

Technical Note No. 13 GLASS BREAKAGE



Introduction

The breakage of glass impairs the safety, security and comfort of buildings. Matching and installing replacement panes of glass or glass units can also be expensive. This Technical Note describes the causes of glass breakage and presents measures to minimise its occurrence and diagnose its cause(s).

Breakage characteristics depend on the glass type. Annealed glass breaks into sharp - edged shards, although these may remain in the frame, depending on the glazing method. Toughened glass, when broken, disintegrates into small, relatively blunt particles ('dice') that will generally fall out of the frame, preventing examination of the breakage pattern. With laminated glass the broken panes will remain adhered to the laminate, enabling the breakage pattern to be examined and the cause of breakage to be identified. The manufacture and properties of different glass types are described in Technical Note 11 *Glass Types*.

Causes of glass breakage

Glass is potentially very strong as shown by its use in glass-fibre reinforced plastic however in sheet form the strength is reduced by the presence of invisibly small defects, known as Griffith cracks, which cause stress concentrations allowing cracks to propagate. Strength may be reduced further by larger visible defects.

The potential causes of breakage of annealed glass are as follows:

- Uniform load,
- Impact,

- Edge damage,
- Poor glazing,
- Site damage,
- Thermal stress.

These factors may also cause breakage of toughened glass but the failure loads will be higher. Breakage of toughened glass may also be caused by nickel sulphide inclusions.

Annealed glass

Uniform load

The most significant form of uniform loading on glass is normally wind load although other causes such as snow may occur in some situations. The safe load on a pane of glass is related to the size of the pane and glass thickness. BS 6262 gives guidance on the selection of glass thickness.

If the glass has been incorrectly selected (i.e. it is not thick enough) or if the peak wind load has been incorrectly assessed, then the glass may not have adequate bending resistance and will ultimately break. Figure 1 shows the glass fracture pattern due to excessive, uniform load.