



SCOTTISH CIVIC TRUST
A HOW-TO GUIDE

WINDOWS: REPAIR & REPLACEMENT



Contents

Introduction	3
Repair	4
Replacement	6
Cost	9
uPVC	10
Wood	12
The Maintenance Myth	13
Energy Savings	14
Upgrade Solutions	17
The Big Picture	18
Further Reading	19

INTRODUCTION

The appearance of windows is a significant factor in shaping the overall character of the building, and this can to some extent dictate the improvement options available for historic properties.

The drive towards energy efficiency is now a significant influence on home improvements. While windows typically account for only 10% of the heat loss of a building, householders often place great importance on being able to improve them. There is no getting away from the fact that we must all do our bit to tackle climate change, however there are inexpensive, effective and less damaging options for upgrading your windows than total replacement.

Thousands of historic timber windows are lost each year because people believe they are beyond repair and as a result many old buildings and historic areas suffer a profound deterioration in their character. This is despite the fact that buyers are increasingly attracted to properties with period features.

While surveying a conservation area, the Trust found that in a randomly selected street 74% of the properties had lost their original windows. However, most historic buildings are not Listed or found in designated Conservation Areas meaning that thousands of historic properties have no protection from potentially damaging changes. Permitted Development Rights allow homeowners to change their windows without planning permission. In conservation areas, additional controls called Article 4 Directions can be applied to restrict some or all of these kinds of small changes to street frontages.

The majority of historic windows are timber vertical sliding sashes, and we will focus on this type of frame in this document. However, there are many different types of window frame and each will have its own issues and solutions.

This booklet sets out to inform about the many ways we can look after the 'eyes' of a building—its traditional windows—and to tackle the issues and myths regarding window replacement.

REPAIR

Signs of ageing and surface deterioration are not necessarily symptoms of irreparable decay and repair will almost always be less costly than replacement.

A historic building starts to lose its integrity and authenticity when any part of its original fabric is replaced. Alongside their cultural value, existing windows represent the embodied energy which was required for their manufacture. In the drive towards energy efficiency it is no longer acceptable to simply throw things away where they can be repaired.

In historic buildings minimal intervention is the best approach in order to save as much original material and extend the useful life of the component. There's rarely a sound reason for replacement as the original features are usually better quality than their modern equivalents and buyers are increasingly attracted to properties with period features.

Common improvements for timber windows include repairing weak joints, restoring pulleys, replacing cords & weights, draught proofing, replacing damaged areas, and freeing frames which have been painted shut.

Regular cleaning inevitably improves performance and will allow any potential problems to be highlighted and repaired earlier. To make sashes more accessible for cleaning the original windows can and should be kept and upgraded with the 'Simplex' hinge system, which is used commonly in Scotland. This allows the lower sash to be swung inward for cleaning. The upper sash can then be drawn down to a comfortable height for



Window frames which appear to be in poor condition are not necessarily beyond repair.

easier cleaning on both the internal and external faces. This allows easier access to the external face of the window for cleaning and maintenance.

Layers of paint may interfere with smooth running of sashes but this is easily remedied. Loose paint can be removed with sandpaper and a scraper taking care not to damage the timber underneath. Where more paint is to be removed Historic Scotland recommends the use of an alkali paint stripper or gentle heat. Complete stripping of a window is rarely necessary; only loose and defective areas of paint should be removed. All accessible surfaces should then be rubbed down and primed for painting.

The choice of paint is very important to protect the timber from decay. Lead-based paints offer excellent durability; however their use is restricted to exempted buildings. Lead paint is also expensive and there are associated health risks



where lead compounds are ingested or inhaled due to disturbed paint. Dust from the inappropriate sanding of old lead paint during its removal or redecoration is the greatest hazard. The presence of lead paint does not justify stripping out historic joinery. It could be safer to renew or overcoat lead paint than attempt its removal. Where the existing paint is likely to contain high levels of lead (most pre-war paints did) wet (not dry) abrasive paper should be used to rub down old paintwork to prevent the release of potentially harmful dust into the air.

Modern alkyd (oil-based) paint systems, such as linseed oil paint, are a compatible alternative to lead paints which may enable the retention and overcoating of old lead-based layers. Alkyd paints offer an initially good level of durability, but require a shorter repainting cycle than lead-based paints. It is important to always make sure that new paint coats are compatible with the existing paint layers.

If the window frame has begun to decay, most often as a result of wet rot, the source of moisture must be identified and remedied. If the structural integrity of the window remains sound, the defective areas can be cut out and replaced with new timber and/or filler.

Old frames tend to allow gentle ventilation at all times. Historic buildings were not made to be completely sealed and in a properly ventilated building, damp may never be a problem. Seal the windows and doors however and the loss of ventilation around the old frames may promote condensation problems and damp within the building. It is therefore important when upgrading existing frames to give

thought to your home's construction to avoid damage.

Homeowners may be able to undertake common maintenance and repair tasks themselves. Guides on the repair of timber window frames are available from Historic Scotland, 'Looking After Your Sash and Case Windows' and SPAB, 'The Repair of Wood Windows'.

If in any doubt, consult a professional. Although there are an increasing number of companies specialising in the repair and restoration of old windows a good joiner will be able to do this work for you. Historic Scotland's Scottish Conservation Bureau maintains a list of qualified and experienced joinery contractors.

REPLACEMENT

“replacement windows consume up to 40 times the energy of renovation”

- ventrolla

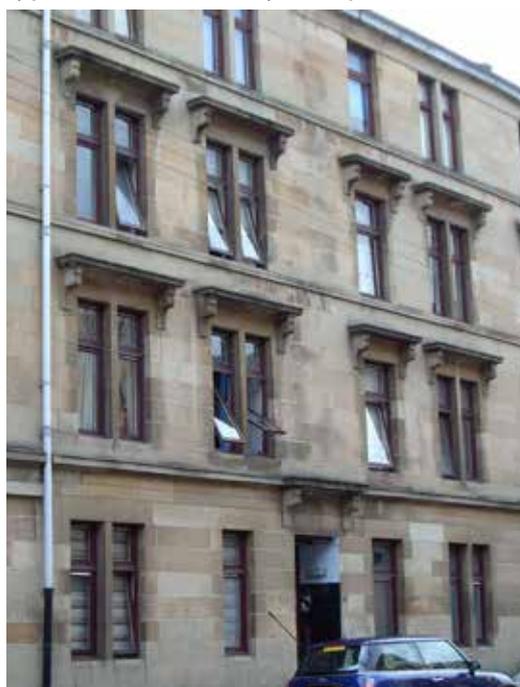
Where a building is listed, planning authorities usually require the existing window frames to be retained and repaired where possible. Listing applies to every part of a building and the replacement of windows will usually be resisted for two reasons; the loss of original fabric and the change in character. In conservation areas the emphasis is on protecting the external appearance of the buildings and the effect of alterations on the character of the area. Sensitive solutions in appropriate materials may be more acceptable in these situations.

LIKE FOR LIKE?

As a general rule, original windows should be retained and only where repair is clearly out of the question should replacement be accepted, and only then on condition that it matches the originals in every respect. Many planning authorities require replacement windows in listed buildings or conservation areas to be 'like for like'. However, what is considered 'like for like' varies between areas. While each case should be treated on its merits and some may be more able to accept change, the Trust defines like for like window replacements as being the same in materials, design, profile and opening method. Too often we see replacement window which could only be considered 'like' the originals after the briefest of glances!

The damage that may be caused by the replacement of any window which is historically and architecturally correct with a modern unit made from a different material, to a different design or with different method of opening should not be underestimated. In conservation areas the effect can be felt well beyond the building itself and these small changes in character can have a potentially immense effect on the character of the area.

Particularly distressing are top-hung casements, centre pivot and tilt-and-turn systems that sometimes attempt to mimic traditional sashes. When opened these types of frame visually disrupt the facade



Tilting windows can visually disrupt a classical facade where the majority of the windows are sliding sashes.



On close inspection the chunky uPVC frame on the ground floor is incapable of replicating the elegance of the original Crittal window frames and curved glass above on this 1930s Art Deco house.

of a historic building and are often not much more convincing when closed.

Features such as lintels, astragals and other design features should be retained and the proportions and patterns of the window should be reproduced exactly. The internal divisions (mullions and transoms) of a window can completely alter the overall effect.

Eventually some windows will be in such bad condition that replacement becomes necessary. However it is rare for all openings in a building to require simultaneous replacement. Each window should therefore be considered on its own merits.

In larger buildings, the effects of multiple occupation can be particularly damaging. The unity that comes from the repetition



The replacement uPVC windows differ from the originals in material, design, colour, profile and opening method—this cannot be considered 'like for like'.

of window patterns and features can be a significant part of the character of a building. It is therefore important to consider the whole building when replacing window frames.

It must be remembered that windows are also more than just their frames. When traditional windows are replaced we also lose the original glass, which may be patterned or stained. Many traditional windows retain crown glass, which has a textured appearance due to the inherent irregularities in the surface. Modern sheet glass will appear very flat and uniform in comparison.



Original glass can be as important as the frames. Curved glass, crown glass and stained glass all contribute much to the liveliness and character of historic buildings and are often lost when windows are replaced.



The above tenement, in Glasgow's West End, is B listed and has retained all of its original windows to the front elevation. The distinctive windows, with small panes and stained glass in the upper sashes, contribute greatly to the character of the building.

Below is a representation of what the building could look like if it was allowed to suffer the piecemeal change common in buildings with multiple owners. The lack of unity detracts from the building's grand facade and most of the original, stained glass has been lost.



COST

“there is hardly anything in the world that some man cannot make a little worse and sell a little cheaper, and the people who consider price only are this man’s lawful prey.”

- John Ruskin

Replacement window costs are notoriously difficult to compare due to the variations in quality of both uPVC and timber frames. Discounts and incentives complicate the picture further. uPVC is often but not always the cheapest option initially. However, the true cost of replacement windows comes not only from the initial cost of replacement but from the best value over their lifetime. Modern timber frames are most often better value in the long term due to their durability, ability to be repaired and longer lifespan.

There is a perception that timber windows cost more initially; however they are also being used in cheaper social housing. For example, at Cedar Brooke in Dublin which is pre-fabricated social and affordable housing all timber windows were used at very low cost.

Building Research Establishment (BRE) estimates from 2002 show softwood to be 43% cheaper on average than uPVC. The National Housing Federation produced figures in 1998 showing that softwood window frames are on average 35% cheaper than uPVC.

Alongside the increasing drive towards energy efficiency, high energy costs are causing many homeowners to look at ways to decrease their energy bills. Which Magazine warns “with only 10% of total

heat escaping through a house’s windows, our expert said that potential savings in this area are not as significant: ‘You’ll save around £110 a year if you double glaze all your windows, but if it costs, say, £8000 to do it, it’ll take more than 70 years to pay for itself.’ (Which Magazine, Dec 2008 p.39)

Lagging your loft, where most heat is lost, will give you a much quicker return on your investment. The Energy Savings Trust estimates that loft insulation will save around £110 a year on bills and will pay for itself in 1-4 years.

UPVC

The evidence is very strong that uPVC is the worst option for the environment. The Building Research Establishment's Green Guide to Housing Specification rates PVC window frames on the lowest grade as C, along with aluminium frames and aluminium faced timber composite frames. Softwood frames are rated as A. It states: 'PVC-U windows perform poorly due to the high intensity of the materials manufacture and the shorter lifespan.'¹ The Scottish Civic Trust objects to the use of uPVC windows in any situation.

uPVC (or PVC-u) is unplasticised polyvinyl chloride. Soft PVC, often called vinyl, contains softeners or plasticisers. uPVC does not contain these softeners and is hard and inflexible as a result.

Production and disposal of any type of PVC creates toxic chemicals. Released during production and disposal these chemicals end up in the environment threatening animal and human health. At least six (dioxins, furans, lead, cadmium, mercury and organic tin compounds) of the 15 most hazardous chemicals listed by the Oslo -Paris Commission (OSPAR—of which the UK is a member state) for priority elimination by 2020 are used in the production of uPVC or released as by-products.²

When disposed of, many of these chemicals are released again through chemical reactions when incinerated or by depositing in landfill.

Incineration of PVC leads to the formation of dioxins which Greenpeace states is the most toxic synthetic chemical known to science. The US Environmental Protection Agency has found dioxin to be 300,000 times more potent a carcinogen than DDT, which was banned in the US in 1972³. Dioxins are on the United Nations Environmental Program priority list for global elimination⁴.

Restrictions on substances used in the production of uPVC such as lead and on incineration of PVC are already in place in Denmark and Sweden and these countries usually take the lead on these issues and give a good indication of future trends in Europe.⁵

Most of the PVC made so far is in 'long life' building products which have not yet become waste, but when they do they will present difficult disposal problems, which will inevitably have to be dealt with by local authorities. As the production of PVC continues to grow, the PVC waste mountain can only increase. The European Commission estimates that 'post consumer PVC waste will increase from about 3.6 million tonnes in 2004 to about 4.7 million tonnes in 2010 and 6.2 million tonnes in 2020.'⁶ Much of this waste will be difficult to recycle and expensive to dispose of. Incineration is the industry's preferred option, but this leads to large quantities of hazardous chemicals. In fact, the life expectancy of PVC window is

A product that uses a non-renewable resource cannot be sustainable; oil makes up 43% of the raw material required to make PVC.

relatively short. The average age of PVC windows being taken out is 18 years.⁷ In contrast, timber windows are expected to last at least 35 years, and Victorian timber windows are lasting as long as 150 years. A realistic estimate for properly maintained modern timber windows is 60 years.

In reality uPVC is rarely recycled and when it is the uPVC degrades so that a window frame can only contain a small percentage of recycled material. The process requires the addition of yet more chemical additives and stabilisers and is actually more expensive than producing new uPVC.

82% of uPVC goes to landfill

15% of uPVC is incinerated

Only 3% of uPVC is recycled⁸

The PVC industry has made a commitment on recycling specific waste streams such as windows in the Vinyl 2010 project; 'The recycling of 50% of collectable available PVC waste of windows profiles, pipes and fittings, and roofing membranes in 2005 and of flooring in 2008.'⁹ Although this sounds impressive this commitment is only for the amount of waste actually collected (usually by local authorities) and not the total amount of PVC waste created.

Many companies, government authorities and other organisations have decided to phase out PVC, because of possible liabilities associated with PVC and PVC waste in the future, and the expense and practical difficulties of dealing with a growing waste stream which is difficult to recycle, not biodegradable and hazardous when incinerated.

Companies that have eliminated or are working to eliminate PVC in products or facilities include:

Nike; Volvo; Saab; Braun; IKEA; Body Shop; Marks & Spencer; Lego¹⁰

Countries working towards the discontinuation of PVC uses include:

Sweden; Spain; Germany; Austria; the Netherlands¹¹

Be wary of uPVC window and door companies claiming environmental benefits. The Advertising Standards Agency has recently (Oct 2008) upheld a complaint about a press advert for uPVC windows which stated 'ecological on design'. The ASA found that currently the manufacture, use and disposal of uPVC window frames has an overall negative effect on the environment.¹²

1 Building Research Establishment, Green Guide to Housing Specification, 2002

2 OSPAR Commission, Sintra Statement, 23 July 1998. The OSPAR Commission guides international cooperation on the protection of the marine environment of the North-East Atlantic.

3 Environment & Heritage Service Northern Ireland, Framing the View: Window Frames for a Sustainable Future, January 2000

4 <http://www.greenpeace.org.uk/tags/incineration?page=12>

5 Madeleine Cobbing, PVC Windows & Alternatives: Research for Islington Council, 2004, p.8

6 Madeleine Cobbing, PVC Windows & Alternatives: Research for Islington Council, 2004, p.7

7 WWF, Window of Opportunity, July 2005, p.14

8 WWF, Window of Opportunity, July 2005, p.3

9 http://www.vinyl2010.org/Home/Home/Our_Voluntary_Commitment/

10 Madeleine Cobbing, PVC Windows & Alternatives: Research for Islington Council, 2004, p.32 & Environment & Heritage Service Northern Ireland, Framing the View: Window Frames for a Sustainable Future, January 2000

11 Madeleine Cobbing, PVC Windows & Alternatives: Research for Islington Council, 2004, p.15

12 http://www.asa.org.uk/asa/adjudications/non_broadcastAdjudication+Details.htm?Adjudication_id=45066

WOOD

Wood has been around for millions of years and is the dominant material for windows in western Europe. Timber has a variable and natural beauty and is repairable, adaptable and durable.

It can also be environmentally damaging, if it isn't sustainably harvested. Buyers should look for the Forest Stewardship Council's logo (FSC approved) on products which means the wood has come from a sustainable forest. Older trees have a natural density and longevity which would ideally make for better window frames. This could however be environmentally unsustainable. Younger trees can be sustainably grown but need more preservatives to protect them and prolong their use.

Older window frames tend to be constructed from slower-grown, better quality timber and with care can last for hundreds of years. It makes sense therefore to retain historic window frames where they exist as they are likely to be constructed from better quality materials than would be used today.



It takes 8 times more energy to manufacture a PVC window than an equivalent new timber frame.

-WWF

THE MAINTENANCE MYTH

There is no such thing as a maintenance free building

Some regular maintenance is required for all window frames and all materials degrade over time.

uPVC frames need regular cleaning or they can become irreversibly discoloured. Sunlight causes brittleness and yellowing. uPVC windows can be installed and never maintained but just like timber the consequences of this will eventually become apparent. Housing Association Property Mutual, a major defect insurer for housing associations, states in their Component Life Manual that uPVC must be cleaned every 6 months, lubricated and adjusted annually and have weather stripping and gaskets renewed every 10 years. So uPVC also needs maintenance to remain in good condition.

Developments in timber technology such as micro-porous paints and stains that allow wood to breathe mean modern high-performance softwood windows need minimal maintenance. Modern finishes also minimise the preparation necessary when it comes to repainting or staining windows.

So timber windows often need little more maintenance than uPVC. However, the greatest benefit of timber is that it can be repaired easily. Sections can be chopped out and replaced. A uPVC window frame is like a car with the bonnet sealed shut – once it has failed it must be totally replaced. Repair of uPVC units is expensive and often impossible.

Maintenance can seem like an even more daunting task with windows above ground floor and particularly for owners of flats. A major issue encountered whilst carrying out maintenance tasks is working at height. The Health and Safety Executive advice is that for straightforward, short duration work stepladders and ladders can be a good option. In this case, a short duration is taken to be between 15 and 30 minutes. The additional cost of scaffolding or cradles to allow safe working at height to maintain windows could therefore potentially be an issue. However there are techniques to access the external face of windows from within a building. Simplex hinges mentioned earlier allow easier access to the external face of sashes for cleaning and maintenance. Make sure you discuss with your contractor the most appropriate and cost effective methods of painting your frames.

ENERGY SAVINGS

Part J of the Building Regulations 'The Conservation of Fuel and Power' recognises the need to conserve historic buildings (not just listed buildings): "The aim should be to improve energy efficiency where and to the extent that it is practically possible, always provided that the work does not prejudice the character of the historic building, or increase the risk of long-term deterioration"

DOUBLE GLAZING

The most important part of a window's insulating properties is the glazing. Double glazing can be added to existing window frames but requires major modifications due to the need for thicker glazing bars to hide the spacer bars, the additional thickness of the sealed unit and the additional weight of glass on fine timber members. [See Typical Sections p.15]

Slim line systems are available which are thinner allowing double glazed units to fit into existing frames without significantly increasing the bulk. Low profile glazing has recently been installed in the replacement steel framed windows at Basil Spence's A listed Gribloch House during its renovation by Simpson & Brown Architects. This allows the new windows to match the existing while improving their thermal performance. This solution is particularly suited to Victorian single pane sashes where the lack of glazing bars limits the visual effect of the additional glazing thickness. In Georgian frames with smaller panes and fine timber glazing bars, slim line systems may be less appropriate.

However, although double glazing existing frames may be physically possible there are cheaper ways to increase insulation. An over simplistic emphasis on double glazing as a cure-all for energy loss has led to an irreplaceable loss of historic fabric and English Heritage research found that it typically takes 60-100 years for double glazing to pay for itself. Where it is desirable to retain original single glazing, other insulation methods and upgrading can be equally effective at reducing heat loss from a building.

SECONDARY GLAZING

An alternative is secondary glazing which can reduce energy loss by 20%. Secondary glazing is not a new idea, in the 19th century some houses were constructed with secondary glazing in the form of a second pair of sash windows which drop down together into a pocket below the



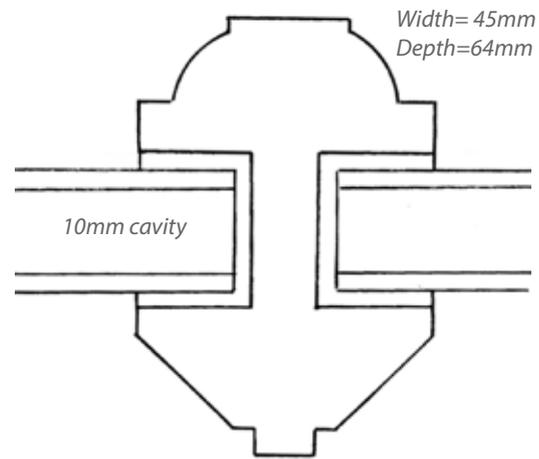
This window features an external secondary glazing system designed so that the original window can still be seen clearly.

window. Although rarely seen today, this approach offers an interesting solution which minimises the effect on internal character that secondary glazing can have. Metal framed vertical sliding sashes are commonly used, which fit tight against the window. A cheap and simple method of secondary glazing is to fit a single frame of glass over the whole window within the reveal which can be removed and stored in the summer. To minimise the visual impact the style of secondary glazing should complement the existing window. Research by Historic Scotland has recently shown that secondary glazing can outperform double glazing.

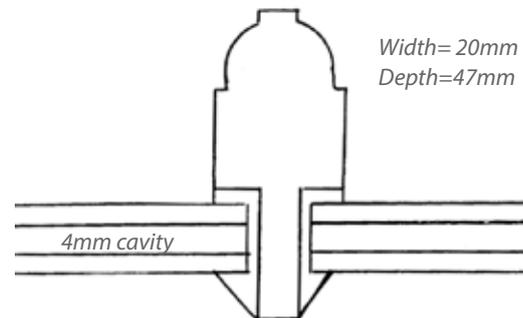
DRAUGHT PROOFING

Draught proofing or draught-stripping is a cheap and easily installed option. Several systems are available usually incorporating rubber blades to maintain the seal at the sides of the frame, and compression seals to the meeting rail, window head and sill. Professionally fitted draught-stripping is one of the most effective methods of reducing air infiltration. The draughtiness felt near older windows is the result of air leakage through the gaps around the window frame and the warmth and comfort of a room can be significantly improved by addressing this issue. Recent Historic Scotland research has found that draught proofing can reduce air leakage around a window by over 80%.

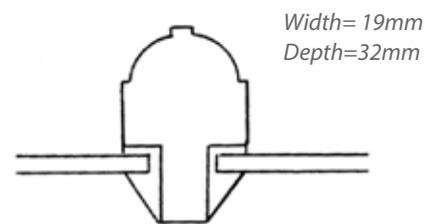
TYPICAL SECTIONS THROUGH GLAZING BARS



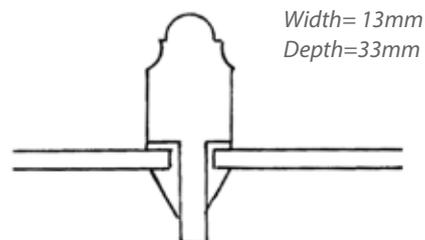
Typical modern double glazing



Standard section with slim double glazed units



Typical early Georgian section with single glazing: The Barons, Reigate, 1721



Typical Georgian section with single glazing: Waterloo Place, Edinburgh, 1815

SHUTTERS & CURTAINS

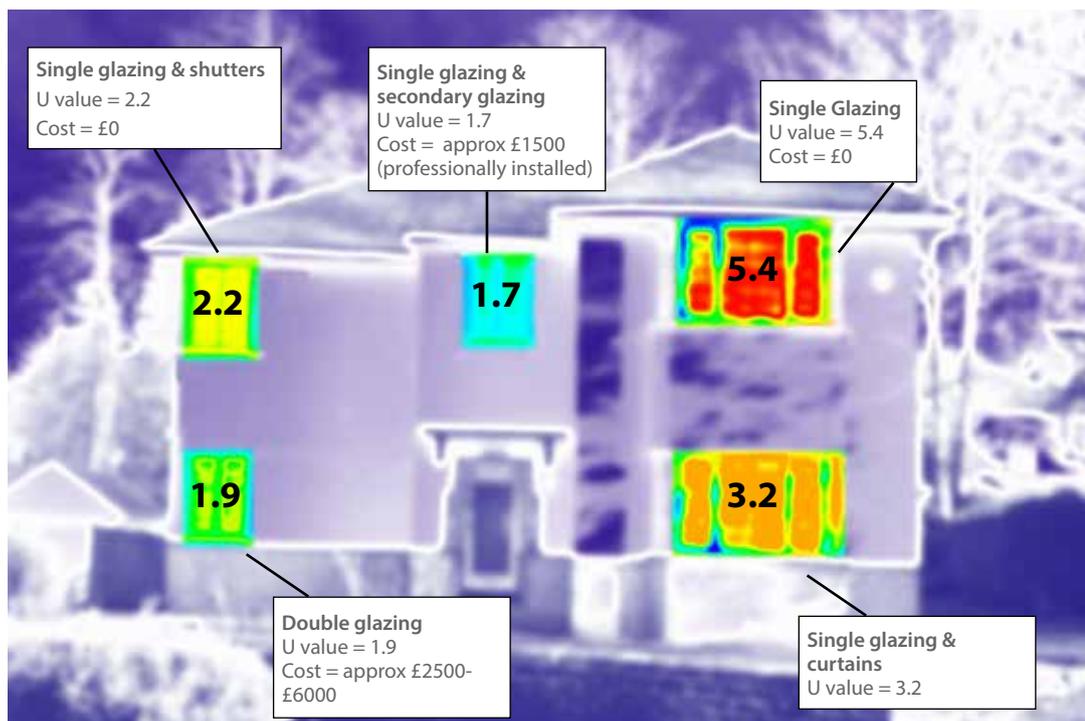
Existing features of your windows can also be used to improve their insulation properties. Shutters and heavy curtains can provide significant reductions in heat loss and cost nothing to use.

The image below represents the relative U-values for different types of glazing and window features. A material's U value indicates its thermal performance and is the rate of transfer of heat (in watts) through one square metre of a structure divided by the difference in temperature across the structure. The lower the U-value the better the ability to keep in heat. Current building regulations set the U-values for both wood & uPVC at 2.0 W/m²k so uPVC frames have no thermal advantage over timber.

It is possible to make significant improvements to the energy performance of your existing windows, making the U-value better than double glazing for a fraction of the cost.



An example of the slim line double glazed panes available for retro fitting into existing timber frames.



Indicative U-values taken from Historic Scotland, Technical Paper 1: Thermal Performance of Windows, Nov 2008

UPGRADE SOLUTIONS

So, where should you start when upgrading your windows, and what are the best options for you? The Scottish Civic Trust encourages a staggered approach of small steps with full replacement as a last resort.



THE BIG PICTURE

- Repair is almost always cheaper than replacement.
- It is rare for all openings in a building to require simultaneous replacement.
- An over simplistic emphasis on double glazing as a cure-all for energy loss has led to an irreplaceable loss of historic fabric.
- A historic building starts to lose its integrity when any part of its original fabric is replaced.
- It is not enough to consider the energy a window saves once installed – the embodied energy used to produce it must be considered too.
- Replacement windows consume up to 40 times the energy of renovation.
- The evidence is very strong that uPVC is the worst option for the environment.
- No building material is maintenance free.
- Wood is our only renewable, recyclable, waste-efficient and biodegradable building material.
- It can take a significant period for double glazing to pay for itself! (English Heritage estimate 60-100yrs)
- Recent Historic Scotland research found that small changes such as draught-proofing can have a dramatic effect on comfort and that secondary glazing outperforms double glazing.

So why not save energy, save money and SAVE OUR HERITAGE!

FURTHER READING

SPAB, *The Repair of Wood Windows*, 1992

Historic Scotland, *Looking After Your Sash and Case Windows*, 2001

Greenpeace, *Look out: Installing New Windows*, 1998

WWF, *Window of Opportunity*, July 2005

English Heritage, *Energy Conservation in Traditional Buildings*, 2007

Building Research Establishment, *Green Guide to Housing Specification*, 2002

Royal Institution of Chartered Surveyors, *Windows: History, repair and conservation*, 2007

Madeleine Cobbing, *PVC Windows & Alternatives: Research for Islington Council*, 2004

Environment & Heritage Service Northern Ireland, *Framing the View: Window Frames for a Sustainable Future*, January 2000

Historic Scotland, *Technical Paper 1: Thermal Performance of Traditional Windows*, Nov 2008



SCOTTISH CIVIC TRUST
The Tobacco Merchants House
42 Miller Street
Glasgow G1 1DT
www.scottishcivictrust.org.uk

Registered Scottish charity No: SC012569

2008