Technical Bulletin

1010 – Balustrades

March 2022 - V1.0

Australian Glass Group®

TB 1010 – Balustrades

Cited National Standards

- **AS/NZS 1170.1** Permanent, imposed & other actions
- **AS/NZS 1170.2** Wind Actions
- **AS 4055** Wind Loads For Housing
- **AS 1288** Glass in buildings – Selection and Installation

Cited International Standards

- **NZS 4223.3** Glazing in Buildings Part 3 – Human impact requirements

Although balustrades are a common item on many building projects and therefore appear relatively straight forward, there are multiple design constraints that need to be considered. Often these constraints can contradict one another, making the specification of a compliant system more complicated than originally anticipated. This Technical Bulletin serves to assist the reader in specifying & selecting the appropriate balustrade glass and hardware for any situation. Key points to consider for balustrade selection and specification;

- Occupancy type
- Wind pressure
- Post failure breakage performance
- Fixing method
- Barrier Geometry

Occupancy type

Occupancy type represents the loads that are placed on the barrier by the amount of people standing behind it. There are several types, which range from inside a residential house to a stadium. Occupancy type should not be confused with the term 'human impact'. Human impact also applies to maximum area of fully framed panes that can be touched by people nearby, such as doors, sidelights, full height windows at ground level etc. Occupancy type is specific to balustrades. Refer to **AS/NZS 1170.1** table 3.3, included on page 4 of this document.

- Occupancy A. Internal residential
- Occupancy A (other) external residential
- B/E/C3 Commercial spaces
- C1/C2/D areas next to fixed seating, retail spaces
- C5 Stadiums, large places of worship, concourses of shopping malls, some portions of schools & theatres.
- Often occupancies A (other) and C3/B/E require the same loads and heights as one another and are used interchangeably

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Wind pressures

Wind forces on a balustrade differ greatly depending on the size & shape of the structure and the balustrade location upon it. Means of calculating wind pressures are either **AS 4055** for small structures or **AS/NZS 1170.2** for large ones. Refer to AGG **Technical Bulletin 1009 - Wind Loads** for further detail.

Post failure breakage performance

Performance of a glass barrier after the glass is broken is outside the scope the current version of **AS 1288**, especially when it comes to structural laminated barriers without a handrail. At this point in time, AS 1288 is being updated with common factors seen in **NZS 4223**, the New Zealand glass standard. **NZS 4223** does cover the performance of all types of glass barriers after the glass has broken. Key points to remember are;

- All barriers will need to be physically tested for their performance after the glass has failed
- Mono toughened barriers in this regard will be governed by the handrail capacity – panes will have a **maximum** length
- Standard interlayer toughened laminates will be governed by either the handrail capacity or the capacity of the clips between panes if no handrail is present – panes will have a **maximum** length.
- Structural interlayer toughened laminates will be governed by the capacity of the interlayer itself – panes will have a **minimum** length in contrast with other barrier solutions.

Fixing method

Two key aspects of any glass design are breaking stress under ULS conditions, and deflection under SLS conditions. How the glass is attached to the structure will directly impact the deflection and breaking stress of any barrier system. For example, stand-off/spot fixings into concrete are quite rigid so they have higher stress in the glass with less deflection under any load compared to a channel system. Also, the size of the glass fixing will affect stress; a larger stand-off/spot fixing will place less stress on the glass than a smaller one as there is more area to spread the load out on. A glass fixing is only as good as how it's connected to the building structure, and that structure itself. Common substrate fixings are adhesives into concrete such as Hilti or Ramset, bolt and nut connections into steel and timber joists, or coach/lag screw into timber joists with an adhesive on the thread. Each AGG balustrade system has been tested and approved for use with these substrates.

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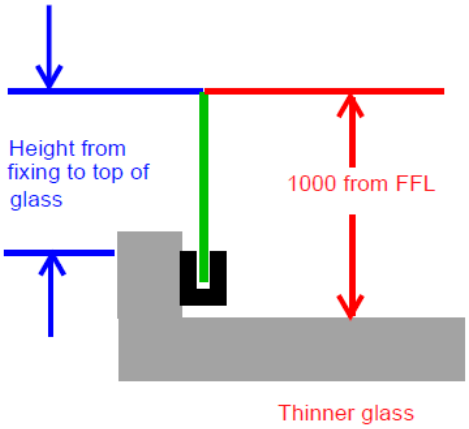
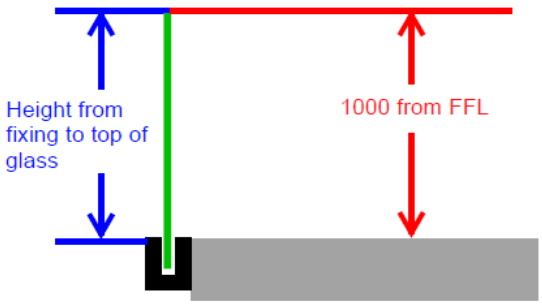
Barrier Geometry

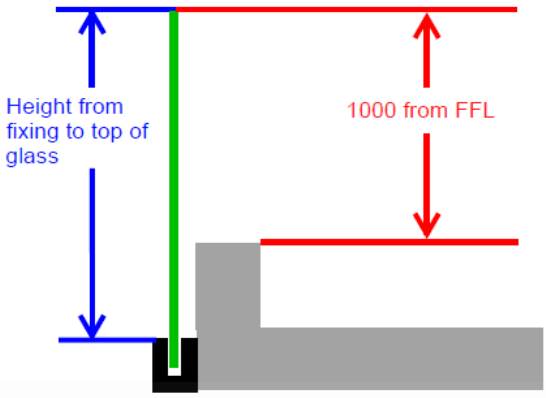
There are two heights that must be considered during balustrade design, height from finished floor level (FFL) and height from glass fixing to top of glass. Required height from FFL is the only method to comply with the safe access components of the NCC. Keeping the height from top fixing to the top of the glass as short as possible whilst still meeting the NCC height from FFL requirements will result in a thinner glass outcome. Consider the effect of a Nib wall, and which side the barrier is attached to:



Thinner glass



Normal thickness glass



Note: Nib wall often big enough to be considered a step, it is then considered as FFL

Thicker glass

Note: in the case of the channel system shown, system glass height is measured from the top of the channel when side fixed and the base of the channel when base fixed

It is important to keep all of these points in mind when specifying a balustrade.

NOTE: There are some instances where a barrier must be both a pool fence and a balustrade. In this case, it must be treated as a balustrade that requires its top edge to be 1200mm from FFL and not be easily climbable by a young child. The 20% increase in height also corresponds to a 20% increase in the load on the system, so thicker glass, more fixings and or a more robust substrate may be required.

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TABLE 3.3

MINIMUM IMPOSED ACTIONS FOR BARRIERS

Type of occupancy for part of the building or structure		Specific uses	Top edge			Infill	
			Horizontal kN/m	Vertical kN/m	Inwards, outwards or downwards kN	Horizontal kPa	Any direction (see Note 2) kN
A	**Domestic and residential activities**	All areas within or serving exclusively one dwelling including stairs, landings, etc. but excluding external balconies and edges of roofs (see C3)	0.35	0.35	0.6	0.5	0.25
		Other residential, (see also C)	0.75	0.75	0.6	1.0	0.5
B, E	**Offices and work areas not included elsewhere including storage areas**	Light access stairs and gangways not more than 600 mm wide	0.22	0.22	0.6	N/A	N/A
		Fixed platforms, walkways, stairways and ladders for access (see Note 1)	0.35	0.35	0.6	N/A	N/A
		Areas not susceptible to overcrowding in office and institutional buildings also industrial and storage buildings	0.75	0.75	0.6	1.0	0.5
C	**Areas where people may congregate**						
C1/C2	Areas with tables or fixed seating	Areas with fixed seating adjacent to a balustrade, restaurants, bars, etc.	1.5	0.75	0.6	1.5	1.5
C3	Areas without obstacles for moving people and not susceptible to over-crowding	Stairs, landings, external balconies, edges of roofs, etc.	0.75	0.75	0.6	1.0	0.5
C5	Areas susceptible to over-crowding	Theatres, cinemas, grandstands, discotheques, bars, auditoria, shopping malls (see also D), assembly areas, studios, etc.	3.0	0.75	0.6	1.5	1.5
D	**Retail areas**	All retail areas including public areas of banks/building societies, (see C5 for areas where overcrowding may occur)	1.5	0.75	0.6	1.5	1.5

(*continued*)

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