

**Household Shelter Structural Requirement Checklist:**

- (1) The essential technical requirements that have impacts on the structural safety, performance and protection levels of the household shelters are listed in the Table.
- (2) The list shall be used as a guide to check that the plan submitted fulfils essential technical requirements.
- (3) For other technical requirements not in the list, they shall be referred to Technical Requirements for Household Shelters 2017.

Disclaimer: This checklist serves as a guide to qualified person in relation to the preparation of (i) Building Plans which will incorporate the architectural aspects of Civil Defence (“CD”) Shelter Plans and (ii) Structural Plans which will incorporate the structural aspects of the CD Shelter Plans and are for informational purposes only. This checklist does not purport to be exhaustive or applicable to all situations and does not constitute professional advice. The Building and Construction Authority disclaims any liability (including any liability arising from negligence) arising in respect of any matter and the consequences of any act done or not done by any person in reliance on anything in or omitted from this checklist.

1	Material	Clause or Table or Fig. in TRHS 2017
	<p><b>Concrete</b></p> <p>Landed development : Min. C25/30                      Non-landed Landed development : Min.C32/40                      Normal concrete density (2400kg/m<sup>3</sup>) and consists of 20mm nominal maximum size coarse aggregate, apply to all HS wall (include hollow core &amp; joints, RC elements within setback distance)</p> <p><b>Steel reinforcement</b>                      Welded steel fabric mesh for steel bar                      Yield stress Min. 500 N/mm<sup>2</sup></p>	<p>Cl. 3.2.1</p> <p>Cl. 3.2.2</p>
2	<p><b>Analysis</b></p> <p>(a) Shielded NS walls and/ or NS columns -                      No additional design check if supporting NS wall/ NS columns are shielded by RC slab</p> <p>(b) Unshielded NS walls and/ or NS columns -                      Min NS wall 300 mm thk; Min NS Column 500 mm thk                      Additional design check against the most severe effects of the removal of a portion of the NS wall equivalent to 1.5m opening (@ most critical position)                      Additional design check against the most severe effects of the removal of one NS column at a time                      Design load and design strength of material to be adopted shall be 1.2 for concrete &amp; 1.0 for steel</p> <p>(c) Shielded Transfer structure supporting HS tower                      No additional design check on transfer structure if transfer structure is adequately shielded</p> <p>(d) Unshielded Transfer structure supporting HS tower</p> <p><u>Unshielded transfer slab/ Beams</u>                      Additional design check against the most severe effects of removal of a portion of the transfer slab/beam equivalent to 1.5m opening (@ most critical position)</p> <p><u>Unshielded exterior columns/ walls</u>                      Min column 500mm thk &amp; wall 300 thk wall                      Additional design check against the most severe effects of the removal of a portion of the exterior wall equivalent to 1.5m opening (@ most critical position)                      Additional design check against the most severe effects of the removal of an exterior column at a time</p> <p>Design load and design strength of material to be adopted shall be 1.2 for concrete &amp; 1.0 for steel</p>	<p>Cl. 3.3.4 (a)</p> <p>Cl. 3.3.4 (b)-(d)                      Fig. 3.3.4(a)-(c)</p> <p>Table 3.3.4 (d)</p> <p>Cl 3.3.5.2 (a)-(b)                      Fig. 3.3.5.2 (a)-(b)</p> <p>Fig. 3.3.5.3(a)(i) &amp; (ii)</p> <p>Fig. 3.3.5.3(b)(i) &amp; (ii)</p> <p>Table 3.3.5.1</p>

3	Member dimensions & reinforcement requirements (a) Reinforcements of HS and NS walls (i) Landed development Minimum reinf. H10-100 c/c at both faces, both directions, max internal clear HS height 3900mm Shear link H8-600 c/c both directions  (ii) Non- Landed development Minimum reinf. H10-100 c/c at both faces, both directions, max internal clear HS/NS height (Ht): $2400 \leq Ht \leq 3000$ mm Minimum reinf. H13-100 c/c at both faces, both directions, max internal clear HS/NS height (Ht): $3000 < Ht \leq 3900$ mm Shear link H8-600 both directions	Table 3.4.2.1 (a)  Table 3.4.2.1 (b)
	(b) Reinforcements in HS and NS slab Minimum reinf. H10-100 c/c & shear link H8-600 c/c at both faces, both directions  Ceiling slab outside HS wall with HS door Min. 125mm thk with H10-100 c/c in both direction  HS slab intergrated with footing/ pilecap Max reinf. Spacing is 200 c/c and shear link provision not required for combine thickness >500mm.	Cl. 3.4.2.2  Cl. 3.4.2.3  Cl. 3.4.2.4
	(c) Reinforcements in precast shielding wall for HS wall Shielding wall with air gap only permitted with HS wall without HS door Can be build of brick/ block wall /precast wall Precast concrete wall reinf. to be minimum H10-200 c/c mesh, shear links with H8-600 c/c with 75mm bend at two ends Air gap shall not be filled up	Cl. 3.4.2.5  Fig. 2.4.5 (a) - (g)
4	Detailing of HS tower (a) Lap and anchorage length Full lap and anchorage length of reinf. to be provided according to concrete grade and bond condition	Table 3.5.2(a) & (b)
	(b) Concrete cover to main reinforcement Minimum 25 mm; maximum 40mm	Cl. 3.5.3
	(c) Details of HS wall reinf. near HS door Reinf. at each sides of blast door frame and its stiffener shall be 2H13	Fig. 3.5.4(f)
	(d) Ventilation sleeve trimmer bars Additional trimmer bars around ventilation sleeve ( to be placed within ventilation sleeve stiffeners), size of bar reinf. to follow wall reinf.	Fig. 3.5.5(h)
	(e) Shear links Hooks and bend must be tie to outermost reinf. of HS where the hook must always placed face internal face of HS	Fig. 3.5.4 (i)
	(f) Precast hollow cores HS Size of precast hollow core to be in multiple of 100mm. Min reinf. of reinf. bars in hollow cores depending on HS clear hieght. Min 4H20 in 200mm cores for max internal clear HS/NS height (Ht): $2400 \leq Ht \leq 3000$ mm Min 4H25 in 200mm cores for max internal clear HS/NS height (Ht): $3000 < Ht \leq 3900$ mm	Table 3.5.6(c)

	<p>(g) Precast HS hollow core provision with HS wall with door</p> <p>All precast HS walls to be provided with hollow cores except for short HS wall with HS door of 1.2m wide HS (internal clear). HS door to be placed centrally  Next permitted short HS wall with HS door is 1.35m (internal clear), with 200mm core cage</p>	<p>Fig. 3.5.6.1 (b)</p>
	<p>Minimum slab thickness and reinforced concrete topping to comply to requirement</p>	<p>Table 3.5.6(d)</p>

**Storey Shelter & Staircase Storey Shelter Structural Requirement Checklist:**

- (1) The essential technical requirements that have impacts on the structural safety, performance and protection levels of the storey shelters are listed in the Table.
- (2) The list shall be used as a guide to check that the plan submitted fulfils essential technical requirements.
- (3) For other technical requirements not in the list, they shall be referred to Technical Requirements for Storey Shelters 2021.

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1	Material	Clause or Table or Fig. in TRSS 2021
	<p><b>Concrete</b>                      Minimum concrete grade: C32/40                      Normal concrete density (2400kg/m<sup>3</sup>) consists of 20mm nominal maximum size coarse aggregate, apply to all SS/NS structures (include hollowcore &amp; joints, RC elements within setback distance)</p> <p><b>Steel reinforcement</b>                      Welded steel fabric mesh for steel bar                      Yield stress min. 500 N/mm<sup>2</sup></p>	<p>Cl. 3.2.1</p> <p>Cl. 3.2.2</p>
2	Analysis	
	<p>(a) Shielded NS walls (2 opposite NS wall [ not applicable for S/C SS tower] or 4 NS walls)                      No additional design check if supporting NS wall/ NS columns are shielded by RC slab</p> <p>(b) Unshielded NS walls (2 opposite NS wall [ not applicable for S/C SS tower] or 4 NS walls)                      Min each NS wall 300 mm thk;                      Additional design check against the most severe effects of the removal of a portion of the NS wall equivalent to 1.5m opening (@ most critical position)</p> <p>Design load and design strength of material to be adopted shall be 1.2 for concrete &amp; 1.0 for steel</p>	<p>Cl. 3.3.3                      Fig. 3.3.3 and 3.3.4(c)</p> <p>Cl. 3.3.4 (a)-(b)                      Fig. 3.3.4(a), (b) &amp; (d)</p> <p>Table 3.3.4</p>
3	Member dimensions & reinforcement requirements	
	<p>(a)Reinforcements of SS and NS walls</p> <p>Minimum reinf. H13-100 at both faces, both directions, max internal clear SS/NS height (Ht): 2400 ≤Ht ≤ 3400mm                      Minimum reinf. H16-100 at both faces, both directions, max internal clear SS/NS height (Ht): 3400 &lt;Ht ≤ 3900mm                      Shear link H8-600 both directions</p> <p>Common wall reinforcement : H10-100 c/c in both faces, shear link H8-600 c/c</p> <p>Shielding wall in front of SS door                      Reinf. to be minimum H10-200 c/c mesh both faces, shear links with H8-600 c/c with L bend at two ends at both directions</p>	<p>Table 3.4.2.1</p>

	<p>(b) Reinforcements in SS and NS slab</p> <p>Intermediate SS/NS slab and slabs/ waists of staircase SS/NS: Minimum reinf. H10-100 c/c &amp; shear link H8-600 at both faces, both directions</p> <p>Ceiling slab of top-most SS: (300 mm minimum) Minimum reinf. H13-100 c/c &amp; shear link H8-600 at both faces, both directions</p> <p>Floor slab of bottom-most SS or NS and floor slab of NS located above a SS: (300 mm minimum) Minimum reinf. H13-100 c/c &amp; shear link H8-600 at both faces, both directions</p> <p>Ceiling slab outside SS tower immediately above SS door Min. 150mm thk with H10-100 in both direction Anchored into SS slab with tension anchorage length</p> <p>Floor slab outside SS tower to be structurally connected to the SS tower</p> <p>SS slab intergrated with footing/ pilecap Max reinf. Spacing is 200 c/c and shear link provision not required for combine thickness &gt;500mm.</p>	Cl. 3.4.2.2 (a) - (f)
4	Detailing of SS tower	
	<p>(a) Lap and anchorage length Full lap and anchorage length of reinf. to be provided according to concrete grade and bond condition</p>	Table 3.5.2
	<p>(b) Concrete cover to main reinforcement Minimum 25 mm; maximum 40mm</p>	Cl. 3.5.3
	<p>(c) Cast in Situ elements for SS and S/C SS All dimension and detailed requirements to follow Fig 3..5.4(a)-(m)</p>	Cl. 3.5.4 Fig. 3.5.4(a)-(m)
	<p>(d) Details of SS wall reinf. near SS door Reinf. at each sides of blast door frame and its stiffener shall be 2H13</p>	Fig. 3.5.4(d)(i), (ii)
	<p>(e) Ventilation sleeve trimmer bars Additional. trimmer bars around ventilation sleeve ( to be placed within stiffeners), size of bar reinf. to follow wall reinf.</p>	Fig. 3.5.4(f) Fig. 3.5.5 (a)(i)-(ii)
	<p>(f) Shear links Hooks and bend must be tie to outermost reinf. of SS where the hook must always placed face internal face of SS</p>	Fig. 3.5.4 (h)
	<p>(g) Rescure hatches/ vertical / horizontal blast hatches Reinf. at each sides of blast hatch frame and its stiffener shall be 2H13</p>	Fig. 3.5.4 (i), (j), (k)
	<p>h) Cat ladder Shock design calculations required. Comply to design for 12g, where g is the gravitational force To adopt CD approved anchor bolts with shock resistance Adhesive anchors are not permitted</p>	Cl. 2.11.2 Fig. 2.11.2

	<p>(i) Precast SS door frames Type 1 to 3  Precast door frame fixed at 300mm, CIS connection fixed at 250mm.  No ventilation sleeve to be placed at the CIS connection zone</p>	<p>Fig. 3.5.5 (a)-(n)</p>
	<p>(j) Precast hollow core S/C SS</p> <p>Size of precast hollow core to be in multiple of 100mm  Min reinf. of reinf. bars in hollow cores depending on SS clear height.  SS/NS wall reinforcement provision as per internal clear height provision  Min. 6 nos of rebars within the overlapping 'U' bars from precast staircase flight and cast-insitu landing slabs</p>	<p>Cl. 3.5.6  Table A &amp; B of Fig. 3.5.6.1 (a)</p> <p>Table 3.4.2.1</p>
	<p>(k) Handrail mounting onto SS outer wall</p> <p>Shock design calculations to comply to design to withstand shock loads of 12.5g, where g is the gravitaional acceleration  Shock design calculations should also take account of the R class value indicated in the manual.  To adopt CD approved anchor bolts with shock resistance  Adhesive anchors are not permitted  Cast in plate for handrail connection is preferred.</p>	