Windows

A Guidance Booklet on Openings

Technical Note 4A

Northern Ireland Environment Agency
www.ni-environment.gov.uk

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Introduction

Technical Guidance Note On Windows

Old windows are unique, they are often astonishingly well crafted objects made from the finest and most durable timber. In many cases they have lasted for over two hundred years with basic repairs and simple maintenance. They form a vital part of the character of our historic buildings, but can be the most complicated element on a facade. In formal architecture their detailed design is a fundamental part of the overall desired effect. This is particularly relevant to Georgian architecture which dominates much of rural Northern Ireland where the windows are the main compositional element.

Historic glass has its own charm. It can give character and humanity to an otherwise aloof and formal facade. This glass is now a finite resource as most types are no longer manufactured. Modern replacements are normally heavier and do not reproduce the movement of the original.

Today windows are threatened as never before. They are replaced rather than repaired as a matter of course. This is often with materials which have a much shorter lifespan than the original window. In a misguided drive to increase energy efficiency their glass is also removed for double glazing even if the original window is kept. Both these actions almost always result in a loss of historic detail and a reduction in the character of a building. This booklet aims to explain how historic windows can be retained and why they are important. It also aims to give clear information to decision makers on the problems associated with this course of action.

The Issues

Decisions taken on existing windows often revolve around the following factors:

Maintenance

Timber and historic windows require regular maintenance. This normally involves cleaning and painting on a regular cycle. Sash windows in particular can have their performance reduced if care is not taken when repainting and can stick as a result. A technique to reduce this problem is discussed later in the text. Regular painting has other benefits, it allows the exterior of the building to be inspected at close range on a regular basis. If a window is replaced by one requiring less maintenance, other items on the facade such as timber eaves and cast iron gutters may be painted less frequently. Maintenance free windows do not exist, uPVC will discolour if not regularly cleaned, aluminum also needs regular cleaning. Both of these have an expected lifespan of 30 years, with gaskets needing replacement earlier. This is much less than those they replace.*

Cost

It is generally considered cheaper to replace a window rather than repair it, particularly if the replacement provides an enhancement in thermal performance. However in most cases' repair should be cheaper and in almost all cases cheaper in the long term. The expected life of a well repaired and maintained historic window far exceeds a replacement in any material. The hidden cost of removing such an important historic element on the value of the house should also be considered.

Reliability

Old windows, particularly sashes, are regarded as unreliable; they stick, are draughty, are prone to rot and are unsecure. All of these issues can be addressed by maintenance and simple intervention. The proven track record of sash windows, in particular, lasting 100s of years shows that their reliability is unrivaled.

Draughts

This is a common complaint in regard to historic windows. Increased heating in houses has increased the nuisance derived from air entering around windows. There are a number of proprietary draught proofing systems on the market, which can effectively solve this problem. The most effective systems recess brushes and seals in the depth of the window, maintaining its appearance. Thought should be given to the effect of draught proofing on the wider house. Current building regulations advise owners to 'build tight and ventilate right!. Care should be taken to ensure a house is still adequately ventilated.

Insulation

English Heritage has proven through research that 90% of the heat loss from windows is due to draught. Draught proofing is therefore the most effective form of insulating historic windows. Traditional shutters and curtains can also substantially reduce heat loss. Upgrading to double glazing has proven not to be a cost-effective option. English Heritage have estimated that it would take 60 years to pay in energy savings for the cost of upgrading sash windows.* Most new windows would have to be replaced within that timeframe.

Secondary glazing can also be considered and properly installed provides more insulation than double-glazing. This is discussed in more detail later in this booklet.

* Framing Opinions. 7 Energy Savings, English Heritage,

Craftsmen

A common complaint is that. It is difficult to find craftsmen who will repair rather than replace windows. Many companies in Northern Ireland have the skills to repair sash windows. It is true, however, that some companies, particularly the larger ones, will be better equipped to provide a complete replacement rather than a repair. To counter this, the Department, in conjunction with the Ulster Architectural Heritage Society, produces the 'Directory of traditional building skills'. Although the standards of companies in this publication is not currently vetted, companies are asked to list examples of window repairs as well as replacements.

Condensation

In today's centrally heated houses condensation is an increasing problem, from washing machines to showers and electric kettles, there are a lot more sources of water vapour inside buildings than there were in the past. Condensation occurs when air containing water vapour cools below dew point on meeting a cold surface and water condenses onto that surface. The two main ways to avoid this problem are insulation and ventilation. Upgrading to double glazing can reduce condensation on windows but if general ventilation is not increased, the problem will simply move and condensation will occur elsewhere. A considerable body of opinion holds that it is a good thing to encourage condensation to remain on the windows. At least there it can be seen and the windows treated. Elsewhere, hidden damage may be caused. However, if windows do have serious condensation problems NIEA recommends that increasing the ventilation from a room is considered such as reopening ventilation from a fireplace. Thought should be given to reducing the moisture creating conditions (mechanical extract from kitchen and shower rooms). Locating radiators under windows can also alleviate the problem.

Noise/Sound

Single paned windows will let in more noise than double-glazing. However nuisance can be substantially reduced by other means. As with heat insulation, sound insulation can be improved by proper draught proofing. Curtains, shutters and secondary glazing can all help.

Building Regulations

When the use of a building is changed, the current Northern Ireland Building Regulations are enforced for any work to the building. In regard to windows this presently implies double-glazing, trickle vents and safety glazing in areas which are considered vulnerable. The new standards are not imposed on windows which are to be repaired, only those to be replaced but there are occasions where there appears to be a direct conflict between the requirements of NIEA and the regulations. Consultation is therefore required with both agencies, but a creative solution can usually be found. Trickle vents can be eliminated by adding other controlled ventilation or they can be installed unobtrusively into the window. Double glazing requirements can sometimes be dropped by increasing insulation elsewhere in the building (usually a cheaper option). Safety from accidental impact can be increased by provision of a rail inside the window. Certain companies in Northern Ireland produce toughened glass by a roller process which can be adapted to put a 'movement' into the panes recreating the appearance of historic glass. This is a less acceptable solution than a rail particularly if historic glass would be lost. It is also worth noting that the regulations can sometimes be relaxed. BS 5750 1999 cites heritage value as a legitimate reason to drop compliance with an otherwise statutory obligation. NIEA has recently produced a guide on historic buildings and energy efficiency and the requirements of the building regulations.*

Security

Older windows are sometimes replaced because of concerns over security. However there are many products on the market specifically designed to counter these problems. Stops can be obtained which limit the opening of windows. This will prevent unwanted access and avoid the danger of children falling out of low windows. Screw locks and bolts can also be fitted, increasing security. Where a design appears particularly vulnerable a traditional solution is to insert a rod behind the window reducing access even if glass is broken. Historic windows can be made as secure as any other.

* Historic Buildings and energy Efficiency a Guide to part F of the Northern Ireland building regulations.

History

Early windows

Very little survives intact in Northern Ireland from the period prior to 1600. The vast majority of our complete historic buildings date from after 1700. However archaeological investigation and contemporary records tell us that developments in windows were similar to those in other parts of Ireland and Britain. Medieval churches were glazed with small panes of glass held together with lead and often had stained glass. Similar to much church glazing of today, these were supported by wrought iron bars or 'ferramenta' to the rear over larger distances. Most early buildings did not have any glazing with small windows open to the elements mabye with timber shutters which could be slid over at night or in extreme weather.

Large castles and houses

In some instances Large castles and houses had adaptations of the church window. Called quarry glazing, diamond shaped panes set in lead 'cames' were contained within a wrought iron frame or were fixed to the walls. Due to the limited strength of the glass, size was small which led to the grouping of windows with stone mullions in between which is characteristic of 'Tudor' architecture.
Such windows would have been found on many of the early plantation houses such as Dunluce Castle. The planters built many of their ordinary houses from timber in the styles which they were used to. These buildings would have had timber casement windows using quarry glazing. None of these windows survive.
With the influence of classical ideas timber mullion (vertical) and transom (horizontal) windows became fashionable towards the end of 17th century. Metal casements were set within this frame.

Sash Windows

Sash windows appear to have been developed from an English adaptation of the French custom of a fixed upper and moveable lower sash. Their earliest use seems to have been in London in the 1680s were they quickly became fashionable. Their use was widespread throughout Britain and Ireland by the 1720s.

Sash window technology developed along clear lines for the two hundred years that they were the construction choice for windows. The earliest examples have many panes of glass and thick glazing bars. As their design was refined, the thickness of the glazing bars progressively reduced, and sometimes were made of metal.

As glass technology improved in the Victorian period the number of glazing bars was reduced. From the 1870s most sash windows were free of glazing bars, with a single pane of glass in each sash. This expanse of glass was much heavier than in the earlier windows and increased stress was put on the joints. The sash horn was developed to overcome this problem. Sash horns also evolved in their design over time. No window had horns prior to 1850.
The position of windows in the wall also evolved over time. In the earliest examples the surrounding box of the sash was encased on the facade and was often built flush with the front wall. In England a series of Acts in Parliament caused sashes to be built one brick back from the façade and then for the wall to be built in front of the boxes. In Ireland an Act was passed in 1730 with similar intent. With the more exposed weather conditions of Ulster this recessing makes common sense as it provided some shelter and it is likely that this improvement was followed from an early period.
To the rear of historic houses it is not uncommon to find exposed boxes. This can be because it is the earliest part of the house, because fashionable improvements were never carried out here, or because cheaper window construction was employed.

Vernacular

Windows in vernacular buildings closely followed developments in more formal architecture, though here many windows did without sash cords and weights and instead employed external props or the friction of the box. Their glazing bars also tend to be cruder and thicker and it is quite common to find sash boxes exposed, though as many dispensed with weights altogether, the need for a deep box was reduced.

Victorian

By the late Victorian period technology had given way to style as the dictator of form. Windows with narrow margins are a common indicator of a rural building built or renovated in the second half of the 19th century. Often a small, heavily subdivided, upper sash is found over a plain lower, but there are a wide variety of sash windows to be found often unique to a specific building.

Glass

Glass technology also evolved through several distinct types along side the development of the sash windows. Crown glass and cylinder glass are two processes which were continually refined. Cylinder glass was made from blown cylinders of glass cut and rolled flat on a sanded surface. After the 1830s the length of glass which could be blown was greatly improved and thickness was reduced.

It has imperfections which are characteristic of a sanded surface, bubbles and other marks which tend to be linear. Crown glass was made from a large bubble of glass being spun out by a very skilled process to form a disc of glass producing the ripple effect characteristic of the material (though sometimes hard to spot on the finest examples). The clarity of glass and the lightness of section which could be achieved by this process made it much sought after. Its development in France and quick adoption in Britain and Ireland in the 1700s coincided with the introduction of the sash window. Imperfections in crown glass and bubbles tend to be circular. The central hub or bullion is thicker and often was cut around and not used in prestige buildings.

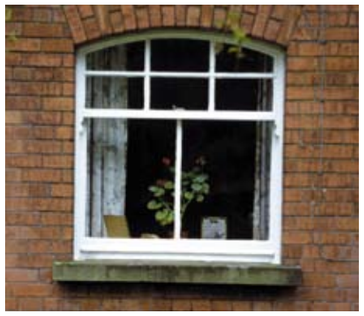


Plate glass was manufactured by pouring or laying a cut cylinder onto a polished metal plate, this was polished in turn to produce a glass largely free from imperfection though swirls from the grinding machine can sometimes be noticed. Although it also was developed in France around the 1680s, mechanisation of the grinding process and other improvements in England after 1838 made the glass much more widely available and lead to the removal of glazing bars from windows. The patent plate glass as the English product was known was much more polished than its traditional predecessor.

Drawn glass was developed in the early 20th century and is characterised by fine parallel lines discernable in the glass. Float glass was developed in the 1950s and is still currently used. The glass is cast onto molten tin which polishes the sheet on both sides and a pane of unvarying width, without imperfection is produced.

Nineteenth Century Casements

Towards the end of the 19th century a renewed interest in historic styles led to an attempt to recreate historic windows. Cast iron and hybrid metals (such as zinc) were widely used in churches, almshouses, gatehouses and other buildings designed in the popular gothic style. These recreated the quarry glazing pattern of their predecessors. General timber casements also became popular. These were often designed for a specific building and can be very detailed and difficult to reproduce.

Incorporation of stained glass and other decorative effects became popular particularly during the Arts and Crafts period of the turn of the century. While the sash window retained its dominance during the period, ordinary buildings also used casements as part of improvement works in the late 19th century. The Skinners Company increased the height of the majority of buildings in Dungiven. This resulted in an interesting pattern of buildings with sashes on the ground floor and casements above.

Window Surrounds and Shutters

As important as the windows themselves are, the surrounds which accompany them were designed as an integral part of the window composition. Formal houses almost always have shutters to the sides as an aid to insulation and security. In some 19th century houses the shutters are contained below the window as an internal sash which slides up behind the window. Due to their complexity most of these windows have now been removed or have become unworkable. Surviving examples are extremely rare and should be cherished. Historic joinery follows the fashion of the age: carefully controlled and proportioned according to classical principles in the Georgian period. less controlled, decorative but still following classical themes in the Victorian era.

The exterior of windows follow a similar development.
Hood mouldings for Tudor windows or in the Tudor style.
Plain surrounds with little embellishment in the Georgian period.
Classical surrounds or other decorative surrounds in the Victorian period. With the exception of church windows, the cills of windows in historic buildings are often of a remarkably consistent depth (which is around twice the common modern depth). Almost always made of stone, a fine vertical tooling along the front edge can often be discerned.

Twentieth Century Windows

Sash windows continued to be used on new buildings, particularly public ones, right up to the Second World War. The last British Standard governing their use and manufacture was published in 1958 (BS644-2). However, from the 1930s onwards casements increasingly became the window used for new building. Paralleled with this was the development of metal windows of increasing sophistication. In Northern Ireland these were used mainly on school buildings but they were also the window of choice for buildings of the Modern Movement. The Crittal Company made one type of window which was very popular. These windows are often very fine and elegant and contribute greatly to the appearance of the building in which they are installed

From the 1950s onwards metal windows became increasingly sophisticated and replaced timber on most buildings.
Timber conversely declined in quality as wood from 30 year old trees became the norm and also in quality of window manufacture. Many of the aluminum and steel systems employed have now been discontinued and specialist advice should be sought in relation to each building.

As with all buildings, the choice of glazing system on modern buildings is an important part of the design and appearance. Replacement windows should only be contemplated after a thorough consideration of the impact the new windows will have on the appearance.

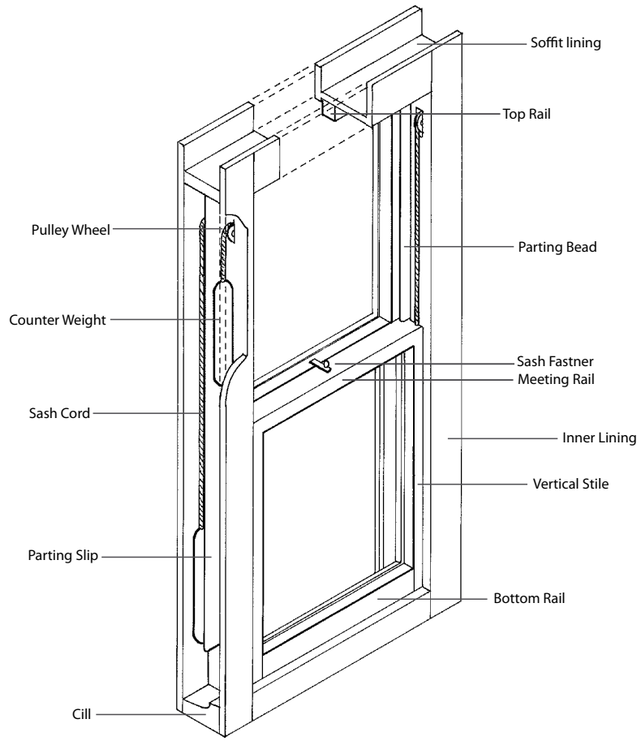
Function

Casement Windows

Many Victorian casements have a bead which gives extra weatherproofing where a pair of windows meet which is not common in modern windows. This, in conjunction with projecting weather beads at the head, which throw water clear of the structure, allowed a refinement of detail. The windows often have recesses along the joints to prevent moisture moving by capillary action and wind pressure from reaching the interior. Cills are particularly vulnerable to damage as all the water hitting the window drains down over them. They are normally designed to throw water away as quickly as possible and reduce the danger of rot. Condensation in the interior can be directed through copper tubes to the exterior, though this is only common in buildings which were designed for large crowds. Historic casement windows are generally side hung with a system of catches to lock and hold them. Because it is easier to weatherproof, the majority open outwards. Those behind stone mullions, however tend to open inwards. Top hung casements are common in some building such as schools.

Sash Windows

The sash window works on the principle of balance between the windows and weights contained within the boxes to each side. Well balanced windows should take only the minimum of effort to open. The sashes are held in place by the surrounding sash box and a central parting bead which provide a track for them to move along. A pulley attached to the top of the track supports the sash chord which is attached to the sash and to a weight within the box. The meeting rail at the junction of the two sashes is designed to give a snug fit and to throw any rainwater outwards. Similarly all other horizontal elements of the window are designed to shed water as quickly as possible and avoid decay. Windows are always glazed from the outside which again reduces the chance of moisture blowing through the construction to the interior. They have an advantage over casements in that they are less exposed to the elements when open than those that open out. They provide better weather resistance than those casements which open inwards. The disadvantage is that they can stick or be draughty if not well maintained.



Preventative Maintenance

'A stitch in time saves nine'

The importance of regular inspection of all parts of a historic building cannot be overstressed. Catching a problem early can allow it to be easily fixed and substantially reduce costs. The following should form part of a regular maintenance routine:

- Regular Painting. This should be carried out every three to five years depending on the exposure of the window.
- Examination of the window for signs of rot, decay of putty and condensation problems.
- Repair of sash chords and oiling sash pulleys.
- Inspecting metalwork for signs of blistering and rust.

Painting

Painting a window, though an important task, can lead to problems if not carried out correctly. Sash windows can stick, the draught proofing and weather proofing of casements can be reduced. Painting over cracks and blisters may not solve a problem as the blisters could expand causing new cracks.

If possible sash windows should be removed from their frame for painting and thought should be given making this easier in the future. Sash styles could be screwed rather than nailed making future removal easier, or hinges could be added behind this to allow the sashes to rotate inwards. Existing paint should be rubbed down with water or a non-alkaline soap before sanding to receive the new coat of paint. If a window needs stripped back to reveal the fineness of the original detail or for repair work then this should be carried out using paint stripper. Dipping in a caustic bath, though quicker, will damage glues and the rapid drying out and expansion of joints will result in strength of the timber windows being reduced.

NIEA recommends that lead paint should be used for the maintenance of historic timber windows. This would have been used until the 1960s, its use is now limited because of its toxic nature. Listed buildings can be made exempt from the prohibition on the material upon the issuing of a certificate by the Department.

Oil based paints can be used on historic windows as an alternative. Linseed oil based paint is currently enjoying a revival, and on such work it has a number of advantages in that it acts as a preservative for the wood as well as a repellant for water.

Examination

A wooden window often gives early warning of problems. Check the most vulnerable areas. the horizontal areas where water may linger; the joints for signs of widening where the window timbers meet side walls which could be wet.

Rot

If rot is found it is likely to be wet rot. This is a localised problem which only occurs in damp timber. It will not spread to dry parts of the window. Try to understand how the rot has occurred. In most cases this will be due to cracked paint allowing water to enter. If the rot is small and the rest of the wood sound then it can be treated by scraping out the damp wood and treating the rest of the area with a preservative. A wood filler can be used to build up the removed area. If the rot covers a larger area then splicing in new timber will be required. On old sash windows it is very common to find spliced repairs as a diagonal joint at the bottom of the side boxes where the timber has rotted due to splashes from the cill below.

Repairs

Other Rots

There are many other forms of rot which affect buildings. Dry rot is the most known and feared though it is common for other types of fungus to be mistaken for it. Most forms of fungus require damp, humid conditions to survive and though they can be found in the sash boxes of windows and elsewhere there is normally an external source, such as a leaking downpipe, causing the problem. Check for fungi, dust of spores, rhynzomes or cobweb like strands. Contact an architect or a specialist surveyor for advice.

Splitting or opening of joints

Over time the glues of old windows may weaken and decay, causing wedges to fall out. These can be reglued and reinserted if tackled in time. If left open they can be a good conduit, allowing water into the frame and hastening decay.

Cracking and loss of putty

Brittle putty can crack and allow moisture through to the timber behind. The window should be inspected for signs of this. Over painting is sometimes sufficient to prevent further decay if cracks are recent, but if much moisture has penetrated the paint and the putty this will be trapped and hasten decay. Great care should be taken in the removal of putty that the historic glass is not damaged. There are some products on the market to help soften putty prior to removal to reduce this danger. NIEA recommends linseed oil putty the traditional material used. This has preservative qualities that modern counterparts do not possess.

Condensation

The generators of condensation have been dealt with previously. If this is a problem, moisture sitting on the horizontal parts of timber windows will over time cause rot or rusting of metal windows. If possible increase ventilation in the room, consider the possibility of tubes draining to the exterior and monitor the window regularly for signs of decay. Ensure that the mullions are painted regularly.

Repair of Sash Chords and Pulleys

On sash windows it is common for these items to stick or become damaged if maintained incorrectly. In most windows the cords were made from cotton or jute but metal chains can be found on some larger nineteenth century windows. Overpainting is a common source of problems which will stiffen and reduce the movement of the cord. This should be avoided. Pulleys should be oiled and inspected to ensure freedom of movement. The original brass or metal pulleys should be maintained in preference to plastic which will damage more easily. Nylon cords will stretch much more than traditional materials and are not normally appropriate replacements. It should be remembered that the weight balancing the sash window may become less effective if modern heavier glass has been installed. The weight should be increased to compensate for this. Increasing the weight will require removal of the sashes and access to the small panels in the side boxes normally provide for this purpose.

Casement Hinges

Check casement hinges, ensure they are not rusting by oiling them and maintain their surface from rust and other dirt, by taking care when painting.

Timber repairs

The need for repairs to timber windows can often appear more extensive at first inspection than is in fact the case. Do not confuse cracked paintwork for decayed wood. If a penknife does not penetrate too far into the wood then the structure is basically sound. Removal of paint and time to dry out before application of a new coat may be sufficient maintenance for the present. Application of wood filler and preservative as described above may be required for small areas of decay. If rot is more extensive then decayed portions will have to be replaced. This is a job for a carpenter but the principle is to angle new joints to allow water to run away from the window and avoid causing future problems. Ensure that new timber has been well dried to avoid shrinkage. Pitch pine or hardwood is often specified for repairs to ensure wood of similar durability to the existing window. Sometimes similar precautions were taken in the past. It is not uncommon to find oak bottom rails to pine windows.

Metal Repairs

Metal windows can also appear beyond repair. Cast iron which has badly rusted can often be brushed down and reused. It is possible to have repairs welded in for particularly decayed components. Lead in windows may have decayed or expanded due to being in strong sunlight or prevailing winds, these will often need to be reset. This is a job for a specialist to remove the window, remove the lead and replace it to the same pattern. Brass rods are sometimes inserted as a replacement for the iron ferramenta to avoid rust, care needs to be taken that such an action does not significantly alter the appearance of the window to the interior.

Fanlights

This is often a very detailed form of ironwork with surviving historic glass. A specialist should be employed to care for these items.

Major Repair

If a window is very badly damaged a decision will have to be taken on the cost and effort of repair techniques against a suitable replacement. Even at this stage it is common to find that the whole window does not need replaced. Very badly decayed sash boxes or frames will often have relatively sound sashes or casement windows. These should be retained for insertion in the new box or frame. Often the detail of the window mullions (astragels) will be very fine and hard to reproduce. Sometimes they are a design unique to the historic building and a valuable part of its history. Often they will contain historic glass which will be hard to remove and install in the new windows without causing damage. All efforts should be made to retain historic windows.

Replacement

If a window is completely damaged and decayed then replacement can be considered. Every element should be assessed as an entity and if capable of repair be incorporated into the new window. For Georgian-paned sash windows a movement test can be applied to the mullions. If there is major movement by gently pressing the mullions, this indicates weakened joints and replacement mullions may be needed. If both sashes exhibit this problem and there is significant wet rot in the box, replacement may be required. For listed buildings NIEA insists that new windows match exactly the windows that they replace and that a part of the original window should be kept on site for inspection by the area architect.

Performance Enhancement

Draught Proofing

Over time the original snug fit of a sash window against its parting beads may reduce, leading to rattling. A casement may similarly permit draughts that are more noticeable in modern, heated buildings. Parting beads and cracks in the windows can be repaired or replaced to reduce this problem or a draught proofing system can be installed.

There are many varieties of draught proofing currently available for windows. Some are specifically designed for sashes. NIEA recommends systems that are recessed into the windows. These cause less visual disruption and tend to work more effectively. As with sash chords, their effectiveness can be substantially reduced by over painting and some systems allow for this by making brushes removable. In some sashes the central parting bead is missing and in others it can be very narrow. This makes effective draught proofing more problematic but central parting beads of 5 mm width or wider can be draught proofed.

Secondary Glazing

In pure energy efficiency terms secondary glazing is much more effective than double glazing. Research has shown that as the air gap between the two panes of glass increases, the insulation value of the window as a whole increases. The cold bridge of heat escaping through the timber/metal construction is also reduced. The same is true for noise reduction. In aesthetic terms secondary glazing can be problematic, reducing the character of the interior. However, the advantage of this as an energy saving measure should be considered carefully. It may be much more efficient to increase insulation in other parts of the building.
Secondary glazing should be installed without internal mullions to avoid detracting from the existing window. In sash windows the most effective installations are where there is sufficient depth in the cill box to mount the system without impairing the use of the shutters. If a system has to be mounted on top of shutters consider the impact of losing this traditional insulating and security measure and ensure that it is mounted in a reversible way so that the system can be removed if desired in the future.

Single Glazed Window

Double Glazed Window

Curtains

Traditional methods can be very effective. Heavy curtains, possibly with enclosure at the head, can substantially reduce draughts and noise around windows.

Double Glazing

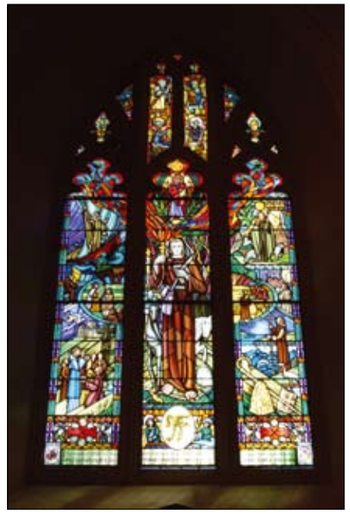
Double glazing is very problematic for historic windows. Its weight and depth often require substantial modification of the frames leading owners to replace rather than repair their windows.
Double glazing almost always requires an exterior glazing bead to secure the glass to the frame and cannot rely upon putty.
The weight of the glass often dictates that glazing bars within the window have to be thickened to support the glass. The result is a window that is much cruder in appearance and a loss of historic character for the building. Sticking on imitation glazing bars to the front of glass is not an acceptable solution. The increase required in thickness to improve thermal performance often requires the depth of the window to be increased as well as causing disruption to internal joinery. 12 mm double glazing is the maximum which can be accommodated in standard 40 mm deep sashes.
The thermal performance achieved from such windows is marginal when compared to properly draught proofed traditional windows.
For all these reasons NIEA does not recommend double glazing to listed buildings. This position has been long standing in regard to windows with fine glazing bars. In the past other types of historic windows were sometimes deemed permissible. However, this has often lead to a reduction in historic character and should be avoided. Because of the particular rarity of historic glass in Northern Ireland due to bomb damage, windows with historic glass are very important and should be retained.

Storm Glazing

Storm glazing is the protection of a historic window by the provision of an external layer of glass or plastic. It is normally only carried out to church windows. As with secondary glazing, great care needs to be taken to ensure that the system is not visually disruptive. In the past polycarbonate was used. This can be prone to scrapes and discolouration and true glass is a much more effective solution. Problems can result from the microclimate set up between the two panes of glass causing thermal movement and distortion of leaded windows. Ventilation should be introduced to this space to avoid the problem but care needs to be taken that insects and plants do not colonise the space as a result.

NIEA recommends that storm glazing should be used only under the following conditions:

- Exposure to severe weather conditions.
- Recurrent vandalism.
- As a holding operation for windows in poor condition. Please note: The benefit of insulation or of noise reduction are slight.



Workmanship

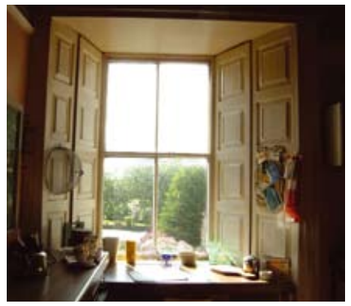
- The glazing should be cut to follow the shape of the opening.
- It should be glazed into a non-ferrous frame and fixed by clips and screws of similar material.
- A small ventilation gap should be provided all around the frame.
- A programme of periodic removal and cleaning of all surfaces should be devised. Puttying the glazing into an opening or leaving a gap at the bottom only should be avoided.
- Any external cleaning of the building complete additional sealing of the opening is necessary.

Isothermal Glazing

This is also only associated with church windows. The historic glass is preserved in a vacuum between two modern pieces of glass. This technique is expensive but eliminates the problems associated with storm glazing. Care needs to be taken that the thicker build-up does not cause damage to the historic supports. As with double glazing, such a technique will not be acceptable where the appearance of windows will be substantially modified as a result. The similar technique often seen in uPVC windows, of placing a pattern of glazing mullions inside two panes of glass is not acceptable as this completely alters the appearance of a window.

Costs

Repairs to a window should normally be cheaper than complete replacement. The vast majority of sash windows even those neglected for some time, will only be suffering from rot and damage along their bottom rails. The cost of carrying out such repairs depends on the scale of work and the specialism of the company or carpenter employed. It should approximate to about one third of the price of complete replacement. In most cases when repairs are carried out the opportunity can be taken to overhaul the window. The sash cords and the putty can be renewed, the windows painted and draught proofing installed. This will raise the average price of the work to about two thirds to three quarters of the price of replacement and will approximate to the cost of replacing in uPVC or aluminium. However it must be borne in mind that repair will maintain the historic profile more accurately, is the option with the longest life expectancy because of the inferiority of modern timber, and is the most sustainable solution. Aluminum is formed at very high temperatures and great use of energy. uPVC employs six of the most toxic chemicals known to man and is very difficult to recycle or destroy without generating more toxic waste.



Summary

1. Check historic windows regularly and take early measures to maintain them.
2. Repair windows, rather than replacing them. This maintains the historic character and is normall. the most cost effective and durable option.
3. Avoid double glazing. Money can be spent more efficiently elsewhere to upgrade thermal performance. Installation can also seriously alter the appearance of historic windows.
4. Consider draught proofing as an effective way of improving thermal and sound performance.
5. Improve ventilation generally to reduce problems of condensation.
6. Consult with NIEA if there are apparent problems with safety regulations. Most problems can be solved with a minimum disruption to the character of the window.
7. Value historic glass as an increasingly rare material.
8. Ensure replacement material matches the detail of the original and take record photographs for future reference.
9. Alterations to windows which affect the special architecture or historic interest of a listed building require listed building consent. Such works include double glazing, changes to the profile or thickness of glazing bars, trickle vents and removal of historic glass.

NIEA Architects can advise if you are in any doubt.

Further Reading

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February 2010

Our aim is to protect, conserve and promote the natural environment and built heritage for the benefit of present and future generations.