

## Technical Note No. 63 GLASS BREAKAGE

*This Technical Note partly supersedes TN13. It describes the different ways in which glass may fracture. It is intended as guidance for those undertaking a detailed study to discover the cause of a failure and any underlying features that predispose the glass to failure.*

*This Technical Note is one of eight describing the use and performance of glass. They are:*

- TN61 Glass types*
- TN62 Specification of insulating glass units*
- TN63 Glass breakage*
- TN65 Thermal fracture of glass*
- TN66 Safety and fragility of glazed roofing: guidance on specification*
- TN67 Safety and fragility of glazed roofing: testing and assessment*
- TN68 Overhead glazing*
- TN69 Selection of glass to prevent falls from height*

*This Technical Note should also be read in conjunction with:*

- TN35 Assessing the appearance of glass*
- TN38 Acoustic performance of windows*
- TN48 U-values of windows*
- TN49 U-values of curtain walls*

### 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. Basic (annealed) glass breaks into sharp-edged shards, although these may remain in the frame, depending on the glazing method. Heat strengthened glass breaks in a similar way to basic glass. Thermally toughened glass, when broken, disintegrates into small, relatively blunt particles ('dice') that may 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 characteristics of different glass types are described in CWCT TN61.

### Causes of glass breakage

Glass is theoretically very strong but its strength can be variable due to the presence of

microscopic defects known as Griffith's flaws, which cause stress concentrations allowing cracks to start. The intensity of Griffith's flaws varies according to how the glass has been handled which leads to a variability in strength of the glass.

As a result of this variability glass thickness is selected to give stresses much lower than the theoretical strength. The glass selection charts in BS 6262-3 and in calculation methods are based on these lower stress levels to allow for the unavoidable presence of Griffith's flaws.

Strength may be further reduced by larger visible defects. However, these are identifiable and the glass can be rejected if visibly flawed or damaged.

The potential causes of breakage of glass are as follows:

- Uniform load,
- Impact,
- Thermal stress.

Breakage of thermally toughened glass may also be caused by nickel sulfide inclusions.