PART 3.9 SAFE MOVEMENT AND ACCESS

2010 Edition

PART 3.9.2 BALUSTRADES

Acceptable construction practice

3.9.2.1 Application

Compliance with this acceptable construction practice satisfies *Performance Requirement* P2.5.2 for balustrades or other barriers.

3.9.2.2 When balustrades or other barriers are required

a) A continuous balustrade or other barrier 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—

(A) 4 m where it is possible for a person to fall through an openable *window*; or

(B) 1 m in any other case (see Figure 3.9.2.3).

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; or

(C) 865 mm above the floor beneath an openable *window*.

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 any opening does not permit a 125 mm sphere to pass through it and for stairs, the space is tested above the nosing line.

d) A balustrade or other barrier must be designed to take loading forces in accordance with AS/NZS 1170.1.

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.

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 and horizontal 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 x 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)								
		60	55	190	263	415	478	823	1080	1139	X

2.5	**7x7**	**80**	382	630	730	824	1025	1288	X	X	X
		100	869	1218	1368	X	X	X	X	X	X
		60	35	218	310	402	585	810	1125	1325	X
2.5	**1x19**	**80**	420	630	735	840	1050	1400	1750	X	X
		100	1140	1565	X	X	X	X	X	X	X
		60	15	178	270	314	506	660	965	1168	1491
3.0	**7x7**	**80**	250	413	500	741	818	1083	1370	1565	X
		100	865	1278	1390	1639	X	X	X	X	X
		60	25	183	261	340	520	790	1025	1180	X
3.0	**1x19**	**80**	325	555	670	785	1015	1330	1725	1980	X
		100	1090	1500	1705	1910	X	X	X	X	X
		60	5	73	97	122	235	440	664	813	1178
4.0	**7x7**	**80**	196	422	480	524	760	1100	1358	1530	2130
		100	835	1182	1360	1528	1837	2381	2811	3098	X
		60	5	5	10	15	20	147	593	890	1280
4.0	**1x19**	**80**	30	192	300	415	593	1105	1303	1435	1844
		100	853	1308	1487	1610	2048	2608	3094	3418	3849
		60	155	290	358	425	599	860	1080	1285	1540
4.0	**7x19**	**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 7x19 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.
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)**
		80	145
2.5	**7x19**	**100**	310
		110	610
		80	130
2.5	**7x7**	**100**	280
		110	500

Notes:

1. Lay = number of strands by the number of individual wires in each strand. For example a lay of 7x19 consists of 7 strands with 19 individual wires in each strand.
2. Vertical wires require two pulley blocks to each 180^0 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 7x7 and 7x19 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:

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 gap when tested above the nosing line.

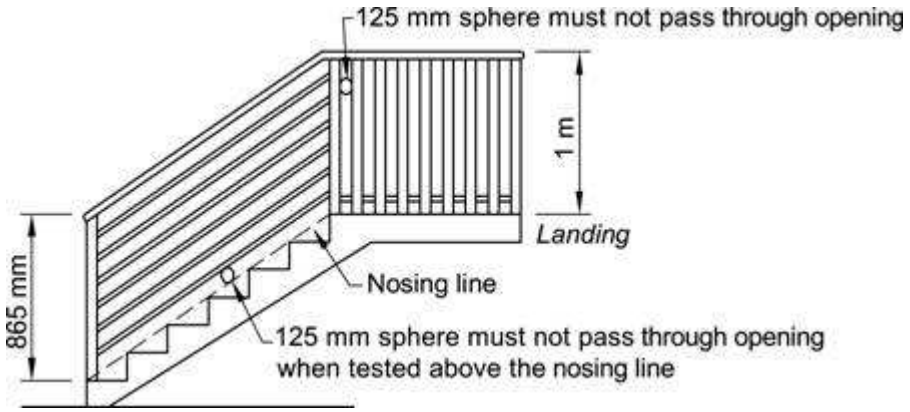

Figure 3.9.2.2

TRANSITION ZONES

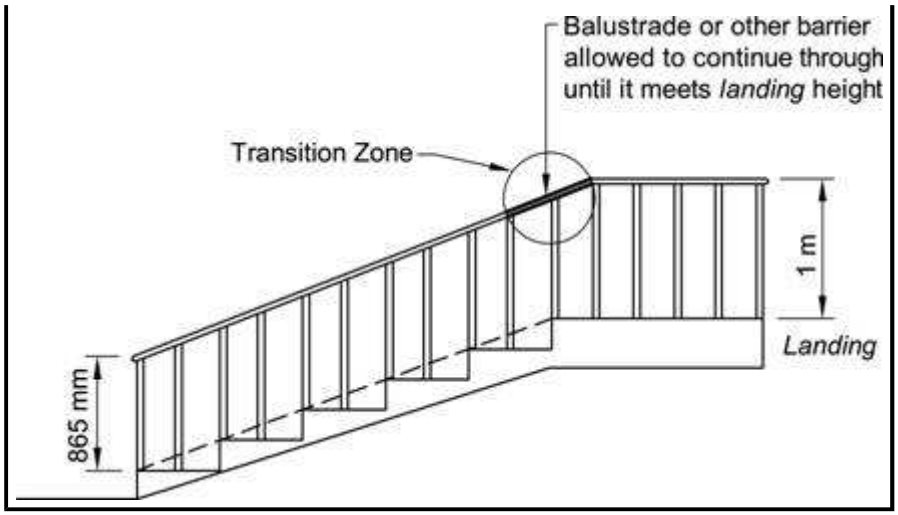

Figure 3.9.2.3

BALUSTRADES OR OTHER BARRIERS — WHEN REQUIRED