

# History of Windows & Glass



*A guide for  
owners &  
occupiers*

# History of Windows and Glass

Windows are a building's most prominent feature and because window design has evolved over the centuries windows can be invaluable in dating and in recognising later phases of alteration. Window design is closely related to the evolution of architectural styles, framing materials and, most importantly, to technological advances in the manufacturing of glass. The importance of windows is in their details:-

- Construction
- Materials
- Fittings
- Mechanics
- Glass

Window design reflects the status of the building and the social hierarchy within that building for example the difference between principal reception rooms and servants' rooms in basement or attic. Local style was usually far slower to respond to the latest fashion, and frequently developed in differing ways in differing regions. Consequently localised types of window style contribute to creating a sense of local identity.

**Pre 16th century** windows were constructed from stone mullions or timber frames with unglazed openings. They could be closed by use of sliding or folding wooden shutters, oiled cloth, paper or even thin sheets of horn. Glazed windows were used only for the highest status buildings and were constructed of small panes of glass quarrels, (also known as quarries), held together in a lattice of lead strips (comes). The lead was quite soft, so it was usually reinforced with iron bars either vertically (stanchions) or horizontally (saddle bars).



*Example of an early timber window - Childswickham*

Stone mullions were moulded on both inside and outside faces, usually with either a chamfer or cavetto moulding. Timber window frames were usually oak with pegged mortice and tenon joints and similarly moulded in imitation of more expensive stone.



*Leaded casement with stay - Childswickham*

## Sixteenth Century

Tudor stability and prosperity was reflected in window size. The much larger windows were subdivided into smaller openings (lights). Both stone and timber had vertical bars (mullions) and horizontal bars (transoms).

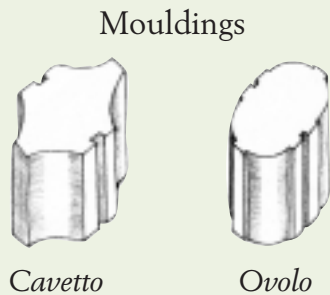


*Larger mullioned subdivided window - Offenham*

A wrought-iron frame set into the mullions with smaller opening frame (hinged casement) provided an opening window. It would be latched shut with an iron catch or held open with an iron stay. In opening lights leaded glazing would be attached to the casement, in fixed lights it would be set into the mullions.

As glass became more available throughout the century windows in wealthy aristocratic households became even larger in a peculiarly English tradition. In contrast the Italian Renaissance influence in Europe resulted in window design conforming to classical ideals. In

smaller houses glazing was still rare but becoming more common. Ovolo moulding was the standard form for both stone and timber windows.



### Seventeenth Century

Windows began to conform to classical ideals at the accession of the House of Stuart in 1603 reflecting renewed contact with Europe and the classical influences of the Italian Renaissance. They became taller than they were wide, typically divided into four lights by a single mullion and transom often of masonry. As the century progressed they were increasingly constructed from timber and known as cross casement windows.



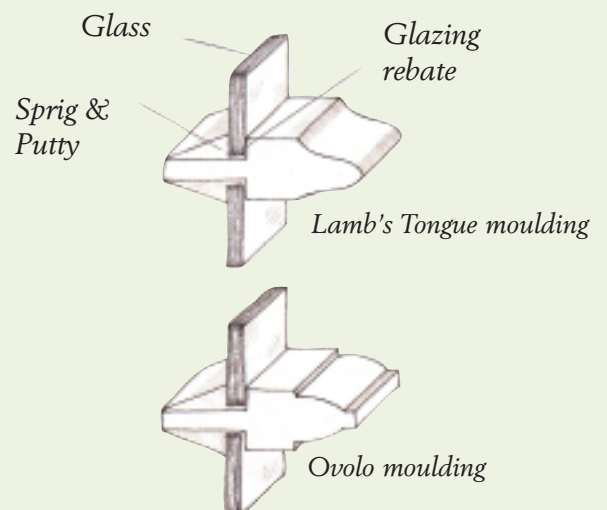
*Cross casement - Elmley Castle*

Stone mullions generally had ovolo mouldings though there could be local variation. As timber frames became more fashionable than stone the mullions and transoms became narrower. Glazing was placed almost flush with the external face of the window. Mouldings were confined to the internal face, usually ogee or reverse ogee. Frames were therefore less conspicuous whilst the surface area of glass increased.

Crown glass was introduced in 1674 leading to a

form of cross-casement window that had larger panes of glass held in timber or iron glazing bars rather than thin small panes in a leaded lattice. This type of window was replaced in Britain by the newly invented sash. Many early timber frame buildings were adapted to the new fashion. With insertion of sash windows and sometimes a skin of brickwork or stone to cover the front of the timber frame.

In the earliest type of sash window the top sash was fixed and the bottom sash slid upwards in a groove held open by means of pegs or metal catches. These existed well before the introduction in the latter part of the 17th century of the 'double hung' sliding sash window, where both upper and lower sashes hung on cords counter-balanced by hidden weights in a hollow part of the frame called the sash box. An intermediate 'single-hung' type provided the same counterweight mechanism. These sashes were always timber, usually oak or pine, with a grid of timber glazing bars to hold the glass. Glazing bars would be up to 35mm thick, often with a flat external face and an ovolo moulded internal face (the thickness was to support the thick and heavy glass), they would divide the windows into as many as 16 panes in the upper sash and twenty in the lower. The double hung sash has remained virtually unchanged for over 250 years though its position in the wall changed significantly. Less common is a sideways sliding type of window called a Yorkshire sash.



At first the window was placed on the outer face of the wall, so the whole of the sash box was visible externally. After the Great Fire of London the exposed box was seen as a fire risk. In 1709 the London Building Act decreed that box sashes should be set back four inches from the face (recessed sash box). Originally this applied to Cities of London and Westminster spreading outwards with similar legislation being adopted by urban centres further afield.

A further London Building Act in 1774 required sash boxes to be placed behind the masonry (concealed-box sash). With the sash box out of sight the glazed area was larger. This Act was gradually adopted widely but the positioning of the box is not a reliable way of dating a building.

Crown glass was very expensive which meant it was beyond the reach of most of the population so casement windows with leaded glazing remained popular throughout the 17th and much of the 18th centuries.



*Exposed sash box - Himbleton.*

### *Eighteenth century*

At first the sash window altered little but as the century progressed design evolved and sash windows were made almost exclusively from Baltic Pine, glass got thinner, and the width of glazing bars slowly reduced. Internal mouldings were of the 'lamb's tongue' type. At the end of the century glazing bars on fine sashes were as little as 10mm wide. To make glazing bars or whole windows even more slender experiments were carried out in iron and copper.

Introduction of plate glass in the 1770s led to further increase in pane size and reduced numbers of glazing bars, though cost meant this was only for the rich. There was some standardisation of windows for example the Georgian 'six over six' but there was also still a great deal of variation on grand and small houses with three over six and eight over eight though the very large sashes of the 17th century went out of fashion.

Sashes became less expensive and by mid-century they could be found in humble homes, by the end of the century they were standard on even the smallest worker's dwelling. Early in the century they were painted pale colours but from the 1760s black was popular, particularly in ashlar stone or stuccoed houses. Greens, browns or graining effects were not uncommon. On some wealthy houses they were painted black and embellished with gold leaf.

Throughout the 18th century casement windows were replaced by sashes. Some survived in small rural dwellings and in late 18th to early 19th century 'cottage orne'. These windows increasingly had crown glass and timber glazing bars and casements, rather than the leaded glazing and wrought-iron opening casements of earlier windows.



*Recessed sash box - Waterside, Evesham*

### *Nineteenth century*

Early in the 19th century patterns of glazing bars changed. Narrow 'margin' lights were common frequently filled with newly fashionable coloured glass. Sometimes glazing bars were curved into interlocking pointed Gothic style arches for 'Venetian' windows.



*Gothic style venetian sash window - Pershore*

Size of windows grew as many 18th century sashes had sills lowered to form access to balconies and sometimes were replaced by French windows.

Increased availability of plate glass meant that glazing bars could be reduced or removed completely. Improved methods of manufacture made glass less expensive from 1837. By mid century most windows had only one central glazing bar or none at all. 'Horns' were introduced to compensate for the increased weight of plate glass and lack of glazing bars.



*Concealed sash box - Pershore*

Victorian revivalist eclecticism in the 2nd half century of the 19th century brought a Gothic Revival with cast iron casements and imitation lead quarrel glazing with many small diamond or rectangular panes

There was some experimentation with setting plate glass in iron frames. These were not popular in houses being mainly used for conservatories, hot houses and industrial buildings. They were, however, popular on estate cottages.

Later on in the century two new styles appeared; the 'Arts and Crafts' movement of genuine leaded lights, set in stone mullions or oak frames and the 'Queen Anne' movement with white painted small pane sash windows. These two became blurred and buildings often contained both elements and sometimes within the same window

## *Glass*

Old glass is of considerable historic and visual

interest, contributing significantly to the character and appearance of old buildings. It has a rippling transparent vitality and greenish hue. Modern glass is featureless and uniform. Old cylinder and crown glass are irreplaceable. They are thin and easily broken and should not be removed from their original frames unless absolutely necessary.

## *Types of historic glass:-*

- Cylinder, Broad or Muff Glass - only made before 1674. The molten glass is blown and swung to form a cylinder, cut, reheated and flattened into sheets in a furnace, cooled on a bed of sand and polished. The glass has a distorted, ripple effect with a greenish tint, often with air bubbles or other imperfections.



*Historic Glass - Pebworth*

- Crown Glass - First recorded in 1674 remaining standard until 1830s. The molten glass is blown into a bubble, pierced, and spun into a disk approximately 4 ft in diameter. The glass is then cooled and cut into panes, curved edges and central bullion where attached to the blowing rod were discarded. Although producing a clearer glass than the previous method, it could still have a slightly rippled effect. It ended the use of leaded glazing in wealthy households.
- Cast glass - Late 17th century, large sheets of glass made by pouring molten glass into flat moulds. Production of this type of glass was very labour intensive used more for decorative mirror glass than windows.
- Plate or cylinder glass - First made in Britain in 1773 becoming more widespread in the 1830s. Chance Brothers industrialised the traditional technique of making cylinder glass. They produced high quality relatively inexpensive plate glass. The rippled effect was greatly reduced though when viewed obliquely reflection is still distorted.
- Drawn glass - invented in 1904 by Belgian, Emile Fourcault. Sheets of glass were drawn through a slot in a tank of molton glass up over rollers into a cooling chamber.
- Float glass - Molten glass is poured onto the surface of molten tin, where it 'floats' to create an even sheet, perfectly smooth and featureless. This has been the standard technique since 1959.

## Modern glass alternatives

Modern machine-made glass is generally not an appropriate alternative to hand made glass. Fine clear hand made cylinder glass is the only compatible glass alternative today. Care must be taken in the selection of handmade glass as there are many types of cylinder glass. Cylinder glass produced for the art market makes poor substitutes for historic window glass.

Handmade window glass can be obtained in the UK and there are some good imported glasses from Germany, France and Poland that are extremely close to old glasses that still survive.

## Double Glazing

Double glazing is never appropriate in listed buildings. For further information see Double Glazing Leaflet.

## Glossary

**Arts and Crafts** An English social and aesthetic movement in the latter part of the nineteenth century. Had its origins in an admiration for traditional art and craftsmanship.

**Cavetto** a hollow moulding, with profile of quadrant of a circle.

**Chamfer** slender H section or extruded lead used to hold pieces of glass in position.

**Casement Window** metal or timber window in which the opening lights are hung on hinges.

**Classical** term applied to architecture, enrichment, and motifs based on the precedents of Graeco-Roman Antiquity.

**Eclecticism** design involving disparate elements from various styles put together coherently.

**Gothic Revival** begun early 18th century largely as a result of growing interest in romantic ruins and antiquities.

**Mullion** a slender pier forming the division between the lights of a window.

**Ogee** an S shaped curve, one convex and the other concave.

**Ovolo** a quarter-round or convex moulding.

**Quarrel or Quarry** a square or lozenge shaped piece of glass used in leaded casement windows.

**Sash** a frame for holding the glass in a window and capable of being raised and lowered in vertical grooves.

**Renaissance** Means literally 'rebirth', it suggests a rediscovery of the architecture of Ancient Rome.

**Revivalist** any use of an earlier style based on scholarly and archaeological investigation.

**Transome** a horizontal bar dividing a window into two or more lights in height.

Ask for further advice leaflets in the window series: Timber, Metal, Leaded Lights, Double Glazing.

## Please be aware

It is a criminal offence to alter a listed building without the necessary consent or not in accordance with the conditions of the consent. Listed Building Consent is necessary for all works, inside and out, that affect the character of the building, including small changes such as windows, doors, walls, staircases and fireplaces, even if those items are not considered to be 'original'.

Some unlisted buildings may have permitted development rights removed and this often includes doors and windows so that planning permission is required for replacement or change. Please contact planning services to find out if your property is affected.

Unauthorised works can lead to prosecution of the owner and the person carrying out the works. In addition an enforcement notice can be served requiring the correction of unauthorised works.

## Help and Advice

For further information and advice on windows in Historic Buildings, contact:

The Heritage Section  
Planning Services  
Wychavon District Council, Civic Centre,  
Queen Elizabeth Drive, Pershore  
Worcs, WR10 1PT  
Tel: 01386 565565

Email: [planning@wychavon.gov.uk](mailto:planning@wychavon.gov.uk)

Web: [www.wychavon.gov.uk](http://www.wychavon.gov.uk)

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اگر آپ کو اس دستاویز سے متعلق مدد درکار ہو تو براہ مہربانی 01905 25121 پر فون کریں۔

如果你在明白這份文件方面需要幫助的話，請致電 01905 25121。

नेवव वुलनुं हिम दसतुवेच घावे विसे मलहिता एी लुज वे ता विरुपा बरवे देलीडिठ नंबर 01905 25121 'वे संभलत वरे।

Se con questo documento avete bisogno di aiuto pregasi telefonare a 01905 25121

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