

5.4 STAIRS

Stairs are the most common means of vertical egress in dwellings. Code requirements for stairs have been derived from evolving practices found to provide reasonable safety and convenience.

5.4.1 General

All stairs must be designed and constructed such that treads and risers have a uniform rise and run. Stairways may contain both curved and straight portions of stairs provided the riser height is uniform throughout the entire flight and the curved portion conforms with Subsection 5.4.4. Where interior stairs extend through the roof of a dwelling, they must be protected from ice and snow.

5.4.2 Stair Dimensions

Code requirements for stair dimensions are illustrated in Figure 5.4.2 (a). The rise and run of stairs, the provision of nosings or backslopes, the minimum width of stairs and the minimum head room are all prescribed by the Code.

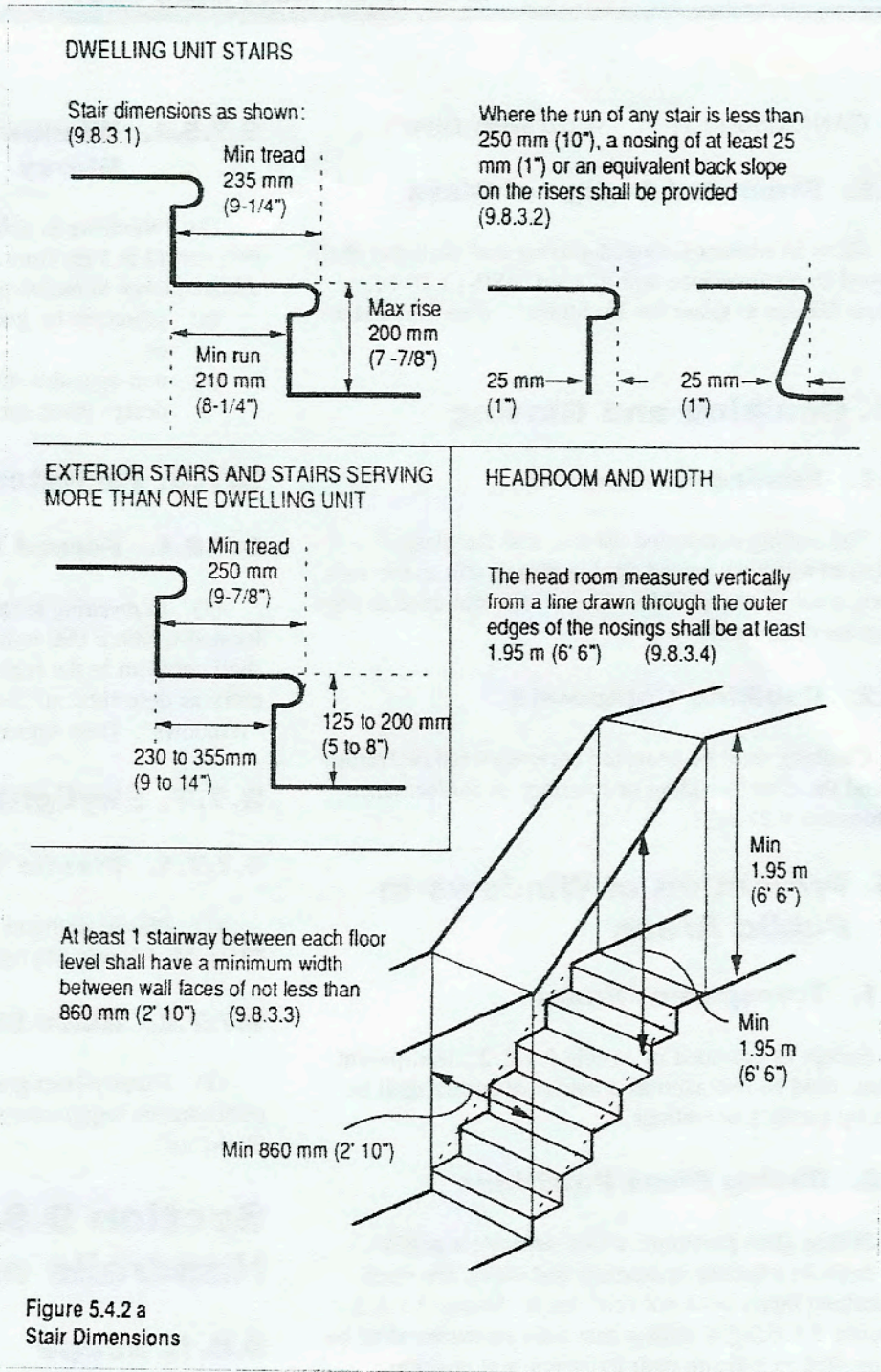


Figure 5.4.2 a
Stair Dimensions

(a) protected by *guards* in accordance with Subsection 9.8.8., or

(b) non-openable and designed to withstand the lateral design loads for *guards* as provided in Articles 4.1.5.15. or 9.8.8.2.

9.7.6. Resistance to Forced Entry

9.7.6.1. Forced Entry Through Windows

(1) In *dwelling units*, windows, any part of which is located within 2 000 mm of adjacent ground level, shall conform to the requirements for resistance to forced entry as described in Clause 10.13 of CAN/CSA-A440-M, "Windows".

9.7.7. Skylights

9.7.7.1. Plastic Skylights

(1) Plastic skylights shall conform to CAN/CGSB-63.14-M, "Plastic Skylights".

9.7.7.2. Glass Skylights

(1) Factory-built glass skylights shall meet the performance requirements of CAN/CGSB-63.14-M, "Plastic Skylights".

Section 9.8. Stairs, Ramps, Handrails and Guards

9.8.1. Application

9.8.1.1. General

(1) This Section applies to the design and construction of interior and exterior stairs, steps, ramps, railings and *guards*.

9.8.1.2. Exit Stairs, Ramps and Landings

(1) Where a stair, ramp or landing forms part of an *exit*, the appropriate requirements in Sections 9.9. and 9.10. shall also apply.

9.8.1.3. Escalators and Moving Walkways

(1) Escalators and moving walkways shall conform to the appropriate requirements in Part 3.

9.8.2. Stair Dimensions

9.8.2.1. Stair Width

(1) Required *exit* stairs and public stairs shall have a width, measured between wall faces or *guards*, of not less than 900 mm.

(2) At least 1 stair between each floor level within a *dwelling unit*, and exterior stairs serving a single *dwelling unit* except required *exit* stairs, shall have a width of not less than 860 mm.

9.8.2.2. Height over Stairs

(1) The clear height over stairs measured vertically from a line drawn through the leading edges of the treads, shall be not less than,

- (a) 1 950 mm for stairs within *dwelling units*, and
- (b) 2 050 mm for stairs not within *dwelling units*.

9.8.3. Stair Configurations

9.8.3.1. Straight and Curved Runs in Stairs

(1) Except as provided in Sentence (2), stairs shall consist of,

- (a) straight-runs, or
- (b) curved-runs.

(2) Stairs within *dwelling units* shall consist of,

- (a) straight-runs,
- (b) curved-runs,
- (c) straight-runs with winders, or
- (d) straight-runs with curved-runs.

9.8.3.2 Minimum Number of Risers

(1) Except for stairs within a *dwelling unit*, at least 3 risers shall be provided in interior flights.

9.8.3.3. Maximum Height of Stairs

(1) The vertical height between any landings shall not exceed 3.7 m.

9.8.4. Step Dimensions

9.8.4.1. Uniformity and Tolerances for Risers and Treads

(1) Except as provided in Sentence (2), risers shall have uniform height in any one flight with a maximum tolerance of,

- (a) 6 mm between adjacent treads or landings, and

(b) 6 mm between the tallest and shortest risers in a flight.

(2) Except for required *exit* stairs, where the top or bottom riser in a stair adjoins a sloping finished walking surface such as a garage floor, driveway or sidewalk, the height of the riser across the stair shall vary by not more than 1 in 12.

(3) Treads shall have uniform run and tread depth, with a maximum tolerance of,

(a) 6 mm between adjacent treads, and

(b) 6 mm between the deepest and shallowest runs and treads in a flight.

(4) Where angled treads or winders are incorporated into a stair, the treads in all sets of angled treads or winders within a flight shall turn in the same direction.

(5) Cross-slope of treads shall not exceed 1 in 100.

9.8.4.2. Dimensions for Risers

(1) Risers shall conform to Table 9.8.4.2.

Table 9.8.4.2. - Riser Height, Run and Tread Depth for Rectangular Treads Forming Part of Sentences 9.8.4.2.(1) and 9.8.4.3.(1)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7
Stair Type	All Steps		Rectangular Treads			
	Rise, mm		Run, mm		Tread Depth, mm	
	max.	min.	max.	min.	max.	min.
Service and <i>mezzanines</i> in <i>live/work units</i> ⁽¹⁾	no limit	125	355	no limit	355	no limit
Private ⁽²⁾	200	125	355	210	355	235
Public ⁽³⁾	200	125	355	230	355	250

Notes to Table 9.8.4.2.:

(1) Service stairs serve areas used only as *service rooms* or *service spaces* and stairs that serve *mezzanines* not exceeding 20 m² within *live/work units*.

(2) Private stairs are interior stairs within *dwelling units* and exterior stairs serving a single *dwelling unit*.

(3) Public stairs are all stairs not described as service stair or private stairs.

9.8.4.3. Dimensions for Rectangular Treads

(1) The run and tread depth of rectangular treads shall conform to Table 9.8.4.2.

(2) The depth of a rectangular tread shall be not less than its run and not more than its run plus 25 mm.

9.8.4.4. Dimensions for Angled Treads

(1) Angled treads in required *exit* stairs shall comply with Article 3.4.6.8.

(2) Except as provided in Article 9.8.4.5., angled treads in other than required *exit* stairs shall have an average run of not less than 200 mm and a minimum run of 150 mm.

(3) The depth of an angled tread shall be not less than its run at any point and not more than its run plus 25 mm.

9.8.4.5. Winders

(1) Stairs within *dwelling units* are permitted to contain winders that converge to a centre point provided,

(a) the winders turn through an angle of not more than 90°,

(b) individual treads turn through an angle of not less than 30° or not more than 45°, and

(c) adjacent winders turn through the same angle.

(2) Where more than one set of winders described in Sentence (1) is provided in a single stairway between adjacent floor levels, such winders shall be separated in plan by at least 1200 mm.

9.8.4.6. Leading Edges of Treads

(1) Leading edges of treads that are bevelled or rounded shall,

(a) not reduce the required tread depth by more than 15 mm, and

(b) not, in any case, exceed 25 mm horizontally.

9.8.4.7. Interior Stairs Extending Through the Roof

(1) Interior stairways extending through the roof of a *building* shall be protected from ice and snow.

9.8.5. Ramps

9.8.5.1. Application

(1) This Subsection applies to pedestrian ramps except ramps in a *barrier-free* path of travel.

(2) Ramps in a *barrier-free* path of travel shall conform to the requirements in Article 3.8.3.4.

9.8.5.2. Ramp Width

(1) Except for required *exit* ramps, public ramps shall have a width of not less than 900 mm.

(2) Ramps within *dwelling units*, and exterior ramps serving a single *dwelling unit* except required *exit* ramps, shall have a width of not less than 860 mm.

9.8.5.3. Height over Ramps

(1) The clear height over ramps shall be not less than,

- (a) 1 950 mm for ramps within *dwelling units*, and
- (b) 2 050 mm for ramps not within *dwelling units*.

9.8.5.4. Slope

(1) The slope of ramps shall be not more than,

- (a) 1 in 10 for exterior ramps,
- (b) 1 in 10 for interior ramps serving *residential occupancies*,
- (c) 1 in 6 for *mercantile* or *industrial occupancies*, and
- (d) 1 in 8 for all other *occupancies*.

9.8.5.5. Maximum Rise

(1) Where the slope of the ramp is greater than 1 in 12, the maximum rise between floors or landings shall be 1 500 mm.

9.8.6. Landings

9.8.6.1. Application

(1) This Subsection applies to landings, except landings for ramps in a *barrier-free* path of travel.

(2) Landings for ramps in a *barrier-free* path of travel shall conform to the requirements in Article 3.8.3.4.

(3) Finished floors, and ground surfaces with a slope not exceeding 1 in 100, at the top and bottom of stairs or ramps shall be considered as landings.

9.8.6.2. Required Landings

(1) Except as provided in Sentences (2) to (4) and Sentence 9.9.6.6.(2), a landing shall be provided,

- (a) at the top and bottom of each flight of interior and exterior stairs, including stairs in garages,
- (b) at the top and bottom of every ramp with a slope greater than 1 in 50, and

(c) where a doorway opens onto a stair or ramp.

(2) Where a door at the top of a stair in a *dwelling unit* swings away from the stair, no landing is required between the doorway and the stair.

(3) Except for an entrance from an attached garage, a landing may be omitted at the top of an exterior stair serving a secondary entrance to a single *dwelling unit*, provided,

(a) the stair does not contain more than 3 risers,

(b) except as provided in Clause (c), the door is a sliding door or swings away from the stair, and

(c) where a storm or screen door is provided, it may swing over the stair if it is equipped with hardware to hold it open.

(4) A landing may be omitted at the bottom of an exterior stair or ramp provided there is no obstruction, such as a gate or door, within the lesser of the width of the stair or ramp or,

(a) 900 mm for stairs or ramps serving a single *dwelling unit*, and

(b) 1100 mm for stairs or ramps not serving a single *dwelling unit*.

9.8.6.3. Dimensions of Landings

(1) Except as provided in Sentences (2) to (4), the width and length of landings shall comply with Table 9.8.6.3.

(2) Where stairs or ramps of different widths adjoin a single landing, the width of the landing shall be,

(a) not less than the greater required stair or ramp width where one or more of the stair or ramp widths do not exceed their respective required widths, or

(b) not less than the lesser actual stair or ramp width where all of the widths of the stairs or ramps exceed their respective required widths.

(3) Where a door swings toward a stair, the full arc of the swing shall be over the landing.

(4) Where a doorway or stairway opens onto the side of a ramp, the landing shall extend for a distance of not less than 300 mm on either side of the doorway or stairway, except on a side abutting an end wall.

Table 9.8.6.3. - Dimensions of Landings Forming Part of Sentence 9.8.6.3.(1)

Column 1	Column 2	Column 3	Column 4
Application	Landing Configuration	Minimum Width, mm	Length, mm
Stairs and ramps serving a single <i>dwelling unit</i>	In straight-run stair or ramp, or landing turning through less than 30°, within a <i>dwelling unit</i>	Width of stair or ramp	Not less than 860
	In straight-run exterior stair or ramp, or exterior landing turning through less than 30°	Width of stair or ramp	Not less than 900
	Landing turning through an angle of 30° or more, but less than 90°	Width of stair or ramp measured at right angle to path of travel	(a) Not less than 230 measured at the inside edge of the landing, and (b) Not less than 370 measured 230 mm from the inside edge of landing or handrail
	Landing turning through not less than 90°	Width of stair or ramp measured at right angle to path of travel	Not less than width of landing
Stairs and ramps serving other than single <i>dwelling units</i>	In straight-run stair or ramp, or landing turning through less than 30°	Width of stair or ramp	Lesser of required width of stair or ramp, or 1 100
	Landing turning through 30° or more	Width of stair or ramp measured at right angle to path of travel	Not less than width of stair or landing

9.8.6.4. Height over Landings

(1) The clear height over landings shall be not less than,

- (a) 1 950 mm for landings within *dwelling units*, and
- (b) 2 050 mm for landings not within *dwelling units*.

9.8.7. Handrails

9.8.7.1. Required Handrails

(1) Except as permitted in Sentences (2) and (3), a handrail shall be provided,

- (a) on at least one side of stairs or ramps less than 1 100 mm in width,
- (b) on 2 sides of curved stairs or ramps of any width, except curved stairs within *dwelling units*, and
- (c) on 2 sides of stairs or ramps 1 100 mm in width or greater.

(2) Handrails are not required for,

- (a) interior stairs having not more than 2 risers and serving a single *dwelling unit*,
- (b) exterior stairs having not more than 3 risers and serving a single *dwelling unit*,
- (c) ramps with a slope of not less than 1 in 12, or
- (d) ramps rising not more than 400 mm.

(3) Only one handrail is required on exterior stairs having more than 3 risers provided such stairs serve a single *dwelling unit*.

9.8.7.2. Continuity of Handrails

(1) Except as provided in Sentence (2), at least one required handrail shall be continuous throughout the length of the stair or ramp, including landings, except where interrupted by,

- (a) doorways, or
- (b) newel posts at changes in direction.

(2) For stairs or ramps serving a single *dwelling unit*, at least one handrail shall be continuous throughout the length of the stair or ramp, except where interrupted by,

- (a) doorways,
- (b) landings, or
- (c) newel posts at changes in direction.

9.8.7.3. Termination of Handrails

(1) Handrails shall be terminated in a manner that will not obstruct pedestrian travel or create a hazard.

(2) Except for stairs and ramps serving a single *dwelling unit*, at least one handrail at the sides of a stair or ramp shall extend horizontally not less than 300 mm beyond the top and bottom of each stair or ramp.

9.8.7.4. Height of Handrails

(1) The height of handrails on stairs and ramps shall be measured vertically from the top of the handrail to,

- (a) a line drawn through the leading edge of the stair treads served by the handrail, or
- (b) the surface of the ramp, floor or landing served by the handrail.

(2) Except as provided in Sentence (3), the height of handrails on stairs and ramps shall be,

- (a) not less than 800 mm, and
- (b) not more than 965 mm.

(3) Where *guards* are required, handrails required on landings shall be not more than 1 070 mm in height.

9.8.7.5. Ergonomic Design

(1) A clearance of not less than 50 mm shall be provided between a handrail and any surface behind it.

(2) All handrails shall be constructed so as to be continually graspable along their entire length with no obstruction on or above them to break a handhold, except where the handrail is interrupted by newels at changes in direction.

9.8.7.6. Projections into Stairs and Ramps

(1) Handrails and projections below handrails, including handrail supports and stair stringers shall not project more than 100 mm into the required width of a stair or ramp.

9.8.7.7. Design and Attachment of Handrails

(1) Handrails and any *building* element that could be used as a handrail shall be designed and attached in such a manner to resist,

- (a) a concentrated load at any point of not less than 0.9 kN, and
- (b) for handrails other than those serving a single *dwelling unit*, a uniformly distributed load of 0.7 kN/m.

(2) Where a handrail serving a single *dwelling unit* is attached to wood studs or blocking, the attachment shall be deemed to comply with Sentence (1) where,

- (a) the attachment points are spaced not more than 1.2 m apart,
- (b) the first attachment point at either end is located not more than 300 mm from the end of the handrail, and
- (c) the fasteners consist of no fewer than 2 wood screws at each point, penetrating not less than 32 mm into solid wood.

9.8.8. Guards

9.8.8.1. Required Guards

(1) Except as provided in Sentences (2) and (3), every surface to which access is provided for other than maintenance purposes, including but not limited to flights of steps and ramps, exterior landings, porches, balconies, *mezzanines*, galleries and raised walkways, shall be protected by a *guard* on each side that is not protected by a wall for the length where,

- (a) there is a difference in elevation of more than 600 mm between the walking surface and the adjacent surface, or
- (b) the adjacent surface within 1.2 m from the walking surface has a slope of more than 1 in 2.

(2) *Guards* are not required,

- (a) at loading docks,
- (b) at floor pits in *repair garages*, or
- (c) where access is provided for maintenance purposes only.

(3) When an interior stair has more than 2 risers or an interior ramp rises more than 400 mm, the sides of the stair or ramp and the landing or floor level around the stairwell or ramp shall be protected by a *guard* on each side that is not protected by a wall.

9.8.8.2. Loads on Guards

(1) Except as provided in Sentence (5), *guards* shall be designed to resist the loads specified in Table 9.8.8.2.

(2) Where the width and spacing of balusters in *guards* within *dwelling units*, and exterior *guards* serving not more than 2 *dwelling units* is such that 3 balusters can be engaged by a load imposed over the 300 mm width, the load shall be imposed so as to engage 3 balusters.

(3) None of the loads specified in Table 9.8.8.2. need be considered to act simultaneously.

(4) For *guards* within *dwelling units* and for exterior *guards* serving not more than 2 *dwelling units*, Table 9.8.8.2. need not apply where the *guard* construction has been demonstrated to provide effective performance.

(5) *Guards* constructed in accordance with the requirements in Supplementary Standard SB-7 shall be deemed to satisfy the requirements of Sentence (1).

**Table 9.8.8.2. - Specified Loads for Guards
Forming Part of Sentence 9.8.8.2.(1)**

Column 1	Column 2	Column 3	Column 4
Location of Guard	Minimum Design Loads		
	Horizontal Load Applied Inward or Outward at any Point at the Top of the Guard	Horizontal Load Applied Inward or Outward on Elements Within the Guard, Including Solid Panels and Pickets	Evenly Distributed Vertical Load Applied at the Top of the Guard
<i>Guards</i> within <i>dwelling units</i> and exterior <i>guards</i> serving not more than 2 <i>dwelling units</i>	0.5 kN/m or concentrated load of 1.0 kN applied at any point ⁽¹⁾	0.5 kN applied over a maximum width of 300 mm and a height of 300 mm ⁽²⁾	1.5 kN/m
<i>Guards</i> serving access walkways to equipment platforms, contiguous stairs and similar areas	Concentrated load of 1.0 kN applied at any point	Concentrated load of 0.5 kN applied at any point on individual elements	1.5 kN/m
All other <i>guards</i>	0.75 kN/m or concentrated load of 1.0 kN applied at any point ⁽¹⁾	Concentrated load of 0.5 kN applied at any point on individual elements	1.5 kN/m

Notes to Table 9.8.8.2.:

(1) The load that creates the most critical condition shall apply.

(2) See Sentence (2).

9.8.8.3. Height of Guards

(1) Except as provided in Sentences (2) to (4), all *guards* shall be not less than 1 070 mm high.

(2) All *guards* within *dwelling units* shall be not less than 900 mm high.

(3) Exterior *guards* serving not more than one *dwelling unit* shall be not less than 900 mm high where the walking surface served by the *guard* is not more than 1 800 mm above the finished ground level.

(4) *Guards* for flights of steps, except in required *exit* stairs, shall be not less than 900 mm high.

(5) The height of *guards* for flights of steps shall be measured vertically from a line drawn through the leading edge of the treads served by the *guard*.

9.8.8.4. Guards for Floors and Ramps in Garages

(1) Except for floors of garages referred to in Section 9.35., where garage floors or ramps are 600 mm or more above the adjacent ground or floor level, every opening through a garage floor and the perimeter of floors and ramps that have no exterior walls shall be provided with,

(a) a continuous curb not less than 150 mm in height, and

(b) a *guard* not less than 1 070 mm above the floor level.

9.8.8.5. Openings in Guards

(1) Except as provided in Sentence (2), openings through any *guard* that is required by Article 9.8.8.1. shall be of a size that will prevent the passage of a spherical object having a diameter of 100 mm unless it can be shown that the location and size of openings that exceed this limit do not represent a hazard.

(2) Openings through any *guard* that is required by Article 9.8.8.1. and that is installed in a *building of industrial occupancy* shall be of a size that will prevent the passage of a spherical object having a diameter of 200 mm unless it can be shown that the location and size of such openings that exceed this limit do not represent a hazard.

(3) Unless it can be shown that the location and size of openings that do not comply with the following limits do not represent a hazard, openings through any *guard* that is not required by Article 9.8.8.1. and that serves a *building of other than industrial occupancy*, shall be of a size that,

(a) will prevent the passage of a spherical object having a diameter of 100 mm, or

(b) will permit the passage of a spherical object having a diameter of 200 mm.

9.8.8.6. Design to Prevent Climbing

(1) *Guards* required by Article 9.8.8.1., except those in *industrial occupancies* and where it can be shown that the location and size of openings do not represent a hazard, shall be designed so that no member, attachment or opening will facilitate climbing.

(2) *Guards* shall be deemed to comply with Sentence (1) where any elements protruding from the vertical and located within the area between 140 mm and 900 mm above the floor or walking surface protected by the *guard*,

- (a) are located more than 450 mm horizontally and vertically from each other,
- (b) provide not more than 15 mm horizontal offset,
- (c) do not provide a toe-space more than 45 mm horizontally and 20 mm vertically, or
- (d) present more than a 1-in-2 slope on the offset.

9.8.8.7. Glass in Guards

(1) Glass in *guards* shall be,

- (a) safety glass of the laminated or tempered type conforming to CAN/CGSB-12.1-M, "Tempered or Laminated Safety Glass", or
- (b) wired glass conforming to CAN/CGSB-12.11-M, "Wired Safety Glass".

9.8.9. Construction

9.8.9.1. Loads on Stairs and Ramps

(1) Except as required in Articles 9.8.9.4. and 9.8.9.5., stairs and ramps shall be designed for strength and rigidity under uniform loading criteria to support specified loads of,

- (a) 1.9 kPa for stairs and ramps serving a single *dwelling unit*, and
- (b) 4.8 kPa for other stairs and ramps.

9.8.9.2. Exterior Concrete Stairs

(1) Exterior concrete stairs with more than 2 risers and 2 treads shall be,

- (a) supported on unit masonry or concrete walls or piers not less than 150 mm in cross section, or
- (b) cantilevered from the main *foundation* wall.

(2) Stairs described in Sentence (1), when cantilevered from the *foundation* wall, shall be constructed and installed in conformance with Subsection 9.8.10.

(3) The depth below ground level for *foundations* for exterior steps shall conform to the requirements in Section 9.12.

9.8.9.3. Exterior Wood Steps

(1) Exterior wood steps shall not be in direct contact with the ground unless suitably treated with a wood preservative.

9.8.9.4. Wooden Stair Stringers

(1) Wooden stair stringers shall,

(a) have a minimum effective depth of 90 mm, measured perpendicularly to the bottom of the stringer at the point of minimum cross-section, and an over-all depth of not less than 235 mm,

(b) be supported and secured top and bottom,

(c) be not less than 25 mm actual thickness if supported along their length and 38 mm actual thickness if unsupported along their length, and

(d) except as permitted in Sentence (2), be spaced not more than 900 mm o.c. for stairs serving not more than one *dwelling unit*, and 600 mm o.c. in other stairs.

(2) For stairs serving not more than one *dwelling unit* where risers support the front portion of the tread, the space between stringers shall be not more than 1 200 mm.

9.8.9.5. Treads

(1) Stair treads of lumber, plywood or O-2 grade OSB within *dwelling units* shall be not less than 25 mm actual thickness, except that if open risers are used and the distance between stringers exceeds 750 mm, the treads shall be not less than 38 mm actual thickness.

(2) Stair treads of plywood or OSB, that are not continuously supported by the riser shall have their face grain or direction of face orientation at right angles to the stringers.

9.8.9.6. Finish for Treads, Landings and Ramps

(1) Except as required in Sentence (4), the finish for treads, landings and ramps shall be,

(a) wear resistant,

(b) slip resistant, and

(c) smooth, even, and free from open defects.

(2) The finish for treads and landings of interior stairs in *dwelling units*, including those from an attached garage serving a single *dwelling unit*, shall be deemed to comply with Sentence (1) where these treads, landings, or ramps are finished with,

(a) hardwood,

- (b) vertical grain softwood,
- (c) resilient flooring,
- (d) low-pile carpet,
- (e) mat finish ceramic tile,
- (f) concrete, or
- (g) for stairs to unfinished *basements* and to garages, plywood.

(3) Stairs and ramps, except those serving a single *dwelling unit* or *service rooms* or *spaces*, shall have either a colour contrast or a distinctive pattern to demarcate,

- (a) the leading edge of the treads,
- (b) the leading edge of the landing, and
- (c) the beginning and end of a ramp.

(4) Treads and landings of interior and exterior stairs and ramps, other than those within *dwelling units*, shall have a slip-resistant finish or be provided with slip-resistant strips that extend not more than 1 mm above the surface.

9.8.10. Cantilevered Precast Concrete Steps

9.8.10.1. Design

(1) Exterior concrete steps and their anchorage system that are cantilevered from a *foundation* wall shall be designed and installed to support the loads to which they may be subjected.

9.8.10.2. Anchorage

(1) Cantilevered concrete steps in Article 9.8.10.1. shall be anchored to concrete *foundation* walls at least 200 mm thick.

9.8.10.3. Prevention of Damage Due to Frost

(1) Suitable precautions shall be taken during backfilling and grading operations to ensure that subsequent freezing of the *soil* will not cause uplift forces on the underside of cantilevered concrete steps to the extent that the steps or the walls to which they are attached will be damaged.