

SINGAPORE CIVIL DEFENCE FORCE

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

Your Ref. :

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President, Singapore Institute of Architects (SIA)
President, Institution of Engineers, Singapore (IES)
President, Association of Consulting Engineers, Singapore (ACES)
President, Real Estates Developers' Association of Singapore (REDAS)

Dear Sir/Mdm,

REVISIONS TO HOUSEHOLD SHELTER TECHNICAL REQUIREMENTS 2012

1 In Nov 2013, a review study by an inter-agency work group to provide greater flexibility in the design of household shelters (HS) was completed and two main proposals were presented and accepted by MHA. SCDF and BCA co-led to establish the technical requirements for these proposals. The first proposal is on design options for HS with shielding walls as permissible variations for setback distance requirements, and the second proposal is to allow for smaller HS area for dwelling units with gross floor area (GFA) ≤ 38 square metres (sqm). The details are as follows:

a Design options for HS with shielding walls. Please refer to **Annex A** (titled: Technical Requirements for Household Shelters (HS) - Shielding Walls to Household Shelter Walls (without HS door)) for the requirements and layouts of the design options which can be adopted as permissible variations.

b Smaller HS area for dwelling unit with GFA ≤ 38 sqm. In recent years, more dwelling units with GFA ≤ 38 sqm are being developed. Due to the disproportionate area of the HS in relation to the GFA of such units, the minimum HS area of 1.4sqm for dwelling unit with GFA of 38sqm is added.



Hence Table 2.2.1 of the Technical Requirements for HS 2012 would be superseded by Table 1 of Annex B.

2 SCDF has also received many waiver applications on the provision of water and gas risers/ ducts within the setback distance envelope of the HS. Approval has been granted for these risers/ ducts to abut or be located within the setback distance envelope of the HS walls (without HS door) provided that the design of the risers/ ducts walls and openings at the roof level comply with the details as shown in Annex C.

3 As part of the review, we note that the existing Table 2.3.1(a) and Table 2.3.1(b) of the Technical Requirements for HS (i.e. minimum HS wall thickness) should strictly apply for a house or flat with storey height up to 4000mm. For storey heights above 4000mm, the HS wall thickness corresponding to the setback distance of the HS wall is tabulated in Annex D. The Tables in Annex D will supersede Table 2.3.1(a) and Table 2.3.1(b).

4. This circular shall take immediate effect from the date of issue.

5 Please convey the contents of this circular to members of your Institution/Association/ Board. The circular is also available in CORENET-e-Info: <http://www.corenet.gov.sg/einfo>. For any inquiry or clarification, please contact me at 68481478. Thank you.

Yours faithfully,

MAJ ANG GUAN HOCK
SSO SHELTER DEVELOPMENT
FIRE SAFETY & SHELTER DEPARTMENT
for COMMISSIONER
SINGAPORE CIVIL DEFENCE FORCE



CC

CEO, BCA

CEO, URA

CEO, HDB

President, IFE

President, SISV

SCDF Fire Safety Standing Committee



**TECHNICAL REQUIREMENTS
FOR
HOUSEHOLD SHELTER (HS)**

**- SHIELDING WALLS TO
HOUSEHOLD SHELTER WALLS
(WITHOUT HS DOOR)**

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TECHNICAL REQUIREMENTS FOR SHIELDING WALLS IN FRONT OF HOUSEHOLD SHELTER WALLS (WITHOUT HS DOOR)

A General

1. The shielding walls to household shelter (HS) walls (without HS door) shall comply with the Technical Requirements as specified in this Annex.

B Setback distance envelopes for HS

2. Household shelter must be protected by either full reinforced concrete slab or combination of reinforced concrete slab and trellis within the setback distance envelopes as stated in the Technical Requirements for Household Shelters 2012. This reinforced concrete slab and/or trellis shall be installed above or at Household Shelter ceiling slab level.

3. When the household shelter is located near to the exterior edge of a dwelling unit or along the building line, it must be protected by adding an exterior reinforced concrete slab which is equal to the setback distance for household shelter wall with door. For household wall without door, it must be protected by adding an exterior reinforced concrete slab which is equal to the setback distance or by a 1 metre (minimum projected reinforced concrete slab followed by reinforcement concrete or steel trellis within the required setback distance.

C Shielding walls for HS walls (without HS door)

4. Where the household shelter is located near the exterior edge of a dwelling unit or along the building line, and there is a shortfall in the setback distance, it can be shielded by having shielding wall in place of reinforced concrete slab at HS ceiling level. Figures 1 to 6 illustrate the permissible shielding wall configurations to household shelter at different locations.

(1) Shielding wall for HS where reinforced concrete slab is less than setback distance (Figure 1)

- (a) Household shelter walls near to exterior space shall be shielded by full height shielding walls.
- (b) For the HS wall which is near to the exterior space, there shall be a shielding wall 'A' parallel to and covering the entire length of this HS wall, and extending outwards for a further distance of minimum 300mm on both ends. This shielding wall 'A' shall be of at least 200mm thick brick or block wall with air gap of 175mm, or 225mm thick brick or block wall with air gap of 150mm as shown in Figure 1.

- (c) For Shielding wall 'A', if precast reinforced concrete wall is used in place of shielding brick or block wall, it shall be of the same thickness.
 - (d) Extending outwards from both ends of shielding wall 'A' and in line with the external side of shielding wall 'A', there shall be a shielding wall 'B' which will continue for a distance at least equal to the required setback distance as shown in Figure 1.
 - (e) Shielding wall 'B' shall consist of a minimum 200mm thick brick or block wall, or a 100mm thick precast reinforced concrete wall.
- (2) Household shelter design with shielding wall at one of its corners (Figure 2a and Figure 2b)
- (a) Household shelter with one of its corners within the setback distance envelope without reinforced concrete slab, thus not complying with setback distance requirements at that location.
 - (b) There shall be a shielding wall 'C' parallel to and extending outwards from the end of the HS wall, continuing for a distance at least equal to the required setback distance as shown in Figure 2a and Figure 2b.
 - (c) There shall be a shielding wall 'D', perpendicular to shielding wall 'C', which shall be located such that its exterior face is 300mm away from the nearest HS wall. This shielding wall 'D' shall continue outwards for a distance at least equal to the required setback distance as shown in Figure 2a and Figure 2b.
 - (d) Shielding wall 'C' shall consist of a minimum 200mm thick brick or block wall, or a minimum 100mm thick precast reinforced concrete wall.
 - (e) Shielding wall 'D' shall either be of the same requirement as Shielding wall 'C' or of full height vertical steel/concrete trellis as shown in Figure 2b.
- (3) Household shelter design with shielding wall at one side of HS wall near exterior (Figure 3 and 4)
- (a) Household shelter walls near to exterior space shall be shielded by full height shielding walls.
 - (b) For the HS wall which is near to the exterior space, there shall be a shielding wall 'A' parallel to and covering the entire length of this HS wall, and extending outwards for a further distance of minimum 300mm on both ends. This shielding wall 'A' shall be of at least 200mm thick brick or block

wall with air gap of 175mm, or 225mm thick brick or block wall with air gap of 150mm as shown in Figure 3 and 4.

- (c) For Shielding wall 'A', if precast reinforced concrete wall is used in place of shielding brick or block wall, it shall be of the same thickness.
 - (d) Extending outwards from both ends of shielding wall 'A' and in line with the external side of shielding wall 'A', there shall be a shielding wall 'B' which will continue for a distance at least equal to the required setback distance as shown in Figure 3 & 4.
 - (e) Shielding wall 'B' shall consist of a minimum 200mm thick brick or block wall, or a 100mm thick precast reinforced concrete wall.
- (4) Household shelter design with shielding wall at two sides of HS wall near exterior (Figure 5 and 6)
- (a) Household shelter walls near to exterior space shall be shielded by full height shielding walls.
 - (b) For each HS wall which is near to the exterior space, there shall be a shielding wall 'A' parallel to and covering the entire length of this HS wall, and extending outwards for a further distance of minimum 300mm on both ends. This shielding wall 'A' shall be of at least 200mm thick brick or block wall with air gap of 175mm, or 225mm thick brick or block wall with air gap of 150mm as shown in Figure 5 and 6.
 - (c) For Shielding wall 'A', if precast reinforced concrete wall is used in place of shielding brick or block wall, it shall be of the same thickness.
 - (d) Extending outwards from both ends of shielding wall 'A' and in line with the external side of shielding wall 'A', there shall be a shielding wall 'B' which will continue for a distance at least equal to the required setback distance as shown in Figure 5 and 6.
 - (e) Shielding wall 'B' shall consist of a minimum 200mm thick brick or block wall, or a 100mm thick precast reinforced concrete wall.

D Details of Shielding Brick/ Block wall

6. The brick/block wall shall be tied to the reinforcement concrete walls or columns by a wall tie system to ensure lateral stability.

E Details of Shielding Reinforced Concrete wall

7. The reinforced concrete wall used as shielding for the HS wall is to comply with the following:

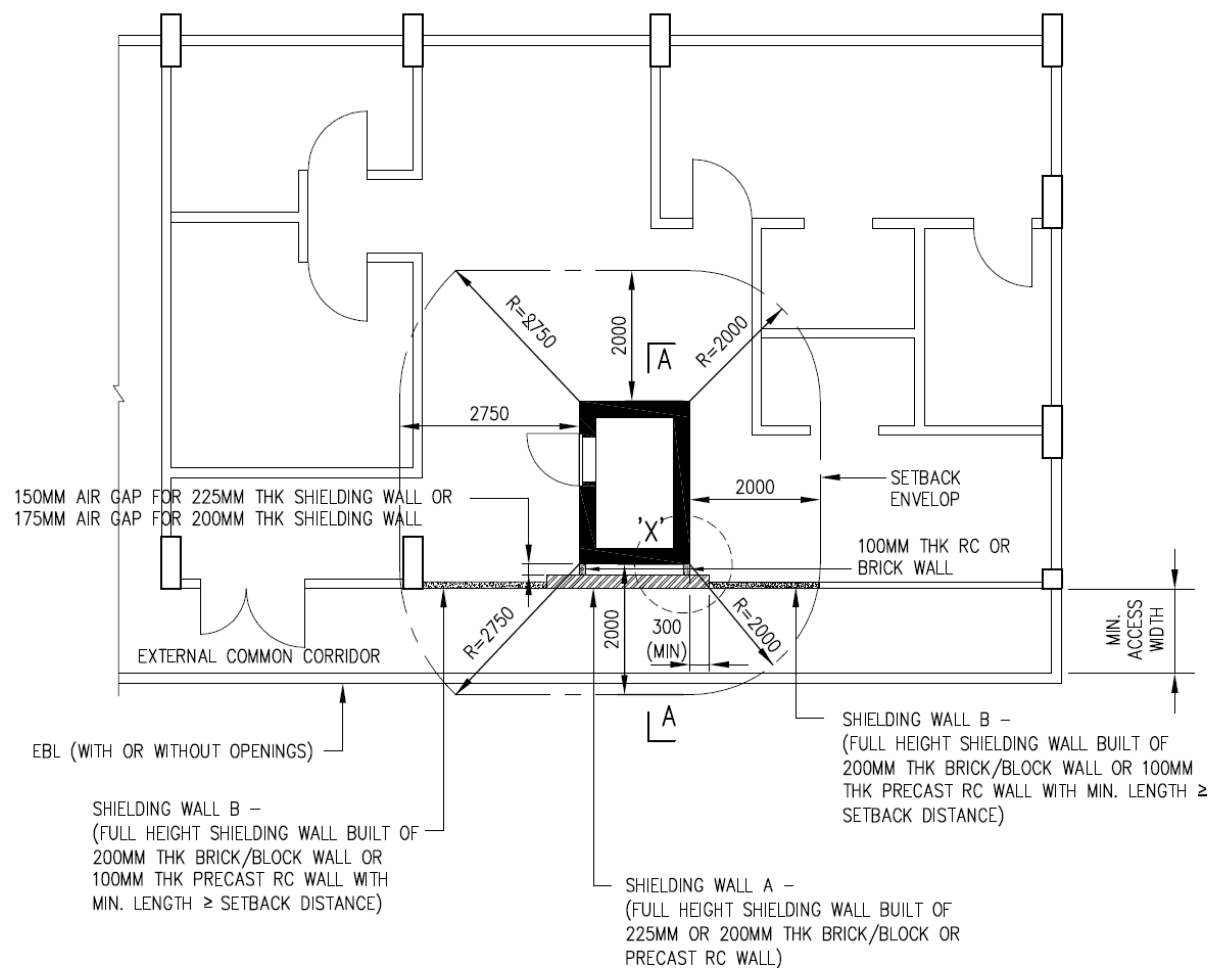
- (a) The minimum concrete grade for reinforced concrete shielding wall shall be Grade 30N/mm².
- (b) The minimum yield stress for main reinforcement bars and links shall be minimum 460N/mm² and 250N/mm² respectively.
- (c) The steel welded mesh used for reinforced concrete wall shall be minimum T10 at 200mm spacing on both faces.
- (d) The shear links (C-shaped) with at least 75mm bent at two ends around the outermost reinforcement bar of non-load bearing shielding wall shall be minimum 6mm diameter spaced at maximum 600mm vertically and horizontally.

F Non-Shelter (NS) Wall, Non-shelter (NS) column and Transfer Structure for HS Tower

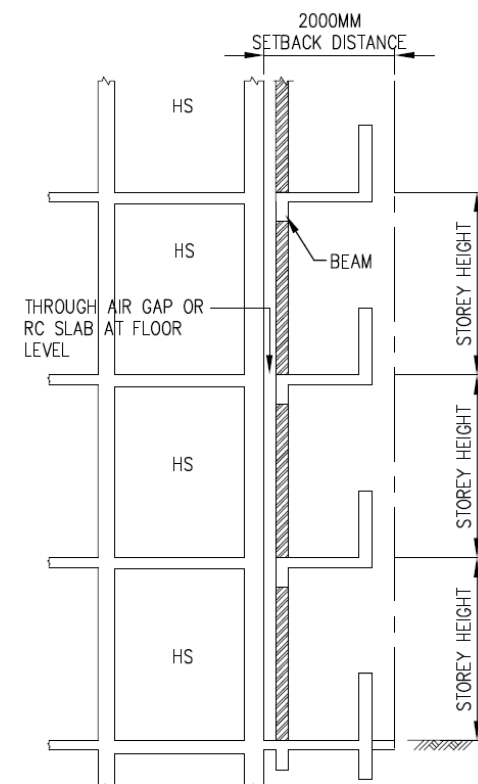
8. Design and analysis of wall and column supporting the household shelter shall comply with shielded and unshielded NS wall and NS column as stated in the Technical Requirements for Household Shelter 2012. Requirements for Transfer Structure for HS tower as stipulated in the Technical Requirements for Household Shelter 2012 will also be applicable here as well.

G Non-permitted Works

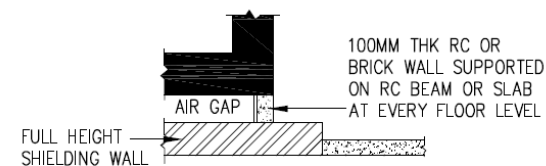
9 The shielding walls and air gaps for the protection of HS in place of reinforced concrete slab shall not be removed or tampered with at all times, without prior approval from the relevant authorities.



**FIGURE 1 : SHIELDING WALL FOR HS WHERE REINFORCED CONCRETE
SLAB IS LESS THAN SETBACK DISTANCE**
(Example : Storey Height \leq 2800mm)



SECTION A - A



DETAIL 'X'

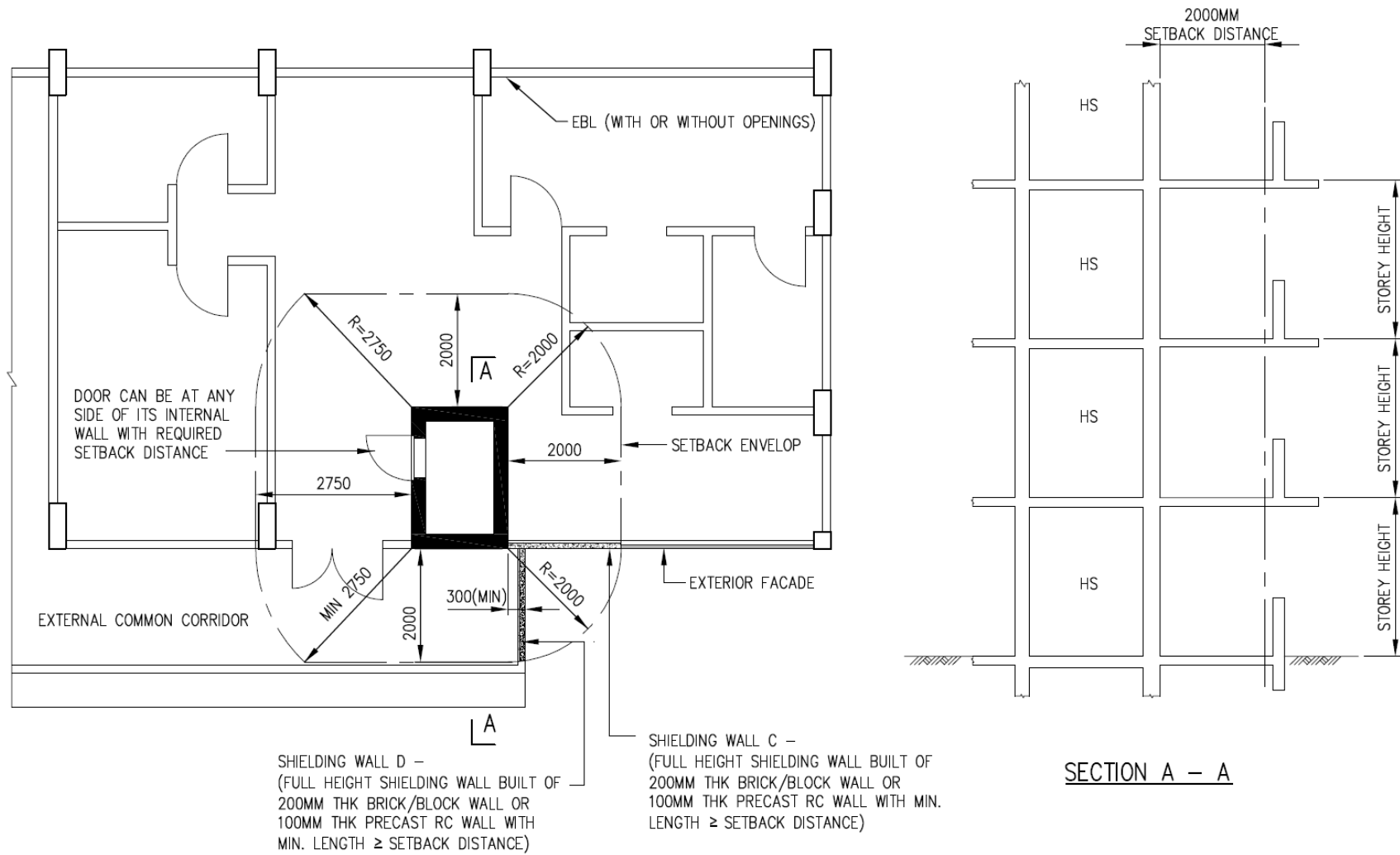


FIGURE 2a : HS DESIGN WITH SHIELDING WALL AT ONE OF ITS CORNER
(Example : Storey Height \leq 2800mm)

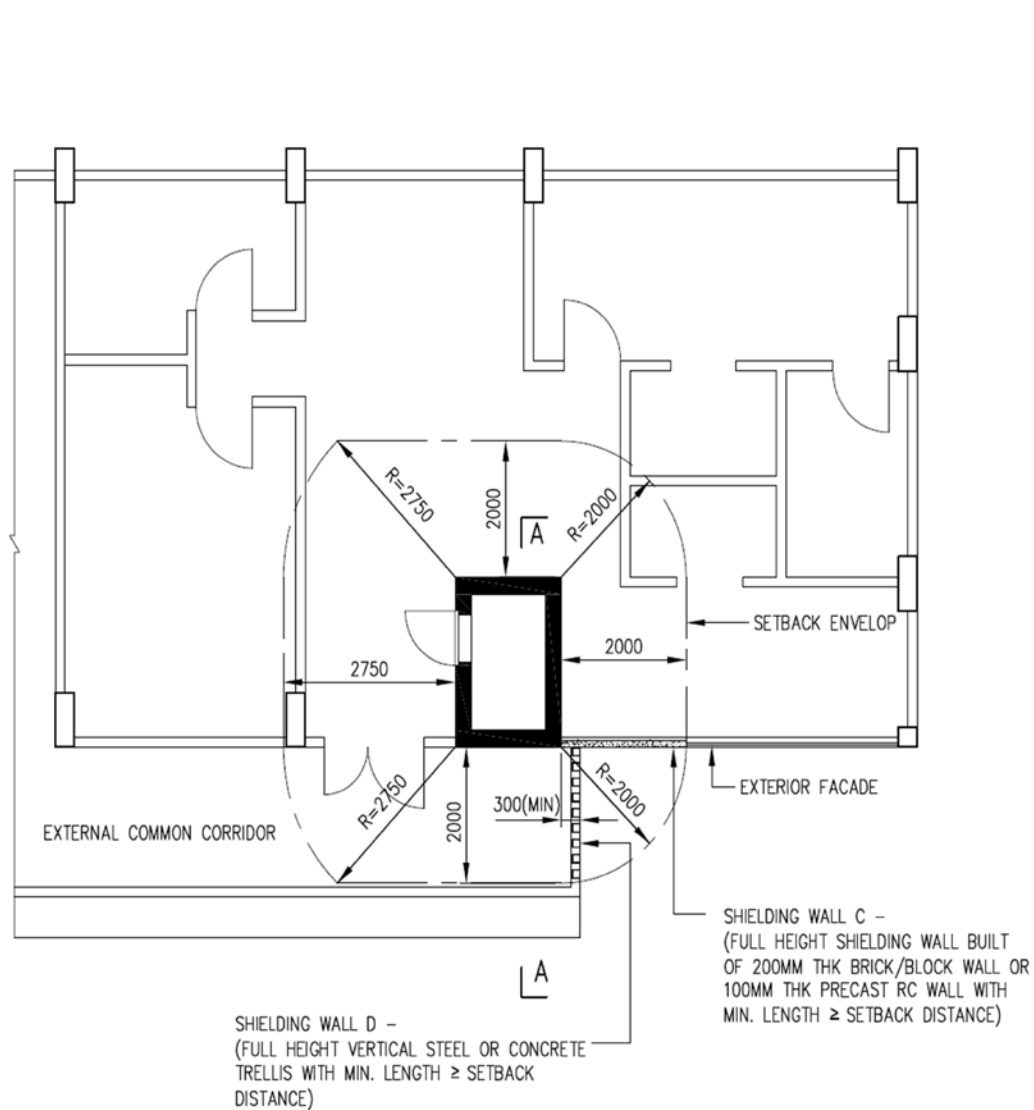
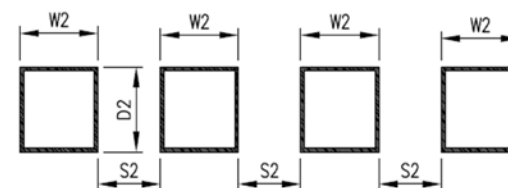
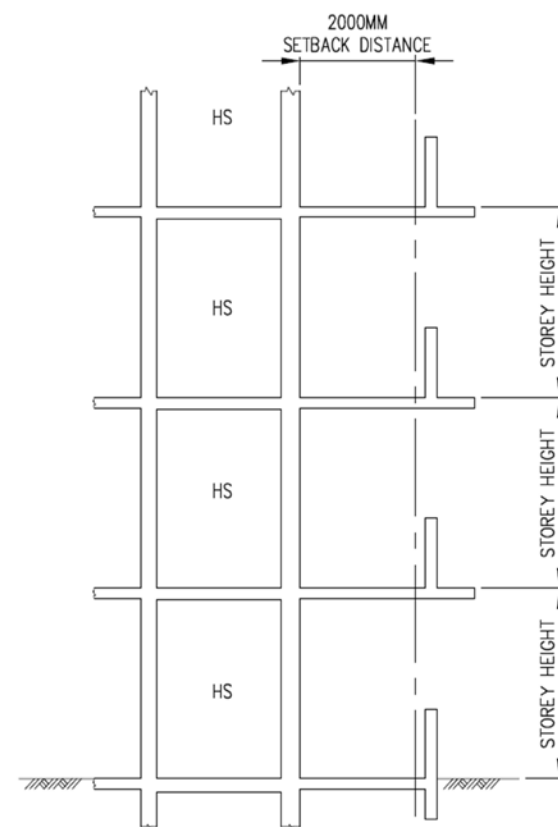


FIGURE 2b : HS DESIGN WITH SHIELDING WALL AT ONE OF ITS CORNER
(Example : Storey Height \leq 2800mm)



W2 = MIN 125MM
S2 = MAX 100MM
D2 = MIN 125MM

NOTE:
IF STEEL TRELLIS IS USED,
MINIMUM THICKNESS OF STEEL
HOLLOW SECTION IS 6MM

PLAN VIEW OF VERTICAL CONCRETE OR STEEL TRELLIS

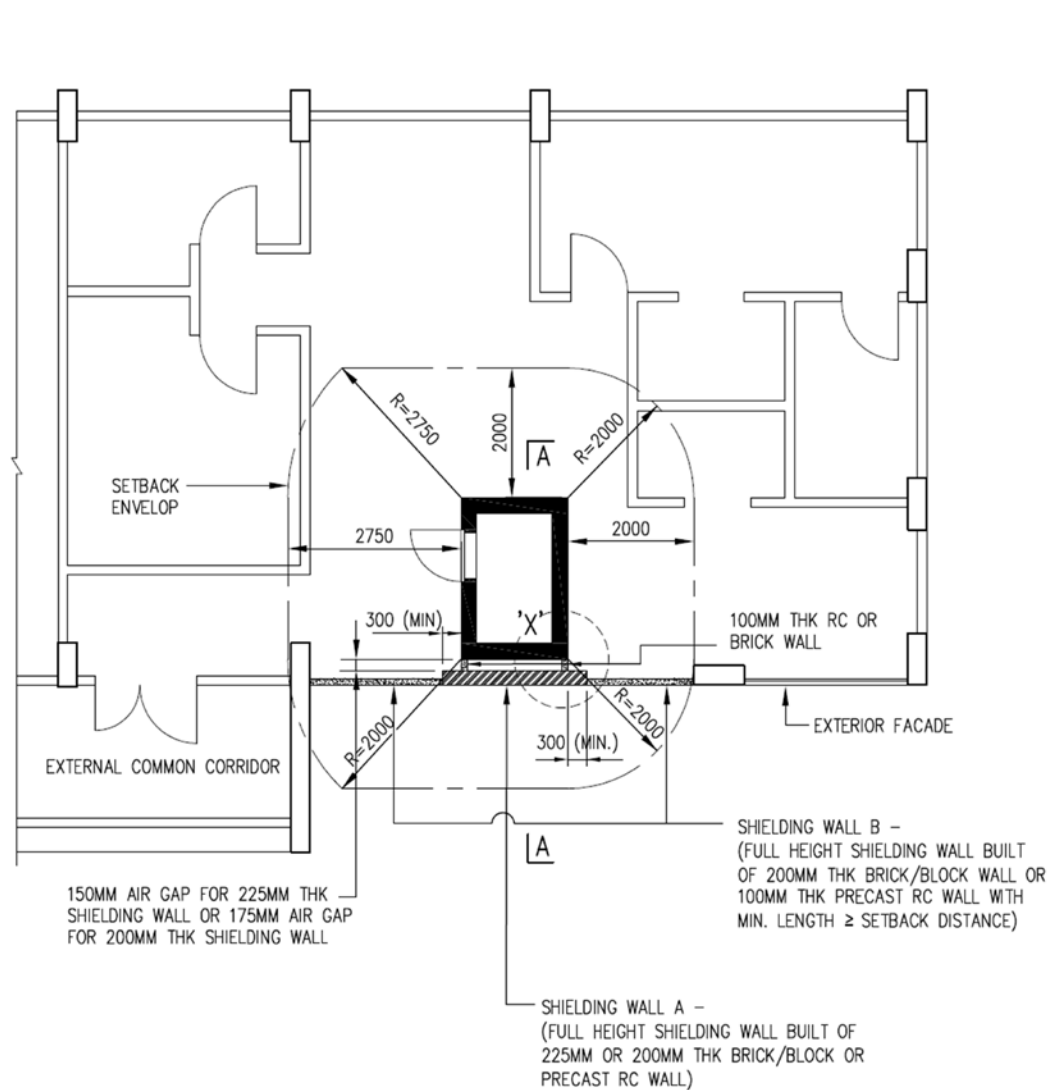
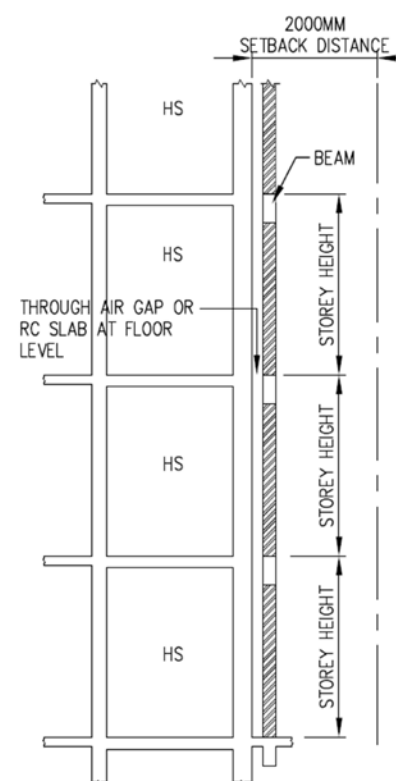
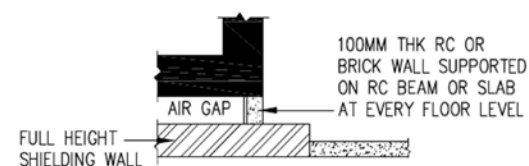


FIGURE 3 : HS DESIGN WITH SHIELDING WALL AT ONE SIDE OF HS WALL NEAR EXTERIOR
(Example : Storey Height \leq 2800mm)



SECTION A - A



DETAIL 'X'

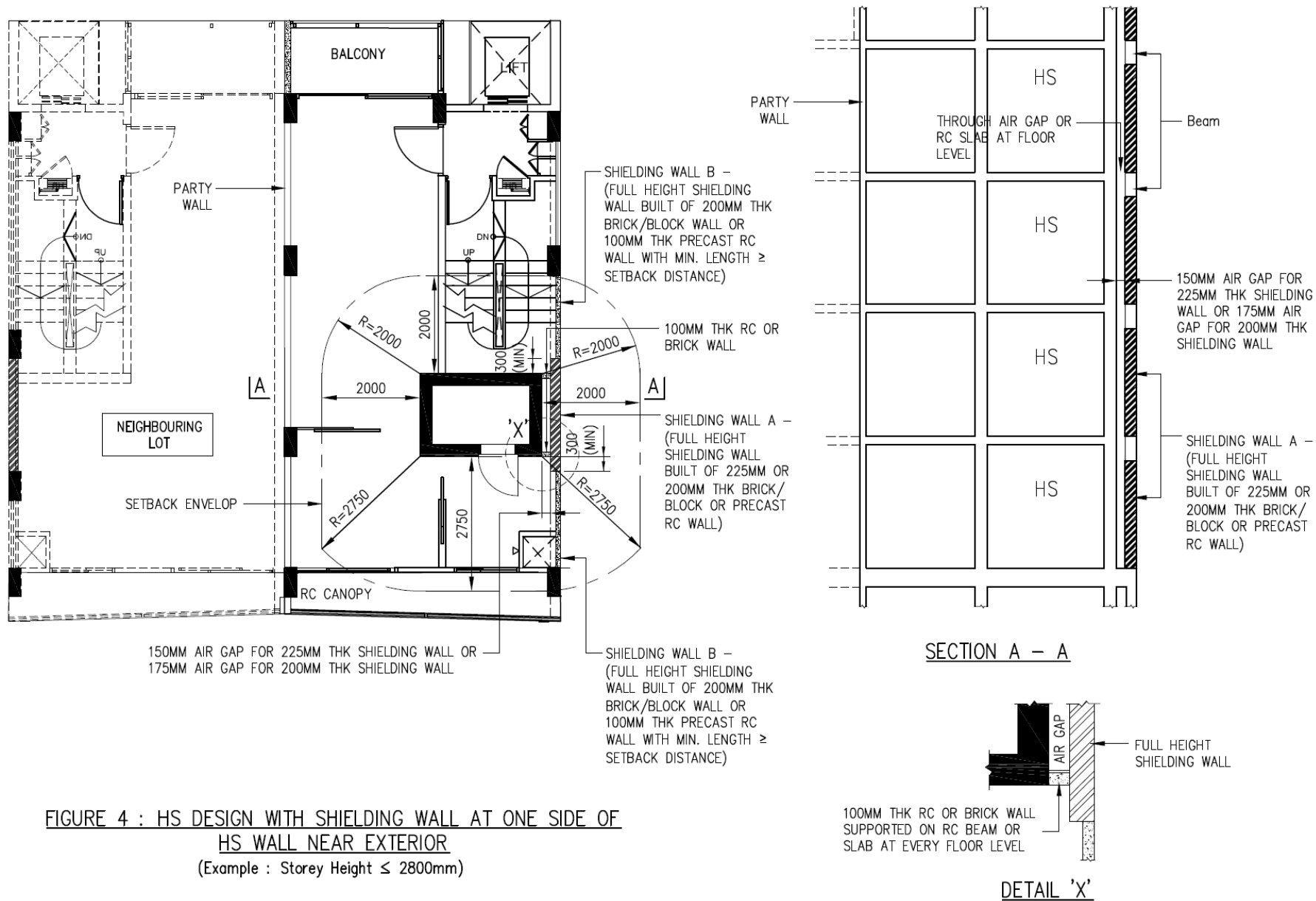


FIGURE 4 : HS DESIGN WITH SHIELDING WALL AT ONE SIDE OF HS WALL NEAR EXTERIOR
(Example : Storey Height \leq 2800mm)

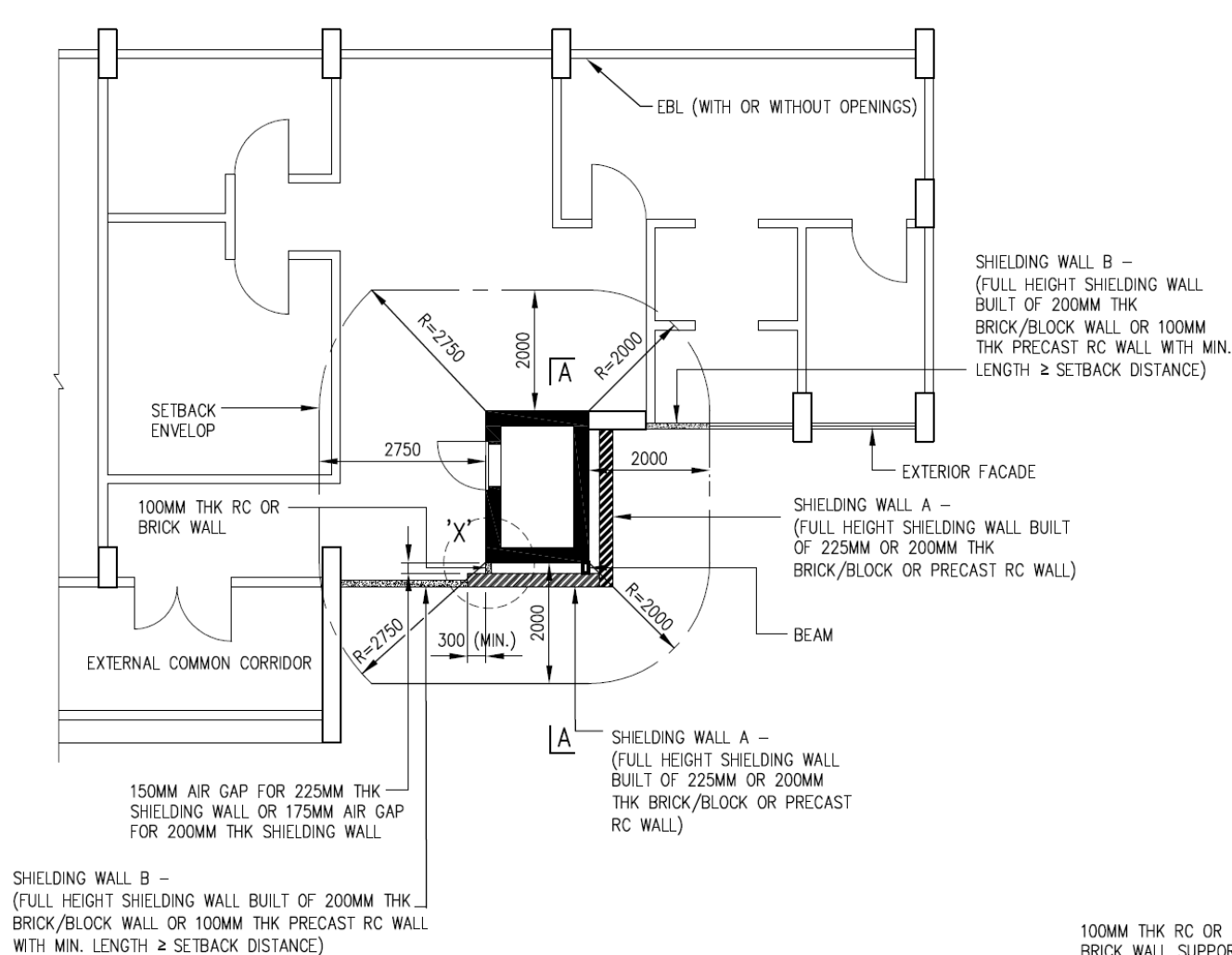
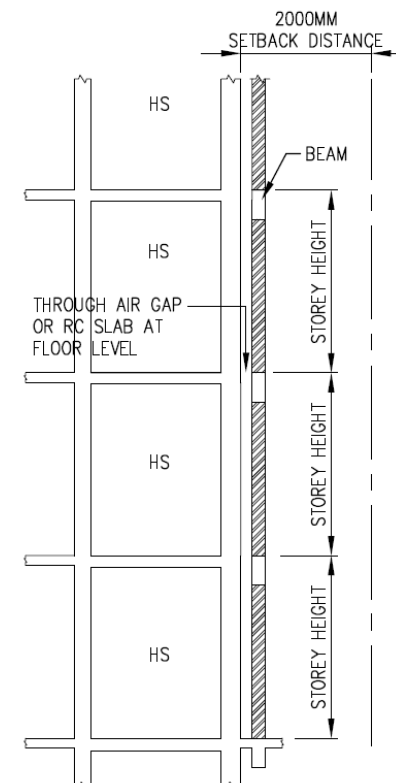
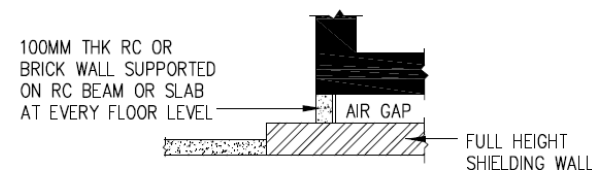


FIGURE 5 : HS DESIGN WITH SHIELDING WALL AT TWO SIDES OF HS WALL NEAR EXTERIOR
(Example : Storey Height \leq 2800mm)



SECTION A – A



DETAIL 'X'

**TABLE 1: MINIMUM INTERNAL HS
FLOOR AREA AND VOLUME**

GFA* of a House (m ²)	HS Floor Area** (m ²)	HS Volume (m ³)
GFA ≤ 38	1.4	3.6
38 < GFA ≤ 45	1.6	3.6
45 < GFA ≤ 75	2.2	5.4
75 < GFA ≤ 140	2.8	7.2
GFA > 140	3.4	9.0

* The GFA of the house excludes the area of balconies that are open on at least two sides to make the balconies conducive for sky-rise gardening in accordance with URA guidelines. Service balconies, which are commonly provided at the utility areas for the purpose of drying clothes, would therefore not qualify for exclusion.

** Whenever possible a larger HS internal floor area (up to a maximum size of 4.8 m²) should be provided to enable a relatively more comfortable stay during a war emergency.

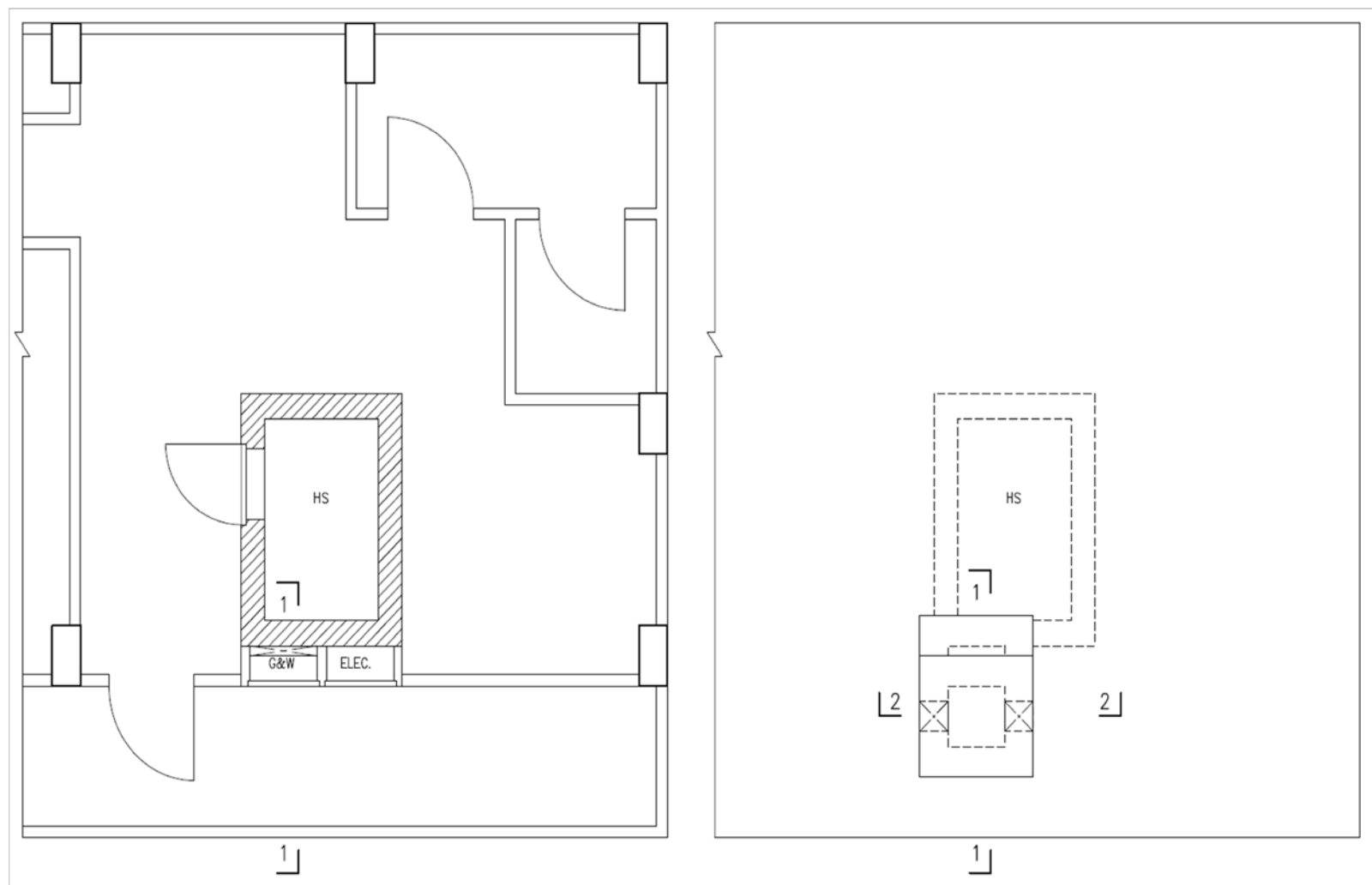
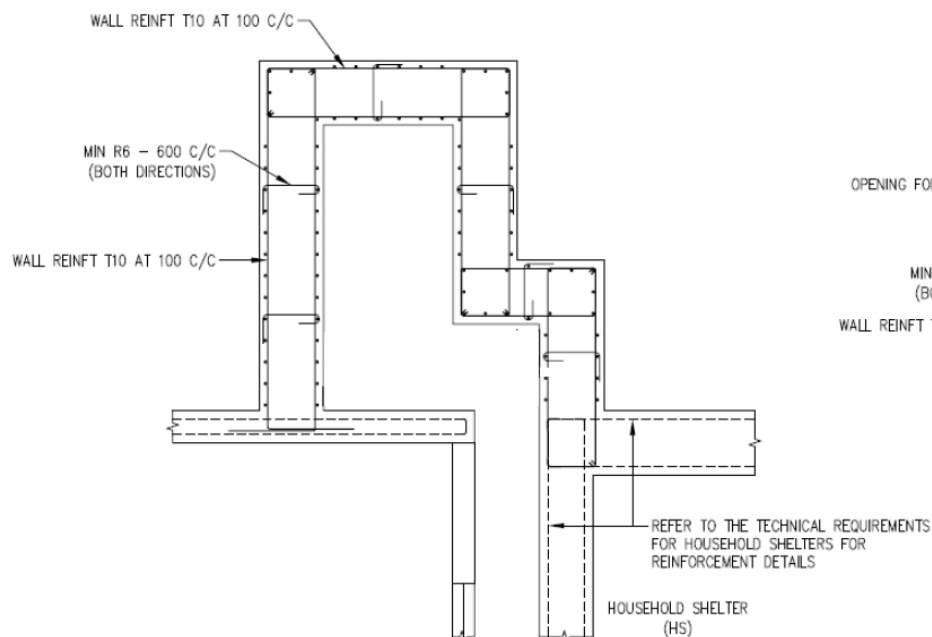
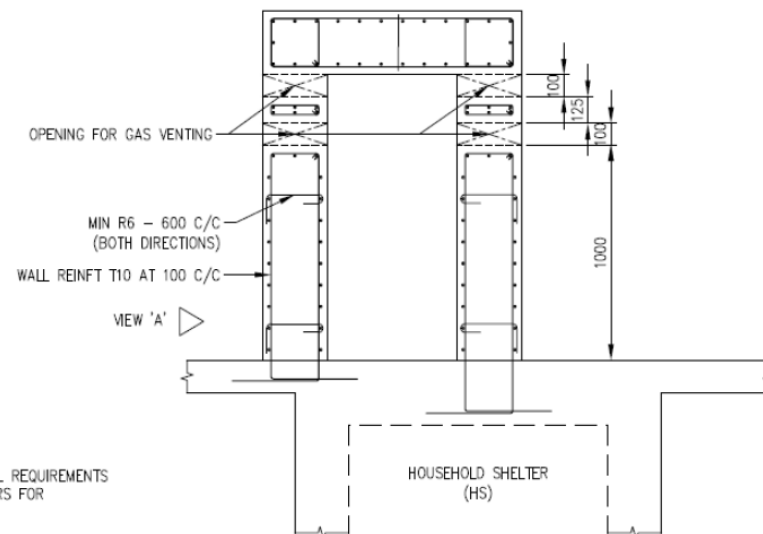


Figure 7: Typical Floor Plan & Plan View For Type A
(Showing Services Riser Locate Next to HS)

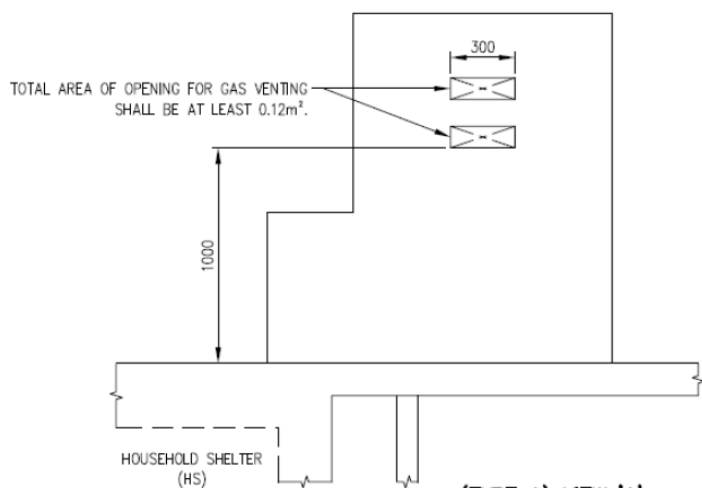


(TYPE A) SECTION 1-1



(TYPE A) SECTION 2-2

Figure 8: Section View - Showing the details of The 300mm thick RC protective structure above the roof level and the reinforcement spacing Between openings for Type A.



(TYPE A) VIEW 'A'

Notes:

1. THE RC WALL AND SLAB THICKNESS OF PROTECTIVE STRUCTURE ABOVE MAIN ROOF LEVEL SHALL BE AT LEAST 300MM.
2. MIN CONCRETE DRADE = 30 N/mm².
3. TOTAL AREA OF OPENING FOR GAS VENTING SHALL BE AT LEAST 0.12m².
4. WIDTH OF OPENING SHALL NOT BE BIGGER THAN 100mm.
5. SPACING BETWEEN OPENINGS SHALL BE EQUAL TO OR MORE THAN 125mm.

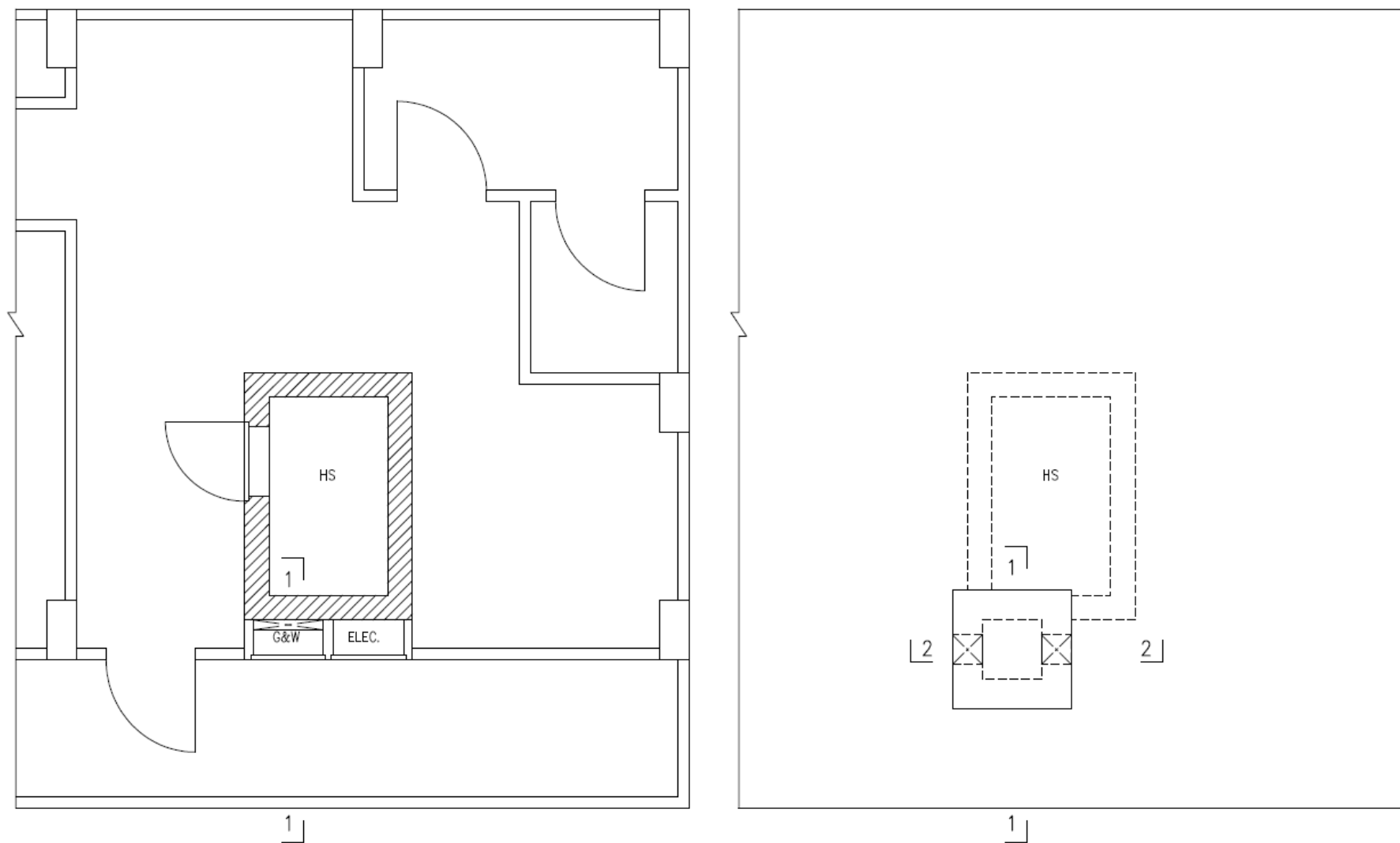
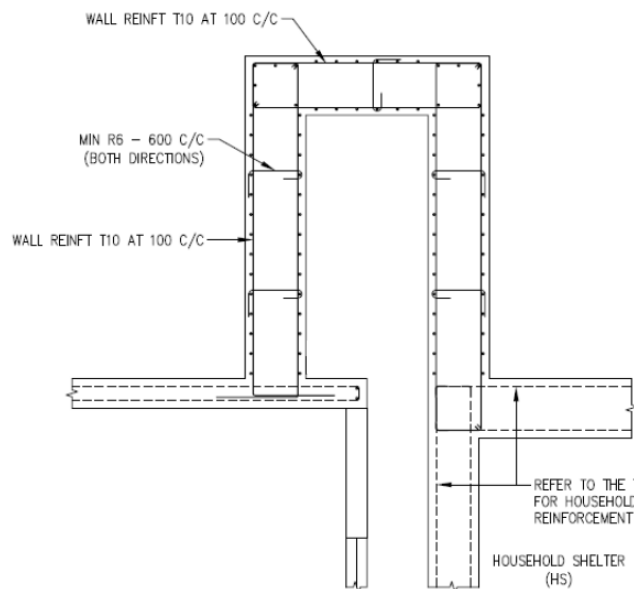
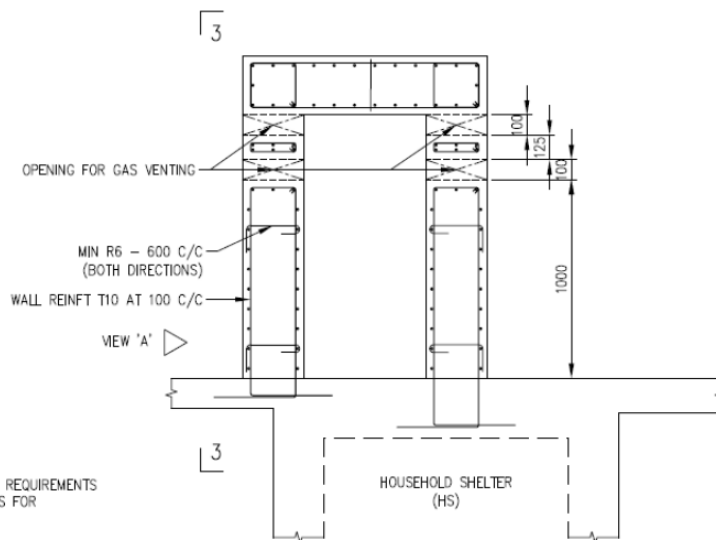


Figure 9: Typical Floor Plan & Plan View For Type B
(Showing Services Riser Locate Next to HS)

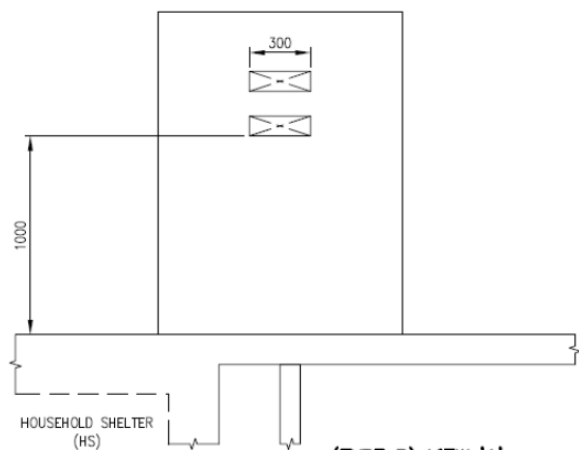


(TYPE B) SECTION 1-1



(TYPE B) SECTION 2-2

Figure 10: Section View - Showing the details of The 300mm thick RC protective structure above the roof level and the reinforcement spacing Between openings For Type B.



(TYPE B) VIEW 'A'

Notes:

1. THE RC WALL AND SLAB THICKNESS OF PROTECTIVE STRUCTURE ABOVE MAIN ROOF LEVEL SHALL BE AT LEAST 300MM.
2. MIN CONCRETE DRADE = 30 N/mm².
3. TOTAL AREA OF OPENING FOR GAS VENTING SHALL BE AT LEAST 0.12m².
4. WIDTH OF OPENING SHALL NOT BE BIGGER THAN 100mm.
5. SPACING BETWEEN OPENINGS SHALL BE EQUAL TO OR MORE THAN 125mm.

TABLE 2: MINIMUM HS AND NS WALL THICKNESS
(FOR LANDED DEVELOPMENTS)

Storey Height (mm)	HS Clear Height (mm)	Setback Distance of HS Wall (mm)	Wall Thickness (mm)
$H_t \leq 4000$	$2400 \leq H_t \leq 3900$	≤ 6000	250
		> 6000	200
$4000 < H_t \leq 6000$	$2400 \leq H_t \leq 3900$	≤ 7000	250
		> 7000	200
$6000 < H_t \leq 8000$	$2400 \leq H_t \leq 3900$	≤ 8000	250
		> 8000	200
$8000 < H_t \leq 10000$	$2400 \leq H_t \leq 3900$	≤ 9000	250
		> 9000	200

TABLE 3: MINIMUM HS AND NS WALL THICKNESS
(FOR NON-LANDED DEVELOPMENTS)

Storey Height (mm)	HS Clear Height (mm)	Setback Distance of HS Wall (mm)	Wall Thickness (mm)
Ht ≤ 4000	2400 ≤ Ht ≤ 3000	≤ 6000	250
		> 6000	200
	3000 < Ht ≤ 3200	≤ 6000	275
		> 6000	225
	3200 < Ht ≤ 3900	≤ 6000	300
		> 6000	250
4000 < Ht ≤ 6000	2400 ≤ Ht ≤ 3000	≤ 7000	250
		> 7000	200
	3000 < Ht ≤ 3200	≤ 7000	275
		> 7000	225
	3200 < Ht ≤ 3900	≤ 7000	300
		> 7000	250
6000 < Ht ≤ 8000	2400 ≤ Ht ≤ 3000	≤ 8000	250
		> 8000	200
	3000 < Ht ≤ 3200	≤ 8000	275
		> 8000	225
	3200 < Ht ≤ 3900	≤ 8000	300
		> 8000	250
8000 < Ht ≤ 10000	2400 ≤ Ht ≤ 3000	≤ 9000	250
		> 9000	200
	3000 < Ht ≤ 3200	≤ 9000	275
		> 9000	225
	3200 < Ht ≤ 3900	≤ 9000	300
		> 9000	250