



Date: 19 August 2019

Our Ref: CD/FSSD/12/02/03/01

Registrar, Board of Architects
Registrar, Professional Engineers Board
President, Singapore Institute of Architects
President, Institution of Engineers, Singapore
President, Association of Consulting Engineers, Singapore

Dear Sir/Mdm,

PERMISSIBLE VARIATIONS/ CLARIFICATIONS/ INSERTIONS TO TECHNICAL REQUIREMENTS FOR STOREY SHELTERS (TR SS) 2015

Arising from the consolidation of waiver applications received on design proposals and industry feedback for certain requirements, SCDF and BCA have jointly conducted a review on the “Technical Requirements for Storey Shelters 2015”.

2. This circular serves to inform the building industry of the following revisions (i.e. Permissible Variations, Clarifications and Insertions) and shall take effect from 1 March 2020. The revisions shall apply to the first CD01 plans that are submitted to BCA from 1 Mar 2020. However, developers or QPs may also choose to comply with any of the specific requirements with immediate effect. For the latter, if CD01 plans have been approved for a particular project, developers/ QPs have to submit “amendment to approved shelter plans” to incorporate these specific requirements to BCA for re-approval.

a) **Permissible Variations**

S/no.	Clauses	Permissible Variations
1.	<u>Clause 2.4.3(d) - Setback Distances of SS wall.</u>	Functional voids for the purpose of concealing water pipe or sanitary pipe are allowed to be located in the setback distance envelope for the SS walls



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	<p>For SS walls (where the SS door is not located), trellis constructed of RC or steel hollow section may be used to make up for the shortfall in setback distance. However, a minimum 1200mm RC ceiling slab from the SS wall shall be provided.</p>	<p>(without SS door) or behind the RC shielding wall for the SS door subject to the following requirements being met:</p> <ul style="list-style-type: none"> (a) Up to 3 functional voids are allowed in each of the dwelling units located around SS tower. (b) The maximum length and area of the functional void shall be 1000mm and 0.35m² respectively. (c) Functional voids can be allowed to adjoin each other provided that the total length and area are also kept at 1000mm and 0.35m² respectively. (d) RC slab of at least 125mm thick shall be provided at the roof of the voids. <p>Refer to Figure 1 for illustration.</p>
<p>2.</p>	<p><u>Clause 2.4.3(d) - Setback Distances of SS wall.</u></p> <p>For SS walls (where the SS door is not located), trellis constructed of RC or steel hollow section may be used to make up for the shortfall in setback distance. However, a minimum 1200mm RC ceiling slab from the SS wall shall be provided.</p>	<ul style="list-style-type: none"> (a) <u>Only one non-functional void</u> is allowed to abut shelter wall without SS door subject to the following requirements being met: <ul style="list-style-type: none"> i. It shall be enclosed by RC walls with minimum thickness of 150mm. ii. Its maximum internal length and internal width (measured perpendicular to shelter wall) shall be 2000mm and 1200mm respectively. iii. RC slab of at least 300mm thick shall be provided at the roof of the void and RC slab of at least 125mm thick shall be provided to cover the void at



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		<p>the top-most storey level immediately below the roof slab.</p> <p>(b) <u>Non-functional voids</u> are allowed to be located in the setback distance envelop after 1200mm from the shelter wall without SS door or behind the RC shielding wall subject to the following requirements being met:</p> <ol style="list-style-type: none"> i. They shall be enclosed by RC walls with minimum thickness of 125mm. ii. RC slab of at least 125mm thick shall be provided at the roof of the voids. iii. The maximum length and area of each non-functional void shall be 1000mm and 0.35m² respectively. iv. Non-functional voids shall not adjoin each other. <p>Refer to Figure 2 for illustration.</p>
3.	<p><u>Clause 2.4.5 - Service Riser, Gas/Water Riser and RC Refuse Chute within Setback Distances of SS walls.</u></p> <p>Service risers for electrical and telecoms are allowed within setback distance envelope of the SS wall.....Refer to Figure 2.5.4(e).</p>	<p>Inter-floor opening of up to 750mm wide is allowed in each service riser (excluding refuse chute). The remaining area shall be slab over with RC slab.</p> <p>Design of these service risers (at the inter-floor opening) shall comply with relevant Code of Practices and statutory requirements for peacetime usage, including the provision of MS grating or walkway mesh on every storey to comply with safety from falling.</p> <p>(a) For service risers that abut SS wall, RC slab of at least 300mm thick shall be provided at the roof of the</p>



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		<p>service risers and RC floor slab of at least 125mm thick shall be provided to cover the service risers at the top-most storey level immediately below the roof slab. At this top-most storey level RC floor slab, a maximum 250mm slit opening (as inter-floor opening) is allowed.</p> <p>(b) For service risers that are not abutting SS wall, the roof of these service risers shall be covered with minimum 125mm thick RC slab.</p> <p>Refer to Figure 3(i) and 3(ii) for illustration.</p>
4.	<p><u>Clause 2.2.1 - Area and Volume</u></p> <p>The minimum internal floor area and minimum internal volume of a SS or a S/C SS shall be based on the gross floor area (GFA) of dwelling unit and nominal occupancy of dwelling unit in accordance with Table 2.2.1.....the maximum internal length of any floor and roof slab of a SS shall be 8000mm. The minimum internal width of a SS shall be 1200mm. The ratio of the internal length to the internal width shall not exceed 3:1. See Figure 2.2.1.</p>	<p>Where the internal length of the shelter wall exceeds 8m (but not more than 10m), the minimum SS wall thickness shall be thickened by 25mm from the thickness shown in Table 2.3.1 of the “Technical Requirements for Storey Shelters 2015”.</p> <p>Refer to Figure 4 for illustration.</p>
5.	<p><u>Clause 2.12.3 - Internal S/C SS Wall and SS Door.</u></p> <p>Inside the S/C SS, there has to be a continuous reinforced concrete internal wall of minimum 200 mm thickness running through the full height of the S/C SS tower. At every</p>	<p>Where the internal SS doors are placed at the end of a staircase landing, it shall have a minimum 500mm clearance distance from the last step to the face of the internal SS door.</p> <p>Refer to Figure 4 for illustration.</p>



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	storey, one internal SS door swinging in the direction of exit travel, with removable door kerb, is to be provided either at the staircase entrance landing or at the intermediate landing.	
6.	<p><u>Clause 2.4.4 - Setback Distances of SS Walls (with Reinforced Concrete Down-hang Beams along EBL)</u></p> <p>(e) For SS walls (where the SS door is not located), RC ledge or trellis constructed of RC or steel hollow section may be used to make up for the shortfall in setback distance...shall comply with the geometrical configuration as shown in FIGURE 2.4.3(f) and 2.4.3(g).</p>	Refer to Figure 5 for revised configuration of RC or steel trellis.

b) Clarifications and Insertions

S/no.	Clauses	Clarifications/ Insertions
7.	<p><u>Clause 2.5. 4 - Shielding Wall</u></p> <p>(b) The shielding wall shall be protected by floor slab or trellis of at least half the storey height measured from the shielding wall. Refer to FIGURE 2.5.4 (a), 2.5.4 (b), 2.5.4 (e) and 2.5.4 (f).</p>	<p>The RC shielding wall shall be protected by floor slab of at least half the storey height measured from the shielding wall. RC or steel trellis may be used to meet the protection requirement provided that the trellis is located outside the setback distance envelope for SS wall with SS door.</p> <p>Refer to Figure 6 for illustration.</p>
8.	<p>Control Requirements for the top-most and bottom-most shelter compartment in S/C SS tower:</p> <p>(a) Top-most shelter compartment in S/C SS tower.</p>	<p>(a) Where there are up to 2 storeys NS spaces above top-most shelter</p>



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	<p>(b) Bottom-most shelter compartment above discharge storey in S/C SS tower.</p> <p>(c) Shelter compartment located in the basement level.</p>	<p>compartment in S/C SS tower, external SS doors with at least 0.5H slab (where H is the storey height of the NS storey) protection and vertical blast hatches leading to these NS spaces shall be provided.</p> <p>(b) Where there is a bottom-most shelter compartment located above discharge storey level in S/C SS tower, the immediate NS compartment below the bottom-most shelter compartment shall be protected with an external SSS door with at least 0.5H slab, where H is the storey height.</p> <p>Refer to Figure 7A(i) - 7A(vii) for illustration.</p> <p>(c) Where there is shelter compartment located in the basement level of S/C SS tower and there are NS spaces below it, external SS doors with at least 0.5H slab protection and vertical blast hatches shall be provided.</p> <p>Refer to Figure 7B(i) – 7B(ii) for illustration.</p>
9.	Protection of RC shielding wall forming part of the MV riser.	The RC shielding wall shall be protected by floor slab of at least half the storey height measured from the shielding wall. RC or steel trellis may be used for this part of the protection slab that is after 1200mm from the shelter wall.



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		Refer to Figure 8 for illustration.
10.	Shielded and Un-shielded NS walls/columns of SS Tower and Shielded and Un-shielded NS walls of S/C SS or scissor S/C SS Tower	To provide clarity of the shielded NS wall protection for SS and S/C SS tower and simulated removal check of unshielded NS wall of SS and S/C SS tower. Refer to Figure 9A-9D for illustration.
11.	External S/C SS door at the basement level and at the 1 st storey discharge level and internal S/C SS door (if located at typical floor main landing level) shall not clash with the fire-rated door.	Refer to Figure 10 for illustration.
12.	Thickness of the SS wall share with the lift core wall.	A lift shaft may share a common wall with the SS or S/C SS. The thickness of the SS wall sharing with the lift core wall shall be increased by 50mm from the thickness shown in Table 2.3.1 of the “Technical Requirements for Storey Shelters 2015”. Refer to Figure 11 for illustration.
13.	<u>Clause 4.1 - General</u> Two 150 mm diameter ventilation sleeves shall be cast into the wall/s of each SS.	Only ventilation sleeves of an approved design from approved SS steelworks suppliers shall be used.
14.	<u>Clause 5.2 - Approved SS Door</u> Only SS doors of an approved design, and which have been certified and listed under the Product Listing Scheme shall be used.	Only SS doors of an approved design from approved SS steelworks suppliers, and which have been certified and listed under the Product Listing Scheme shall be used. Only rescue hatches and blast hatches of an approved design from approved SS steelworks suppliers shall be used.



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15.	<p><u>Clause 6.2 - Structural Works</u></p> <p>(g) Method statement of the remedial work on structural elements, including SS door frame, shall be approved by the Commissioner of Building Control.</p>	<p>(g) Method statement of the remedial work on structural elements, including SS door frame and ventilation sleeves, shall be approved by the Commissioner of Building Control. The approval shall be obtained before the commencement of the rectification works.</p>
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3. Please convey the contents of this circular to members of your Institution/Association/Board. The circular is also available on CORENET-e-Info: <http://www.corenet.gov.sg/einfo>. For any enquiry or clarification, please contact the undersigned at 6848 1478.

Yours faithfully,

(transmitted via e-mail)

MAJ Andy Tan
 Fire Safety & Shelter Department
for Commissioner
 Singapore Civil Defence Force



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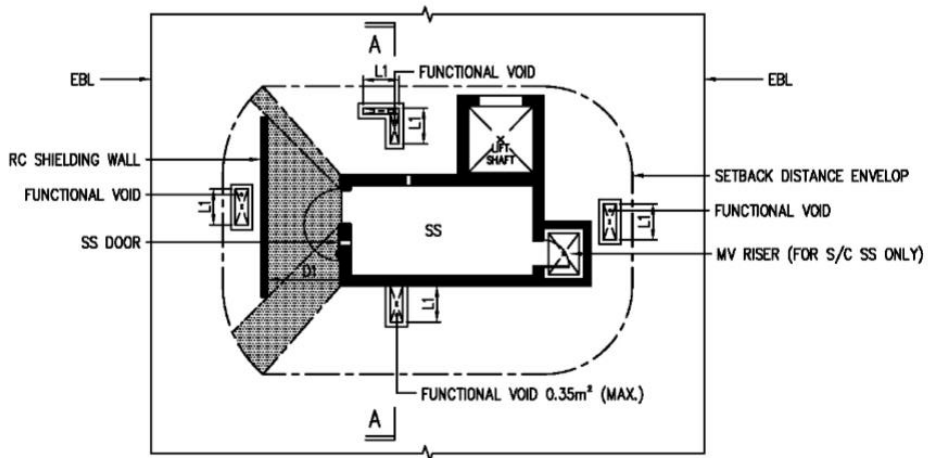
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Fire Code Review Committee
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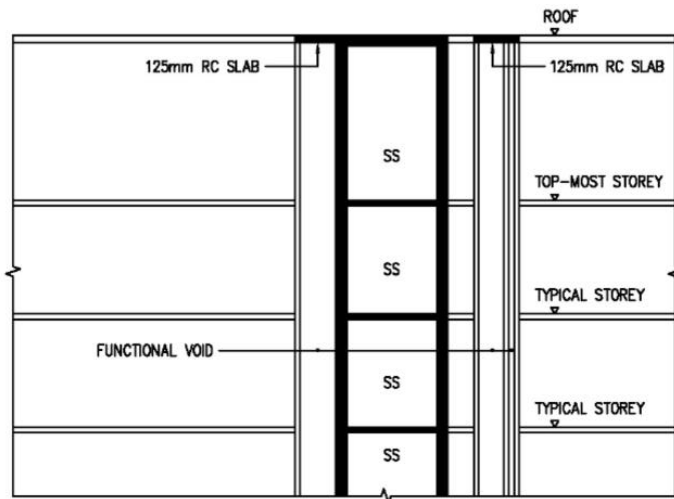
Figure 1



TYPICAL STOREY PLAN

NOTE:

- 1) [Shaded Zone] - NO VOIDS ARE ALLOWED WITHIN SHADED ZONE
- 2) UP TO 3 FUNCTIONAL VOIDS ARE ALLOWED FOR EACH OF THE DWELLING UNITS LOCATED AROUND SS TOWER
- 3) VOID AREA = 0.35m² (MAX.)
- 4) D1 = 1200mm (MIN.) AND 3000mm (MAX.)
- 5) EBL = EXTERNAL BUILDING LINE
- 6) L1 = 1000mm (MAX.)



SECTION A-A

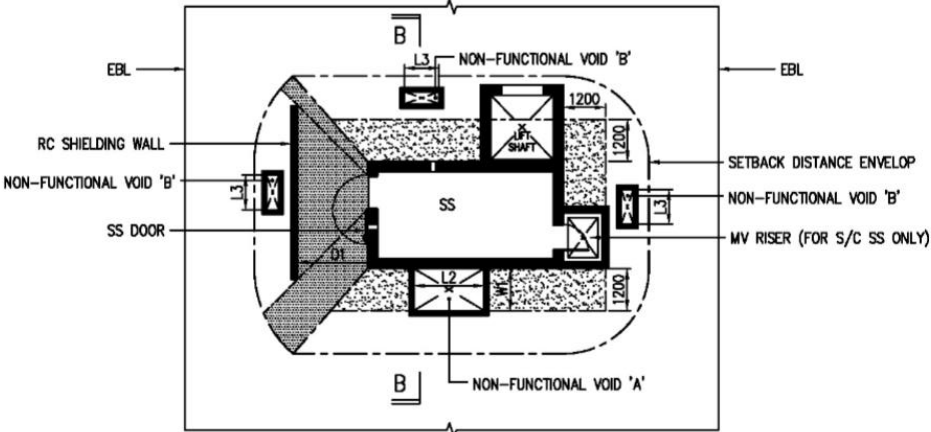
FIGURE 1 : CONTROL REQUIREMENTS OF FUNCTIONAL VOIDS



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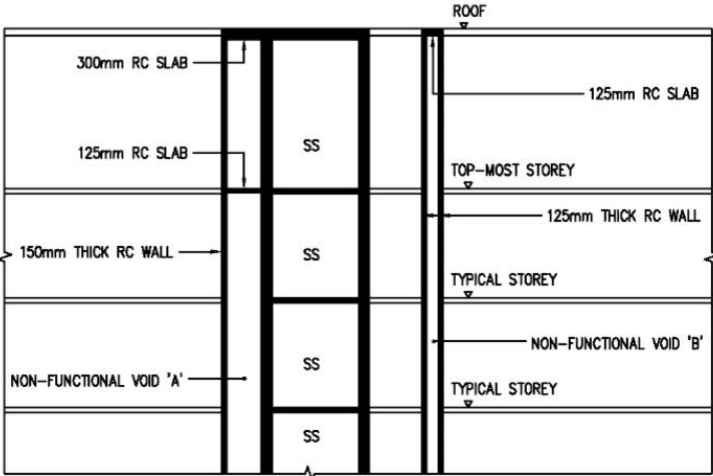
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Figure 2



TYPICAL STOREY PLAN

- NOTE:**
- 1) [Pattern] - ONLY ONE (1) NON-FUNCTIONAL VOID 'A' IS ALLOWED IN THIS SHADED ZONE
 - 2) [Pattern] - NO VOIDS ARE ALLOWED WITHIN THIS SHADED ZONE
 - 3) D1 = 1200mm (MIN.) AND 3000mm (MAX.)
 - 4) EBL = EXTERNAL BUILDING LINE
 - 5) NON-FUNCTIONAL VOID 'A':
 - i) TO BE ENCLOSED BY 150mm THICK RC WALL
 - ii) L2 = 2000mm (MAX.)
 - iii) W1 = 1200mm (MAX.)
 - 6) NON-FUNCTIONAL VOID 'B':
 - i) TO BE ENCLOSED BY 125mm THICK RC WALL
 - ii) L3 = 1000mm (MAX.)
 - iii) VOID AREA = 0.35m² (MAX.)



SECTION B-B

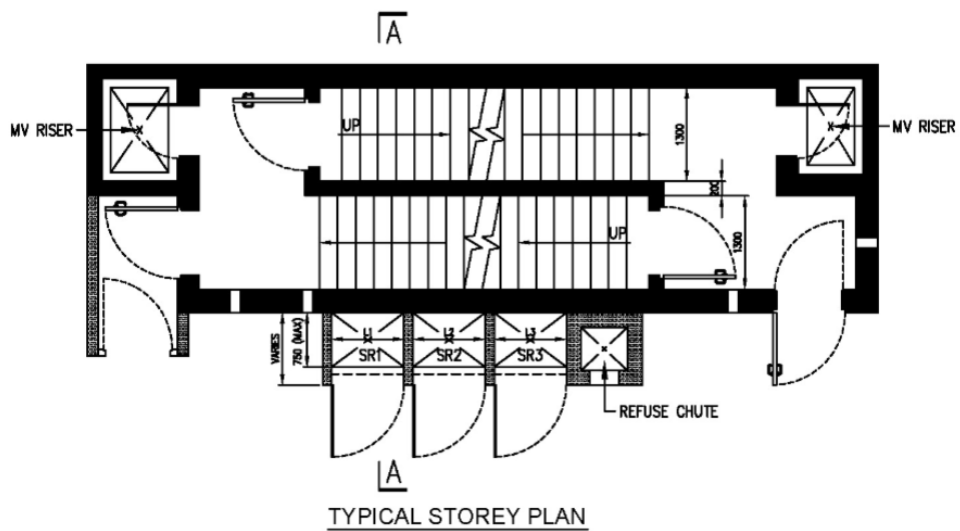
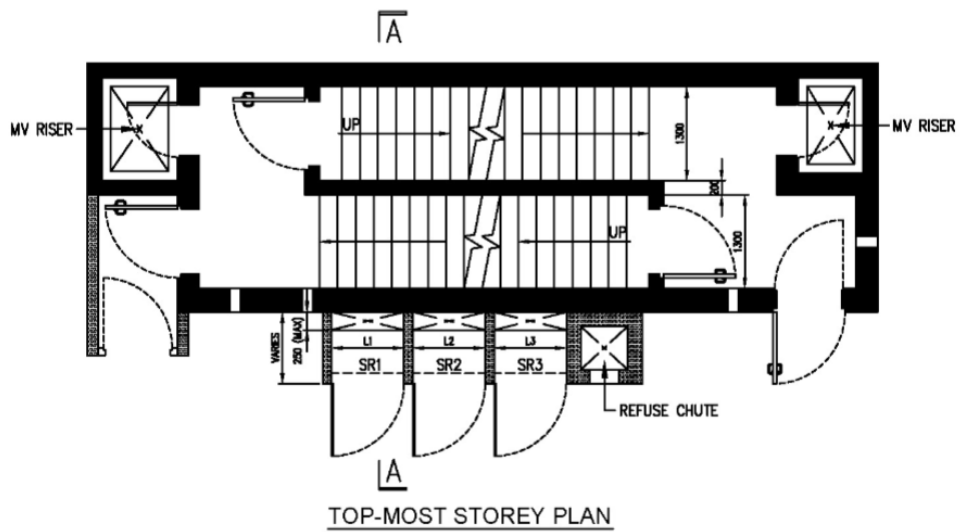
FIGURE 2 : CONTROL REQUIREMENTS OF NON-FUNCTIONAL VOIDS



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Figure 3(i)



- NOTE:**
- 1) SR = SERVICE RISER
 - 2) L1, L2, & L3 = 2000mm(MAX)
 - 3) DESIGN OF SERVICE RISER SHALL COMPLY WITH STATUTORY REQUIREMENTS, INCLUDING PROVISION OF MS GRATING OR WALKWAY MESH WITH ANGLE CLEAT ON EVERY STOREY TO COMPLY WITH SAFETY FROM FALLING

FIGURE 3(i) : SERVICE RISERS ABUTTING SS WALLS



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Figure 3(ii)

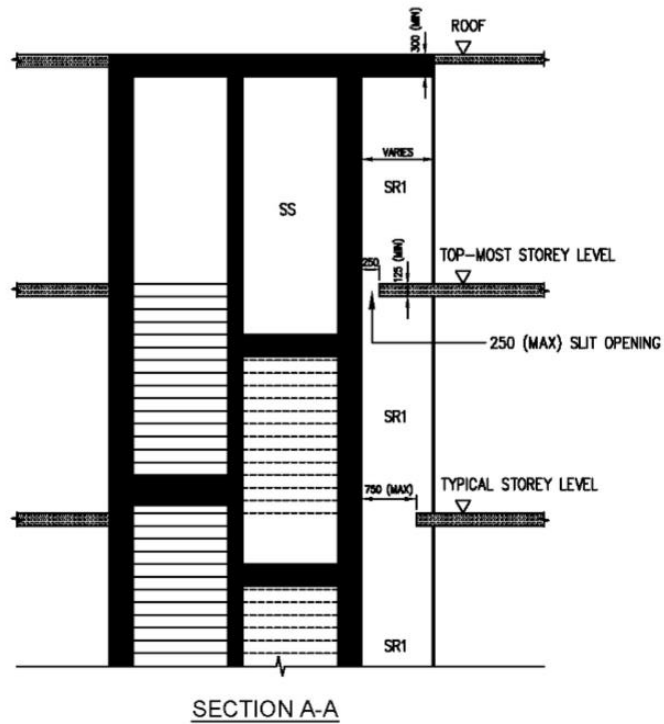


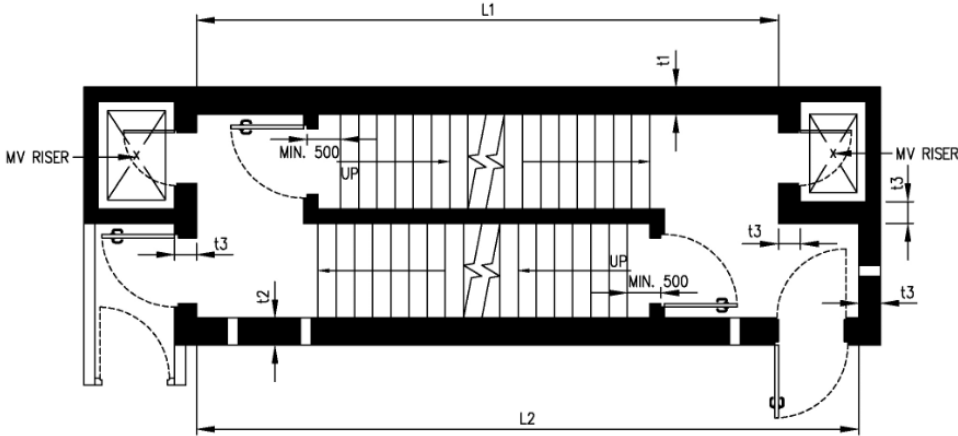
FIGURE 3(ii) : SERVICE RISERS ABUTTING SS WALLS



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Figure 4



- NOTE:**
- 1) L1, L2 = INTERNAL LENGTH OF STAIRCASE STOREY SHELTER (MAXIMUM LENGTH = 10M)
 - 2) t1, t2 = MINIMUM WALL THICKNESS BASED ON S/C SS CLEAR HEIGHT + 25mm, FOR 8M < L ≤ 10M
 - 3) t3 = MINIMUM WALL THICKNESS BASED ON S/C SS CLEAR HEIGHT

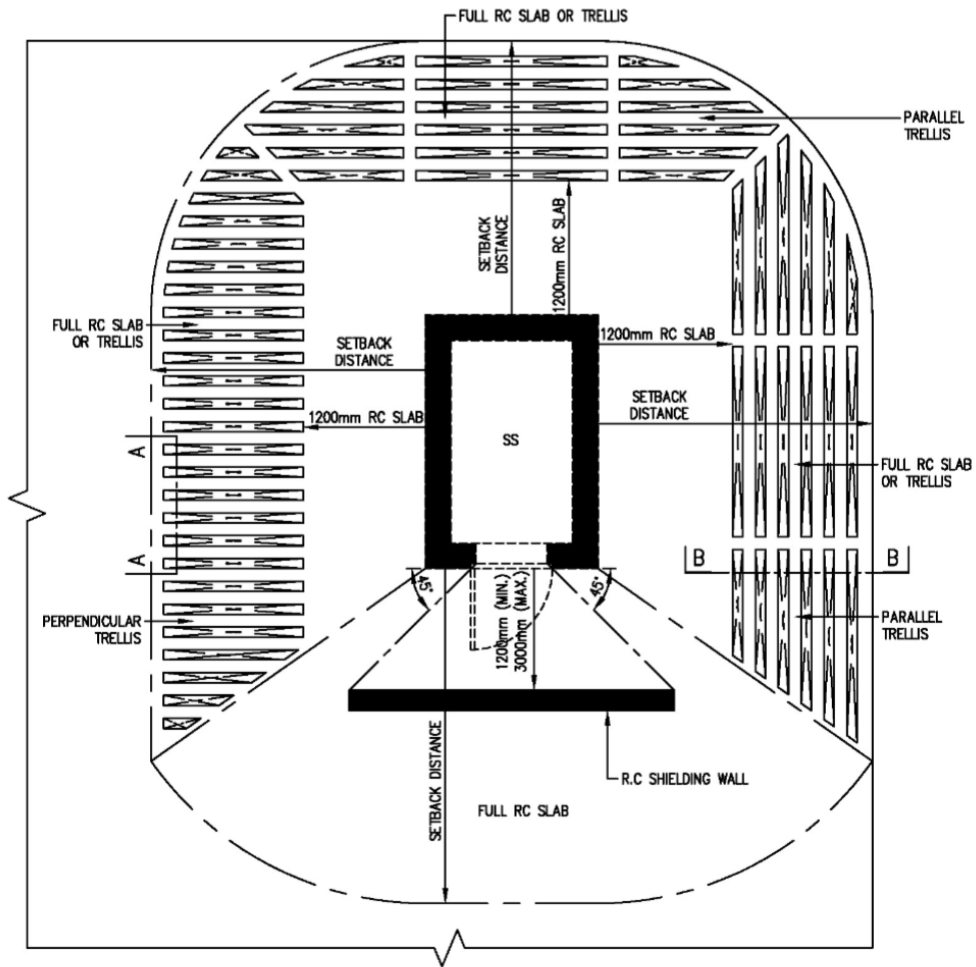
FIGURE 4 : CONTROL OF INTERNAL LENGTH AND LOCATION OF INTERNAL SS DOORS OF SCISSOR S/C SS



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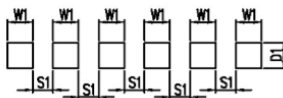
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Figure 5



PLAN

NOTE:
1) THICKNESS OF STEEL HOLLOW SECTIONS SHALL BE AT LEAST 6 mm



SECTION A-A
PERPENDICULAR TRELLIS

NOTE:
1) W1, D1 = MIN 125 mm
2) S1 = MAX 100 mm



SECTION B-B
PARALLEL TRELLIS

NOTE:
1) IF S2 ≤ 100mm, W2 = 125mm (MIN) AND D2 = 125 mm (MIN)
2) IF S2 > 100mm, W2 = 125mm (MIN) AND D2 = 2 TIMES OF S2

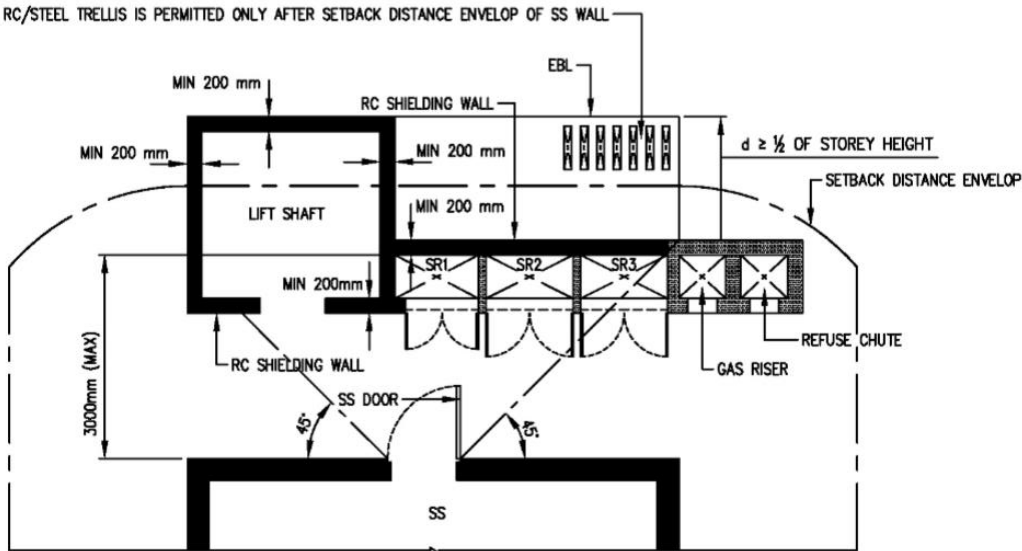
FIGURE 5 : ARRANGEMENT OF TRELLIS (RC/STEEL HOLLOW SECTION)



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Figure 6



NOTE:
 1) SR = SERVICE RISER
 2) TRELLIS IS PERMITTED ONLY AFTER SETBACK DISTANCE ENVELOP OF SS WALL

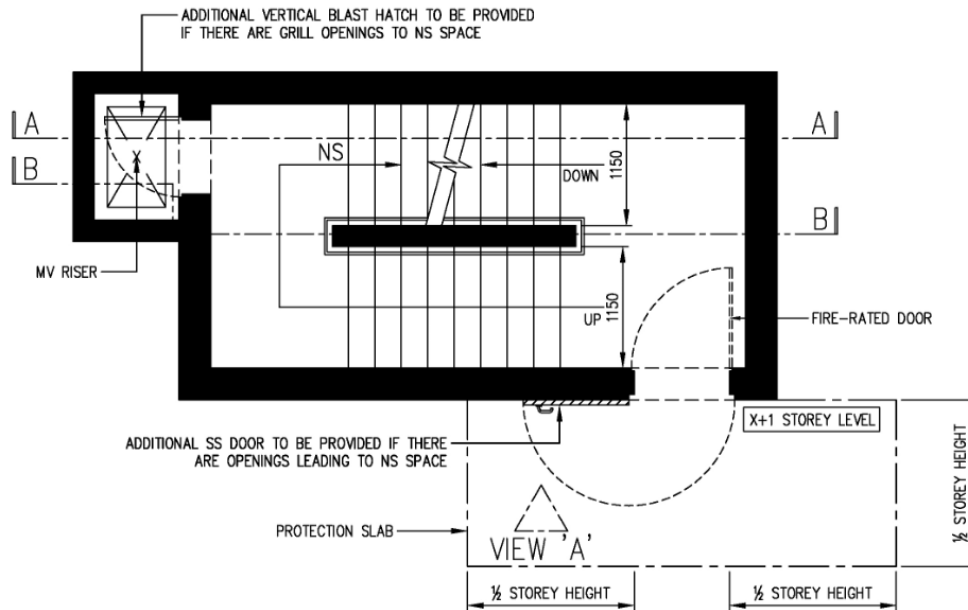
FIGURE 6 : PROTECTION OF RC SHIELDING WALL



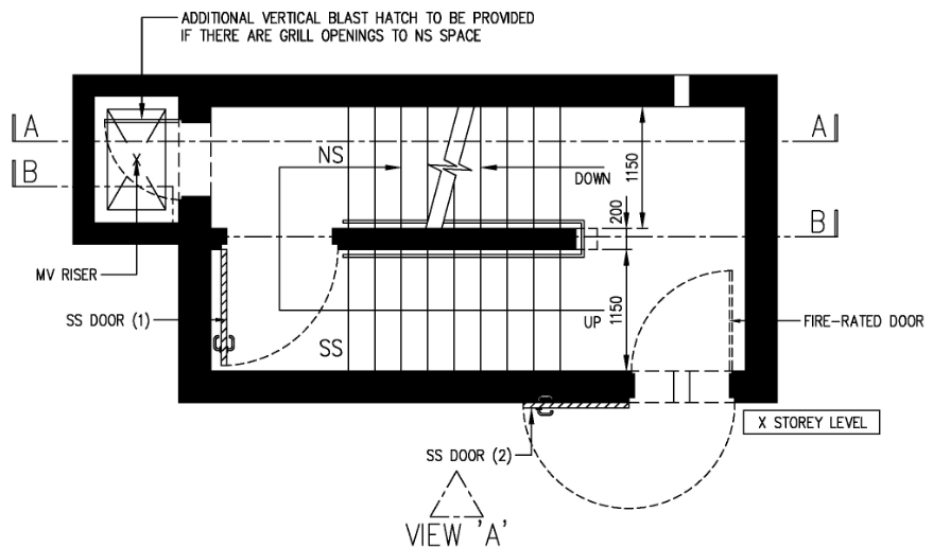
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Figure 7A(i)



(a) PLAN OF NON-SHELTER (NS) ABOVE TOP-MOST SS COMPARTMENT



(b) PLAN OF TOP-MOST SS COMPARTMENT

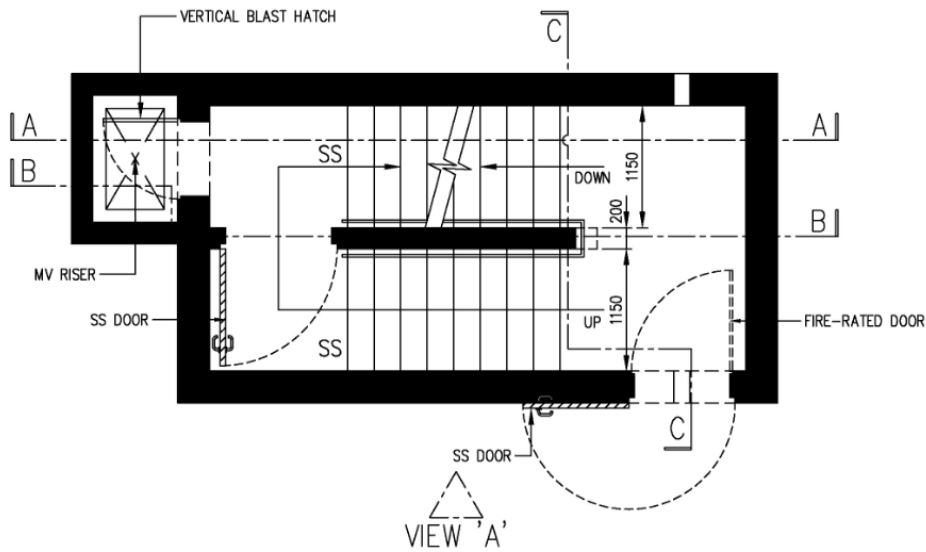
FIGURE 7A(i) : SS WITH NS ABOVE TOP-MOST SS COMPARTMENT, INTERMEDIATE SS COMPARTMENT AND SS WITH NS BELOW BOTTOM-MOST SS COMPARTMENT



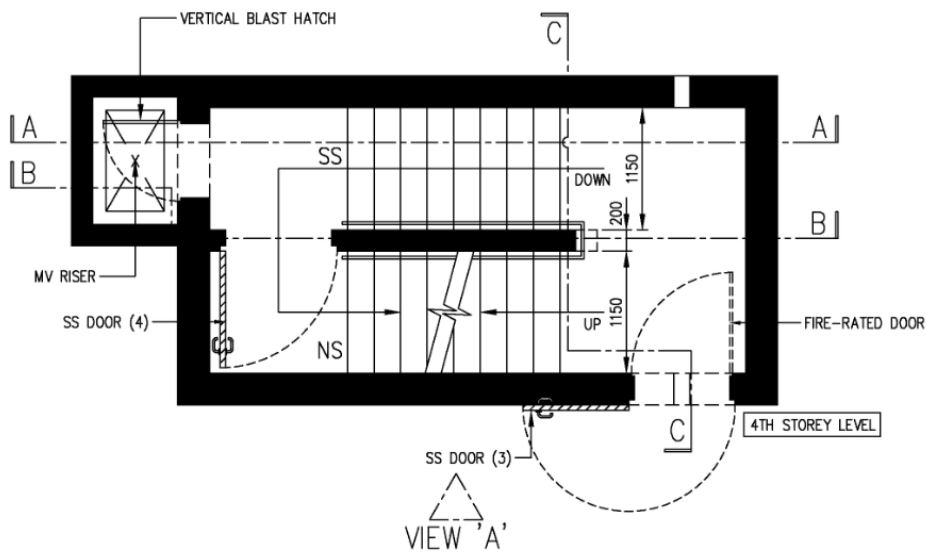
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Figure 7A(ii)



(c) TYPICAL PLAN OF SS INTERMEDIATE COMPARTMENT



(d) PLAN OF BOTTOM-MOST SS COMPARTMENT

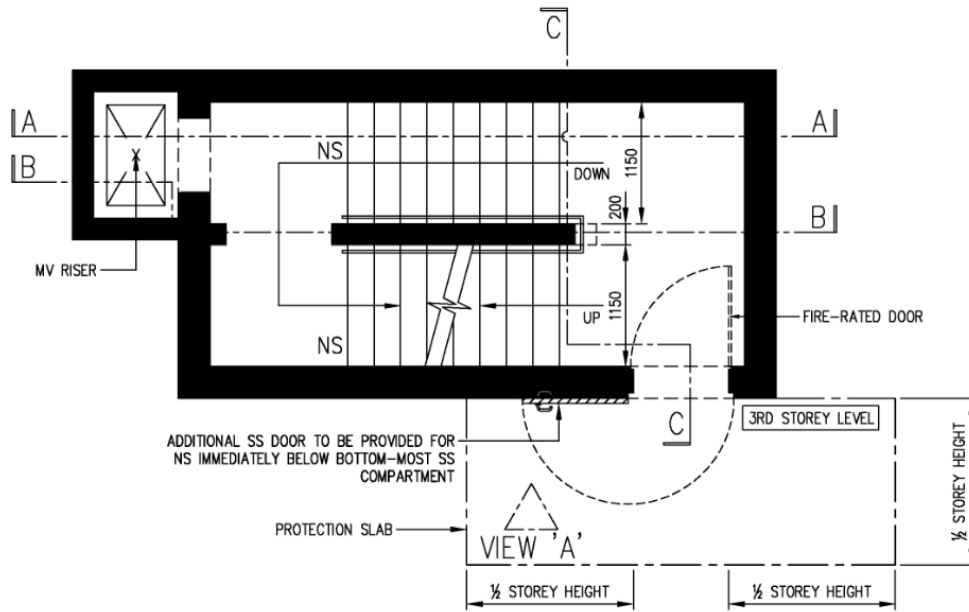
FIGURE 7A(ii) : SS WITH NS ABOVE TOP-MOST SS COMPARTMENT, INTERMEDIATE SS COMPARTMENT AND SS WITH NS BELOW BOTTOM-MOST SS COMPARTMENT



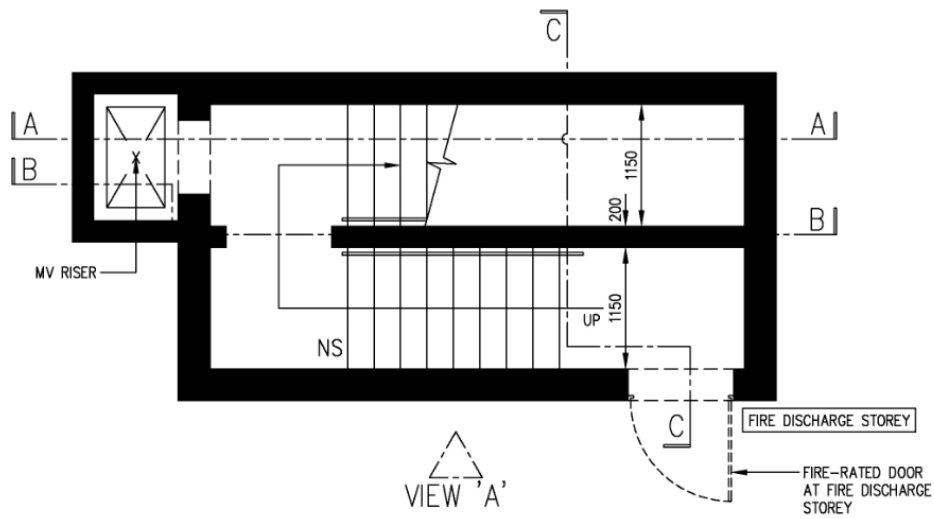
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Figure 7A(iii)



(e) PLAN OF NS IMMEDIATELY BELOW BOTTOM-MOST SS



(f) PLAN OF SS AT FIRE DISCHARGE STOREY

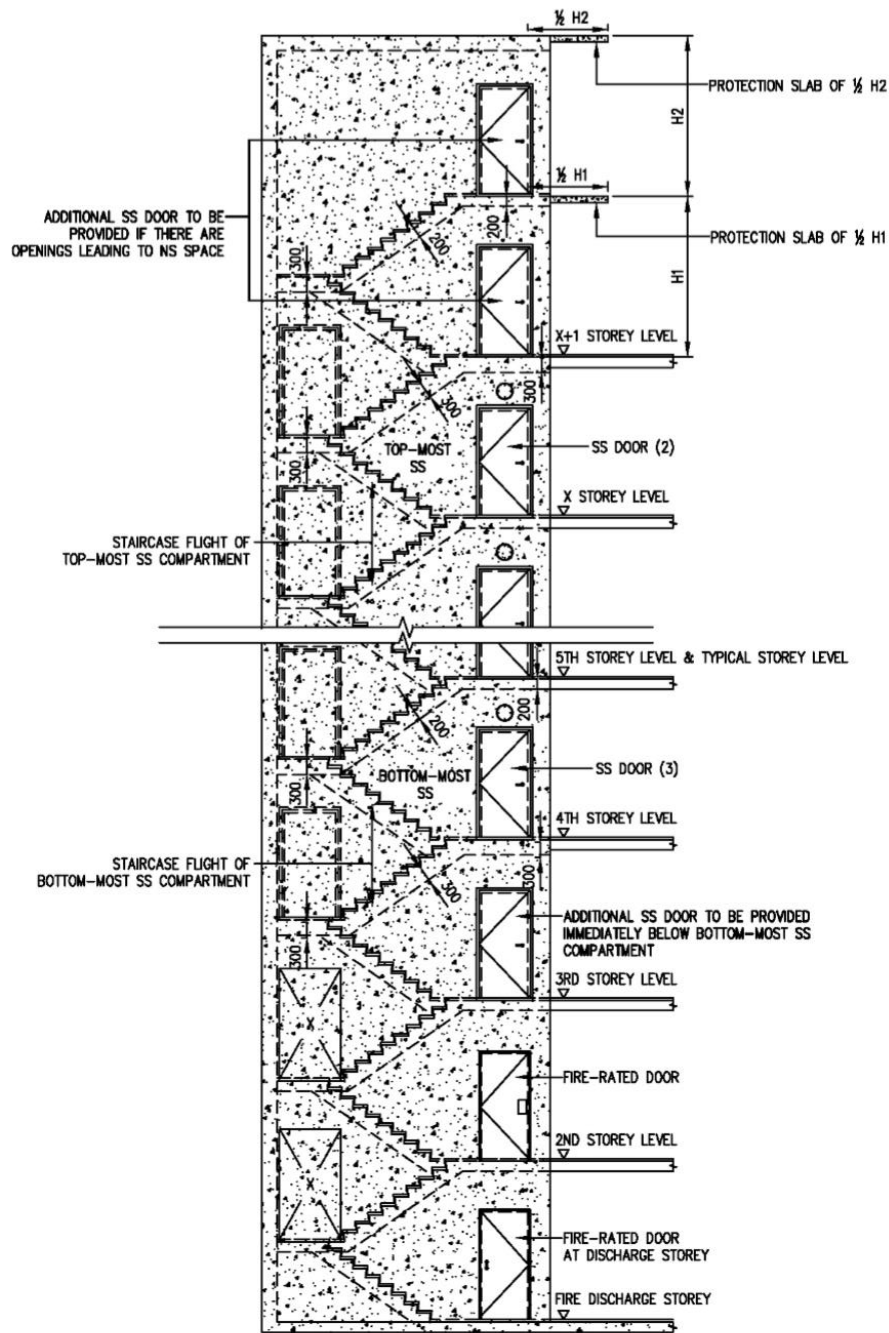
FIGURE 7A(iii) : SS WITH NS ABOVE TOP-MOST SS COMPARTMENT, INTERMEDIATE SS COMPARTMENT AND SS WITH NS BELOW BOTTOM-MOST SS COMPARTMENT



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Figure 7A(iv)



VIEW 'A': NS ABOVE TOP-MOST SS AND NS BELOW BOTTOM-MOST SS

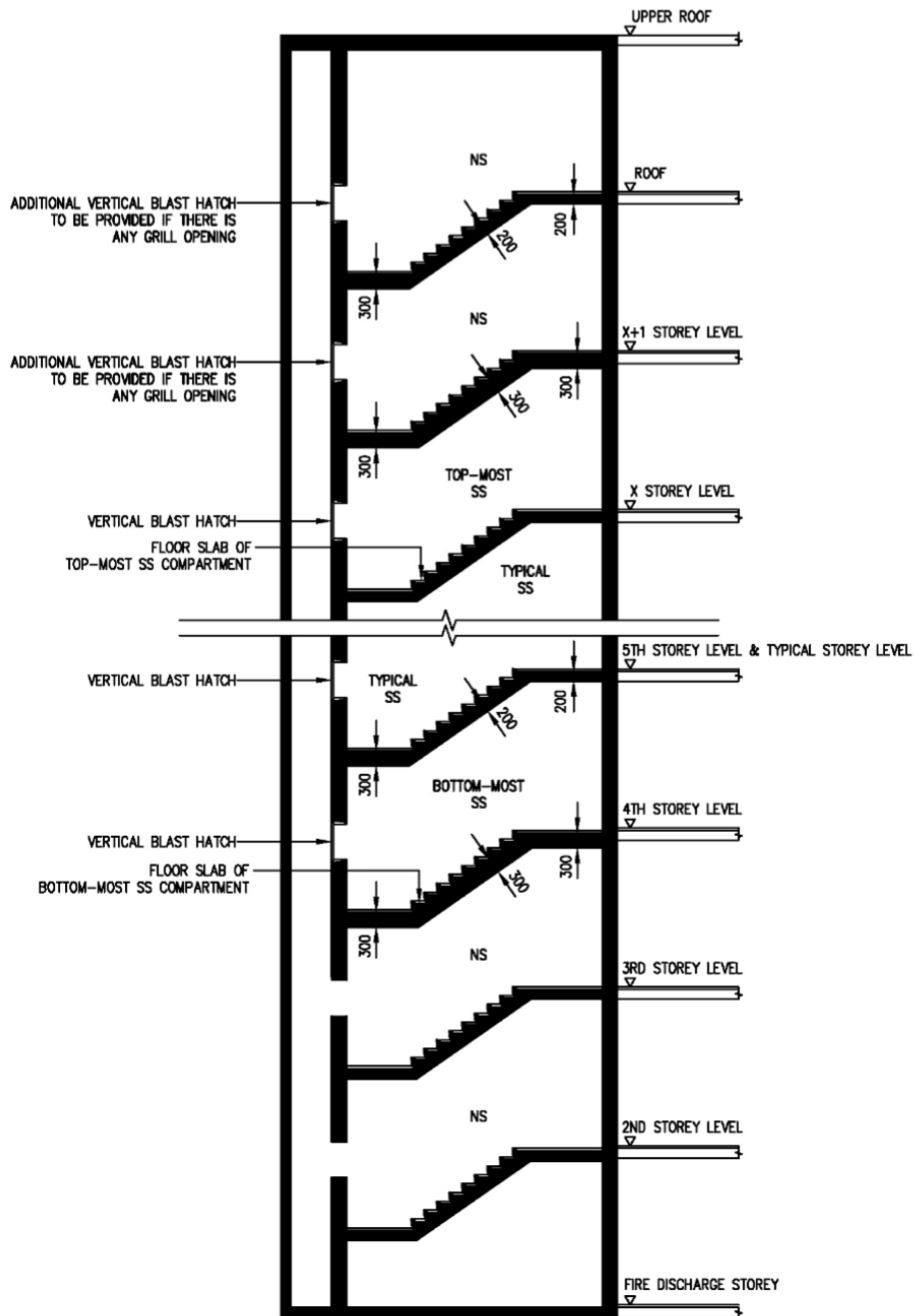
FIGURE 7A(iv) : SS WITH NS ABOVE TOP-MOST SS COMPARTMENT, INTERMEDIATE SS COMPARTMENT AND SS WITH NS BELOW BOTTOM-MOST SS COMPARTMENT



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Figure 7A(v)



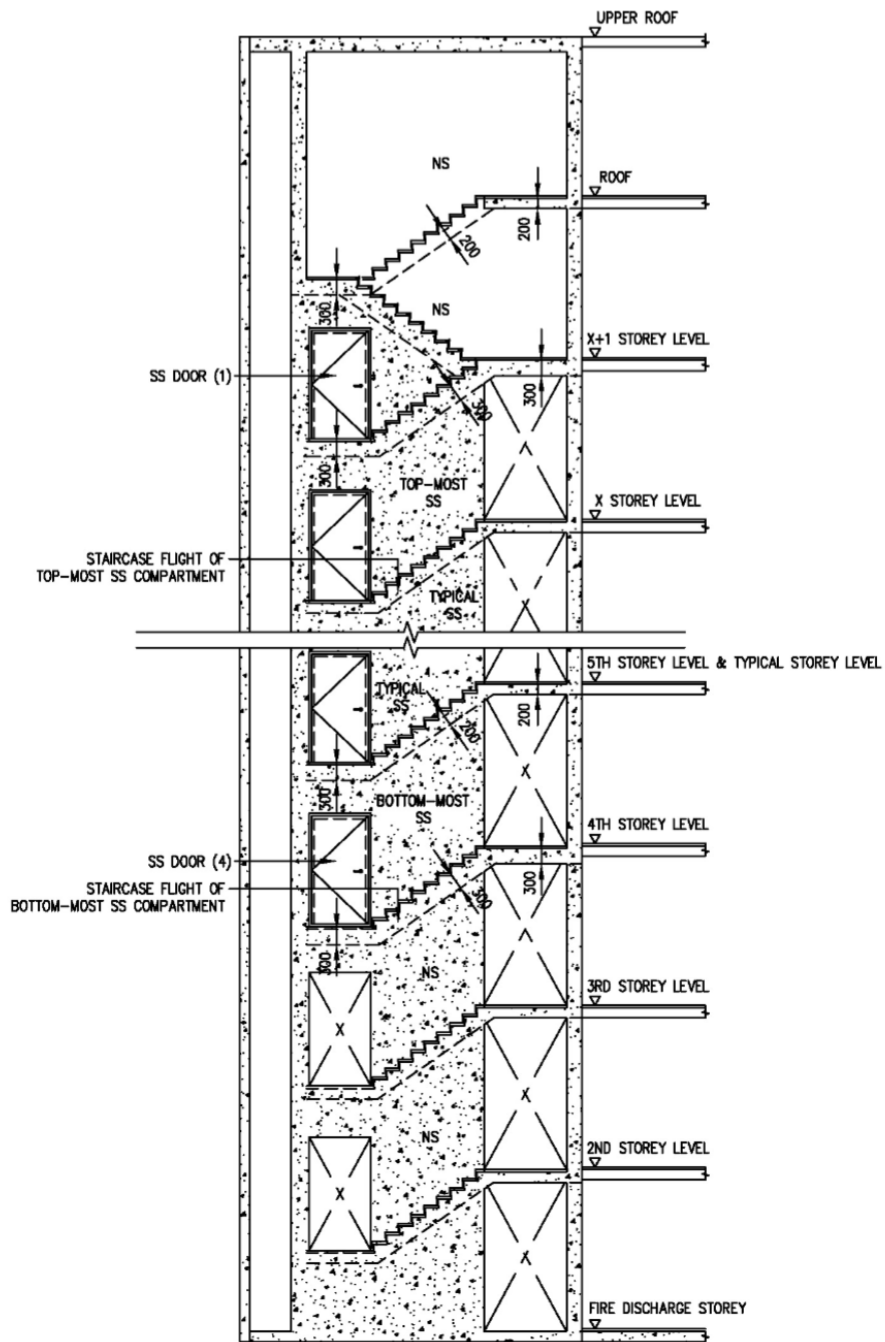
SECTION A-A: NS ABOVE TOP-MOST SS AND BELOW BOTTOM-MOST SS
FIGURE 7A(v) : SS WITH NS ABOVE TOP-MOST SS COMPARTMENT, INTERMEDIATE SS COMPARTMENT AND SS WITH NS BELOW BOTTOM-MOST SS COMPARTMENT



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Figure 7A(vi)



SECTION B-B: NS ABOVE TOP-MOST SS AND NS BELOW BOTTOM-MOST SS

FIGURE 7A(vi) : SS WITH NS ABOVE TOP-MOST SS COMPARTMENT, INTERMEDIATE SS COMPARTMENT AND SS WITH NS BELOW BOTTOM-MOST SS COMPARTMENT



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Figure 7A(vii)

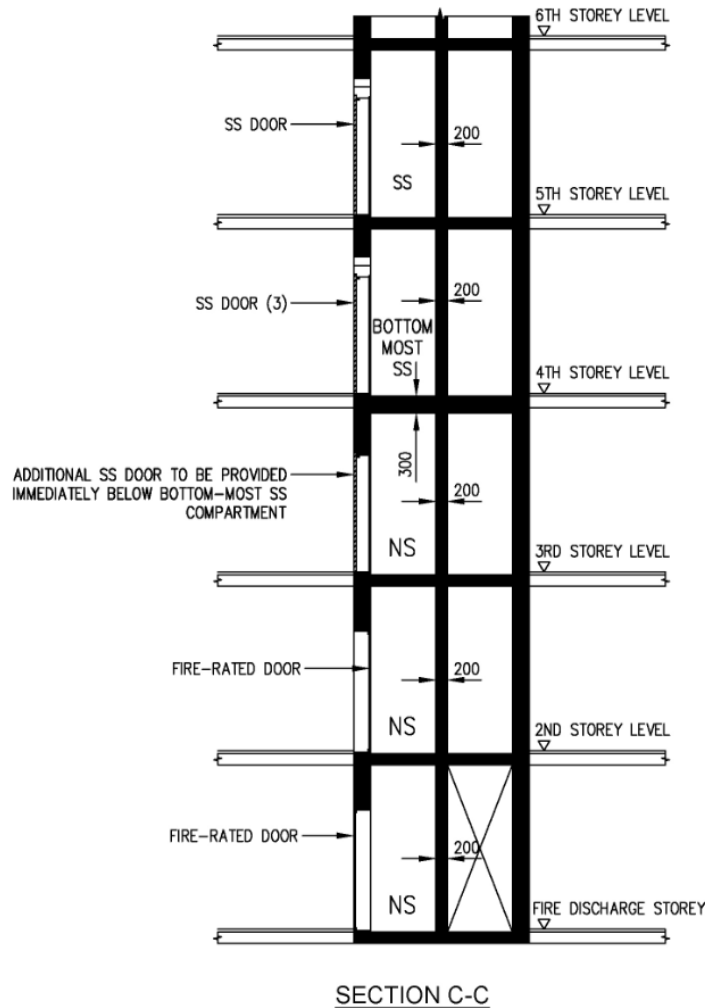


FIGURE 7A(vii) : SS WITH NS ABOVE TOP-MOST SS COMPARTMENT, INTERMEDIATE SS COMPARTMENT AND SS WITH NS BELOW BOTTOM-MOST SS COMPARTMENT



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Figure 7B(i)

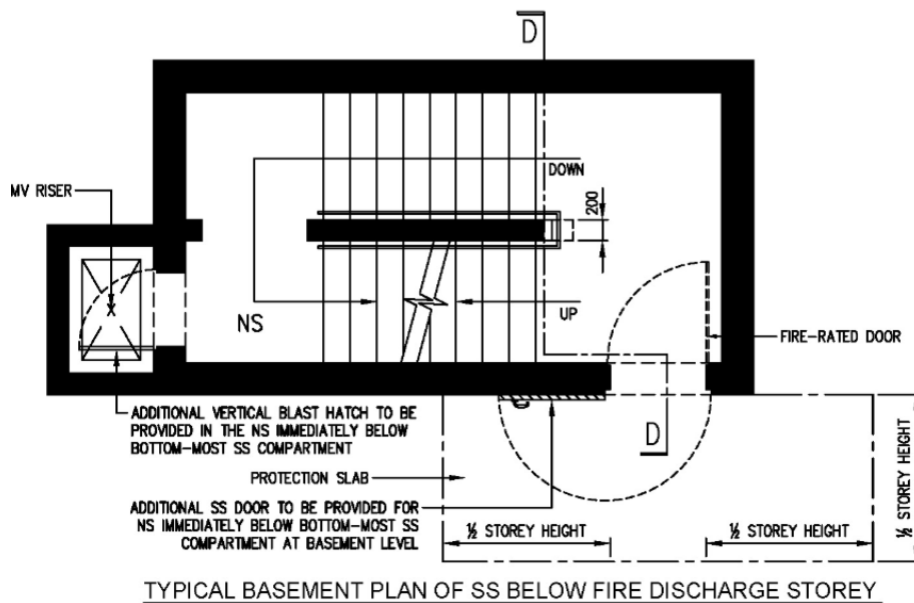
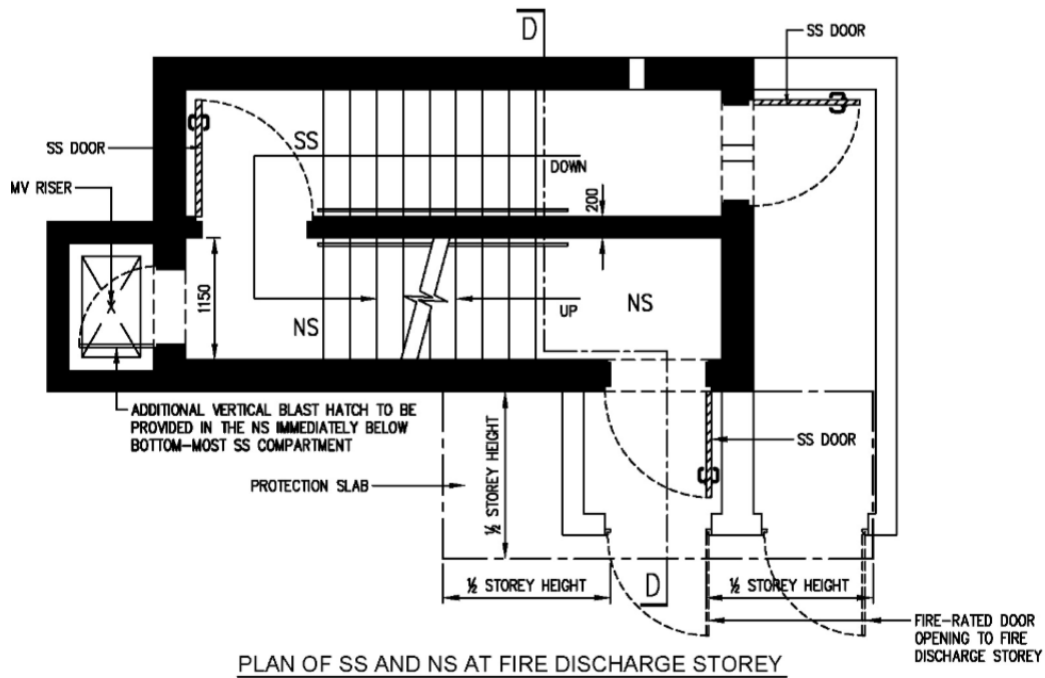


FIGURE 7B(i) : SS AND NS AT BASEMENT STOREY



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Figure 7B(ii)

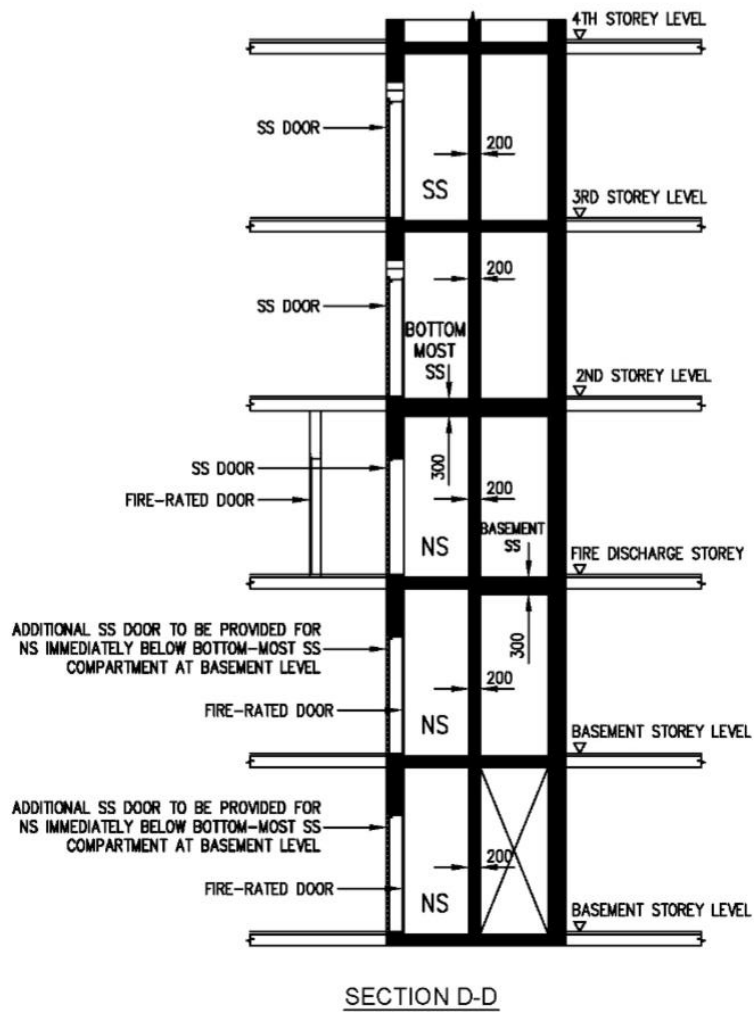


FIGURE 7B(ii) : SS AND NS AT BASEMENT STOREY



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Figure 8

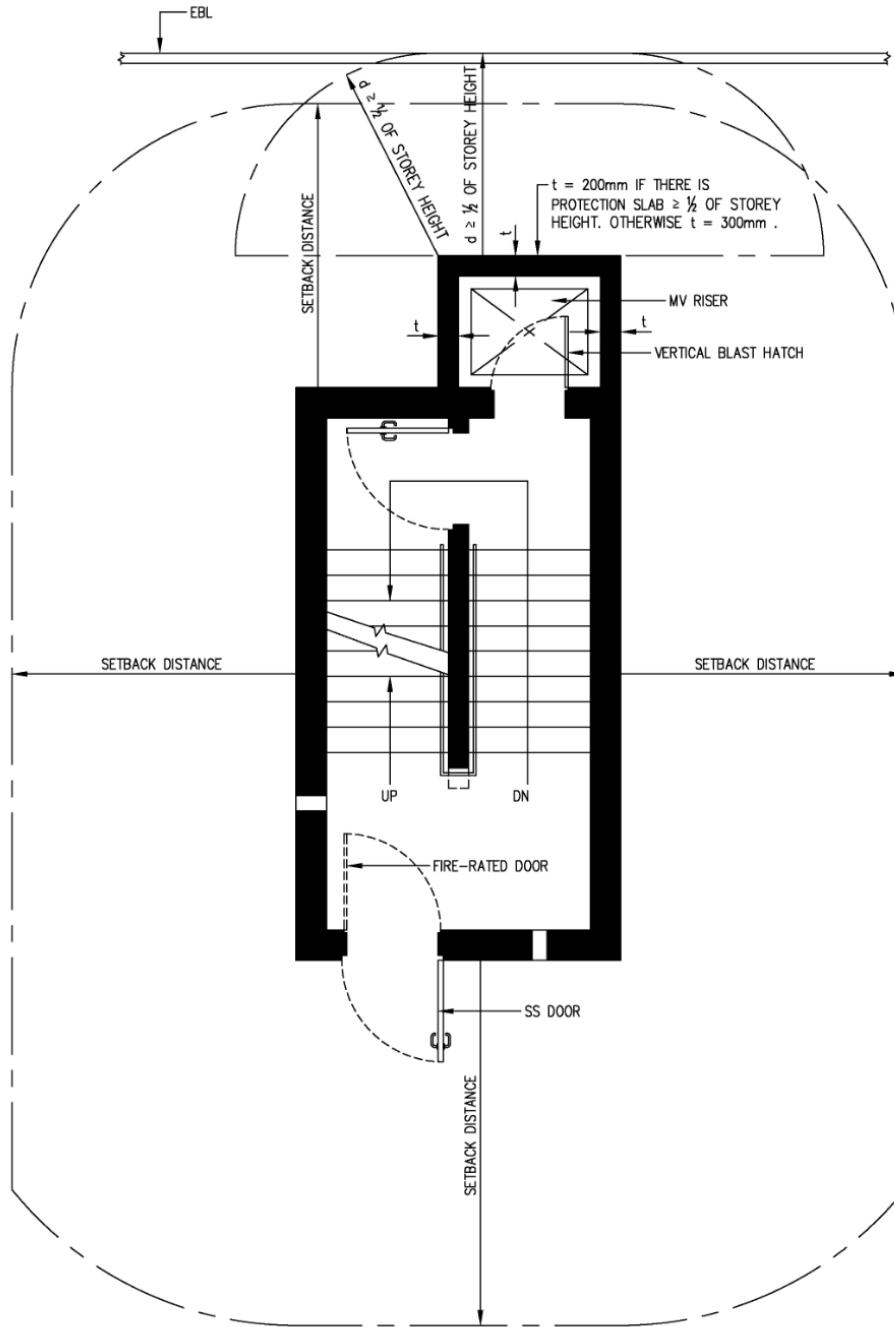


FIGURE 8 : PROTECTION OF RC SHIELDING WALL IN FRONT OF VERTICAL BLAST HATCH IN MV RISER



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Figure 9A

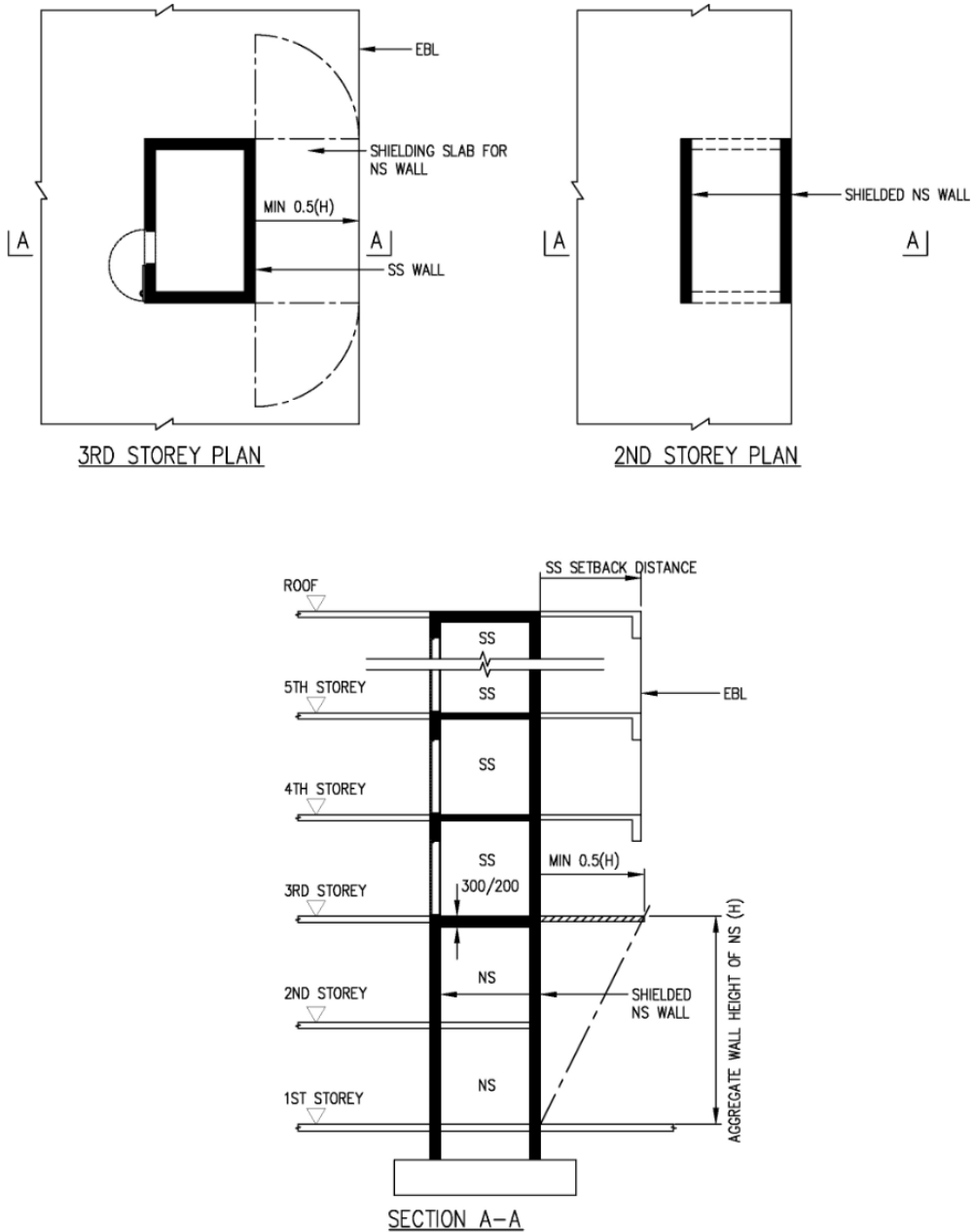


FIGURE 9A : SHIELDED NS WALLS OF SS TOWER



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Figure 9B

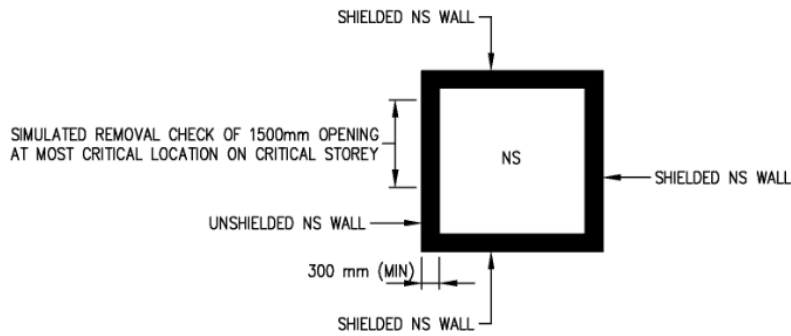


FIGURE 9B(i) : UNSHIELDED NS WALL OF SS TOWER

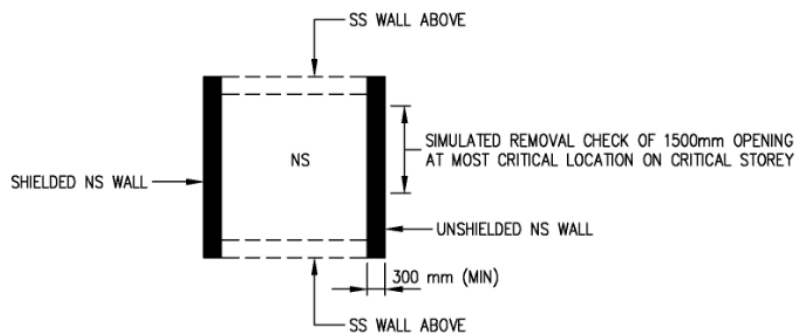


FIGURE 9B(ii) : UNSHIELDED NS WALL OF SS TOWER



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Figure 9C

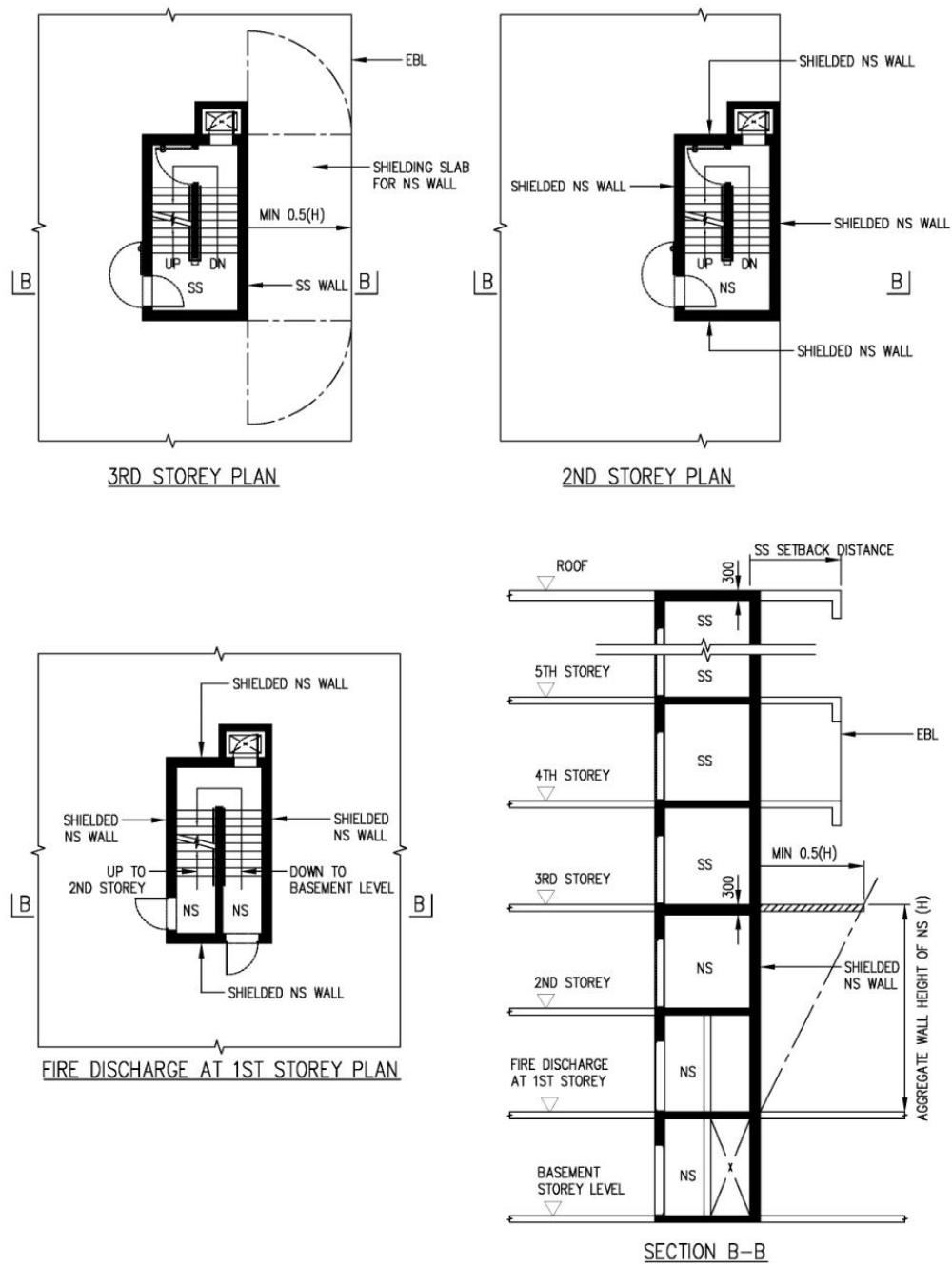


FIGURE 9C : SHIELDED NS WALLS OF S/C SS TOWER



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Figure 9D

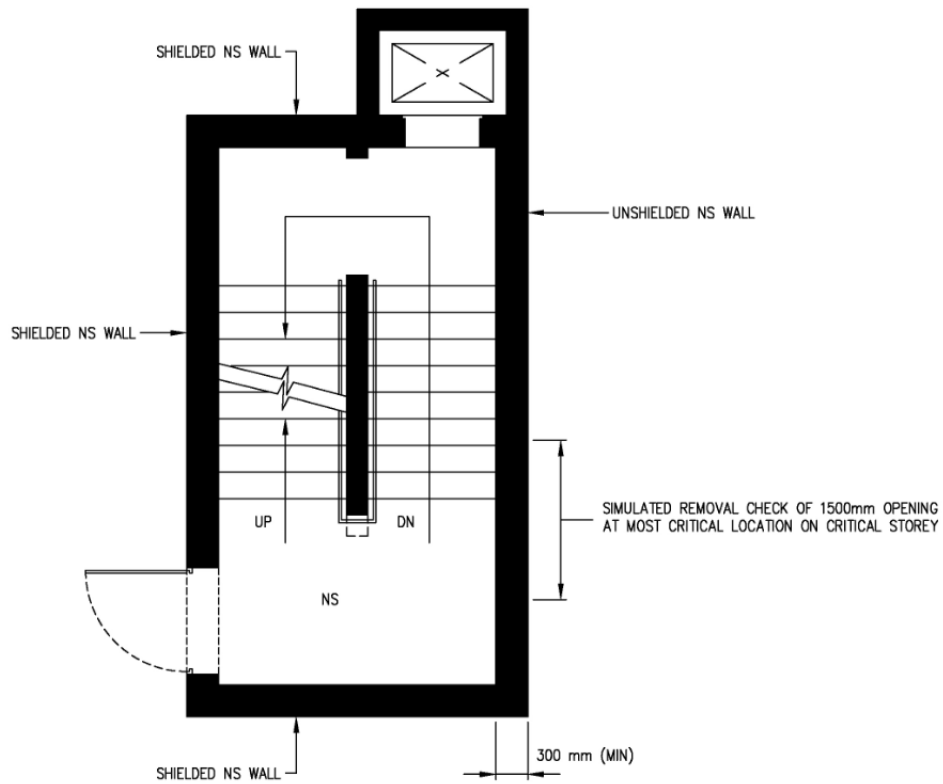


FIGURE 9D : UNSHIELDED NS WALL OF S/C SS TOWER



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Figure 10

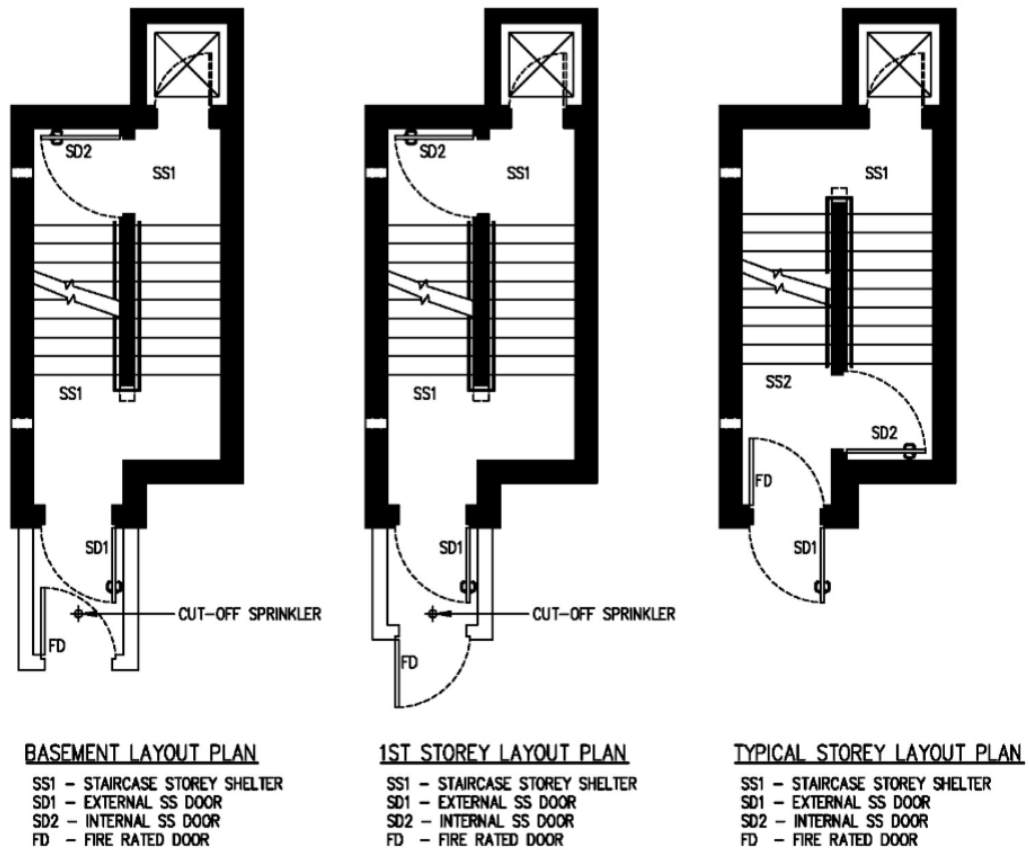


FIGURE 10 : PROVISION OF CUT-OFF SPRINKLER IN STAIRCASE STOREY SHELTER



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Figure 11

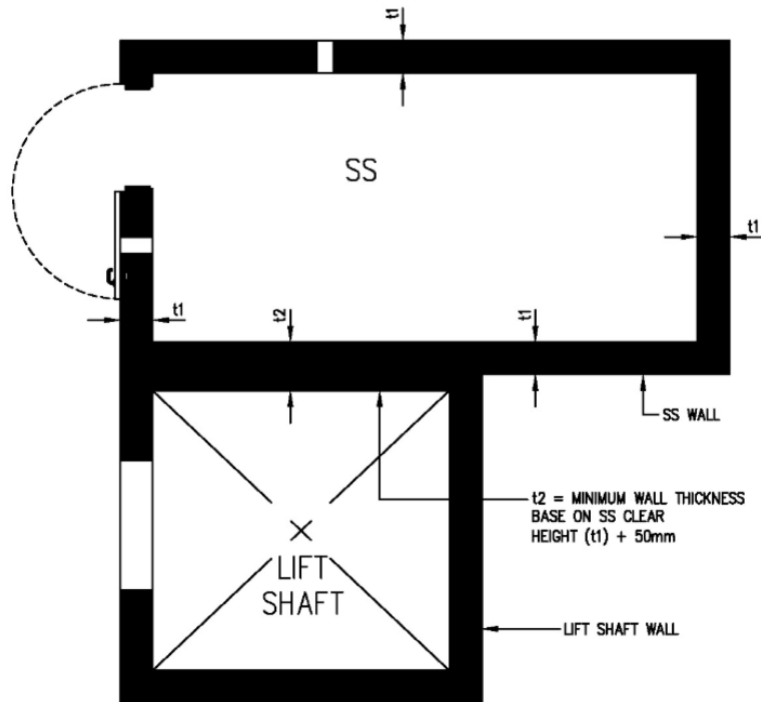


FIGURE 11 : LIFT SHAFT ABUTTING SS TOWER



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