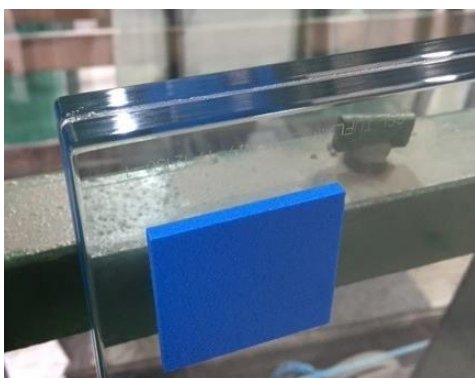
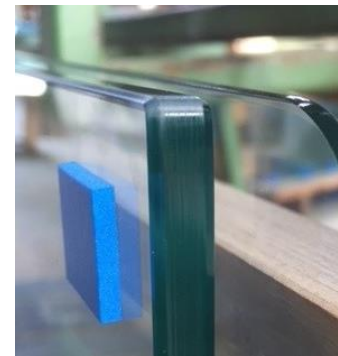


Guidance Notes for Stairs, Balustrading & Barriers

Revised; 1st April 2022

- Glass used in stairs, balustrading and barriers will most often fall under **Building Regulations Document K 2010** (Protection from falling, collision and impact). A copy of this is available from our website to download.
- **Regulation K** must be followed when protecting a level (drop) of **600mm or more**
- A single toughened glass (normally a minimum of 10mm) can be used only if there is to be a handrail above, that is to be fitted/fixe**d independently of the glass** (not on the glass). The handrail must be capable of withstanding the required loadings to satisfy Document K.
- The need for an independent handrail is that if the glass is broken and falls away, the handrail remains intact to prevent anyone falling. This is classed as an **'infill'** panel design. It is generally recommended not to exceed 2100mm width of glass in 10mm and 2400mm in 12mm glass. Larger spans are always possible, but loadings must be considered, and additional fixings used to reduce load deflection on the glass.
- If in doubt, we are able to provide basic calculations on whether an item will pass loadings applied in an 'infill' or 'freestanding' type installation.
- Where larger glass panels are planned in being installed, drilling for security pins in suitable clamps should also be considered. Generally, two pins per panel are adequate (one each side) to prevent glass slipping/dropping.



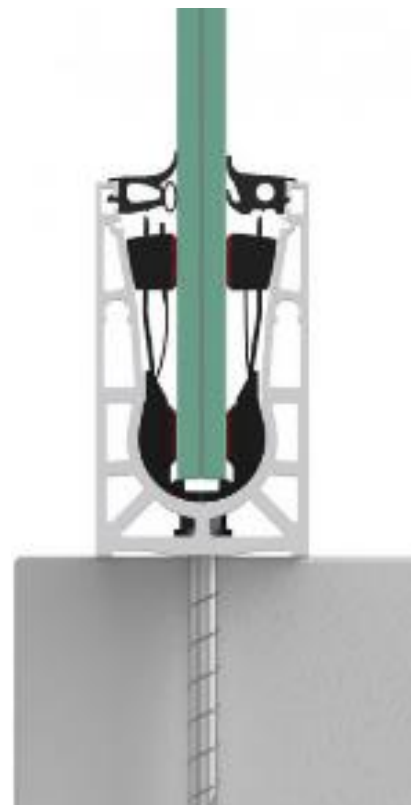
- Where it is desired that no handrail is fitted, a suitable material must be used that meets the loadings laid out in Document K. Generally, as a minimum, this will be 17.5mm Toughened Laminated. However, industry 'norm' is moving towards 21.5mm thicknesses. Thicker, laminates have greater load resistance and less deflection in both normal and broken states.

- A toughened laminated used as a barrier has three functions.

1. In it's normal installed state it provides the load resistance to meet **Document K**.
2. In the event of an **impact** causing one leaf to break, the remaining leaf of glass **retains a barrier but with reduced structural integrity**. Generally, in a broken state, a toughened laminated will not pass the barrier loadings laid out in Document K. It could be reduced by as much as 50%. However this is generally considered better than nothing.

In the event of both leaves being broken, this would be classed as a total failure and no protection would be present.

3. In the event of breakage, the lamination(s) prevent the shattered glass from falling or spreading and so causing less damage to other persons/property.



- Glass barriers that have **no handrail** are generally classed as '**freestanding**' and would normally be either fixed along a bottom edge with round stand-off point fixings or clamped continuously in a rail.

- Special consideration should be given to the use of round stand-off point fixings. They should be of a size and specification suitable for the application. They should also be placed in intervals of no more than **500mm** apart and offer adequate surface contact with the glass to dissipate bending forces applied on loading the barrier. By nature of their design, they generally offer reduced surface contact area and high load dissipation into the glass and substate. Consideration should also be given to the fixing substrate and whether it's capable of withstanding the high bending forces being applied through the glass and fixings.





- Free-standing glass U-channels by nature of their design offer greater load dissipation into the glass and fixing substrate. Therefore, there is greater evidence to support this type of fixing meets Document K without further calculations being required.

• Loadings and Calculations

We are able to provide **simulated assessments** of proposed glass specifications against their intended fixing method. The assessments will show whether the glass will withstand the loadings applied, how much deflection to expect if so and how much allowable stress remains under normal circumstances. The assessments do not take into account the strength of fixing and it is assumed they will suitably withstand the loads applied.

In order to provide a simulated assessment for a barrier specification we would need to know

1. The fixing method (i.e. free-standing barrier or infill panel fixed on two sides) and
2. the design loadings to be applied.

EN 1991-1-1:2002 defines buildings, and so associated load requirements, by categories based on building occupancy and sub categories based on specific areas or utilisation of the space. Some detail for categories A to D are shown below, with further guidance available in the standard.

With a category identified it is then possible to take the design loads associated to that category and apply them to a glass specification, size and installed scenario to formulate an assessment.

Table 1 – Load categories and occupancy types

Category	Occupancy	Area
A	Domestic & Residential	Residential buildings, hospital wards, hotel bedrooms, kitchens and toilets
B	Office Areas	---
C1	Areas Where People Congregate	Areas with tables; cafes, restaurants, dining halls, receptions
C2		Areas with fixed seats; theatres, cinemas, lecture halls, waiting rooms
C3		Areas with obstacles; museums, exhibition halls, access areas in hotels and hospitals
C4		Areas with physical activities taking place; dance halls, gymnasias, stages
C5		Areas susceptible to large crowds; concert halls, sports halls, railway platforms
D1	Shopping/Retail Areas	Areas in general retail shops
D2		Areas in department stores

Table 2 – Load sub-categories and area descriptors

Category	Sub-Category	Area
A	(i)	Single dwelling, including stairs and landings, but excluding external balconies and edges of roofs
	(ii)	Residential areas not covered by (i)
B C1	(iii)	Areas not susceptible to overcrowding in office and institutional buildings, reading rooms, and classrooms (including stairs)
	(iv)	Restaurants and Cafes
C2	(v)	Areas with fixed seating within 530 mm of the barrier
C3	(vi)	Stairs, landings, balustrades, corridors and ramps
C4	(vii)	External balconies and edges of roofs. Footways adjacent to sunken areas
D1		
D2		
C5	(viii)	All retail areas
	(ix)	Footways or paths less than 3 m wide adjacent to sunken areas
	(x)	Theatres, cinemas, discotheques, bars, auditoria, shopping malls, assembly areas and studios. Footways greater than 3 m wide adjacent to sunken areas
	(xi)	Grandstands and stadia

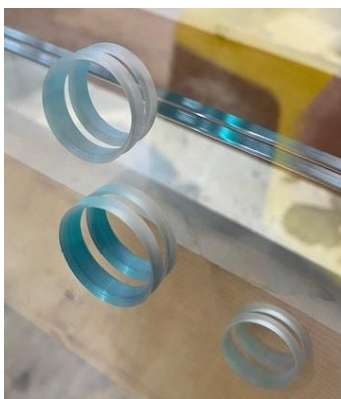
Table 3 – Load values

Category	Sub-Category	Horizontal Uniformly Distributed Line Load (kN/m)	Uniformly Distributed Load (kN/m ²)	Concentrated Point Load (kN)
A	(i)	0.36 (0.50)	0.50	0.25
	(ii)	0.74 (0.75)	1.00	0.50
B C1	(iii)	0.74 (0.75)	1.00	0.50
	(iv)	1.50	1.50	1.50
C2	(v)	1.50	1.50	1.50
C3	(vi)	0.74 (0.75)	1.00	0.50
C4	(vii)	0.74 (0.75)	1.00	0.50
D1 D2	(viii)	1.50	1.50	1.50
C5	(ix)	1.50	1.50	1.50
	(x)	3.00	1.50	1.50
	(xi)	See Requirements of Local Certifying Authority		

- Glass Bow - All toughened carries a degree of bow and is to be expected and compensated for with fixing points or material thickness. Thicker glass will generally have less bow. In certain circumstances bow in laminated glass can be temporarily exaggerated by being bent out of shape. This is due to the interlayer holding the surface tensions of the shape it has been held in. Allowing the glass to relax, it can return to it's original shape, or with gentle pressure applied in reverse.

Bow in toughened / toughened-laminated is a known factor in glazing. All reputable barrier glazing systems have adjustment to compensate for this and the mounting surface. This includes rail fixing and standoff designs.

- We CNC match-pair our toughened laminates where possible. This gives perfect alignment between the panels for a flush edge finish. The CNC machined edges also produce stronger glass panels as opposed to traditional edging machines.



- Fixing holes in toughened laminates should generally be a diameter equal to the thickness of the glass. Consideration should be given to a tolerance allowance of 3-4mm on tight size of bush. So as to allow clearance on any excess EVA in the holes and any minor mis-alignment.

• Any free-standing or infill barrier must be fitted in such a way that allows **no hard-contact**, generally to metal. This applies to surfaces, edges and just a importantly inside holes with fixing bolts and security-pins. There must be no possible contact with hard objects when in a normal fitted state, but also when **full loading is applied** to the glass/barrier.



- Holes in barriers, apart from those required for perimeter fixings, are generally **not** acceptable as they greatly reduce the load which it can withstand.

- Fixing toughened-laminated glass to form a free-standing barrier with edge point-fixing clamps is generally **not** acceptable. The main reason being is that they do **not offer the surface contact area** required to dissipate loadings.



- As in any case, it is the 'buyers' or 'end-users' responsibly to ensure compliance with all current Building Regulations. If there is any doubt, further

advice should be sought. We are happy to advise on information provided.
Unfortunately, we are unable to specify.