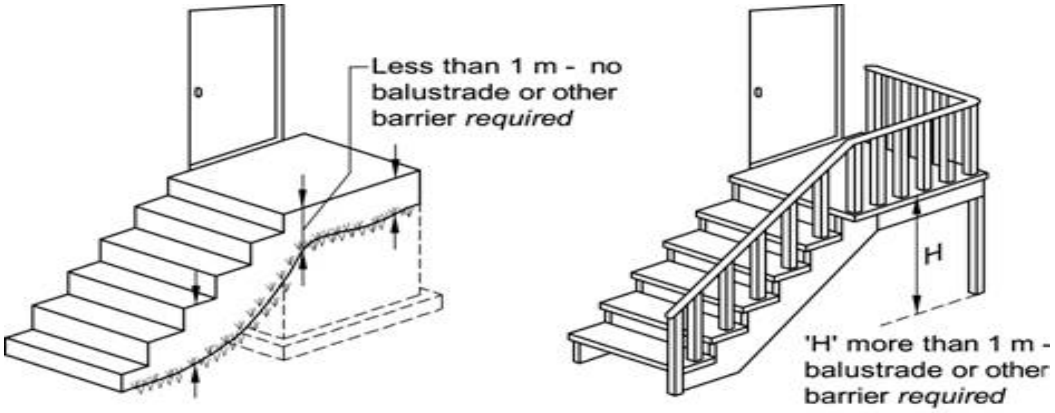
BALUSTRADES INFORMATION

GYMPIE REGIONAL COUNCIL

PO Box 155
Gympie QLD 4570
Phone: 1300 307 800
Fax: (07) 5481 0801
ABN: 91 269 530 353

When Balustrades are generally required

The Building Code of Australia requires a continuous balustrade or another barrier along the side of stairways, balconies, verandas, access bridges, decks and the like, if any level is more than 1 metre above the adjoining floor or finished ground level.

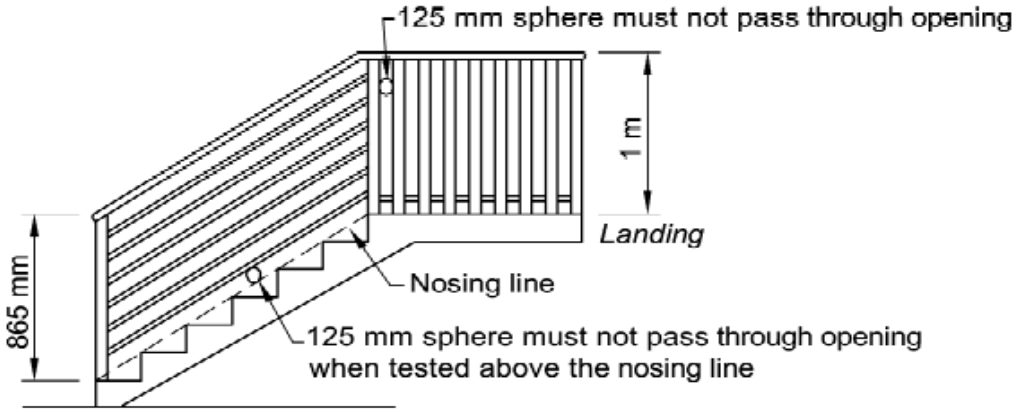


(a) Balustrade not required **(b) Balustrade required**

Balustrade Construction

Openings in balustrades must be constructed so that any opening does not permit a 125mm sphere to pass through it. The balustrade must also be designed to take loading forces in accordance with AS/NZS 1170.1.

For floors more than 4 metres above the ground, any horizontal elements within the balustrade between 150mm and 760 mm above the floor must not facilitate climbing.
For stairways, the height must not be less than 865mm above the nosing of the stair treads and for decks and the like; the height must not be less than 1 metre above the floor. (See figure 1 below)



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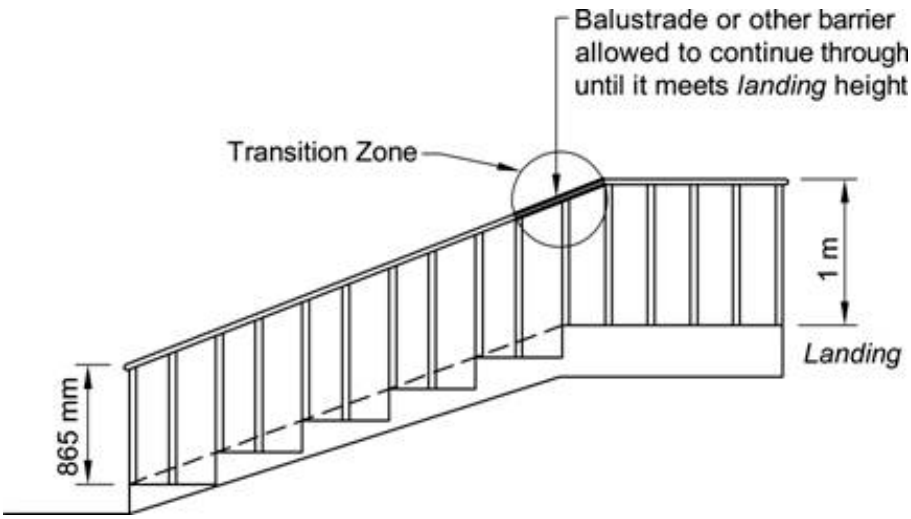
A transition zone may be incorporated where the balustrade or other barrier height changes from 865 mm on the stair flight or ramp to 1 m at the landing.



Stainless Steel Balustrades

The requirements for stainless steel balustrade are generally the same as for that indicated above. However it is the nature of Stainless Steel wire to flex open, allowing a larger gap than 125mm. (Testing was performed, and it is Council's experience that unless the gap is minimised and spacers are installed, the balustrade will not comply with the Building Code of Australia. The following construction is advised)

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	**7x19**	**80**	145
		100	310
		110	610
2.5	**7x7**	**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 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.

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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	**7x7**	**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	**1x19**	**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	**7x7**	**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	**1x19**	**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	**7x7**	**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	**1x19**	**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	**7x19**	**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 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.

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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.

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.