

## TECHNICAL BULLETIN

### THE USE OF GLASS IN FLOORS AND STAIRS

This data sheet provides information that must be considered prior to proceeding with the use of glass in floors and stairs. Information is given to aid identification of risks and to aid the development of the correct specification and installation of glass.

#### **1. Introduction**

When considering glass as a flooring material, reference should be made to two British Standards that may have a bearing on the installation. BS6399: Part 1, 1996, Code of Practice for dead and imposed loads, gives guidance on design loadings (*though this standard has been superseded it is still referenced for floor loadings*). BS5395: Part 1, 2000, Code of Practice for the design of straight stairs, makes reference to the danger of slippage and specifies minimum coefficients of friction. Approved Document K of the Building Regulations (2010 Edition), Stairs, Ramps & Guards, controls safety and design.

#### **2. Glass Specification**

In most situations only thick annealed glass or thick laminated annealed glass should be considered. Toughened glass, although stronger than annealed glass, is not generally considered suitable due to its breakage characteristics and subsequent loss of integrity.

Provided below is information relating to typical situations in which glass may be used and appropriate glazing methods together with comments on the safety considerations.

#### **3. Design Criteria for Pedestrian Access Floors**

Firstly it is necessary to consider the location of the floor and whether it protects a dangerous drop. Breakage could result in a fall from a high level, or cause cutting injuries to the lower leg even when the drop is quite small. The nature of the building and the likely behaviour of its users must be taken into account with drops in excess of 300mm being categorised as “dangerous”.

3.1 A single thickness may be used if the floor does not protect a dangerous drop, perhaps where it is required to view something immediately below the glass or for use as a dance floor.

Example - dance floor designed to 5.0kN/m<sup>2</sup> uniformly distributed load and 3.6kN concentrated load

- a) 450mm by 450mm, 25mm single annealed, weight 12kg
- b) 600mm by 600mm, 25mm laminated to 12mm annealed, weight 32kg
- c) 900mm by 900mm, 25mm laminated to 19mm annealed, weight 85kg

This example clearly illustrates that a small increase in glass area can lead to a relatively large increase in weight and thickness.

3.2 If the floor protects a dangerous drop which could result in serious injury a laminated glass is normally required. If there is no access to the underside a single thickness may be used but with secondary protection by means of a suitable grill 10-30mm below the glass. This grill must be designed to withstand the same loading as the floor together with the weight of the glass and must be restricted to a grid size which will prevent a foot passing through, maximum size of 100mm by 100mm.

Example - 1000mm diameter well cover designed to 1.5kN/m<sup>2</sup> UDL and 1.4 kN concentrated load.

- a) With protective grill - 19mm annealed
- b) Without protective grill - 19mm laminated to 10mm annealed

3.3 If there is a risk of a dangerous drop and there is unrestricted access to the underside, such as a pedestrian bridge, laminated solutions must be used. The lower glass of the laminate will prevent glass fragments falling should breakage of the upper glass occur. The use of laminated glass also permits larger pane sizes.

Example - Bridge deck designed to 4.0kN/m<sup>2</sup> UDL and 4.5 kN concentrated load

- a) 1200mm by 300mm, 25mm laminated to 10mm annealed, weight 30kg
- b) 1200mm by 600mm, 25mm laminated to 19mm annealed, weight 75kg
- c) 1200mm by 900mm, 25mm laminated to 25mm annealed, weight 129kg

#### **4. Glazing and Support Structure**

The frame should provide continuous support to the perimeter of each individual element of glazing, and must be capable of withstanding both the design loading and the self-weight of the glass without excessive deflection. The weight of the glass may be taken as approximately 2.5 kg/m<sup>2</sup>/ mm of thickness.

No specific comments can be made as to the structural suitability of any proposed support system, but the maximum permitted centre span deflection of the support method under full load may be estimated by the use of the following formulae: -

$$\text{Deflection (mm)} = L^2 / 50000 \times t$$

Where            L = Length of the glass sides (both sides should be calculated when not a square)  
                      t = glass thickness (exclusive of interlayer if laminated)

Example: Glass floor 1000mm × 1000mm in two thicknesses of 25mm annealed glass, laminated together.

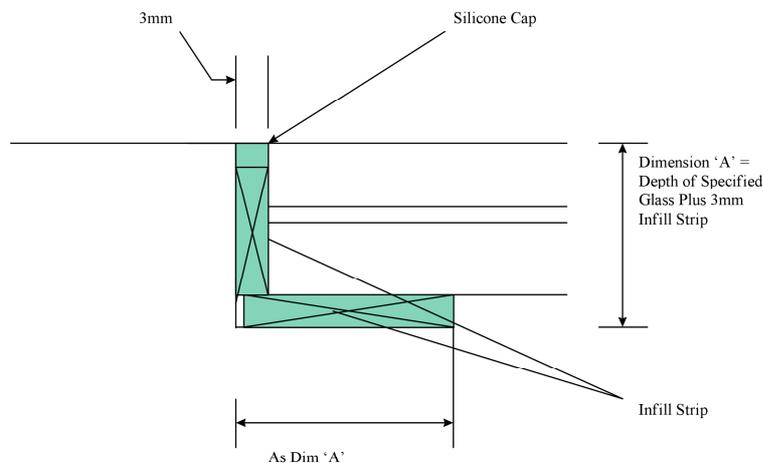
Deflection (mm) =  $1000^2 / 50000 \times 50 = 1000000 / 2500000 = 0.4\text{mm}$   
maximum deflection.

The frame may be of metal, masonry or wood and the glass must be cushioned from it by 3mm thick neoprene rubber or other material similar in hardness to an eraser.

The clearance between the edge of the glass and the frame, or between adjacent glasses, should be 3mm minimum and infill strips of a material such as wood, cork or neoprene, should be inserted to finish just below the upper surface of the glass. To provide a flush finish a compatible high-grade synthetic rubber, polysulphide or silicone sealant can be used as a top pointing.

The edges of the glass should be either flat-ground and arrisbed or water-jet cut. The frame should support all edges at least to the minimum illustrated in the diagram overleaf.

#### Glass Floor Perimeter Support Detail



### 5. Additional Design Considerations

5.1 Avoid point or concentrated loadings with hard objects of small contact area such as castors on furniture.

5.2 Artificial lighting that is sometimes used beneath glass floors can generate high temperatures that can cause breakage of the glass or delamination to occur.

5.3 People whose footwear is still wet may walk on Glass floors near entrance areas. Whilst the use of small glasses and a slip retardant surface such as

sandblasted glass may be beneficial, the provision of suitable matting should be considered.

- 5.4 The use of clear glass floors at high level may be very disturbing to users. The use of a grill beneath the glass may help to overcome this problem. A decorated or obscured upper surface or the use of a tinted or diffused interlayer to laminated glass may also help. Modesty problems can also be avoided using these techniques.
- 5.5 Fire resistance may be required where the glass is being used to pass light between different floors of a building.
- 5.6 It is recommended that the nosing of stair treads are protected by a suitable flange projecting upwards from the tread support.
- 5.7 Suitable floor protection must be provided if heavy pedestrian or other traffic will be passing over the area from time to time. This must be part of the design and maintenance specification for the building.

*This data sheet gives only general guidance. Individual designs must be suitable for the particular application and comply with all relevant local and national legislation, standards, codes of practice and other requirements. This is the responsibility of the designers.*

*Glassolutions Solaglas disclaim all liability howsoever arising from any error in or omission from this publication and for all consequences of relying on it.*

For further advice on the design and installation of glass floors and stairs contact your local sales representative.

For enquiries concerning price and availability of supply only glass for use in floors and stairs please contact our Hayes branch on Tel. 01895 424900.