PART 3.9.2 BALUSTRADES AND HANDRAILS

Appropriate *Performance Requirements*:

(a) Where an alternative balustrade or other barrier is proposed as an *Alternative Solution* to that described in **Part 3.9.2**, that proposal must comply with—

(i) *Performance Requirement* **P2.1.1**; and

(ii) *Performance Requirement* **P2.5.2**; and

(iii) the relevant *Performance Requirements* determined in accordance with **1.0.10**.

(b) Where an alternative handrail is proposed as an *Alternative Solution* to that described in **Part 3.9.2**, that proposal must comply with—

(i) *Performance Requirement* **P2.1.1**; and

(ii) *Performance Requirement* **P2.5.1(b)(i)**; and

(iii) the relevant *Performance Requirements* determined in accordance with **1.0.10**.

Acceptable construction practice

3.9.2.1 Application

Compliance with this acceptable construction practice satisfies *Performance Requirements* **P2.5.2** for balustrades or other barriers and **P2.5.1(b)(i)** for handrails.

3.9.2.2 When balustrades or other barriers are required

(a) A continuous balustrade or other barrier, except for a barrier provided to an openable window covered by **3.9.2.5**, must be provided along the side of any roof to which public access is provided, any stairway or ramp, any floor, corridor, hallway, balcony, deck, verandah, mezzanine, access bridge or the like and along the side of any delineated path of access to a building, if—

(i) it is not bounded by a wall; and

(ii) its level above the surface beneath, is more than 1 m.

(b) The requirements of **(a)** do not apply to—

(i) areas referred to in **3.9.1.2(b)**; or

(ii) a retaining wall unless the retaining wall forms part of, or is directly associated with a delineated path of access to a building from the road, or a delineated path of access between buildings.

3.9.2.3 Balustrades or other barrier construction

(a) The height of a balustrade or other barrier must be in accordance with the following:

(i) The height must not be less than 865 mm above the nosings of the stair treads or the floor of a ramp.

(ii) The height must not be less than—

(A) 1 m above the floor of any access path, balcony, *landing* or the like (see **Figure 3.9.2.1**); or

(B) 865 mm above the floor of a *landing* to a stair or ramp where the balustrade or other barrier is provided along the inside edge of the *landing* and does not exceed a length of 500 mm.

(b) A transition zone may be incorporated where the balustrade or other barrier height changes from 865 mm on the stair *flight* or ramp to 1 m at the *landing* (see **Figure 3.9.2.2**).

(c) Openings in balustrades (including decorative balustrades) or other barriers must be constructed so that they do not permit a 125 mm sphere to pass through it and for stairs, the opening is measured above the nosing line of the stair treads.

(d) A balustrade or other barrier, except a window serving as a barrier, must be designed to take loading forces in accordance with AS/NZS 1170.1.

Explanatory Information:

A window forming part of a barrier is not *required* to comply with AS/NZS 1170.1 as it is exempted by **3.9.2.3(d)**. However, a window serving as a barrier must comply with the glazing assembly provisions of AS 2047 or AS 1288. These provisions consider the wind loading on the glass and human impact requirements.

(e) For floors more than 4 m above the surface beneath, any horizontal elements within the balustrade or other barrier between 150 mm and 760 mm above the floor must not facilitate climbing.

Explanatory Information:

For a *window* forming part of a barrier, a *window* sill between 150 mm and 760 mm above the floor is deemed to facilitate climbing.

(f) A wire balustrade must be constructed in accordance with the following and is deemed to meet the requirements of **(c)**:

(i) For horizontal wire systems—

(A) when measured with a strain indicator, it must be in accordance with the tension values in **Table 3.9.2.1**; or

(B) must not exceed the maximum deflections in **Table 3.9.2.3**.

(ii) For non-continuous vertical wire systems, when measured with a strain indicator, must be in accordance with the tension values in **Table 3.9.2.1** (see Note 4).

(iii) For continuous vertical or continuous near vertical sloped wire systems—

(A) must have wires of no more than 2.5 mm diameter with a lay of 7×7 or 7×19 construction; and

(B) changes in direction at support rails must pass around a pulley block without causing permanent deformation to the wire; and

(C) must have supporting rails, constructed with a spacing of not more than 900 mm, of a material that does not allow deflection that would decrease the tension of the wire under load; and

(D) when the wire tension is measured with a strain indicator, it must be in accordance with the tension values in Table 3.9.2.2 and measured in the furthermost span from the tensioning device.

Explanatory information:

1. For the purpose of this clause, a wire balustrade consist of a series of tensioned wire rope connected to either vertical or horizontal supports serving as a guard to minimise the risk of a person falling from a roof, stairway, raised floor level or the like.
2. A wire balustrade excludes wire mesh fences and the like.
3. To assist in the application of 3.9.2.3(f), the following terms have been defined:
   (a) Continuous — where the wire spans three or more supports.
   (b) Non-continuous — where the wire only spans between two supports.
   (c) Pulley block — a device consisting of a wheel in which a wire runs around to change its direction.
   (d) Permissible deflection — is the allowable bending of the wire.
   (e) Support rails — are horizontal components of the balustrade system that span across the top and bottom to provide structural support.
4. Tables 3.9.2.1 and 3.9.2.2 contains tension requirements for wires in vertical wire balustrades systems with varying post spacings, wire spacings and wire types. The figures contained in the table were derived from testing the spacing combinations in order to prevent the passage of a 125 mm diameter solid cone penetrating between the wires at a predetermined force.
5. Care needs to be taken to ensure that wire tension will be maintained during the life of the balustrade. In some situations, it may be necessary to incorporate "lock-off" devices to prevent loosening of the wire.
6. Likewise, if a threaded anchor bears against a soft wood post or rail, the anchor may indent the post or rail, thus loosening the wire.
7. Temperature effects on the tension of the wire may be significant but there is little that can be done to allow for temperature variation in service. The shorter the wire span, the lesser the effect will be.
8. Stainless steel wire with a lay of 1×19 has the greatest elastic modulus and will take up the same load with less extension than equivalent wires with other lays.
9. Sharp ends of wires at terminations and swages need to be removed for the safety of children and other people. No wire end should protrude more than half the diameter of the wire from the swage or termination fitting.

Table 3.9.2.1 WIRE BALUSTRADE CONSTRUCTION – REQUIRED TENSION FOR STAINLESS STEEL HORIZONTAL WIRES

			Clear distance between posts (mm)								
			600	800	900	1000	1200	1500	1800	2000	2500
Wire dia. (mm)	Lay	Wire spacing (mm)	Minimum *required* tension in Newtons (N)								
2.5	7×7	60	55	190	263	415	478	823	1080	1139	X
		80	382	630	730	824	1025	1288	X	X	X
		100	869	1218	1368	X	X	X	X	X	X
2.5	1×19	60	35	218	310	402	585	810	1125	1325	X
		80	420	630	735	840	1050	1400	1750	X	X
		100	1140	1565	X	X	X	X	X	X	X
3.0	7×7	60	15	178	270	314	506	660	965	1168	1491
		80	250	413	500	741	818	1083	1370	1565	X
		100	865	1278	1390	1639	X	X	X	X	X
3.0	1×19	60	25	183	261	340	520	790	1025	1180	X
		80	325	555	670	785	1015	1330	1725	1980	X
		100	1090	1500	1705	1910	X	X	X	X	X
4.0	7×7	60	5	73	97	122	235	440	664	813	1178
		80	196	422	480	524	760	1100	1358	1530	2130
		100	835	1182	1360	1528	1837	2381	2811	3098	X
4.0	1×19	60	5	5	10	15	20	147	593	890	1280
		80	30	192	300	415	593	1105	1303	1435	1844
		100	853	1308	1487	1610	2048	2608	3094	3418	3849
4.0	7×19	60	155	290	358	425	599	860	1080	1285	1540
		80	394	654	785	915	1143	1485	1860	2105	2615
		100	1038	1412	1598	1785	2165	2735	X	X	X

Notes:

1. Lay = number of strands by the number of individual wires in each strand. For example a lay of 7×19 consists of 7 strands with 19 individual wires in each strand.
2. Where a change of direction is made in a run of wire, the tensioning device is to be placed at the end of the longest span.
3. If a 3.2 mm wire is used the tension figures for 3.0 mm wire are applied.
4. This table may also be used for a set of non-continuous (single) vertical wires forming a balustrade using the appropriate clear distance between posts as the vertical clear distance between the rails.
5. X = Not allowed because the required tension would exceed the safe load of the wire.

Table 3.9.2.1 WIRE BALUSTRADE CONSTRUCTION – REQUIRED TENSION FOR STAINLESS STEEL HORIZONTAL WIRES — continued

6. Tension measured with a strain indicator.

Table 3.9.2.2 CONTINUOUS WIRE BALUSTRADE CONSTRUCTION – REQUIRED TENSION FOR VERTICAL OR NEAR VERTICAL STAINLESS STEEL WIRES

Wire dia. (mm)	Lay	Widest spacing between wires (mm)	Maximum clear spacing between rails (mm)
			900
			Required tension in Newtons (N)
2.5	7×19	80	145
		100	310
		110	610
2.5	7×7	80	130
		100	280
		110	500

Notes:

1. Lay = number of strands by the number of individual wires in each strand. For example a lay of 7×19 consists of 7 strands with 19 individual wires in each strand.
2. Vertical wires require two pulley blocks to each 180° change of direction in the wire.
3. Near vertical wires may only require one pulley block for each change of direction.
4. Tension measured with a strain indicator.
5. The table only includes 7×7 and 7×19 wires due to other wires not having sufficient flexibility to make the necessary turns.

Table 3.9.2.3 WIRE BALUSTRADE CONSTRUCTION – MAXIMUM PERMISSIBLE DEFLECTION FOR STAINLESS STEEL WIRES

		Clear distance between posts(mm)					
		600	900	1200	1500	1800	2000
Wire dia. (mm)	Wire spacing (mm)	Maximum permissible deflection of each wire in mm when a 2 kg mass is suspended at mid span					
2.5	60	17	11	9	8	8	8
	80	7	5	5	5	X	X
3.0	60	19	13	8	7	7	7
	80	8	6	6	5	5	5
4.0	60	18	12	8	8	7	7
	80	8	6	4	4	4	4

Notes:

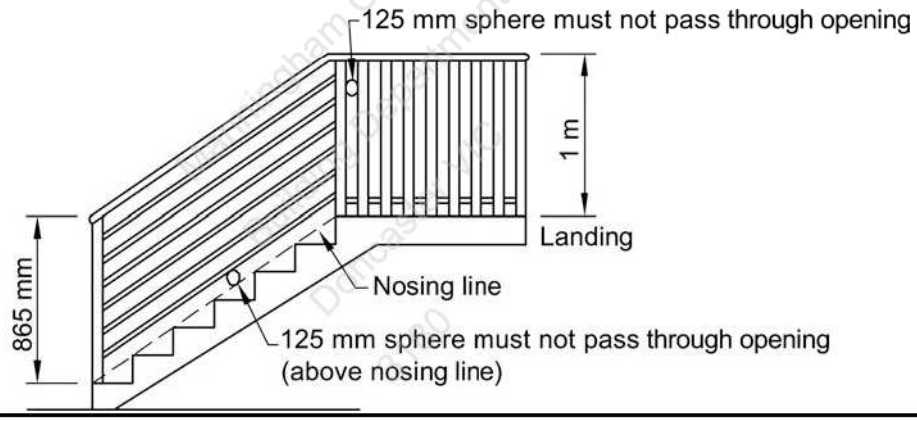
Table 3.9.2.3 WIRE BALUSTRADE CONSTRUCTION – MAXIMUM PERMISSIBLE DEFLECTION FOR STAINLESS STEEL WIRES — continued

1. Where a change of direction is made in a run of wire the 2 kg mass must be placed at the middle of the longest span.
2. If a 3.2 mm wire is used the deflection figures for 3.0 mm wire are applied.
3. This table may also be used for a set of non-continuous (single) vertical wires forming a balustrade using the appropriate clear distance between posts as the vertical clear distance between the rails. The deflection (offset) is measured by hooking a standard spring scale to the mid span of each wire and pulling it horizontally until a force of 19.6 N is applied.
4. X = Not allowed because the *required* tension would exceed the safe load of the wire.
5. This table has been limited to 60 mm and 80 mm spaces for 2.5 mm, 3 mm and 4 mm diameter wires because the *required* wire tensions at greater spacings would require the tension to be beyond the wire safe load limit, or the allowed deflection would be impractical to measure.

(g) A glass balustrade must comply with AS 1288.

Figure 3.9.2.1

BALUSTRADE OR OTHER BARRIER CONSTRUCTION



Note: For the purposes of this Figure, a 125 mm sphere must not pass between rails or through the opening when measured above the nosing line.

Figure 3.9.2.2

TRANSITION ZONES

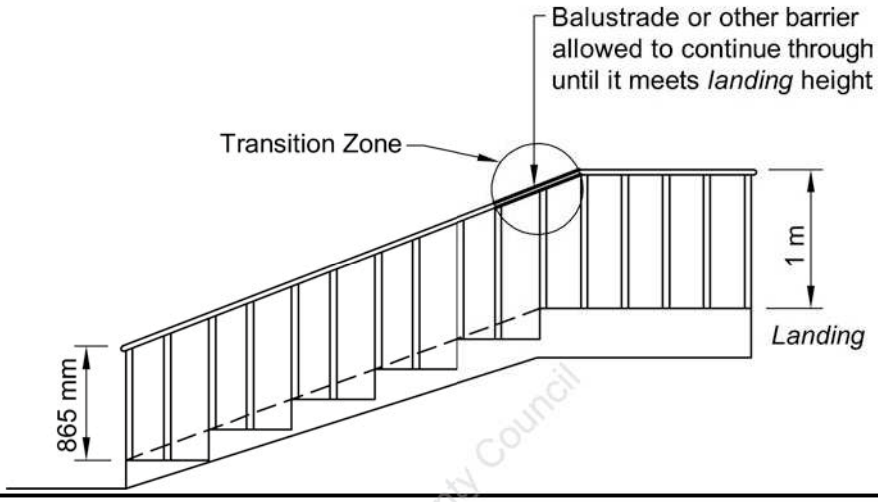
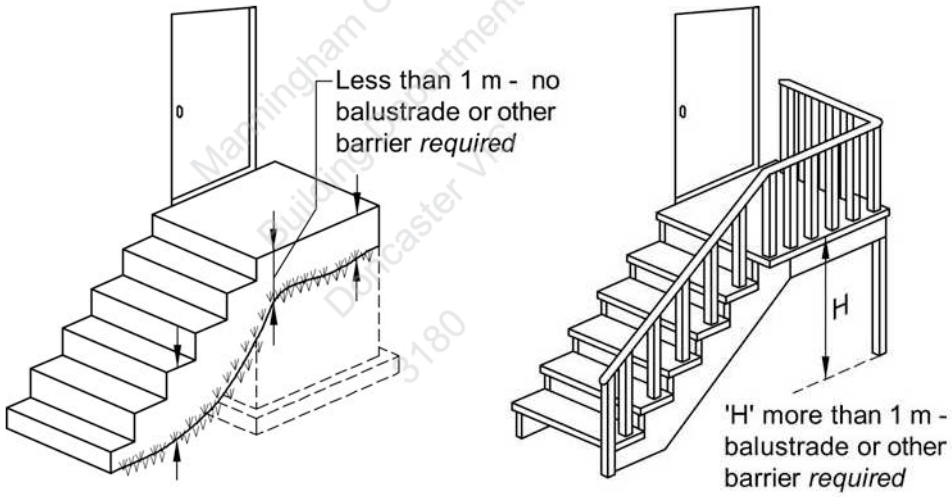


Figure 3.9.2.3

BALUSTRADES OR OTHER BARRIERS — WHEN REQUIRED



(a) Balustrade not required **(b) Balustrade required**

3.9.2.4 Handrails

(a) Handrails to a stairway or ramp must—

(i) be located along at least one side of the *flight* or ramp; and

(ii) be located along the full length of the *flight* or ramp, except in the case where a handrail is associated with a balustrade the handrail may terminate where the balustrade terminates; and

(iii) have the top surface of the handrail not less than 865 mm vertically above the nosings of the stair treads or the floor surface of the ramp; and

(iv) have no obstruction on or above them that will tend to break a handhold, except for newel posts, ball type stanchions, or the like.

(b) The requirements of **(a)** do not apply to—

(i) areas referred to in **3.9.1.2(b)**; or

(ii) a stairway or ramp providing a change in elevation of less than 1 m; or

(iii) a *landing*; or

(iv) a winder where a newel post is installed to provide a handhold; or

(v) a stairway or ramp in a Class 10 building.

Explanatory Information:

1. A balustrade top rail may be suitable as a handrail if it meets **3.9.2.4**.
2. A handrail is only *required* on one side of the *flight* or ramp.
3. The handrail may extend the full length of the *flight* or ramp except where the handrail is associated with the balustrade, in which case the handrail can terminate where the balustrade is allowed to terminate. This would allow for designer or geometric balustrades which may finish a few treads from the bottom of the stairway.
4. An example of where a handrail is not *required* would be a *flight* consisting of 5 *risers* as the change in elevation is less than 1 m.
5 A handrail is not *required* for winders if a newel post is installed to provide a handhold.

3.9.2.5 Protection of openable windows

(a) A window opening must be provided with protection, if the floor below the window in a bedroom is 2 m or more above the surface beneath.

(b) Where the lowest level of the window opening is less than 1.7 m above the floor, a window opening covered by **(a)** must comply with the following:

(i) The openable portion of the window must be protected with—

(A) a device capable of restricting the window opening; or

(B) a screen with secure fittings.

(ii) A device or screen *required* by **(i)** must—

(A) not permit a 125 mm sphere to pass through the window opening or screen; and

(B) resist an outward horizontal action of 250 N against the—

(aa) window restrained by a device; or

(bb) screen protecting the opening; and

(C) have a child resistant release mechanism if the screen or device is able to be removed, unlocked or overridden.

(c) A barrier with a height not less than 865 mm above the floor is *required* to an openable window—

(i) in addition to window protection, when a child resistant release mechanism is *required* by **(b)(ii)(C)**; and

(ii) where the floor below the window is 4 m or more above the surface beneath if the window is not covered by **(a)**.

(d) A barrier covered by **(c)** must not—

(i) permit a 125 mm sphere to pass through it; and

(ii) have any horizontal or near horizontal elements between 150 mm and 760 mm above the floor that facilitate climbing.

Explanatory information:

The intent of **3.9.2.5** is to limit the risk of a person (especially a young child) falling through an openable window. Where the floor level below an openable window is less than 2 m there are no specific requirements. For an openable window in a bedroom 2 m or more above the surface beneath, openable windows are *required* to restrict passage of a 125 mm sphere using any one of the following design solutions:

1. The window be designed such that any opening does not allow a 125 mm sphere to pass through (e.g. louvres).
2. The window be fitted with a fixed or dynamic device that is capable of restricting the window opening so it does not allow a 125 mm sphere to pass through and is difficult for a young child to operate. The restricting device must be capable of restricting a 250 N force when directed against the window such as a casement window or in attempting to push a sliding window open. An internal screen with similar parameters may be installed.
3. The window be fitted with an internal or external screen that does not allow a 125 mm sphere to pass through and which must resist a horizontal outward force of 250 N.

If the openable part of the window is at least 1.7 m above the floor, no further protection is *required*.

3.9.2.5(b)(ii)(C) relates to a screen or window restricting device protecting an openable window in a bedroom. The screen or opening restricting device may be installed in a manner that allows it to be removed, unlocked or overridden in the event of a fire or other emergency to allow safe egress. In these situations the unlocking device must be child resistant.

Child resistance could be achieved by the need to use a tool, key or two hands.

There are a number of hardware options available. Short chain winders and barrier screens will allow windows to comply with this requirement. Sliding window locks may lock a sash so a 125 mm sphere cannot pass through. Where provision is made to fully open the window beyond 125 mm then the child resistant release mechanism is *required* in addition to the device resisting a 250 N force as *required* by **3.9.2.5(b)(ii)(B)**.

3.9.2.5(c) in addition prescribes that an 865 mm barrier (sill) would be *required*. A wall beneath an openable window can be considered as the barrier if the criteria in **(d)** are met.

3.9.2.5(c)(ii) relates to the height of a barrier under an openable window in a room that is not a bedroom in a Class 1 building or a window in a Class 10 building.

The term 'window' is not italicised in **3.9.2.5** and as such, is not restricted to the definition of 'window' in the BCA. The reason for this is to also capture windows that may let in air but not light, e.g. metal louvres. A metal louvre or openable panel would not fit in the BCA definition of window but is subject to the window barrier provisions.