	
Establish design exposure limits	✓	✓
Calculate required shielding		✓
Prepare detailed physics report with calculations		✓
Language translation and submittal for physics approval	✓	
Establish testing protocol	✓	✓
Provide drawings and sketches of ancillary spaces surrounding vault	✓	
Provide section drawings illustrating conditions above and below bunker	✓	
Submit for local licensing, permits, etc.	✓	
Operating facility within design parameters	✓	
Supply selected machine energy dose rate output and equipment specifications	✓	
Assign occupancy factors to adjacent spaces		✓
Review and approval of above factors	✓	
Assign usage factors		✓
Design primary ceiling barrier width		✓
Design primary wall barrier width		✓

ENGINEERING	To be provided by Client	To be provided by Veritas
Prepare facility layout for client approval		✓
Provide foundation loading from bunker		✓
Prepare detailed installation drawings		✓
Prepare installation specifications		✓
Prepare sequence of shipping and logistics		✓
Layout of column gridlines and isocenter	✓	
Layout of linac vault from previously marked column gridlines and isocenters		✓
Resolution of any site field layout discrepancies	✓	✓
Structural calculations for seismic conditions - walls		✓
Structural calculations for seismic conditions – ceilings		✓
Structural calculations for seismic conditions – foundation(s)	✓	
Provide product specifications		✓
Review Veritas installation drawings for site location accuracy	✓	
Calculate required room air changes	✓	
Establish required electrical, plumbing, and air service needs	✓	
Determine water chiller	✓	
Determine power conditioner requirements	✓	
Obtain all required architectural, structural, electrical, and mechanical approvals	✓	
Apply for any required permits	✓	
Provide architectural support services		✓
Obtain local architectural design services for project	✓	
Obtain local engineering services	✓	
Design main works	✓	



PRODUCT AND MANUFACTURING BASIC PACKAGE	To be provided by Client	To be provided by Veritas
Procure all required raw materials for shielded bunker walls and ceiling		✓
Manufacture all VeriShield™ interlocking block modules		✓
Provide all steel bearing plates, steel rebar reinforcement, clips, and fasteners related to structural ceiling support		✓
Provide all structural steel beams		✓
Furnish the embedded shielded door frame		✓
Provide (1) opening each for supply and return air		✓
Furnish duct shielding		✓
Provide (1) 4" diameter (100 mm) dosimetry pipe shielding		✓
Provide all required grout		✓
Provide all supplemental shielding plates		✓
Provide structural support for all duct shielding		✓
Provide sufficient materials to construct shielded bunker to 3.3m height to underside of steel beam structure		✓

PRODUCT AND MANUFACTURING RADIATION SHIELDED DOOR – BASIC PACKAGE	To be provided by Client	To be provided by Veritas
Procure all required raw materials		✓
Manufacture door, support structure, etc.		✓
Install/assemble all necessary components – install shielding		✓
Provide and install included safety systems		✓
Furnish/Install decorative surface finishes		✓
Furnish appropriate control stations and push buttons – touchscreen		✓

PRODUCT AND MANUFACTURING INTERIORS – OPTIONAL PACKAGE	To be provided by Client	To be provided by Veritas
Prepare architectural selection materials		✓
Provide all engineering and architectural services as required		✓
Procure all required materials as identified in final offer sheet		✓
Install client-selected interior package		✓

PRODUCT AND MANUFACTURING HVAC – OPTIONAL PACKAGE	To be provided by Client	To be provided by Veritas
Establish operating requirements		✓
Design appropriate system for conditions		✓
Procure all required materials as identified in final offer sheet		✓
Install final system		✓



SHIPPING & IMPORTATION – AS APPLICABLE	To be provided by Client	To be provided by Veritas
Preparation of commercial invoice, ocean bill of lading, and related shipping documents		✓
Loading of shipping containers with seal numbers		✓
Land transport from Veritas facility to Port of Departure		✓
Ocean transit with marine insurance – if applicable		✓
Customs clearing at Port of Entry – if applicable	✓	
Settlement of duties and taxes as may be applicable upon arrival at port	✓	
Transfer of shipping containers from port of entry to project site		✓
Off-loading of containers and transit to storage area		✓

GENERAL SITE INSTALLATION CONDITIONS	To be provided by Client	To be provided by Veritas
Welfare (toilets, canteen)	✓	
Temporary Water Supply	✓	
Temporary Electricity Supply (110V)	✓	
Lighting	✓	Task lighting
Heating	✓	
One-time handling		✓
Storage (size, closed/open, etc.)	✓	
Security (hours of operation)	✓	
Telephone (authorized person)	✓	
Scaffolding/Access arrangements	✓	
Unloading/Movement of materials to workforce		✓ (one time)
Disposal of Rubbish (provision of skips, arrangements for contaminated waste, etc.)	✓	
Craneage (tower crane, mobiles, etc.)	✓	
Hoists (type, operation of and load capacity) – if required	✓	
Transport from Veritas manufacturing		✓
Transport from port of entry to jobsite (after customs clearing and duties and taxes settlement by client)		✓
Clear customs and pay any duties and/or taxes – if applicable	✓	
Transport on site		✓
NOTE: When Veritas supplies craneage for the sub-contractor/supplier, any downtime which results from the crane being winded off/broken down etc. will be borne by the sub-contractor/supplier		



INSTALLATION	To be provided by Client	To be provided by Veritas
Laying of all high and low density VeriShield block		✓
Installation of steel support structure		✓
Installation of door frame		✓
Provide opening for HVAC supply and return air		✓
Shielding of all HVAC and other MEP services		✓
Installation of all reinforced grout cells and bond beams		✓
Installation of door		✓
Wiring of door controls and operator	✓	
Room layout from isocenter and column marks		✓
Preparation of method statements		✓
Preparation of work sequencing		✓
Preparation of risk assessment		✓
Preparation of health and safety manual		✓
Provide on-site mixers		✓
Provide general hand tools and equipment		✓
FINAL INSPECTIONS & CLOSE OUT DOCUMENTS	To be provided by Client	To be provided by Veritas
Quality assurance inspections and report during construction		✓
Radiation survey of facility	✓	✓
Preliminary report of radiation survey readings	✓	✓
Review of survey results and findings report	✓	✓
Submissions to national, state, and/or local regulators for licensing, permits, acceptance, etc.	✓	
Remediation (if necessary)		✓
Removal and replacement of finishes in case of remediation	✓	✓
Preparation of all manuals for shielded door		✓
Warranty and guarantee certificate		✓
Review and final approval of drawings	✓	
Testing of mortars or grout as may be required per spec		✓
Structural reviews and reports of field connections per spec as applicable		✓



Typical VeriShield Installation - Individual Module Placement (non-VPAC™)

Swing-Style SmartDoor

Erection/Construction Requirements

Veritas' subcontractor is responsible for providing all necessary tools to complete the room installation. A tool for splitting block is greatly beneficial both in time and in accuracy of the size of the split block. Three types of tools are customarily used: a block splitter with a 30-ton capacity bottle jack, a 30-ton capacity log-splitter, and a diamond-tipped saw. It is the discretion of the installation subcontractor as to the tool utilized.

Other tools found to be of benefit are block lines, whisk hand-brooms, chalk lines, laser level, six-foot bubble level, torpedo level, and heavy-duty leather gloves.

Plant and Material Requirements

The following list describes typical equipment and materials that are typically the responsibility of the owner/general contractor, although this is not always the case. It is the owner/general contractor's responsibility to verify material requirements with the Veritas Project Manager. All materials must be available onsite prior to the arrival of the installation crew.

Plant Requirements

- Forklift with side shift - 2268kg (5,000 lb.) capacity, to be used at foundation level of the VeriShield room for constructing walls and general material handling duties. Note: General Contractor will need to crane or lift ceiling shielding up onto the steel beams after the beams are rigged into place. Depending on site conditions, delivered block will need to be stored in proximity to the crane for the ceiling shielding.

- Large Two-bag Concrete Mixer
- Large Cement Mixer (for mortar)
- Tele-Handler Boom Lift
- Block Splitter
- 200 linear meters of scaffold 3m high with sufficient planking - coordinated with subcontractor
- Two Hilman equipment rollers or equivalent - 453kg (1,000 lb.) capacity each
- Oxygen/acetylene cutting torch
- 225 amp welder
- Electric pallet jack - 2268kg (5,000 lb.) capacity (Note: electric, battery driven with charger)
- Manual pallet jack - 2268kg (5,000 lb.) capacity





- Crane or LOL for lifting and setting I-beams and ceiling shielding materials
- "Hilti" shot gun w/ charges
- Hammer drill with 19mm (3/4") bore
- Trash dumpster for used pallets and debris
- Ladders - types and specifications to be determined
- Wheelbarrows for transporting mortar and grout
- Electrical power access for hand tools, power saws, etc.

Site Preparation

Newly poured concrete floors or foundations must be cured and capable of supporting forklift and palletized block. Veritas assumes no responsibility for the adequacy of concrete, routing paths, etc. It is the customer's responsibility to ensure proper foundations are available at time of installation of VeriShield vault.



Reasonable access to the site must be provided, and assumes that palletized VeriShield material weighing approximately 1814kg (4,000 lbs.), with skid dimensions of 1219 x 1219 x 762mm (48" x 48" x 30"h), may be transported through corridors, doorways, elevators, etc. using conventional material handling (carts, electric pallet lift, forklift, etc.) equipment as necessary.



Where special rigging problems may be encountered, such as lowering materials to a basement level through an elevator shaft, cutting holes in existing floors or walls, etc., a separate quotation (after a field inspection is made) shall be provided to cover rigging costs, etc.

Unless directed in writing by Veritas, the VeriShield block installer is to install Veritas' products to the specifications and dimensions as shown on the issued Veritas installation drawings. Should conflicts or questions arise, Veritas is to be notified immediately before continuing further with the installation.

Prior to starting the installation, the installer shall verify that all impediments to the shielding installation have been removed from the work area. Any impediments or penetrations that have not been removed shall be reported immediately to the Veritas Project Manager.

The VeriShield installation subcontractor shall verify all dimensions as shown on the Veritas installation drawings prior to commencing the installation.





All demolition work is the responsibility of the owner/general contractor, who will also handle all street offloading permits (if applicable) and supply all necessary special equipment, such as cranes, etc.

Temporary lighting, heat, water, electrical service for mixers, welders, etc. (110v, 30A & 220v, 75A) must be supplied by owner/general contractor. Access routing may require pallets be transported through hospital corridors utilizing propane or electric powered handling equipment. Protection of floors, carpets, tile, etc. is the responsibility of owner/general contractor.

Vertical Height Requirements: All existing pipes, ductwork, electrical conduits, clips and other items located above or around the VeriShield vault area must be removed. Consult with Veritas regarding any questions concerning existing items that may interfere with installation.

Where existing beams or columns fall within the shielding ceiling or walls, all fireproofing materials must be removed to allow proper grouting around beams to maintain shielding integrity.

The owner's structural engineer must check any beams that need to be grouted around and incorporated into the ceiling shielding system. VeriShield ceiling support beams are only designed to carry shielding loads. If building loads are to be transferred to the VeriShield Accelerator Room system, the owner's structural engineer must provide details, engineering, etc. as required to comply with all building codes. Note: This information must be provided during the design development stage of the project so Veritas Design Department can account for the necessary loads in the overall shielding design.

Customer is responsible for pre-delivery inspection of construction zone and for providing or preparing:

- layout of isocenter of each room and other agreed upon boundaries or layout lines
- column locations
- properly sized and fully cured footings
- floor slab - poured and cured
- covering of any open trenches that would prevent the movement of forklifts/pallet jacks to the jobsite
- a clear delivery path
- no steps (can use elevators if properly coordinated and sized)
- forklift accessibility
- temporary heat, power and water

Material Requirements to be Obtained Locally by Owner/General Contractor

- 50 sheets of 1219 x 2438 x 19mm (4'0" x 8'0" x 3/4") rough exterior grade plywood
- Welding rods - 22.7kg (50 lb.) box
- 50 pieces 51 x 76 x 2438mm (2" x 3" x 8') long subgrade timber
- 4 boxes masonry wall ties (500 per box)
- 5443kg (6 tons) of Type I Portland cement
- 4535kg (5 tons) of masonry sand
- 300 linear meters of #6 rebar (reinforcing rod)
- 1,500 "Hilti" gun nails 38mm (1-1/2")
- 1,500 "Hilti" gun shots

Crews

Installation crews should be skilled mason(s) with 5 years or more construction experience and shall be trained in the proper installation of VeriShield. Individual work crews will generally consist of 3 to 4 masons, 3 to 4 laborers and 1 forklift operator.

Veritas shall provide a field supervisor/Project Manager periodically during the course of installation to ensure proper placement of the Veritas materials and the integrity of radiation shielding. Frequency and duration of site reviews/visits are at the discretion of Veritas Project Management.

Administrative Responsibilities

Reports and Paperwork: Veritas requires that the Veritas Daily Progress Report be completed and faxed to Veritas' home office (484-991-8521) after completion of each day's installation work.

Each day's progress should be clearly represented on a plan view sketch. Indicated elevations or courses of block installed on the various walls or ceiling by the end of the day's work should also be delineated. Any problems or difficulties encountered in the course of the day's work should be described in full on the Daily Progress Report.

Any onsite project meetings attended by Veritas' installation subcontractor should be reported in full on the Daily Progress Report.

When material is delivered to the project, signed and dated copies of the Bills of Lading are to be faxed (484-991-8521) to Veritas' home office within twelve hours of the completion of the day's deliveries.



Layout

It is the owner/general contractors responsibility to determine and mark isocenter. Based on that location, layout lines will be marked out for the shielding locations and other room structure such as the door frame, etc. as indicated on the issued Veritas Design Drawings.

Surface is to be flat, plumb and level within 6.35mm (1/4") in all directions.



Prior to the start of shielding placement, all layout lines will be clearly marked and labeled. All dimensions (vertical and horizontal) of the project area are to be confirmed by direct measurement, in more than a single location, prior to the start of work.



Materials are then positioned for convenience to begin construction. Provide proper access routes to the installation area. Proper coordination between trades must be established in order to transport VeriShield materials to the installation site. Provide an adequate storage/staging area.

First Course

The initial layer of VeriShield block is to be mortared in place. A maximum of 9mm (3/8") bed of mortar shall be laid to start the installation of VeriShield. Block will be laid in a modified running bond pattern with staggered seams between each respective wythe of block.

Mortar must be freshly mixed and be proportioned with 1 part cement, 1 part lime and 6 parts sand (Type N Mix). Mortar shall comply with ASTM C270 specification for Type N Mix.



Should the block require more than 9mm (3/8") of mortar due to the floor not being level, the condition must be reported to the Veritas representative immediately.



It is important to ensure the first course is plumb and level and each block is securely mated with its neighboring block. No gaps should be left between blocks.



The space for the second wythe of block is left open to become the bond beam. The third and all subsequent wythes of block (if necessary when specified by the shielding design) are installed in the mortar. It is important to fit block together as tightly as possible to avoid any gaps between wythes of block or the individual blocks themselves.



Depending upon the overall shielding design, additional wythes of block may be left out for the placement of additional bond beams. High seismic zones will incorporate a large number of bond beams throughout the shielding.



Corners are constructed by butting staggered blocks together as shown, with first layer blocks set in mortar. Multiple corners can be constructed simultaneously with care given to maintaining accurate alignment of the wythes of block running between the corners.



Empty wythe spaces for the first level of bond beams are left according to Veritas supplied drawings. This high-density grouted bond beam shall consist of steel reinforcing bar laid in accordance with installation drawings with grout materials placed and properly compacted.





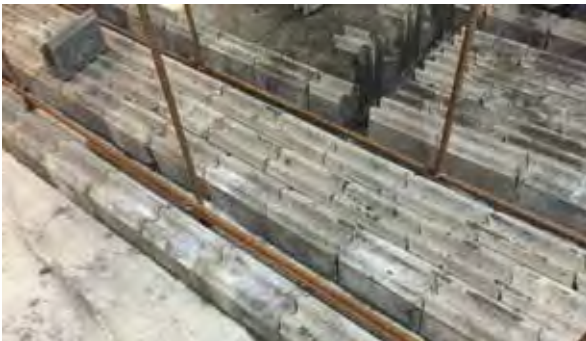
Locations for vertical rebar placement are measured out and clearly marked according to the drawings. Size and type of rebar will be specified (typically #6 rebar).



Holes of the required diameter are drilled to a depth of 228mm (9"), and all debris blown out of the holes.



2268kg (5,000 lb.) non-shrink epoxy is installed into the holes and filled to the top. Care should be taken to avoid air pockets.



Vertical rebar is inserted into the holes and set as deeply as possible. Allow epoxy to cure prior to attaching horizontal rebar. Sections of rebar shall be oriented in the middle of the horizontal bond beam.



Once the vertical rebar is set, additional rebar is added horizontally to reinforce the horizontal bond beams. Where sections of rebar overlap, a minimum of two feet of overlap is required and overlapping sections of rebar must be tightly wired together every one foot in distance. All corners and intersections shall have a minimum two-foot rebar overlap.



Horizontal rebar is tied wherever possible to the vertical rebar using wire ties. All overlapping sections of rebar must be tightly wired together every 305mm (1') in distance.



Following rebar installation, VeriShield grout is poured into the empty spaces left between blocks and filled to the level of the shoulder of the block (just below the start of the sine wave curves located on the top of the VeriShield blocks). A screed may be used to ensure the correct elevation and levelness of the VeriShield grout in the bond beam.



Grout should not extend above the sine wave curves of the block as this will prevent the curves on the bottom of the next layer of block from fitting precisely with the curves on the top of the first layer. Grout materials must be placed and properly compacted to avoid voids in the bond beam.



Bond beam grout installation continues around the perimeter of the room until all first course bond beams are filled. Bond beam sections require a minimum 24-hour curing period before erecting additional block layers. For safety, install high visibility cushioned safety covers on top ends of all rebar.



Once the grout is set, the second layer of block can be placed, leaving an open area around the projecting vertical rebars. This space will be filled later with grout to form the vertical bond beams. This and subsequent layers of block are dry fit, with care given to placing all block as tightly as possible. Remove any debris as necessary prior to placing blocks. Gaps between blocks should not exceed 3mm (1/8").





Additional Courses

Place all VeriShield block in a modified running bond pattern. The first two courses are placed in a stack bond. The third course is offset to form a standard running bond pattern. The fourth course resumes the stack bond. Subsequent courses of VeriShield continue this four course bond pattern. All block is to be installed as tightly as possible, and all wythes of block are to be installed within 6mm (1/4") of the preceding wythe of block. VeriShield grout may be used to level block between any/all courses of block if necessary to maintain the level and plumb of the block and walls. All walls should be laid plumb, level, and true to line. Finished walls are to be plumb within 6mm (1/4") in ten feet.

Intersecting block (ie: corners) is installed in the same manner as normal masonry block corner construction. However, in order to permit intersecting VeriShield block to be installed properly, the curves on one-half of the top face of the block beneath the course being installed must be removed completely to the level of shoulder of the block. Failure to remove the teeth on the lower block will keep the upper course of block from being installed level. When the upper overlapping block is installed, a small amount of VeriShield grout is installed on the surface of the bottom block to completely fill the void created by the upper block's teeth laying on the flat surface of the bottom block.

Block is laid to provide space around the vertical rebar. Typical opening is 127mm x 127mm (5" x 5"). Drawings will specify if additional space is required for a larger bond beam. Where horizontal and vertical bond beams intersect, rebar must be wire tied together.

Spacing of block is repeated for upper level bond beams, rebar is placed and tied as before, and VeriShield grout is poured into the spaces. Grout should be vibrated to ensure complete filling of all voids.

Block may be dry stacked up to 5 courses. At every 5th course of block (63 cm high) a mortar joint will be required between the horizontal joint in order to keep walls level. At every 5th course VeriShield HT half-thickness blocks are also added to the layer in order to offset the full blocks, enabling them to span across the lower blocks. This serves to lock the vertical wythes together without the use of wall ties or other attachments.



Every fifth course of block is to be leveled with mortar as necessary. Leveling bed should be kept to a minimum thickness as large quantities of mortar will affect the shielding integrity. Maximum thickness of leveling bed should be no more than 6mm (1/4"). If any VeriShield units are displaced after mortar has stiffened – remove and reinstall the block. Strike flush all joints. Ensure the curved interlocking edges are fully intact and flush with adjacent VeriShield block.

Other than every fifth course, all block is normally dry stacked.

All walls of VeriShield block at the level of the fourth course must be installed to the same elevation. The regular use of a laser level to verify the level of each fourth course of wall block is strongly suggested. VeriShield grout joints shall be kept as small as possible. Once block are laid to a height of 1270 mm high (approx. 4'), scaffolding with planking is erected on the inside of the room. Safety railing must be installed where required. Block to be stacked on approved scaffolding using an appropriate forklift.

Any and all voids (such as are found at the ends of a row of block) are to be packed solid for their entire length with VeriShield grout. Spaces between wythes of block are to be filled and packed solid with VeriShield grout only if directed by a Veritas representative.

Door Frame

The Veritas Swing-Style SmartDoor consists of a single leaf, swing-style shielding door supported by a radial/thrust pivot bearing, surface mounted to the concrete and top radial bearing installed into a steel frame support. The door is hinged from the spine edge of the door and provides a 1219mm x 2133mm (4' x 7') clear opening when positioned at the 90 degree position.

The door frame is delivered separate from the door shell and mechanical equipment, and is installed during the wall construction.





To ensure the door frame is level and plumb it is strongly suggested that the door width be measured at a least three points – the bottom, the middle and the top as shown in the diagram below. The frame should be square and plumb.



At the top of the mechanical penetrations opening (also termed the duct opening), a steel header lintel is installed. Usually, this header lintel is a steel channel that is installed with the flat side of the channel downward. The upper section of the channel then becomes the form into which VeriShield grout and VeriShield block is installed.



Door frame(s) shall be bolted to floor slab according to Veritas drawings. Typical embedments are 19mm (3/4") dia. HILTI H.A.S. min. 152mm (6") embed. After drilling mounting holes, fill with HILTI HY200 injection adhesive and insert bolts. Allow 24 hrs. for curing before securing frame to anchors..





VeriShield block is laid up to the door frame and grout added to fill any voids. Subsequent layers are laid leaving space around the embedment studs welded to the frame. These spaces are filled with grout, firmly embedding the studs within the wall shielding



After the door sub-frame has been installed, and all adjacent walls constructed to the level of the opening of the top flange of the door sub-frame, the area above the door sub-frame is to be grouted solid with VeriShield grout to the top of the flange.

One continuous length of rebar shall be in the grouted area over the door sub-frame. It shall have a minimum 914mm (3') overlap with, and be wired to the vertical rebar in the vertical grout cells located to each side of the door sub-frame.



In the header lintel, VeriShield block is installed on a base of VeriShield grout. VeriShield grout is installed in the channel trough to an elevation permitting the subsequent courses of block to resume at the same level as those above each side of the penetrations opening. VeriShield block is installed directly in the top of the VeriShield grout. The teeth on the lower side of VeriShield block are embedded in the VeriShield grout when the grout is installed.



Dosimetry Penetrations

Dosimetry pipe penetrations are constructed by positioning the dosimetry pipe in the wall and adding block layers up to and around the pipe. Care should be taken to angle the pipe as directed in the Veritas drawings.





Voids are then filled with grout to fully encase the pipe within the shielding.



After the grout has hardened, the pipe can be cut flush with the face of the wall.



Walls are constructed of multiple layers of VeriShield block, a lift of blocks approximately 1270mm (4') high will be laid to a bunker, then appropriately designed scaffold will be erected within the footprint of the bunker. Once the scaffold is handed over the next 1270mm (4') high lift of blocks will be installed.



This sequence will continue until the bearing plate level for the roof steelwork has been reached. Bearing plates will be grouted in with high density grout and left to cure for 24-hours.





Bearing Plates

Once the bearing plate level has been reached, additional bond beams with steel embedded bearing plates shall be constructed.

Rebar shall be installed in center of bearing plate horizontal bond beam. Overlap rebar and wire-tie firmly every 305mm (12"). Overlap corner rebar as per drawings and tied to vertical rebar as indicated.



Form as required to contain grout during installation of bearing plates and header plates as per drawings and insure the proper bearing heights as indicated on the drawings.





The grout is smoothed and readied for the insertion of the bearing plate anchor bolts.



Insure that the bearing plates and header plates are installed level in both axes.



Insure that grout has been installed and tamped firmly to remove all voids.



Ceiling Structure

Prior to any and all steel headers and steel beams insure that grouted bearing plates and header plates have been allowed to cure for a minimum of 18 hours prior to setting any steel headers or steel beams. Structural steelwork will then be installed spanning between bearing plates on opposites of bunker walls. One to three steel beams will be placed at correct positions starting from one end of the room and working outward. Beam(s) will then be loaded with appropriate block thickness as called for on drawings.



Begin by installing first beam, insure beams and lengths being installed are the correct beams as indicated on the Veritas drawings.



Space out the beams as indicated on the drawings working your way out of the room. Beams are to be installed per the actual spacing as shown on Veritas' installation drawings. Beam spacing is to be strictly held to $\pm 3\text{mm}$ ($1/8''$) as measured from the first installed and welded beam.



After a few beams have been lifted and set roughly in place insure they have been spaced per the drawings and weld in place per the drawings. Continue this process until all ceiling beams and header beams are in place. This process may be adjusted in field to allow for an easier installation of the ceiling blocks.



Beams are to be installed with the full bearing as shown on the Veritas installation drawings. The full amount of bearing surface is to be kept to a tolerance of $\pm 4.5\text{mm}$ ($3/16''$) to the dimension shown on Veritas' drawings.



Once steel beams have been installed per drawings, they will be tack welded to bearing plates to hold them in position. A solid weld the length of end of the beam and a 76mm ($3''$) weld along the side of each beam are required for welding the beam to the bearing plate. If steel plate is to be installed in the beam webs, a tack weld is to be placed on the exposed ends of the steel plates to maintain their position relative to the other plates of steel. Welding to be performed by a certified welder and all welds are to be completed as per drawings.





After the beams are positioned, place block to fill the areas between the beams above the bearing plates.



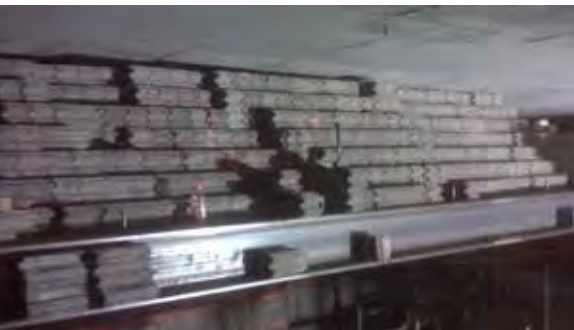
Add grout as needed to fill any remaining voids.



Build the surrounding block walls up to the level of the steel support beams.



Where vertical space is limited, shielding may sometimes be placed within the beam webs of the steel I beams. Shielding is then placed above the beams filling the remaining space.



In instances where it is not possible to place all the support beams at once and then add the shielding blocks, it may be necessary to start at a point farthest away from the delivery area, and continually build the ceiling shielding until you are out of the area.

Several beams would be placed into position, welded and then the required thickness of shielding block placed on top. Once the area is complete, additional beams would be placed and the process repeated until the ceiling is complete.



After working across the room, once the last beam and ceiling block has been placed the front shielding wall can be completed



Perimeter areas surrounding the support beams may be filled with grout, tamped and screeded flat to the top of the beams. This provides a flat surface on which to lay the ceiling shielding blocks.



Once the grout has hardened, VeriShield blocks are laid on their sides and slid into position. Care should be taken to ensure tight block-to-block contact, avoiding any gaps between blocks.



Block is packed as tightly as possible with staggered joints. No mortar or leveling bed is typically necessary, but VeriShield grout should be used to fill any unforeseen gaps or holes.





Install VeriShield Block in the locations and thicknesses as indicated on the Veritas drawings.



Ceiling shielding block layers should be offset one-half block on each axis to stagger joints.



Levels of roof shielding and walls should match (unless otherwise specified in Veritas drawings), and all gaps filled with VeriShield grout.



Use VeriShield grout to fill any perimeter gaps and infill any remaining voids.



All ceiling support steel beams are again welded to the steel bearing plates from within the room interior.



Duct/Penetration Shielding

It is important that the penetration shielding support system be installed at the correct location and elevation as shown on the Veritas installation drawings and that the support system is level on both horizontal axes.

The shielding of the mechanical penetrations opening is critical to the total overall shielding of the project. It is important that the shielding material be installed so that no gaps exist between the shielding materials.

Note: The duct/penetration opening is typically located above the room entrance. The shielded door system must be installed prior to the installation of any duct/penetration shielding.



VeriShield block is laid on its side on top of the support steel at a thickness specified in the shielding drawings. Grout is not typically required in this area, however no voids in the shielding are acceptable.





The bottom teeth of the VeriShield block to be installed in the grouted area over the door sub-frame are to be embedded in the VeriShield grout formed by the door sub-frame top flange. The appropriate courses of VeriShield block are then installed to the level of the bottom of the mechanical penetrations opening (also termed the duct opening). At that point, block is installed on the sides of the mechanical penetrations opening to form said opening. Close adherence to the dimensions of the mechanical penetrations opening size is critical.



Completed duct shielding will fully shield all penetrations through the room's wall shielding. There should be no gaps or straight line passages from the duct or services opening through the duct shielding.

Door Installation



The door is shipped on top of the front door skin. The interior of the door is used to contain associated components. In addition, there may be supplemental boxes. Please go over the packing list and make sure that everything on this list has arrived. If any items are missing or damaged contact the Veritas Service Department immediately.



If space allows, the shell may be delivered into the room space prior to the completion of the wall shielding and stored until required. Care must be taken to protect the associated components that are shipped with the door.



Note: For Complete Door Installation instructions please refer to Veritas Door Installation Manual available from the Veritas Project Management or Door Departments. The following is a brief synopsis of the major elements of installation, which is typically handled by Veritas personnel.

To lift the door shell into position it is necessary to attach a 453kg (1/2 ton) capacity chain hoist to the steel beams above the door opening.



Measure the door opening to ensure the door frame is level and plumb by measuring the door width in at least three points – the bottom, the middle and the top. After checking the door frame, the Lower Bearing Subplate is positioned and bolted to the floor. After the Lower Bearing Subplate is bolted in position, the Upper Bearing Subplate is positioned using a self-leveling alignment laser.

The laser beam should hit the dimples at the center of both the Lower and Upper Bearing Subplates. The cropped corner of the Upper Bearing Subplate should be aligned with the rounded corner of the Lower Bearing Subplate. Once aligned properly, the Upper Bearing Subplate is clamped down and welded into position on the Door Header.

Once the Lower and Upper Bearing Subplates are in position the bearings are inserted and the Upper and Lower Bearing Retainer Plates are bolted in position. Next position the hinges for attachment to the door. After putting together the Lower Hinge Block assembly put the axle into the Bottom Bearing Assembly but do not bolt the Bottom Hinge Assembly to the Wood Hinge Spacer at this time. Next put together the Upper Hinge Block Assembly and bolt it to the Wood Hinge Spacer using 152mm (6") bolts and nuts. Then using the Wood Hinge Spacer, lift the Upper Hinge Block Assembly and insert it into position in the Upper Bearing and then bolt the Wood Spacer to the Bottom Hinge Assembly to keep the Hinges in position. Rotate the Wood Spacer Hinge Assembly to the Door's 45 degree position and roll the Door Shell Assembly in place using 25mm (1") outside dimension pipes (19mm (3/4") inside dimension). These pipes are used to move the door into position.

Tighten all 8 bolts with 38mm (1 1/2") ratcheting or socket wrench. Insert the grease fittings and plugs into the ports on both the lower and upper hinge blocks

Remove the cover of the door to allow access to the interior for loading of the shielding.





While the door REMAINS ON THE PIPES, OR OTHER SUPPORT AT THE MIDDLE & ENDS OF THE FRAME, begin loading block starting on the strike side of the door starting with a full block. Keep block tight to door shell. Stagger pattern every two courses, keeping block tight together. Cut blocks as necessary to fill door shell as completely as possible.



Top course of block will have to be cut horizontally to fill door completely. Ensure a tight fit. Any voids from top of shielding to inside of door shell should be filled with V250 Grout mixture. Any leftover grout should be used to skim coat the face of the shielding to fill voids.



Place the door skin on the pipes and align countersunk holes with threaded holes in door and insert all screws. Using the slotted holes on the bottom of the skin may be helpful for alignment. A pry bar may also be useful for this task.



Reinstall door cover and hand tighten all bolts. Remove pipes from under door and verify all door reveals are minimum 25mm (1") and even throughout.



Veritas personnel will install and attach the motor drive, hinge coupler gearbox motor assembly and all other drive and operating components following the shielding installation. Decorative finish panels will also be supplied and installed.

Electrical Rough-In

The electrical rough-in to supply power to the Veritas SmartDoor shall be provided by the General Contractors. The electrical rough-in locations shall be coordinated with the GC to insure proper locations. The Veritas PM shall provide the Veritas drawing indicating the required electrical locations for the Veritas Door. GC is to provide said electrical rough-in to these locations.

Interior Finishes

For installations that include the Veritas SmartSuite Interior Finish Package, once the room shielding is complete, interior finish components will be delivered and installed.

Typical interior packages include Veritas' pre-engineered wall panels and other pre-manufactured components.

For complete installation information please refer to the Veritas SmartSuite Installation Manual, available from the Veritas Project Management Department.





Typical Veritas VPAC™ Installation - Craneable Shielding Packs

Erection/Construction Requirements

Veritas or its designated subcontractor is responsible for providing all necessary tools to complete the room installation. VPAC shielding packs are pre-manufactured assemblies of VeriShield blocks supplied in various lengths and thicknesses. Weight will vary depending upon pack dimensions and shielding composition.

Typical weights will range from 4,535 to 6,803 kgs. (10,000 - 15,000 lbs.).

A mobile crane of sufficient capacity will be required to offload and place the VPACs into position as specified on the Veritas drawings.

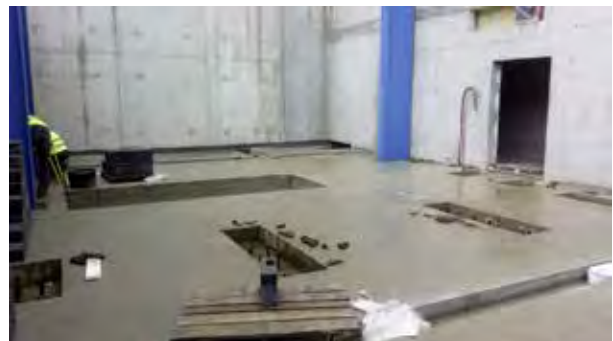
A 30,000 lb. cap. forklift/all-terrain lift is recommended for ease of handling individual VPAC units.

Veritas will provide all necessary engineering drawings and data for the proper design of the foundation and slab that will be supplied by the Trust. Embedments will be required for the attachment of support columns and service modules and shall be placed prior to the concrete pour.

Foundations and Columns Embedments

Prior to pouring of concrete Veritas will inspect all embedments to ensure accurate placement and alignment. Once slab has been poured (by others) and properly cured, Veritas' installation team will layout the isocenter marks, elevations and setting out points for the installation of leveling plates, preassembled shielding packs and associated column members. The vertical support columns will be erected using a 70T mobile crane (capacity will be determined based on site logistics) and secured by anchor bolts to the leveling plate embedments. Columns for both treatment room vaults will be erected.

To create the shielded walls, VPAC shielding packs will be craned between the column supports and constructed to a height of 3 m.





Erection of Support Steel

Columns are craned into position and affixed to the appropriate mounting bolts as specified in the Veritas drawings.



Columns are leveled and trued by turning the appropriate bolts and tightening to the specified torque. It is recommended that after leveling and tightening, the bolts be welded in place to avoid loosening.



Following column placement, the bases of the columns are grouted to fully cover the attachment bolts. Column areas fully surrounded by the concrete slab can be simply filled with grout. Other areas should be formed up as necessary.

Should VPACs be placed prior to final grouting, metal sheet is bent and placed over the column base to prevent loose grout, which is placed between the VPAC and the column, from spilling into the void and preventing the placement of the high-strength grout.





Column placement will continue until all vertical steel is erected, correctly leveled and plumbed.



Starting on a primary wall side, the main horizontal support beam is bolted as specified onto the columns. Care should be taken to torque the bolts as specified in the drawings.



Additional horizontal support beams are attached to the secondary wall columns.



The second primary wall support beam is attached opposite the first beam. These two beams will carry the majority of the ceiling shielding weight.



Once the outer ring of horizontal support beams is set, the additional horizontal support beams can be craned into position. Place and connect the horizontal beams to each pair of columns first.



Then fill in between with the balance of the horizontal support beams.



All beams are welded as specified to the columns and main support beams.



Following the placement of all support steel, metal decking is placed on top of the full ceiling area.





It is recommended that the metal decking be tack welded to the support steel to prevent any movement during block placement.



VPAC Placement

After the erection of all steel and the placement of all decking material, the VPAC modules can start to be craned into position between the support columns.



VPACs are staged, lifted and placed into position.



It is typical to place the first layer of VPACs and then work upwards. This is not a requirement though. Individual installers may adjust the placement as desired, depending on crew size, skill sets and experience.



Each VPAC is transported via four lifting lugs. Once in position the lifting lugs must be removed for reuse. This will leave an opening in the VPAC approx. 5" x 5" x 5", which must be filled prior to the placement of the next layer of VPACs.



For permanent installations a wet mixture of VeriShield grout and cement can be prepared and poured into the lifting lug voids as well as any gaps between the VPAC and the support column.

For temporary installations, dry VeriShield grout without any cement is utilized to fill any voids. This allows the grout to be removed and recovered upon disassembly of the shielding.



A simple method of retaining the grout (either wet or dry) is to nail lengths of 2" x 4" wooded studs directly to the face of the VPACs, taking care to push tightly against the side of the columns. In permanent installations and when using a wet mixture of VeriShield grout, these studs can be removed after the grout sets. For temporary facilities, these studs must remain in place to prevent the loose grout from escaping from between the VPACs and columns.





There is a specific location for each VPAC within the shielding design. Care must be taken to ensure that the numbered, or otherwise identified VPACs, are placed as specified in the Veritas drawings.



The process is repeated, and continues until all VPACs are properly placed and reach the roof level.





Care must be taken to ensure that each VPAC is lifted and placed into its specified position as indicated on the Veritas drawings.



There are various sizes of VPACs and some VPACs with precast conduit runs installed, so it's important to make sure each VPAC is placed as designed.



After all wall VPACs have been placed, the structure is ready for the attachment of exterior horizontal support plates.



Though not always necessary, these plates serve to lock the top edges of the VPAC walls firmly into the steel structure. Veritas drawings will specify plate configuration, sizes and mounting methods.





Following the attachment of the horizontal support steel, the placement of the ceiling shielding may commence.



Roof Shielding Placement

Starting at one corner of the decking and working out towards the opposite sides, standard sized VeriShield blocks are placed on their sides and laid in a running bond pattern making sure to overlap the seams.



Blocks are placed firmly into position and butted against the top layer of VPACs, and laid to the thicknesses specified in the Veritas drawings.



As the ceiling shielding approaches the opposing VPACs, the last row of VeriShield blocks will probably not precisely butt up to the placed VPACs. This will leave a gap that must be filled with VeriShield grout.



It is important to prevent any grout from slipping through any cracks down into the room below. A simple fix is to place thin strips of sheet steel over the gaps and then place the VeriShield block and grout. This will result in a clean transition between the blocks and the VPACs.





The VeriShield block is continuously laid to the thicknesses and coverage as specified in the drawings. VeriShield grout is used as necessary to fill any voids or gaps.



Supplemental Shielding Installation

Some installations may call for the installation of additional shielding outside the column areas of the primary barriers. This is typically accomplished by stacking layers of individual VeriShield blocks next to the columns.



The additional blocks are held in position through the use of steel straps, which are welded onto the columns at various intervals. This will provide full support and containment of the loose stacked block.



At this stage the roof shielding would be complete and ready for the installation of any required weatherproofing (if part of the Veritas Scope of Work).

Door Installation

If part of the design, the Veritas SmartDoor Bi-Parting door system can be installed, starting with the steel support columns and overhead support beam. These are placed and anchored according to the Veritas door installation drawings supplied with the doors.

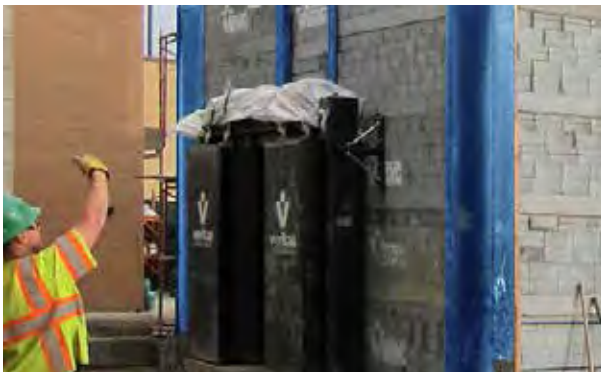
Once the support structure is anchored, the individual door leafs are attached to the support beam, front cover plates removed, and readied for installation of the door shielding materials.

Individual VeriShield blocks are inserted into the door shells and all voids are fully grouted prior to the re-installation of the cover plates.





Following the door shielding installation, the doors are ready for the attachment of the door drive mechanisms and related components.



Once the mechanical drive system is installed, it is critical to protect the components from the elements. Protective wrapping should be placed over the drive as soon as it is installed.



Following the installation of the door system, a final shielding review should be conducted to ensure there are no voids in the shielding, and that all elements of the shielding design have been fully and properly installed.



Once the final review is complete, the room is ready for enclosure or the attachment of pre-manufactured service modules (Veritas VROC Facilities).



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