

**APPROVED DOCUMENT**

**ACCEPTABLE SOLUTIONS**

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

Ver 6.0  
Oct 2013

## 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 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 references 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> a) Paragraph B.3.2.1 (c) – incorporates current practice on wind loads	04 May 2009

S/N	Brief description of changes	Revision date
	<ul style="list-style-type: none"> <li>b) Paragraph B.3.3.1 (a) - Facilitate use of concrete with strength greater than 60 N/mm<sup>2</sup></li> <li>c) Paragraph B.3.3.1 (c) - Facilitate use of wider choice of structural steel material.</li> <li>d) Paragraph B.3.3.1 (g) - Facilitate use of glued laminated timber structures and non-tropical timber.</li> <li>e) Paragraph B.3.3.1 (l) - Incorporate design code for agricultural/farm structures.</li> <li>f) Paragraph B.3.3.1 (m) - Incorporate design guides for FRP system.</li> <li>g) Paragraph B.3.3.1 (n) - Incorporate design codes for maritime structures.</li> <li>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.</li> <li>i) Paragraph B.3.7.1 (b) - Incorporate design guides for ground granulated blast furnace slag.</li> <li>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.</li> <li>k) Paragraph B.3.7.1 (d) - Current code has been replaced by BS EN 1008.</li> <li>l) Paragraph B.3.7.1 (e) - Title of code has been changed.</li> <li>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.</li> <li>n) Paragraph B.3.7.1 (i) - Current codes have been replaced by BS EN 934-2.</li> <li>o) Paragraph B.3.7.1 (j) - Current codes have been replaced by BS EN 10025, Incorporate design code for stainless steels.</li> <li>p) Paragraph B.3.7.1 (k) - Current code has been replaced by BS EN 12020.</li> <li>q) Paragraph B.3.7.1 (m) - Facilitate use of glued laminated timber structures and non-tropical timber.</li> <li>r) Paragraph B.3.8.1 (a) - SS 26, SS 477 and SS476 have been deleted as they are covered in current SS 397, Incorporate SS EN 196</li> <li>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</li> <li>t) Paragraph B.3.8.1 (c) - Incorporate BS EN 12350, BS EN 12390, BS EN 12504, BS EN 13971, Incorporate BS EN 13971</li> <li>u) Paragraph B.3.8.1 (e) - Incorporate BS EN 480</li> <li>v) Paragraph B.3.8.1 (f) - Title of code has been changed.</li> <li>w) Paragraph B.3.8.1 (g) - Current code has been replaced by BS EN 10025</li> <li>x) Paragraph B.3.8.1 (k) - Incorporate codes for testing of timber</li> </ul> <p><b>Section H :</b></p> <ul style="list-style-type: none"> <li>a) Paragraph 3.3 – Heading has been changed to include design of glass panel barrier</li> <li>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.</li> </ul>	
9	<p>Ver 3.01 – Revision to section H on Safety from Falling:</p> <ul style="list-style-type: none"> <li>a) Paragraph H.3.4.4 - Editorial changes to improve clarity on the opening or gap in a barrier.</li> <li>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</li> </ul>	16 Jul 2009

S/N	Brief description of changes	Revision date
	<p>boardwalks at ground level along the waterfront.</p> <p>c) Note 2 of Paragraph H.3.4 - This is re-numbered to become new paragraph H.3.4.7</p>	
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	<p>Ver 3.03 –</p> <p>a) SS CP 38 referred to in Section F has been amended to SS 531 to reflect the change.</p> <p>b) SS CP 13 referred to in Section G has been amended to SS 553 to reflect the change.</p>	31 Dec 2010
12	<p>Ver 4.0 – Revisions are:</p> <p>a) SS CP 11 referred to in Section B has been amended to SS 557: 2010 to reflect the change.</p> <p>b) Addition of a new Section N on Use Of Glass At Height</p> <p>c) Addition of new paragraph H.3.5 on Glass Barrier to Section H on Safety from Falling</p> <p>d) SS CP 33 referred to in Section L has been amended to SS 555 to reflect the change.</p>	01 Jul 2011
13	<p>Ver 5.0 – Revisions to Section B on Structural Design and Construction and Section H on Safety from Falling.</p> <p><u>Section B</u></p> <p>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</p> <p>b) Paragraph B .3.2.1 – Addition of table showing the standards to be used with the adoption of the Eurocodes</p> <p>c) Paragraph B .3.2.1 (b) - Incorporate BS 4592</p> <p>d) Paragraph B.3.2.1(e) - Revised for clarity</p> <p>e) Paragraph B.3.2.1(g) - Addition of new paragraph on Seismic Loads</p> <p>f) Paragraph B .3.3.1 – Addition of table showing the standards to be used with the adoption of the Eurocodes</p> <p>g) Paragraph B.3.3.1(d) - Precast concrete structures omitted and the remaining paragraphs are renumbered</p> <p>h) Paragraph B.3.3.1(k) – Paragraph on Cranes omitted for clarity and the remaining paragraphs are renumbered</p> <p>i) Paragraph B.3.3.1(k) – ACI 440.2R-02 amended to ACI 440.2R</p> <p>j) Paragraph B.3.3.1(m) - Addition of new paragraph on Glass</p> <p>k) Paragraph B.3.3.1(n) - Addition of new paragraph on Seismic Loads</p> <p>l) Paragraph B.3.4.1 – Incorporate SS EN 1997-2 for use with the adoption of the Eurocodes</p> <p>m) Paragraph B.3.5.1 - Incorporate BS 6031 for use with the adoption of the Eurocodes</p> <p>n) Paragraph B.3.6.1 – SS 557:2010 amended to SS 557</p> <p>o) Paragraph B .3.7.1 – Addition of table showing the standards to be used with the adoption of the Eurocodes</p> <p>p) Paragraph B.3.7.1(a) - Incorporate BS EN 15743</p> <p>q) Paragraph B.3.7.1(b) - Incorporate BS 6699 for this transition period to the Eurocodes</p> <p>r) Paragraph B.3.7.1(e) - Incorporate BS 4483, SS 560 and SS 561</p> <p>s) Paragraph B.3.7.1(f) and (g) – Combined and revised as a new</p>	01 Apr 2013

S/N	Brief description of changes	Revision date
	<p>paragraph B.3.7.1(f) on Prestressing wires, strands or bars and incorporating BS 5896 and BS 4486 and the remaining paragraphs are renumbered</p> <p>t) Paragraph B.3.7.1(h) - BS EN 934-2 is replaced by SS EN 934</p> <p>u) Paragraph B.3.7.1(i) - SS 470 is replaced by BS EN 10210</p> <p>v) Paragraph B.3.7.1(j) - Incorporate BC 1</p> <p>w) Paragraph B.3.7.1(l) - Incorporate BS EN 14080 and BS EN 14081</p> <p>x) Paragraph B.3.8.1 – Addition of table showing the standards to be used with the adoption of the Eurocodes</p> <p>y) Paragraph B.3.8.1(c) - Incorporate BS 3148 in for this transition period to the Eurocodes</p> <p>z) Paragraph B.3.8.1(d) - Incorporate SS 78 in for this transition period to the Eurocodes</p> <p>aa) Paragraph B.3.8.1(e) - Incorporate SS 320 in for this transition period to the Eurocodes</p> <p>bb) Paragraph B.3.8.1(g) - Incorporate BS EN 10210, BS EN 10219, BS EN 10088 and BC 1</p> <p>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</p> <p>dd) Paragraph B.3.8.1(k) - Incorporate BS EN 14080 and BS EN 14081 <u>Section H</u></p> <p>ee) Paragraph H.3.3.1 – Addition of table showing the standards to be used with the adoption of the Eurocodes <u>New Annexes</u></p> <p>ff) Addition of Annex A – Structural design standards based on the Eurocodes and the corresponding Singapore National Annexes.</p> <p>gg) Addition of Annex B– Comparative list of Singapore/British standards and their equivalent Singapore/European Standards.</p>	
14	<p>Ver 6.0 – <u>Section M :</u></p> <p>a) Paragraph M.2.2 – Revised to amend performance requirements to cover all window types and not just for casement windows.</p> <p><u>Section C :</u></p> <p>b) Paragraph C.2.2 – Revised to limit the exemption to attic rooms, toilets, bathrooms, lavatory and store room:</p> <ol style="list-style-type: none"> <li>i. attic rooms of area 10m<sup>2</sup> or less, built by the owners for their own use;</li> <li>ii. toilets, bathrooms or lavatories within houses built by the owners for their own use</li> <li>iii. store room of area 6m<sup>2</sup> or less</li> </ol> <p>c) Addition of new Paragraph C.3.2.2 on headroom requirement within a sheltered carpark</p> <p>d) Addition of new Paragraph C.3.2.2.Note 4 to clarify on the manner in which headroom is measured on staircases</p> <p>e) Paragraph C.3.3.1.Note 1 - Addition of new paragraph to exempt ceiling height requirement for toilets, bathrooms, lavatories or powder rooms</p> <p>f) Paragraph C.3.3.1.Note.2 – Revised for clarity</p> <p><u>Section D :</u></p> <p>a) Renamed to “Accessibility in Built Environment”</p> <p>b) Paragraph D.1.1 – Revised to incorporate new requirements that</p>	<p>28 Oct 2013</p> <p>1 Apr 2014</p>

S/N	Brief description of changes	Revision date
	<p>will benefit the young and parents or caregivers with infants.</p> <p>c) Paragraph D.2.2 – Revised to incorporate new requirements that will benefit the young.</p> <p>d) Paragraph D.2.3 – Revised to incorporate new requirements that will benefit parents or caregivers with infants.</p> <p>e) Paragraph D.2.4 – Revised to incorporate new requirements on audible and tactile information providing directions or instructions.</p> <p>f) Paragraph D.3.1 –</p> <p>i. Revised to include the young and parents or caregivers with infants</p> <p>ii. Renamed Code document to “Code on Accessibility in the Built Environment”.</p> <p><u>Section E :</u></p> <p>a) Paragraph E.1.1 – Amended the typographical error and updated omission of Paragraph E.2.3</p> <p>b) Paragraph E.2.3 – Omitted</p> <p>c) Paragraph E.3.1 – Updated omission of Paragraphs E.3.6 and E.3.8</p> <p>d) Paragraph E.3.3.1 – Revised to clarify the width requirement refers to a clear width</p> <p>e) Paragraph E.3.3.1.Note 2(c) – Revised to limit the exemption to attic rooms of area 10m<sup>2</sup> or less</p> <p>f) Paragraph E.3.4.2 – Revised to require minimum tread width of 275 mm in all buildings except in industrial buildings and residential units</p> <p>g) Addition of Paragraph E.3.4.2A – Tread requirement in residential units</p> <p>h) Addition of Paragraph E.3.4.2B - Tread requirement in industrial buildings</p> <p>i) Paragraph E.3.4.3 – Revised for clarity</p> <p>j) Paragraph E.3.4 Note1 – Revised for clarity</p> <p>k) Paragraph E.3.4 Note 2(c) – Revised to limit the exemption to attic rooms of area 10m<sup>2</sup> or less</p> <p>l) Paragraph E.3.5.2 – Revised to omit circular and geometric staircase</p> <p>m) Paragraph E.3.5.3 – Revised to take into consideration chamfered landing</p> <p>n) Paragraph E.3.5.4 – Revised to Paragraph E.3.5.4 and new Paragraph E.3.5.5 for clarity</p> <p>o) Paragraph E.3.5 Note –</p> <p>i. Note (c) - Revised to limit the exemption to attic rooms of area 10m<sup>2</sup> or less</p> <p>p) Paragraph E.3.6 – Moved to requirements under Section C, and the remaining paragraphs are renumbered</p> <p>q) Paragraph E.3.6 (renumbered from Paragraph E.3.7) –</p> <p>i. Paragraph E.3.6.2 – Revised to change the max. height of handrail to 1000mm</p> <p>ii. Addition of new Paragraphs E.3.6.3 and E.3.6.4</p> <p>iii. Paragraph E.3.6 Note.1 - Omitted and the remaining paragraphs are renumbered</p> <p>iv. Paragraph E.3.6 Note.2 - Amended to require handrail to be continuous throughout the entire length of stairs</p> <p>r) Paragraph E.3.8 – Moved to requirements under Section H.</p>	

S/N	Brief description of changes	Revision date
	<p><u>Section G :</u></p> <ul style="list-style-type: none"> <li>a) Addition of new Paragraph G.3.1A to exempt store room of area not exceeding 6m<sup>2</sup> and private lift lobby of area not exceeding 6m<sup>2</sup></li> <li>b) Paragraph G.3.1.Note – Omitted</li> <li>c) Paragraph G.3.2.1 – Revised ventilation requirement for above ground car park</li> <li>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</li> <li>e) Paragraph G.3.2.2 – Amendments for clarity for acceptable sources for natural ventilation</li> <li>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.</li> <li>g) Addition of new Paragraph G,3.2.3 to set a maximum distance (12.0m) for effective natural ventilation</li> </ul> <p><u>Section H:</u></p> <ul style="list-style-type: none"> <li>h) Paragraph H.1.1 - Revised for clarity and to include new Paragraphs H.2.1A and H.2.1B</li> <li>i) Paragraph H.2.1 – Addition of new Paragraphs H.2.1A and H.2.1B</li> <li>j) Paragraph H.2.2.(a) - Revised to improve the safety of occupants in buildings</li> <li>a) Paragraph H.2.2.(b) - Revised to clarify the scope of “special service or usage areas” in the original paragraph</li> <li>k) Paragraph H.3.1 – Revised to include new paragraphs H.2.1A and H.2.1B</li> <li>l) Paragraph H.3.2.1.(b) – Revised to standardize the minimum safety barrier height requirement at stairs and ramps to 1.0 m.</li> <li>m) 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</li> <li>n) Paragraph H.3.4.1 – Revised to standardize the application of the requirement to all safety barriers and clarify the intent of the requirement</li> <li>o) 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</li> <li>p) Addition of new Paragraph H.3.4.4A to relax the requirement on gap size for safety barriers in maintenance areas</li> <li>q) 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</li> <li>r) Paragraph H.3.4.7 – Paragraph is moved to new Paragraph H.3.4A</li> <li>s) Addition of new Paragraph H.3.4A</li> </ul> <p><u>Section N:</u> Paragraph N.2.1 - Revised to amend performance requirement to provide greater clarity</p> <p><u>Section O:</u></p> <ul style="list-style-type: none"> <li>a) Addition of a new Section O on Protection from Injury by Vehicles in Buildings</li> </ul>	

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## 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, disabled-friendly 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 –

<u>Abbreviation or Symbol</u>	<u>Definition</u>
BS	British Standard
CP	Code of Practice
°K	degree Kelvin
kW	kiloWatt
kg	kilogram
m	metre
m <sup>2</sup>	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 caused 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.2.2 The building 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 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 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.

Type of loads	When adopting Singapore or British design standards	When adopting Eurocodes
(b) Imposed floor and ceiling loads, dynamic loads due to crowd movement, loads on parapets and balustrades, loads on vehicular barrier for car parks, accidental loads	(i) Loading for buildings. Code of practice for dead and imposed loads – BS 6399: Part 1; and (ii) Industrial type flooring and stair treads – BS 4592.	(i) Actions on structures – General actions - SS EN 1991; and (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 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 –

<b>Type of structures</b>	<b>When adopting Singapore or British design standards</b>	<b>When adopting Eurocodes</b>
(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 Materials to BS 5950 and Eurocode 3 – BC 1.	(i) Design of steel structures - SS EN 1993 (ii) Design of composite steel and concrete structures - SS EN 1994; and (iii) Design Guide on Use of Alternative Structural Steel Materials to BS 5950 and Eurocode 3 – BC 1.
(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 – BS EN 1995.
(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.
(j) Buildings and structures for agriculture	(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.	
(l) Maritime structures (including floating platforms)	(i) Maritime 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 (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.

### 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 materials	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.
(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.	

Type of materials	When adopting Singapore or British design standards	When adopting Eurocodes
(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 'Alkali-silica reaction in concrete' (2004) by <ul style="list-style-type: none"> <li>- using low alkali cement<sup>1</sup> with equivalent Na<sub>2</sub>O of not more than 0.6% ; or</li> <li>- limiting the total alkali content of concrete to 2.5kg equivalent Na<sub>2</sub>O /m<sup>3</sup>.</li> </ul>	(i) Concrete - Specification, performance, production and conformity – SS EN 206-1; (ii) Concrete - Complementary 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 <ul style="list-style-type: none"> <li>- using low alkali cement<sup>1</sup> with equivalent Na<sub>2</sub>O of not more than 0.6% ; or</li> <li>- limiting the total alkali content of concrete to 2.5kg equivalent Na<sub>2</sub>O /m<sup>3</sup>; and</li> </ul> (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; (iv) Cold formed welded structural hollow sections of non-alloy and fine grain steels – BS EN 10219; (v) Stainless steels - BS EN 10088; and (vi) Design Guide on Use of Alternative Structural Steel Materials to BS 5950 and Eurocode 3 – BC 1.	

<sup>1</sup> To be used with aggregates with marginal reactivity having expansion not greater than 0.2% when evaluated using ASTM C1260.

Type of materials	When adopting Singapore or British design standards	When adopting Eurocodes
(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 (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.	
(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.

### 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.
(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.

<b>Material of element</b>	<b>When adopting Singapore or British design standards</b>	<b>When adopting Eurocodes</b>
(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 (vi) 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 (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.
(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; and (v) Design Guide on Use of Alternative Structural Steel Materials to BS 5950 and Eurocode 3 – BC 1.	
(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) 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.	

<b>Material of element</b>	<b>When adopting Singapore or British design standards</b>	<b>When adopting Eurocodes</b>
(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 paragraph C.2.1 are to protect people from –
- (a) injury caused by inadequate headroom; and
  - (b) injury or loss of amenity caused by inadequate height of room or space.

### **C.2 PERFORMANCE REQUIREMENT**

- C.2.1 All rooms and spaces in a building shall be provided with adequate headroom and height for their intended uses.
- C.2.2 The requirement in paragraph C.2.1 shall not apply to the following rooms and spaces –
- (a) an attic room not exceeding an area of 10 square metres, built by the owners for their own use;
  - (b) equipment and plant rooms;
  - (c) the underside of a staircase or escalator if such staircase or escalator is not located along an access route or circulation space;
  - (d) toilets, bathrooms or lavatories built by the owner for his own use; and
  - (e) store rooms not exceeding an area of 6 square metres.

### **C.3 ACCEPTABLE SOLUTION**

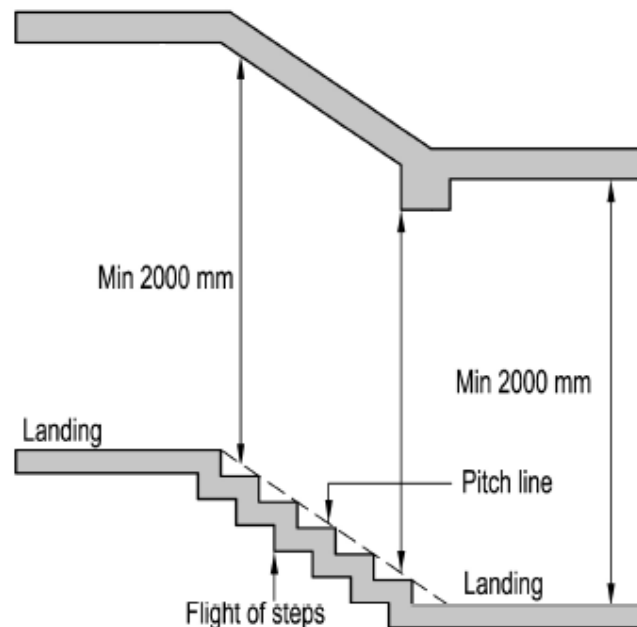
- C.3.1 The requirement in paragraph C.2.1 is deemed to be satisfied if the specifications set out in paragraphs C.3.2 and C.3.3 are complied with.

#### **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 m.

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

- 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 the underside of any beam, duct, service pipe, fixture, fitting or other obstruction or projection; and in the case of a doorway, it shall be measured up to the underside of the transom.*
  - 3 *Windows, which open into any access route or circulation space, shall not result in any inadequacy in headroom in the access route or circulation space.*
  - 4 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).



**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 m.

*Note:* 1 *The requirement in paragraph C.3.3.1 does not apply to the following–*

- (a) corridors and lobbies;*
- (b) toilets, bathrooms, lavatories or powder rooms; and*
- (c) localised areas within a room or space where there is a drop in ceiling height due to physical constraints such as structural beams or building services.*

2 *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.2.1 and 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 shall have –

- (a) handrails or guides to assist movement;
- (b) landings to break a fall and provide a place for rest;
- (c) sufficient headroom to avoid injury; and
- (d) barriers against falling from 1.0 m or more from an open side.

**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.3.6.

**E.3.2 Projection**

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

**E.3.3 Width of staircase**

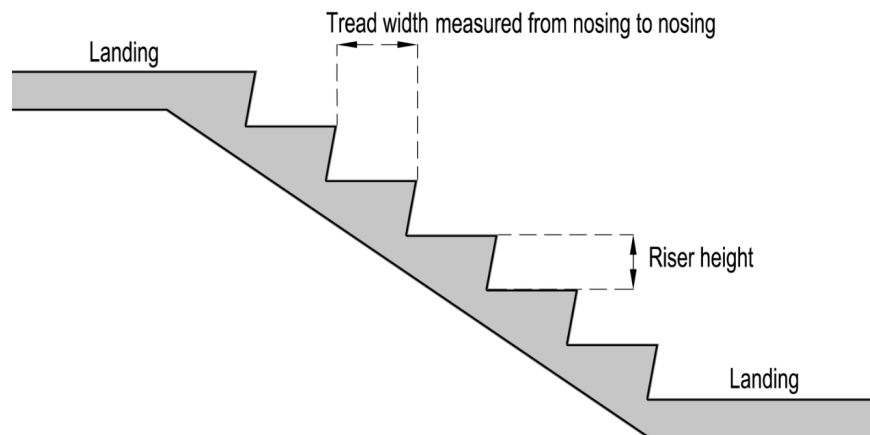
E.3.3.1 The clearance of the width of every staircase shall not be less than 900 mm.

- Note:*
- 1 *The width is measured from the inner side of the wall, balustrade or handrail.*
  - 2 *The requirement in paragraph E.3.3.1 does not apply to the following –*
    - (a) *plants and equipment rooms;*
    - (b) *the production area of an industrial building;*
    - (c) *attic rooms of area not exceeding 10 m<sup>2</sup> in residential buildings; and*
    - (d) *houses built by the owners for their own use.*

#### E.3.4 Risers and treads

E.3.4.1 The height of a riser shall not be more than 175 mm.

E.3.4.2 The width of a tread shall not be less than 275 mm. See Figure E.3.4.2(a) on measurements of tread and riser.



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

E.3.4.2A Notwithstanding paragraph E.3.4.2, the width of a tread of any staircase in any residential unit shall not be less than 225mm.

E.3.4.2B Notwithstanding paragraph E.3.4.2, the width of a tread of any staircase in any industrial building shall not be less than 250mm.

E.3.4.3 The width of the tread of any tapered step shall be taken as that when measured at a distance of 500mm 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 *The requirements in paragraphs E.3.4.1 to E.3.4.3 do not apply to the following –*

*(a) plants and equipment rooms;*

*(b) the production area of an industrial building;*

*(c) attic rooms of area not exceeding 10 m<sup>2</sup> in residential buildings; and*

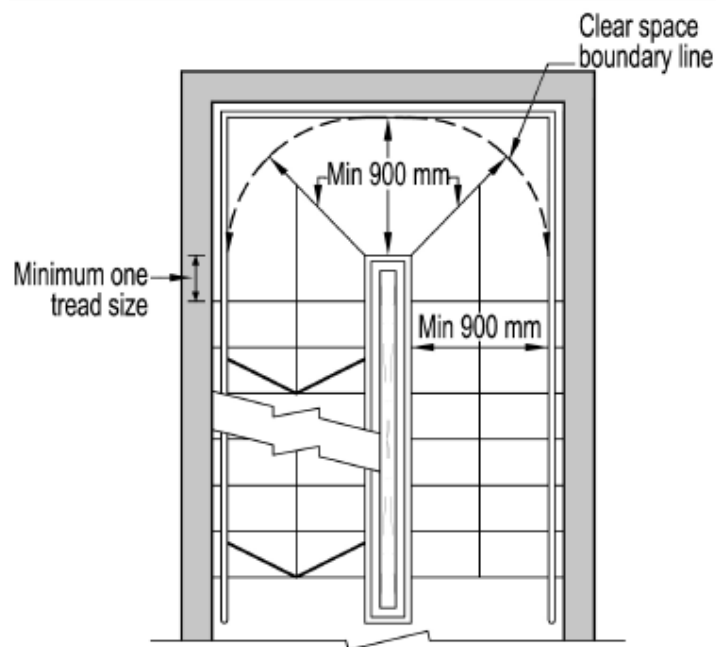
*(d) houses built by the owners for their own use.*

### 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, 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).



**Figure E.3.5.3(a) – Measurement of landing Width**

E.3.5.4 A landing shall not have any step or drop.

E.3.5.5 Notwithstanding paragraph E.3.5.4, one winder is allowed in every 90° turn in the staircase of any dwelling unit.

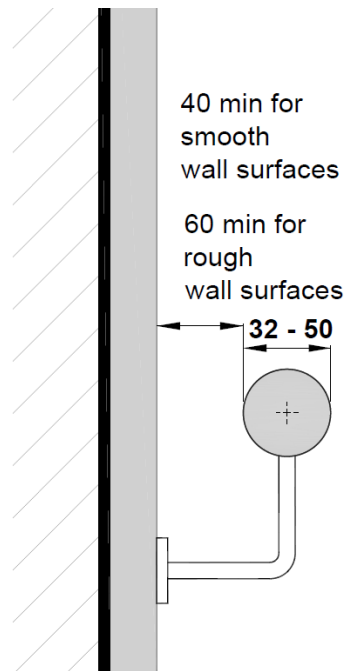
*Note:* The requirements in paragraphs E.3.5.1 to E.3.5.4 do not apply to the following –

- (a) plants and equipment rooms;
- (b) the production area of an industrial building;
- (c) attic rooms of area not exceeding 10 m<sup>2</sup> in residential buildings; and
- (d) houses built by the owners for their own use.

### E.3.6 Handrails

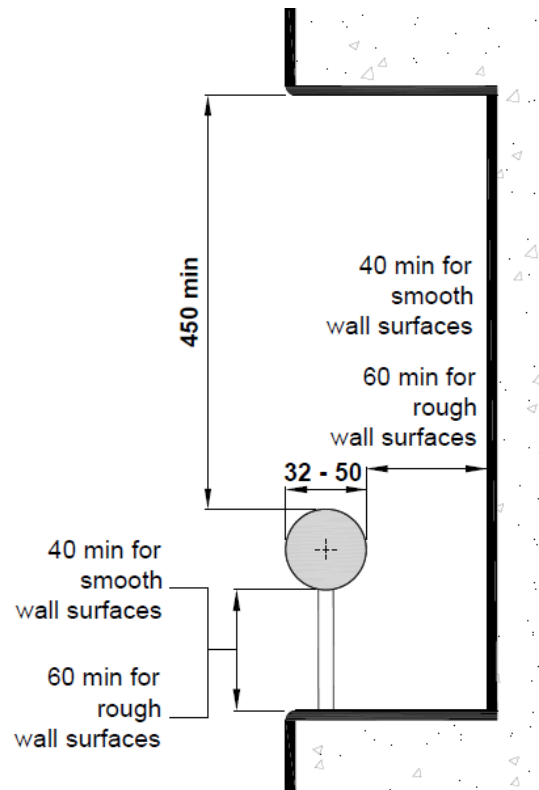
E.3.6.1 A handrail shall be provided on at least one side of the flight of staircase.

- E.3.6.2 The height of the handrail shall be between 750mm and 1000mm above the pitch line.
- E.3.6.3 Handrails shall:
- (a) have a circular section of 32mm to 50mm in diameter or an equivalent gripping surface; and
  - (b) have a clear space between the handrail and all wall surface as shown in Figure E.3.6.3(a) of –
    - (i) not less than 40mm; or
    - (ii) at least 60mm 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**

*Note:*

- 1 *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.*
- 2 *The requirements in paragraphs E.3.6.1 and E.3.6.2 do not apply to the following –*
  - (a) *plants and equipment rooms;*
  - (b) *the production area of an industrial building; and*
  - (c) *houses built by the owners for their own use.*



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**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 isolation from natural lighting and lack of artificial lighting.

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

2 *In lieu of natural lighting, artificial lighting may be provided to the following rooms or spaces within residential units –*

(a) *bathroom, toilet or lavatory;*

(b) *store room;*

(c) *basement; or*

(d) *civil defence shelter.*

3 *For the purpose of promoting energy efficiency in buildings, the use of artificial lighting as the sole means of lighting is to be discouraged.*

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**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.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 or air-conditioning system that complies with the ventilation rates given in SS 553 - Code of Practice for Air-Conditioning and Mechanical Ventilation in Buildings

is provided.

G.3.1A The requirement in paragraph G.3.1 does not apply to the following rooms or spaces –

- (a) any store room of area not exceeding 6.0 m<sup>2</sup>; and
- (b) any private lift lobby of area not exceeding 6.0 m<sup>2</sup>.

### 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.*

- (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.*

G.3.2.1A Notwithstanding clause G.2.2 and in lieu of natural ventilation, mechanical ventilation shall be provided to the following rooms or spaces within residential developments including house built by the owners for their own use -

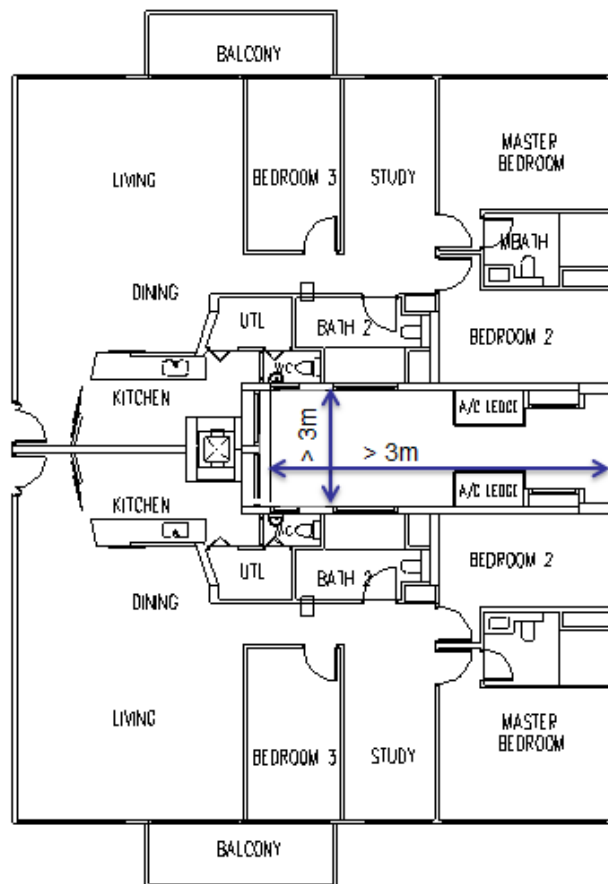
- (a) fitness room;
- (b) clubhouse;
- (c) civil defence shelter;
- (d) bathroom, toilet or lavatory; and
- (e) basement.

G.3.2.2 The windows or other openings 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); and
- (c) a recess, exceeding 3.0m from the external building wall, of minimum width 3.0m. See Figure G.3.2.2(b).

Height	Minimum airwell size (m <sup>2</sup> )
<= 30m	10
Subsequent 3m	+1

**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 more than 12.0m from any window/opening ventilating the space.

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## **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 used to prevent falling from a height, the barrier shall not have any feature that facilitates the climbing of 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 shall not apply to –

- (a) any roof which is accessible for maintenance purposes only and not easily accessible to the public; 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.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.3.2 Height of barrier

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

- (a) 1.0 m at all locations except for locations indicated in (b);
- (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 *Where a kerb or step with dimensions more than 150mm by 150mm is provided next to a barrier, the height of the barrier shall be measured from the top of the kerb or step.*
  - 4 *The requirements in paragraph H.3.2.1 do not apply to houses built by the owners for their own use.*

### 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 the following Standards –

When adopting Singapore or British design standards	When adopting Eurocodes
(i) BS 6399: Part 1 – Loading for buildings. Code of practice for dead and imposed loads.	(i) 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.3.3.2 Glass panel barriers shall be designed and installed in accordance with Section 8 of BS 6180 – Barriers in and about Buildings – Code of Practice.

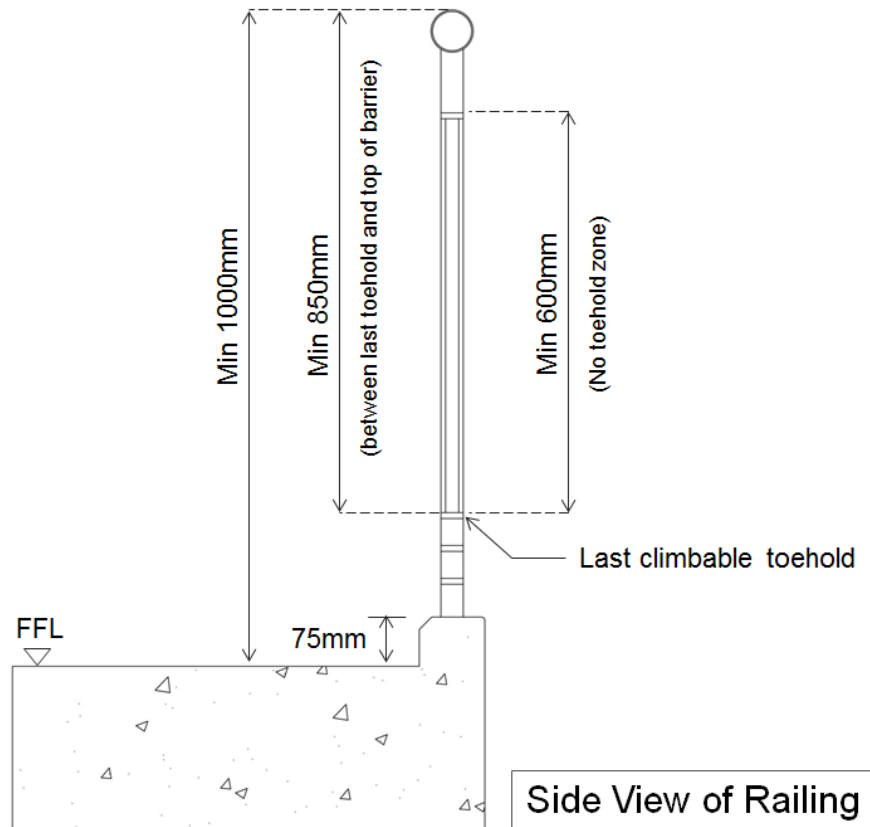
### H.3.4 Size of opening

H.3.4.1 The lowest part of the barrier (being at least 75mm measured from the finished floor level) shall be built with no gap, in order to prevent any object from falling through the base of the barrier.



- H.3.4.2 The lowest 75mm of the bay window shall not be openable.
- H.3.4.3 In non-industrial buildings, the size of any opening or gap in a barrier shall not be large enough as to permit the passage of a sphere of a diameter of 100mm.
- H.3.4.4 In industrial buildings, the size of any opening or gap in a barrier shall not be large enough as to permit the passage of a sphere of a diameter of 150mm.
- H.3.4.4A In areas of maintenance, including plants, equipment rooms, catwalks or platforms for maintenance, accessible by authorised personnel only where necessary, the size of the opening or gap in the barrier shall not be large enough as to permit the passage of a sphere of a diameter of 500mm.
- H.3.4.5 For a flight of staircase,
- (a) In all buildings, except for industrial buildings, any triangular opening or void formed around a tread, riser and the bottom edge of the barrier, the size of any opening or gap shall not be large enough as to permit the passage of a sphere of a diameter of 150mm.
  - (b) In all buildings, except for industrial buildings, the gap size between any two consecutive steps shall not be large enough as to permit the passage of a sphere of a diameter of 100mm; and
  - (c) In industrial buildings, the gap size between any two consecutive steps shall not be large enough as to permit the passage of a sphere of a diameter of 150mm.
- H.3.4.6 The requirements under paragraph H.3.4 do not apply to promenades and boardwalks at ground level along the waterfront; or houses built by the owners for their own use.
- H.3.4A **Requirements to prevent climbing**
- H.3.4A.1 In all buildings except industrial buildings, the barrier at a location where there is a vertical drop in level of 1.0m or more shall have a height of at least –
- (a) that specified in paragraph H.3.2.1; or
  - (b) 850mm measured from the last climbable toehold,

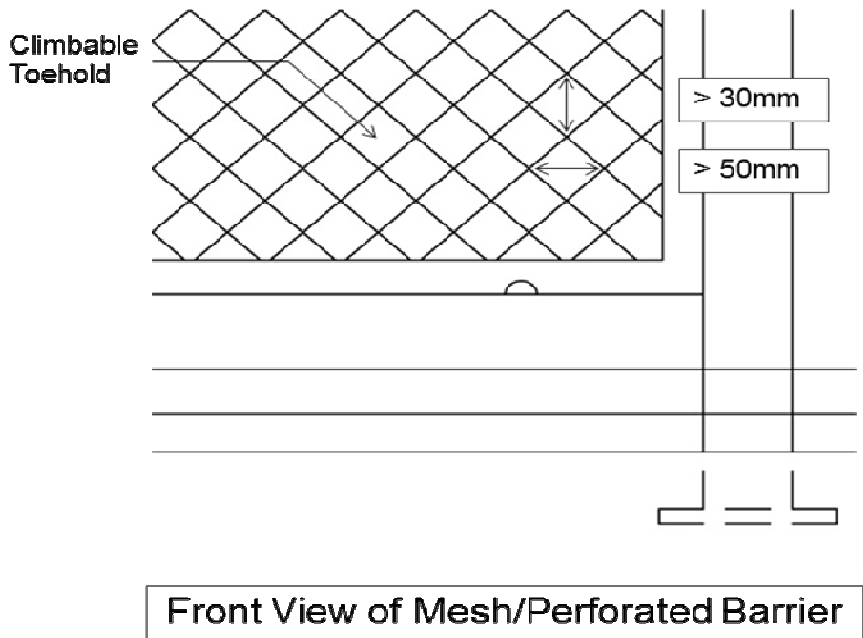
whichever is higher. See Figure H.3.4A.1(a).



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

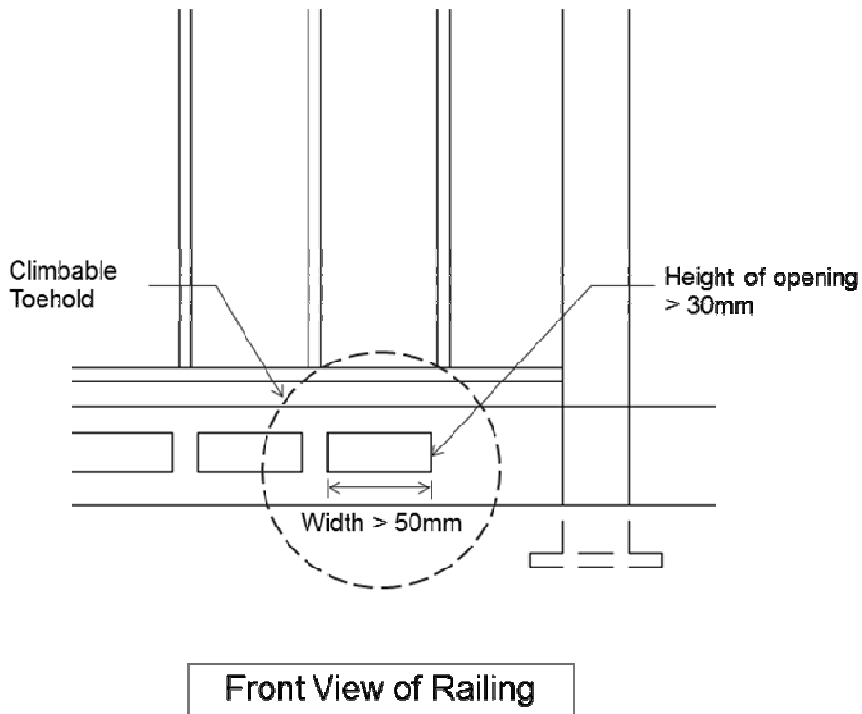
- H.3.4A.2 A toehold means –
- any opening in a perforated sheet or mesh having a horizontal dimension of more than 50mm and a vertical dimension of more than 30mm; or
  - a kerb or protrusion having a width of more than 50mm and has a chamfer gentler than 45° relative to the horizontal plane.

See Figures H.3.4A.2(a), (b) and (c) for an illustration of the toehold dimensions.



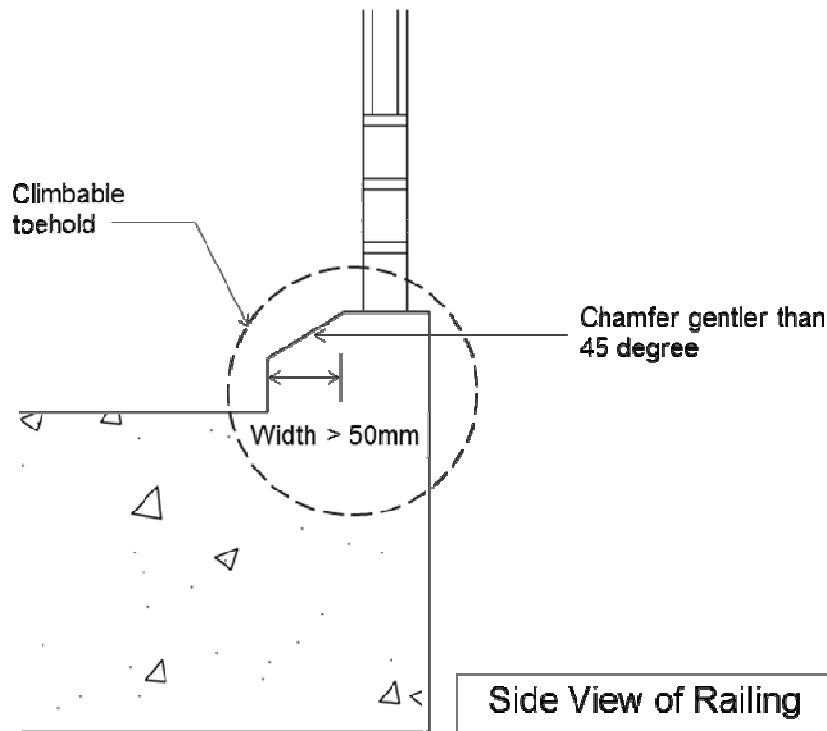
Front View of Mesh/Perforated Barrier

Figure H.3.4A.2(a) – Toehold Dimensions at Mesh/Perforated Barrier



Front View of Railing

Figure H.3.4A.2(b) – Toehold Dimensions at Railing



**Figure H.3.4A.2(c) – Toehold Dimensions at Kerb/ Protrusion**

H.3.4A.3 A toehold is considered to be climbable if it measures within 600mm vertically from –

- (a) the finished floor level;
- (b) a step; or
- (c) another climbable toehold.

H.3.4A.4 The requirements under paragraph H.3.4A do not apply to –

- (a) promenades and boardwalks at ground level along the waterfront;
- (b) bay windows in a residential unit; or
- (c) houses built by the owners for their own use.

### 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.

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## **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<sup>2</sup> shall be installed or equipped with means to facilitate the collection of energy consumption data.

### **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<sup>2</sup> 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<sup>2</sup>.

- 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:

$$WWR_{\text{Bldg}} < 0.3 \text{ and } SC_{\text{facade}} < 0.7$$

Or

$$WWR_{\text{Bldg}} < 0.4 \text{ and } SC_{\text{facade}} < 0.5$$

Or

$$WWR_{\text{Bldg}} < 0.5 \text{ and } SC_{\text{facade}} < 0.43$$

Where:

WWR: Window to wall ratio

SC: Shading coefficient of fenestration =  $SC_{\text{glass}} \times SC_{\text{shading device}}$

- I.3.2.3 For all non-residential buildings with an aggregate air-conditioned area of more than 500m<sup>2</sup>, 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<sup>2</sup>.
- 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<sup>2</sup>.
- 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 <sup>2</sup> )	Maximum thermal transmittance (W/m <sup>2</sup> °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<sup>2</sup>.*
  - 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 <sup>2</sup> )	Maximum thermal transmittance (W/m <sup>2</sup> ·K)
Light	Under 50	0.8
Medium	50 to 230	1.1
Heavy	Over 230	1.5

- Note:*
- 1 *The requirement in paragraph I.3.3.1 does not apply to the following –*
    - (a) *buildings with a gross floor area not exceeding 500 m<sup>2</sup>;*
    - (b) *open-sided sheds;*
    - (c) *linkways;*
    - (d) *covered walkways;*
    - (e) *store rooms and utility rooms; and*
    - (f) *plants and equipment rooms.*

- 2 *Where a building is partially air-conditioned and the aggregate air-conditioned area is less than 500 m<sup>2</sup>, the requirement in paragraph 1.3.3.1 shall apply if the total gross floor area of the building exceeds 500 m<sup>2</sup>.*

#### 1.3.4 **Air tightness and leakage**

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

1.3.4.2 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 1.3.4.1 and 1.3.4.2 do not apply to non air-conditioned buildings.*

- 2 *The requirement in paragraph 1.3.4.2 also applies to commercial units, the doors of which open into an exterior open space, external corridor, passageway or pedestrian walkway.*

#### 1.3.5 **Air-conditioning system**

1.3.5.1 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.

#### 1.3.6 **Artificial lighting**

1.3.6.1 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.



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### 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 objective of paragraphs K.2.1 and K.2.2 is 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.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 in accordance with the requirements of SS 550 - Code of Practice for Installation, Operation and Maintenance of Electric Passenger and Goods Lifts; and
- (b) the escalators are designed and installed in accordance with SS CP 15 - Code of Practice for Installation, Operation and Maintenance of Escalators and Passenger Conveyors.

**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 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.

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## **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.

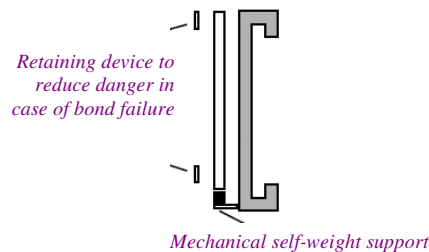
### **N.3 ACCEPTABLE SOLUTION**

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 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.
- 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
- Note:*
- 1 *The requirement in paragraph N.3.6(b) is illustrated in Figure N1*
  - 2 *Retaining devices are to be designed and constructed to prevent any fall of facade panels in the event of bond failure of the structural sealant.*
- N.3.7 Mechanical self-weight supports shall be provided for all glass panels of the SSG.



**Figure N1**

**Four-sided SSGs 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: 2006: Glass in Building - Structural Sealant Glazing and BS EN 15434: 2006: Glass in Building – Product Standard for Structural and/or Ultra-violet 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 Loading for Buildings. Code of Practice for Dead and Imposed Loads BS 6399-Part 1; and SS EN 1991.

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

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

<b>Eurocode 1 : Actions on structures</b>	<b>Associated National Annex (NA) to be used for design</b>
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

<b>Eurocode 2 : Design of concrete structures</b>	<b>Associated National Annex (NA) to be used for design</b>
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

<b>Eurocode 2 : Design of concrete structures</b>	<b>Associated National Annex (NA) to be used for design</b>
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

<b>Eurocode 3 : Design of steel structures</b>	<b>Associated National Annex (NA) to be used for design</b>
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*
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

<b>Eurocode 3 : Design of steel structures</b>	<b>Associated National Annex (NA) to be used for design</b>
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

<b>Eurocode 4 : Design of composite steel and concrete structures</b>	<b>Associated National Annex (NA) to be used for design</b>
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

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

<b>Eurocode 5 : Design of timber structures</b>	<b>Associated National Annex (NA) to be used for design</b>
BS EN 1995-2 Design of timber structures. Bridges.	NA to BS EN 1995-2

<b>Eurocode 7 : Geotechnical design</b>	<b>Associated National Annex (NA) to be used for design</b>
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

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

<b>Eurocode 9 : Design of aluminium structures</b>	<b>Associated National Annex (NA) to be used for design</b>
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.	Still current.
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.	Still current.
BS 1377-6 Methods of test for soils for civil engineering purposes. Consolidation and permeability tests in hydraulic cells and with pore pressure measurement.	Still current.
BS 1377-7 Methods of test for soils for civil engineering purposes. Shear strength tests (total stress).	Still current.
BS 1377-8 Methods of test for soils for civil engineering purposes. Shear strength tests (effective stress).	Still current.
BS 1377-9 Methods of test for soils for civil engineering purposes. In-situ tests.	Partially replaced by 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
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

Standards that will apply if using the current Singapore/British Standards	Standards that will apply if using the Eurocode Standards
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 (20°C method).	BS EN 12390-2
BS 1881-112 Testing concrete. Methods of accelerated curing of test cubes.	This standard has been declared obsolescent by BSI.
BS 1881-113 Testing concrete. Method for making and curing no-fines test cubes.	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.
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 elasticity in 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 as the standard can no longer be maintained.
BS 1881-128 Testing concrete. Method for analysis of fresh concrete.	This standard has been declared obsolescent by BSI as it is no longer relevant.
BS 1881-129 Testing concrete. Method for determination of density of partially compacted semi-dry fresh concrete.	Still current.

Standards that will apply if using the current Singapore/British Standards	Standards that will apply if using the Eurocode Standards
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 declared obsolescent 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.
BS 1881-205 Testing concrete. Recommendations for radiography of concrete.	This standard has been withdrawn by BSI as the standard can no longer be maintained.
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
BS 3923-2 Methods for ultrasonic examination of welds. Automatic examination of fusion welded butt joints in ferritic steels.	This standard has been declared obsolescent by BSI.
BS 4027 Specification for sulphate-resisting Portland cement.	This standard has been withdrawn by BSI as it conflicts with BS EN 197-1:2011
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 reinforcement of concrete - Specification.	Still current.



Standards that will apply if using the current Singapore/British Standards	Standards that will apply if using the Eurocode Standards
BS 4486 Specification for hot rolled and hot rolled and processed high tensile alloy steel bars for the prestressing concrete.	Still current.
BS 5268-2 Structural use of timber. Code of practice for permissible stress design, materials and workmanship. [note: For use of glued laminated timber structures and non-tropical timber.]	BS EN 14080
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 classification of details for fatigue.	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.	BS 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
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.	Partially replaced by BS EN ISO 14688-1, BS EN ISO 14688-2, BS EN ISO 14689-1, BS EN ISO 22475-1, BS EN ISO 22476-2, BS EN ISO 22476-3 and SS EN 1997-2
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,

Standards that will apply if using the current Singapore/British Standards	Standards that will apply if using the Eurocode Standards
BS 5950-2 Structural use of steelworks in building. Specification for materials, fabrication and erection – Rolled and welded sections.	BS 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.
BS 6349-2 Maritime works. Code of practice for the design of quay walls, jetties and 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.	Still current.
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

Standards that will apply if using the current Singapore/British Standards	Standards that will apply if using the Eurocode Standards
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 British Standards Institution (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 alloys EN AW-6060 and EN AW-6063. Technical conditions for inspection and delivery.	Still current.
BS EN 12020-2 Aluminium and aluminium alloys. Extruded precision profiles in alloys EN AW-6060 and EN AW-6063. Tolerances on 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.	Still current.
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.	Still current.
BS EN 573-1 Aluminium and aluminium alloys. Chemical composition and form of wrought products. Numerical designation system.	Still current.

<b>Standards that will apply if using the current Singapore/British Standards</b>	<b>Standards that will apply if using the Eurocode Standards</b>
BS EN 573-2 Aluminium and aluminium alloys. Chemical composition and form of wrought products. Chemical symbol based designation system.	Still current.
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.
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.

Standards that will apply if using the current Singapore/British Standards	Standards that will apply if using the Eurocode Standards
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
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

Standards that will apply if using the current Singapore/British Standards	Standards that will apply if using the Eurocode Standards
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.	To be withdrawn by SPRING.
SS 470: Part 2 Specification for hot-finished structural hollow sections of non-alloy and fine grain structural steels - Tolerances, dimensions and sectional properties.	To be withdrawn by SPRING.
SS 475: Part 1 Specification for steel for the prestressing of concrete. General requirements.	To be reviewed by SPRING Singapore.
SS 475: Part 2 Specification for steel for the prestressing of concrete. Cold-drawn wire.	To be reviewed by SPRING Singapore.
SS 476 Specification for high slag blastfurnace cement.	SS EN 197-4
SS 477 Specification for Portland blastfurnace cement.	SS EN 197-4
SS 557 Code of practice for demolition.	Still current.
SS CP 4 Code of practice for foundations.	To be reviewed by SPRING 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 use of timber.	To be reviewed by SPRING 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.	To be reviewed by SPRING Singapore.