Building and Construction Authority

APPROVED DOCUMENT

ACCEPTABLE SOLUTIONS

Issued by the Commissioner of Building Control
under
Regulation 27 of the Building Control Regulations

Version 7.06
June 2024

HISTORY OF AMENDMENTS

S/N	Brief description of changes	Revision date
1	Ver 1.0 - first issue	01 Jan 2004
2	Ver 1.01 - first revision a) Re-numbering of paragraphs in all sections to make it easier for referencing purposes. b) First two paragraphs of each section amended to be consistent with the Fifth Schedule of the Building Control Regulations. c) Paragraph A.2.1 – removal of abbreviations and symbols not used in the Document. d) Paragraph B.3 – title of codes and specifications amended to reflect the current names. e) Exemption scope expanded for the following specifications in section E – i. width of staircase; ii. risers and treads; iii. landing; iv. handrails; and v. protection from falling f) Paragraph E.3.8.1 – new note added to make it clearer. g) Note 2 of paragraph F.3.2.1 – amended to make it clearer. h) Amendments to description of acceptable solution for section G – Ventilation to make it clearer. i) Paragraphs I.3.2 and I.3.3 – new note added to make it clearer.	11 Feb 2004
3	Ver 2.0 – Addition of a new Section M on Safety of Windows	01 Oct 2004
4	Ver 2.01 – SS CP 24 referred to in Section I has been amended to SS CP 530 to reflect the change.	27 Feb 2007
5	Ver 2.02 – Revision to Section H on Safety from Falling: a) Paragraph H.3.2 – i. changes to the minimum height; and ii. additional note added b) Paragraph H.3.4 – i. scope of application expanded to include all buildings; ii. new provision added and iii. re-numbering of clauses.	01 Apr 2007
6	Ver 2.03 – Revision to Section B on Structural Design and Construction: a) Paragraph B.3.3.1 amended to include design for glass panel barrier.	24 Oct 2007
7	Ver 2.04 – Revision to Section I on Energy Efficiency a) Paragraph I.3.2 – i. New Paragraphs I.3.2.1 to I.3.2.3 added, to include requirement for RETV ii. Amendment to Paragraph I.3.2.4 to make it clearer iii. Re-numbering of clauses b) All reference to “Guidelines on Envelope Thermal Transfer Value for Buildings” amended to “Code on Envelope Thermal Performance for Buildings”.	15 Apr 2008
8	Ver 3.0 – Revision to Section B on Structural Design and Construction and Section H on Safety from Falling. <u>Section B:</u>	04 May 2009

S/N	Brief description of changes	Revision date
	a) Paragraph B.3.2.1 (c) – Incorporates current practice on wind loads. b) Paragraph B.3.3.1 (a) – Facilitate use of concrete with strength greater than 60 N/mm^2. c) Paragraph B.3.3.1 (c) – Facilitate use of wider choice of structural steel material. d) Paragraph B.3.3.1 (g) – Facilitate use of glued laminated timber structures and non-tropical timber. e) Paragraph B.3.3.1 (i) – Incorporate design code for agricultural/farm structures. f) Paragraph B.3.3.1 (m) – Incorporate design guides for FRP system. g) Paragraph B.3.3.1 (n) – Incorporate design codes for maritime structures. h) Paragraph B.3.7.1 (a) – Title of code for BS 4248 has been changed. SS EN 197 will co-exist with current SS 26 until SS 26 is withdrawn in Jan 2011. i) Paragraph B.3.7.1 (b) – Incorporate design guides for ground granulated blast furnace slag. j) Paragraph B.3.7.1 (c) – SS EN 12620 will co-exist with current SS 31 until SS 31 is withdrawn in Jan 2011. k) Paragraph B.3.7.1 (d) – Current code has been replaced with BS EN 1008. l) Paragraph B.3.7.1 (e) – Title of code has been changed. m) Paragraph B.3.7.1 (h) – Incorporate SS EN 206, Introduce control on alkali content in concrete, Incorporate design code for repair of concrete structures. n) Paragraph B.3.7.1 (i) – Current codes have been replaced by BD EN 934-2. o) Paragraph B.3.7.1 (j) – Current codes have been replaced by BS EN 10025, Incorporate design code for stainless steels. p) Paragraph B.3.7.1 (l) – Current code has been replaced by BS EN 12020. q) Paragraph B.3.7.1 (m) – Facilitate use of glued laminated timber structures and non-tropical timber. r) Paragraph B.3.8.1 (a) – SS 26, SS 477 and SS 476 have been deleted as they are covered in current SS 397, Incorporate SS EN 196. s) Paragraph B.3.8.1 (b) – SS 73 has been replaced by SS 31, BS EN 12620 will co-exist with SS 31 until SS 31 is withdrawn by Jan 2011. t) Paragraph B.3.8.1 (c) – Incorporate BS EN 12350, BS EN 12390, BS EN 12504, BS EN 13971, Incorporate BS EN 13971. u) Paragraph B.3.8.1 (e) – Incorporate BS EN 480. v) Paragraph B.3.8.1 (f) – Title of code has been changed. w) Paragraph B.3.8.1 (g) – Current code has been replaced by BS EN 10025. x) Paragraph B.3.8.1 (k) – Incorporate codes for testing of timber. <u>Section H:</u> a) Paragraph 3.3 – Heading has been changed to include design of glass panel barrier. b) Paragraph 3.3.2 – This item is moved from B.3.3 on Structural Design so as to group all requirements pertaining to safety barrier under Section H on Safety from Falling.	
9	Ver 3.01 – Revision to Section H on Safety from Falling:	16 Jul 2009

S/N	Brief description of changes	Revision date
	a) Paragraph H.3.4.4 – Editorial changes to improve clarity on the opening or gap in a barrier. b) Note 1 of Paragraph H.3.4 – This is re-phrased and re-numbered to become new paragraph H.3.4.6 to include promenades and boardwalks at ground level along the waterfront. c) Note 2 of Paragraph H.3.4 – This is renumbered to become new paragraph H.3.4.7.	
10	Ver 3.02 – SS CP 2 referred to in Section K has been amended to SS 550 to reflect the change.	16 Jul 2010
11	Ver 3.03 – a) SS CP 38 referred to in Section F has been amended to SS 531 to reflect the change. b) SS CP 13 referred to in Section G has been amended to SS 553 to reflect the change.	31 Dec 2010
12	Ver 4.0 – The revisions are as follows: a) SS CP 11 referred to in Section B has been amended to SS 557:2010 to reflect the change. b) Addition of a new Section N on “Use of Glass at Height”. c) Addition of new paragraph H.3.5 on Glass Barrier to Section H on Safety from Falling. d) SS CP 33 referred to in Section L has been amended to SS 555 to reflect the change.	01 Jul 2011
13	Ver 5.0 – Revisions to Section B on Structural Design and Construction and Section H on Safety from Falling. <u>Section B:</u> a) Paragraph B.3 – Addition of new paragraphs B.3.1a, B.3.1b and B.3.1c to incorporate the Eurocodes as part of the acceptable solutions. b) Paragraph B.3.2.1 – Addition of table showing the standards to be used with the adoption of the Eurocodes. c) Paragraph B.3.2.1 (b) – Incorporate BS 4592. d) Paragraph B.3.2.1 (e) – Revised for clarity. e) Paragraph B.3.2.1 (g) – Addition of new paragraph on Seismic Loads. f) Paragraph B.3.3.1 – Addition of table showing the standards to be used with the adoption of the Eurocodes. g) Paragraph B.3.3.1 (d) – Precast concrete structures omitted and the remaining paragraphs are renumbered. h) Paragraph B.3.3.1 (k) – Paragraph on Cranes omitted for clarity and the remaining paragraphs are renumbered. i) Paragraph B.3.3.1 (k) – ACI 440.2R-02 amended to ACI 440.2R. j) Paragraph B.3.3.1 (m) – Addition of new paragraph on Glass. k) Paragraph B.3.3.1 (n) – Addition of new paragraph on Seismic Loads l) Paragraph B.3.4.1 – Incorporate SS EN 1997-2 for use with the adoption of the Eurocodes. m) Paragraph B.3.5.1 – Incorporate BS 6031 for use with the adoption of the Eurocodes. n) Paragraph B.3.6.1 – SS 557:2010 amended to SS 557. o) Paragraph B.3.7.1 – Addition of table showing the standards to be used with the adoption of the Eurocodes. p) Paragraph B.3.7.1 (a) – Incorporate BS EN 15743	01 Apr 2013

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	q) Paragraph B.3.7.1 (b) – Incorporate BS 6699 for this transition period to the Eurocodes. r) Paragraph B.3.7.1 (e) – Incorporate BS 4483, SS 560 and SS 561. s) Paragraph B.3.7.1 (f) and (g) – Combined and revised as a new paragraph B.3.7.1 (f) on Prestressing wires. t) Paragraph B.3.7.1 (h) – BS EN 934-2 is replaced by SS EN 934. u) Paragraph B.3.7.1 (i) – SS 470 is replaced by BS EN 10210. v) Paragraph B.3.7.1 (i) – Incorporate BC 1. w) Paragraph B.3.7.1 (l) – Incorporate BS EN 14080 and BS EN 14081. x) Paragraph B.3.8.1 – Addition of table showing the standards to be used with the adoption of the Eurocodes. y) Paragraph B.3.8.1 (c) – Incorporate BS 3148 in for this transition period to the Eurocodes. z) Paragraph B.3.8.1 (d) – Incorporate SS 78 in for this transition period to the Eurocodes. aa) Paragraph B.3.8.1 (e) – Incorporate SS 320 in for this transition period to the Eurocodes. bb) Paragraph B.3.8.1 (g) – Incorporate BS EN 10210, BS EN 10219, BS EN 10088 and BC 1. cc) Paragraph B.3.8.1 (i) – BS EN 1290, BS EN 1291, BS EN 1714 and BS 3923 are replaced by BS EN ISO 17638, BS EN 23278 and BS EN ISO 17640. dd) Paragraph B.3.8.1 (k) – Incorporate BS EN 14080 and BS EN 14081. <u>Section H:</u> Paragraph H.3.3.1 – Addition of table showing the standards to be used with the adoption of the Eurocodes. <u>New Annexes:</u> a) Addition of Annex A – Structural design standards based on the Eurocodes and the corresponding Singapore National Annexes. b) Addition of Annex B – Comparative list of Singapore/British standards and their equivalent Singapore/European Standards.	
14	Ver 6.0 – <u>Section M:</u> Paragraph M.2.2 – Revised to amend performance requirements to cover all window types and not just for casement windows.	28 Oct 2013
15	Ver 6.01 – <u>Section C:</u> a) Paragraph C.2.2 – Revised to limit the exemption to attic rooms, toilets, bathrooms, lavatory and store room: i. attic rooms of area 10m^2 or less, built by the owners for their own use; ii. toilets, bathrooms or lavatories within houses built by the owners for their own use; iii. store room of area 6m^2 or less. b) Addition of new Paragraph C.3.2.2 on headroom requirement within a sheltered carpark. c) Addition of new Paragraph C.3.2.2 Note 4 to clarify on the manner in which headroom is measured on staircases.	1 Apr 2014

S/N	Brief description of changes	Revision date
	d) Paragraph C.3.3.1.Note 1 – Addition of new paragraph to exempt ceiling height requirement for toilets, bathrooms, lavatories or powder rooms. e) Paragraph C.3.3.1.Note 2 – Revised for clarity. <u>Section D:</u> a) Renamed to "Accessibility in Built Environment". b) Paragraph D.1.1 – Revised to incorporate new requirements that will benefit the young and parents or caregivers with infants. c) Paragraph D.2.2 – Revised to incorporate new requirements that will benefit the young. d) Paragraph D.2.3 – Revised to incorporate new requirements that will benefit parents or caregivers with infants. e) Paragraph D.2.4 – Revised to incorporate new requirements on audible and tactile information providing directions or instructions. f) Paragraph D.3.1 – i. Revised to include the young and parents or caregivers with infants. ii. Renamed Code document to "Code on Accessibility in the Built Environment". <u>Section E:</u> a) Paragraph E.1.1 – Amended the typographical error and updated omission of Paragraph E.2.3. b) Paragraph E.2.3 – Omitted. c) Paragraph E.3.1 – Updated omission of Paragraphs E.3.6 and E.3.8. d) Paragraph E.3.3.1 – Revised to clarify the width requirement refers to a clear width. e) Paragraph E.3.3.1.Note 2(c) – Revised to limit the exemption to attic rooms of area 10m^2 or less. f) Paragraph E.3.4.2 – Revised to require minimum tread width of 275mm in all buildings except in industrial buildings and residential units. g) Addition of Paragraph E.3.4.2A – Tread requirement in residential units. h) Addition of Paragraph E.3.4.2B – Tread requirement in industrial buildings. i) Paragraph E.3.4.3 – Revised for clarity. j) Paragraph E.3.4.Note 1 – Revised for clarity. k) Paragraph E.3.4.Note 2(c) – Revised to limit the exemption to attic rooms of area 10m^2 or less. l) Paragraph E.3.5.2 – Revised to omit circular and geometric staircase. m) Paragraph E.3.5.3 – Revised to take into consideration chamfered landing. n) Paragraph E.3.5.4 – Revised to Paragraph E.3.5.4 and new Paragraph E.3.5.5 for clarity. o) Paragraph E.3.5 Note – i. Note (c) – Revised to limit the exemption to attic rooms of area 10m^2 or less. p) Paragraph E.3.6 – Moved to requirements under Section C, and the remaining paragraphs are renumbered. q) Paragraph E.3.6 (renumbered from Paragraph E.3.7) – i. Paragraph E.3.6.2 – Revised to change the max. height of handrail to 1000mm. ii. Addition of new Paragraphs E.3.6.3 and E.3.6.4.	

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	iii. Paragraph E.3.6 Note.1 – Omitted and the remaining paragraphs are renumbered. iv. Paragraph E.3.6 Note.2 – Amended to require handrail to be continuous throughout the entire length of stairs. r) Paragraph E.3.8 – Moved to requirements under Section H. <u>Section G:</u> a) Addition of new Paragraph G.3.1A to exempt store room of area not exceeding 6m^2 and private lift lobby of area not exceeding 6m^2. b) Paragraph G.3.1.Note – Omitted. c) Paragraph G.3.2.1 – Revised ventilation requirement for above ground car park. d) Addition of new Paragraph G.3.2.1.Note for clarity on the calculation of effective open area for natural ventilation for various types of openings. e) Paragraph G.3.2.2 – Amendments for clarity for acceptable sources for natural ventilation f) Paragraph G.3.2. Note – Paragraph is moved to new Paragraph G.3.2.1A and revised to allow fitness room and clubhouse within residential developments to be mechanically ventilated. g) Addition of new Paragraph G.3.2.3 to set a maximum distance (12.0m) for effective natural ventilation. <u>Section H:</u> a) Paragraph H.1.1 – Revised for clarity and to include new Paragraphs H.2.1A and H.2.1B. b) Paragraph H.2.1 – Addition of new Paragraphs H.2.1A and H.2.1B. c) Paragraph H.2.2.(a) – Revised to improve the safety of occupants in buildings. d) Paragraph H.2.2.(b) – Revised to clarify the scope of “special service or usage areas” in the original paragraph. e) Paragraph H.3.1 – Revised to include new paragraphs H.2.1A and H.2.1B f) Paragraph H.3.2.1.(b) – Revised to standardize the minimum safety barrier height requirement at stairs and ramps to 1.0m. g) Paragraph H.3.2.1. Note – Addition of new paragraph H.3.2.1. Note 3 to clarify the measurement of safety barrier height where a foothold is provided next to the safety barrier. h) Paragraph H.3.4.1 – Revised to standardize the application of the requirement to all safety barriers and clarify the intent of the requirement. i) Paragraph H.3.4.3.(b) – Paragraph is moved to new Paragraph H.3.4A and revised to provide greater clarity on the climbability requirements. j) Addition of new Paragraph H.3.4.4A to relax the requirement on gap size for safety barriers in maintenance areas. k) Paragraph H.3.4.5 – Revised and addition of new paragraphs (b) and (c) to prevent little children from slipping through gaps in-between steps. l) Paragraph H.3.4.7 – Paragraph is move to new Paragraph H.3.4A. m) Addition of new Paragraph H.3.4A. <u>Section N:</u> Paragraph N.2.1 – Revised to amend performance requirement to provide greater clarity.	

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	<u>Section O:</u> Addition of a new Section O on Protection from Injury by Vehicles in Buildings.	
16	Ver 6.1 – Revision to Section B on Structural Design and Construction and Section K on Lifts and Escalators <u>Section B:</u> a) Paragraph B.3.7.1 (i) – Incorporate BS EN 10340, BS EN 1559-1 and 2. b) Paragraph B.3.7.1 (m) – New paragraph on the selection and installation of post-installed anchors using BS 8539. c) Paragraph B.3.8.1 (g) – Incorporate BS EN 10340, BS EN 1559-1 and 2, BS EN 1369, BS EN 12680-1 and 2, and BS EN 12681. <u>Section K:</u> Addition of new Paragraph K.3.2 to incorporate the acceptable solutions for the design, installation and operation of vertical platform lifts and stair lifts.	01 Oct 2014
17	Ver 6.2 – Addition of a new Section P on Daylight Reflectance	27 Jun 2016
18	Ver 6.3 – Deletion of the words “or air-conditioning system” from paragraph G.3.1(b) and addition of new paragraph G.3.1(c) on new requirements for air-conditioning system for all types of building works.	01 Apr 2017
19	Ver 6.4 – Amendments to section K on Lifts and Escalators a) Addition of new requirements for lifts and escalators in Paragraph K.3.1(a)(ii), (iii) & (iv) and (b)(ii) & (iii). b) Paragraph K.3.1.(b)(i) – SS626 to replace CP15 as the acceptable solution for escalators. c) Paragraph K.3.1 – Addition of definition for light curtain. d) Paragraph K.3.2 – Addition of definition for stairlifts and vertical platform lifts. e) Addition of new Paragraph K.3.3 to incorporate the acceptable solutions and definition for home lifts.	01 Mar 2018
20	Ver 7.0 – The revisions are as follows: a) Addition of new performance requirements requirement in paragraph B.2.1A for a floating structure on a body of water. b) Paragraphs B.2.2 and B.2.4 – Addition of “or structure” after the word “building”. c) Paragraphs C.2.1 and C.2.2 deleted and replaced by new paragraphs C.2.1, C.2.2 and C.2.3. d) Note (1) after paragraph C.3.3.1 removed *(relocated to paragraph C.2.3)*. e) Revision made to paragraph E.2.2 and addition of paragraphs E.2.3 and E.2.4. f) The “Note” after paragraph E.3.5.5 and the “Note (2)” after paragraphs E.3.3.1, E.3.4.4 and E.3.6.4 are removed *(relocated to paragraphs E.2.3 and E.2.4)*. g) Revision made to paragraph F.1.1. h) Addition of paragraph F.2.3. i) Note (2) after paragraph F.3.2.1 removed *(relocated to paragraph F.2.3)*.	25 May 2018

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	j) Addition of paragraphs G.2.3 and G.2.4. k) Paragraph G.3.1A is removed *(relocated to paragraph G.2.3)*. l) Paragraph G.3.2.1A is removed *(relocated to paragraph G.2.4)*. m) Revision made to paragraph H.2.1A. n) Addition of paragraphs H.2.3, H.2.4 and H.2.5. o) Note (4) after paragraph H.3.2.1 is removed *(relocated to paragraph H.2.3)*. p) Paragraph H.3.4.6 s removed *(relocated to paragraph H.2.4)*. q) Paragraph H.3.4A is removed *(relocated to paragraph H.2.5)*. r) Addition of paragraph I.2.3. s) Note (1) after paragraph I.3.3.1 is removed *(relocated to paragraph I.2.3)*. t) Addition of paragraphs K.2.3, K.2.4 and K.2.3.5.	
20	Ver 7.01 – Corrected error in paragraph C.2.3. The paragraph should read "The requirement in paragraph C.2.1(b) does not apply…" and not "The requirement in paragraph C.2.1(a) does not apply…".	20 Jun 2018
21	Ver 7.02 – The revisions are as follows: a) Paragraph A.1.1 – editorial change: delete "a safe disabled-friendly and energy efficient building" and replace with "a safe, accessible and energy efficient building". b) Paragraph B.3.3.1 – A. add to the third column for "(c) Steel structures; composite steel and concrete structures" the following: "(iv) Design Guide for Concrete Filled Tubular Members with High Strength Materials – BC4". B. replace "(i) Design of timber structures – BS EN 1995" in the third column for "(f) Timber structures" with the following: "(i) Design of timber structures – SS EN 1995-1-1, SS EN 1995-1-2". C. add to the third column for "(i) Assessment of concrete" the following: "(ii) Complementary guidance to that given in SS EN 13791 – SS 592". c) Paragraph B.3.7.1 – add to the third column for "(i) Structural steel" the following: "(ix) Open die steel forgings for general engineering purposes – BS EN 10250-1 and BS EN 10250-2". d) Paragraph C.3.2.1 – editorial change: replace "less than 2.0m" with "less than 2.0 metres". e) Paragraph C.3.2.2 – A. editorial change: replace "less than 2.2m" with "less than 2.2 metres". B. delete Notes 2, 3 and 4 and replace with the following: *"2 The headroom is measured from the finished floor level to –* *a) in the case of a doorway, the underside of the transom;* *b) in the case where a window opens into an access route or circulation space, the underside of the opened window, or* *c) in all other cases, the underside of any beam, duct, service pipe, fixture, fitting or other obstruction or projection.* *3 The headroom along a flight of staircase is measured vertically between the pitch line and any point directly above*	05 Jul 2019

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	that limits the headroom. See Figure C.3.2.1(a) for illustration of headroom measurement at staircases. *4 The pitch line is the notional line joining the leading edge or nosings (if any) of successive stair treads within a flight of a stairway."* f) Paragraph E.3.1 – editorial change: replace "set out in paragraphs E.3.2 to E.3.6" to set out in paragraphs E.3.2 to E.3.7". g) Paragraph E.3.2.1 – A. editorial change: delete all and replace with the following: "No projection, other than handrails, is allowed into the space of a staircase that is within a height of 2.0 m from the landing or pitch line". B. add the following: "Note: The pitch line is the notional line joining the leading edge or nosings (if any) of successive stair treads within a flight of a stairway." h) Paragraph E.3.3 – editorial change: replace "clearance of the with" with "clear width". i) Paragraph E.3.4.1 – add "(see Figure E.3.4.2(a) for measurement of "riser")". j) Paragraphs E.3.4.2, E.3.4.2A and E.3.4.2B – editorial change: delete all and replace with the following: "*E.3.4.2 The width of a tread of a staircase (see Figure E.3.4.2(a) for measurement of "tread") shall not be less than:* *a) 225 mm, if the staircase is in a residential unit within a residential building;* *b) 250 mm, if the staircase is in an industrial building, or* *c) 275 mm, if the staircase is in any other type of building, including common staircases in a residential building."* k) Paragraphs E.3.4.3 – editorial change: replace "shall be taken as that when measured" with "shall be measured". l) Paragraphs E.3.5.3 – editorial change: delete "See Figure E.3.5.3(a)" and replace with "See Figure E.3.5.3(a) and (b) on how to measure landing width". m) Figure E.3.5.3(a) – delete and replace with new "Figure E.3.5.3(a)" and new "Figure E.3.5.3(b)". n) Paragraphs E.3.5.4 and E.3.5.5 – delete both and replace with the following: "*E.3.5.4 A landing shall not have any step or drop, except that in a dwelling unit, one winder is allowed in every 90 degrees turn in the staircase. Note: A 'winder' means a tread within a straight flight that is used to change the direction of the stair. A winder will not halt a person's fall and therefore will be counted as a riser in a flight of stairs.*" o) Paragraph E.3.6 – editorial change: replace "flight of staircase" with "flight of any staircase with more than 5 steps". p) Paragraph E.3.6.3(a) – replace "circular section of 32 mm" with "circular section from 32 mm". q) Paragraph E.3.6.3(b) – editorial change: replace "wall surface" with "wall surfaces". r) Paragraph E.3.6.3(b)(ii) – editorial change: replace "at least 30 mm" with" not less than 60 mm". s) After Figure E.3.6.4(a) – rename "Note: 1" to "E.3.6.5". t) New paragraph E.3.7 – add new paragraphs E.3.7.1, E.3.7.2, E.3.7.3 and E.3.7.4" and new Figure E.3.7.1(a) on Stair Nosings.	

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<tr><th>S/N</th><th>Brief description of changes</th><th>Revision date</th></tr>
<tr><td></td><td>
u) Paragraph F.3.2.1 – remove Note 2.
v) Paragraph G.3.2.1 – add to Note, after “unobstructed”, the following: “and for the purposes of paragraph G.3.2.1, the effective open area may be taken as the entire area of the opening.
w) Paragraph G.3.2.2 – editorial change: delete G.3.2.2 and replace with the following: “G.3.2.2 All windows and openings intended for natural ventilation shall be located such that they open to –
a) the exterior of the building;
b) an airwell with a minimum width of 3.0m and a minimum area open to the sky complying with Table G.3.2.2(a); or
c) a recess, exceeding 3.0m from the external building wall, and of minimum width 3.0m. See Figure G.3.2.2(b) for illustration.”
x) Table G.3.2.2(a) Dimension of airwells – remove Table and replace with revised table as follows:
<table>
<tr><td>Height of airwell</td><td>Minimum airwell size (m^2)</td></tr>
<tr><td>Not more than 30 m</td><td>10</td></tr>
<tr><td>For each additional 3m height, or part of, beyond 30 m</td><td>Add 1 to the minimum size of 10</td></tr>
</table>
y) Figure G.3.2.2(b) Recessed Void Dimension – replace the figure with a new figure for better clarity.
z) Paragraph G.3.2.3 – editorial change: replace “shall be more than 12.0m from any window/opening ventilating the space” with “shall be located more than 12 metres from any window or opening that is used to ventilate the room or space”.
aa) Paragraph H.2.1A(b) – editorial change: replace “must no have” with “must not have”.
bb) Paragraph H.2.2 – editorial change: replace “The requirement in paragraphs H.2.1, H.2.1A and H.2.1B shall not apply” with “The requirement in paragraphs H.2.1, H.2.1A and H.2.1B do not apply”.
cc) Paragraph H.2.5(b) – editorial change: replace “any promenade and boardwalk” with “any promenade or boardwalk”.
dd) Paragraph H.3.2 –
A. paragraph H.3.2.1(a) - editorial change: replace “1.0 m at all locations except for locations indicated in (b);” with “1.0 metre or”
B. Note 3 – editorial change: replace “dimensions more than 150mm by 150mm is provided” with “dimensions more than 150 mm width by 150 mm length is provided”.
ee) Paragraph H.3.3.1 – delete the entire paragraph and table and replace with the following: “A barrier shall be designed to withstand a horizontal loading determined in accordance with SS EN 1991 Actions on structures – Part 1-1: General actions – Densities, self-weight, imposed loads for buildings and the associated Singapore National Annex.”
ff) Paragraph H.3.4 –
A. paragraph H.3.4.1 - editorial change: delete entire paragraph and replace with “There must not be any gap, from the finished floor level to a height no less than 75 mm, at the lowest part of a barrier.
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</table>

S/N	Brief description of changes	Revision date
	Note: This is to prevent objects from slipping through the base of the barrier and falling off into the space below". B. paragraph H.3.4.2 - editorial change: replace "*The lowest 75mm of the bay window*" with "*The lowest 75 mm section of a bay window*". C. paragraph H.3.4.3, H.3.4.4 and H.3.4.4A - editorial change: delete all three paragraphs and replace with "*H.3.4.3 The size of any opening or gap in a barrier must not be large enough as to permit the passage of –* *(i) in the case of non-industrial buildings, a 100 mm diameter sphere;* *(ii) in the case of industrial buildings, a 150 mm diameter sphere, or* *(iii) in the case of maintenance areas, including plants, equipment rooms, catwalks or maintenance platforms that are accessible only by authorised personnel, a 500 mm diameter sphere.*" D. paragraph H.3.4.5 - editorial change: delete the entire paragraph and sub-paragraphs and replace with *"H.3.4.4 For any flight of staircase –* *(i) the gap size between any two consecutive steps in a flight of staircases shall not be large enough as to permit the passage of –* *(i) in the case of industrial buildings, a 150 mm diameter sphere, or* *(ii) in the case of all other buildings, a 100 mm diameter sphere.* *(ii) the size of any triangular opening, gap or void formed around a tread, riser and bottom edge of the barrier at a staircase in any building other than an industrial building shall not be large enough as to permit the passage of a 150 mm diameter sphere*". gg) Paragraph H.3.4A – A. paragraph H.3.4A.1 - editorial change: delete entire paragraph and replace with "*A barrier must have a height no less than –* *(i) the height specified in paragraph H.3.2.1, or* *(ii) 850 mm when measured from the last climbable toehold;* *whichever is higher. See Figure H.3.4A.1(a) for illustration".* B. paragraph H.3.4A.2 – editorial change: delete entire paragraph and replace with the following: "*Note 1: A toehold means –* *(i) any opening in a perforated sheet or mesh having a horizontal dimension of more than 50 mm and a vertical dimension of more than 30 mm; or* *(ii) any kerb or protrusion having a width of more than 50mm and has a chamfer gentler than 45˚relative to the horizontal plane*. *See Figures H.3.4A.1(b), H.3.4A.1(c) and H.3.4A.1(d) for examples on toehold dimensions*". C. Figure H.3.4A.2(a) – delete and replace with new drawing that is renumbered Figure H.3.4A.1(b). D. Figure H.3.4A.2(b) – delete and replace with new drawing that is renumbered Figure H.3.4A.1(c). E. Figure H.3.4A.2(c) – renumber the figure as "Figure H.3.4A.1(d).	

S/N	Brief description of changes	Revision date
	F. paragraph H.3.4A.3 – editorial change: delete entire paragraph and replace with "*Note 2: A toehold is considered to be climbable if it is located within 600 mm vertically from –* *(i) the finished floor level;* *(ii) a step; or* *(iii) another climbable toehold*". hh) Paragraph K.1.1 – editorial change: replace "*The objective of paragraphs K.2.1 and K.2.2 is to*" with "*The objectives of paragraphs K.2.1, K.2.2, K.2.3 and K.2.4 are to*". ii) Paragraph K.3.4 – add as a new paragraph on mechanical fasteners. jj) Paragraph M.3.1 – editorial change: replace "*In the case of aluminium alloy"* with "In *the case of an aluminium alloy*". kk) Paragraph N.3.2 – replace "*Float (or annealed) glass*" with "*Except as provided in N.3.3, float (or annealed) glass*". ll) Paragraph N.3.6(b) – editorial change: delete entire sub- paragraph and replace with the following: "*four-sided SSG type with retaining devices that are to be designed and constructed to prevent any fall of façade panels in the event of bond failure of the structural sealant*", and delete Note 2 that comes after the paragraph. mm) Figure N1 – rename to "*Four-sided SSG with mechanical self-weight and retaining devices*". nn) Paragraph N.3.8(b) – replace "BS EN 13022-2: 2006" with "BS EN 13022-2" and "BS EN 15434: 2006" with "BS EN 15424". oo) Paragraph O.3.2 – editorial change: delete entire paragraph and replace with "*The vehicular barrier should be capable of resisting forces set out in SS EN 1991*". pp) Add new paragraph O.3.3 – "*Notwithstanding paragraph O.3.2, in the case of a vehicular barrier in a project where the first structural plans have been submitted for approval by the Commissioner of Building Control before 1 April 2015, the vehicular barrier may be designed to be capable of resisting forces set out in BS 6399-Part 1: Loading for Buildings. Code of Practice for Dead and Imposed Loads*". qq) Paragraph P.3.2 – editorial changes: A. sub-paragraph P.3.2(a): replace "*The glass for*" with "*the glass for*". B. sub-paragraph P.3.2(b): delete the entire sub- paragraph and replace with the following: *"any material, other than glass, for the building work on –* *(i) the façade of the building has a specular reflectance not exceeding 10%* *(ii) the roof of the building, inclined at an angle not exceeding 20 degrees from the horizontal plane, has a specular reflectance not exceeding 10%* *(iii) the roof of the building, inclined at an angle more than 20 degrees from the horizontal plane, has a daylight reflectance not exceeding 20% and a specular reflectance not exceeding 10%* C. sub-paragraph P.3.2(c): delete the entire sub- paragraph and replace with the following: "*emulsion paint on plastered or concrete surfaces has a specular reflectance not exceeding 10%.*" rr) Annex A – Structural design standards based on the Eurocodes and the corresponding Singapore National Annexes – *relevant standards are updated*.	

S/N	Brief description of changes	Revision date
	ss) Annex B – Comparative list of Singapore/British standards and their equivalent Singapore/European Standards - *relevant standards are updated.*	
23	Ver 7.02A – The note on "winder" just after E.3.5.4 is removed.	04 Sep 2019
24	Ver 7.03 – The revisions are as follows: a) Paragraph B.3.1.1 – editorial changes A. Replace *"(iv) Design Guide for Concrete Filled Tubular Members with High Strength Materials – BC4"* in the third column for "(c) Steel structures; composite steel and concrete structures" with the following: *"(iv) Design Guide for Steel-Concrete Composite Columns with High Strength Materials – BC4"*. B. Add to the third column for "(c) Steel structures; composite steel and concrete structures" with the following: "*(v) Design Guide for Semi-rigid Composite Joints and Beams*". C. Add new sub-paragraph B.3.3.1(o) *"Fastenings for use in concrete".* D. Add to the third column for "(o) Fastenings for use in concrete" the following: *"(i) Design of concrete structures – Design of fastenings for use in concrete – SS EN 1992-4."* E. Add new sub-paragraph B.3.3.1(p) *"Fibre concrete structures"* F. Add to the third column for "(p) Fibre concrete structures" the following: *"(i) Fibre concrete – Design of fibre concrete structures – SS 674."* b) Paragraph B.3.7.1 – editorial changes A. Replace *"(m) Post-installed anchors"* with the following *"(m) Post-installed anchors and fastenings for use in concrete".* B. Add to the third column for "(m) Post-installed anchors and fastenings for use in concrete" the following: *"(ii) Design of concrete structures – Design of fastenings for use in concrete – SS EN 1992-4."* c) Paragraph E.3.3.1 – editorial changes: A. Replace *"The clearance of the width of every staircase shall not be less than 900 mm"* with the following: *"The clearance of the width of every staircase shall not be less than 1000 mm."* B. Replace Note "*The width is measured from the inner side of the wall, balustrade or handrail.*" with the following: "*If the projection of the handrail into the clear width does not exceed 80 mm on each side of the staircase, the width is measured from (a) the finished surfaces of the walls, if the staircase is enclosed on both sides by walls only, or (b) the finished surface of the wall and the inner side of the balustrade, if the staircase has a wall on one side and a balustrade on the other side, or (c) the inner sides of the balustrades if the staircase has balustrades on both sides. If the projection of the handrail into the clear width exceeds 80 mm on one or more side of the staircase, the clear width of the staircase shall be measured from (a) the finished surface of the wall and the inner side of the handrail, if the staircase has a wall on one side and a handrail on the other side, or (b) the inner sides of the handrails if the staircase has handrails on both sides.*" C. Add new Figure E.3.3.1(a) "*Figure E.3.3.1(a) – Measurement of Clear Width with 80mm or less balustrade / handrail projection*"	01 Dec 2022

S/N	Brief description of changes	Revision date
	D. Add new Figure E.3.3.1(b) "*Figure E.3.3.1(b) – Measurement of Clear Width more than 80mm balustrade or handrail projection*" d) Paragraph E.3.5.3 – editorial changes: A. Replace *"The clear width of any landing, measured from the handrail or kerb (whichever protrudes further into the landing) to the wall or external railing of the landing, shall not be less than 900 mm. See Figure E.3.5.3(a) and (b) on how to measure landing width."* with the following: *"The clearance width of any landing shall not be less than 1000 mm. See Figure E.3.5.3(a) and (b) on how to measure landing width."* B. Figure E.3.5.3(a) – delete and replace with new "Figure E.3.5.3(a)". C. Figure E.3.5.3(b) – delete and replace with new "Figure E.3.5.3(b)". e) Paragraph E.3.6.3 - editorial changes: A. sub-paragraph E.3.6.3(a): replace *"having a circular section from 32 mm to 50 mm in diameter or an equivalent gripping surface; and"* with the following *"have a circular section from 32 mm to 50 mm in diameter or an equivalent gripping surface as shown in Code on Accessibility in the Built Environment, Clause 4.7.3.1(b); and".* f) Paragraph E.3.7 – editorial changes: A. Add New Note *"The requirements on stair nosing in Section E.3.7 do not apply to dwelling units including landed houses. For the avoidance of doubt, the requirements in Section E.3.7 apply to common property such as corridors, lift lobbies etc. within residential developments.".* g) Paragraph G.2.4 – editorial changes: A. sub-paragraph G.2.4(i): replace *"any fitness room"* with the following: *"any fitness room forming part of the communal area or common property;"*. h) Paragraph K.3.1 – editorial changes: A. sub-paragraph K.3.1(a)(ii): replace *"with light curtain installed at the lift door as a door protective device that shall automatically initiate re-opening of the door(s) in the event of a person crossing the entrance during the closing movement, and that the light curtain:"* with the following: *"with light curtain installed at the lift door as a door protective device that shall automatically initiate re-opening of the door(s) in the event of a person crossing the entrance during the closing movement, and that the light curtain shall have its nudging mode de-activated if nudging mode is provided; and"*. B. sub-paragraph K.3.1(a)(ii) – delete sub-paragraph (a), (b), (c) and (d). C. sub-paragraph K.3.1(a)(iii) – delete entire sub-paragraph. D. sub-paragraph K.3.1(a)(iv) – rename to "K.3.1(a)(iv)" to "K.3.1(a)(iii)" E. sub-paragraph K.3.1(a)(iii) – replace *"with a video recorder that has the following minimum specifications –"* with the following *"provided with a video recorder that has the following minimum specifications - ".* F. sub-paragraph K.3.1(a)(iii)(b) - replace *"Capture footage of the entire lift car including in-car floor indicator;"* with the following: *"Capture footage of the entire lift car including in-car floor indicator, lift car door(s) and landing area outside the lift car in front of the lift doors;"*.	

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	G. sub-paragraph K.3.1(a)(iii)(e) – replace *"Storage of video footage of at least 30 days;"* with the following: *"Storage of video footage for at least 30 days;"*. H. sub-paragraph K.3.1(b)(iii) – replace *"with a video recorder that has the following minimum specifications –"* with the following *"provided with a video recorder that has the following minimum specifications -"*. I. sub-paragraph K.3.1(b)(iii)(b) – replace *"Capture the entire length of the escalator;"* with the following: *"Capture footage of the entire length of escalator including landing floor plates on both the upper and lower landing areas of the escalator;"*. J. sub-paragraph K.3.1(b)(iii)(e) – replace *"Storage of video footage of at least 30 days;"* with the following: *"Storage of video footage for at least 30 days"*. i) Paragraph K.3.2 – editorial changes: replace *"The requirements in paragraphs K2.1 are deemed to be satisfied if vertical platform lifts and stairlifts which are primarily designed for persons with impaired mobility are designed, installed and operated in accordance with the requirements of –*" with the following: *"The requirements in paragraphs K2.1 are deemed to be satisfied if vertical platforms lifts and stairlifts which are primarily design for persons with impaired mobility are designed and installed in accordance with the requirements of -"*. j) Paragraph K.3.2 – editorial changes: A. sub-paragraph K.3.2(c) – replace *"AMSE 18.1 – Safety standard for platform lifts and stairway chairlifts; or"* with the following: *"AMSE A18.1 – Safety standard for platform lifts and stairway chairlifts; or"*. B. sub-paragraph K.3.2(d) – replace *"Other relevant standards which are acceptable to the Commissioner of Building Control."* with the following: *"Other relevant standards which are acceptable to the Commissioner of Building Control; and".* C. Add new sub-paragraph K.3.2(e) *"except for stairlifts and chairlifts, with a telephone, intercom system or any other communication device that enables notification or direct communication with personnel who can initiate an emergency response; and"*. D. Add new sub-paragraph K.3.2(f) *"for vertical platform lifts that are not installed in private homes solely for the use of the occupants, in addition to the above standards, they are provided with a video recorder that has the following minimum specifications –* *i. Capacity to record 24 hours a day, 7 days a week;* *ii. Capture footage of the entire lift platform and platform entrance, from floor to ceiling (if any), and landing area outside the lift platform in front of the landing doors;* *iii. Frame rate of at least 6 frames per second;* *iv. Video resolution of at least 352 x 240 pixels or CIF CCTV resolution; and* *v. Storage of video footage for at least 30 days."* k) Paragraph K.3.3 – editorial changes: replace *"The requirements in paragraph K2.1 are deemed to be satisfied if home lifts are designed, installed and operated in accordance with the requirements of –"* with the following: *"The requirements in paragraph K2.1 are deemed to be*	

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	satisfied if home lifts are designed, and installed in accordance with the requirements of –". l) Paragraph K.3.3 – editorial changes: A. sub-paragraph K.3.3(b) – replace *"other relevant standards which are acceptable to the Commissioner of Building Control."* With the following: *"other relevant standards which are acceptable to the Commissioner of Building Control; and"*. B. Add new sub-paragraph K.3.3(c) *"with a telephone, intercom system or any other communication device that enables notification or direct communication with personnel who can initiate an emergency response."* C. definition for home lifts – replace *""homelift" means a lift, not being common property, installed in a private home solely for the use of its occupants."* with the following: *""home lift" means a lift, excluding a stairlift or a vertical platform lift, not being common property, installed in a private home solely for the use of its occupants."*. m) Paragraph P.3.2 – editorial changes: A. sub-paragraph P.3.2(b) - replace *"Any material, other than glass, for the building on –"* with the following: *"Any material, other than glass and paint on plastered and concrete surfaces, for the building on –"*. n) Annex A – Structural design standards based on the Eurocodes and the corresponding Singapore National Annexes – editorial changes: A. Add to "Eurocode 2 Design of concrete structures" the following: *"SS EN 1992-4 Design of concrete structures. Design of fastenings for use in concrete."* B. Add to the second column for *"SS EN 1992-4 Design of concrete structures. Design of fastenings for use in concrete."* the following: *"NA to SS EN 1992-4"*	
25	Ver 7.04 – The revisions are as follows: a) Paragraph H.3.1– editorial changes A. Add new sub-paragraph H.3.1A The requirements in paragraphs H.2.1, H.2.1A and H.2.1B are deemed to be satisfied for a safety barrier integrated with window at existing residential buildings, if such safety barrier is in accordance with the standardised design. *Note: For purposes of Regulation 2 of the Building Control Regulations 2003 and paragraph H3.1A, "standardised design" means the standardised design set out in Annex C in this Approved Document.* <u>New Annexes:</u> a) Addition of Annex C – Standardised Designs for replacement and reinstatement of safety barriers integrated with windows in existing residential buildings	01 Mar 2023
26	Ver 7.05 – The revisions are as follows: a) Paragraph C.2 – editorial changes: A. sub-paragraph C.2.2(d) - replace "*any toilet, bathroom or lavatory*" with "*any toilet or bathroom*" B. sub-paragraph C.2.3(b) - replace "*any toilet, bathroom, lavatory or powder room*;" with "*any toilet, bathroom or powder room;"* b) Paragraph C.3.2 – editorial changes: Figure C.3.2.1(a) – delete and replace with new "Figure C.3.2.1(a)".	01 Mar 2024

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	c) Paragraph E.2.2(a) – editorial change: Add on to "*handrails or guides to assist movement*" with the following: "*(in accordance with paragraph E.3.6.1*);" d) Paragraph E.3.4.4 – editorial changes: Add New Note *"2. Uniformity of risers and treads is applicable to all rooms or spaces under paragraph E.2.4 (except houses built for owner's own use)."* e) Paragraph E.3.5 – A. paragraph E.3.5.3 – editorial change: "*Figure E.3.5.3(b)"* relocated to above paragraph E.3.5.4. B. paragraph E.3.5.4 – editorial change: delete entire paragraph and replace with *"A landing shall not have any step or drop. A winder does not constitute a landing and is only allowed in a dwelling residential unit, where one winder is allowed in every 90 degrees turn in the staircase with a minimum of one tread in between. See Fig. E.3.5.4 on acceptable winder layout."* C. Add new Figure E.3.5.4(a) "*Figure E.3.5.4(a) – Winders as part of total riser count*" f) Paragraph E.3.6.2 – Replace "*The height of the handrail shall be between 750 mm and 1000 mm above the pitch line*." with the following: "*The height of the handrail shall be between 800 mm and 1000 mm above the pitch line*." g) Paragraph E.3.7 – A. Figure E.3.7.1(a) – delete and replace with new "Figure E.3.7.1(a) Stair nosing" B. Paragraph E.3.7.3 – Replace "*All steps must be fitted with nosing strips between 50 mm and 65 mm in width.*" with the following: "*All steps must be fitted with nosing strips between 50 mm and 75 mm in width.*" C. *"Note:"* after Paragraph E.3.7.4 – editorial changes: replace the term *"dwelling"* with *"residential".* h) Paragraph F.2.3 – editorial changes: sub-paragraph F.2.3(a) - replace "*any toilet, bathroom or lavatory;*" with "*any toilet or bathroom;*" i) Paragraph G.2.3 – delete all and replace with the following: "*The requirement in paragraph G.2.1 does not apply to any of the following rooms or spaces not exceeding an area of 6 square metres –* *(a) any store room;* *(b) any private lift lobby;* *(c) any walk-in wardrobe;"* j) Paragraph G.2.4 – editorial changes: sub-paragraph G.2.4(iv) – replace "*any toilet, bathroom or lavatory;*" with "*any toilet or bathroom;*" k) Paragraph H.2.2 – editorial changes: sub-paragraph H.2.2(a) - replace "*any roof which is accessible for maintenance purposes only and not easily accessible to the public;*" with "*any roof or maintenance area which is not easily accessible;"* *l)* Paragraph H.3.2 – editorial changes: A. delete and replace "*Note: 3."* with the following: "*3. A kerb, protrusion or flat surface with dimensions more than*	

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	150 mm width by 150 mm length must be not less than 1000 mm away from the top of the barrier. B. Add New Note *"4. Where a kerb, protrusion or flat surface with dimensions more than 150 mm width by 150 mm length is provided next to a barrier, the height of the barrier shall be measured from the top of the kerb, protrusion or flat surface."*	
27	Ver 7.06 – The revisions are as follows: Paragraph K3.2 – Add new sub-paragraph K.3.2(d) *"Code of Practice for installation, operation and maintenance of vertical platform lift with enclosed platform and automatic sliding doors; or"*	03 Jun 2024

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CONTENTS

A GENERAL

A.1 INTRODUCTION

A.1.1 The framework for performance-based building code is set out in the Building Control Regulations 2003 (referred to in this Document as the Regulations). The Fifth Schedule of the Regulations sets out the objectives and performance requirements that must be complied with in the design and construction of building works (referred to in this Document as "prescribed objectives and performance requirements"). The objectives set out community expectations of a safe, accessible and energy efficient building. The performance requirements outline the level of performance, which must be met in order for a building to meet the objectives.

A.1.2 This Approved Document provides a set of 'acceptable solutions' that meet the prescribed objectives and performance requirements. The prescribed objectives and performance requirements are deemed to be satisfied if the design and construction of a building comply with the acceptable solutions.

A.1.3 Alternatively, a person may utilise alternative solutions in respect of the design and construction of any building if these solutions satisfy the prescribed objectives and performance requirements. Alternative solutions are solutions that entail the use of any design, material or construction method that differs completely or partially from those in the acceptable solutions.

A.2 ABBREVIATIONS AND SYMBOLS

A.2.1 The following abbreviations and symbols are used in this Document –

Abbreviation or Symbol	Definition
BS	British Standard
CP	Code of Practice
^{o}K	degree Kelvin
kW	kiloWatt
kg	kilogram
m	metre
m^2	square metre
mm	millimetre
SS	Singapore Standard

B STRUCTURAL DESIGN AND CONSTRUCTION

B.1 OBJECTIVE

B.1.1 The objectives of paragraphs B.2.1 to B.2.4 are to –

(a) protect people from injury caused by structural failure;

(b) protect people from loss of amenity cause by structural failure; and

(c) protect other property from physical damage caused by structural failure.

B.2 PERFORMANCE REQUIREMENT

B.2.1 A building, including its foundation, shall be designed and constructed so that the combined dead, imposed, wind and other intended loads can be sustained and transmitted by it to the ground –

(a) safely; and

(b) without causing such deflection or deformation of any part of that building, or such movement of the ground, as will impair the stability of any part of another building or property.

B.2.1A A floating structure on a body of water, including the foundation of the structure, must be designed and constructed so that the combined dead, imposed, wind and other intended loads can be sustained and transmitted by the floating structure to the body of water supporting the structure –

B.2.2 The building or structure shall be constructed with materials that are appropriate for the circumstances in which they are used.

B.2.3 Tests that are appropriate to the materials and building works concerned shall be performed on those materials and building works.

B.2.4 If a building or structure or any part thereof is to be demolished, the demolition works shall be carried out safely and without impairing the stability of any other part of that building or structure or another property.

B.3 **ACCEPTABLE SOLUTION**

B.3.1 The requirements in paragraphs B.2.1 to B.2.4 are deemed to be satisfied if the design and construction of a building comply with the specifications set out in paragraphs B.3.2 to B.3.7.

B.3.1a Structural design standards based on the Eurocodes will co-exist with the Singapore/British design standards. During this co-existence period, either the current Singapore/British design standards or the Eurocodes are acceptable standards as set out in paragraphs B.3.2 to B.3.7. However, inappropriate mixing the new Eurocode design standards with the current Singapore/British design standards within the same building design will not be acceptable.

B.3.1b Any reference to the Eurocodes must be taken to include reference to the relevant Singapore National Annex listed in Annex A. However, in the absence of Singapore National Annex, reference shall be made to the relevant UK National Annex.

B.3.1c Similar to the design standards, the use of Eurocodes will require the product and execution standards to be based on the equivalent Singapore/European standards. Annex B provides a comparative table showing all the standards that are applicable for each of the option.

B.3.2 **Loads**

B.3.2.1 The building shall be able to resist loads determined in accordance with the following Standards –

Type of loads	When adopting Singapore or British design standards	When adopting Eurocodes
(a) Dead loads	(i) Schedule of weights of building materials - BS 648; and (ii) Loading for buildings. Code of practice for dead and imposed loads – BS 6399: Part 1.	(i) Actions on structures – General actions - Densities, self-weight and imposed loads for buildings - SS EN 1991- 1-1.
(b) Imposed floor and ceiling loads, dynamic loads due to crowd movement, loads on balustrades, loads on vehicular barrier for car parks, accidental loads	(i) Loading for building. Code of practice for dead and imposed loads – BS 6399: Part 1; and	(i) Actions on structures – General actions - SS EN 1991; and

Type of loads	When adopting Singapore or British design standards	When adopting Eurocodes
on parapets and balustrades, loads on vehicular barrier for car parks, accidental loads	(ii) Industrial type flooring and stair treads – BS 4592.	(ii) Industrial type flooring and stair treads - BS 4592.
(c) Wind loads	(i) Code of basic data for the design of buildings. Loading. Wind loads – CP 3 Chapter V Part 2, using 33 m/s as the basic wind speed (3 second gust speed); and (ii) Loading for buildings. Code of practice for wind loads – BS 6399: Part 2, using 22 m/s as the basic wind speed (hourly mean speed).	(i) Actions on structures – General actions - Wind actions - SS EN 1991-1-4.
(d) Imposed roof loads	(i) Loading for buildings. Code of practice for imposed roof loads – BS 6399: Part 3.	(i) Actions on structures – General actions - Actions on structures - General actions - Densities, self-weight and imposed loads for buildings - SS EN 1991 - 1-1.
(e) Crane loads	(i) Rules for the design of cranes. Specification for classification, stress calculations and design criteria for structures – BS 2573: Part 1.	(i) Actions on structures – Actions induced by cranes and machinery - SS EN 1991-3.
(f) Vehicular bridge live loads	(i) Land Transport Authority (LTA)'s design criteria for vehicular bridge.	(i) Actions on structures – Traffic loads on bridges – SS EN 1991- 2.
(g) Seismic loads	Nil	(i) Design of structures for earthquake resistance – General rules, seismic actions

Type of loads	When adopting Singapore or British design standards	When adopting Eurocodes
		and rules for buildings - SS EN 1998-1.

B.3.3 **Structural Design**

B.3.3.1 The design of the building structures shall comply with the following Standards –

Type of structures	When adopting Singapore or British design standards	When adopting Eurocodes
(a) Reinforced and prestressed concrete structures	(i) Code of practice for structural use of concrete – SS CP 65; and (ii) Design Guide of High Strength Concrete to Singapore Standard CP 65 – BC 2.	(i) Design of concrete structures – SS EN 1992.
(b) Bridges	(i) Steel, concrete and composite bridges – BS 5400.	(i) Design of concrete structures – Concrete bridges – Design and detailing rules – SS EN 1992-2; (ii) Design of steel structures – Steel bridges – SS EN 1993-2; and (iii) Design of composite steel and concrete structures – General rules and rules for bridges – SS EN 1994- 2.
(c) Steel structures; composite steel and concrete structures	(i) Structural use of steelwork in building – BS 5950; and (ii) Design Guide on Use of Alternative Structural Steel	(i) Design of steel structures - SS EN 1993; (ii) Design of composite steel and

Type of structures	When adopting Singapore or British design standards	When adopting Eurocodes
	Materials to BS 5950 and Eurocode 3 – BC 1.	concrete structures - SS EN 1994; (iii) Design Guide on Use of Alternative Structural Steel Materials to BS 5950 and Eurocode 3 – BC 1; (iv) Design Guide for Steel-Concrete Composite Columns with High Strength Materials – BC4; and (v) Design Guide for Semi-rigid Composite Joints and Beams
(d) Foundations	(i) Code of practice for foundations – SS CP 4.	(i) Geotechnical design – General rules - SS EN 1997-1.
(e) Aluminium structures	(i) Structural use of aluminium – BS 8118.	(i) Design of aluminium structures - BS EN 1999.
(f) Timber structures	(i) Code of practice for structural use of timber – SS CP 7; and (ii) Structure use of timber – BS 5268-2 – For use of glued laminated timber structures and non-tropical timber.	(i) Design of timber structures – SS EN 1995-1-1, SS EN 1995-1-2.
(g) Aqueous retaining concrete structures	(i) Code of practice for design of concrete structures for retaining aqueous liquids – SS CP 73.	(i) Design of concrete structures – Liquid retaining and containment structures – SS EN 1992-3.
(h) Retaining structures	(i) Code of practice for earth retaining structures – BS 8002.	(i) Geotechnical design – General rules - SS EN 1997-1.

Type of structures	When adopting Singapore or British design standards	When adopting Eurocodes
(i) Assessment of concrete	(i) Testing concrete – BS 1881; and (ii) Guide to assessment of concrete strength in existing structures – BS 6089.	(i) Assessment of in-situ compressive strength in structures and precast concrete components – SS EN 13791. (ii) Complementary guidance to that given in SS EN 13791 – SS 592.
(j) Buildings and structures for agriculture	(i) Buildings and structures for agriculture. Code of practice for design, construction and loading - BS 5502-22.	(i) Buildings and structures for agriculture. Code of practice for design, construction and loading - BS 5502-22.
(k) Externally Bonded Fibre-Reinforced Polymer (FRP) Systems	(i) Design guidance for strengthening concrete structures using fibre composite materials – Concrete Society Technical Report 55; and (ii) Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures – ACI 440.2R.	(i) Design guidance for strengthening concrete structures using fibre composite materials – Concrete Society Technical Report 55; and (ii) Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures – ACI 440.2R.
(l) Maritime structures (including floating platforms)	(i) Maritime works and structures – BS 6349.	(i) Maritime works and structures – BS 6349.
(m) Glass	(i) Glass in buildings – Selection and installation – AS 1288; (ii) Standard practice for determining load resistance of glass in buildings – ASTM E1300; and	(i) Glass in buildings – Selection and installation – AS 1288; (ii) Standard practice for determining load resistance of glass in buildings – ASTM E1300; and

Type of structures	When adopting Singapore or British design standards	When adopting Eurocodes
	(iii) Structural use of glass in buildings – The Institution of Engineers of Structural Engineers, United Kingdom.	(iii) Structural use of glass in buildings – The Institution of Engineers of Structural Engineers, United Kingdom.
(n) Seismic Loads	Nil.	(i) Design of structures for earthquake resistance – General rules, seismic actions and rules for buildings - SS EN 1998-1.
(o) Fastenings for use in concrete		(i) Design of concrete structures – Design of fastenings for use in concrete – SS EN 1992-4.
(p) Fibre concrete structures		(i) Fibre concrete – Design of fibre concrete structures – SS 674

B.3.4 **Site Investigation and Instrumentation**

B.3.4.1 Site investigation and instrumentation shall be carried out in accordance with the following Standards –

When adopting Singapore or British design standards	When adopting Eurocodes
(i) Code of practice for site investigations – BS 5930; and (ii) Method of test for soils for civil engineering purposes – BS1377.	(i) Geotechnical design – Ground investigation and testing - SS EN 1997- 2.

B.3.5 **Site Formation**

B.3.5.1 Site formation works shall conform to the following Standards –

When adopting Singapore or British design standards	When adopting Eurocodes
(i) Code of practice for earthworks – SS CP 18.	(i) Code of practice for earthworks – BS 6031.

B.3.6 **Demolition Works**

B.3.6.1 The demolition works shall conform to the Code of Practice for Demolition – SS 557.

B.3.7 **Construction Materials**

B.3.7.1 Construction materials shall comply with the following Standards –

Type of loads	When adopting Singapore or British design standards	When adopting Eurocodes
(a) Cement	(i) Ordinary Portland cement – SS 26; (ii) Specification for sulphate-resisting Portland cement – BS 4027; (iii) Supersulfated cement – BS 4248; (iv) Portland blastfurnace cement – SS 477; and (v) High slag blastfurnace cement – SS 476.	(i) Cement – SS EN 197; and (ii) Supersulfated cement – BS EN 15743.
(b) Ground granulated blast furnace slag	(i) Specification for ground granulated blastfurnace slag for use with Portland cement - BS 6699.	(i) Ground granulated blast furnace slag for use in concrete, mortar and grout – SS EN 15167.
(c) Aggregates	(i) Aggregates from natural sources for concrete – SS 31.	(i) Aggregates for concrete – SS EN 12620.

Type of loads	When adopting Singapore or British design standards	When adopting Eurocodes
(d) Water	(i) Methods of test for water for making concrete – BS 3148.	(i) Mixing water for concrete – BS EN 1008.
(e) Steel reinforcement	(i) Steel for the reinforcement of concrete – SS 2; (ii) Cold-reduced steel wire for the reinforcement of concrete and the manufacture of welded fabric – SS 18; and (iii) Welded steel fabric for the reinforcement of concrete – SS 32.	(i) Steel for the reinforcement of concrete. Weldable reinforcing steel. Bar, coil and decoiled product. Specification – BS 4449. (ii) Steel fabric for the reinforcement of concrete. Specification – BS 4483; (iii) Steel for reinforcement of concrete – Weldable reinforcing steel – Bar, coil and decoiled product - SS 560; and (iv) Steel fabric for the reinforcement of concrete - SS 561.
(f) Prestressing wires, strands or bars	(i) Specification for high tensile steel wire and strand for the prestressing of concrete – BS 5896; and (ii) Specification for hot rolled and processed high tensile alloy steel bars for the prestressing of concrete – BS 4486.	(i) Specification for high tensile steel wire and strand for the prestressing of concrete – BS 5896; and (ii) Specification for hot rolled and processed high tensile alloy steel bars for the prestressing of concrete – BS 4486.
(g) Concrete	(i) Concrete – Guide to specifying concrete & methods for specifying concrete mixes – SS 289; and (ii) Control on alkali content in accordance with BRE Digest 330	(i) Concrete - Specification, performance, production and conformity – SS EN 206-1; (ii) Concrete - Complementary

Type of loads	When adopting Singapore or British design standards	When adopting Eurocodes
	'Alkali-silica reaction in concrete' (2004) by - using low alkali cement[1] with equivalent Na2O of not more than 0.6%; or - limiting the total alkali content of concrete to 2.5kg equivalent Na2O /m^3.	Singapore Standard to SS EN 206-1 – SS 544; (iii) Control on alkali content in accordance with BRE Digest 330 'Alkali-silica reaction in concrete' (2004) by - using low alkali cement[1] with equivalent Na2O of not more than 0.6% ; or - limiting the total alkali content of concrete to 2.5kg equivalent Na2O /m^3; and (iv) Repair of concrete structures - Products and systems for the protection and repair of concrete structures - BS EN 1504.
(h) Admixture	(i) Concrete admixtures – SS 320.	(i) Admixtures for concrete, mortar and grout –SS EN 934.
(i) Structural steel	(i) Specification for weldable structural steels. Hot finished structural hollow sections in weather resistant steels – BS 7668; (ii) Hot rolled products of structural steels – BS EN 10025; (iii) Hot finished structural hollow sections of non- alloy and fine grain steels – BS EN 10210;	(i) Specification for weldable structural steels. Hot finished structural hollow sections in weather resistant steels – BS 7668; (ii) Hot rolled products of structural steels – BS EN 10025; (iii) Hot finished structural hollow sections of non- alloy and fine grain steels – BS EN 10210;

[1] To be used with aggregates with marginal reactivity having expansion not greater than 0.2% when evaluated using ASTM C1260.

Type of loads	When adopting Singapore or British design standards	When adopting Eurocodes
	(iv) Cold formed welded structural hollow sections of non-alloy and fine grain steels – BS EN 10219; (v) Stainless steels – BS EN 10088; (vi) Design Guide on Use of Alternative Structural Steel Materials to BS 5950 and Eurocode 3 – BC 1; (vii) Steel castings for structural uses – BS EN 10340; (viii) Founding – Technical conditions of delivery – BS EN 1559-1 and 2; and (ix) Open die steel forgings for general engineering purposes – BS EN 10250-1 and BS EN 10250-2.	(iv) Cold formed welded structural hollow sections of non-alloy and fine grain steels – BS EN 10219; (v) Stainless steels – BS EN 10088; (vi) Design Guide on Use of Alternative Structural Steel Materials to BS 5950 and Eurocode 3 – BC 1; (vii) Steel castings for structural uses – BS EN 10340; (viii) Founding – Technical conditions of delivery – BS EN 1559-1 and 2; and (ix) Open die steel forgings for general engineering purposes – BS EN 10250-1 and BS EN 10250-2.
(j) Aluminium and aluminium alloys	(i) Sheet, strip and plate – BS EN 485; (ii) Wrought products: Temper designations – BS EN 515; (iii) Chemical composition and form of wrought product – BS EN 573; (iv) Extruded rod/bar, tube and profiles – BS EN 755; and (v) Extruded precision profiles in alloys EN AW- 6060 and EN AW-6063 – BS EN 12020.	(i) Sheet, strip and plate – BS EN 485; (ii) Wrought products: Temper designations – BS EN 515; (iii) Chemical composition and form of wrought product – BS EN 573; (iv) Extruded rod/bar, tube and profiles – BS EN 755; (v) Extruded precision profiles in alloys EN AW- 6060 and EN AW-6063 – BS EN 12020; and

Type of loads	When adopting Singapore or British design standards	When adopting Eurocodes
		(vi) Design of aluminium structures - BS EN 1999.
(k) Fixings of claddings	(i) Mechanical properties of corrosion-resistant stainless steel fasteners – BS EN ISO 3506.	(i) Mechanical properties of corrosion-resistant stainless steel fasteners – BS EN ISO 3506.
(l) Timber structures	(i) Code of practice for structural use of timber – SS CP 7; and (ii) Structure use of timber – BS 5268-2 – For use of glued laminated timber structures and non-tropical timber.	(i) Timber structures - Glued laminated timber – Requirements – BS EN 14080; and (ii) Timber structures - Strength graded structural timber with rectangular cross section – BS EN 14081.
(m) Post-installed anchors and fastenings for use in concrete		(i) Code of practice for the selection and installation of post-installed anchors in concrete and masonry – BS 8539. (ii) Design of concrete structures – Design of fastenings for use in concrete – SS EN 1992-4.

B.3.8 **Construction Tests**

B.3.8.1 Construction tests for the materials and the structural members or elements of a building shall comply with the following Standards –

Material of element	When adopting Singapore or British design standards	When adopting Eurocodes
(a) Cement	(i) Methods of testing cement – SS 397.	(i) Methods of testing cement – BS EN 196.

Material of element	When adopting Singapore or British design standards	When adopting Eurocodes
(b) Aggregate	(i) Aggregates from natural sources for concrete – SS 31.	(i) Aggregates for concrete – SS EN 12620.
(c) Water	(i) Methods of test for water for making concrete – BS 3148	(i) Mixing water for concrete – BS EN 1008.
(d) Concrete	(i) Testing concrete – BS 1881; (ii) Testing concrete – SS 78; and (iii) Assessment of concrete strength in existing structures – BS 6089.	(i) Testing concrete – BS 1881 (parts of the standard which have been withdrawn will not be applicable); (ii) Testing fresh concrete – BS EN 12350; (iii) Testing hardened concrete – BS EN 12390; (iv) Testing concrete in structures - BS EN 12504; and (v) Assessment of in-situ compressive strength in structures and precast concrete components – SS EN 13791.
(e) Admixture	(i) Concrete admixtures – SS 320.	(i) Admixtures for concrete, mortar and grout –SS EN 934.
(f) Steel reinforcement	(i) Steel for the reinforcement of concrete – SS 2; (ii) Cold-reduced steel wire for the reinforcement of concrete and the manufacture of welded fabric – SS 18; and	(i) Steel for the reinforcement of concrete. Weldable reinforcing steel. Bar, coil and decoiled product. Specification – BS 4449; (ii) Steel fabric for the reinforcement of concrete. Specification – BS 4483;

Material of element	When adopting Singapore or British design standards	When adopting Eurocodes
	(iii) Welded steel fabric for the reinforcement of concrete – SS 32.	(iii) Steel for reinforcement of concrete – Weldable reinforcing steel – Bar, coil and decoiled product - SS 560; and (iv) Steel fabric for the reinforcement of concrete - SS 561.
(g) Structural steel	(i) Hot rolled products of structural steels – BS EN 10025; (ii) Hot finished structural hollow sections of non-alloy and fine grain steels – BS EN 10210; (iii) Cold formed welded structural hollow sections of non-alloy and fine grain steels – BS EN 10219; (iv) Stainless steels – BS EN 10088; (v) Design Guide on Use of Alternative Structural Steel Materials to BS 5950 and Eurocode 3 – BC 1; (vi) Steel castings for structural uses – BS EN 10340; (vii) Founding – Technical conditions of delivery – BS EN 1559-1 and 2; (viii) Founding – Magnetic particle testing – BS EN 1369; (ix) Founding – Ultrasonic examination	(i) Hot rolled products of structural steels – BS EN 10025; (ii) Hot finished structural hollow sections of non-alloy and fine grain steels – BS EN 10210; (iii) Cold formed welded structural hollow sections of non-alloy and fine grain steels – BS EN 10219; (iv) Stainless steels – BS EN 10088; (v) Design Guide on Use of Alternative Structural Steel Materials to BS 5950 and Eurocode 3 – BC 1; (vi) Steel castings for structural uses – BS EN 10340; (vii) Founding – Technical conditions of delivery – BS EN 1559-1 and 2; (viii) Founding – Magnetic particle testing – BS EN 1369; (ix) Founding – Ultrasonic examination

Material of element	When adopting Singapore or British design standards	When adopting Eurocodes
	– BS EN 12680-1 and 2; and (x) Founding – Radiographic examination – BS EN 12681.	– BS EN 12680-1 and 2; and (x) Founding – Radiographic examination – BS EN 12681.
(h) Prestressing wires, strands or bars	(i) Specification for high tensile steel wire and strand for the prestressing of concrete – BS 5896; and (ii) Specification for hot rolled and processed high tensile alloy steel bars for the prestressing of concrete – BS 4486.	(i) Specification for high tensile steel wire and strand for the prestressing of concrete – BS 5896; and (ii) Specification for hot rolled and processed high tensile alloy steel bars for the prestressing of concrete – BS 4486.
(i) Weld quality	(i) Non-destructive testing of welds. Magnetic particle testing - BS EN ISO 17638; (ii) Non-destructive testing of welds. Magnetic particle testing. Acceptance levels - BS EN ISO 23278; (iii) Non-destructive testing. Penetrant testing – BS EN 571; (iv) Non-destructive testing of welds. Ultrasonic testing. Techniques, testing levels and assessment – BS EN ISO 17640; and (v) Non-destructive examination of welds. Radiographic examination of welded joints – BS EN 1435.	(i) Non-destructive testing of welds. Magnetic particle testing - BS EN ISO 17638; (ii) Non-destructive testing of welds. Magnetic particle testing. Acceptance levels - BS EN ISO 23278; (iii) Non-destructive testing. Penetrant testing – BS EN 571; (iv) Non-destructive testing of welds. Ultrasonic testing. Techniques, testing levels and assessment – BS EN ISO 17640; and (v) Non-destructive examination of welds. Radiographic examination of welded joints – BS EN 1435.

Material of element	When adopting Singapore or British design standards	When adopting Eurocodes
(j) Pile load test	(i) Code of practice for foundations – SS CP 4.	(i) Geotechnical design – General rules - SS EN 1997-1.
(k) Timber	(i) Code of practice for structural use of timber – SS CP 7; and (ii) Structure use of timber – BS 5268-2 – For use of glued laminated timber structures and non-tropical timber.	(i) Timber structures – Glued laminated timber – Requirements - BS EN 14080; and (ii) Timber structures – Strength graded structural timber with rectangular cross section – BS EN 14081.

C HEADROOM AND CEILING HEIGHT

C.1 OBJECTIVE

C.1.1 The objectives of paragraphs C.2.1 are –

(a) to protect people from injury caused by inadequate headroom; and

(b) to prevent loss of amenity caused by inadequate height of room or space.

C.2 PERFORMANCE REQUIREMENT

C.2.1 Any room or space in a building must be provided with –

(a) adequate headroom; and

(b) adequate height,

for the intended uses of the room or space.

C.2.2 The requirements in paragraph C.2.1(a) and (b) do not apply to any of the following rooms or spaces:

(a) any attic that –

(ii) does not exceed an area of 10 square metres; and

(iii) is in a house that is built for the owner's own use;

(b) any equipment or plant room;

(c) the underside of any staircase or escalator if the staircase or escalator is not located along an access route or circulation space;

(d) any toilet or bathroom in any house built for the owner's own use;

(e) any store room not exceeding an area of 6 square metres.

C.2.3 The requirement in paragraph C.2.1(b) does not apply to any of the following rooms or spaces:

(a) any corridor or lobby;

(b) any toilet, bathroom or powder room;

(c) any localised area within a room or space where there is a drop in ceiling height due to physical constraints such as structural beams or building services.

C.3 **ACCEPTABLE SOLUTION**

C.3.1 The requirement in paragraph C.2.1 is deemed to be satisfied if the specifications set out in paragraphs C.3.2 and C.3.3 are complied with.

C.3.2 **Headroom**

C.3.2.1 The headroom of every room, access route and circulation space shall not be less than 2.0 metres.

C.3.2.2 For sheltered car parks, the headroom at parking lots and driveway shall not be less than 2.2 metres.

Note:

1 The term "access route" shall include a covered walkway or footway of a building.

2 The headroom is measured from the finished floor level to –
a) in the case of a doorway, the underside of the transom;
b) in the case where a window opens into an access route or circulation space, the underside of the opened window, or
c) in all other cases, the underside of any beam, duct, service pipe, fixture, fitting or other obstruction or projection.

3 The headroom along a flight of staircase is measured vertically between the pitch line and any point directly above that limits the headroom. See Figure C.3.2.1(a) for illustration of headroom measurement at staircases.

4 The pitch line is the notional line joining the leading edge or nosings (if any) of successive stair treads within a flight of a stairway.

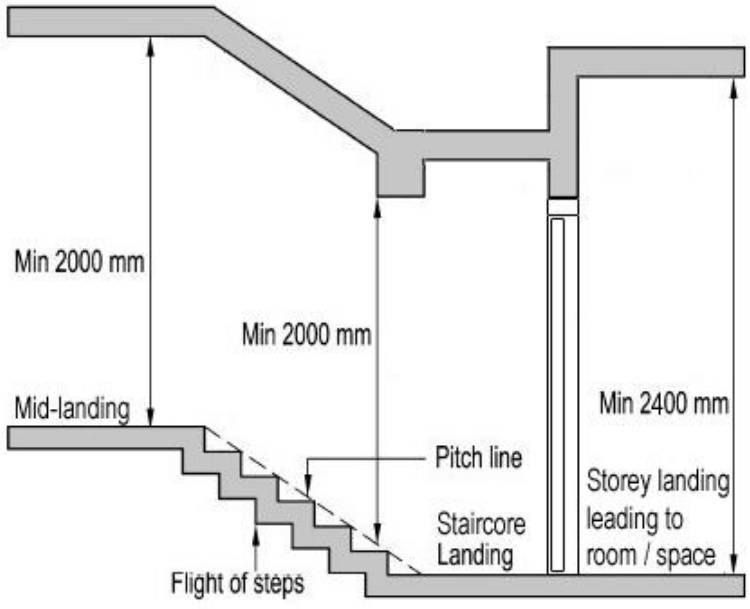


Figure C.3.2.1(a) – Measurement of Headroom

C.3.3 **Ceiling height**

C.3.3.1 The ceiling height of rooms and spaces shall not be less than 2.4 metres.

Note: The ceiling height is measured from the finished floor level to the underside of any slab, false ceiling or suspended ceiling, whichever is lower.

D ACCESSIBILITY IN BUILT ENVIRONMENT

D.1 OBJECTIVE

D.1.1 The objective of paragraphs D.2.1 to D.2.4 is to ensure that persons with disabilities are able to easily gain access to and exit from the whole or part of a building, and that persons with disabilities, children between 90cm and 120cm in height, caregivers of infants, and nursing women are able to carry out their activities within the building with reasonable ease.

D.2 PERFORMANCE REQUIREMENT

D.2.1 At least one access route shall have barrier-free features to enable persons with disabilities to –

(a) approach the building or the vehicle park; and

(b) have access to those spaces where they may be expected to work or visit.

D.2.2 Sanitary facilities that are appropriate for use by persons with disabilities and sanitary facilities that are appropriate for use by children between 90cm and 120cm in height shall be adequately provided for use by such persons.

D.2.3 Appropriate facilities for lactation and changing of diapers shall be adequately provided and be accessible for use by nursing women and caregivers of infants.

D.2.4 Appropriate wayfinding guides such as signages or audible or tactile information providing directions or instructions shall be adequately provided within a building to guide persons with disabilities to spaces or facilities where or which they may be expected to work, visit or use.

D.3 ACCEPTABLE SOLUTION

D.3.1 The requirements in paragraphs D.2.1 to D.2.4 are deemed to be satisfied if the provisions and facilities for persons with disabilities, children between 90cm and 120cm in height, caregivers of infants, and nursing women comply with the Code on Accessibility in the Built Environment issued by the Commissioner of Building Control.

E STAIRCASES

E.1 OBJECTIVE

E.1.1 The objective of paragraphs E.2.1and E.2.2 is to protect people from injury and to facilitate access during movement from one level to another in a building.

E.2 PERFORMANCE REQUIREMENT

E.2.1 A staircase (including a flight of 2 steps or more) shall provide a safe and suitable passage for movement of people.

E.2.2 A staircase must have –

(a) handrails or guides to assist movement (in accordance with paragraph E.3.6.1);

(b) landings to break a fall and provide a place for rest;

(c) sufficient width, tread and riser to avoid injury;

(d) sufficient headroom to avoid injury; and

(e) barriers to prevent people from falling off the edge of any open side that has a drop of 1,000 mm or more.

E.2.3 The requirement in paragraph E.2.2(a) does not apply to a staircase located in any of the following rooms or spaces:

(a) any equipment or plant room;

(b) any production area of an industrial building; and

(c) any house built for the owner's own use.

E.2.4 The requirements in paragraph E.2.2(b) and (c) do not apply to a staircase located in any of the following rooms or spaces:

(a) any equipment or plant room;

(b) any production area of an industrial building;

(c) any attic that –

(ii) does not exceed an area of 10 square metres; and

(iii) is in a residential building;

(d) any house built for the owner's own use.

E.3 **ACCEPTABLE SOLUTION**

E.3.1 The requirements in paragraphs E.2.1 and E.2.2 are deemed to be satisfied if a staircase is designed and constructed in accordance with the specifications set out in paragraphs E.3.2 to E.3.7.

E.3.2 **Projection**

E.3.2.1 No projection, other than handrails, is allowed into the space of a staircase that is within a height of 2.0 m from the landing or pitch line.

Note:
The pitch line is the notional line joining the leading edge or nosings (if any) of successive stair treads within a flight of a stairway.

E.3.3 **Width of staircase**

E.3.3.1 The clear width of every staircase shall not be less than 1000 mm.

Note: *If the projection of the handrail into the clear width does not exceed 80 mm on each side of the staircase, the width is measured from:*

(a) *The finished surfaces of the walls, if the staircase is enclosed on both sides by walls only; or*

(b) *The finished surface of the wall and the inner side of the balustrade, if the staircase has a wall on one side and a balustrade on the other side; or*

(c) *The inner sides of the balustrades if the staircase has balustrades on both sides.*

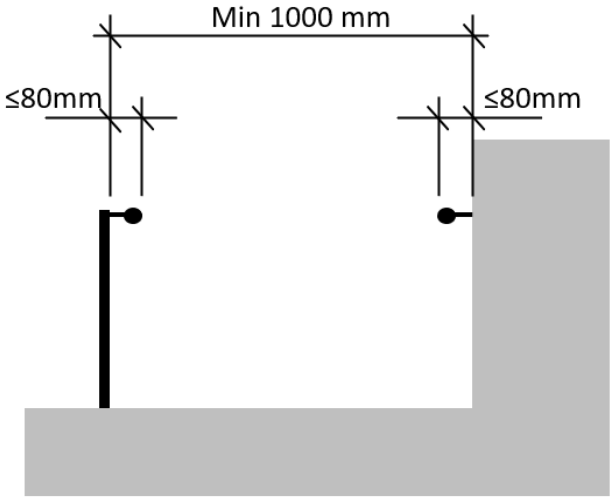


Figure E.3.3.1(a) – Measurement of Clear Width with 80mm or less handrail projection

If the projection of the handrail into the clear width exceeds 80 mm on one or more side of the staircase, the clear width of the staircase shall be measured from:

(a) *The finished surface of the wall and the inner side of the handrail, if the staircase has a wall on one side and a handrail on the other side; or*

(b) *The inner sides of the handrails if the staircase has handrails on both sides.*

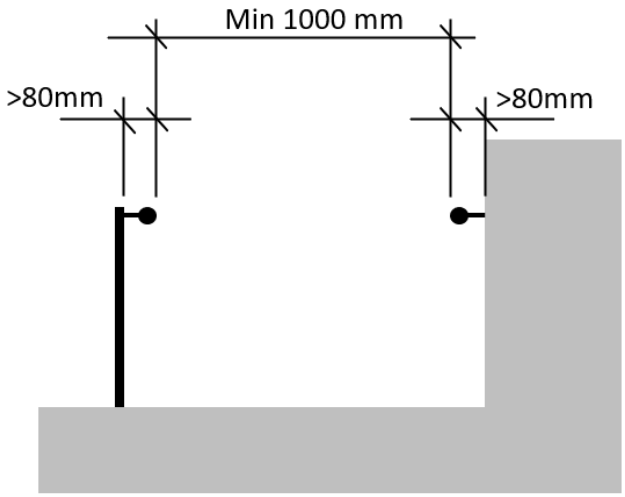


Figure E.3.3.1(b) – Measurement of Clear Width more than 80mm handrail projection

E.3.4 Risers and treads

E.3.4.1 The height of a riser shall not be more than 175 mm. (see Figure E.3.4.2(a) for measurement of "riser")

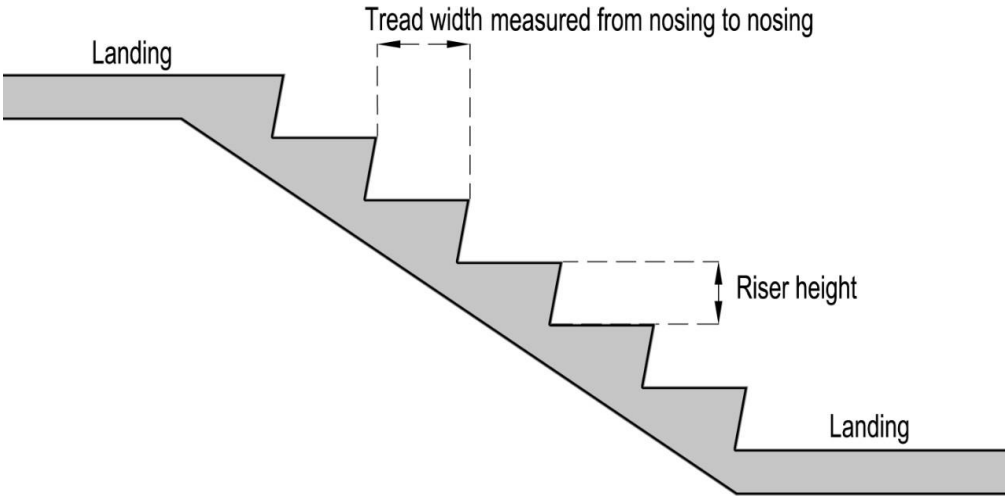


Figure E.3.4.2(a) – Measurement of Tread and Riser

E.3.4.2 The width of a tread of a staircase (see Figure E.3.4.2(a) for measurement of "tread") shall not be less than:

a) 225 mm, if the staircase is in a residential unit within a residential building;

b) 250 mm, if the staircase is in an industrial building; or

c) 275 mm, if the staircase is in any other type of building, including common staircases in a residential building.

E.3.4.3 The width of the tread of any tapered step shall be measured at a distance of 500 mm from the narrower end.

E.3.4.4 The risers and treads within each flight of stairs shall be of uniform height and size.

Note:

1. *A tolerance of 5mm between two consecutive steps in any flight of staircase is acceptable.*

2. *Uniformity of risers and treads is applicable to all rooms or spaces under paragraph E.2.4 (except houses built for owner's own use).*

E.3.5 **Landing**

E.3.5.1 A landing shall be provided at every floor level and door opening.

E.3.5.2 Except for spiral staircases, an intermediate landing shall be provided in between floor levels at intervals of not more than 18 risers.

E.3.5.3 The clear width of any landing shall not be less than 1000 mm. See Figure E.3.5.3(a) and (b) on how to measure landing width.

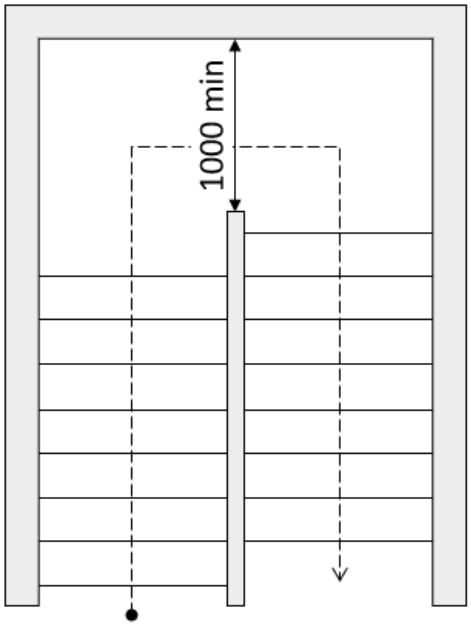


Figure E.3.5.3(a) – Measurement of landing width

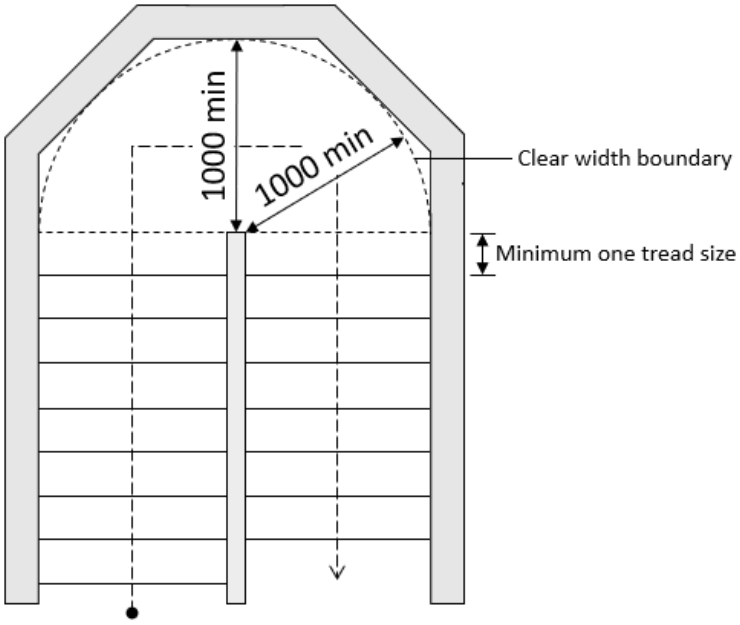


Figure E.3.5.3(b) – Measurement of the width of an irregular landing

E.3.5.4 A landing shall not have any step or drop. A winder does not constitute a landing and is only allowed in a residential unit, where one winder is allowed in every 90 degrees turn in the staircase with a minimum of one tread in between. See Fig. E.3.5.4 on acceptable winder layout.

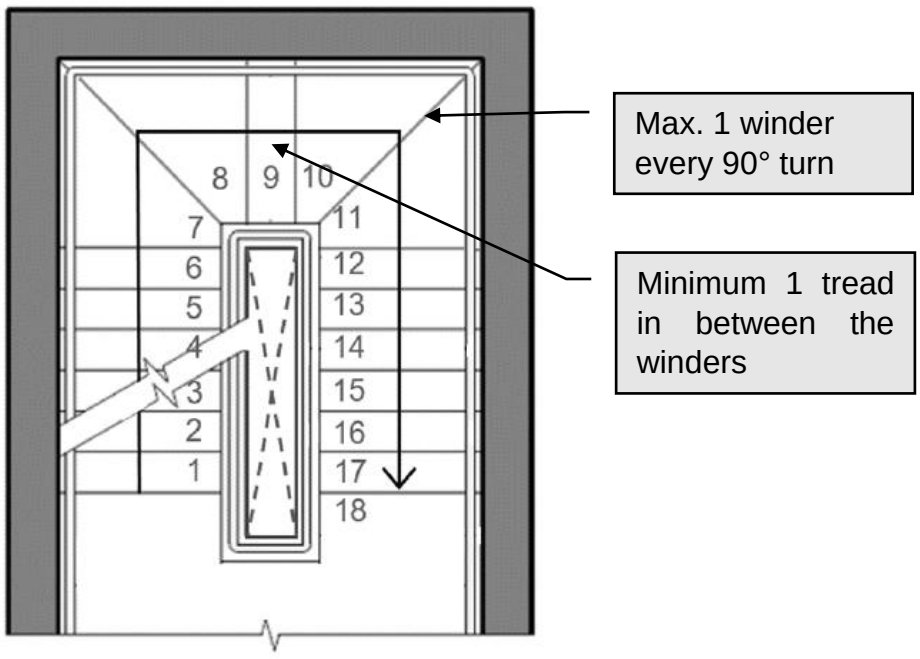


Figure E.3.5.4(a) – Winders as part of total riser count

E.3.6 **Handrails**

E.3.6.1 A handrail shall be provided on at least one side of the flight of any staircase with more than 5 steps.

E.3.6.2 The height of the handrail shall be between 800 mm and 1000 mm above the pitch line.

E.3.6.3 Handrails shall:

a) have a circular section from 32 mm to 50 mm in diameter or an equivalent gripping surface as shown in Code on Accessibility in the Built Environment, Clause 4.7.3.1(b); and

b) have a clear space between the handrail and all wall surfaces as shown in Figure E.3.6.3(a) of –

(ii) not less than 40 mm; or

(iii) not less than 60 mm where the wall has a rough surface.

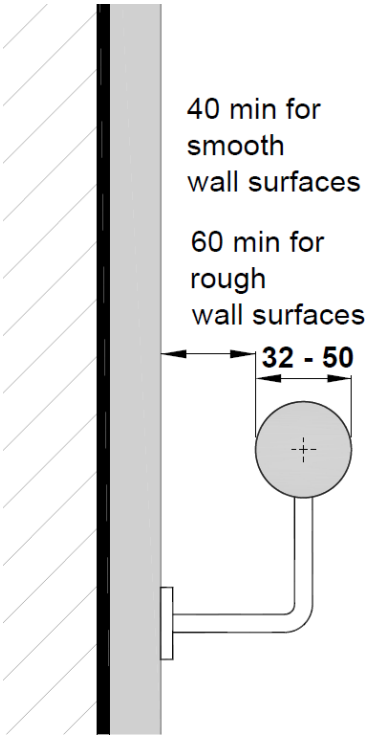


Figure E.3.6.3(a) – Handrails Clearance from Wall

E.3.6.4 A recess containing a handrail shall extend at least 450mm above the top of the rail as shown in Figure E.3.6.4(a).

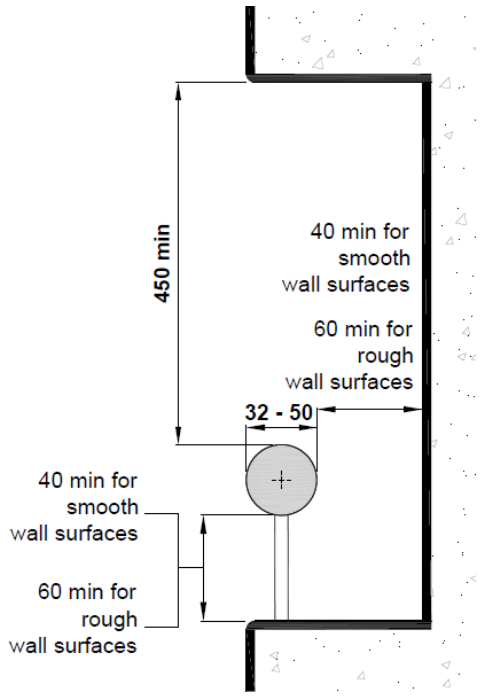


Figure E.3.6.4(a) – Handrail in Recess

E.3.6.5 A handrail shall be continuous throughout the entire length of stairs and the ends of the handrail should be properly formed or rounded off so that they do not pose a danger to the user.

E.3.7 **Stair Nosing**

E.3.7.1 Stair nosing must not project beyond the face of the riser and the riser may be vertical or have a splay backwards up to a maximum 25 mm, as shown in Fig E.3.7.1(a).

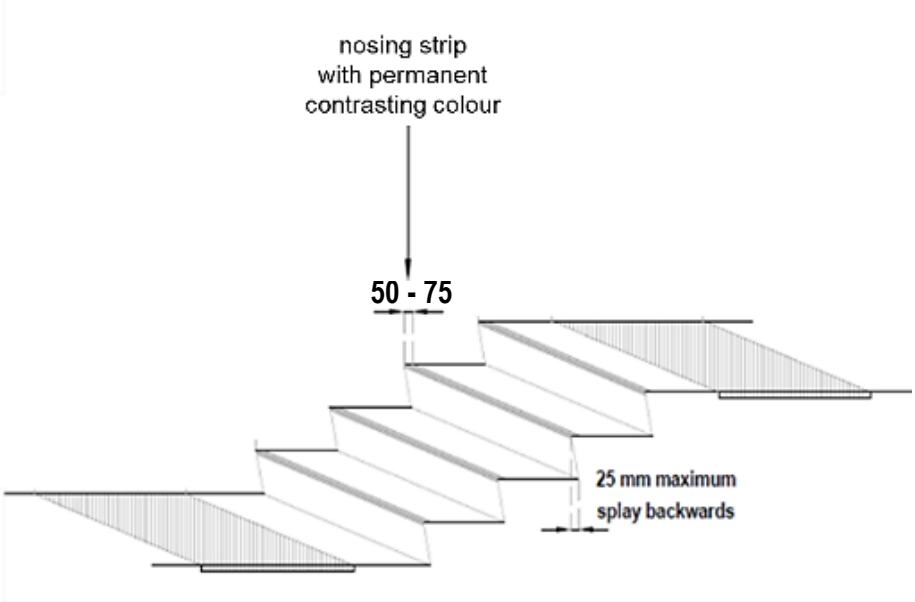


Figure E.3.7.1(a) – Stair nosing

E.3.7.2 All steps must be fitted with nosing strips between 50 mm and 75 mm in width.

E.3.7.3 Nosing strips must be of a colour that contrasts with the steps to make the drop edge of each step clearly visible.

E.3.7.4 Painting of a nosing strip to achieve the colour contrast mentioned in sub-paragraph E.3.7.3 is not acceptable.

Note: The requirements on stair nosing in Section E.3.7 do not apply to residential units including landed houses. For the avoidance of doubt, the requirements in Section E.3.7 apply to common property such as corridors, lift lobbies etc. within residential developments.

F LIGHTING

F.1 OBJECTIVE

F.1.1 The objective of paragraphs F.2.1 and F.2.2 is to protect people from injury or loss of amenity due to lack of lighting, whether natural or artificial.

F.2 PERFORMANCE REQUIREMENT

F.2.1 Lighting shall be adequately provided in a building for its intended purpose.

F.2.2 Residential buildings, other than houses built by the owners for their own use, shall be provided with natural lighting for the purpose of paragraph F.2.1.

F.2.3 Despite paragraph F.2.2, artificial lighting may be provided to any of the following rooms or spaces in a residential unit, instead of natural lighting –

(a) any toilet or bathroom;

(b) any store room;

(c) any basement;

(d) any civil defence shelter.

F.3 ACCEPTABLE SOLUTION

F.3.1 The requirement in paragraph F.2.1 is deemed to be satisfied if –

(a) natural lighting that complies with paragraph F.3.2.1; or

(b) artificial lighting that complies with the recommended illuminance given in SS 531 - Code of Practice for Lighting of Work Places.

is provided.

F.3.2 Natural lighting

F.3.2.1 Natural lighting shall be provided by means of one or more windows or other openings with an aggregate light transmitting area of not less than 10% of the floor area of the room or space required to be lighted.

Note: The light transmitting area for a window and other similar devices may be measured over the framing members and glazing bars.

G VENTILATION

G.1 OBJECTIVE

G.1.1 The objective of paragraphs G.2.1 and G.2.2 is to protect people from loss of amenity due to lack of fresh air.

G.2 PERFORMANCE REQUIREMENT

G.2.1 Ventilation shall be adequately provided in a building for its intended occupancy.

G.2.2 Residential buildings, other than houses built by the owners for their own use, shall be provided with natural ventilation for the purpose of paragraph G.2.1.

G.2.3 The requirement in paragraph G.2.1 does not apply to any of the following rooms or spaces not exceeding an area of 6 square metres –

(a) any store room;

(b) any private lift lobby;

(c) any walk-in wardrobe;

G.2.4 Despite paragraph G.2.2, mechanical ventilation may be provided to any of the following rooms or spaces in any residential development:

(i) any fitness room forming part of the communal area or common property;

(ii) any clubhouse;

(iii) any civil defence shelter;

(iv) any toilet or bathroom;

(v) any basement.

G.3 ACCEPTABLE SOLUTION

G.3.1 The requirement in paragraph G.2.1 is deemed to be satisfied if –

(a) natural ventilation that complies with paragraphs G.3.2.1 and G.3.2.2; or

(b) mechanical ventilation that complies with the ventilation rates given in SS 553 - Code of Practice for Air-Conditioning and Mechanical Ventilation in Buildings; or

(c) air-conditioning system that complies with –

(for new erections of non-residential buildings)

(i) the ventilation rates given in SS 553 – Code of Practice for Air-Conditioning and Mechanical Ventilation in Buildings; and

(ii) the Minimum Efficiency Reporting Value (MERV) for cleaning the air given in SS 553 – Code of Practice for Air-Conditioning and Mechanical Ventilation in Buildings

(for all other types of building works)

the ventilation rates given in SS 553 – Code of Practice for Air-Conditioning and Mechanical Ventilation in Buildings,

is provided.

G.3.2 **Natural ventilation**

G.3.2.1 Natural ventilation shall be provided by means of one or more openable windows or other openings with an aggregate area of not less than –

(a) 5% of the floor area of the room or space required to be ventilated; and

(b) in the case of an aboveground car park, comply with relevant clause in SS553 – Code of Practice for Air-Conditioning and Mechanical Ventilation in Buildings.

Note: *Except otherwise stated in the following, any openable window or opening may be considered to be unobstructed and for the purposes of paragraph G.3.2.1, the effective open area may be taken as the entire area of the opening.*

(a) The effective open area of a sliding window is the unobstructed area when the sliding window is opened fully.

(b) The effective open area of any opening installed with fixed louvers shall be assumed to be 50% of the area of the opening.

(c) For any casement windows installed with restrictors and can be opened at least 30 degrees or more, the effective open area of the window shall be assumed to be 50% of the window opening. Where the window is restricted from opening to an angle less than 30 degrees, the window shall be taken to have no effective open area for the purposes of paragraph G.3.2.1.

G.3.2.2 All windows and openings intended for natural ventilation shall be located such that they open to –

(a) the exterior of the building;

(b) an airwell with a minimum width of 3.0m and a minimum area open to the sky complying with Table G.3.2.2(a); or

(c) a recess, exceeding 3.0m from the external building wall, and of minimum width 3.0m. See Figure G.3.2.2(b) for illustration.

Height of airwell	Minimum airwell size (m^2)
Not more than 30 m	10
For each additional 3m height, or part of, beyond 30 m	Add 1 to the minimum size of 10

Table G.3.2.2(a) – Dimension of airwells

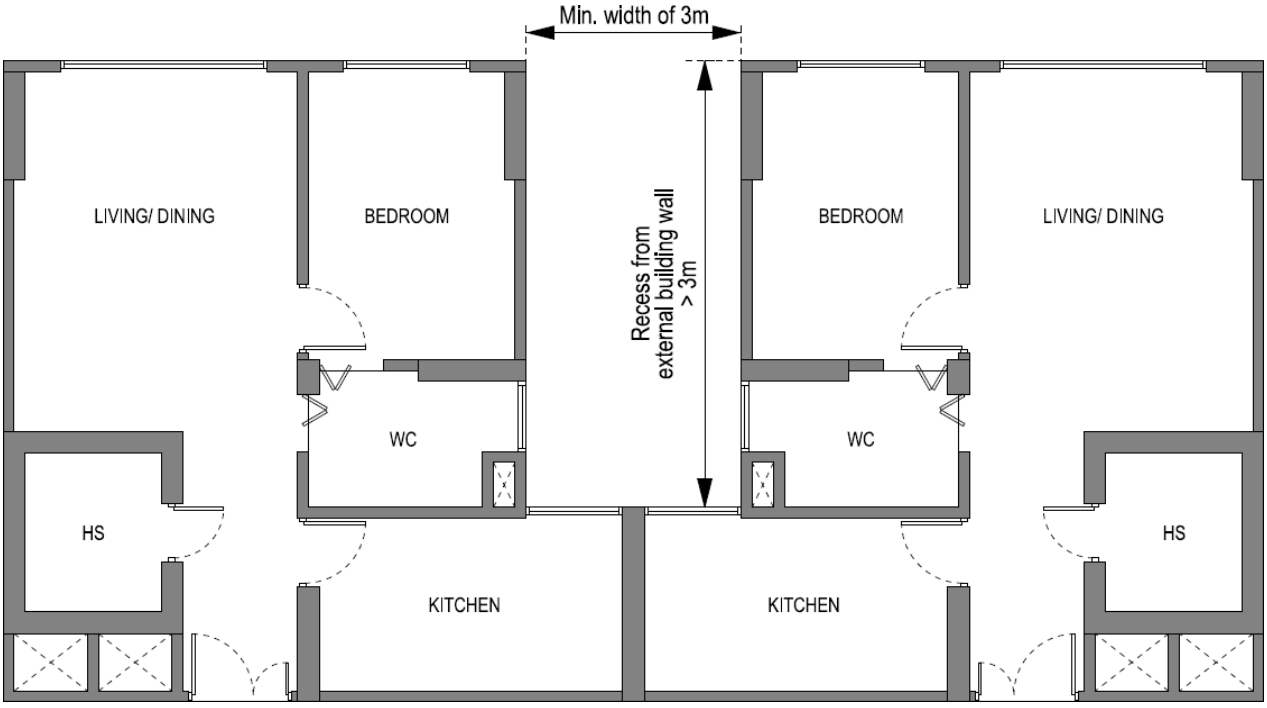


Figure G.3.2.2(b) – Recessed Void Dimension

G.3.2.3 No part of any room or space (other than a room in a warehouse) that is designed for natural ventilation shall be located more than 12 metres from any window or opening that is used to ventilate the room or space.

H SAFETY FROM FALLING

H.1 OBJECTIVE

H.1.1 The objective of paragraphs H.2.1, H.2.1A and H.2.1B is to protect people from injury caused by falling from a height.

H.2 PERFORMANCE REQUIREMENT

H.2.1 Where there is a vertical drop in level of 1.0 m or more, appropriate measures shall be taken to prevent people from falling from a height.

H.2.1A Where a barrier is installed to prevent a person from falling from a height, the barrier –

(a) must be sufficiently high to prevent a person from falling over the top of the barrier;

(b) must not have any opening or gap that will allow a person to slip through the barrier; and

(c) must not have any feature that facilitates a person in climbing over the barrier.

H.2.1B Where glass is used as a part or whole of a barrier, the glass used shall be able to withstand the loading for which it is designed and shall not be susceptible to spontaneous breakage or to shattering.

H.2.2 The requirement in paragraphs H.2.1, H.2.1A and H.2.1B do not apply to –

(a) any roof or maintenance area which is not easily accessible; and

(b) any area where the provision of a barrier would prevent it from being used as intended, such as a loading dock or pier, platform for the loading or unloading of goods, or for boarding or alighting of passengers, stage for performance or entertainment, golf driving range, equipment pit and the like.

H.2.3 The requirement in paragraph H.2.1A(a) does not apply to a barrier installed in any house built for the owner's own use.

H.2.4 The requirement in paragraph H.2.1A(b) does not apply to a barrier installed in any of the following places:

(a) any promenade or boardwalk at ground level along a waterfront;

(b) any houses built for the owner's own use.

H.2.5 The requirements under paragraph H.2.1A(c) does not apply to –

(a) any industrial building;

(b) any promenade or boardwalk at ground level along a waterfront;

(c) any bay window in a residential unit;

(d) any house built for the owner's own use.

H.3 ACCEPTABLE SOLUTION

H.3.1 The requirement in paragraphs H.2.1, H.2.1A and H.2.1B is deemed to be satisfied if a barrier is provided in accordance with the specifications set out in paragraphs H.3.2 to H.3.5.

H.3.1A The requirements in paragraphs H.2.1, H.2.1A and H.2.1B are deemed to be satisfied for a safety barrier integrated with window at existing residential buildings, if such safety barrier is in accordance with the standardised design.

Note: For purposes of Regulation 2 of the Building Control Regulations 2003 and paragraph H3.1A, "standardised design" means the standardised design set out in Annex C in this Approved Document.

H.3.2 Height of barrier

H.3.2.1 The height of a barrier shall not be less than –

(a) 1.0 metre; or

(b) 900 mm at the lower edge of the window and gallery or balcony with fixed seating in areas such as theatres, cinemas and assembling halls.

Note: 1. The height of a barrier is measured vertically from the finished floor level to the top of the barrier.

2. The height of a barrier at the flight of stairs is measured vertically from the pitch line to the top of the barrier.

3. A kerb, protrusion or flat surface with dimensions more than 150 mm width by 150 mm length must be not less than 1000 mm away from the top of the barrier.

4. Where a kerb, protrusion or flat surface with dimensions more than 150 mm width by 150 mm length is provided next to a barrier, the height of the barrier shall be measured from the top of the kerb, protrusion or flat surface.

H.3.3 **Horizontal loading and design of glass panel barriers**

H.3.3.1 A barrier shall be designed to withstand a horizontal loading determined in accordance with SS EN 1991 Actions on structures – Part 1-1: General actions – Densities, self-weight, imposed loads for buildings and the associated Singapore National Annex.

H.3.3.1A Notwithstanding paragraph H.3.3.1, in the case of a barrier in a project where the first structural plans have been submitted for approval by the Commissioner of Building Control before 1 April 2015, the vehicular barrier may be designed to be capable of resisting forces set out in BS 6399: Part 1 - Loading for buildings. Code of practice for dead and imposed loads.

H.3.3.2 Glass panel barriers shall be designed and installed in accordance with Section 8 of BS 6180 – Barriers in and about Buildings – Code of Practice.

H.3.4 **Size of opening**

H.3.4.1 There must not be any gap, from the finished floor level to a height no less than 75 mm, at the lowest part of a barrier.

Note: *This is to prevent objects from slipping through the base of the barrier and falling off into the space below.*

H.3.4.2 The lowest 75 mm section of a bay window shall not be openable.

H.3.4.3 The size of any opening or gap in a barrier must not be large enough as to permit the passage of –

(a) in the case of non-industrial buildings, a 100 mm diameter sphere;

(b) in the case of industrial buildings, a 150 mm diameter sphere, or

(c) in the case of maintenance areas, including plants, equipment rooms, catwalks or maintenance platforms that are accessible only by authorised personnel, a 500 mm diameter sphere.

H.3.4.4 For any flight of staircase –

(a) the gap size between any two consecutive steps in a flight of staircases shall not be large enough as to permit the passage of –

(i) in the case of industrial buildings, a 150 mm diameter sphere, or

(ii) in the case of all other buildings, a 100 mm diameter sphere

(b) the size of any triangular opening, gap or void formed around a tread, riser and bottom edge of the barrier at a staircase in any building other than an industrial building shall not be large enough as to permit the passage of a 150 mm diameter sphere.

H.3.4A **Requirements to prevent climbing**

H.3.4A.1 A barrier must have a height no less than –

(a) the height specified in paragraph H.3.2.1, or

(b) 850 mm when measured from the last climbable toehold;

whichever is higher.

See Figure H.3.4A.1(a) for illustration.

Note 1: A toehold means –

(a) any opening in a perforated sheet or mesh having a horizontal dimension of more than 50 mm and a vertical dimension of more than 30 mm; or

(b) any kerb or protrusion having a width of more than 50mm and has a chamfer gentler than 45˚relative to the horizontal plane.

See Figures H.3.4A.1(b), H.3.4A.1(c) and H.3.4A.1(d) for examples on toehold dimensions.

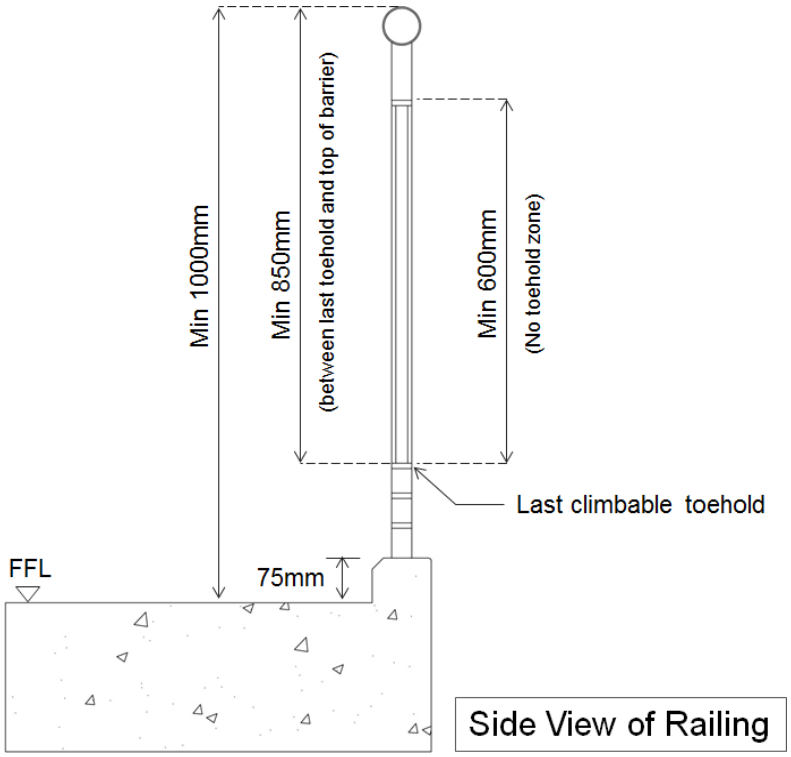


Figure H.3.4A.1(a) – Requirements to Prevent Climbing

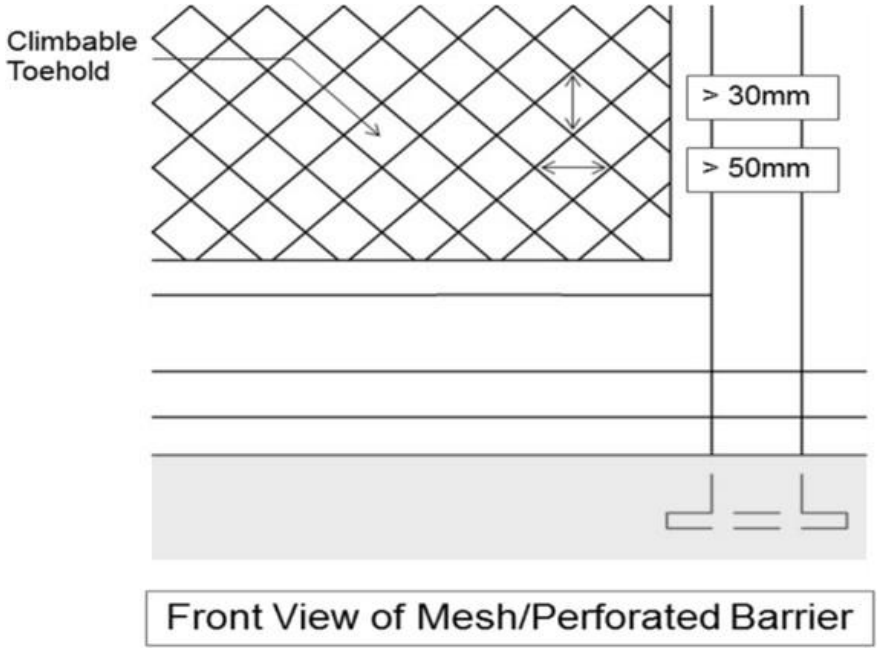


Figure H.3.4A.1(b) - Toehold Dimensions at Mesh/ Perforated Barrier

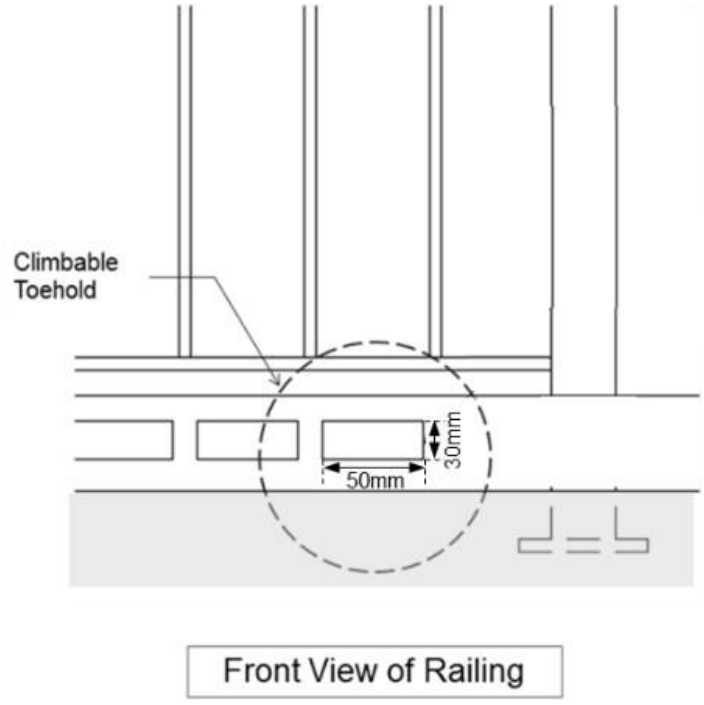


Figure H.3.4A.1(c) - Toehold Dimensions at Railing

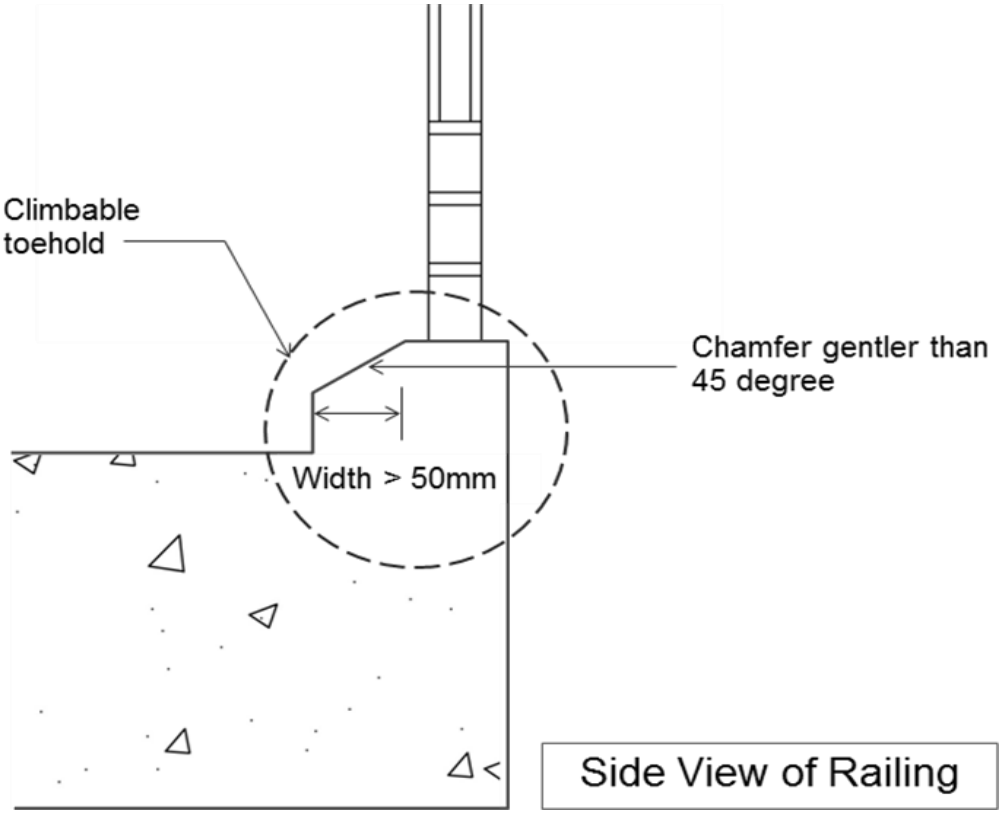


Figure H.3.4A.1(d) – Toehold Dimensions at Kerb/Protrusion

Note 2: *A toehold is considered to be climbable if it is located within 600 mm vertically from –*

(a) *the finished floor level;*

(b) a step; or

another climbable toehold.

H.3.5 **Glass Barrier**

H.3.5.1 Where glass is used as a part or whole of a barrier, laminated glass shall be used.

H.3.5.2 All glass used must comply with SS 341: Specification for Safety Glazing Materials for Use in Buildings.

I ENERGY EFFICIENCY

I.1 OBJECTIVE

I.1.1 The objective of paragraphs I.2.1 and I.2.2 is to facilitate efficient use of energy.

I.2 PERFORMANCE REQUIREMENT

I.2.1 A building shall be designed and constructed with energy conservation measures to reduce –

(a) solar heat gain through the roof;

(b) solar heat gain through the building envelope;

(c) air leakage through doors, windows and other openings on the building envelope;

(d) energy consumption of lighting, air-conditioning and mechanical ventilation systems; and

(e) energy wastage through adequate provisions of switching means.

I.2.2 Commercial buildings with a gross area of more than 500 m^2 shall be installed or equipped with means to facilitate the collection of energy consumption data.

I.2.3 The requirement in paragraph I.2.1(a) does not apply to a roof of any of the following buildings that does not have air-conditioning:

(a) any building with a gross floor area not exceeding 500 square metres;

(b) any open-sided shed;

(c) any linkway;

(d) any covered walkway;

(e) any store room and utility room;

(f) any equipment or plant room.

I.3 ACCEPTABLE SOLUTION

I.3.1 The requirements in paragraphs I.2.1 and I.2.2 are deemed to be satisfied if the design and construction of a building comply with the specifications set out in paragraphs I.3.2 to I.3.8.

I.3.2 **Air-conditioned building**

I.3.2.1 For all residential buildings with a gross floor area of 2000m^2 or more, the Residential Envelope Transmittance Value (RETV) of the building, as determined in accordance with the formula set out in the "Code on Envelope Thermal Performance for Buildings" issued by the Commissioner of Building Control, shall not exceed 25 W/m^2.

I.3.2.2 The requirements in paragraphs I.3.2.1 are deemed to be satisfied if a residential building with external walls consisting of masonry construction, satisfies the criteria below:

$$WWR_{Bldg} < 0.3 \text{ and } SC_{facade} < 0.7$$
Or
$$WWR_{Bldg} < 0.4 \text{ and } SC_{facade} < 0.5$$
Or
$$WWR_{Bldg} < 0.5 \text{ and } SC_{facade} < 0.43$$

Where: WR: Window to wall ratio
SC: Shading coefficient of fenestration = $SC_{glass} \times SC_{shading\ device}$

I.3.2.3 For all non-residential buildings with an aggregate air-conditioned area of more than 500m^2, the Envelope Thermal Transfer Value (ETTV) of the building, as determined in accordance with the formula set out in the "Code on Envelope Thermal Performance for Buildings" issued by the Commissioner of Building Control, shall not exceed 50 W/m^2.

I.3.2.4 In respect of roofs with skylight, the roof thermal transfer value (RTTV) as determined in accordance with the formula set out in the "Code on Envelope Thermal Performance for Buildings" issued by the Commissioner of Building Control, shall not exceed 50 W/m^2.

I.3.2.5 In respect of roofs without skylight, the average thermal transmittance (U- value) for the gross area of the roof shall not exceed the limit prescribed in Table I1 for the corresponding weight group.

TABLE I1

Maximum thermal transmittance for roof of air-conditioned building

Weight group	Weight range (kg/m^2)	Maximum thermal transmittance (W/m $^{2^\circ}$K)
Light	Under 50	0.5
Medium	50 to 230	0.8
Heavy	Over 230	1.2

Note 1 The requirements in paragraphs I.3.2.3 to I.3.2.5 apply to buildings with a gross floor area exceeding 500 m^2.

2 In the case of semi-detached, terraced and linked houses, each unit of the semi-detached, terraced or linked houses is construed as a building for the purpose of the above note (1).

I.3.3 **Non air-conditioned building**

I.3.3.1 The thermal transmittance (U-value) of the roof, as determined in accordance with the formula set out in the "Code on Envelope Thermal Performance for Buildings" issued by the Commissioner of Building Control, shall not exceed the limit specified in Table I2 for the corresponding weight group.

TABLE I2

Maximum thermal transmittance for roof of non air-conditioned building

Weight group	Weight range (kg/m^2)	Maximum thermal transmittance ($W/m^{2^\circ}K$)
Light	Under 50	0.8
Medium	50 to 230	1.1
Heavy	Over 230	1.5

Note Where a building is partially air-conditioned and the aggregate air-conditioned area is less than 500 m2, the requirement in paragraph I.3.3.1 shall apply if the total gross floor area of the building exceeds 500 m^2.

I.3.4 **Air tightness and leakage**

I.3.4.1 All windows on the building envelope shall not exceed the air leakage rates specified in SS 212 – Specification for Aluminium Alloy Windows.

I.3.4.2 Where the door opening of any commercial unit is located along the perimeter of the building envelope, that unit shall –

(a) be completely separated from the other parts of the building; and

(b) has its air-conditioning system separated from and independent of the central system.

Note 1 The requirements in paragraphs I.3.4.1 and I.3.4.2 do not apply to non air-conditioned buildings.

2 The requirement in paragraph I.3.4.2 also applies to commercial units, the doors of which open into an exterior open space, external corridor, passageway or pedestrian walkway.

I.3.5 **Air-conditioning system**

I.3.5.1 Where the cooling capacity of any air-conditioning system exceeds 30 kW, the equipment shall comply with the relevant provisions of SS 530 - Code of Practice for Energy Efficiency Standard for Building Services and Equipment.

I.3.6 **Artificial lighting**

I.3.6.1 The maximum lighting power budget in a building shall comply with SS 530 - Code of Practice for Energy Efficiency Standard for Building Services and Equipment.

I.3.7 **Switching control**

I.3.7.1 Air-conditioning system shall be equipped with manual switches, timers or automatic controllers for shutting off part of the air-conditioning system during periods of non-use or reduced heat load.

I.3.7.2 Lighting control for artificial lighting shall be provided in accordance with SS 530 - Code of Practice for Energy Efficiency Standard for Building Services and Equipment.

I.3.7.3 In any hotel building, a control device acceptable to the Commissioner of Building Control, shall be installed in every guestroom for the purpose of automatically switching off the lighting and reducing the air-conditioning when a guestroom is not occupied.

I.3.8 **Energy auditing**

I.3.8.1 For buildings used as offices, shops, hotels or a combination thereof, suitable means for the monitoring of energy consumption shall be provided to all incoming power supply to a building and the sub-circuits serving –

(a) a central air-conditioning system;

(b) a major mechanical ventilation system;

(c) a vertical transportation system;

(d) a water pumping system;

(e) the general power supply to tenancy areas;

(f) the general lighting supply to tenancy areas;

(g) the general power supply to owner’s premises; and

(h) the general lighting supply to owner’s premises.

J ROOF

J.1 OBJECTIVE

J.1.1 The objective of paragraph J.2.1 is to protect the roof of semi-detached houses, terraced houses and linked houses from physical damage when repairs, alterations or additions to the roof of an adjoining house are being carried out.

J.2 PERFORMANCE REQUIREMENT

J.2.1 The roof shall be designed and constructed such that the roof of every house is separate and independent of each other.

J.3 ACCEPTABLE SOLUTION

J.3.1 The requirement in paragraph J.2.1 is deemed to be satisfied if the party wall is extended above the level of the roof so that each roof is separate and independent of the roof of the adjoining house.

K LIFTS AND ESCALATORS

K.1 OBJECTIVE

K.1.1 The objectives of paragraphs K.2.1, K.2.2, K.2.3 and K.2.4 are to provide a convenient means of vertical transportation and to protect people from injury while using the lifts or escalators.

K.2 PERFORMANCE REQUIREMENT

K.2.1 Lifts and escalators shall –

(a) move people safely; and

(b) not produce excessive acceleration or deceleration.

K.2.2 A building comprising 5 or more storeys (including the ground level) shall be provided with one or more passenger lifts.

K.2.3 All lift interior fittings and fixtures must be securely fastened by appropriate mechanical fasteners.

K.2.4 The requirement in paragraph K.2.1 does not apply to any stairlift or vertical platform lift that –

(a) has a maximum vertical displacement of less than 1,000 mm when the lift is in operation;

(b) has a maximum obstruction force of less than 150 Newtons when the lift is in operation; and

(c) serves a single residential unit.

K.2.5 In paragraph K.2.4, “stairlift” and “vertical platform lift” have the same meanings given to them in regulation 2(1) of the Building Maintenance and Strata Management (Lift, Escalator and Building Maintenance) Regulations 2016 (G.N. No. S 348/2016).

K.3 ACCEPTABLE SOLUTION

K.3.1 The requirements in paragraphs K.2.1 and K.2.2 are deemed to be satisfied if –

(a) the lifts are designed and installed:

(i) in accordance with the requirements of SS 550 - Code of Practice for Installation, Operation and Maintenance of Electric Passenger and Goods Lifts;

(ii) with light curtain installed at the lift door as a door protective device that shall automatically initiate re-opening of the door(s) in the event of a person crossing the entrance during the closing movement, and that the light curtain shall have its nudging mode de-activated if nudging mode is provided; and

(iii) provided with a video recorder that has the following minimum specifications –

a. Capacity to record 24 hours a day, 7 days a week;

b. Capture footage of the entire lift car including in-car floor indicator, lift car door(s) and landing area outside the lift car in front of the lift doors;

c. Frame rate of at least 6 frames per second;

d. Video resolution of at least 352 x 240 pixels or CIF CCTV resolution; and

e. Storage of video footage for at least 30 days;

and

(b) the escalators are designed and installed:

(i) in accordance with SS 626 - Code of Practice for Design, Installation and Maintenance of Escalators and Moving Walks;

(ii) with means to limit or detect the riser end of the step being displaced upward by more than 5mm at the upper and lower transition curves at or prior to the point of tangency of the horizontal and curved track. When the upward displacement exceeds 5mm, the means shall cut off the power to the driving machine and brake and stop the escalator before the detected step reaches the comb plate with any load up to brake rated load with escalator running; and

(iii) provided with a video recorder that has the following minimum specifications –

a. Capacity to record 24 hours a day, 7 days a week;

b. Capture footage of the entire length of escalator, including landing floor plates on both the upper and lower landing areas of the escalator;

c. Frame rate of at least 6 frames per second;

d. Video resolution of at least 352 x 240 pixels; or CIF CCTV resolution; and

e. Storage of video footage for at least 30 days.

For the purposes of this part:

"light curtain" means an opto-electronic device that is usually mounted at the lift doors to detect the presence of objects in the path of its light rays.

K.3.2 The requirements in paragraphs K2.1 are deemed to be satisfied if vertical platform lifts and stairlifts which are primarily designed for persons with impaired mobility are designed and installed in accordance with the requirements of –

(a) EN 81-41 – Safety rules for the construction and installation of lifts – Special lifts for the transport of persons and goods. Part 41: Vertical platforms intended for use by persons with impaired mobility; or

(b) EN 81-40 – Safety rules for the construction and installation of lifts – Special lifts for the transport of persons and goods. Part 40: Stairlifts and inclined lifting platforms intended for persons with impaired mobility; or

(c) ASME A18.1 – Safety standard for platform lifts and stairway chairlifts; or

(d) Code of Practice for installation, operation and maintenance of vertical platform lift with enclosed platform and automatic sliding doors; or

(e) other relevant standards which are acceptable to the Commissioner of Building Control; and

(f) except for stairlifts and chairlifts, with a telephone, intercom system or any other communication device that enables notification or direct communication with personnel who can initiate an emergency response; and

(g) for vertical platform lifts that are not installed in private homes solely for the use of the occupants, in addition to the above standards, they are provided with a video recorder that has the following minimum specifications –

(i) Capacity to record 24 hours a day, 7 days a week;

(ii) Capture footage of the entire lift platform and platform entrance, from floor to ceiling (if any), and landing area outside the lift platform in front of the landing doors;

(iii) Frame rate of at least 6 frames per second;

(iv) Video resolution of at least 352 x 240 pixels or CIF CCTV resolution; and

(v) Storage of video footage for at least 30 days.

For the purposes of this part:

"stairlift" means a motorised platform or seat installed in a stairway, which traverses the stairs when activated; and

"vertical platform lift" means a vertical lifting platform intended for use by people with impaired mobility, with or without wheelchair, travelling vertically between predefined levels along a guided path.

K.3.3 The requirements in paragraph K2.1 are deemed to be satisfied if home lifts are designed and installed in accordance with the requirements of –

(a) the SS 550 - Code of Practice for Installation, Operation and Maintenance of Electric Passenger and Goods Lifts; or

(b) other relevant standards which are acceptable to the Commissioner of Building Control.

(c) With a telephone, intercom system or any other communication device that enables notification or direct communication with personnel who can initiate an emergency response.

For the purposes of this part:

"home lift" means a lift, excluding a stairlift or a vertical platform lift, not being common property, installed in a private home solely for the use of its occupants.

K.3.4 The requirements in paragraph K2.3 are deemed to be satisfied if the mechanical fasteners are provided in accordance with the following:

(a) Mechanical fasteners are devices that can transmit mechanical load, keeping two or more elements of an assembly of fittings and fixtures in relative position, assuring continuity, stability and mechanical strength as needed.

(b) The fittings and fixtures must not be at risk of dislodging from its intended position, and the strength of the fastening means must not become undone, neither with the application of reasonable force, nor with the passage of time.

(c) Examples of mechanical fasteners include bolts and nuts, screws, pins and rivets.

L LIGHTNING PROTECTION

L.1 OBJECTIVE

L.1.1 The objective of paragraph L.2.1 is to protect a building from the direct effects of lightning strike and to protect its occupants from the risk of lightning current being discharged through the building.

L.2 PERFORMANCE REQUIREMENT

L.2.1 A lightning protection system shall be capable of protecting the building and its occupants from the effects of lightning strike.

L.3 ACCEPTABLE SOLUTION

L.3.1 The requirement in paragraph L.2.1 is deemed to be satisfied if the lightning protection system is designed and installed in accordance with SS 555 - Code of Practice for Protection Against Lightning.

M SAFETY OF WINDOWS

M.1 OBJECTIVE

M.1.1 The objective of paragraphs M.2.1 and M.2.2 is to protect people from injury caused by falling windows.

M.2 PERFORMANCE REQUIREMENT

M.2.1 A window system shall be adequately designed and constructed with appropriate materials for its intended use.

M.2.2 A window system shall have –

(a) window components, including fasteners, fixings, hinges and stays of adequate number, size and strength to safely support the weight of the window system and other loads imposed on it;

(b) a structural frame profile that is of adequate size and strength and adequately reinforced at locations where screws or rivets are to be affixed; and

(c) features and components to prevent the window from detaching, dislodging or falling during its intended use.

M.3 ACCEPTABLE SOLUTION

M.3.1 In the case of an aluminium alloy window, the requirements in paragraphs M.2.1 and M.2.2 are deemed to be satisfied if such window is designed and constructed in accordance with SS 212 – Specification for Aluminium Alloy Windows.

N USE OF GLASS AT HEIGHT

N.1 OBJECTIVE

N.1.1 The objective of paragraph N2 is to protect persons from injury cause by spontaneous breakage of glass elements at height and by falling glass panels resulting from bond failure of structural sealant.

N.2 PERFORMANCE REQUIREMENT

N.2.1 Where glass is used as a part or whole of the facade, roof, canopy or other type of overhead glazing of a building located at height of 2.4 metres or more, whether situated within the interior or forming the exterior of a building, appropriate measures shall be taken to minimise the risk of injury to people in the event of spontaneous breakage of such glass elements.

N.2.2 Where structural sealant glazing is used in a glass curtain wall or other glass installation located at a height of 2.4 metres or more, whether situated within the interior or forming the exterior of a building, appropriate measures shall be taken to minimise the risk of injury to people in the event of falling glass panels resulting from bond failure of the structural sealant.

N.3 ACCEPTABLE SOLUTION

Spontaneous breakage of glass

N.3.1 The requirement in paragraphs N.2.1 is deemed to be satisfied if the specifications set out in paragraphs N.3.2 to N.3.4 are complied with.

N.3.2 Except as provided in N.3.3, float (or annealed) glass, heat strengthened glass, laminated glass or other type of glass that is not prone to spontaneous breakage shall be used as the glass material at height.

N.3.3 Where monolithic tempered glass, heat-soaked tempered glass or other types of glass that are prone to spontaneous breakage is used in the facade, roof, canopy or other type of overhead glazing located at a height of 2.4 metres or more, the design of the facade, roof, canopy or overhead glazing shall provide for suitable protection such as installation of screens or shields to protect people from any injury in the event of breakage of such glass elements at height.

N.3.4 Where the glass is used as a part or whole of the facade, roof, canopy or other type of overhead glazing, the glass used shall comply with SS 341: Specification for Safety Glazing Materials for Use in Buildings.

Falling glass resulting from bond failure of the structural sealant

N.3.5 The requirement in paragraph N.2.2 is deemed to be satisfied if the specifications set out in paragraphs N.3.6 to N.3.8 are complied with.

N.3.6 The structural sealant glazing (SSG) shall be constructed to be of

(a) two-sided SSG type; or

(b) four-sided SSG type with retaining devices that are to be designed and constructed to prevent any fall of façade panels in the event of bond failure of the structural sealant.

Note: The requirement in paragraph N.3.6(b) is illustrated in Figure N1.

N.3.7 Mechanical self-weight supports shall be provided for all glass panels of the SSG.

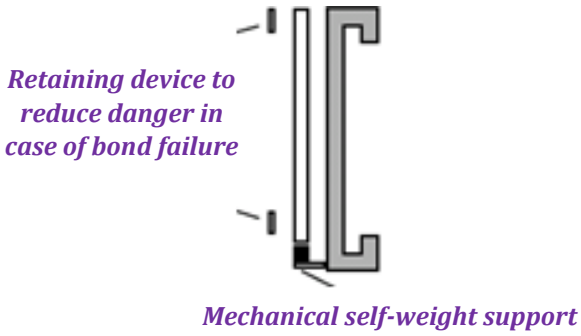


***Figure N1* – Four-sided SSG with mechanical self-weight and retaining devices**

N.3.8 The SSG shall be designed and constructed in accordance with the following Standards –

(a) ASTM C1184: Standard Specification for Structural Silicone Sealants and ASTM C1401: Standard Guide for Structural Sealant Glazing; or

(b) BS EN 13022-2: Glass in Building - Structural Sealant Glazing and BS EN 15434: Glass in Building – Product Standard for Structural and/or Ultraviolet Resistant Sealant.

O PROTECTION FROM INJURY BY VEHICLES IN BUILDINGS

O.1 OBJECTIVE

O.1.1 The objectives of paragraphs O.2.1 and O.2.2 are to protect people from injury caused by a vehicle breaching designated spaces for vehicular access in a building.

O.2 PERFORMANCE REQUIREMENT

O.2.1 Where the whole or part of a floor of a building allows vehicular access, such as a vehicle park or a ramp or route for vehicular access, appropriate barriers shall be installed to prevent vehicles from breaching the perimeter of the floor of the building.

O.2.2 Where any part of a building allows vehicular access near an area where people are likely to be present, such as passenger pick-up point, vehicle park lift lobby and the like, appropriate measures shall be taken to prevent vehicles from encroaching into such areas.

O.3 ACCEPTABLE SOLUTION

O.3.1 The requirements in paragraphs O.2.1 and O.2.2 are deemed to be satisfied if a barrier is provided in accordance with the specifications set out in paragraph O.3.2.

O.3.2 Horizontal loading of barrier

O.3.2 The vehicular barrier should be capable of resisting forces set out in SS EN 1991.

O.3.3 Notwithstanding paragraph O.3.2, in the case of a vehicular barrier in a project where the first structural plans have been submitted for approval by the Commissioner of Building Control before 1 April 2015, the vehicular barrier may be designed to be capable of resisting forces set out in BS 6399- Part 1: Loading for Buildings. Code of Practice for Dead and Imposed Loads.

P DAYLIGHT REFLECTANCE

P.1 OBJECTIVE

P.1.1 The objective of paragraph P.2.1 is to protect occupants of buildings in the vicinity of a building from loss of amenity caused by the reflection of sunlight off the external surface of that building, arising from the use of materials with high daylight reflectance.

P.2 PERFORMANCE REQUIREMENT

P.2.1 The external surface (including a roof) of a building must be designed and constructed in a manner such that any reflection of sunlight off the external surface of the building does not result in loss of amenity to occupants of other buildings in the vicinity of that building.

P.3 ACCEPTABLE SOLUTION

P.3.1 The requirement in paragraph P.2.1 is deemed to be satisfied if the specifications set out in paragraphs P.3.2 to P.3.3 are complied with.

P.3.2 The material used for the building work is deemed acceptable if –

(a) the glass for the building work has a daylight reflectance not exceeding 20%

(b) any material, other than glass and paint on plastered or concrete surfaces, for the building work on –

(i) the façade of the building has a specular reflectance not exceeding 10%

(ii) the roof of the building, inclined at an angle not exceeding 20 degrees from the horizontal plane, has a specular reflectance not exceeding 10%

(iii) the roof of the building, inclined at an angle more than 20 degrees from the horizontal plane, has a daylight reflectance not exceeding 20% and a specular reflectance not exceeding 10%

(c) emulsion paint on plastered or concrete surfaces has a specular reflectance not exceeding 10%

Note 1 For the purpose of (b)(ii) and b(iii), in any building where the façade and the roof continue seamlessly, the area above the last finished floor will be considered the roof.

2 Daylight reflectance is the sum of specular reflectance and diffuse reflectance.

P.3.3 The testing of reflectance values for any material shall be conducted in accordance with ASTM E903: Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres, or equivalent, with an integrating sphere of minimum 150mm diameter.

Annex A – Structural design standards based on the Eurocodes and the corresponding Singapore National Annexes

Eurocode: Basis of structural design	**Associated National Annex (NA) to be used for design**
SS EN 1990 Basis of structural design.	NA to SS EN 1990

Eurocode 1 : Actions on structures	**Associated National Annex (NA) to be used for design**
SS EN 1991-1-1 Actions on structures. General actions – Densities, self-weight, imposed loads for buildings.	NA to SS EN 1991-1-1
SS EN 1991-1-2 Actions on structures. General actions – Actions on structures exposed to fire.	NA to SS EN 1991-1-2
SS EN 1991-1-4 Actions on structures. General actions - Wind actions.	NA to SS EN 1991-1-4
SS EN 1991-1-5 Actions on structures. General actions – Thermal actions.	NA to SS EN 1991-1-5
SS EN 1991-1-6 Actions on structures. General actions - Actions during execution.	NA to SS EN 1991-1-6
SS EN 1991-1-7 Actions on structures. General actions - Accidental actions.	NA to SS EN 1991-1-7
SS EN 1991-2 Actions on structures. Traffic loads on bridges.	NA to SS EN 1991-2
SS EN 1991-3 Actions on structures. Actions induced by cranes and machinery.	NA to SS EN 1991-3
SS EN 1991-4 Actions on structures. Silos and tanks.	NA to SS EN 1991-4

Eurocode 2 : Design of concrete structures	**Associated National Annex (NA) to be used for design**
SS EN 1992-1-1 Design of concrete structures. General rules and rules for buildings.	NA to SS EN 1992-1-1
SS EN 1992-1-2 Design of concrete structures. General rules - Structural fire design.	NA to SS EN 1992-1-2
SS EN 1992-2 Design of concrete structures. Concrete bridges - Design and detailing rules.	NA to SS EN 1992-2
SS EN 1992-3 Design of concrete structures. Liquid retaining and containment structures.	NA to SS EN 1992-3
SS EN 1992-4 Design of concrete structures. Design of fastenings for use in concrete.	NA to SS EN 1992-4

Eurocode 3 : Design of steel structures	**Associated National Annex (NA) to be used for design**
SS EN 1993-1-1 Design of steel structures. General rules and rules for buildings.	NA to SS EN 1993-1-1
SS EN 1993-1-2 Design of steel structures. General rules - Structural fire design.	NA to SS EN 1993-1-2
SS EN 1993-1-3 Design of steel structures. General rules - Supplementary rules for cold-formed members and sheeting.	NA to SS EN 1993-1-3
SS EN 1993-1-4 Design of steel structures. General rules - Supplementary rules for stainless steels.	NA to SS EN 1993-1-4
SS EN 1993-1-5 Design of steel structures. Plated structural elements.	NA to SS EN 1993-1-5
SS EN 1993-1-6 Design of steel structures. Strength and stability of shell structures.	Nil*

SS EN 1993-1-7 Design of steel structures. Plated structures subject to out of plane loading.	Nil*

Eurocode 3 : Design of steel structures	**Associated National Annex (NA) to be used for design**
SS EN 1993-1-8 Design of steel structures. Design of joints.	NA to SS EN 1993-1-8
SS EN 1993-1-9 Design of steel structures. Fatigue.	NA to SS EN 1993-1-9
SS EN 1993-1-10 Design of steel structures. Material toughness and through-thickness properties.	NA to SS EN 1993-1-10
SS EN 1993-1-11 Design of steel structures. Design of structures with tension components.	NA to SS EN 1993-1-11
SS EN 1993-1-12 Design of steel structures. Additional rules for the extension of EN 1993 up to steel grades S 700.	NA to SS EN 1993-1-12
SS EN 1993-2 Design of steel structures. Steel bridges.	NA to SS EN 1993-2
SS EN 1993-3-1 Design of steel structures. Towers, masts and chimneys -Towers and masts.	NA to SS EN 1993-3-1
SS EN 1993-3-2 Design of steel structures. Towers, masts and chimneys – Chimneys.	Nil*
SS EN 1993-4-1 Design of steel structures. Silos.	Nil*
SS EN 1993-4-2 Design of steel structures. Tanks.	Nil*
SS EN 1993-4-3 Design of steel structures. Pipelines	Nil*

SS EN 1993-5 Piling.	NA to SS EN 1993-5
SS EN 1993-6 Design of steel structures. Crane supporting structures.	NA to SS EN 1993-6

Eurocode 4 : Design of composite steel and concrete structures	**Associated National Annex (NA) to be used for design**
SS EN 1994-1-1 Design of composite steel and concrete structures. General rules and rules for buildings.	NA to SS EN 1994-1-1
SS EN 1994-1-2 General rules - Structural fire design.	NA to SS EN 1994-1-2
SS EN 1994-2 Design of composite steel and concrete structures. General rules and rules for bridges.	NA to SS EN 1994-2

Eurocode 5 : Design of timber structures	**Associated National Annex (NA) to be used for design**
SS EN 1995-1-1 Design of timber structures General – Common rules and rules for buildings.	NA to SS EN 1995-1-1.
SS EN 1995-1-2 Design of timber structures General – Structural fire design.	NA to SS EN 1995-1-2.
BS EN 1995-2 Design of timber structures. Bridges.	NA to BS EN 1995-2

Eurocode 7 : Geotechnical design	**Associated National Annex (NA) to be used for design**
SS EN 1997-1 Geotechnical design. General rules.	NA to SS EN 1997-1
SS EN 1997-2 Geotechnical design. Ground investigation and testing.	NA to SS EN 1997-2

Eurocode 8 : Design of structures for earthquake resistance	**Associated National Annex (NA) to be used for design**
SS EN 1998-1 Design of structures for earthquake resistance. General rules, seismic actions and rules for buildings.	NA to SS EN 1998-1

Eurocode 9: Design of aluminium structures	**Associated National Annex (NA) to be used for design**
BS EN1999-1-1 Design of aluminium structures. General structural rules.	NA to BS EN 1999-1-1
BS EN1999-1-2 Design of aluminium structures. Structural fire design	NA to BS EN 1999-1-2
BS EN1999-1-3 Design of aluminium structures. Structures susceptible to fatigue.	NA to BS EN 1999-1-3
BS EN1999-1-4 Design of aluminium structures. Cold-formed structural sheeting.	NA to BS EN 1999-1-4
BS EN1999-1-5 Design of aluminium structures. Shell structures.	NA to BS EN 1999-1-5

Note:
** - There is no UK National Annex for this part of the Eurocode.*

Annex B – Comparative list of Singapore / British standards and their equivalent Singapore / European Standards

Standards that will apply if using the current Singapore/British Standards	Standards that will apply if using the Eurocode Standards
BS 1377-1 Methods of test for soils for civil engineering purposes. General requirements and sample preparation.	Still current.
BS 1377-2 Methods of test for soils for civil engineering purposes. Classification tests.	Partially replaced by BS EN ISO 17892-12.
BS 1377-3 Methods of test for soils for civil engineering purposes. Chemical and electro-chemical tests.	Still current.
BS 1377-4 Methods of test for soils for civil engineering purposes. Compaction-related tests.	Still current.
BS 1377-5 Methods of test for soils for civil engineering purposes. Compressibility, permeability and durability tests.	BS EN ISO 17892-5, BS EN ISO 17892-11.
BS 1377-6 Methods of test for soils for civil engineering purposes. Consolidation and permeability tests in hydraulic cells and with pore pressure measurement.	BS EN ISO 17892-11.
BS 1377-7 Methods of test for soils for civil engineering purposes. Shear strength tests (total stress).	BS EN ISO 17892-7, BS EN ISO 17892-8.
BS 1377-8 Methods of test for soils for civil engineering purposes. Shear strength tests (effective stress).	This standard has been withdrawn by British Standards Institution (BSI).
BS 1377-9 Methods of test for soils for civil engineering purposes. In-situ tests.	Partially replaced by BS EN ISO 22476-1, BS EN ISO 22476-2, BS EN ISO 22476-3 and SS EN 1997-2
BS 1881-1 Methods of testing concrete. Method of mixing and sampling fresh concrete in the laboratory.	BS EN 12350-1, BS 1881-125
BS 1881-101 Testing concrete. Method of sampling fresh concrete on site.	BS EN 12350-1
BS 1881-102 Testing concrete. Method for determination of slump.	BS EN 12350-2
BS 1881-103 Testing concrete. Method for determination of compacting factor.	BS EN 12350-4

Standards that will apply if using the current Singapore/British Standards	Standards that will apply if using the Eurocode Standards
BS 1881-104 Testing concrete. Method for determination of Vebe time.	BS EN 12350-3
BS 1881-105 Testing concrete. Method for determination of flow.	BS EN 12350-5
BS 1881-106 Testing concrete. Methods for determination of air content of fresh concrete.	BS EN 12350-7
BS 1881-107 Testing concrete. Method for determination of density of compacted fresh concrete.	BS EN 12350-6
BS 1881-108 Testing concrete. Method for making test cubes from fresh concrete.	BS EN 12390-1, BS EN 12390-2
BS 1881-109 Testing concrete. Method for making test beams from fresh concrete.	BS EN 12390-1, BS EN 12390-2
BS 1881-110 Testing concrete. Method for making test cylinders from fresh concrete.	BS EN 12390-1, BS EN 12390-2
BS 1881-111 Testing concrete. Method of normal curing of test specimens (20ºC method).	BS EN 12390-2
BS 1881-112 Testing concrete. Methods of accelerated curing of test cubes.	This standard has been withdrawn by BSI.
BS 1881-113 Testing concrete. Method for making and curing no-fines test cubes.	Still current.
BS 1881-114 Testing concrete. Methods for determination of density of hardened concrete.	BS EN 12390-7
BS 1881-115 Testing concrete. Specification for compression testing machines for concrete.	BS EN 12390-4
BS 1881-116 Testing concrete. Method for determination of compressive strength of concrete cubes.	BS EN 12390-3
BS 1881-117 Testing concrete. Method for determination of tensile splitting strength.	BS EN 12390-6
BS 1881-118 Testing concrete. Method for determination of flexural strength.	BS EN 12390-5
BS 1881-119 Testing concrete. Method for determination of compressive strength using portions of beams broken in flexure (equivalent cube method).	Still current.

Standards that will apply if using the current Singapore/British Standards	Standards that will apply if using the Eurocode Standards
BS 1881-120 Testing concrete. Method for determination of the compressive strength of concrete cores.	BS EN 12504-1
BS 1881-121 Testing concrete. Method for determination of static modulus of elasticityin compression.	Still current.
BS 1881-122 Testing concrete. Method for determination of water absorption.	Still current.
BS 1881-124 Testing concrete. Methods for analysis of hardened concrete.	Still current.
BS 1881-125 Testing concrete. Methods for mixing and sampling fresh concrete in the laboratory.	Still current.
BS 1881-127 Testing concrete. Method of verifying the performance of a concrete cube compression machine using the comparative cube test.	This standard has been withdrawn by BSI.
BS 1881-128 Testing concrete. Method for analysis of fresh concrete.	This standard has been withdrawn by BSI.
BS 1881-129 Testing concrete. Method for determination of density of partially compacted semi-dry fresh concrete.	Still current.
BS 1881-130 Testing concrete. Method for temperature-matched curing of concrete specimens.	Still current.
BS 1881-131 Testing concrete. Method for testing cement in a reference cement.	Still current.
BS 1881-201 Testing concrete. Guide to the use of non-destructive methods of test for hardened concrete.	This standard has been withdrawn by BSI.
BS 1881-202 Testing concrete. Recommendations for surface hardness testing by rebound hammer.	BS EN 12504-2
BS 1881-203 Testing concrete. Recommendations for measurement of velocity of ultrasonic pulses in concrete.	BS EN 12504-4
BS 1881-204 Testing concrete. Recommendations on the use of electromagnetic covermeters.	Still current.

Standards that will apply if using the current Singapore/British Standards	Standards that will apply if using the Eurocode Standards
BS 1881-205 Testing concrete. Recommendations for radiography of concrete.	This standard has been withdrawn by BSI.
BS 1881-206 Testing concrete. Recommendations for determination of strain in concrete.	Still current.
BS 1881-207 Testing concrete. Recommendations for the assessment of concrete strength by near-to-surface tests.	Still current.
BS 1881-208 Testing concrete. Recommendation for the determination of the initial surface absorption of concrete.	Still current.
BS 1881-209 Testing concrete. Recommendations for the measurement of dynamic modulus of elasticity.	Still current.
BS 1881-5 Testing concrete. Methods of testing hardened concrete for other than strength.	BS 1881-208, BS 1881-209, BS 1881-121, BS 1881-122, BS EN 12390-7
BS 1881-6 Methods of testing concrete. Analysis of hardened concrete.	BS 1881-124
BS 2573-1 Rules for the design of cranes. Specifications for classification, stress calculations and design criteria for structures.	BS EN 13001-1, BS EN 13001-2, BS EN 13001-3-2, BS EN 13001-3-3
BS 3923-2 Methods for ultrasonic examination of welds. Automatic examination of fusion welded butt joints in ferritic steels.	This standard has been withdrawn by BSI.
BS 4027 Specification for sulphate-resisting Portland cement.	This standard has been withdrawn by BSI.
BS 4248 Supersulfated cement.	BS EN 15743
BS 4449 Steel for the reinforcement of concrete – Weldable reinforcing steel – Bar, coil and decoiled product – Specification.	Still current.
BS 4483 Steel fabric for the reinforcementof concrete - Specification.	Still current.
BS 4486 Specification for hot rolled and hot rolled and processed high tensile alloy steel bars for the prestressing concrete.	Still current.

Standards that will apply if using the current Singapore/British Standards	Standards that will apply if using the Eurocode Standards
BS 5268-2 Structural use of timber. Code of practice for permissible stress design, materials and workmanship. [note: For useof glued laminated timber structures and non-tropical timber.]	SS EN 1995-1-1
BS 5400-1 Steel, concrete and composite bridges. General statement.	SS EN 1991-1-7, SS EN 1990
BS 5400-10 Steel, concrete and composite bridges. Code of practice for fatigue.	SS EN 1993-1-9
BS 5400-10C Steel, concrete and composite bridges. Charts for classificationof details for fatigue.	This standard has been withdrawn by BSI.
BS 5400-2 Steel, concrete and composite bridges. Specification for loads.	SS EN 1991-1-7, SS EN 1990
BS 5400-3 Steel, concrete and composite bridges. Code of practice for design of steel bridges.	SS EN 1993-1-1, SS EN 1993-1-5, SS EN 1993-1-8, SS EN 1993-1-10
BS 5400-4 Steel, concrete and composite bridges. Code of practice for design of concrete bridges.	SS EN 1992-2
BS 5400-5 Steel, concrete and composite bridges. Code of practice for the design of composite bridges.	SS EN 1994-2
BS 5400-6 Steel, concrete and composite bridges. Specification for materials and workmanship, steel.	SS EN 1090-2
BS 5400-7 Steel, concrete and composite bridges. Specification for materials and workmanship, concrete, reinforcement and prestressing tendons.	SS EN 1992-2
BS 5400-8 Steel, concrete and composite bridges. Specification for materials and workmanship, concrete, reinforcement and prestressing tendons.	SS EN 1992-2
BS 5400-9.1 Steel, concrete and composite bridges. Bridge bearings. Code of practice for design of bridge bearings.	BS EN 1337 Parts 2 to 8
BS 5400-9.2 Steel, concrete and composite bridges. Bridge bearings. Specification for material, manufacture and installation of bridge bearings.	BS EN 1337 Parts 2, 3, 5, 7 and 8

Standards that will apply if using the current Singapore/British Standards	Standards that will apply if using the Eurocode Standards
BS 5502-22 Buildings and structures for agriculture. Code of practice for design, construction and loading.	Still current.
BS 5896 Specification for high tensile steel wire and strand for the prestressing of concrete.	Still current.
BS 5930 Code of practice for site investigation.	Still current.
BS 5950-1 Structural use of steelworks in building. Code of practice for design – Rolled and welded sections.	SS EN 1993-1-1, SS EN 1993-1-5, SS EN 1993-1-8, SS EN 1993-1-10, SS EN 1993-5, SS EN 1993-6,
BS 5950-2 Structural use of steelworks in building. Specification for materials, fabrication and erection – Rolled and welded sections.	SS EN 1090-2
BS 5950-3.1 Structural use of steelworks in building. Code of practice for design of simple and continuous composite beams.	SS EN 1994-1-1
BS 5950-4 Structural use of steelworks in building. Code of practice for design of composite slabs with profiled steel sheeting.	SS EN 1994-1-1
BS 5950-5 Structural use of steelworks in building. Code of practice for design of cold formed thin gauge sections.	SS EN 1993-1-3
BS 5950-6 Structural use of steelworks in building. Code of practice for design of light gauge profiled steel sheeting.	SS EN 1993-1-3
BS 5950-7 Structural use of steelworks in building. Specification for materials and workmanship: cold formed sections.	This standard has been withdrawn by BSI as it is no longer relevant.
BS 5950-8 Structural use of steelworks in building. Code of practice for fire resistant design.	SS EN 1993-1-2
BS 5950-9 Structural use of steelworks in building. Code of practice for stressed skin design.	SS EN 1993-1-3
BS 6089 Guide to assessment of concrete strength in existing structures.	SS EN 13791, BS 6089:2010
BS 6349-1 Maritime structures. Code of practice for general criteria.	Still current.

Standards that will apply if using the current Singapore/British Standards	Standards that will apply if using the Eurocode Standards
BS 6349-2 Maritime works. Code of practice for the design of quay walls, jettiesand dolphins.	Still current.
BS 6349-3 Maritime structures. Design of dry docks, locks, slipways and shipbuilding berths, shiplifts and dock and lock gates.	Still current.
BS 6349-4 Maritime structures. Code of practice for design of fendering and mooring systems.	Still current.
BS 6349-5 Maritime structures. Code of practice for dredging and land reclamation.	Still current.
BS 6349-6 Maritime structures. Design of inshore moorings and floating structures.	This standard has been withdrawn by BSI.
BS 6349-7 Maritime structures. Guide to the design and construction of breakwaters.	Still current.
BS 6349-8 Maritime structures. Code of practice for the design of RO-Ro ramps, linkspans and walkways.	Still current.
BS 6399-1 Loading for buildings. Code of practice for dead and imposed loads.	SS EN 1991-1-1, SS EN 1991-1-7
BS 6399-2 Loading for buildings. Code of practice for wind loads.	SS EN 1991-1-4
BS 6399-3 Loading for buildings. Code of practice for imposed roof loads.	BS EN 1991-1-3
BS 648 Schedule of weights of building materials.	This standard has been withdrawn by BSI.
BS 7668 Weldable structural steels – Hot finished structural hollow sections in weather resistant steels – Specification.	Still current.
BS 8002 Code of practice for earth retaining structures.	SS EN 1997-1
BS 8118-1 Structural use of aluminium. Code of practice for design.	BS EN 1999-1-1, BS EN 1999-1-3, BS EN 1999-1-4
BS 8118-2 Structural use of aluminium. Specification for materials, workmanship and protection.	BS EN 1999-1-1
BS EN 12020-1 Aluminium and aluminium alloys. Extruded precision profiles in alloysEN AW-6060 and EN AW-6063. Technical conditions for inspection and delivery.	Still current.

Standards that will apply if using the current Singapore/British Standards	Standards that will apply if using the Eurocode Standards
BS EN 12020-2 Aluminium and aluminium alloys. Extruded precision profiles in alloys EN AW-6060 and EN AW-6063. Toleranceson dimensions and form.	Still current.
BS EN 1290 Non-destructive examination of welds. Magnetic particle examination of welds.	BS EN ISO 17638
BS EN 1291 Non-destructive examination of welds. Magnetic particle testing of welds. Acceptance levels.	BS EN ISO 23278
BS EN 1435 Non-destructive examination of welds. Radiographic examination of welded joints.	BS EN ISO 17636-1, BS EN ISO 17636-2
BS EN 1714 Non-destructive testing of welded joints. Ultrasonic testing of welded joints.	BS EN ISO 17640
BS EN 485-1 Aluminium and aluminium alloys. Sheet strip and plate. Technical conditions for inspection and delivery.	Still current.
BS EN 485-2 Aluminium and aluminium alloys. Sheet strip and plate. Mechanical properties.	Still current.
BS EN 485-3 Aluminium and aluminium alloys. Sheet strip and plate. Tolerances on dimensions and form for hot-rolled products.	Still current.
BS EN 485-4 Aluminium and aluminium alloys. Sheet strip and plate. Tolerances on shape and dimensions for cold-rolled products.	Still current.
BS EN 571-1 Non-destructive testing. Penetrant testing. General principles.	BS EN ISO 3452-1
BS EN 573-1 Aluminium and aluminium alloys. Chemical composition and form of wrought products. Numerical designation system.	Still current.
BS EN 573-2 Aluminium and aluminium alloys. Chemical composition and form of wrought products. Chemical symbol based designation system.	Still current.

Standards that will apply if using the current Singapore/British Standards	Standards that will apply if using the Eurocode Standards
BS EN 573-3 Aluminium and aluminium alloys. Chemical composition and form of wrought products. Chemical composition and form of products.	Still current.
BS EN 573-5 Aluminium and aluminium alloys. Chemical composition and form of wrought products. Codification of standardized wrought products.	Still current.
BS EN 755-1 Aluminium and aluminium alloys. Extruded rod/bar, tube and profiles. Technical conditions for inspection and delivery.	Still current.
BS EN 755-2 Aluminium and aluminium alloys. Extruded rod/bar, tube and profiles. Mechanical properties.	Still current.
BS EN 755-3 Aluminium and aluminium alloys. Extruded rod/bar, tube and profiles. Round bars, tolerances on dimensions and form.	Still current.
BS EN 755-4 Aluminium and aluminium alloys. Extruded rod/bar, tube and profiles. Square bars, tolerances on dimensions and form.	Still current.
BS EN 755-5 Aluminium and aluminium alloys. Extruded rod/bar, tube and profiles. Rectangular bars, tolerances on dimensions and form.	Still current.
BS EN 755-6 Aluminium and aluminium alloys. Extruded rod/bar, tube and profiles. Hexagonal bars, tolerances on dimensions and form.	Still current.
BS EN 755-7 Aluminium and aluminium alloys. Extruded rod/bar, tube and profiles. Seamless tubes, tolerances on dimensions and form.	Still current.
BS EN 755-8 Aluminium and aluminium alloys. Extruded rod/bar, tube and profiles. Porthole tubes, tolerances on dimensions and form.	Still current.
BS EN 755-9 Aluminium and aluminium alloys. Extruded rod/bar, tube and profiles. Profiles, tolerances on dimensions and form.	Still current.

Standards that will apply if using the current Singapore/British Standards	Standards that will apply if using the Eurocode Standards
BS EN ISO 3506-1 Mechanical properties of corrosion-resistant stainless steel fasteners. Bolts, screws and studs.	Still current.
BS EN ISO 3506-2 Mechanical properties of corrosion-resistant stainless steel fasteners. Nuts.	Still current.
BS EN ISO 3506-3 Mechanical properties of corrosion-resistant stainless steel fasteners. Set screws and similar fasteners not under tensile stress.	Still current.
BS EN ISO 3506-4 Mechanical properties of corrosion-resistant stainless steel fasteners. Tapping screws.	Still current.
CP3: Chapter V-2 Code of basic data for the design of buildings. Loadings. Wind loads.	SS EN 1991-1-4
SS 18: Part 2 Specification for cold-reduced steel wire for the reinforcement of concrete and the manufacture of welded fabric. Steel grade 485.	SS 561
SS 18: Part1 Specification for cold-reduced steel wire for the reinforcement of concrete and the manufacture of welded fabric. Steel grade 500.	SS 561
SS 2: Part 1 Specification for steel for the reinforcement of concrete. Plain bars (steel grade 300).	SS 560
SS 2: Part 2 Specification for steel for the reinforcement of concrete. Ribbed bars (steel grade 500).	SS 560
SS 2: Part 3 Specification for steel for the reinforcement of concrete. Plain and ribbed bars (steel grades 250 and 460).	SS 560
SS 26 Specification for ordinary Portland cement.	SS EN 197-1
SS 289: Part 1 Specification for concrete. Guide to specifying concrete.	SS EN 206-1, SS 544-1, SS 544-2
SS 289: Part 2 Specification for concrete. Method for specifying concrete mixes.	SS EN 206-1, SS 544-1, SS 544-2
SS 289: Part 3 Specification for concrete. Specification for the procedures to be used in producing and transporting concrete.	SS EN 206-1, SS 544-1, SS 544-2

Standards that will apply if using the current Singapore/British Standards	Standards that will apply if using the Eurocode Standards
SS 289: Part 4 Specification for concrete. Specification for the procedures to be used in sampling, testing and assessing compliance of concrete.	SS EN 206-1, SS 544-1, SS 544-2
SS 31 Specification for aggregates from natural sources for concrete.	SS EN 12620
SS 32: Part 1 Specification for welded steel fabric for the reinforcement of concrete. Steel grades 300 and 500.	SS 561
SS 32: Part 2 Specification for welded steel fabric for the reinforcement of concrete. Steel grade 485.	SS 561
SS 320 Specification for concrete admixtures.	SS EN 934-2, SS EN 934-6, BS EN 480-1, BS EN 480-2, BS EN 480-4, BS EN 480-5, BS EN 480-6, BS EN 480-8, BS EN 480-10, BS EN 480-11, BS EN 480-12,
SS 397: Part 1 Methods of testing cement. Determination of strength.	BS EN 196-1
SS 397: Part 2 Methods of testing cement. Chemical analysis of strength	BS EN 196-2
SS 397: Part 21 Methods of testing cement. Determination of the chloride, carbon dioxide and alkali content of cement.	BS EN 196-2
SS 397: Part 3 Methods of testing cement. Determination of setting time and soundness.	BS EN 196-3
SS 397: Part 6 Methods of testing cement. Determination of fineness.	BS EN 196-6
SS 397: Part 7 Methods of testing cement. Methods of taking and preparing samples of cement.	BS EN 196-7
SS 470: Part 1 Specification for hot finished structural hollow sections of non-alloy and fine grain structural steels.	BS EN 10210
SS 470: Part 2 Specification for hot-finished structural hollow sections of non-alloy and fine grain structural steels - Tolerances, dimensions and sectional properties.	BS EN 10210

Standards that will apply if using the current Singapore/British Standards	Standards that will apply if using the Eurocode Standards
SS 475: Part 1 Specification for steel for the prestressing of concrete. General requirements.	To be reviewed by Enterprise Singapore.
SS 475: Part 2 Specification for steel for the prestressing of concrete. Cold-drawn wire.	To be reviewed by Enterprise Singapore.
SS 476 Specification for high slag blastfurnace cement.	SS EN 197
SS 477 Specification for Portland blastfurnace cement.	SS EN 15167
SS 557 Code of practice for demolition.	Still current.
SS CP 4 Code of practice for foundations.	Withdrawn by Enterprise Singapore.
SS CP 65: Part 1 Code of practice for structural use of concrete. Design and construction.	SS EN 1992-1-1
SS CP 65: Part 2 Code of practice for structural use of concrete. Special circumstances.	SS EN 1992-1-1
SS CP 7 Code of practice for structural useof timber.	To be reviewed by Enterprise Singapore.
SS CP 73 Code of practice for design of concrete structures for retaining aqueous liquids.	SS EN 1992-3
SS CP18 Code of practice for earthworks.	SS EN 1997-1, SS EN 1997-2.

Annex C – Standardised Designs for replacement and reinstatement of safety barriers integrated with windows in existing residential buildings.

General Notes

The contractor shall ensure the specifications in the following General Notes are complied with.

List of Drawings

S/NO	DRAWING TITTLE
01	FULL HEIGHT WINDOW SCHEDULE (CASE 1-4)
02	FULL HEIGHT WINDOW SCHEDULE (CASE 5-7)
03	3/4 HEIGHT WINDOW SCHEDULE (CASE 1-4)
04	3/4 HEIGHT WINDOW SCHEDULE (CASE 5-7)
05	VERTICAL FRAME DETAILS
06	HORIZONTAL FRAME DETAILS
07	TYPICAL CONNECTION DETAIL (1)
08	TYPICAL CONNECTION DETAIL (2)

1.0 General

A. The Contractor shall check all drawings and verify dimensions on site prior to commencement of work.
B. All workmanship and materials shall be in strict compliance with the latest current editions of Singapore Standards.
C. The Contractor shall be responsible for the design of structural steel works at the fabrication stage, transportation stage and installation stage.
D. All dimensions shall be in millimeters or meter metric.
E. The total height of full height window frame shall be less than or equal to 2.65m for all type of windows including sliding windows and casement windows.
F. The total height of 3/4 height window frame shall be less than or equal to 2.05m for all type of windows including sliding windows and casement windows.
G. Maximum fixed glass panels width shall be equal or less than 1.0m for all type of windows including sliding windows and casement windows.
H. All cement grout shall be high strength non-shrink grout with minimum compression strength of 30MPa (7 days).
I. The contractor shall ensure that all the existing concrete strength shall be minimum grade C16/20.
J. Works shall be carried out in accordance with SS 212 Specification for Aluminium Alloy Windows and SS 341 Specification for Safety Glazing Materials for Use in Buildings.
K. Contractor shall put in place measures to prevent water leakage into the residential unit.
L. For demolition of existing safety barrier, method and construction of the demolition works shall be in accordance with SS 557:2010.
M. Contractor shall ensure that total window height ≤2.65m for all types of windows.
N. Contractor is to ensure that top and bottom surface where the anchor bolts are to be installed are RC structure.

2.0 Structural Steelwork

A. All steel sections shall be with material grade S275 unless otherwise stated and all the steel materials are designed to conforming with BS EN 1993 and compliance to BC1-2012 Class 1.
B. Quality of structural steel shall conform to Eurocode EN1993 and shall be obtained from an approved manufacturer.
C. The contractor shall propose the erection procedures at their own expense including stability system and calculations for the engineer to review and comment before proceeding with the erection. The contractor shall ensure the structural steel works is stable throughout the construction, paying attention to the safe erection of structural steelworks is accordance with EN1090.
D. It will be the responsibility of the contractor to provide adequate shoring and bracing during construction to take care of wind load and other loads during construction.
E. The contractors shall verify all the dimensions by measuring at the site and resolve all the discrepancies before commencement of the fabrication works.

F. All steelwork shall be hot-dip galvanized.

3.0 Aluminium

3.1 Aluminium Sections

A. All aluminium mullions and transoms shall be minimum RHS 100x50x3mm with material grade 6061-T6. Other sections shall be with material grade 6063-T5 designed to conforming with BS EN 1999-1-1, BS EN 1999-1-3 and BS EN 1999-1-4.

B. All aluminium sections shall refer to table below or equivalent,

	Characteristic value of 0.2% proof strength	Characteristic value of ultimate tensile strength
6061-T6	240 N/mm²	260 N/mm²
6063-T5	110 N/mm²	160 N/mm²

C. Rubber separator shall be provided between other sections which are different materials from aluminium to prevent galvanized corrosion.

3.2 Finish Aluminium Section

A. All visible surface of aluminium sections and other surfaces exposed to external environmental condition or visually shall be deemed to be coated PVDF2 (Primer: 5-10 microns; Colour: 30 micron; Clear: 10 microns) with approved Accredited Applicator.

B. Daylight Reflectance of the surface to comply with BCA requirement.

C. The paint system shall be maintenance free with the exception of regular cleaning as prescribed, be durable and have a colourfast of at least 20 years. The contractor shall collate comprehensive maintenance requirements from both paint manufacturer and the PVF 2 coating applicator for inclusion into the maintenance manuals.

D. The colour coat shall not contain less than 70% polyvinylidene fluoride.

E. The cured film shall be dense and consistent, with no seeding and free from flow lines, steaks, pin holes, blister, tear damage and other coating defects/surface imperfections when viewed from a distance of 1m under diffused daylight.

F. Prior to commencement of coating, Contractor shall submit samples showing the variations in colour and texture for confirmation.

4.0 Stainless steel

A. All bolts, nuts and washers shall be stainless steel unless otherwise stated.

B. Material data of A4-70 stainless steel bolts, nuts & screws

	Shear Strength	Tension Strength	Bearing Strength	Yield Strength	Tensile Strength
A4-70	310 N/mm²	373 kN/m²	828 kN/m²	450 kN/m²	700 kN/m²

C. All stainless steel fasteners bolts and nuts shall be nonmagnetic grade A4-70 as per SS EN 1993-1-4.

D. All stainless steel screws shall be non-magnetic grade A4-70 as per SS EN 1993-1-4.

E. All stainless steel screws shall be minimum M5 self-tapping screws at maximum spacing 400mm c/c unless otherwise stated.

F. Minimum edge distance of screws shall be 15mm unless otherwise stated.

G. Minimum spacing of screws shall be 25mm unless otherwise stated

H. All anchor bolts to concrete shall be stainless steel unless otherwise stated in the drawings.

I. Minimum concrete edge distance of the anchor bolts shall be 100mm unless otherwise stated.

J. Minimum spacing of the anchor bolts shall be 75mm unless otherwise stated.

5.0 Glazing Material

A. All setting blocks shall be 85±5, shore a durometer santoprene no less than 150mm long panel 1/4 points unless otherwise stated.

B. All glazing works shall comply to ASTM E1300-09a Standard Practice for Determine Load Resistance of Glass in Buildings

C. All glazing works shall comply to Section 8 of BS 6180: Barriers in and about Buildings - Code of Practice.

D. Allowable stress of heat-strengthen (HS) glass shall be minimum 32MPa.

E. All the 13.52mm thick laminated glazing as 6mm thick heat-strengthen glass + 1.52mm thick PVB + 6mm thick heat-strengthen glass for full height windows.

F. All the 9.52mm thick laminated glazing as 4mm thick heat-strengthen glass + 1.52mm thick PVB + 4mm thick heat-strengthen glass for 3/4 height windows.

6.0 Sealant

A. The Contractor must ensure that the silicone proposed is compatible with the type of glass and cladding used for the project.
B. Testing by the sealant manufacturer for compatibility, adhesion and staining for all substrates in contact with the sealant must be completed successfully.
C. Oil base sealants are not acceptable.
D. Records for sealant batch number and date of manufacturer, as well as units to which the sealant is applied shall be maintained and made available upon request.
E. All sealant, in so far as practical for the weather and structural integrity of the Exterior Wall System, should be supplied by one manufacturer with a reputable background in the sealant industry.
F. The Contractor shall maintain a sealant recommendation letter with endorsed details by the sealant manufacturer to ensure proper application and performance warrantee.
G. The Contractor shall maintain compatibility test of all material substrates interface with silicone sealant to ensure material compatibility and submission of laboratory report on sealant adhesion.
H. Non-structural (weatherseal) silicone to adopt shall be FS TI-S-001543A (COM-NBS) and ASTM C920, Type SIM, NS, Class 25 or equivalent.
I. The colour of weatherproof silicone sealant to be black or any standard colour from sealant manufacturer.
J. All weatherproof silicone sealant shall compatible with all substrates including PVB interlayer of laminated glass.
K. All external weather seal silicone shall be non-bleed non-stain sealant.
L. All weatherproof silicone sealant shall be with ±50% movement capacity.
M. Metal to metal shop joint or external facade shall be GE SCS9000 weather seal sealant or equivalent.
N. Silicone shall not be used to support dead weight of vertical glass or panels.
O. Where a test Prototype is subjected to 1.5 times design pressures and loads, the structural silicone and related structural components are required to withstand such loading without failure.
P. Weather sealant shall be applied at all screws' locations after the erection.

7.0 Insulation, gasket, and accessories

A. All gaskets and weather-strips to be extruded EPDM compatible extruded rubber or equivalent when in contact with silicone sealants.
B. Interior/ Exterior Set (Dry) Gasket

- The exterior "sponge" glazing gaskets shall be cellular complying with ASTM C50991, Option 2. Sponge gaskets shall have a hardness of 40 ±5 durometer Shore A and shall be compressed 20% to 35% in the final installed position.
- The interior "wedge" glazing gasket shall be non-cellular complying with ASTM C864-90 Option 2. Wedge gaskets shall have a hardness of 75 ±5 durometer Shore A for hollow profiles and 60 ±5 for solid profiles.
- Both gaskets shall be compatible for incidental point contact with structural or weather seal silicones.

C. Exterior Visual Gasket at Glass Butt Joint

- Exterior visual gaskets at glass butt joints shall be silicone.
- The design of these gaskets must prevent "roll out" or dislocation under all performance requirements.

D. Setting blocks

- Shall be silicone-rubber or silicone compatible rubber. In the case of structural silicone glazing, dense extruded silicone with a Shore A hardness of 85 ±5 durometer.
- Shall have a minimum length of 100mm and in accordance with BS 6262.
- Minimum width shall correspond to the glass thickness and retaining member but, in no case, shall be less than the glass thickness at point of contact.
- Shall be located at quarter points.
- Shall be secured against migration

E. Backing rod

- Only closed-cell (polyethylene) foam to be adopted as backing rod.
- Must be compatible with sealants and substrate.
- Use only round tools (no sharp edges) to install backing rod. Do not pierce the rod skin of closed-cell rod.
- Use specially designed extruded silicone gaskets at the weather seal joints between any butt glazed laminated vision glass lights to protect the PVB interlayer from the silicone

8.0 Load

A. Dead load

Glass: 2700 kg/m³ Alum: 2700 kg/m³ Steel: 7850 kg/m³

B. Structural

- Design wind pressure, WL: 1.5kN/m²
- Horizontal uniformly distributed line load, BL: 0.74 kN/m
- Horizontal infill load, BL: 1.0 kN/m²
- Horizontal point load, BL: 0.5 kN
- Aluminium/GMS to be separated by EPDM sheet or bituminous paint or equivalent
- Aluminium/concrete to be separated by EPDM sheet or bituminous paint or equivalent

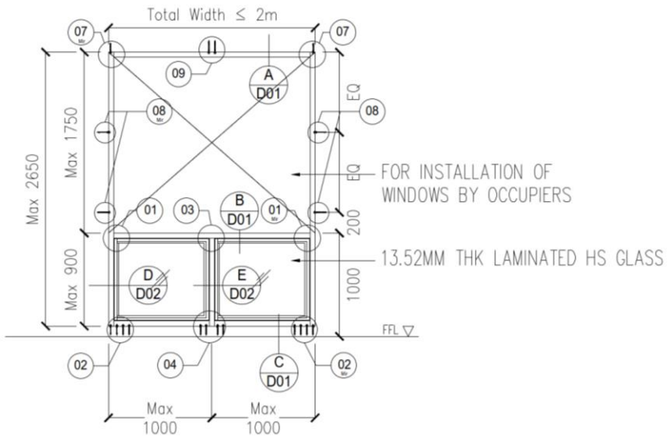
9.0 Abbreviation

SS	Stainless Steel (A4-70/ Grade 316)	L	Length
ST	Self tapping screw	HS	Heat strengthened
ALUM	Aluminium alloy	EQ	Equal/ Equivalent
W/	Width	NTS	Not to scale
THK	Thickness	GMS	Galvanized mild steel
MOIx	Moment of inertia about direction-x	C/C	Centre to centre
MOIy	Moment of inertia about direction-y	FFL	Floor finish level
hef	Effective embedment depth of anchor bolts	Mir	Mirror detail
Max	Maximum	<	Less than
Min	Minimum	≤	Less than or equal to

FULL HEIGHT WINDOW SCHEDULE (CASE 1-4)

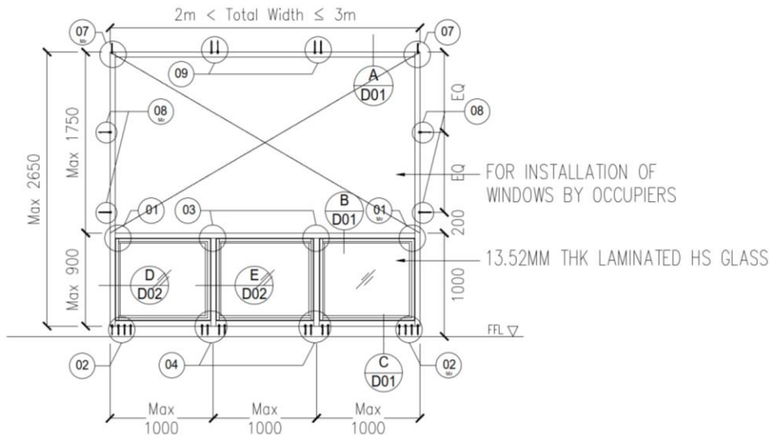
(1.)

Total Window Width ≤ 2.0m



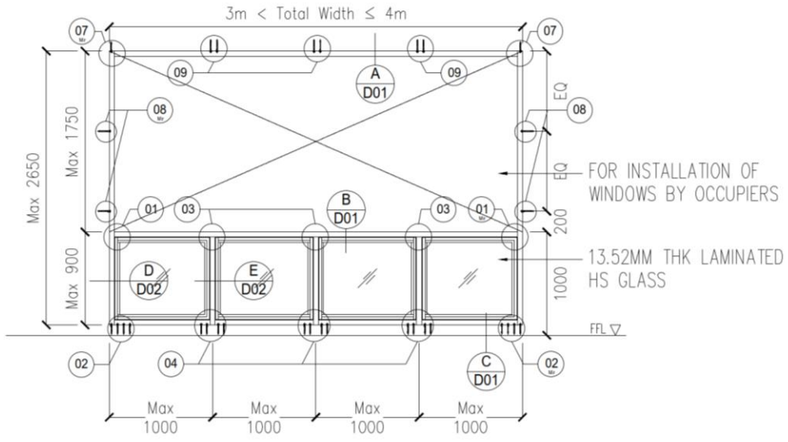
(2.)

2.0m < Total Window Width ≤ 3.0m



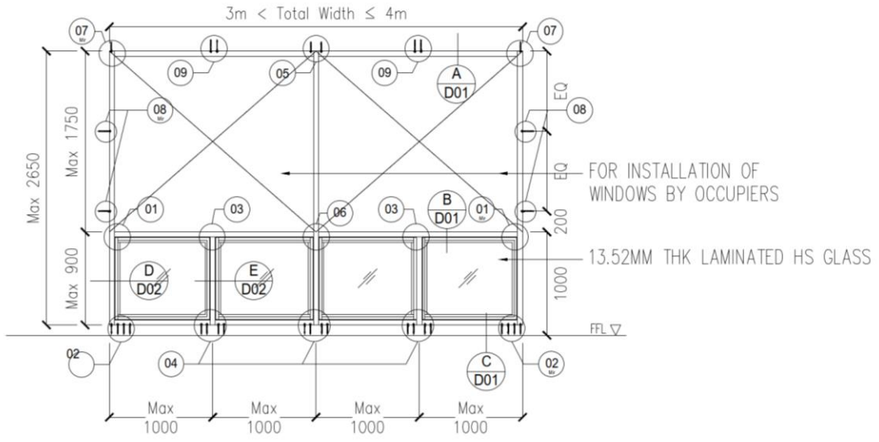
(3.)

3.0m < Total Window Width ≤ 4.0m



(4.)

3.0m < Total Window Width ≤ 4.0m



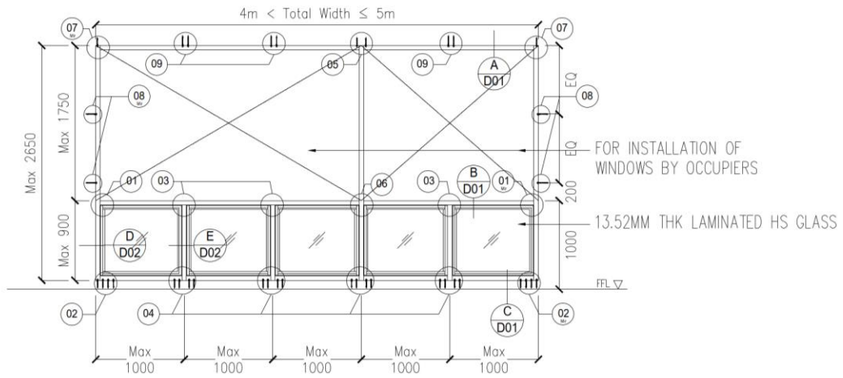
NOTES:

1. Total window height ≤ 2.65m for all types of windows.
2. All the window metal frames shall be minimum aluminium RHS 100x50x3mm (6061-T6) sections.
3. All the fixed glass panels shall be 13.52mm thick laminated glazing (6mm HS + 1.52mm PVB + 6mm HS)
4. The minimum allowable stress of HS glass shall be 32MPa.
5. All steel sections shall be with material grade S275.
6. Non-structural (weatherseal) silicone shall be FS TI-S-001543A (COM-NBS) and ASTM C920, Type SIM, NS, Class 25 or equivalent.
7. All cement grout shall be high strength non-shrink grout with minimum compression strength of 30MPa (7 days).

FULL HEIGHT WINDOW SCHEDULE (CASE 5-7)

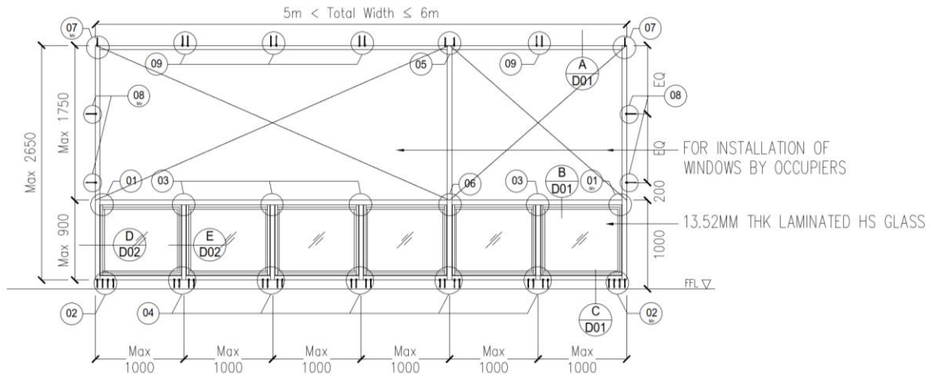
(5.)

4.0m < Total Window Width ≤ 5.0m



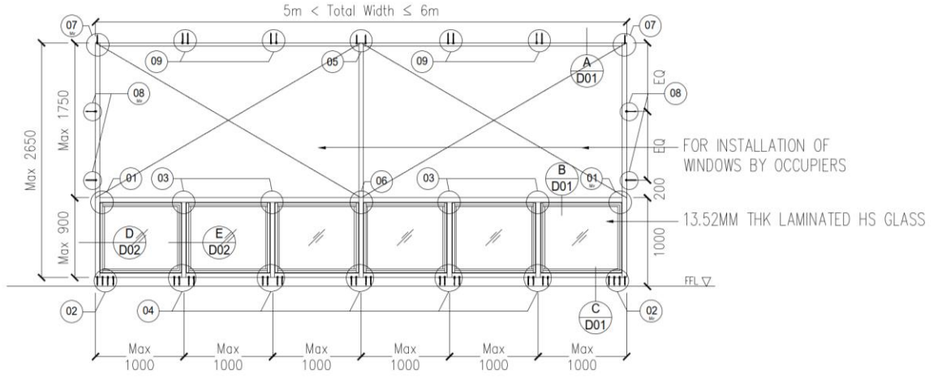
(6.)

5.0m < Total Window Width ≤ 6.0m



(7.)

5.0m < Total Window Width ≤ 6.0m



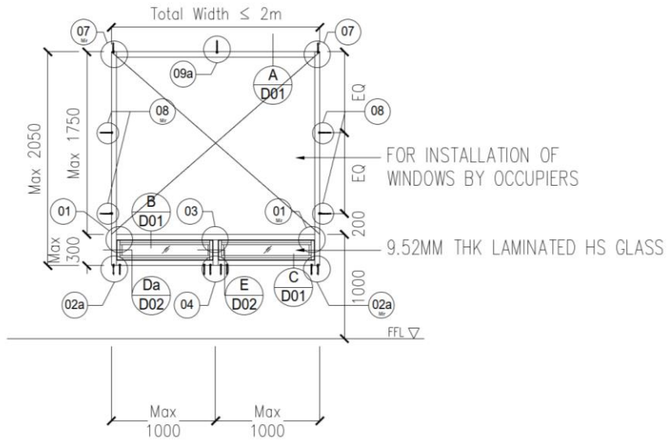
NOTES:

1. Total window height ≤ 2.65m for all types of windows.
2. All the window metal frames shall be minimum aluminium RHS 100x50x3mm (6061-T6) sections.
3. All the fixed glass panels shall be 13.52mm thick laminated glazing (6mm HS + 1.52mm PVB + 6mm HS).
4. The minimum allowable stress of HS glass shall be 32MPa.
5. All steel sections shall be with material grade S275.
6. Non-structural (weatherseal) silicone shall be FS TI-S-001543A (COM-NBS) and ASTM C920, Type SIM, NS, Class 25 or equivalent.
7. All cement grout shall be high strength non-shrink grout with minimum compression strength of 30MPa (7 days).

3/4 HEIGHT WINDOW SCHEDULE (CASE 1-4)

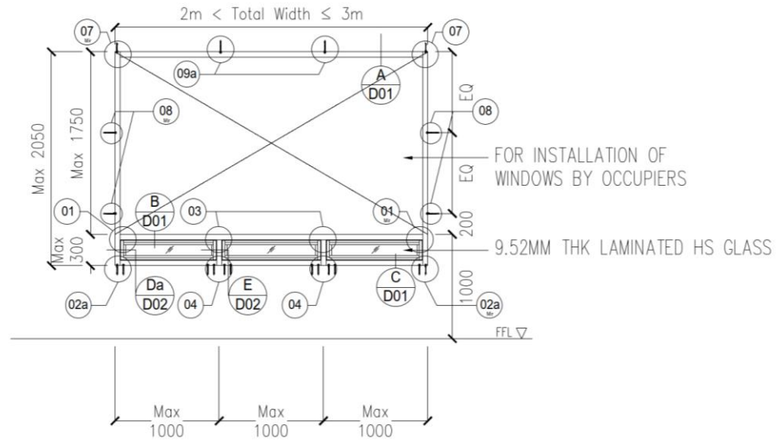
(1.)

Total Window Width ≤ 2.0m



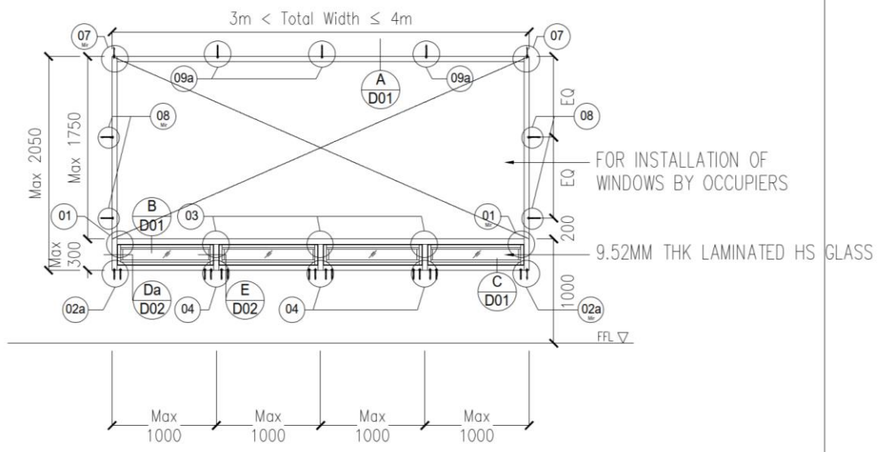
(2.)

2.0m < Total Window Width ≤ 3.0m



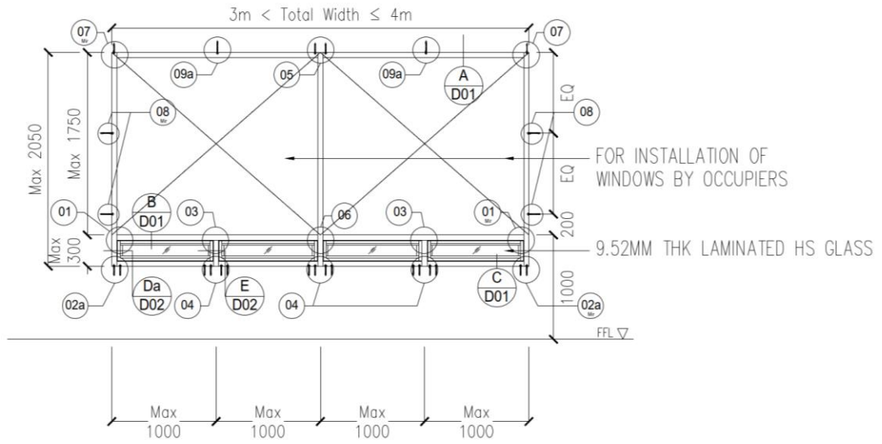
(3.)

3.0m < Total Window Width ≤ 4.0m



(4.)

3.0m < Total Window Width ≤ 4.0m



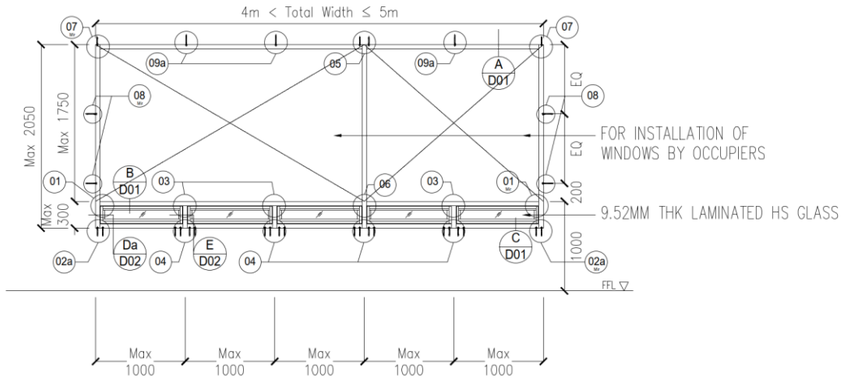
NOTES:

1. Total window height ≤ 2.05m for all types of windows.
2. All the window metal frames shall be minimum aluminium RHS 100x50x3mm (6061-T6) sections.
3. All the fixed glass panels shall be 9.52mm thick laminated glazing (4mm HS + 1.52mm PVB + 4mm HS)
4. The minimum allowable stress of HS glass shall be 32MPa.
5. All steel sections shall be with material grade S275.
6. Non-structural (weatherseal) silicone shall be FS TI-S-001543A (COM-NBS) and ASTM C920, Type SIM, NS, Class 25 or equivalent.
7. All cement grout shall be high strength non-shrink grout with minimum compression strength of 30MPa (7 days).

3/4 HEIGHT WINDOW SCHEDULE (CASE 5-7)

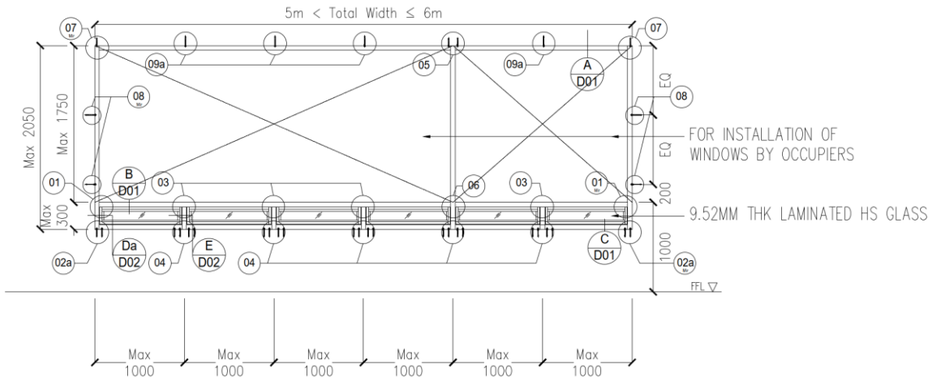
(5.)

4.0m < Total Window Width ≤ 5.0m



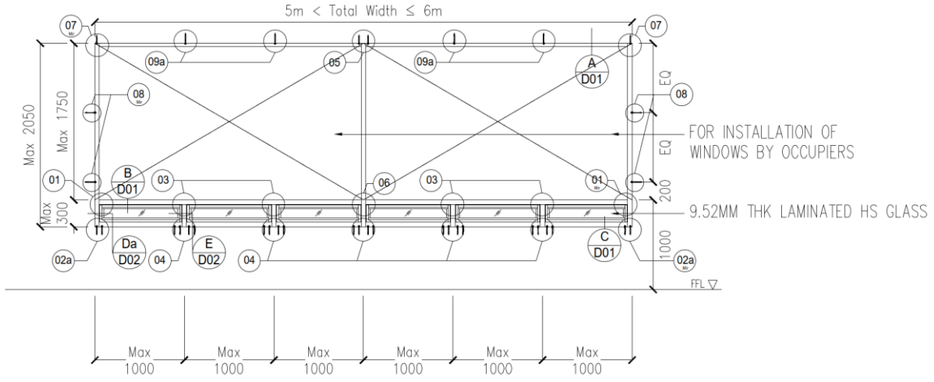
(6.)

5.0m < Total Window Width ≤ 6.0m



(7.)

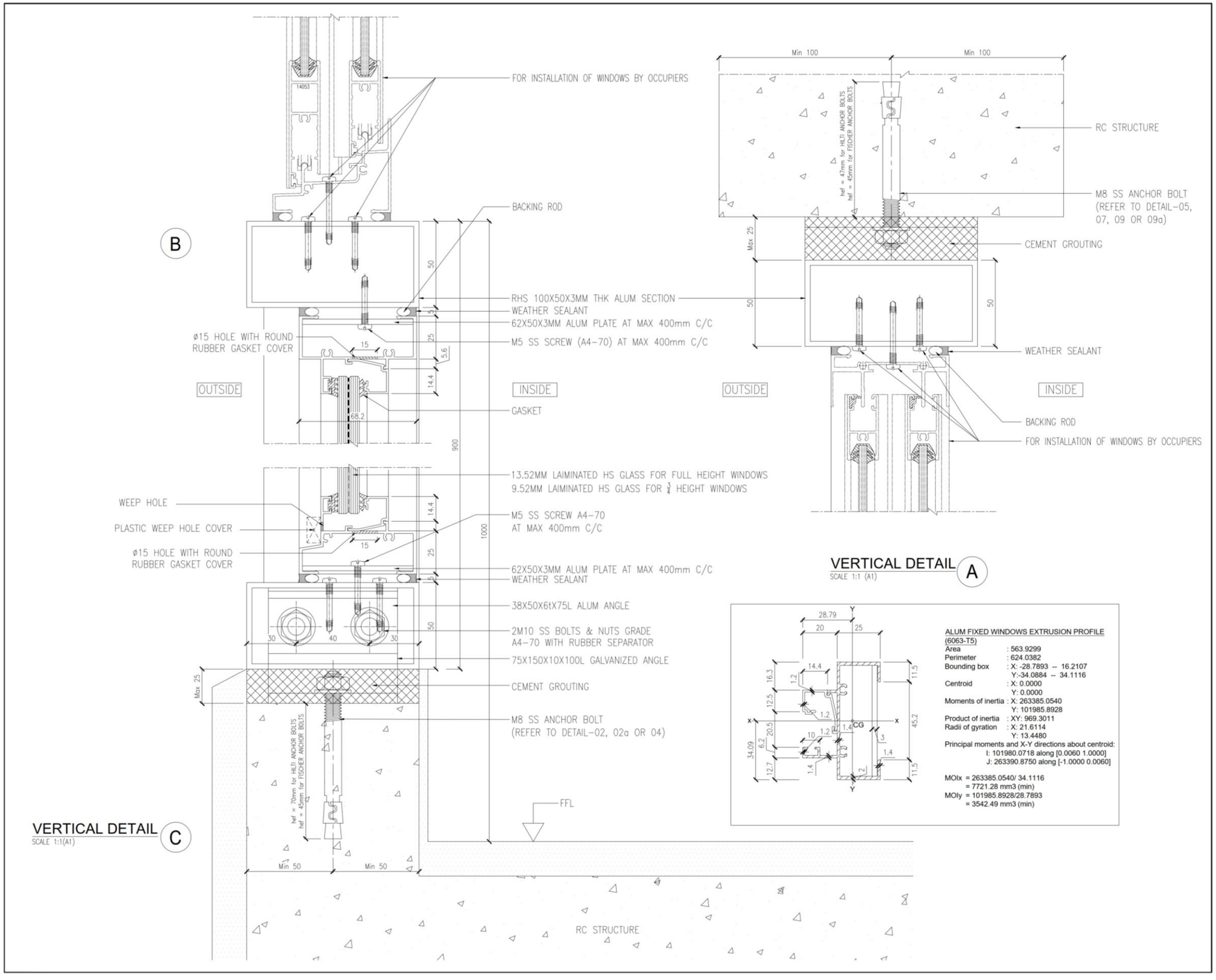
5.0m < Total Window Width ≤ 6.0m



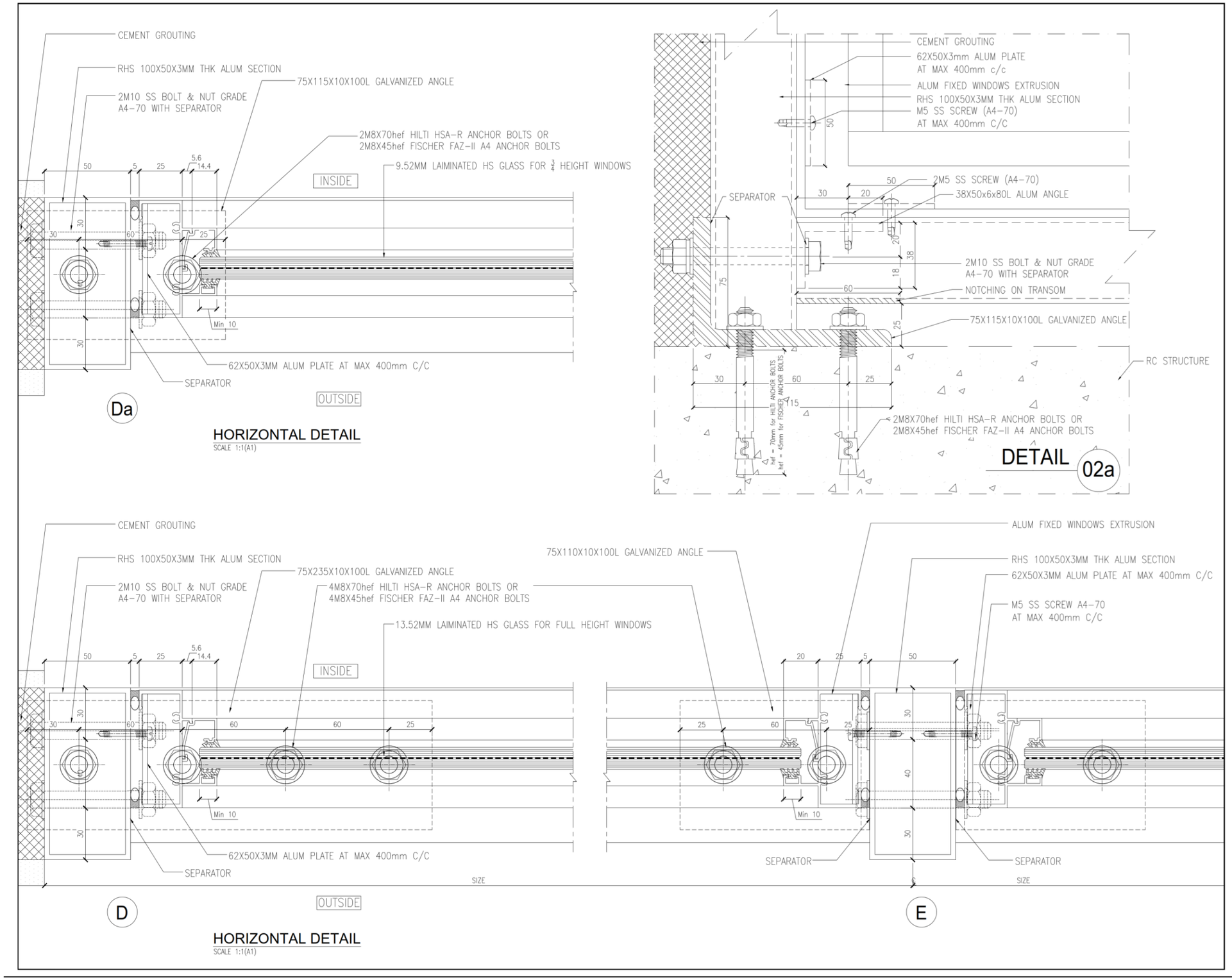
NOTES:

1. Total window height ≤ 2.05m for all types of windows.
2. All the window metal frames shall be minimum aluminium RHS 100x50x3mm (6061-T6) sections.
3. All the fixed glass panels shall be 9.52mm thick laminated glazing (4mm HS + 1.52mm PVB + 4mm HS).
4. The minimum allowable stress of HS glass shall be 32MPa.
5. All steel sections shall be with material grade S275.
6. Non-structural (weatherseal) silicone shall be FS TI-S-001543A (COM-NBS) and ASTM C920, Type SIM, NS, Class 25 or equivalent.
7. All cement grout shall be high strength non-shrink grout with minimum compression strength of 30MPa (7 days).

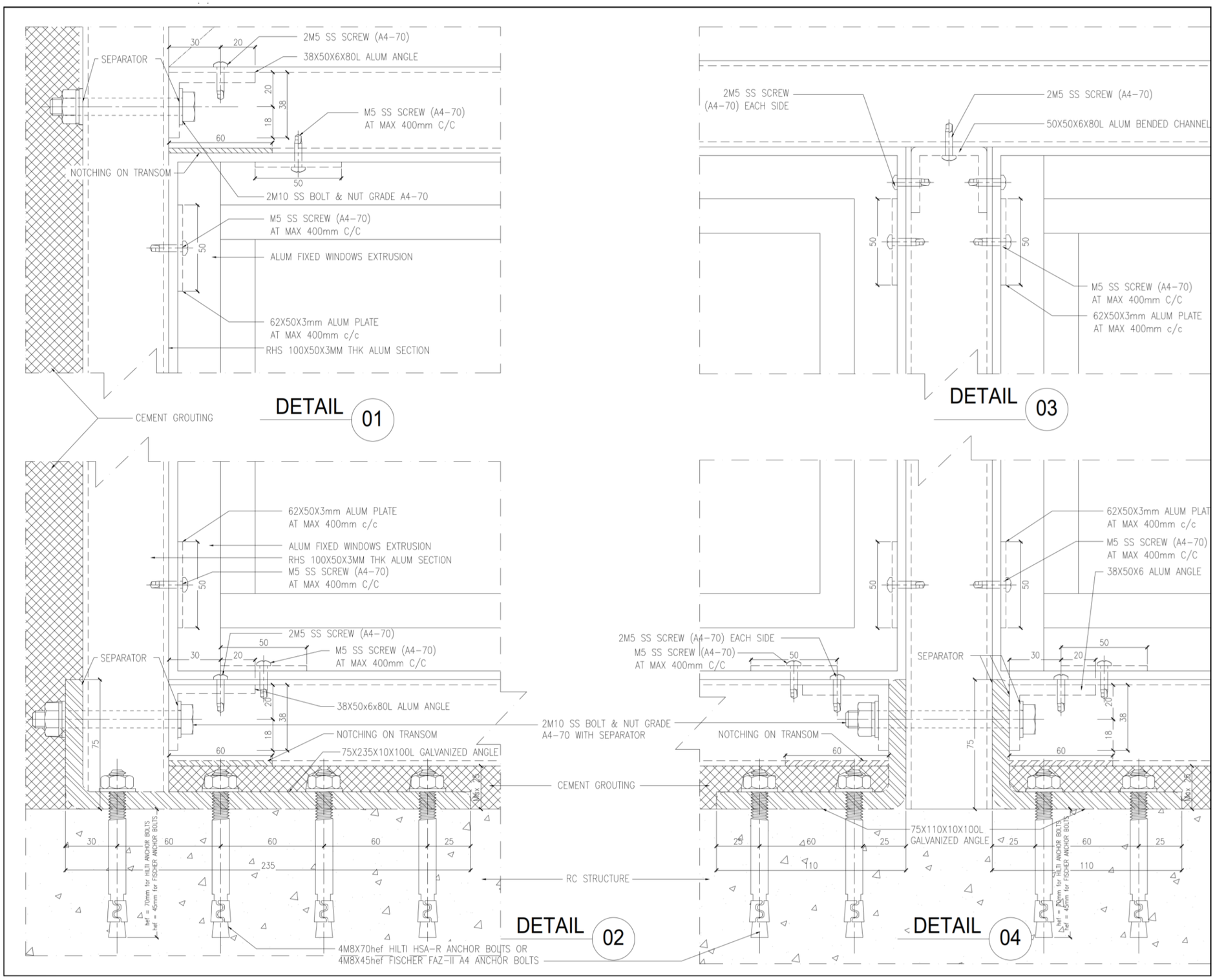
VERTICAL FRAME DETAILS



HORIZONTAL FRAME DETAILS



TYPICAL CONNECTION DETAIL (1)



TYPICAL CONNECTION DETAIL (2)