

Historic Window Guide



A brief illustrated history of window development from the Middle Ages to the present



Why are windows important?



Tredington Court Tredington

One of the most common questions asked in relation to old windows is 'Why are windows so important?' There are a number of answers to this question:

Windows are, in effect, a building's eyes; often a building's most prominent feature, they are one of the most significant components in determining a building's character and appearance.

Window design has evolved continuously over the centuries, so windows can be of invaluable assistance in dating buildings, and 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.

Consequently the importance of windows does not just rest in their overall appearance, but in details such as their construction and materials, their fittings and mechanics, and even the very glass that is the reason for their existence. The type of windows that a building contained usually reflected the status of that building, and that of the owner. Within a single building, windows of differing status often reflected the social hierarchy of the internal spaces, from the principal reception rooms on the ground or first floors, to the servants' rooms in the basement or attic.

Vernacular window design, which was usually far slower to respond to the latest advances in fashion, often

developed in markedly differing ways in different regions (the further from London, the longer advances took to reach it). Consequently highly localised types of vernacular window developed in some areas and such windows contribute enormously to creating a sense of 'place' or local identity.

Pre-16th

Pre-Sixteenth Century

Before the sixteenth century, most windows were constructed from stone mullions or timber frames with unglazed openings; these could be closed with either sliding or folding wooden shutters, or oiled cloth or paper, or even thin sheets of horn. Only the wealthiest houses could afford to have glazed windows; these would have been constructed from small panes of glass, or quarrels, held in a lattice of lead strips or cames. This lead lattice was quite soft, so it was usually reinforced with steel bars, either vertically ('stanchions') or horizontally ('saddle bars').

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



Detail of Leaded Glazing



9 Church Street Tewkesbury



Little Museum, Tewkesbury

Timber	 Ogee Moulding 17th & 18th Century	 Beaded 17th Century onwards	 Chamfer Moulding all dates
Stone	 Cavetto Moulding late 16th Century	 Chamfer Moulding all dates	 Ovolo Moulding 17th Century

Mullion Details

16th

Sixteenth Century

This century, which was a period of greatly increased stability and prosperity due to the newly established Tudor dynasty, saw a considerable increase in window size. These large windows were subdivided into smaller openings, or 'lights' by 'mullions' (vertical bars of masonry or timber) and 'transoms' (horizontal bars). To achieve an opening window, a wrought-iron frame would be set into the mullions, to which a smaller, opening frame, or 'casement', would be hinged; this could be latched shut with an iron catch, or held open with an iron stay. The leaded glazing would be attached to the casement in opening lights, or set into the mullions in fixed lights.

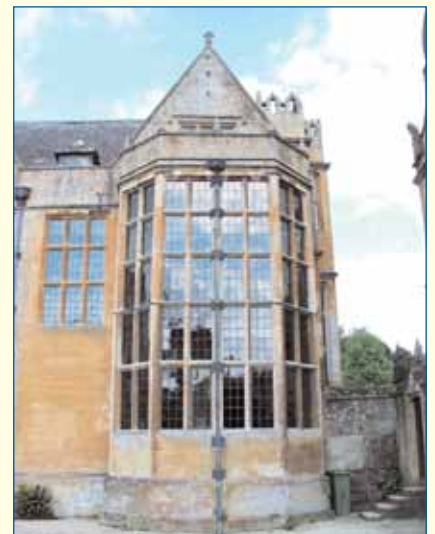
As the century progressed, and glass became more readily available, windows in wealthy households became ever larger and more extravagant as the Elizabethan aristocracy vied to display their wealth. In smaller houses glazing remained rare, but nevertheless was still more common than in previous centuries. In this century the ovolo moulding became the standard form for both stone and timber windows.



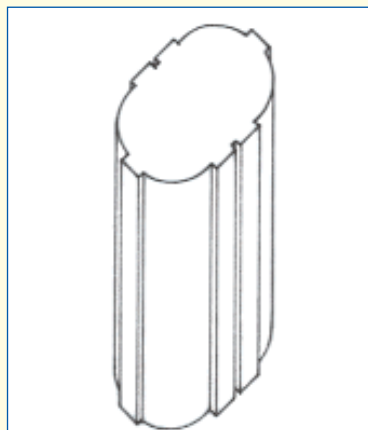
64 Barton Street, Tewkesbury: timber mullioned & transomed windows 17th Century



88A Church Street Tewkesbury: wrought iron casement & stay



Stanway House



Ovolo Moulding



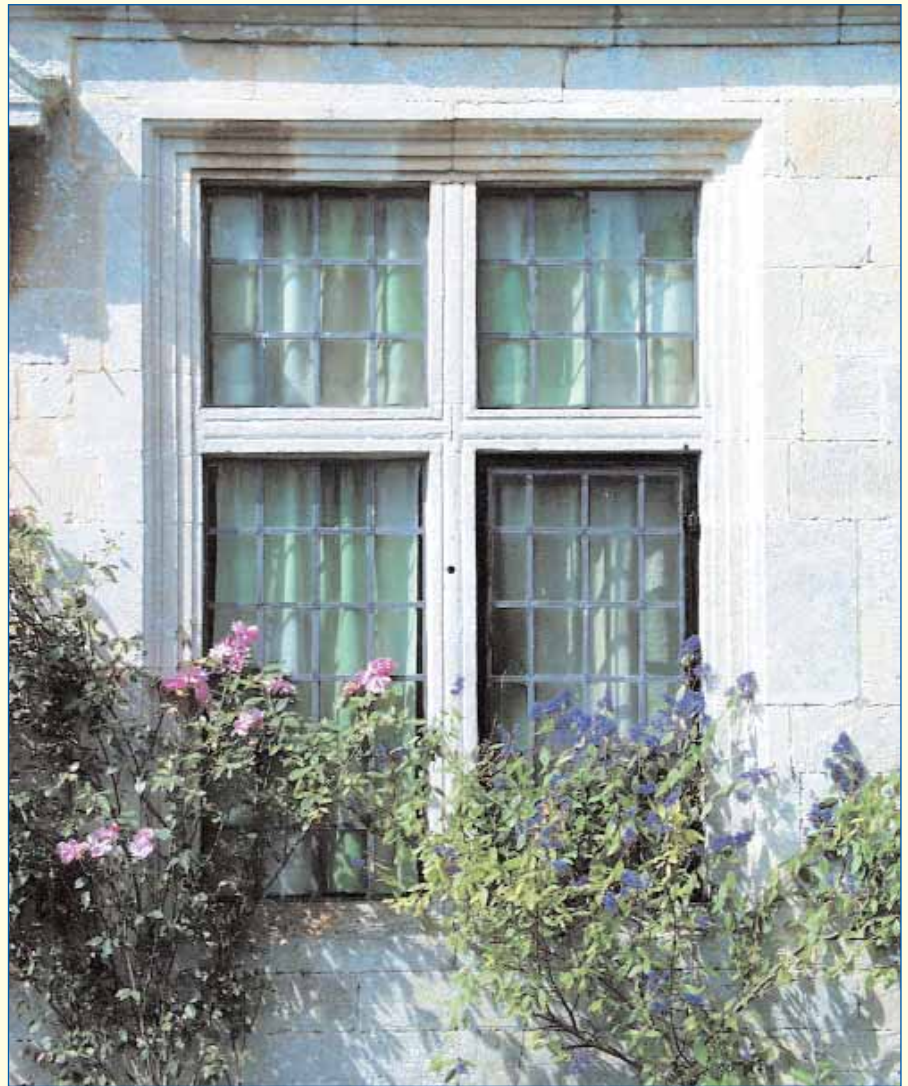
Details of Catch & Stays

17th

Seventeenth Century

The accession of the house of Stuart, in 1603, brought about renewed contact with the Catholic countries of Europe, enabling Caroline artists, like Inigo Jones, to bring back first-hand experience of the Italian Renaissance. As a result of this new influence windows began to conform to new classical ideals; they became taller than they were wide, with such width to height ratios as 1:1 or 1:2. These windows were typically divided into four lights by a single mullion and transom; these could be masonry, but as the century progressed, they were increasingly constructed from timber (a 'cross-casement' window). Smaller windows were usually lower and wider, with several mullions and no transoms, but otherwise they differed little from the cross-casement windows.

Seventeenth-century stone mullions usually still had ovolo mouldings, although localised variations occurred. However, as timber frames became more fashionable than stone mullions, they stopped imitating them; the mullions and transoms becoming narrower, glazing was now placed almost flush with the external face of the window and mouldings were confined to the internal face (usually 'ogee' or 'reverse ogee' mouldings). These changes allowed a larger area of glazing and made the frame far less conspicuous.



Snowhill Manor: stone cross casement with leaded lights. Mullions show Renaissance influence



Old Rectory Dumbleton: timber cross casement early 18th Century



Lower Moorcroft Farm Minsterworth: early 18th Century

In 1674 the introduction of 'crown glass' led to a form of cross-casement window that had larger panes of glass held in timber or iron glazing bars rather than small panes in a leaded lattice. However, although this type of window became the basis for window design throughout the eighteenth century in France, in Britain it was soon replaced by the newly invented sash.

The sash window consisted of two sashes, or glazed frames; the front one would be suspended in the top half of the frame, and the rear would close the bottom half. Better quality sashes would be hung on cords attached to counter-weights that were concealed in a hollow part of the frame (the 'sash-box'), allowing the sashes to slide up and down (a 'double-hung' sash); simpler sashes had the upper sash fixed to the frame, and counter-weights or even pegs or props to hold the lower sash open (a 'single-hung' sash). Seventeenth-century sashes were always timber, usually oak or pine, with a grid of timber glazing bars to hold the glass. These glazing bars would be up to thirty-five millimetres 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 sixteen panes in the upper sash and twenty in the lower (expressed as a 'sixteen-over-twenty' sash window).

Most early sashes were set almost flush to the external face of the wall (a 'flush-box' sash), but the Building Act of 1709 banned these, decreeing that windows should be set back into the opening by four inches (a 'recessed-box' sash).

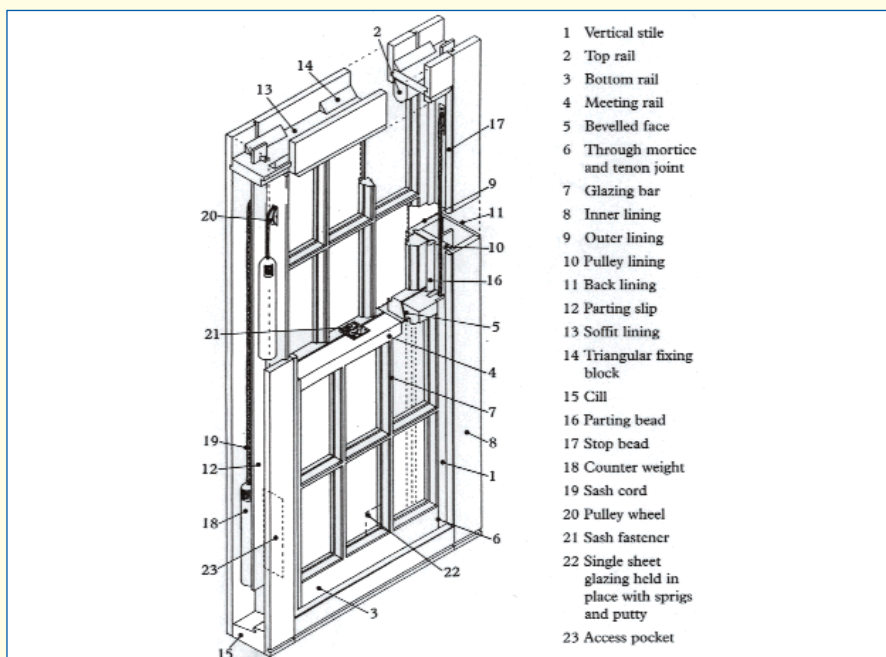
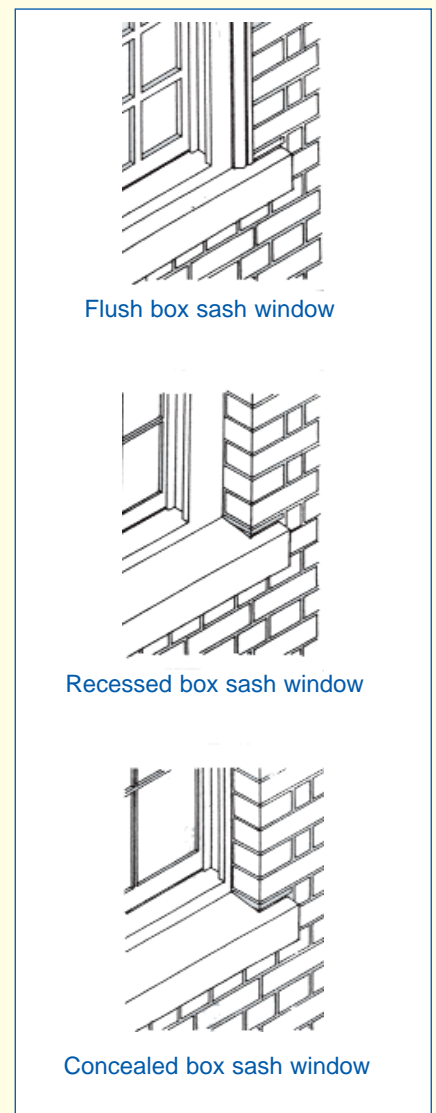


Snowhill Yorkshire sideways sliding Sash

A further Act in 1774 decreed that all sash-boxes be concealed within the fabric of the wall (a 'concealed-box' sash). However these acts were none too scrupulously adhered to, particularly in the provinces.

Seventeenth and early-eighteenth-century sashes were always externally painted; usually off-white or pale stone colours, although on some very wealthy houses they were sometimes painted black and embellished with gold leaf.

The expense of crown glass kept it beyond the reach of the majority of the population, so casement windows with leaded glazing remained very common throughout the seventeenth and much of the eighteenth centuries.



Double hung sash details (reproduced with kind permission of English Heritage)

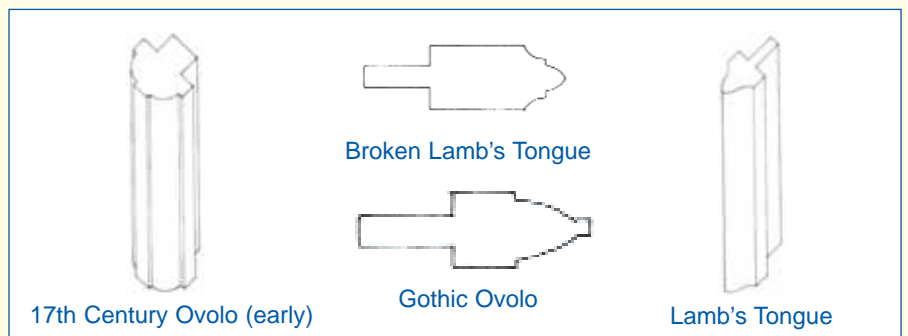
C 18th

Eighteenth Century

In the early years of the eighteenth century, the sash altered little from those of the latter seventeenth century. However, as the century progressed sash design evolved; they came to be made almost exclusively from pine (usually Baltic pine); as the quality of glass available improved and panes became thinner, the width of the glazing bars began slowly to reduce; and the common moulding for the internal face of the bars became the 'lamb's tongue' moulding. By the end of the century, timber glazing bars on very fine sashes were as little as ten millimetres wide, and there was some experimentation with making glazing bars, or even entire windows, from iron or copper, in an attempt to make them ever more slender. From the 1770's, the introduction of early plate glass led to further increases of pane size and reduction of the number of glazing bars, although the initial cost confined plate glass to the rich. The size of mid-eighteenth-century sash windows began to standardise, the usual Georgian arrangement being a 'six-over-six'; although there was still considerable variation on both grand houses and small provincial houses, where three-over-sixes and eight-over-eights were not uncommon, although the very large sashes of the previous century became almost unheard of.



77 Church Street Tewkesbury: early 18th Century flush box sash windows



Details of Glazing Bars



Wallsworth Hall Twigworth: mid 18th Century ovolo moulded sash window with rubbed brick lintel, stone cill and keystone



Wallsworth Hall Twigworth: window to principal elevation with classical stone surround

Throughout the century sashes became increasingly less expensive; by mid-century they were appearing in quite humble houses and by the end of the century they were standard on even the smallest worker's dwellings. Whilst they were painted pale colours in the early part of the century, from the 1760's black became fairly popular (particularly in ashlar stone or stuccoed houses) and the use of greens, browns and graining effects were not uncommon.

Casement windows became increasingly rare throughout the eighteenth century, but survived predominantly in small, rural dwellings and in the late-eighteenth and early-nineteenth-century vogue for 'cottage orne' (small ornamental cottages designed specifically to look romantically quaint, usually in the gardens or parks of country houses). 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.



62 North Street Winchcombe: typical Georgian 6 over 6 sash windows



Timber casement window replacing leaded lights in a stone mullioned frame



32 Church Street Tewkesbury: 1813 a remarkable elongated sash to light the staircase

19th

Nineteenth Century

In the early years of the nineteenth century, the 'Regency' era, there was some experimentation with the patterns of glazing bars in an attempt to break away from the simple 'grid-like' arrangements of the previous century. The use of narrow 'margin lights' became common (these were long, thin panes of glass that ran around the edge of the window like a border); they were often filled with newly fashionable coloured glass (particularly popular were pink, lilac, blue, purple, red or amber). Glazing bars were even curved into interlocking pointed arches to imitate Gothic tracery.

The size of windows began to grow, to flood rooms with light and allow access to newly fashionable balconies; many eighteenth-century sashes had their sills lowered to become full-length or were even replaced by French windows.

The increasing availability of plate glass meant that the numbers of glazing bars in windows was continually being decreased, or, for the very rich, done away with altogether. After the accession of Victoria, in 1837, plate glass became far more common as improved methods of manufacture made it less expensive; by the mid-century most sashes either had only a single, central glazing bar, or none at all. To compensate for the increased weight of the plate glass, and the loss of strength from the lack



Late 18th Century curved gothic glazing bared sashes in 'Venetian' windows at 9 & 10 Barton Street, Tewkesbury with flush boxes. No 11 (right) has later 19th Century recessed tripartite sash windows



Abbey Tea Rooms Tewkesbury, margin light casement window

of glazing bars, 'horns' were introduced onto the sashes to strengthen them; such horns had never been used before the mid-nineteenth century.

In grander buildings, the Victorians' love of the past led to sash windows often being disguised by being recessed behind stone-mullion frames that approximated historical styles; such sashes were usually painted quite dark colours, deep greens, browns, or grained to approximate more expensive hardwoods.

In the second half of the century, following on from the Great Exhibition's Crystal Palace (1850), there was some experimentation with setting plate glass in iron frames, creating very twentieth-century-looking windows, but this did not become popular in houses and was predominantly confined to conservatories, hot houses and industrial buildings. However, more historically-inspired wrought-iron frames, set behind stone mullions, did become quite common in the Gothic revival style that became fashionable in the second half of the century. Elaborate cast-iron casements, which imitated the leaded quarrel glazing of earlier centuries by dividing the windows into many small rectangular or diamond-shaped panes of glass, also became popular, particularly on estate cottages.

The latter part of the century saw the rise of two new historical styles, the 'Arts and Crafts' movement and the 'Queen Anne' movement; under the former, genuine leaded-lights again became popular, set in stone mullions or oak frames; under the latter, white-painted small-pane sash windows. Towards the end of the century, the distinction between these two styles became blurred, creating a hybrid that often contained both elements within the same building, sometimes within the same window.



1905 Chance Street Primary School Tewkesbury: concealed box sash windows with horns



19th Century cast iron casements mimic leaded lights of previous centuries



Cotteswold Road Tewkesbury: hybrid sash design typical of Edwardian houses



Ropewalk Tewkesbury: Victorian sash with horns



19 High Street Tewkesbury (Lloyds TSB Bank): built in 1921 in the Tudor revival style with intricate leaded light oriel windows

20th

Twentieth Century

The pre-war and inter-war periods of the twentieth century saw a split between revived-traditional and modernist windows.

The revived-traditional windows were a continued evolution of the Arts and Crafts and Queen Anne styles and eventually evolved in two directions: the first simplified to become the common style for most inter-war housing estates, with timber casements, often with small panels of leaded and coloured glass in doors and at the top of windows; the second evolved into a late-seventeenth/early-eighteenth-century revival, and was particularly popular for public buildings, where large multi-paned sashes again became common.

At the same time, the modernist windows, influenced by the Art Deco style, were made from recently developed hot-rolled steel; these 'Crittall' windows, manufactured using the latest technology, produced a simple, functional window of strikingly modern appearance, in keeping with the crisp, minimalist International Style.



Bishops Drive Bishops Cleeve: metal framed casement windows 1948



Brockworth Airfield control tower c. 1942 (now demolished) in the Art Deco style



Crittall windows: GAC Gloucester Aircraft Co. Brockworth

In the post-war period, functionalism became the leading design principle. Typical features of post-war windows were simple white-painted softwood frames, usually of very plain, un moulded timber section with storm-proofed opening casements and storm-proofed top-hung fanlights; they often formed 'picture windows', with a single, very large sheet of glass. Windows of similar design were also constructed from aluminium. On larger buildings the production of large sheets of toughened glass saw the introduction of 'curtain walling', where buildings were entirely clad in glass.



The Hyde Winchcombe: storm-proofed picture windows with top hung fanlights

The 1980's saw the arrival of 'Planar' glazing; using this system the glass is not held in frames, but is attached, by bolts or vacuum pads, to an internal armature, often of steel tubing or cables; silicon sealant between the panes of glass makes them weather-tight. This decade also saw the arrival both of 'sealed-unit' double glazing, and the 'unplasticised-polyvinyl chloride' (U.-P.V.C.) frames which invariably hold them.



Planar Glazing



Millennium Houses Tewkesbury



Glass Blowing

Glass

Because of the transparent nature of clear glass, few people pay it much attention as a material in its own right; it is something that we look through, not at. As a result, it is often undervalued, and needlessly smashed out of windows on the excuse that it is 'only glass' and easily replaceable. However, old glass is of considerable historic and visual interest. It is an integral part of the fabric and history of old windows as advances in glass manufacturing were usually the principal reason for changes in window design. Old glass, with its rippling transparency, dancing reflections and greenish hue, contributes significantly, if subtly, to the character and appearance of old buildings, giving a far more lively and interesting display than the featureless, static qualities of unrelentingly uniform, modern glass.

The principal forms of glass are:

Cylinder, Broad or Muff Glass

This was the only glass manufactured in England before 1674; it was invented in Germany in the 11th century, although the date of its introduction into England is unknown. The molten glass was blown and then swung to form a cylinder; this was then cut, reheated and flattened into

sheets in a furnace, cooled on a bed of sand and polished. The glass produced has a distorted, rippled effect and greenish tint when looked through, often with some air bubbles and other imperfections.

Crown Glass

The first recorded crown glass in England was in 1674, and it remained the standard high-quality glass until the 1830's. The molten glass was blown into a bubble, this is then pierced and the 'punty', or rod, spun, flinging the malleable glass out into a disk of approximately four feet in diameter. The glass was cooled on the punty, before being cut into panes; the central 'bullion' (or bull's eye), where the rod attached, was usually discarded, as were the curved edges. Crown glass was a far finer, clearer glass than that produced by the preceding method, although it could still have a slightly rippled texture; its introduction heralded the end of the use of leaded glazing in wealthy households.

Cast Glass

The technique of pouring molten glass into flat moulds to create large sheets of cast glass, a technique used by the Romans, was rediscovered in the late seventeenth century in

France, and was soon being used in the windows of the new royal apartments at Hampton Court Palace (1689-94); however, the labour required to pour and then polish cast glass made it extremely expensive, and it was used more for decorative mirror-glass than for windows.

Plate or Cylinder-Sheet Glass

Plate glass was first made in Britain in 1773, although it did not become widespread until the 1830's, when Chance Brothers of Stourbridge (who later supplied glass for the Crystal Palace) industrialised the traditional technique of making cylinder glass, to produce large sheets of high-quality and relatively inexpensive plate glass. The rippled effect of earlier glasses was greatly reduced, although when viewed obliquely, reflections still distort, rippling across the surface.

Drawn Glass

This was invented in 1904 by a Belgian, Emile Fourcault, and later improved by several American companies. The process involved drawing sheets of glass through a slot in a tank of molten glass up over rollers and into a cooling chamber.

Float Glass

Since 1959, the standard technique for making sheets of glass has been to pour the molten glass onto the surface of molten tin, where it 'floats' out to create an even sheet, with a perfectly smooth, featureless surface.

Old cylinder and crown glasses are irreplaceable. They are thin and easily broken and should not be removed from their original frames unless absolutely necessary. If removal is unavoidable, paint solvents, soldering irons, infra-red heaters or even household bleach can be used to soften old putty; in all cases great patience is required as it may take many applications to soften the putty sufficiently.

Useful Contacts

English Heritage

Conservation Team
South-West Region
29 Queen's Square
Bristol
BS1 HND
0117 9750700

Tewkesbury Borough Council

Council Offices
Gloucester Road
Tewkesbury
GL20 5TT
01684 272097
01684 272060

The Society for the Protection of Ancient Buildings (S.P.A.B.)

37 Spital Square
London
E1 6DY
020 73771644

The Georgian Group

6 Fitzroy Square
London
W1P 6DX
020 73871720

The Victorian Society

1 Priory Gardens
London
W4 1TT
020 89941016

The Twentieth Century Society

70 Cowcross Street
Bedford Park
London
EC1M 6EJ
020 72503857

Glossary

Arts & Crafts

Artistic movement that flourished in Britain from c.1851 to c.1939, that rejected industrial mass-production in favour of traditional craftsmanship

Art Deco

A geometric modernist style popular in the 1920's and 30's; it depended upon the latest technology and materials, and decoration was stylised

Came

Slender strips of lead, 'H' shaped in section, which hold quarrels (q.v.) of glass in leaded glazing

Caroline

Pertaining to the reign of Charles I (1625-49)

Casement

That part of a window frame that swings open on hinges; traditionally they were wrought iron or timber. A casement window is a window that contains side-hung opening casements

Commonwealth

Pertaining to the republican period (1649-60) between the reigns of Charles I and Charles II

Elizabethan

Pertaining to the reign of Elizabeth I (1558-1603)

Facade

Any exterior elevation of a building, but particularly the main elevations

Fretwork

A trellis-like ornament of repeating geometric patterns; common in Greek and Chinese design, both of which were influential in Britain in the latter 18th and early 19th centuries.

Georgian

Pertaining to the reigns of George I, II & III (1714-1820), and sometimes George IV (1820-30); overlaps with the Regency (q.v.)

Glazing bar

Slender timber bars, with a decorative moulding on the inner face, that form a grid-like framework that holds panes of glass within a timber window frame

Gothic

Term used to describe the architectural styles common throughout northern Europe from the 12th century to the 16th century. Those used in Britain were: Early English (c.1180-c.1280), Decorated-geometric (c.1250-c.1300), Decorated-curved (c.1300-c.1350), Perpendicular (c.1350-c.1550)

Gothic Revival

Serious revival of the Gothic style (strongly linked to Christian morality); the predominant style in Britain from the 1830's to the 1860's, it was more scholarly than the Gothick (q.v.), the four different phases of Gothic (q.v.) were clearly differentiated

Gothick

Name commonly applied to the light-hearted Gothic revival of the 18th and early 19th centuries, distinguished from the later Gothic Revival (q.v.) by its delicate, playful nature; it often confused the different phases of Gothic (q.v.)

Quarrel/quarry

Small pane of glass held within a grid-like pattern of lead comes (q.v.)

Horns

Small projecting spurs of timber on a sash window (hanging down from the top sash and projecting up from the bottom sash), introduced from the mid-19th century to strengthen the joints

International Style

Modernist style that evolved from the Art Deco (q.v.), it pared down all ornament in line with the principles of 'form and function'; it was the origin of most modern architecture

Jacobean

Pertaining to the reign of James I (1603-25)

Lamb's tongue

Moulding common on 18th century glazing bars (q.v.)

Light

The areas or compartments within a window, framed by mullions, transoms, or glazing bars (q.v.), through which light is admitted

Margin lights

A narrow window flanking a larger window or door; or narrow panes of glass around the edge of a window composed mainly of larger panes of glass

Mullion

A slender pier that forms the vertical division between the lights (q.v.) of a window

Ogee

A shape common in the Decorated (curvilinear) style; also a popular moulding on timber casement windows in the 17th and 18th centuries

Ovolo

A moulding common on 16th century mullions

Polite

Describes buildings that are built to a specific fashion or style, with little dependence upon local tradition or materials; opposite of vernacular (q.v.)

Queen Anne

Pertaining to the reign of Queen Anne (1702-14)

Queen Anne Style

Popular from the 1860's, it was a free interpretation of the style of the Queen Anne (q.v.) era

Regency

The style of the Regency era, c.1800-c.1830 (the actual Regency was technically 1811-1820)

Restoration

Pertaining to the reigns of Charles II & James II (1660-88)

Saddle bar

A horizontal iron bar set into a window frame, to which leaded glazing is tied

Sash

That part of a window frame that slides up or down, usually counterbalanced on weights. A sash window is a window that contains such sliding sashes

Stanchion

A vertical iron bar set into a window frame to support leaded glazing

Stay

A horizontal metal bar that attaches between the window frame and the casement to hold the latter open

Terracotta

Unglazed, baked clay; often used for decorative details on buildings. Common in the 15th and 16th centuries, and again in the 19th and early 20th centuries

Transom

A horizontal bar dividing a window into two or more lights (q.v.)

Tudor

Pertaining to the Tudor dynasty, 1485-1603, although things pertaining to Elizabeth I's reign (1558-1603) are more normally referred to as Elizabethan (q.v.)

Vernacular

Describes buildings that are built from local materials according to local traditions; buildings that have few pretensions towards architectural grandeur; opposite of polite (q.v.)

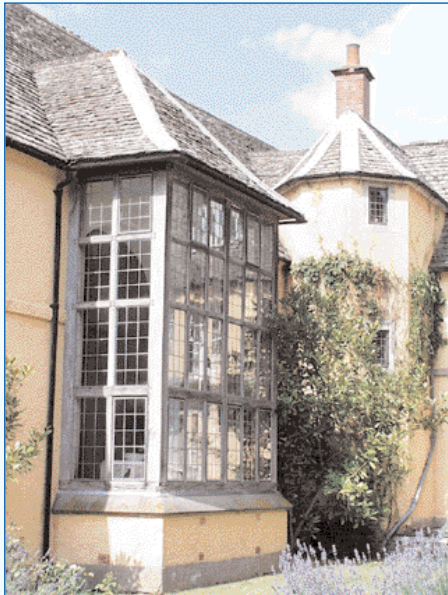
Victorian

Pertaining to the reign of Victoria (1837-1901)

William & Mary

Pertaining to the joint reign of William III (1688-1702) & Mary II (1688-94)

The Conservation Team at
Tewkesbury Borough Council
Council Offices
Gloucester Road Tewkesbury
Glos GL20 5TT
Tel: 01684 295010 Fax: 01684 272067
Email: buildingconservation@tewkesburybc.gov.uk



Forthampton Court