



**City of Dayton  
Landmark Commission  
APPLICATION FOR REPLACEMENT OF HISTORIC WINDOWS**

Property owners undertaking historic rehabilitation projects are encouraged to repair and retain existing historic windows. Repairing window frames and sash can be done by patching, splicing, consolidating or otherwise reinforcing. If conservation of energy is a concern, storm windows can be installed. The energy savings these provide enable the economical retention of original decorative windows.

In some cases, replacement windows may be justified. For review of replacement windows for conformance with the Secretary of the Interior's Standards for Rehabilitation the following minimum information should be provided.

Instructions: Please complete this application and return with a description of the replacement windows. This should include manufacturer's literature, name of the style of window replacement selected, a picture of the exterior view of the style of window installed including trim and a description from the installer on how the window will be installed. The window installer should complete page two (2) of this application, which requires his or her signature.

Property Address\_\_\_\_\_

Property Owner\_\_\_\_\_

Owner Address\_\_\_\_\_

Telephone Number\_\_\_\_\_

Applicant\_\_\_\_\_

Applicant Address\_\_\_\_\_

Telephone\_\_\_\_\_

Signature of Applicant\_\_\_\_\_

Date

Return to: City of Dayton – Department of Planning and Community Development  
101 West Third Street – Dayton, Ohio 45402

(See Definitions, Page 4)



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- 1) In any replacement window installation, the setback of the new window must match the original window plane. Windows set into original frames must be installed behind original window stops.*
- 2) In any replacement window installation, the new window and frame are set back behind the original trim.*
- 3) In any replacement window installation, the window stiles/rails must appear to be as wide or wider than the frame.*
- 4) The muntin profile must match the original light configuration. Muntin width can be no greater than 1"*
- 5) Trim or brick mold replacement must match original.*

**TYPE OF REPLACEMENT (CIRCLE)**

- A) Insert (sash package configuration designed to fit within existing frame)
- B) Complete Frame and Sash Replacement

All or Partial Window (s) replacement  All  Partial (#of Windows)

Name and Style of Window\_\_\_\_\_

Name of Window Installer\_\_\_\_\_

Address of Window Installer\_\_\_\_\_

Telephone of Installer\_\_\_\_\_

I do hereby agree to install the window(s) at \_\_\_\_\_ in a manner as prescribed above and according to the U.S. Departments of the Interior, The Secretary of the Interior's Standard for Rehabilitation and Guidelines for Rehabilitating Historic Buildings.

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Signature of Window Installer

Date



City of Dayton  
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APPLICATION FOR REPLACEMENT OF HISTORIC WINDOWS

TOP VIEW  
Cross-Section Of A Double-Hung Window

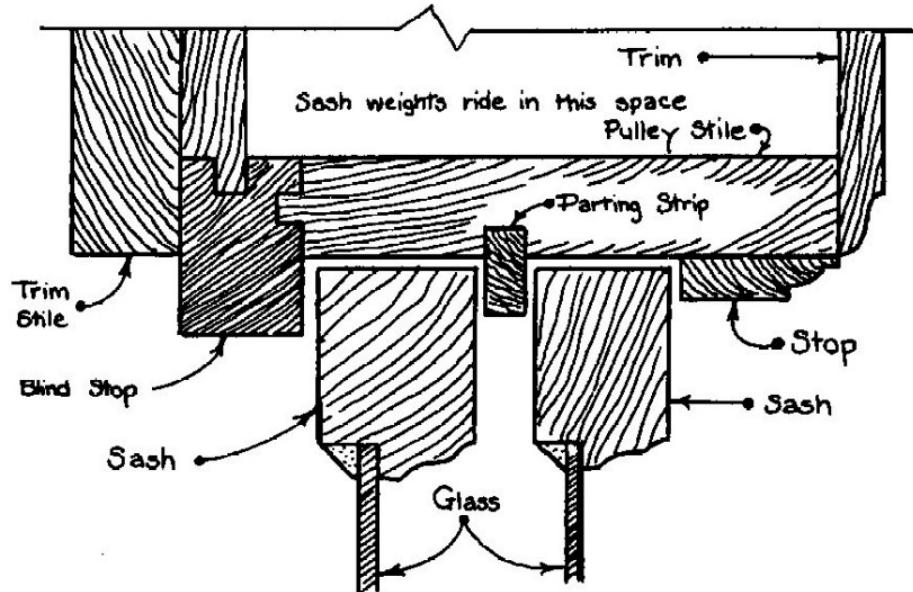


Figure 1

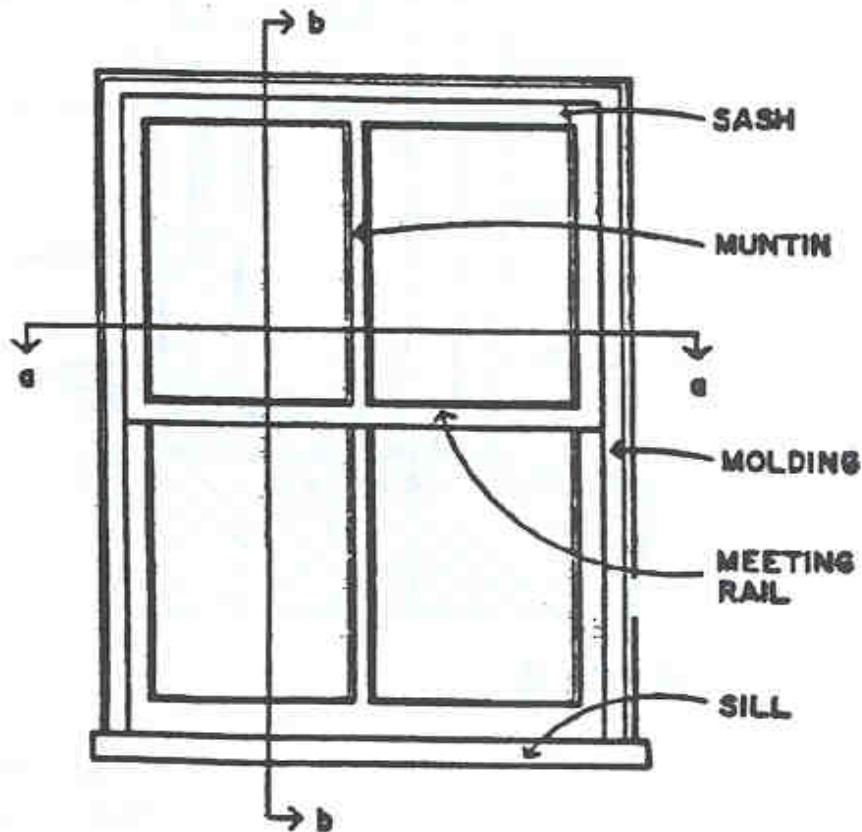


Figure 2



**City of Dayton  
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APPLICATION FOR REPLACEMENT OF HISTORIC WINDOWS**

*Definitions*

**STOP:** A trim member attached to the window frame to stop the sash of a projecting window when closed from swinging through the opening. It also covers the perimeter crack between the sash and the window frame in double hung and sliding windows and prevents the sash from coming out of the frame. Stops used at the top or bottom of the balance channel prevent the sash in hung windows from hitting when opened.

**FRAME:** The enclosure in which window sash or door panels are mounted. The fixed frame of a window holds the sash as well as the operating hardware for the window. These parts frame" the sash in an operating window and form an immediate boundary for the glass in a direct fixed unit.

**RAIL:** The top and bottom horizontal members of the framework of a window sash.

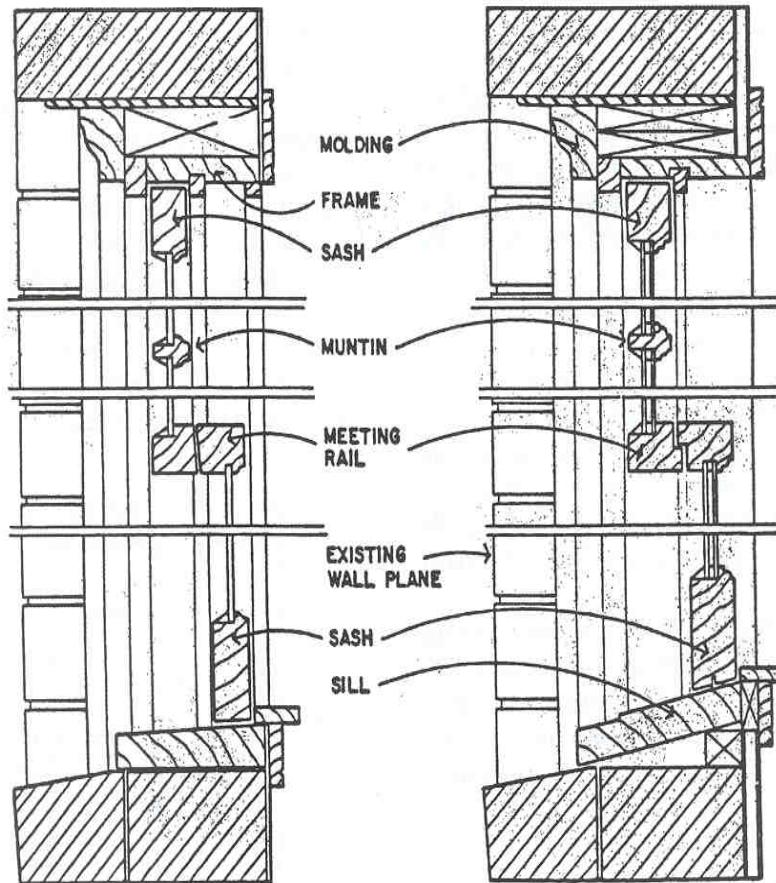
**STILE:** The main vertical members of the framework of a sash.

**SASH:** The part of the window, which contains the glass

**SILL:** The horizontal member, which forms the bottom of a window frame.

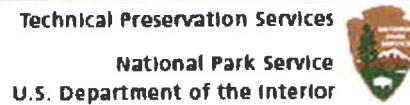
**MUNTIN BAR** Any small bar that divides a window glass. Also called a grille or windowpane divider.

**MUNTIN GRILLS:** Wood, plastic, or metal grids designed for a single-light sash to give the appearance of muntins in a multilight sash, but removable for ease in cleaning the window.



**Figure 3**

# 9 Preservation Briefs



## The Repair of Historic Wooden Windows

**John H. Myers**

- » Architectural or Historical Significance
- » Physical Evaluation
- » Repair Class I: Routine Maintenance
- » Repair Class II: Stabilization
- » Repair Class III: Splices and Parts Replacement
- » Weatherization
- » Window Replacement
- » Conclusion
- » Additional Reading



**A NOTE TO OUR USERS:** The web versions of the **Preservation Briefs** differ somewhat from the printed versions. Many illustrations are new, captions are simplified, illustrations are typically in color rather than black and white, and some complex charts have been omitted.

**The windows on many historic buildings are an important aspect of the architectural character of those buildings.** Their design, craftsmanship, or other qualities may make them worthy of preservation. This is self-evident for ornamental windows, but it can be equally true for warehouses or factories where the windows may be the most dominant visual element of an otherwise plain building. Evaluating the significance of these windows and planning for their repair or replacement can be a complex process involving both objective and subjective considerations. *The Secretary of the Interior's Standards for Rehabilitation* and the accompanying guidelines, call for respecting the significance of original materials and features, repairing and retaining them wherever possible, and when necessary, replacing them in kind. This Brief is based on the issues of significance and repair which are implicit in the standards, but the primary emphasis is on the technical issues of planning for the repair of windows including evaluation of their physical condition, techniques of repair, and design considerations when replacement is necessary.

Much of the technical section presents repair techniques as an instructional guide for the do-it-yourselfer. The information will be useful, however, for the architect, contractor, or developer on large-scale projects. It presents a methodology for approaching the evaluation and repair of existing windows, and considerations for replacement, from which the professional can develop alternatives and specify appropriate materials and procedures.

## Architectural or Historical Significance

Evaluating the architectural or historical significance of windows is the first step in planning for window treatments, and a general understanding of the function and history of windows is vital to making a proper evaluation. As a part of this evaluation, one must consider four basic window functions: admitting light to the interior spaces, providing fresh air and ventilation to the interior, providing a visual link to the outside world, and enhancing the appearance of a building. No single factor can be disregarded when planning window treatments; for example, attempting to conserve energy by closing up or reducing the size of window openings may result in the use of *more* energy by increasing electric lighting loads and decreasing passive solar heat gains.



**Windows are frequently important visual focal points, especially on simple facades such as this mill building. Replacement of the multi-pane windows with larger panes could dramatically alter the appearance of the building.** Photo: NPS files.

Historically, the first windows in early American houses were casement windows; that is, they were hinged at the side and opened outward. In the beginning of the eighteenth century single- and double-hung windows were introduced. Subsequently many styles of these vertical sliding sash windows have come to be associated with specific building periods or architectural styles, and this is an important consideration in determining the significance of windows, especially on a local or regional basis. Site-specific, regionally oriented architectural comparisons should be made to determine the significance of windows in question. Although such comparisons may focus on specific window types and their details, the ultimate determination of significance should be made within the context of the whole building, wherein the windows are one architectural element.

After all of the factors have been evaluated, **windows should be considered significant to a building if they:** **1)** are original, **2)** reflect the original design intent for the building, **3)** reflect period or regional styles or building practices, **4)** reflect changes to the building resulting from major periods or events, or **5)** are examples of exceptional craftsmanship or design. Once this evaluation of significance has been completed, it is possible to proceed with planning appropriate treatments, beginning with an investigation of the physical condition of the windows.

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## Physical Evaluation

The key to successful planning for window treatments is a careful evaluation of existing physical conditions on a unit-by-unit basis. A graphic or photographic system may be devised to record existing conditions and illustrate the scope of any necessary repairs. Another effective tool is a window schedule which lists all of the parts of each window unit. Spaces by each part allow notes on existing conditions and repair instructions. When such a schedule is completed, it indicates the precise tasks to be performed in the repair of each unit and becomes a part of the specifications. In any evaluation, one should note at a minimum:

- **1)** window location
- **2)** condition of the paint

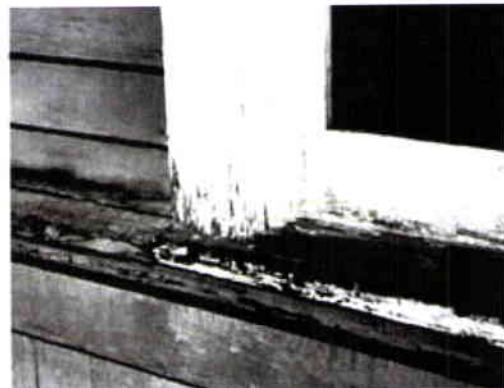
- 3) condition of the frame and sill
- 4) condition of the sash (rails, stiles and muntins)
- 5) glazing problems
- 6) hardware, and
- 7) the overall condition of the window (excellent, fair, poor, and so forth)

Many factors such as poor design, moisture, vandalism, insect attack, and lack of maintenance can contribute to window deterioration, but moisture is the primary contributing factor in wooden window decay. All window units should be inspected to see if water is entering around the edges of the frame and, if so, the joints or seams should be caulked to eliminate this danger. The glazing putty should be checked for cracked, loose, or missing sections which allow water to saturate the wood, especially at the joints. The back putty on the interior side of the pane should also be inspected, because it creates a seal which prevents condensation from running down into the joinery. The sill should be examined to insure that it slopes downward away from the building and allows water to drain off. In addition, it may be advisable to cut a dripline along the underside of the sill. This almost invisible treatment will insure proper water runoff, particularly if the bottom of the sill is flat. Any conditions, including poor original design, which permit water to come in contact with the wood or to puddle on the sill must be corrected as they contribute to deterioration of the window.

One clue to the location of areas of excessive moisture is the condition of the paint; therefore, each window should be examined for areas of paint failure. Since excessive moisture is detrimental to the paint bond, areas of paint blistering, cracking, flaking, and peeling usually identify points of water penetration, moisture saturation, and potential deterioration. Failure of the paint should not, however, be mistakenly interpreted as a sign that the wood is in poor condition and hence, irreparable. Wood is frequently in sound physical condition beneath unsightly paint. After noting areas of paint failure, the next step is to inspect the condition of the wood, particularly at the points identified during the paint examination.

Each window should be examined for operational soundness beginning with the lower portions of the frame and sash. Exterior rainwater and interior condensation can flow downward along the window, entering and collecting at points where the flow is blocked. The sill, joints between the sill and jamb, corners of the bottom rails and muntin joints are typical points where water collects and deterioration begins. The operation of the window (continuous opening and closing over the years and seasonal temperature changes) weakens the joints, causing movement and slight separation. This process makes the joints more vulnerable to water which is readily absorbed into the endgrain of the wood. If severe deterioration exists in these areas, it will usually be apparent on visual inspection, but other less severely deteriorated areas of the wood may be tested by two traditional methods using a small ice pick.

An ice pick or an awl may be used to test wood for soundness. The technique is simply to jab the pick into a wetted wood surface at an angle and pry up a small section of the wood. Sound wood will separate in long fibrous splinters, but decayed wood will lift up in short irregular pieces due to the breakdown of fiber strength.



Deterioration of poorly maintained windows usually begins on horizontal surfaces and at joints, where water can collect and saturate the wood. Photo: NPS files.

Another method of testing for soundness consists of pushing a sharp object into the wood, perpendicular to the surface. If deterioration has begun from the hidden side of a member and the core is badly decayed, the visible surface may appear to be sound wood. Pressure on the probe can force it through an apparently sound skin to penetrate deeply into decayed wood. This technique is especially useful for checking sills where visual access to the underside is restricted.

Following the inspection and analysis of the results, the scope of the necessary repairs will be evident and a plan for the rehabilitation can be formulated. Generally the actions necessary to return a window to "like new" condition will fall into three broad categories: **1) routine maintenance procedures, 2) structural stabilization, and 3) parts replacement.** These categories will be discussed in the following sections and will be referred to respectively as **Repair Class I, Repair Class II, and Repair Class III.** Each successive repair class represents an increasing level of difficulty, expense, and work time. Note that most of the points mentioned in Repair Class I are routine maintenance items and should be provided in a regular maintenance program for any building. The neglect of these routine items can contribute to many common window problems.

Before undertaking any of the repairs mentioned in the following sections all sources of moisture penetration should be identified and eliminated, and all existing decay fungi destroyed in order to arrest the deterioration process. Many commercially available fungicides and wood preservatives are toxic, so it is extremely important to follow the manufacturer's recommendations for application, and store all chemical materials away from children and animals. After fungicidal and preservative treatment the windows may be stabilized, retained, and restored with every expectation for a long service life.

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## Repair Class I: Routine Maintenance

Repairs to wooden windows are usually labor intensive and relatively uncomplicated. On small scale projects this allows the do-it-yourselfer to save money by repairing all or part of the windows. On larger projects it presents the opportunity for time and money which might otherwise be spent on the removal and replacement of existing windows, to be spent on repairs, subsequently saving all or part of the material cost of new window units. Regardless of the actual costs, or who performs the work, the evaluation process described earlier will provide the knowledge from which to specify an appropriate work program, establish the work element priorities, and identify the level of skill needed by the labor force.

The routine maintenance required to upgrade a window to "like new" condition normally includes the following steps: 1) some degree of interior and exterior paint removal, 2) removal and repair of sash (including reglazing where necessary), 3) repairs to the frame, 4) weatherstripping and reinstallation of the sash, and 5) repainting. These operations are illustrated for a typical



**This historic double-hung window has many layers of paint, some cracked and missing putty, slight separation at the joints, broken sash cords, and one cracked pane.**

**Photo: NPS files.**



After removing paint from the seam between the interior stop and the jamb, the stop can be pried out and gradually worked loose using a pair of putty knives as shown. Photo: NPS files.

seam where these stops meet the jamb. This can be accomplished by running a utility knife along the length of the seam, breaking the paint bond. It will then be much easier to remove the stop, the parting bead and the sash. The interior stop may be initially loosened from the sash side to avoid visible scarring of the wood and then gradually pried loose using a pair of putty knives, working up and down the stop in small increments. With the stop removed, the lower or interior sash may be withdrawn. The sash cords should be detached from the sides of the sash and their ends may be pinned with a nail or tied in a knot to prevent them from falling into the weight pocket.

Removal of the upper sash on double-hung units is similar but the parting bead which holds it in place is set into a groove in the center of the stile and is thinner and more delicate than the interior stop. After removing any paint along the seam, the parting bead should be carefully pried out and worked free in the same manner as the interior stop. The upper sash can be removed in the same manner as the lower one and both sash taken to a convenient work area (in order to remove the sash the interior stop and parting bead need only be removed from one side of the window). Window openings can be covered with polyethylene sheets or plywood sheathing while the sash are out for repair.

The sash can be stripped of paint using appropriate techniques, but if any heat treatment is used, the glass should be removed or protected from the sudden temperature change which can cause breakage. An overlay of aluminum foil on gypsum board or asbestos can protect the glass from such rapid temperature change. It is important to protect the glass because it may be historic and often adds character to the window. Deteriorated putty should be removed manually, taking care not to damage the wood along the rabbet. If the glass is to be removed, the glazing points which hold the glass in place can be extracted and the panes numbered and removed for cleaning and reuse in the same openings. With the glass panes out, the remaining putty can be removed and the sash can be sanded, patched, and primed with a preservative primer. Hardened putty in the rabbets may be softened by heating with a soldering iron at the

double-hung wooden window, but they may be adapted to other window types and styles as applicable.

Historic windows have usually acquired many layers of paint over time. Removal of excess layers or peeling and flaking paint will facilitate operation of the window and restore the clarity of the original detailing. Some degree of paint removal is also necessary as a first step in the proper surface preparation for subsequent refinishing (if paint color analysis is desired, it should be conducted prior to the onset of the paint removal). There are several safe and effective techniques for removing paint from wood, depending on the amount of paint to be removed.

Paint removal should begin on the interior frames, being careful to remove the paint from the interior stop and the parting bead, particularly along the

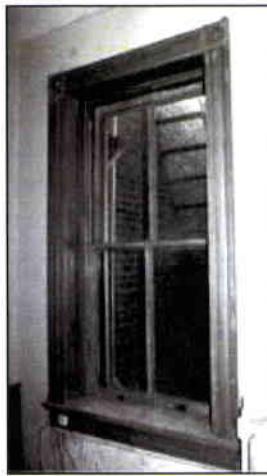


Sash can be removed and repaired in a convenient work area. Paint is being removed from this sash with a hot air gun. Photo: NPS files.

point of removal. Putty remaining on the glass may be softened by soaking the panes in linseed oil, and then removed with less risk of breaking the glass. Before reinstalling the glass, a bead of glazing compound or linseed oil putty should be laid around the rabbet to cushion and seal the glass. Glazing compound should only be used on wood which has been brushed with linseed oil and primed with an oil based primer or paint. The pane is then pressed into place and the glazing points are pushed into the wood around the perimeter of the pane.

The final glazing compound or putty is applied and beveled to complete the seal. The sash can be refinished as desired on the inside and painted on the outside as soon as a "skin" has formed on the putty, usually in 2 or 3 days. Exterior paint should cover the beveled glazing compound or putty and lap over onto the glass slightly to complete a weather-tight seal. After the proper curing times have elapsed for paint and putty, the sash will be ready for reinstallation.

While the sash are out of the frame, the condition of the wood in the jamb and sill can be evaluated. Repair and refinishing of the frame may proceed concurrently with repairs to the sash, taking advantage of the curing times for the paints and putty used on the sash. One of the most common work items is the replacement of the sash cords with new rope cords or with chains. The weight pocket is frequently accessible through a door on the face of the frame near the sill, but if no door exists, the trim on the interior face may be removed for access. Sash weights may be increased for easier window operation by elderly or handicapped persons. Additional repairs to the frame and sash may include consolidation or replacement of deteriorated wood. Techniques for these repairs are discussed in the following sections.



Following the relatively simple repairs, the window is weathertight, like new in appearance, and serviceable for many years to come. Photo: NPS files.

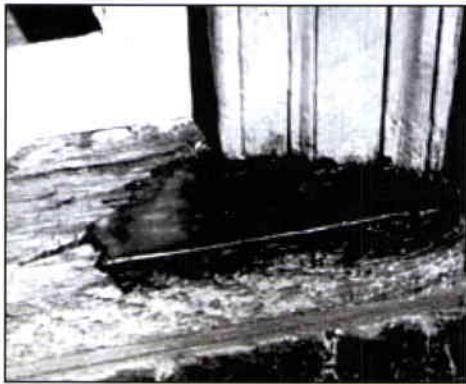
The operations just discussed summarize the efforts necessary to restore a window with minor deterioration to "like new" condition. The techniques can be applied by an unskilled person with minimal training and experience. To demonstrate the practicality of this approach, and photograph it, a Technical Preservation Services staff member repaired a wooden double-hung, two over two window which had been in service over ninety years. The wood was structurally sound but the window had one broken pane, many layers of paint, broken sash cords and inadequate, worn-out weatherstripping. The staff member found that the frame could be stripped of paint and the sash removed quite easily. Paint, putty and glass removal required about one hour for each sash, and the reglazing of both sash was accomplished in about one hour. Weatherstripping of the sash and frame, replacement of the sash cords and reinstallation of the sash, parting bead, and stop required an hour and a half. These times refer only to individual operations; the entire process took several days due to the drying and curing times for putty, primer, and paint, however, work on other window units could have been in progress during these lag times.

## Repair Class II: Stabilization

The preceding description of a window repair job focused on a unit which was operationally sound. Many windows will show some additional degree of physical deterioration, especially in the vulnerable areas mentioned earlier, but even badly

damaged windows can be repaired using simple processes. Partially decayed wood can be waterproofed, patched, built-up, or consolidated and then painted to achieve a sound condition, good appearance, and greatly extended life. Three techniques for repairing partially decayed or weathered wood are discussed in this section, and all three can be accomplished using products available at most hardware stores.

One established technique for repairing wood which is split, checked or shows signs of rot, is to: **1**) dry the wood, **2**) treat decayed areas with a fungicide, **3**) waterproof with two or three applications of boiled linseed oil (applications every 24 hours), **4**) fill cracks and holes with putty, and **5**) after a "skin" forms on the putty, paint the surface. Care should be taken with the use of fungicide which is toxic. Follow the manufacturers' directions and use only on areas which will be painted. When using any technique of building up or patching a flat surface, the finished surface should be sloped slightly to carry water away from the window and not allow it to puddle. Caulking of the joints between the sill and the jamb will help reduce further water penetration.



This illustrates a two-part epoxy patching compound used to fill the surface of a weathered sill and rebuild the missing edge. When the epoxy cures, it can be sanded smooth and painted to achieve a durable and waterproof repair. Photo: NPS files.

When sills or other members exhibit surface weathering they may also be built-up using wood putties or homemade mixtures such as sawdust and resorcinol glue, or whiting and varnish. These mixtures can be built up in successive layers, then sanded, primed, and painted. The same caution about proper slope for flat surfaces applies to this technique.

Wood may also be strengthened and stabilized by consolidation, using semirigid epoxies which saturate the porous decayed wood and then harden. The surface of the consolidated wood can then be filled with a semirigid epoxy patching compound, sanded and painted. Epoxy patching compounds can be used to build up missing sections or decayed ends of members. Profiles can

be duplicated using hand molds, which are created by pressing a ball of patching compound over a sound section of the profile which has been rubbed with butcher's wax. This can be a very efficient technique where there are many typical repairs to be done. The process has been widely used and proven in marine applications; and proprietary products are available at hardware and marine supply stores. Although epoxy materials may be comparatively expensive, they hold the promise of being among the most durable and long lasting materials available for wood repair. More information on epoxies can be found in the publication "Epoxies for Wood Repairs in Historic Buildings," cited in the bibliography.

Any of the three techniques discussed can stabilize and restore the appearance of the window unit. There are times, however, when the degree of deterioration is so advanced that stabilization is impractical, and the only way to retain some of the original fabric is to replace damaged parts.

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### Repair Class III: Splices and Parts Replacement

When parts of the frame or sash are so badly deteriorated that they cannot be stabilized there are methods which permit the retention of some of the existing or original fabric.

These methods involve replacing the deteriorated parts with new matching pieces, or splicing new wood into existing members. The techniques require more skill and are more expensive than any of the previously discussed alternatives. It is necessary to remove the sash and/or the affected parts of the frame and have a carpenter or woodworking mill reproduce the damaged or missing parts. Most millwork firms can duplicate parts, such as muntins, bottom rails, or sills, which can then be incorporated into the existing window, but it may be necessary to shop around because there are several factors controlling the practicality of this approach. Some woodworking mills do not like to repair old sash because nails or other foreign objects in the sash can damage expensive knives (which cost far more than their profits on small repair jobs); others do not have cutting knives to duplicate muntin profiles. Some firms prefer to concentrate on larger jobs with more profit potential, and some may not have a craftsman who can duplicate the parts. A little searching should locate a firm which will do the job, and at a reasonable price. If such a firm does not exist locally, there are firms which undertake this kind of repair and ship nationwide. It is possible, however, for the advanced do-it-yourselfer or craftsman with a table saw to duplicate moulding profiles using techniques discussed by Gordie Whittington in "Simplified Methods for Reproducing Wood Mouldings," *Bulletin of the Association for Preservation Technology*, Vol. III, No. 4, 1971, or illustrated more recently in *The Old House*, Time-Life Books, Alexandria, Virginia, 1979.

The repairs discussed in this section involve window frames which may be in very deteriorated condition, possibly requiring removal; therefore, caution is in order. The actual construction of wooden window frames and sash is not complicated. Pegged mortise and tenon units can be disassembled easily, if the units are out of the building. The installation or connection of some frames to the surrounding structure, especially masonry walls, can complicate the work immeasurably, and may even require dismantling of the wall. It may be useful, therefore, to take the following approach to frame repair: **1)** conduct regular maintenance of sound frames to achieve the longest life possible, **2)** make necessary repairs in place, wherever possible, using stabilization and splicing techniques, and **3)** if removal is necessary, thoroughly investigate the structural detailing and seek appropriate professional consultation.

Another alternative may be considered if parts replacement is required, and that is sash replacement. If extensive replacement of parts is necessary and the job becomes prohibitively expensive it may be more practical to purchase new sash which can be installed into the existing frames. Such sash are available as exact custom reproductions, reasonable facsimiles (custom windows with similar profiles), and contemporary wooden sash which are similar in appearance. There are companies which still manufacture high quality wooden sash which would duplicate most historic sash. A few calls to local building suppliers may provide a source of appropriate replacement sash, but if not, check with local historical associations, the state historic preservation office, or preservation related magazines and supply catalogs for information.

If a rehabilitation project has a large number of windows such as a commercial building or an industrial complex, there may be less of a problem arriving at a solution. Once the evaluation of the windows is completed and the scope of the work is known, there may be a potential economy of scale. Woodworking mills may be interested in the work from a large project; new sash in volume may be considerably less expensive per unit; crews can be assembled and trained on site to perform all of the window repairs; and a few extensive repairs can be absorbed (without undue burden) into the total budget for a large number of sound windows. While it may be expensive for the average historic home owner to pay seventy dollars or more for a mill to grind a custom knife to duplicate four or five bad muntins, that cost becomes negligible on large commercial projects which may have several hundred windows.

Most windows should not require the extensive repairs discussed in this section. The ones which do are usually in buildings which have been abandoned for long periods or have totally lacked maintenance for years. It is necessary to thoroughly investigate the alternatives for windows which do require extensive repairs to arrive at a solution which retains historic significance and is also economically feasible. Even for projects requiring repairs identified in this section, if the percentage of parts replacement per window is low, or the number of windows requiring repair is small, repair can still be a cost effective solution.

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## Weatherization

A window which is repaired should be made as energy efficient as possible by the use of appropriate weatherstripping to reduce air infiltration. A wide variety of products are available to assist in this task. Felt may be fastened to the top, bottom, and meeting rails, but may have the disadvantage of absorbing and holding moisture, particularly at the bottom rail. Rolled vinyl strips may also be tacked into place in appropriate locations to reduce infiltration. Metal strips or new plastic spring strips may be used on the rails and, if space permits, in the channels between the sash and jamb. Weatherstripping is a historic treatment, but old weatherstripping (felt) is not likely to perform very satisfactorily. Appropriate contemporary weatherstripping should be considered an integral part of the repair process for windows. The use of sash locks installed on the meeting rail will insure that the sash are kept tightly closed so that the weatherstripping will function more effectively to reduce infiltration. Although such locks will not always be historically accurate, they will usually be viewed as an acceptable contemporary modification in the interest of improved thermal performance.

Many styles of storm windows are available to improve the thermal performance of existing windows. The use of exterior storm windows should be investigated whenever feasible because they are thermally efficient, cost-effective, reversible, and allow the retention of original windows (see "Preservation Briefs: 3"). Storm window frames may be made of wood, aluminum, vinyl, or plastic; however, the use of unfinished aluminum storms should be avoided. The visual impact of storms may be minimized by selecting colors which match existing trim color. Arched top storms are available for windows with special shapes. Although interior storm windows appear to offer an attractive option for achieving double glazing with minimal visual impact, the potential for damaging condensation problems must be addressed. Moisture which becomes trapped between the layers of glazing can condense on the colder, outer prime window, potentially leading to deterioration. The correct approach to using interior storms is to create a seal on the interior storm while allowing some ventilation around the prime window. In actual practice, the creation of such a durable, airtight seal is difficult.

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## Window Replacement

Although the retention of original or existing windows is always desirable and this Brief is intended to encourage that goal, there is a point when the condition of a window may clearly indicate replacement. The decision process for selecting replacement windows should not begin with a survey of contemporary window products which are available as replacements, but should begin with a look at the windows which are being replaced. Attempt to understand the contribution of the window(s) to the appearance of the facade including: **1)** the pattern of the openings and their size; **2)** proportions of the

frame and sash; **3)** configuration of window panes; **4)** muntin profiles; **5)** type of wood; **6)** paint color; **7)** characteristics of the glass; and **8)** associated details such as arched tops, hoods, or other decorative elements. Develop an understanding of how the window reflects the period, style, or regional characteristics of the building, or represents technological development.

Armed with an awareness of the significance of the existing window, begin to search for a replacement which retains as much of the character of the historic window as possible. There are many sources of suitable new windows. Continue looking until an acceptable replacement can be found. Check building supply firms, local woodworking mills, carpenters, preservation oriented magazines, or catalogs or suppliers of old building materials, for product information. Local historical associations and state historic preservation offices may be good sources of information on products which have been used successfully in preservation projects.

Consider energy efficiency as one of the factors for replacements, but do not let it dominate the issue. Energy conservation is no excuse for the wholesale destruction of historic windows which can be made thermally efficient by historically and aesthetically acceptable means. In fact, a historic wooden window with a high quality storm window added should thermally outperform a new double-glazed metal window which does not have thermal breaks (insulation between the inner and outer frames intended to break the path of heat flow). This occurs because the wood has far better insulating value than the metal, and in addition many historic windows have high ratios of wood to glass, thus reducing the area of highest heat transfer. One measure of heat transfer is the U-value, the number of Btu's per hour transferred through a square foot of material. When comparing thermal performance, the lower the U-value the better the performance. According to ASHRAE 1977 Fundamentals, the U-values for single glazed wooden windows range from 0.88 to 0.99. The addition of a storm window should reduce these figures to a range of 0.44 to 0.49. A non-thermal break, double-glazed metal window has a U-value of about 0.6.

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## Conclusion

Technical Preservation Services recommends the retention and repair of original windows whenever possible. We believe that the repair and weatherization of existing wooden windows is more practical than most people realize, and that many windows are unfortunately replaced because of a lack of awareness of techniques for evaluation, repair, and weatherization. Wooden windows which are repaired and properly maintained will have greatly extended service lives while contributing to the historic character of the building. Thus, an important element of a building's significance will have been preserved for the future.

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## Additional Reading

*ASHRAE Handbook 1977 Fundamentals*. New York: American Society of Heating, Refrigerating and Air-conditioning Engineers, 1978 (chapter 26).

Ferro, Maximillian. *Preservation: Present Pathway to Fall River's Future*. Fall River, Massachusetts: City of Fall River, 1979 (chapter 7).

"Fixing Double-hung Windows." *Old House Journal* (no. 12, 1979): 135.

Morrison, Hugh. *Early American Architecture*. New York: Oxford University Press, 1952.

Phillips, Morgan, and Selwyn, Judith. *Epoxies for Wood Repairs in Historic Buildings*. Washington, DC: Technical Preservation Services, U.S. Department of the Interior (Government Printing Office, Stock No. 024016000951), 1978.

*Rehab Right*. Oakland, California: City of Oakland Planning Department, 1978 (pp. 7883).

"Sealing Leaky Windows." *Old House Journal* (no. 1, 1973): 5.

Smith, Baird M. "Preservation Briefs: 3 Conserving Energy in Historic Buildings." Washington, DC: Technical Preservation Services, U.S. Department of the Interior, 1978.

Weeks, Kay D. and David W. Look, "Preservation Briefs: 10 Exterior Paint Problems on Historic Woodwork." Washington, DC: Technical Preservation Services, U.S. Department of the Interior, 1982.

## **Washington, D.C. 1981**

**Home page logo: Historic six-over-six windows--preserved. Photo: NPS files.**

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*This publication has been prepared pursuant to the National Historic Preservation Act of 1966, as amended, which directs the Secretary of the Interior to develop and make available information concerning historic properties. Technical Preservation Services (TPS), Heritage Preservation Services Division, National Park Service prepares standards, guidelines, and other educational materials on responsible historic preservation treatments for a broad public.*

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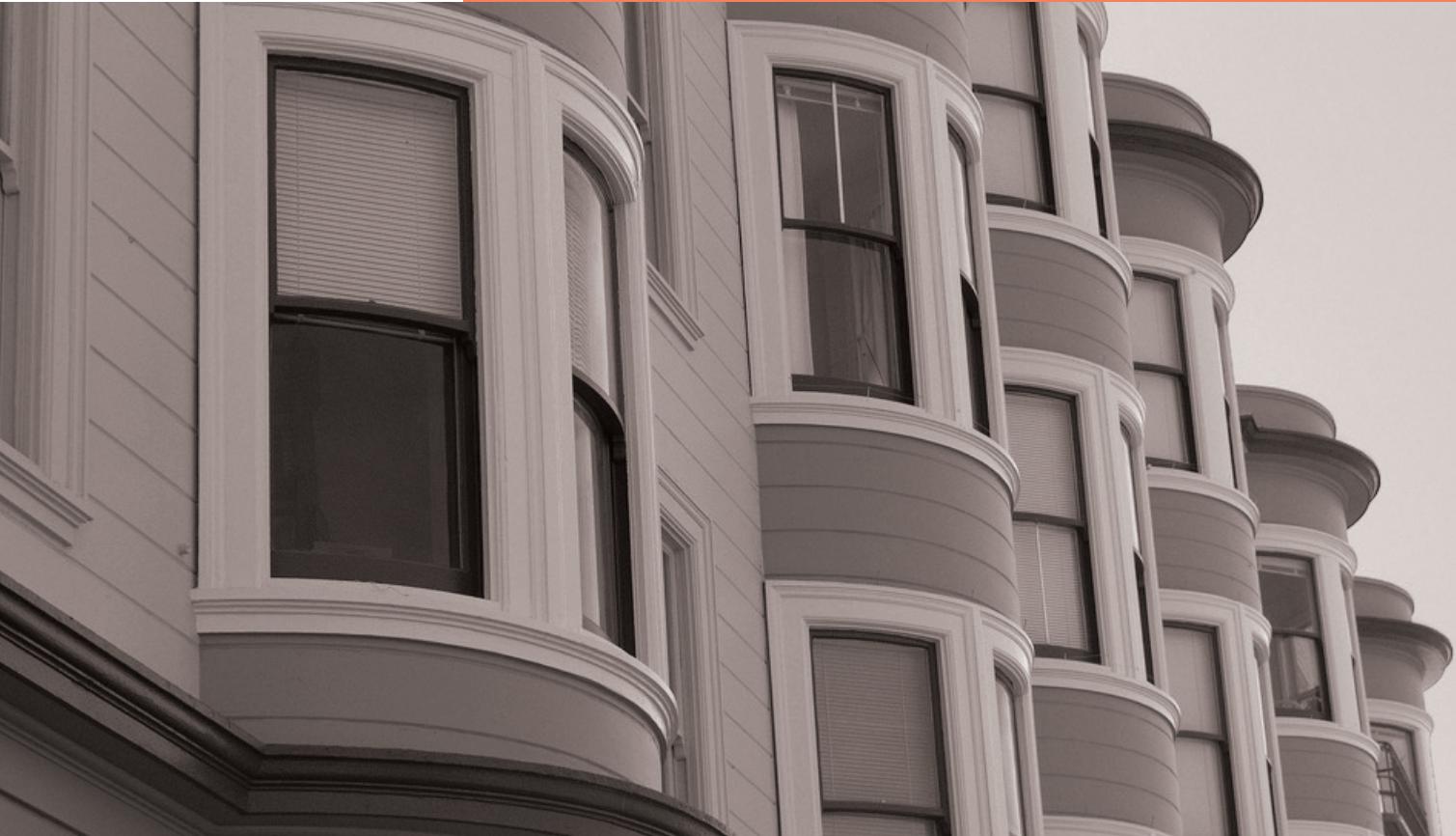


SAN FRANCISCO  
**PLANNING**  
DEPARTMENT

# Standards for Window Replacement

A GUIDE TO APPLYING FOR  
A WINDOW REPLACEMENT PERMIT

SAN FRANCISCO PLANNING DEPARTMENT | APRIL 2010





Windows are an integral part of the design and character of most buildings, and choosing appropriate replacement windows is frequently a critical aspect of any rehabilitation project. Along with the need for energy conservation, the various window systems available today can overwhelm an owner in selecting the appropriate treatment for window re-placement. Windows located on primary – the front or visible elevations – traditionally feature a higher degree of detail and ornamentation than windows located on secondary – the side or rear elevations. With such a variety of different window shapes, muntin profiles, methods of operation and configurations, seemingly minor changes can seriously damage or alter the appearance of a building, or overall neighborhood character. The Planning Department recognizes this challenge and has developed A Guide to Apply for a *Window Replacement Permit*, which also includes a list of frequently asked questions.

The San Francisco General Plan, the Planning Code's Priority Planning Policies and the Residential Design Guidelines each call for protecting and enhancing neighborhood architectural character citywide. Since their revision in 2003, the Residential Design Guidelines set window requirements for all buildings within a Residential Zoning District (Page 46). To clarify the Department's policy and serve as an additional guide to answer frequently asked questions in regard to window replacement and neighborhood character, the Department developed this *Window Replacement Standards* handout. This document

#### **ORGANIZATION:**

This document is divided into two sections:

#### **Frequently Asked Questions Regarding Window Replacement**

#### **How to Apply for a Window Replacement Permit**

also answers questions regarding what materials are required to be submitted to review a permit application for the repair, rehabilitation, restoration, or replacement of windows in San Francisco. Please note that rehabilitation and alteration standards for the preservation of designated City Landmark properties, including contributing buildings in historic or conservation districts, are contained in Articles 10 and 11 of the Planning Code.

This document hereinafter represents the San Francisco Planning Department's policy in regards to this type of work and is based on the following principles:

1. Windows that are seen from the street or other public right-of-ways are an important part of neighborhood character as well as the individual architectural character of a building.
2. If replacement windows are proposed for any type of structure, the new windows visible from the public rights-of-way should be compatible with both the character of the neighborhood and the subject building in terms of size, glazing, operation, finish, exterior profiles and arrangement.
3. Historic windows and character-defining window features on architecturally significant structures should be retained and repaired wherever possible.

# Frequently Asked Questions Regarding Window Replacement

The information listed below can assist an owner in determining what replacement windows are appropriate for their property. If replacement is necessary, thoroughly document and investigate the structural and architectural detailing of the window and seek appropriate professional consultation. At any time, a Planner located at the Planning Information Center (PIC) can answer questions regarding window replacement. The PIC may also be reached by phone at 415-558-6377. For more information, please also review the How to Apply for a Window Replacement Permit Handout & Checklist.

## REMINDER:

**Do not purchase replacement windows before confirming with the Planning Department that the windows can be approved. The Planning Department will not approve inappropriate replacement windows, even if they have already been purchased or installed.**

## ?

### DO I NEED A BUILDING PERMIT TO REPLACE WINDOWS?

**ALL** replacement windows that are visible from a street or other public right-of-way require Planning Department review. This includes:

- Windows on the primary elevation (commonly the street façade of the building). Please note that corner buildings are considered to have two primary elevations.
- Windows on the side of a building or in a visible recessed area near or next to the street.
- Windows on a back wall that can be seen from the street or another public right-of-way.

## ?

### CAN I REPLACE HISTORIC WINDOWS WITH VINYL, FIBERGLASS, OR ALUMINUM WINDOWS? CAN'T I GET VINYL OR ALUMINUM WINDOWS THAT LOOK VIRTUALLY THE SAME FROM THE STREET AS WOOD PAINTED WINDOWS?

Wood windows were originally installed on the majority of residential buildings constructed up until World War II. In San Francisco, where most buildings are viewed at close range from the street, the differences between wood windows and substitute materials are almost always easily detectable. Particularly with older buildings, these alternate materials usually stand out visually, and rarely match the character of the neighborhood. They always look like what they are: plastic or aluminum – materials that are not architecturally compatible with the building.



Vinyl, fiberglass, and aluminum windows almost never look similar to painted wood windows for a number of reasons. The primary reason is that these windows have a flat appearance and their exterior profiles, depth, and dimensions are not designed to match the dimensions of most common wood window sashes and moldings. In addition, windows of substitute materials have very little or no reveal between the face of the sash and the glass, have visible seams, have multi-faceted tracks, and in some windows the upper sash is often larger than the lower sash. Furthermore, most aluminum or vinyl windows cannot be painted, come in limited colors, and have an overall finish that is inappropriate to the overall character of the building and the neighborhood.

Another significant difference is that vinyl, fiberglass, and aluminum windows often do not have an important detail that is common on most older wood windows: the Ogee (*pronounced Oh-jee*) lugs at the bottom of the top sash (also called the meeting rail) of a double-hung window. These details are considered an important character-defining feature of older wood windows. (Please refer to the parts of a window diagram on page 8 for more information on the location and design of ogee lugs).

However, some manufacturers have recently begun producing better quality aluminum windows that come in a variety of colors and profiles. From a distance these windows can appear similar to wood painted windows. If proposed, these windows will be evaluated on a case-by-case basis.



**Need another reason?** Authentic wood windows (or, in the case of some early 20th century buildings, steel casement windows) add the appearance of warmth and beauty to the interior and exterior of a residential or commercial building, where the appearance of alternative materials commonly appears foreign to the interior architectural design. Using architecturally appropriate windows will enhance the property value of your building by improving its appearance inside and out.



### Take a Look Around:

If you have any doubts about the difference in appearance between vinyl, fiberglass, or aluminum, and painted wood windows, take a walk around your neighborhood and notice the buildings that have wood windows and compare them to the ones that have used substitute materials (many of them installed without benefit of a permit or before the current window replacement standards). You will easily notice differences in the profile and depth of the window. The older and more elaborate the architectural style of the building, the more likely new vinyl, fiberglass, or aluminum windows will look out of place.

**REMINDER:**

If you are required to use wood windows on the visible elevations you are often able to use replacement windows of a substitute material in light wells or rear facades that are not visible from the street or other public rights-of-way.

## 2 DON'T WOOD WINDOWS COST MORE AND REQUIRE MORE MAINTENANCE, AS OPPOSED TO VINYL AND ALUMINUM WINDOWS?

It depends. The highest quality custom-made wood windows by major manufacturers may be more expensive than windows of other materials. But there are a number of manufacturers and local craftsmen that produce quality, double-paned, architectural grade, painted wood replacement windows that are competitive in price and also provide the beauty and authenticity that only comes with real painted wood sashes and assemblies.

Also, while it is often desirable to have all wood replacement windows in your building or house, in many cases, you may choose to use replacement windows of a substitute material in light wells or rear facades that are not visible from the street or other public right-of-ways. The only instance when a property owner may be required to use historically appropriate windows on all elevations is when the subject property has been determined to have historic significance. Examples of these properties are those identified as part of Article 10 or 11 of the Planning Code or as an eligible historic resource for the purposes of the California Environmental Quality Act (CEQA).

In terms of maintenance, wood windows do require painting every five to ten years, depending on their location, sun exposure, water exposure, paint quality, priming, wood quality, etc. Although vinyl and aluminum windows do not require painting, they are

rarely maintenance free, and economy grade vinyl and aluminum windows can fail within a few years. Finishes on vinyl and aluminum can deteriorate through UV exposure, oxidation, and denting. **Quality wood windows can last indefinitely**, depending on maintenance and the quality of wood used. Double-hung painted wood windows can also be installed with metal or vinyl tracks, making them easier to open and close as they age.

## 2 WHAT ABOUT WOOD WINDOWS THAT HAVE VINYL, FIBERGLASS, OR ALUMINUM CLAD EXTERIORS?

For clarification, a clad window is part of a window system that is primarily constructed of wood but has an additional material, such as aluminum, applied to the exterior face for maintenance purposes. Generally, clad windows are not appropriate, especially on older residential and commercial properties. However, in some instances they may be acceptable, and if proposed, shall be reviewed on a case-by-case basis. Most clad window products do not have Ogee lugs, which are an important feature of older double-hung wood windows. In addition, a true divided light option is not offered for clad windows by any manufacturer. Another issue with vinyl-clad window systems is that they often show seams, as some of these windows are clad with vinyl strips on the outer surface. Aluminum and fiberglass finishes can come in a variety of colors and often have a finish that more closely resembles a painted surface.

There are a number of windows constructed of substitute materials on the market today that strive to match the styles and profiles of historic windows. The Planning Department is always open to reviewing any new products for compatibility with older properties. A quick way to get a initial feedback on a new product is to bring the manufacturer's specification sheet to the PIC for a planner to review. In some cases, the Planning Department may consider approving clad replacement windows that are visible from the street or other public rights-of-way if their architectural compatibility can be adequately demonstrated in terms of overall, size, glazing, operation, finish, exterior profiles, and arrangement.



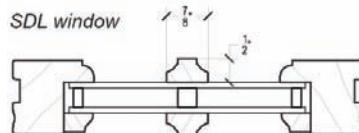
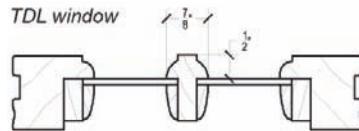
## SOME INFORMATION REGARDING SIMULATED DIVIDED LITE (SDL) WINDOWS.

Older windows are often made up of two sashes that include smaller panes of glass. These windows are referred to as “divided-lite windows.” The panes of glass are separated by thin wood members, or moldings referred to as a “muntin.” A true divided-lite (TDL) window is defined when the muntin separates individual panes of glass. Most TDL windows are single-paned; however, a simulated divided-lite (SDL) window often contains an insulated unit of glass with an applied exterior grid that mimics the appearance of a divided-lite window. The majority of simulated divided-lite windows do not accurately reflect the depth and the profile of a true divided-lite window.

If a property owner chooses to use an SDL window to replace a window that has true divided lites, then the replacement window must meet all of the following criteria to be considered for Planning Department approval. Please note that the Planning Department has the discretion to prohibit the use of SDL windows when the existing windows to be replaced are determined to be architecturally unique or considered to be an example of outstanding craftsmanship. In these cases, the Planning Department may ask for the existing windows to be repaired rather than replaced.

### Criteria for using SDL windows in place of TDL windows:

- The SDL must match the existing window muntin in profile and depth to the greatest extent possible. This width may vary; however, the most common width for a TDL window muntin is 7/8" including glazing putty on either side of the division. The SDL muntin must have a depth of at least 1/2".
- There should be an interior space bar, preferably of a dark color, within the insulated unit that visually divides the interior and exterior grilles.
- The SDL should be integral to the window sash – snap on grilles or grilles placed between an insulated glass unit are not permitted.



The differences between a true divided-lite (TDL) window and a simulated divided-light (SDL) window can be seen in the illustrations at left. The muntin on the TDL window (top image) separates two individual panes of glass while the muntin on the SDL window (bottom image) is applied to the interior and exterior of the window without piercing the insulated glass unit.

### REMINDER:

**Simulated divided lite windows will not be approved for individually listed City Landmarks in Article 10 of the Planning Code on ANY elevation visible from a public right-of-way. Simulated divided lite windows will be reviewed on a case-by-case basis for contributors within Article 10 Districts or within and Article 11 Conservative District.**

### WHY SHOULD I LOOK INTO REPAIRING MY WINDOWS BEFORE REPLACING THEM?

Deterioration of poorly maintained windows usually begins on horizontal surfaces and at joints, where water can collect and saturate the wood. Wood windows, when repaired and properly maintained, will have an extended life while contributing to the architectural character of the building and the neighborhood. Property owners should conduct regular maintenance of window frames and sashes to achieve the longest life possible.

It's important to note that many wood windows constructed during the late 19th- and early 20th-centuries still perform very well and may not require replacement. This is largely due to the fact that these windows were constructed out of Heartwood or the center of tree. This durable old-growth wood is denser and more resistant to fungi, insects, and rot than wood farmed to manufacture windows today. For this reason always explore the possibility of repairing the historic windows on a building before replacing them. There are a number of professional window replacement companies who can help you determine if your windows can be repaired, or if some or all need to be replaced.

Be sure to evaluate **ALL** of the existing windows or hire a professional to conduct a conditions assessment to avoid spending money on windows that don't need replacement. It may be that only certain windows on your building need replacement, while some may only need repairs or other minor refurbishments, thus significantly reducing costs. One solution for replacing deteriorated windows on visible elevations is to consolidate other windows from the rear and sides of the building that are still in good condition and relocate them to the primary façade.

## ENERGY CONSERVATION & SUSTAINABILITY.

Windows don't always require replacement in order to see and feel big results in reducing energy usage; however, energy conservation and sustainability is one of the primary reasons for replacing windows that are considered to be obsolete, particularly replacing single-glazed sashes with double-glazed sashes. Currently, most manufacturers' warranties for replacement windows are from 2 to 10 years; however, historic wood windows with minimal maintenance have a performance life of 60 to 100 years. Retaining and repairing existing windows also conserves embodied energy (i.e. the sum of the energy required to extract raw materials, manufacture, transport, and install building products). Replacement window materials – primarily aluminum, vinyl, and glass possess some of the highest levels of embodied energy of all building materials.<sup>1</sup>

Are you planning a major renovation on a historic property?

**The California Office of Historic Preservation (OHP)** administers the 20% Federal Rehabilitation Tax Credit for California in partnership with the National Park Service pursuant to federal regulations (36 CFR Part 67). This federal program provides a dollar-for-dollar income tax reduction

credit equal to 20% of qualified rehabilitation expenditures on income producing properties that are certified historic structures. For more information regarding this program, please contact the OHP at 916-653-6624.

**The Mills Act** is designed to provide owners of both owner-occupied and income-producing property the opportunity to rehabilitate, restore, preserve and maintain "qualified historical properties" while

receiving property tax relief. The Mills Act provides for a potential 50 percent reduction in property taxes on "qualified historical properties" in exchange for the owner's agreement to maintain and preserve the resource in accordance with standards established by the Secretary of the Interior's Standards for the Treatment of Historic Properties. For more information on the Mills Act in San Francisco, please refer to San Francisco Planning Department Preservation Bulletin No. 8.



## 2 MY WINDOWS ARE BEYOND REPAIR AND NEED TO BE REPLACED. WHAT TYPE OF WINDOW IS ACCEPTABLE FOR MY PROPERTY?

If replacement windows are required due to deterioration, those that are visible from the street or other public rights-of-way should be replaced with windows that are appropriate to the time period your building was originally constructed. For example, if the building was originally constructed in 1908 with wood double-hung windows, then they should be replaced with wood double-hung windows with similar exterior dimensions. If the appropriate window type cannot be determined, then a window that is otherwise architecturally appropriate to the building and surrounding neighborhood character, in terms of style, material, visual quality, and detailing can be considered. For example, if the building was originally constructed in 1925 and currently has vinyl sliding windows but similar neighboring buildings from the same time period have their original steel casement windows, then the appropriate replacement window would be a metal casement window.

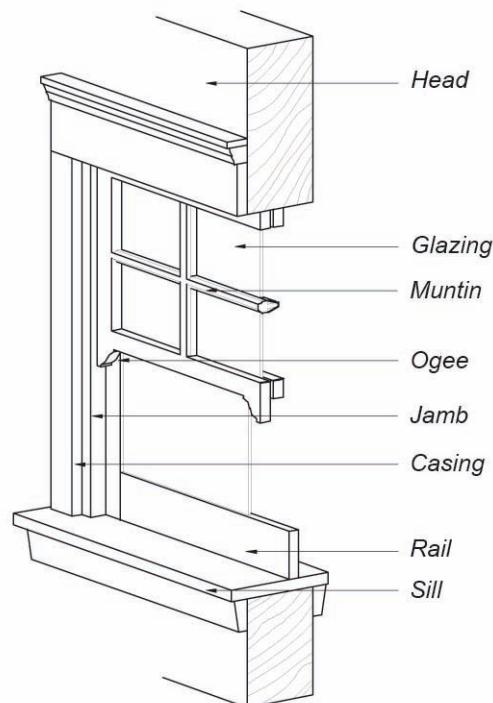
## 3 WHAT IS THE IMPORTANCE OF BRICK MOLDS AND OTHER EXTERIOR MILLWORK?

A brick mold is the exterior molding often used to trim the edge of windows in a masonry opening. On a wood frame building this window detail is referred to as millwork. A common practice when installing replacement windows is to replace only the sashes and cover the trim and framework around the exterior of the window with capping or panning to give the window a cleaner, "updated" look. This panning, whether vinyl, fiberglass, or aluminum, is used to cover over brick molds and other exterior millwork that frame the opening and makes up part of the exterior profile of the windows. The Planning Department will not approve replacement windows where these elements are covered or obscured from view. Wherever possible, all surrounding millwork or brick molds should be retained and left exposed. When replacement is required due to deterioration or missing elements, these elements should be replaced

in the original material, and a profile of the existing and proposed millwork should be included as part of the permit application drawings for review by Planning Department staff.

### Mixing Window Types:

Mixing window types and materials creates an inconsistent appearance to a building's facades. This issue becomes particularly important in dealing with condominium and apartment buildings. In general, the Planning Department will not approve partial window replacement for a building unless the replacement windows are meant to restore the windows to their historic configuration.



The axonometric drawing of a wood window above identifies the parts of a window system that most owners should be familiar with when applying for a window replacement permit.

**2 WHO ARE SOME WINDOW MANUFACTURERS THAT SPECIALIZE IN HISTORIC OR OTHER ARCHITECTURAL GRADE REPLACEMENT WINDOWS?**

As a city agency, the Planning Department cannot recommend the use of one manufacturer over another; however, a list of some commonly used window manufacturers or representatives can be obtained from the Planning Information Center (PIC) on the first-floor of 1660 Mission Street. The PIC may also be reached by phone at 415-558-6377.

If your building is protected under Article 10 or 11 of the Planning Code or is deemed an eligible historic resource, please contact the PIC for a list of the organizations that may help you find a product or manufacturer that best suits your needs.

**2 WHAT SHOULD I DO FIRST IF I NEED TO REPLACE MY WINDOWS?**

If replacement is necessary, thoroughly document and investigate the structural and architectural detailing of the window and seek appropriate professional consultation. Please refer to the following questions every applicant should review before applying for a permit to replace windows. At any time, a Planner located at the Planning Information Center (PIC) can answer additional questions regarding these standards and window replacement. The PIC may also be reached by phone at 415-558-6377.

Basic Window Questions:

- **What is the pattern of window openings and their size?**  
(Irregular, Regular)
- **What are the proportions of the frame and the type of sash operation?**  
(Double-Hung, Casement, Pivot, Slide, Hopper)
- **What is the configuration of the windowpanes?**  
(2-over-2, 4-over-1, 6-over-6)

**APPLYING FOR A WINDOW REPLACEMENT PERMIT.**

When applying for a window replacement permit, please bring as many of the applicable items on the How to Apply for a Window Replacement Permit as possible in order to ensure the most efficient review possible. There are a number of basic questions that a property-owner can answer when examining the windows proposed for window replacement.

**2 MANY OF THE BUILDINGS IN MY NEIGHBORHOOD ALREADY HAVE VINYL, ALUMINUM, OR FIBERGLASS WINDOWS. WHY CAN'T I HAVE SIMILAR WINDOWS APPROVED FOR MY BUILDING?**

There may be a number of reasons why a Planner may not approve vinyl, aluminum, or fiberglass windows for your building. The most common reason is that the windows in your own building and in adjacent buildings may have been installed before the revision of the Residential Design Guidelines in 2003 and the preparation of this document, Window Replacement Standards, August 2008. As the Planning Department strives to promote and enhance neighborhood character citywide, the Department acknowledges that windows may be inconsistent with the architectural features and the original design intent of older structures. In addition, it is possible that the

- **What (if any) are the muntin profiles?**  
(Shallow, Deep, Simple, Ornate)
- **What is the material?**  
(Wood, Steel, Vinyl, Aluminum, Fiberglass)
- **What are the characteristics of the glass?**  
(Decorative, Wavy, Clear, Opaque, Translucent, Leaded)
- **Are there any associated details?**  
(Decorative millwork, Brick Molds, Arched Tops, Window Surrounds or Hoods)



windows installed on adjacent buildings were done without the benefit of a permit or contrary to the scope of work outlined in the building permit.

#### **2 THE PLANNER SAID THAT I HAVE TO REPLACE MY WINDOWS “IN-KIND.” WHAT DOES THAT MEAN?**

If a Planner has stated that you should replace your windows “in-kind” this means that a wood double-hung window should be replaced with a wood double-hung window or a metal casement window should be replaced with a metal casement window. All details must match, including muntin profiles and exterior millwork. Please note that replacing a double-hung wood window with a double-hung vinyl window is not “in-kind” replacement.

#### **2 HOW LONG WILL IT TAKE THE PLANNING DEPARTMENT TO REVIEW MY PERMIT?**

- If windows are being replaced in-kind or on non-visible elevations and all the required materials for review are submitted, an over-the-counter approval can be issued at the Planning Information Center.
- If the windows are visible from the street and the new windows are consistent with the building’s historic window type or compatible with the building and neighborhood character, planning approval will be over-the-counter at the Planning Information Center. Please note that in some instances window replacement on an Article 10 or Article 11 property must be approved by the Historic Preservation Commission or the Zoning Administrator.
- If installing a new window on a portion of the building that is visible from the street is desired, and the plans and photos are adequate, a planner will determine right away if the permit can be approved, or if it will require further design review.
- In some situations such as window replacement on a historic building, further review may be required. The window replacement permit application will be reviewed at the Planning Information Center and may be referred upstairs to a Preservation Technical Specialist for review.

# How to Apply for a Window Replacement Permit



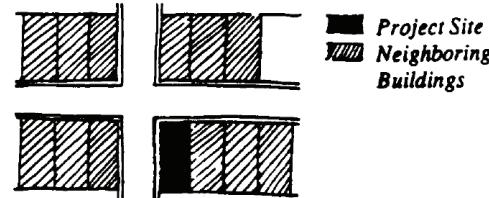
The Planning Department reviews each window permit application on a case-by-case basis. The following is a list of information that may be required to process an application to replace windows. Please note that buildings listed as City Landmarks or as contributors to a historic district as part of Article 10 of the Planning Code require a Certificate of Appropriateness for any exterior work. In addition, buildings listed under Article 11 of the Planning Code must also be reviewed for historic architectural compatibility by the Zoning Administrator. Either approval must be obtained before the building permit is issued. Please note that in some instances Planning Department staff may request additional information.

**Where original or historic windows exist and replacement is proposed, please submit the information on the following checklist for review:**

- Photographs of the overall building taken from the curb and streetscape photos of the immediate block. Also, include close-up photos of the different types of windows to be replaced, including any millwork or brick molds between windows and surrounding the window openings.
- A site plan or a clear aerial photograph showing your building and the walls of your neighbor's building on each side of you as well as overall photos of each elevation where the proposed window replacement is to occur.
- Please provide window details for the proposed windows (head, jamb, meeting rail, sill, etc.) with dimensions and showing exterior profiles including brick molds and surrounding exterior millwork. The Planning Department needs to know the materials, size, and appearance of both the existing and the replacement windows. The manufacturer's product sheet may have this information for the new windows. Please note that if historic windows are to be replaced then the replacement windows should match the existing windows in overall, size, glazing, operation, material, finish, exterior profiles and arrangement.
- If the existing windows have divisions (muntins) they may be replaced with either true divided light or simulated divided light (SDL) windows provided that the replacement windows match the historic size, glazing, operation, finish, exterior profiles and arrangement and the SDL windows meet the additional requirements listed in this document.
- If proposing to replace or change the profile of exterior millwork or brick mold, please submit details of the existing and proposed new millwork or brick molds with dimensions.

**When the original or historic windows no longer exist, the owner has the option of retaining the existing window or replacing it with a compatible sash. For window replacement, please submit the information above for review, the following:**

- Photographs of the neighboring buildings and their windows on each side of your building
- Photographs of the neighboring buildings and their windows immediately across the street
- For corner lots, bring photos of the subject building and the building's other three intersections, showing their windows closest to each corner.



## A QUICK SUMMARY:

### 1. A building permit is required for ALL window replacements.

- A permit is needed to replace windows regardless of their location on the building.
- Failure to obtain a building permit may result in enforcement, fines and removal of windows installed without the benefit of permit.

### 2. DO NOT purchase windows until you have obtained a building permit for their replacement.

- The Planning Department must review all permits for windows proposed for replacement that are visible from the street for architectural compatibility.
- The Planning Department review applies to all buildings in San Francisco, not just historic buildings.
- The Planning Department will not approve windows if it is determined that they are not architecturally appropriate, even if they have already been purchased and/or installed without benefit of a permit.

### 3. Evaluate what windows may only need repairing rather than replacing.

- Survey all of the windows on your buildings to determine which ones actually need replacement.
- Windows on eastern and northern facades often last longer and need less frequent replacement than windows with southern or western exposure.

### 4. Replacement windows should match the HISTORIC windows in size, glazing, operation, material, finish, exterior profiles and arrangement.

- The Residential Design Guidelines, since their revision in 2003, have set requirements for windows for all buildings within residential zoning districts (P. 46).
  - If the historic window type cannot be determined, a window type appropriate to the building's architectural period and style should be used. A Preservation Technical Specialist can help in determining an appropriate window type.
  - Please refer to pages 44-46 of the Residential Design Guidelines for more information on determining what types of windows are compatible with the architectural character of the building.
  - Where visible from the street, aluminum and vinyl windows cannot be approved as replacements for windows that were originally wood.
  - The proposed use of Simulated Divided Lites (SDLs) will be reviewed on a case-by-case basis and must meet the criteria identified in this document.
  - Replacement wood windows that have vinyl, fiberglass, or aluminum clad exteriors will also be reviewed on a case-by-case basis.

### 5. All exterior trim and millwork must be left exposed.

- The underlying trim and millwork must be left exposed and be repaired in place. If beyond repair, the trim and millwork must be replaced in kind.

## NOTES

- 1 Walter Sedovic and Jill H. Gotthelf, "What Replacement Windows Can't Replace: The Real Cost of Removing Historic Windows", APT Bulletin: Journal of Preservation Technology, 36.4, (2005): 25.



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### FOR MORE INFORMATION: Call or visit the San Francisco Planning Department

#### Central Reception

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# Historic District Windows

PDS

Department Application

#188

## Preserving the Charm of Boise's Historic Districts

The windows within historic districts are as varied as the houses themselves. Each architectural style's unique windows are integral to interpreting the style. Altering the windows can potentially change the structure's status from contributing to noncontributing to the historic district. The window type (slider, double hung, single hung, etc.), the material used (wood, vinyl, aluminum, etc.), and the window depth within the wall plane all affect the overall building design.

Whether ornate or plain, windows are an integral part of a building's style, and express its history and architectural style. Although it is easy to see the need to preserve the high-style windows of a Queen Anne mansion, the humbler windows of a small cottage are as important since they may be the building's only stylistic feature. On a simple building, altering the windows' shape or configuration could easily change the structure's entire appearance and historic integrity.

## The Secretary of the Interior

The U.S. Department of Interior has written a set of Historic Preservation recommendations titled *Standards for the Treatment of Historic Properties*. These guidelines are widely used by the nationwide preservation community. This resource was used in developing the City of Boise *Design Guidelines for Residential Historic District* document. In this publication, the Secretary of the Interior recommends against "changing the historic appearance of windows through the use of inappropriate designs, materials, finishes, or colors which noticeably change the sash, depth of reveal, and muntin configuration; the reflectivity and color of the glazing; or the appearance of the frame." (pg. 81).

Although a vinyl window with a large sill depth and compatible framing may meet this recommendation, the figures below illustrate the results of using an incompatible material and design when replacing a historic window.

## Historic Window Modifications

The Secretary of the Interior recommends "identifying, retaining and preserving windows-and their functional and decorative features-that are important in defining the overall historic character of the building. Such features can include frames, sash, muntins, glazing, sills, heads, hoodmolds, paneled or decorated jambs and moldings and interior and exterior shutters and blinds."

When making decisions regarding renovations in a historic district, first identify these important window features. Consider making small improvements such as removing paint that has sealed the window closed, and weatherproofing by recaulking or installing weatherstripping or storm windows. If elements of the window's structure have rotted, consolidation or in kind replacement of those elements can be an effective way to save an otherwise viable window while retaining the window's character defining elements.

The Secretary of the Interior states that when an entire window is too deteriorated to be saved, the replacement of the window is acceptable. However, it is important that the new window is compatible with the structure and the other windows. For instance, if the historic windows are long, double hung windows, replacing them with short, wide horizontal sliders is inappropriate. Likewise, if a large, multi-paned window has always been on the front elevation of a house, replacing it with two single-hung windows is inappropriate. Replacement windows should be congruous, or compatible with the shape, placement and material of the windows historically on the house.

[www.cityofboise.org/pds](http://www.cityofboise.org/pds)

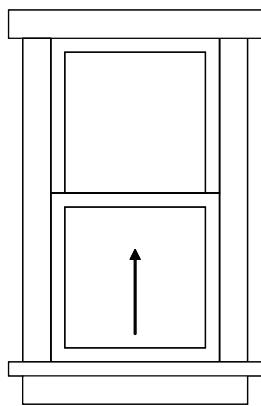


City of Boise Planning & Development Services

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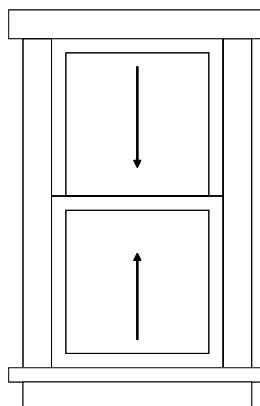
Phone: 208/384-3830 • Fax: 208/433-5688 • TTD/TTY 800/377-3529

# Window Information



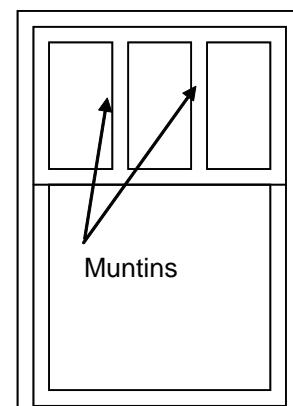
## Single-hung

A window whose bottom sash slides along vertical tracks.



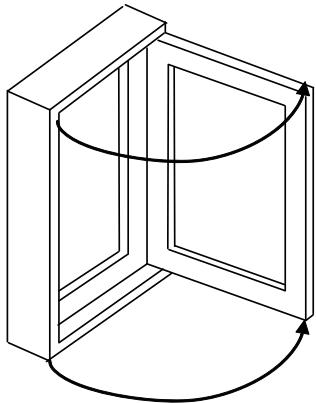
## Double-hung

A window whose top and bottom sashes slide along vertical tracks.



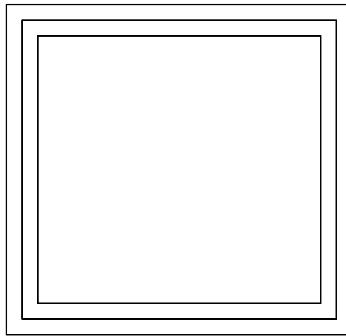
## Muntin

A rabbited member that holds the glass panes in place



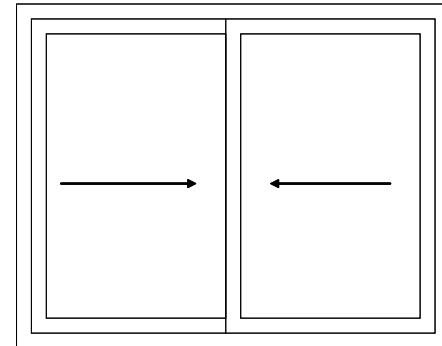
## Casement

The sash opens on hinges usually attached to the vertical side of the frame.



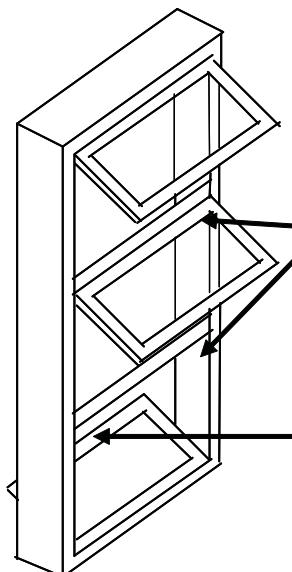
## Fixed Pane

A window whose sash does not open.



## Horizontal Slider

A window whose sashes slide along horizontal tracks.



## Awning

A window whose sashes open on hinges attached to the top of the frame

## Hopper

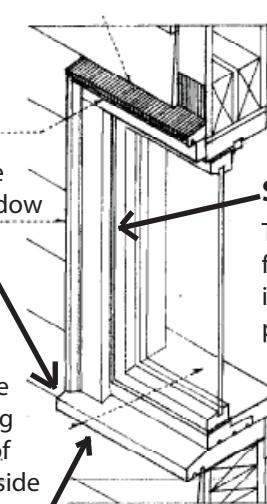
A window whose sash opens on hinges attached to the bottom of the frame.

## Sill

The ledge at the base of the window opening

## Sill Depth

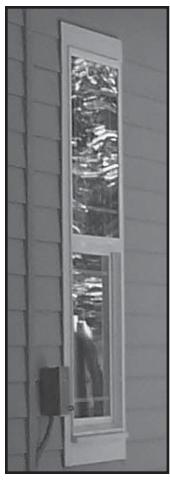
The depth of the window opening from the pane of glass to the outside wall.



## Sash

The openable framework in which the pane is set

## Vinyl vs. Wood: Does it Really Matter?



Vinyl



Wood

These houses are similar in age and sit side by side in the North End. While the house on the right retains its original double hung windows, the one on the left has all new vinyl windows replacements.

The vinyl window's top pane sits flush with the wall, while wood window's top pane is recessed. The difference in sill depth is also easy to see, as the sill on the vinyl window is much shallower than that of the wood window.

This example highlights the difference between the wood window's muntins and the interior grid system of the vinyl window. In this picture, it is almost impossible to see the grid system of the vinyl window, and, while muntins cast shadows and break the reflective surface of the window, an internal grid system allows for an uninterrupted reflective surface.

## Inappropriate Windows



This home's replacement windows are inappropriately sized and configured. The window openings were altered and windows were changed from wood, double-hung windows to vinyl horizontal sliders, and the window frames were replaced with simpler, thinner frames. This alters the building's look so it no longer contributes to the district's architectural or historical characteristics.

## Appropriate Materials

Appropriate materials to use are wood, metal clad wood and wood clad composite.

## Additional Information

These resources provide more information on windows in historic buildings. They are available online or at the Planning & Development Services Library.

**Fisher, Charles Ed.** *The Window Handbook: Successful Strategies for Rehabilitating Windows in Historic Buildings.*

**McAlester, Virginia and Lee.** *A Field Guide to American Houses.*

**Myers, John H.** "Technical Brief #9 The Repair of Historic Wood Windows." *The National Register of Historic Places.* [www.cr.nps.gov/hps/tps/briefs/brief09.htm](http://www.cr.nps.gov/hps/tps/briefs/brief09.htm).

**Park, Sharon C.** "Technical Brief #13 The Repair and Thermal Upgrading of Historic Steel Windows." *The National Register of Historic Places.* [www.cr.nps.gov/hps/tps/briefs/brief13.htm](http://www.cr.nps.gov/hps/tps/briefs/brief13.htm).

**Park, Sharon C.** "Technical Brief #24 Heating, Ventilating, and Cooling Historic Buildings: Problems and Recommended Approaches." *The National Register of Historic Places.* [www.cr.nps.gov/hps/tps/briefs/brief24.htm](http://www.cr.nps.gov/hps/tps/briefs/brief24.htm).

**Smith, Baird M.** "Technical Brief # 3 Conserving Energy in Historic Buildings." *The National Register of Historic Places.* [www.cr.nps.gov/hps/tps/brief03.htm](http://www.cr.nps.gov/hps/tps/brief03.htm)

**Weeks, Kay D. and Anne E. Grimmer.** *The Secretary of the Interior's Standards For the Treatment of Historic Properties with Guidelines for Preserving, Restoring, Rehabilitating and Reconstructing Historic Buildings.* [www.cr.nps.gov/hps/tps/standguide/](http://www.cr.nps.gov/hps/tps/standguide/)

News  
from the  
National  
Alliance of  
Preservation  
Commissions  
**Jan-February 2012**

# *the Alliance review*

## THE WINDOWS ISSUE

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*Written and compiled by  
Paul Trudeau and the National Alliance of  
Preservation Commissions*

# A WINDOWS SHORT GUIDE for Historic Preservation Commissions

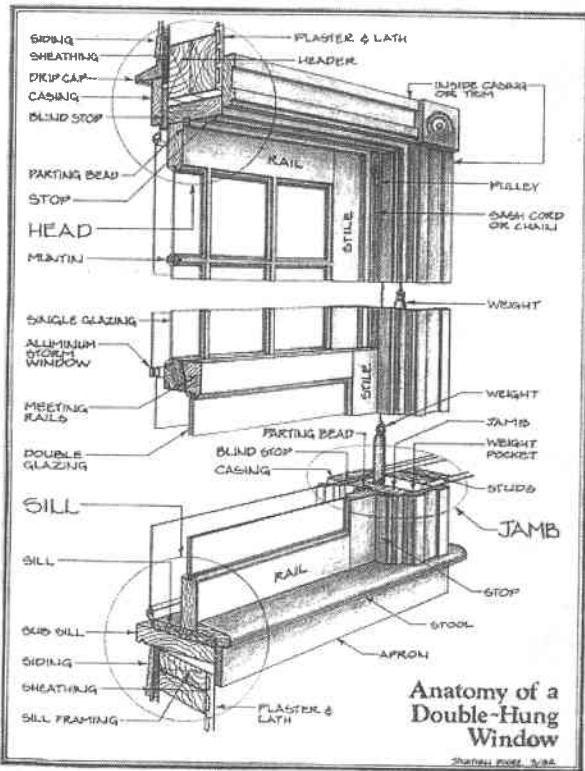
## The Great Debate

One of the most prevalent topics in the historic preservation community is the debate over when to restore and when to replace historic wood windows. Local preservation commissions across the country must consider a myriad of issues when reviewing window replacement proposals, including, but not limited to, historic character, energy efficiency, sustainability, cost, existing condition, necessary maintenance, installation details, natural ventilation, and a wide variety of replacement models. Aggressive advertising from window replacement manufacturers, dealers, and installers, along with misinformed property owners, makes this task even more difficult.

Because window replacement is one of the most common items a commission finds on its agenda, commission members and staff must be prepared to address these issues. An important part of this preparation is developing a clear and consistent review methodology that follows adopted guidelines. Accordingly, the National Alliance of Preservation Commissions (NAPC) has produced this issue of *The Alliance Review* to give local commissions information necessary to make defensible decisions. In addition to providing a historical overview of windows, the handbook addresses popular myths and facts of the restore vs. replace debate. It also provides detailed preparation strategies and a series of questions for commissions to consider when reviewing window replacement proposals.

## An Historical Overview

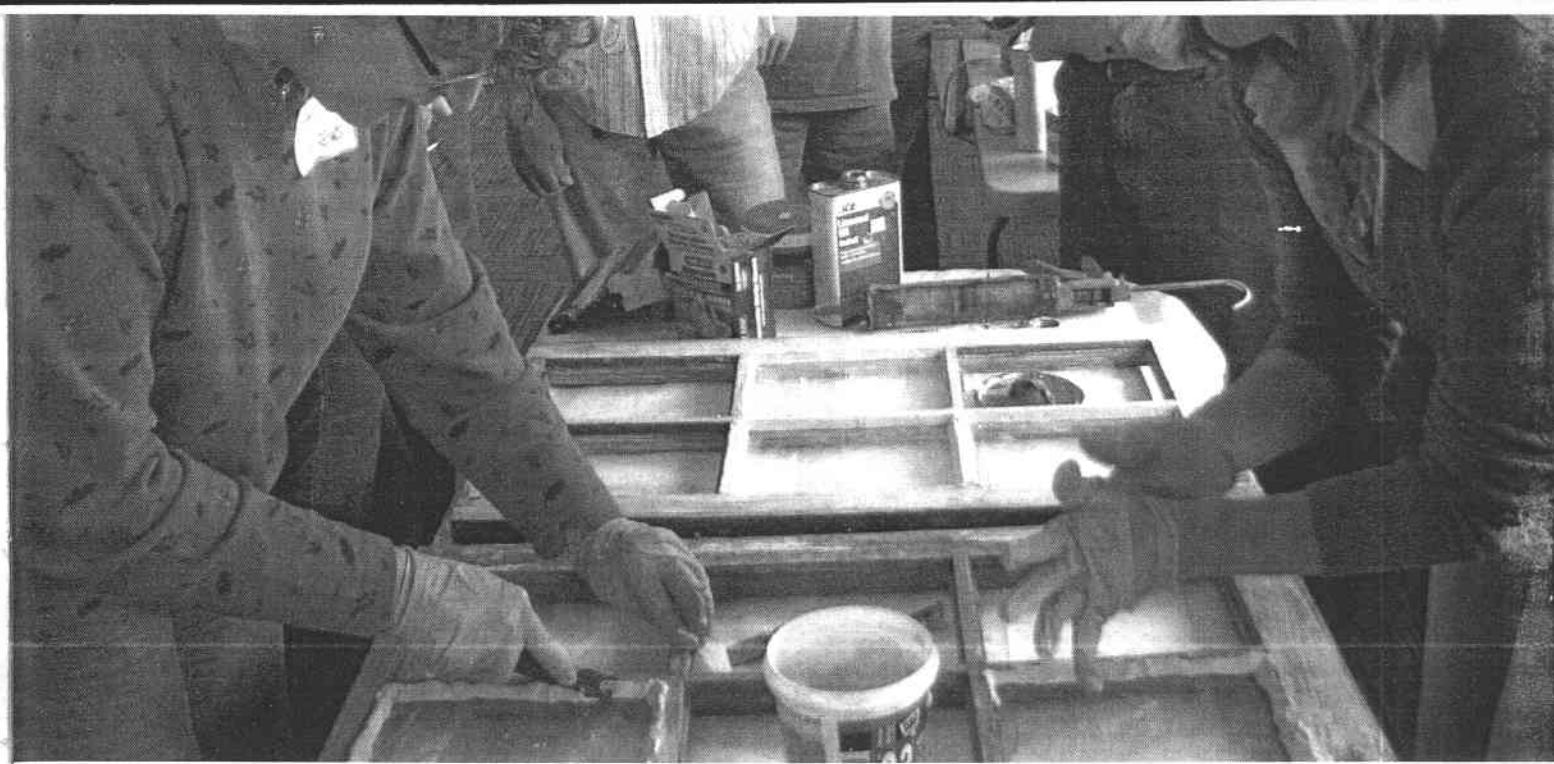
First and foremost, it is important to have a basic understanding of why windows are a valuable component of a building. Often referred to as the "eyes"



*The Old-House Journal*

*Traditional double-hung sash construction was an intricate process, consisting of numerous parts and detailed components. Image source: <http://urbanplacesandspaces.blogspot.com/2011/09/historic-house-expo.html>*

of a building, windows are a character-defining feature that provide scale, profile, and composition to a façade. Federal preservation guidelines advise, "windows should be considered significant to a building if they: 1) are original, 2) reflect the original design intent for the building, 3) reflect period or regional styles or building practices, 4) reflect changes to the building resulting



*Hosting a hands-on window repair workshop is a great way to great property owners energized about wood window restoration.*  
Photo courtesy of Athens-Clarke Heritage Foundation

from major periods or events, or 5) are examples of exceptional craftsmanship or design.”<sup>1</sup>

The most common window type, the double-hung sash, dates back over three centuries in America. The purpose of a movable top and bottom sash was to allow for ventilation and air circulation throughout the house in warm months. Traditional sash construction was an intricate process, using mortise and tenon joinery to create sash that fit tight into the window openings of a house. The construction technique of individual panes of glass (“lites”) held by molded wooden members (“muntins”) evolved at an early stage. The time and attention to detail that went into window sash and frame construction paralleled other structural framing components in early American buildings. Similarly, the old-growth lumber used for these buildings, including window sash, is extremely resilient and will continue to last if maintained properly.

Window styles changed significantly over the years as glass became less expensive to manufacture. Early wood sash windows were marked by thick muntins and small lites, partly due to the high price of glass and technical difficulties in manufacturing large panes. As glass technology improved and prices decreased, lites became larger and muntins became thinner. By the late eighteenth century, dimensions of windows had become standardized according to the sizes of glass imported from Britain. This evolution can be seen with the change of architectural styles in America; the typical six-over-six muntin patterns found in early Greek and Classical Revival buildings gave way to two or one-over-one configurations in Italianate and Queen Anne

styles by the late 1800s. With this change came different moulding and casing details, evidence that windows were regarded as a major element of architectural design.

## **Homeowner Education**

The most important aspect of the restore vs. replace debate is educating district residents and property owners. With numerous misconceptions about old wood windows in the public eye, owners of historic buildings are easily swayed to quick-fix solutions that may be inappropriate. Proactive educational programs and user-friendly materials and literature can successfully influence public opinion and decision-making by historic property owners. Local historic preservation commissions have the ability to get involved in this cause, and many commissions may even have a mandate by their local preservation ordinance to promote and/or conduct educational outreach programs. There are many ways to do so:

1. Include a section on the benefits of window restoration in historic district design guidelines.
2. Host a window repair workshop through a preservation non-profit or local contractor.
3. Prepare window brochures and handouts for distribution at City Hall, public hearings, neighborhood meetings, or elsewhere.
4. Encourage property owners in historic districts to join historic preservation Listservs.
5. Work with local non-profits to hold annual events such as a window condition assessment weekend to offer homeowners firsthand experience of various window issues.

It is also important to know your audience. If there is a growing trend to replace windows in your local historic districts, try to get a sense of what is fueling this trend. If it is based on economics or energy-related issues, provide studies to property owners that focus on these topics in layman's terms. This information may convince those who do not value the historic character of old wood windows to reconsider replacement.

## The Myths and Realities of the Window Debate

Frequently, well-intentioned property owners are persuaded to replace repairable windows by the various myths of the restore vs. replace debate. By being aware of the misconceptions and having a clear understanding of the issues involved, local preservation commissions can proactively educate property owners and make defensible decisions when reviewing window replacement proposals. As a first step, commission staff should provide property owners with the appropriate literature and educational information about why restoration is the preferred option, and then commission members need to know the

facts in order to make consistent, valid decisions.<sup>2</sup> The myths and realities discussed below are extensive but not comprehensive or absolute; more discussion and research should be expected as the window-replacement industry finds new ways to promote its products.

Moreover, aside from change of exterior appearance, these myths include issues that are typically not under a commission's jurisdiction. Commissions and staff will likely hear concerns about energy efficiency, cost, and other related issues from property owners as a justification for window replacement. While it is important to educate property owners, commissions must avoid making design review decisions based on issues that are not within their purview (see following examples of cost, energy efficiency, etc.). However, as property owners will propose window replacement for a variety of reasons, it is important to gather as much information as possible on these topics in preparation for public meetings. This preparation will put commissions in the best possible position to educate and inform property owners when making decisions.

### Aesthetic or Appearance Argument

#### THE MYTH: "Replacement Windows Look Just the Same as Historic Wood Windows."

The issue most directly associated with a local preservation commission's jurisdiction is how a replacement window will alter a designated property's character. A popular claim is that a replacement window will easily and conveniently match the character-defining components of historic wood windows. This assertion typically focuses on a grid configuration in the replacement model that would resemble the existing muntin configuration of the original wood windows. Muntin profiles in wood windows are, in fact, difficult to replicate and replacement windows or sash rarely have the same details. A "true divided-lite" window with a traditional 1/2" or 5/8" exterior muntin with a putty bead is hard to reproduce in an insulated glass, "true divided-light" window, as heavier muntins are required to support the insulating glass.<sup>3</sup> This type of replacement window reproduction is also more costly. Many wood replacement windows have a muntin at least 7/8" wide with a surface-mounted molding affixed to the glass (or sometimes an "air-space grille" sandwiched between the glass) that is not actually holding individual panes of glass. Its appearance is intended to simulate a "true divided-lite" profile. Cheaper models, typically of vinyl or aluminum, feature snap-in grilles or grilles between the double glazing, providing no profile, depth, or shadow lines.

In some replacement windows, the heavier framing required to support insulating glass decreases the overall glazed opening by as much as 3 inches in width, with a significant loss of light and alteration of the appearance. In some cases,



These vinyl replacement windows have a "grid between the glass" configuration that does not accurately represent the muntin profiles of traditional "true divided-light" wood windows.  
NAPC file photo

it may be considered appropriate to replace deteriorated one-over-one windows (which have no muntins holding individual panes of glass) with certain wood, fiberglass, or vinyl replacement models.

Aside from the difference in muntin profiles, replacement windows will also often require a change in a window's rough opening because their size is based on current industry standards and does not match traditional window dimensions, which are frequently larger.



*The framing component required for this replacement window model diminishes the window's rough opening by several inches.*  
Photo courtesy of Paul Trudeau

This change will sometimes involve the installation of additional vinyl balances or aluminum framing members to hold the replacement window properly. Custom sizing will add to the expense of replacement windows. Other appearance-altering features of new replacement windows include the inherent shiny and glossy look of vinyl or other synthetic cladding compared to wood, and the stark differences between "wavy," antique glass and replacement glass (fiberglass models, which can be painted, may be a better alternative). These changes to the fenestration's appearance can have a negative impact on a building's character. Commissions need to take into account all of these considerations when reviewing replacement models, as no two cases are the same. Oftentimes, questions of visibility from a public way will enter the equation when considering the overall effect of replacement windows on a building. In addition to the required information listed below, commissions and staff should always request a sample replacement window to be brought to a public hearing or on-site meeting in order to get a better sense of the various details involved.

### **How commissions and staff can prepare in advance for window replacement proposals based on the AESTHETIC/ APPEARANCE ARGUMENT:**

1. Document the typical historic wood windows found on your community's historic buildings and take notes on their details, including muntin profiles, glass, trim, casings, etc. Compare the same elements to those found on a recently installed replacement window.
2. Become familiar with replacement window components as viewed from the exterior of a building (e.g., simulated muntin grids, claddings, and framing systems) by attending trade shows or visiting local replacement window distributors.
3. Compile a file or brochure of comparison photographs (replacement windows vs. restored windows) to share with property owners.

### **Information to require of the applicant before a public hearing or meeting for window replacement proposals based on the AESTHETIC/ APPEARANCE ARGUMENT:**

1. Of what materials will the replacement window be constructed? How will these materials be similar in appearance to the original windows?
2. If the replacement window has a grid pattern, will the grids be snap-in (i.e., surface mounted), between the glass ("airspace grids"), or "true divided lites" (i.e., authentic through-the-glass muntins)?
3. How closely will the grid profile in the replacement window match the muntin profile (i.e., width, contour) of the original wood window?
4. Is the whole window (casing, stops, counterweighted ropes, etc.) being replaced or just the operable sash?
5. If only the sash is being replaced, will additional framing be required to hold the replacement sash?
6. Will the replacement sash have an aluminum or vinyl cladding?

It is essential to distinguish between "windows" and "sash," especially when discussing their potential replacement. "Replacing a window" means removing the entire window, including the sash, the jambs, the interior and exterior casings, and the sill, and installing an entire new unit. This replacement is often problematic because the casings will almost inevitably have different dimensions from the original, leaving gaps against both exterior and interior finishes. Unless specially ordered, modern windows will have a different configuration of casings, stops, and screens, dimensionally thinner sills and casings, and will sometimes occupy a different plane in the wall. "Replacing a sash" means replacing the moveable parts of a window, leaving the casings, jambs, and sill intact.



*The costs of a complete window restoration will vary depending on the level of work required. Image source: <http://www.doublehungwindowrestoration.com/about.html>*

## Cost Argument

### THE MYTH: "It's More Expensive to Restore Historic Wood Windows than to Install Replacement Windows"

The claim that it is too expensive to repair existing windows is one of the most frequently used arguments in favor of window replacement. A clear understanding of the economic realities of window restoration and replacement is needed to refute this claim.

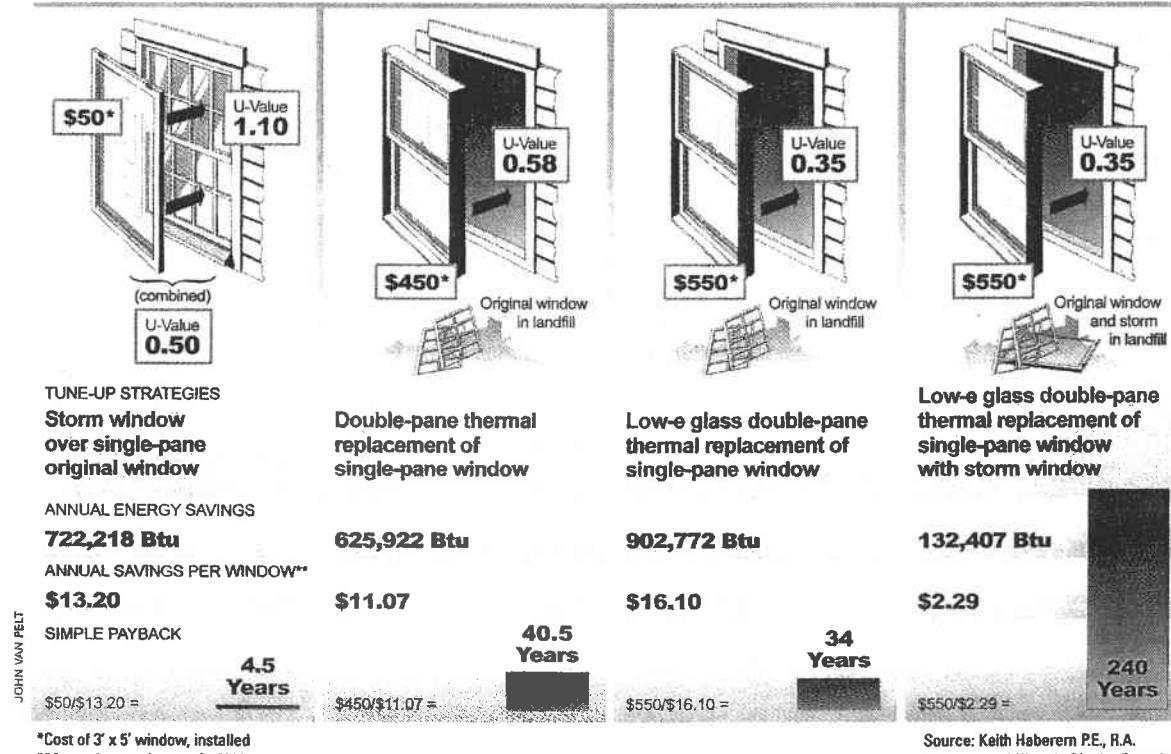
If a property owner believes that old wood windows need to be replaced because it would be too expensive to restore or repair them, a detailed assessment of the existing window's condition is necessary to support this contention. Commission members or staff may need a site visit to gain a clear understanding of the actual state of the windows. In many cases, simple repairs will greatly improve a window's condition and overall performance, but no two cases are the same. If a window is in workable condition, it may need only work such as spot glazing, caulking, scraping, filling holes, repainting, or replacing a pane of glass. These costs should be well below the cost of even the cheapest replacement model. A more detailed restoration – including fixing broken sash cords, removing the sash for weatherstripping, replacing rotted or missing wood sections, re-glazing the entire sash – and/or the installation of a storm window – may cost more than an inexpensive replacement model, because the windows often have to be moved off site to a workshop and the work is much more labor intensive.

A closer look at the long-term picture reveals that the installation of cheaper replacement windows will make less economic sense than restoring the existing windows. Property owners may not realize that the life cycle of a product must be considered when calculating actual expenses. In the short term, installing bargain replacement windows may be easier on a property owner's wallet; but with only a 10- to 15-year life expectancy, the new windows will likely need to be replaced in the not-so-distant future. In fact, a property owner may have to replace new windows several times before well-maintained historic wood windows will complete their life cycle. In this sense, short term gain does not always mean long term savings.

One study in the Northeast United States revealed that the average cost for ten, mid-range priced vinyl replacement windows was \$9,705, with the average annual energy savings a mere \$405 a year and up to 24 years to recoup the investment<sup>4</sup> (not to mention that most houses have more than ten windows). So, in essence, a one-time investment for a thorough restoration of the existing wood windows can make the most economic sense because the cost of basic maintenance to keep them in good condition will be far less than the cost of repeated replacement as subsequent models fail. Another study showed a return on investment of up to 200 years for replacement windows!<sup>5</sup>

Restoring and maintaining historic wood windows is a sustainable economic practice, and local commissions should emphasize this point when presented with the economic argument for window replacement.

## Let the Numbers Convince You: Do the Math



Source: Keith Habermann PE, R.A.  
 Collingswood Historic District Commission

*A 2007 study found that window replacement was generally not cost-effective for homeowners. Image source: <http://blog.timesunion.com/holland/this-message-brought-to-you-by-the-letter-%E2%80%9Cw%E2%80%9D/131/>*

### How commissions and staff can prepare in advance for window replacement proposals based on the COST ARGUMENT:

1. Do research on window replacement payback period studies.
2. Talk with local carpenters and/or window restoration specialists to get a sense of the costs involved for both simple window repairs and a complete restoration.
3. Gather contact information from knowledgeable local carpenters and/or window restoration specialists to provide to property owners.
4. Gather information about the life cycle costs of cheaper replacement models versus that of more expensive models whose life cycles are comparable to that of a restored and maintained original window.

### Information to require of the applicant before a public hearing or meeting for window replacement proposals based on the COST ARGUMENT:

1. What is the condition of the existing windows?
2. Did the property owner get a cost estimate (at least two) for repairing or restoring the existing windows?
3. What type of warranty is provided for the proposed replacement windows? What parts of the window are covered under the warranty?
4. Can the proposed replacement windows be easily repaired when their components start to break down?
5. Could weather-proofing improve the overall performance of the window and has that option been explored as a cheaper solution to replacement?
6. What proof has the manufacturer provided to show that their product will outlast the existing windows?

# Some Notes on Storm Windows

Some may believe that modern storm windows are an inappropriate addition to a historic building, when, in fact, this is not always the case. There are several important points to consider when determining the appropriateness of storm windows.



*A storm window and door advertisement from 1918 – note the emphasis on energy savings.*  
NAPC file photo



*A quality aluminum storm window can be an appropriate addition to a historic window.*  
Photo courtesy of Paul Trudeau



*Storm windows that are installed flush within a window casing can have a minimal impact, as shown with this wood model.* Image source: <http://smithrestorationsash.com/woodstormwindows.html>

**Precedent.** The concept of protecting your window sash from the elements has existed for several centuries in America, first in the form of shutters and then storm windows. Storm windows themselves have been around for over 100 years, initially constructed of wood and then steel in the 1940s and aluminum by the 1960s. So while some storm windows may look out of character, it's important to remember that there is historic precedent for their use.

**Appearance.** While it's true that old, dilapidated aluminum storm windows are considered an eyesore by most people, there are high-quality models on the market today. These newer versions look and perform better than older models. Wood storm windows are even a better insulator than aluminum models. Some current models are installed flush with the exterior window frame for minimal visual impact, while others provide a variety of colors to match various color palettes. Additionally, with proper preparation, aluminum storm windows can be painted to better blend in with the preferred color scheme.

**Reversibility.** One of the most important considerations regarding storm windows is that the installation process is reversible. Replacing the window sash is not. This reversibility is why the addition of storm windows is often exempt from review under many local preservation ordinances.

**Energy Efficiency.** Aside from protecting the window sash, a properly installed, sealed storm window will help cut down on air infiltration and lower your heating and cooling bills!

**Tax Credits.** Tax credits for storm windows were offered as part of the American Recovery and Reinvestment Tax Act of 2009, which provided homeowners with an energy-saving alternative to unnecessary window replacement. How long these tax credits will be available is unknown at the time of this publication; visit energystar.gov for more information.

## Energy Efficiency Argument

### THE MYTH: "Replacement windows are more energy efficient than old wood windows."

Another frequently heard claim from the window replacement industry is that an old, drafty wood window is no match for a newly installed wood or vinyl replacement window with insulating glass. A local preservation commission's jurisdiction does not usually extend to questions of energy efficiency when reviewing exterior alterations to a designated property, but when a property owner uses this argument as a basis for replacing historic wood windows, a commission should know the facts to successfully refute this claim and to suggest alternate ways of achieving energy efficiency without removing historic windows.

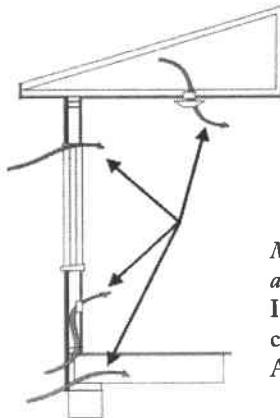
One important consideration is that replacement window manufacturers will often compare their product to a historic wood window that has *not* been maintained or restored. A window that fits this description will likely be drafty and inefficient, especially in colder climates. In most cases, however, a well-maintained or fully restored, tight-fitting, properly functioning, weatherstripped wood window coupled with a high-quality storm window will have virtually the same insulating properties as a double-glazed replacement window.<sup>6</sup> Consequently, one of the most important things a commission can do is encourage and advise property owners about the need and benefits of regular maintenance.

As replacement window manufacturers will attest, the best insulation on a small scale is dead air space. The extra dead air space created with a sealed storm window (typically about two inches, opposed to approximately 1/16 to 1/32 of an inch in insulating glass) means more insulation and increased energy efficiency. For warmer climates, the issue may be limiting heat transfer through the glass to keep the house cooler; this can be remedied by cellular shades, thick curtains, or low-e storm windows.<sup>7</sup>

Another popular term you hear in the energy efficiency debate is the U-value of a window. U-values gauge how well a material allows heat to pass through it. U-value ratings generally fall between 0.20 and 1.20; the lower the U-value, the greater a product's resistance to heat flow and the better its insulating value. Replacement window manufacturers often misquote U-values as the value through the center of the glass (the location of the best U-value) and not for the entire unit.<sup>8</sup> In truth, a U-value is a rating of energy efficiency for all the combined components of a window or door. It is also important to remember that air infiltration is the principal cause of energy loss in a window; it can account for as much as 50% of the total heat loss of a building.<sup>9</sup>

In addition to weatherstripping and storm windows, caulking around the window trim will help reduce drafts. The installation of a double-glazed replacement window alone will not solve problems of air leakage in old wood-framed

buildings. Moreover, most of the heat loss in a house occurs in areas other than windows; insulation in attics and between floors and weather stripping around doors will make a big difference.<sup>10</sup>



*Major points of air infiltration around a window.*

Image source: <http://www.clemdesign.com/InfoPages/AirInfiltration.htm>

### How commissions and staff can prepare in advance for window replacement proposals based on the ENERGY EFFICIENCY ARGUMENT

1. Do your homework! There are several studies that show how a restored wood window with a properly installed, high-quality storm window will have comparable energy savings to a double-glazed replacement window. [See bibliography or contact NAPC for more information]
2. Understand the basic terminology the window replacement manufacturers utilize in their promotional literature, including U-values, R-values, solar heat gain coefficient, and low-e glass.
3. If possible, observe replacement window performance on the interior of a building, preferably on a cold day to feel for air infiltration. Compare its performance to a restored window with a storm window.
4. Stay up-to-date on the latest window replacement models and the benefits touted by their manufacturers regarding energy savings. Attend trade shows or other exhibit events where replacement windows are featured and promoted.
5. Compile a list of resources for property owners regarding energy efficiency in historic buildings.

## Information to require of the applicant before a public hearing or meeting for window replacement proposals based on the ENERGY EFFICIENCY ARGUMENT:

1. What is the general condition of the existing windows and storm windows (if applicable)?
2. Has there been any weatherization of the existing windows?
3. Has there been a quote for a full restoration of the existing windows?
4. Has the applicant considered installing storm windows as an alternative to window replacement?
5. Have other areas of the house/building been insulated or weatherized?

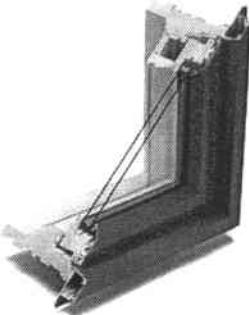
### Sustainability Argument

#### THE MYTH: "Replacement windows are the 'greener' option."

Another topic not directly related to a local preservation commission's jurisdiction is the issue of environmental responsibility; however, it is an important issue to address because towns, cities, and counties may have energy codes that require property owners to address old wood windows. Various window replacement manufacturers have regularly promoted their product as a "green" choice because of the purported energy savings one gets with a new window. The greenness of a product is not limited to energy savings alone. It also includes other sustainability criteria such as embodied energy, landfill waste, the carbon footprint of replacement window manufacturing and transportation, etc. With these considerations in mind, a closer analysis of window restoration will prove to be a greener option, and that window replacement is an inherently unsustainable practice.

Regarding sustainability,<sup>11</sup> it is important to consider the durability of old wood windows. These windows are remarkably resilient even when not maintained, because most were milled with old-growth lumber and carefully constructed with mortise and tenon joinery to fit tight into the window openings of a house. Old wood windows were built to last, and are the very definition of a sustainable product. Conversely, mass-produced wood replacement windows are typically constructed of new-growth lumber, often with glued-together finger joints, and are highly susceptible to

rot. In many cases, wood replacement sash have protective exterior aluminum or vinyl cladding. If moisture finds its way in, through split seams or other infiltration sources, the new-growth lumber beneath the cladding will deteriorate. The notion of a vinyl window as a sustainable product is also questionable – vinyl is prone to denting, warping, and fading in high temperatures. Accordingly, most replacement windows come with a limited warranty. No warranties



*Exterior cladding can trap in undetected moisture on replacement windows, which can lead to rot. Image source: <http://chicagowindowexpert.com/windowtags/wood-window-leaks/>*

are available or required for historic wood windows; basic maintenance will suffice to keep them functional.

Sustainability also relates to the need and frequency of repairs and maintenance for a building component and all of its parts and materials. A determining factor of a product's life cycle is its maintenance requirements over time. Old wood windows usually need only simple repair and routine maintenance, including replacing broken panes of glass, replacing glazing compound, and a new coat of paint, which can be done by most property owners with tools and materials found at a local hardware store. The same simply is not true for replacement windows; when repairs are needed, replacement is usually the only option, especially for window products no longer in production.

A major selling point touted for replacement windows is insulating glass: two panes of glass with an inert gas sealed in the space between them (also called "double-glazed" windows). Windows with insulating glass come with only a 15-to 20-year warranty; when the sealant fails, the window will gradually lose its insulating quality, the glass will fog, and the entire window may have to be replaced.<sup>12</sup>



*When the seal on insulating glass fails, the window loses its insulating properties and the glass fogs up. Photo courtesy of Paul Trudeau*

Vinyl and wood replacement windows are also made with stock parts that quickly become outmoded, making them difficult, if not impossible, to repair if a spring or other suspension component breaks. For these and other reasons, it's no surprise that there's no such thing as a vinyl window repair workshop!

A product's larger environmental impacts are another important consideration when determining environmental sustainability and "greenness." Restoring old wood windows, much like the restoration of any component of a historic building, is the ultimate practice of reuse and recycling. The removal of wood windows for replacement

### **How commissions and staff can prepare in advance for window replacement proposals based on the SUSTAINABILITY ARGUMENT**

1. Research common "green" terminology and issues in building construction and historic preservation – including sustainability, environmental impacts, and energy efficiency – through blogs, trade shows, historic preservation Listserves, etc.
2. Stay up-to-date on replacement window technologies and materials.
3. Attend or host a window restoration workshop to learn about the durability of old wood windows and how they can be refurbished, with an emphasis on sustainability and energy efficiency.

models adds unnecessary waste to landfills. Moreover, the manufacture of vinyl and aluminum creates a number of toxic by-products.

The claim that a replacement window is more "green" in terms of energy efficiency, sustainability, and environmental impact is highly debatable. When these three elements are carefully analyzed, it becomes evident that the restoration of existing wood windows can be a more environmentally responsible choice. Understanding these facts can be helpful to commissions in framing counterarguments when property owners or window sales representatives pitch claims of "green" as a basis for window replacement.

### **Information to require of the applicant before a public hearing or meeting for window replacement proposals based on the SUSTAINABILITY ARGUMENT**

1. Has the applicant considered the sustainability and environmental impacts of the proposed replacement windows?
2. What are the warranty details of the replacement windows?
3. Can the replacement windows be easily repaired?
4. What proof has the manufacturer provided to show that the replacement windows will last longer than the existing wood windows, especially if they are properly repaired or restored?

## **Many "green" experts agree that window replacement isn't always the best option when it comes to energy savings.**

### **From the GreenBuildingAdvisor.com**

(<http://www.greenbuildingadvisor.com/green-basics/windows-glass-ratings-and-installation-0>)

"When planning energy improvements to an existing house, replacing windows should show up toward the bottom of the list. It almost always makes sense to improve an existing home's air tightness and add insulation to the attic and basement. Replacing an old furnace or refrigerator can also be cost-effective. But if the windows work well, it's usually best to put replacing windows lower on the list. In a cold climate, the best way to improve single-glazed windows is to install exterior storm windows with low-e glass."

### **From the GreenBridge Blog**

(<http://greenbridge.wordpress.com/2009/01/17/help-for-historic-windows/>)

"The repair of an historic window, with the addition of a storm window, proper sealant and weather-stripping, can result in a window with energy efficiency close to that of a new window."

### **From Planetgreen.discovery.com**

(<http://planetgreen.discovery.com/home-garden/green-windows.html>)

"Windows are a critical part of the look of an historic home, but they are often sacrificed on the altar of supposed energy efficiency and convenience... in the end, the greenest window is the one that's already in the wall."

# OTHER MYTHS

## Commissions Should Expect to Hear:

### The Lead Paint Argument

**THE MYTH: "Old Wood Windows with Lead Paint are Hazardous and Should Be Discarded."**

Lead paint in older buildings is a serious issue that should be dealt with accordingly. The detection of lead paint on older wood windows, however, should not lead to a knee-jerk reaction for wholesale replacement. With proper planning, precautions, and safety measures, historic wood windows with lead paint can be remedied. It is possible to remove lead paint from historic sash without posing serious health hazards. Local municipalities often have guidelines for safe and effective lead abatement, including windows, but it needs to be done by a certified professional.<sup>13</sup> An experienced

contractor or window restoration specialist should be able to identify unstable lead paint (the most hazardous condition) and treat it appropriately according to local and Federal standards. Stable lead paint can be encapsulated with lead-free paint to comply with federal and state laws. For more information about addressing lead paint hazards in historic buildings, refer to *Preservation Brief 37: Appropriate Methods of Reducing Lead-Paint Hazards in Historic Housing* from the National Park Service: <http://www.nps.gov/history/hps/TPS/briefs/brief37.htm>

### The Maintenance Argument

**THE MYTH: "Replacement Windows are Maintenance-Free"**

While this claim may sound appealing to property owners, the fact remains that no material or building component is maintenance free. Maintenance is an important part of property ownership and contributes to the overall value of a building. Buying into the notion that a replacement window will never need maintenance from the time it is installed does the property owner a disservice. Any product that is in constant operation and is susceptible to seasonal fluctuations and weathering will need regular inspection and

periodic attention and care. As mentioned earlier, vinyl is prone to denting, warping and fading; vinyl and aluminum claddings can also dent and fade. These deficiencies cannot be repaired or maintained, nor can most failed insulating glass or plastic parts in replacement windows. So, although the pitch of a "maintenance-free" product is tempting, property owners need to be informed of the facts. Simple maintenance to a single-glazed, historic wood window is all that is needed to keep it in operation for years to come.

### The Operability Argument

**THE MYTH: "Old Wood Windows Don't Operate Properly and Need to be Replaced"**

Deferred maintenance is not uncommon with old wood windows, and can lead to poor performance. Problems include broken sash weight ropes, sashes painted shut, worn jambs, and off-center parting beads and stops. Much like the energy performance of an unmaintained window, the best treatment is to systematically repair the deficiencies,

focusing efforts on solving the specific problems related to its operation. There is no need to discard an entire window unit because one component is not working optimally. If the window is not functioning properly, a property owner should be encouraged to get quotes for a repair or restoration job. The results can be surprising!

# WHEN IS REPLACEMENT ACCEPTABLE?

In some cases, an old wood sash may be beyond repair and need to be replaced. It is also common to find original windows already replaced with inappropriate aluminum or vinyl models from earlier decades. The challenge for commissions is determining the appropriateness of a proposed replacement model, and this type review comes down to details.

If the original windows are still in place but are beyond repair, the commission has an advantage in determining the appropriateness of a replacement model, as the existing windows can serve as a guide. Depending on the significance of the building, a single-glazed reproduction wood sash with the same number of lites may be the preferred option. Coupled with a high-quality storm window, this solution satisfies much of the rationale for restoration as discussed earlier. As a service to property owners, the commission and staff can compile a list of window manufacturers that produce single-glazed, "true divided-light" windows with individual panes of glass set into authentic muntins.

If a double-glazed replacement window is the only option, Commissions will generally consider how the proposal will impact the historic character of a building; namely how the replacements match the originals in pattern, details,



*With the variety of window replacement models available on the market today, a commission's review of a replacement proposal all comes down to the details.* Image source: <http://schmidthomes.wordpress.com/2008/02/20/a-visit-with-marvin-windows/>

materials and finishes as closely as practicable. Dimensions and profiles of casings, sills, jambs, meeting rails and muntins should all be subject to review.

Some manufacturers have been able to produce double-glazed wood windows with muntin profiles that are similar to those found on single-glazed sash. Although there have been advances in recreating the details of historic windows, the sustainability and energy efficiency issues discussed in this short guide merit consideration when considering the appropriateness of proposed replacements. It should be noted that there are window replacement models of higher quality than others. The appearance, durability and energy efficiency of these high quality replacements often make them more expensive. Although costly, they may provide an acceptable replacement option. In some municipalities, replacing an existing non-original window with an in-kind replacement that does not alter the structural opening of the window may not be subject to review and permit requirements. In these instances, public education and outreach to property owners may be the only means for ensuring that careful considerations are given to repair or replacement decisions. In some locales, window replacements may be approved at the staff level.

## CONCLUSION

Local preservation commissions are likely to be confronted with more and more window replacement proposals as public opinion continues to be influenced by window replacement manufacturers and the economies of building repair and maintenance. With issues of "green," energy efficiency, sustainability, and related tax credits gaining popularity, the case for window preservation becomes a greater challenge. Commissions must understand the issues in advance of addressing them and be prepared to make defensible decisions. Like any proposal at a public hearing or meeting, window

replacement must be dealt with on a case-by-case basis, but there is an abundance of information available for commissions to arm themselves with when perfectly good historic wood windows are threatened. If proper steps are taken, through education and consistent review procedures, window restoration could become a more common and accepted trend in local historic districts. Please contact NAPC with any questions regarding window replacement not covered in this issue of The Alliance Review; we want to hear from you!

*Jeremy C. Wells, Ph.D., is an assistant professor at Roger Williams University where he specializes in historic preservation planning. He was formerly the historic preservation officer for the City and County of Denver.*

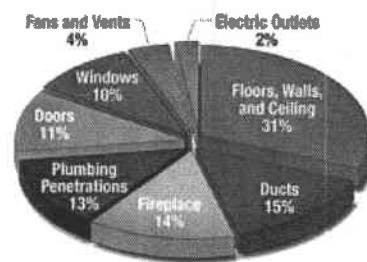
# Window Replacement, Energy Efficiency, and Economic Payback: Making Informed Decisions

**By Jeremy C. Wells**

Ideally, decisions on whether or not to repair or replace existing windows should be based on sound energy efficiency evidence. This assessment needs to consider the relative role that windows play in retaining a building's thermal energy versus other components and systems. The loss of heat from a building is largely through air leaks, yet windows are responsible for only 10% of these leaks compared to other sources in a typical building.<sup>1</sup>

In addition, single-glazed windows in an older building, independent of air leaks, only transmit 10% of a building's heat to the outside.<sup>2</sup> Moreover, the most efficient (and very expensive) triple-glazed windows struggle to achieve the energy efficiency comparable to a single inch of standard fiberglass insulation. (Compare this to the twelve, or more, inches of insulation in a typical attic. You would have to stack twelve triple-glazed windows on top of each other to achieve the equivalent of an R-30 insulation rating.) Or another way to look at the energy saving potential of the very best triple-glazed windows on the market is that they perform about as well as an uninsulated 3-½ inch wood cavity wall.<sup>3</sup>

So what does all this mean? The answer is that approaching windows as a first line of attack in achieving improved energy efficiency in an older building makes little sense from a financial perspective. Studies indicate that it would take from thirty to one hundred years to achieve a payback through improved energy efficiency by replacing single-glazed windows with good quality double-glazed windows.<sup>4</sup>



*A familiar graphic to preservationists is the U.S. Department of Energy's air leak chart, which shows that windows only account for 10% of heat loss in a house. Image source: [http://www.energysavers.gov/tips/air\\_leaks.cfm](http://www.energysavers.gov/tips/air_leaks.cfm)*

Realistically, as the sources below indicate, it makes a lot more sense to assure that an attic is well insulated and the number of air leaks in a building are reduced through caulking, insulation, and window and door repairs than to begin addressing energy efficiency through window replacement. Even so, simple treatments such as storm windows, heavy curtains, and interior shutters can bring a traditional single-glazed wood, double-hung window into the same performance specs as a good quality double-glazed, new window.

If a replacement window fails, however, the fix is typically replacement, not repair, due to the way these windows are designed and manufactured in a way that makes repair difficult or impossible. On the other hand, the only non-repairable components in a traditional wood window system are the sash cord, glazing putty, and paint. The replacement of original, repairable windows is therefore tantamount to swapping a sustainable window system with one that is now disposable – a situation that may be good for window

<sup>1</sup>Source: U.S. Department of Energy Office of Energy Efficiency and Renewable Energy

<sup>2</sup>Source: Energy Saving Trust (UK)

<sup>3</sup>Refer to table of R-values at <http://www.coloradoenergy.org/procorner/stuff/r-values.htm>

<sup>4</sup>See Andrew M. Shapiro and Brad James, "Creating Windows of Energy-Saving Opportunity," *Home Energy* 14, no. 5 (1997).

manufacturers, but bad for our landfills and limited natural resources. More importantly, the cost savings of window replacement is entirely dependent on the longevity of the new windows and their ability to provide an economic payback based on increased energy efficiency.

For instance, if the new windows fail in less than thirty years, any savings would be wiped out by the need to purchase new windows before there is a total recoup of costs. The lack of repairability, especially with inexpensive vinyl windows (think of how difficult it is to repair most things that are largely made of plastic), coupled with the improbability of spare parts still being available for a modern window thirty or more years into the future (think of how difficult parts for a thirty-year old car are to get) compromise the potential for an economic payback based on increased energy efficiency. While traditional window systems chiefly fail due to rot and glazing putty, paint, and sash cord failure, the more complicated systems of modern windows are subject to an increased number of problems including the seal between glazing failing, the friction track system malfunctioning, plastic parts breaking, and thermal expansion issues that render windows inoperable (especially with vinyl windows). Vinyl components are particularly vulnerable to ultraviolet radiation in high altitude cities such as Denver or Santa Fe. In these environments, vinyl windows can begin to powder and crack on the southern exposure of buildings in as little as four or five years.

So what is the actual longevity of replacement windows? Unfortunately, there does not appear to be any open, non-biased scientific studies on the subject, although window manufacturers have performed their own (proprietary) tests, but even in this latter case, the data may not be readily available to the public. Due to the large variety of window types and quality on the market, there would undoubtedly be a fairly wide variation in longevity. There are some guides, however, that can be used as an approximate rule of thumb. The National Trust for Historic Preservation indicates that the expected lifetime of a replacement window is twenty years,<sup>5</sup> and is a figure often cited in most preservation-oriented window replacement literature. Donovan Rypkema (an acknowledged international expert in preservation economics), in his closing speech at the 2007 Main Streets Conference, indicated that "thirty percent of the windows being replaced each year are less than 10 years old, and many only two years old."<sup>6</sup> Perhaps most telling is that window manufacturers typically have a maximum warranty of twenty years (or exceptionally, thirty years). Based on this information, the cost of repairing existing, traditional windows over the next couple of centuries is likely to be far less than replacing those same windows repeatedly over the same period of time.

Window replacements in historic buildings, therefore, tend to be based more on feelings than facts. But there is some truth to this assessment: single-glazed windows do "feel"

colder than multiple-glazed windows. This is largely due to two factors: convection currents and air leakage. The interior surface of a single-glazed window can be many tens of degrees colder than the ambient inside air. This sets up a convection current whereby the air inside the room cools and sinks as it hits the glass, creating a slight breeze.<sup>7</sup> If there are significant air leaks around the window and its components, the draft can dramatically increase the perception of cold near the window. This gives credence to an often-stated claim made by owners of older homes in reference to single-glazed windows: it feels cold to be standing next to them. A simple remediation is to correct air infiltration issues, close a shutter or curtain, or install interior or exterior storm windows. (An even simpler solution to address this largely psychological phenomenon is to arrange interior furniture such that the users of the space are not constantly seated directly next to a window.)

#### For further information on older windows and energy efficiency, refer to the following list of resources:

Baker, Paul. *Improving the Thermal Performance of Traditional Windows*. Glasgow, Scotland: Glasgow Caledonian University, 2008. <http://www.historic-scotland.gov.uk/thermal-windows.pdf>.

———. *U-Values and Traditional Buildings: In Situ Measurements and Their Comparisons to Calculated Values*. Glasgow, Scotland: Glasgow Caledonian University, 2011. <http://www.historic-scotland.gov.uk/hstp102011-u-values-and-traditional-buildings.pdf>.

Baker, Paul, Roger Curtis, Craig Kennedy, and Chris Wood. "Thermal Performance of Traditional Windows and Low-Cost Energy-Saving Retrofits." *APT Bulletin* 41, no. 1 (2010): 29-34.

Cavallo, James. "Capturing Energy-Efficiency Opportunities in Historic Houses." *APT Bulletin* 36, no. 4 (2005): 19-23.

James, Brad, Andrew Shapiro, and Steve Flanders. *Testing the Energy Performance of Wood Windows in Cold Climates*. Montpelier, VT: State of Vermont Division for Historic Preservation, 1996. <http://www.ports.parks.ca.gov/pages/1054/files/testing%20windows%20in%20cold%20climates.pdf>.

Kinney, Larry, and Amy Ellsworth. *The Effects of Energy Efficiency Treatments on Historic Windows*. Boulder, CO: Center for ReSource Conservation, 2011. <http://conservationcenter.org/assets/EffectsEnergyonHistoricWindows.pdf>.

Klems, Joseph H. *Measured Performance of Storm Windows*. Berkeley, CA: Lawrence Berkeley National Laboratory, 2002. <http://repositories.cdlib.org/lbl/LBNL-51453>.

Score, Robert, and Bradford S. Carpenter. "An Analysis of the Thermal Performance of Repaired and Replacement Windows." *APT Bulletin* 40, no. 2 (2009): 11-19.

Sedovik, Walter, and Jill H. Gotthelf. "What Replacement Windows Can't Replace: The Real Cost of Removing Historic Windows." *APT Bulletin* 36, no. 4 (2005): 25-29.

Shapiro, Andrew M., and Brad James. "Creating Windows of Energy-Saving Opportunity." *Home Energy* 14, no. 5 (1997). <http://www.homeenergy.org/show/article/nav/windows/page/3/id/1330>.

<sup>5</sup>See <http://www.preservationnation.org/issues/weatherization/windows/windows-faq.html>

<sup>6</sup>See [http://www.placeconomics.com/wp-content/uploads/2011/03/2007\\_closingplenary\\_rypkema.pdf](http://www.placeconomics.com/wp-content/uploads/2011/03/2007_closingplenary_rypkema.pdf)

<sup>7</sup>John Carmody et al, *Residential Windows: a Guide to New Technologies and Energy Performance* (New York: W.W. Norton, 2007), 37.

*Rosemary Johnson is the Planner and Historic Preservation Officer for the City of Astoria. She has staffed the Planning Commission, Historic Landmarks Commission, and Design Review Committee for the City for over 24 years.*

# PRESERVATION TAKES PERSEVERANCE: A WINDOWS CASE STUDY

BY ROSEMARY JOHNSON, PLANNER  
CITY OF ASTORIA, OR



*The Owens Adair Senior Housing facility in Astoria, OR.*

It is Art Deco in style with Mediterranean detailing and has over 250 wood, double-hung, one over one windows. The project manager said that the windows were in poor condition, leaked cold air, were hard to maintain because of the height of the building, and were a safety hazard. One senior had just experienced an injury when she tried to open a window and it fell back and broke her arm. Something had to be done. His solution: replace all the windows with vinyl windows! As Planner and Historic Preservation Officer for the City of Astoria, this proposal is always dreaded ... and, we hate to wreak someone's plans.

There was no hesitation in my "NO!" answer, but clearly, we had to work together to find a solution to the problem. I noted that to repair the windows would not require permits or additional historic public review, but any replacement would require review by the Historic Landmarks Commission and there could be a problem getting approval. I asked him to research some options because vinyl was inappropriate. I also told him that we would need to determine if the windows really needed

In 2010, Owens Adair Senior Housing facility in Astoria approached me about replacing their windows. The four-story building, including the parking lot, encompasses an entire city block and is a highly visible historic building in the Downtown National Register Historic District. It was constructed in 1931 as Saint Mary's Hospital and holds a special place in the hearts of many Astorians who were born there.



*Window detail before rehabilitation.*

to be replaced or just repaired. Of course, his reply was that replacement was the only answer due to cost. The housing agency had a limited budget—and had put some money aside to deal with the windows—but could not afford to repair the windows to historic-preservation standards. I met him on site and, as I guessed, the windows needed repair (80 years of poor maintenance had left its mark on them), but they did not need to be replaced. Windows had been painted over time with

lead-based paint. They were loose and leaked air. Many of the sash cords were broken, and the counter-weights laid uselessly in the bottom of the weight pockets. In their current condition, many were a safety hazard to the elderly tenants.

I asked the project manager if he would be willing to meet with someone from the State Historic Preservation Office (SHPO) to see if they had any ideas on what to do with the windows. He agreed. SHPO Restoration Specialist Joy Sears came to Astoria and met us on site. After a wonderful tour of the building, which included the 1930's monster boiler and the interior of some of the apartments, Ms. Sears came to the same conclusion as I had: the windows needed work but were repairable. She offered suggestions about different types of pulley systems that could replace the counter-weights and contractors equipped to do restoration work. The project manager agreed to do some more research into his options with this new information.

After several months, he met with me and a local wood-window maker who said he could replace all of the windows with new wood windows with the same dimensions and appearance, but that repair and restoration of the windows would be more expensive. If the windows had to be replaced, an in-kind replacement with new wood windows would have been the best option, but we were holding to the idea that we wanted to preserve the original material. A couple more months passed, and the project manager said he was soliciting bids to repair and/or replace the windows. I talked with many of the potential contractors about the historic concerns of the City and what options might be available for the client. Some of the contractors talked about constructing temporary enclosures in the apartments around the windows to create a confined working space. This was not appealing to the elderly tenants, who were very protective of their spaces.

Then one day I got a call from the project manager. He had tallied the bids and selected a firm. I held my breath fearing the worse and the rocky path that could lie ahead until he told me, "We've selected Chosen Wood Window Maintenance from Canby OR who says they can repair the existing windows." I was so excited but also a little hesitant to hear what this would cost them because I knew they were on a limited budget. He said the bids ranged from \$259,000 to \$450,000 to \$680,000 . . . drum roll . . . and their bid was the \$259,000! He couldn't thank me enough for the savings they would have in this project because they were originally looking at the \$680,000 replacement.

Well, it's now the end of 2011, and the job is complete. The contractors removed each window, a few at a time, took them back to their shop, and stripped them to remove the lead-based paint and asbestos glazing compound. They then routed the sash to accommodate

double-paned insulated glass. They replaced the lead-weight system with a spring balance customized to each window's weight and size, but kept the weight pockets and lead weights intact. They painted, reinstalled, caulked, and sealed every window while the tenants remained in their apartments. They were able to keep the old storm windows in place to keep out some of the weather while the windows were being repaired and then removed the storm windows as they reinstalled the restored windows. New screens were installed on the lower half of each window allowing the seniors to open the windows and keep out the unwanted insects. The windows were installed so that one pane could be removed allowing both windows to be cleaned inside and out from inside the apartment, thus eliminating the need for a lift truck each year.



*Window detail after rehabilitation.*

*All photos courtesy of the author*

The seniors are thrilled with the results and can now easily, and safely, open and close their own windows. They were so pleased with the contractors that they took up a collection and gave the contractor a gift upon completion of the project. The project manager reported that Chosen Wood Windows caused very little disruption to the everyday operations and living conditions of the tenants, followed Department of Environmental Quality (DEQ), and Occupational Safety and Health Administration (OSHA) requirements, and completed the job better than anyone anticipated. While time will only tell how much the new windows will help with energy conservation, the initial reports on the first month's heating bill is a reduction of \$1,000 alone in one month. This project has been a win for everyone involved and the City has another champion for our historic preservation efforts. The project manager has thanked the City for our efforts and our perseverance in wanting the job to be done right while understanding their concerns. And, the City thanks the Oregon SHPO for their continued support and assistance in projects such as this. The technical knowledge and moral support we receive from SHPO make our jobs easier and more credible in the eyes of property owners such as this one. It is a great example of how team effort and researching ALL options can lead to cost reductions and better end products. Historic preservation can be the right solution!