

THE SECRETARY
OF THE INTERIOR'S
STANDARDS FOR
THE TREATMENT
OF HISTORIC
PROPERTIES

WITH
GUIDELINES FOR
PRESERVING,
REHABILITATING,
RESTORING &
RECONSTRUCTING
HISTORIC
BUILDINGS



U.S. Department of the Interior
National Park Service
Technical Preservation Services

Windows

Technology and prevailing architectural styles shaped the history of windows in America. The earliest windows were essentially medieval in their form. Small panes of glass, usually diamond-shaped and held together with lead, were set in a hinged casement sash of wood or iron. By the beginning of the 18th century, the glass had increased in size and had become rectangular, with putty holding it in place. Wood muntins replaced lead came between the panes, and two sashes were placed in a frame where the lower one could slide vertically. Such simple windows remained common in utilitarian buildings well into the 20th century. With the introduction of iron pulleys, the sash could be hung from cords connected to counterweights, which resulted in single-hung windows, or double hung when both sashes were counterbalanced.

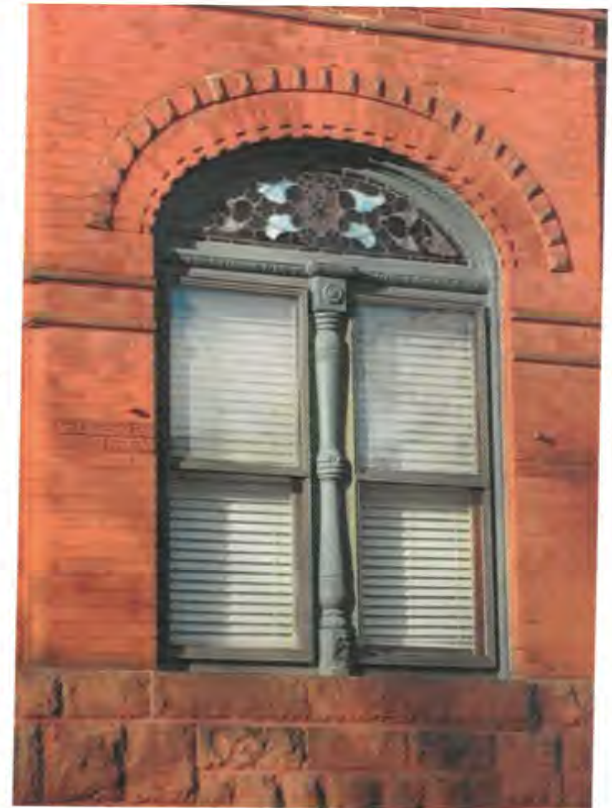
Sash increased in depth as it evolved, providing additional strength that allowed narrower muntins. As the production of glass (blown initially as a disk and later as a cylinder) improved, larger pieces of glass became more affordable, resulting in fewer panes of glass in a window. A sash that would have had twelve panes of glass in the 18th century often had only two by the mid 19th century. After about 1850, with the advent of mass-produced millwork, standard profiles and sizes of windows were established with a wide variety of designs and glazing configurations that could be purchased from catalogues. The Chicago window, which featured a large fixed pane of glass in the center with a narrow, double-hung, operable sash window on either side of it, was introduced in the last decades of the 19th century as a feature of the Chicago School-style of architecture. The picture window, popular in ranch-style houses in the mid 20th century, evolved from this.

Steel was employed beginning at the end of the 19th century to build fire-resistant windows in tight urban environments. These hollow-core windows were frequently galvanized. Windows with solid, rolled steel sections were first produced in the first decade of the 20th century in many forms, ranging from casements (especially popular in domestic construction) to large, multi-pane units

that provided whole walls of natural light in industrial and warehouse buildings. Operable vents in these large windows pivoted on simple pins. Their relatively small panes and the fact that they were puttied in from the interior made the inevitable breakage easy and inexpensive to repair. Rolled steel was also used for double-hung windows, which were common in high-rise buildings in the 1920s and beyond. Aluminum windows were developed in the 1930s and, by the 1970s, rivaled wood in popularity, particularly in commercial and institutional buildings. They were produced in a variety of styles and functionality, including casement, hopper, awning, and double-hung sash.

Metal-clad (initially copper) wood windows appeared early in the 20th century but were not common until the later part of the century, when enameled aluminum cladding replaced copper. Although used primarily as replacements in older buildings, vinyl windows were developed in the latter part of the 20th century and marketed as inexpensive and thermally efficient. Modern windows are also made of fiberglass and polymer-based composites.

Storm windows were used historically and are still used to help regulate interior temperatures. Limited commercial use of thermal-pane or insulated glass in windows began in the 1930s, but it was not readily available until about 1950. Tempered glass also came into use about this time. Since then, work has continued to improve its efficiency and to reduce the effect of ultra-violet rays with tinted and low-e (low emissivity) glass. Impact-resistant glass is not new, but its use in windows continues to expand to meet modern hurricane code requirements as well as protection and security requirements.



WINDOWS

RECOMMENDED	NOT RECOMMENDED
<p>Identifying, retaining, and preserving windows and their functional and decorative features that are important to the overall historic character of the building. The window material and how the window operates (e.g., double hung, casement, awning, or hopper) are significant, as are its components (including sash, muntins, ogee lugs, glazing, pane configuration, sills, mullions, casings, or brick molds) and related features, such as shutters.</p>	<p>Altering windows or window features which are important in defining the historic character of the building so that, as a result, the character is diminished.</p> <p>Changing the appearance of windows that contribute to the historic character of the building by replacing 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.</p> <p>Obscuring historic wood window trim with metal or other material.</p>
<p>Stabilizing deteriorated or damaged windows as a preliminary measure, when necessary, prior to undertaking preservation work.</p>	<p>Failing to stabilize deteriorated or damaged windows as a preliminary measure, when necessary, prior to undertaking preservation work.</p>
<p>Protecting and maintaining the wood or metal which comprises the window jamb, sash, and trim through appropriate surface treatments, such as cleaning, paint removal, and reapplication of the same protective coating systems.</p>	<p>Failing to protect and maintain materials on a cyclical basis so that deterioration of the window results.</p>
<p>Protecting windows against vandalism before work begins by covering them and by installing alarm systems that are keyed into local protection agencies.</p>	<p>Leaving windows unprotected and subject to vandalism before work begins, thereby also allowing the interior to be damaged if it can be accessed through unprotected windows.</p>
<p>Installing impact-resistant glazing, when necessary for security, so that it is compatible with the historic windows and does not damage them or negatively impact their character.</p>	<p>Installing impact-resistant glazing, when necessary for security, that is not compatible with the historic windows and damages them or negatively impacts their character.</p>
<p>Making windows weathertight by recaulking gaps in fixed joints and replacing or installing weatherstripping.</p>	<p>Replacing windows rather than maintaining the sash, frame, or glazing.</p>
<p>Protecting windows from chemical cleaners, paint, or abrasion during work on the exterior of the building.</p>	<p>Failing to protect historic windows from chemical cleaners, paint, or abrasion when work is being done on the exterior of the building.</p>
<p>Protecting and retaining historic glass when replacing putty or repairing other components of the window.</p>	<p>Failing to protect the historic glass when making repairs.</p>



[10] Historic exterior storm windows preserve and help to insulate wood windows.



[11] Old and brittle glazing putty should be removed carefully before reputtying to keep window glazing weathertight.

WINDOWS

RECOMMENDED	NOT RECOMMENDED
Sustaining the historic operability of windows by lubricating friction points and replacing broken components of the operating system (such as hinges, latches, sash chains or cords) or replacing deteriorated gaskets or insulating units.	Failing to maintain windows and window components so that windows are inoperable, or sealing operable sash permanently. Failing to repair and reuse window hardware such as sash lifts, latches, and locks
Adding storm windows with a matching or a one-over-one pane configuration that will not obscure the characteristics of the historic windows. Storm windows improve energy efficiency and are especially beneficial when installed over wood windows because they also protect them from accelerated deterioration.	
Protecting adjacent materials when working on windows.	Failing to protect adjacent materials when working on windows.
Evaluating the overall condition of windows to determine whether more than protection and maintenance, such as repairs to windows and window features, will be necessary.	Failing to undertake adequate measures to ensure the protection of windows.
Repairing window frames and sash by patching, splicing, consolidating, or otherwise reinforcing them using recognized preservation methods.	Removing window frames or sash that could be stabilized, repaired, and conserved, or using untested consolidants, improper repair techniques, or untrained personnel, potentially causing further damage to historic buildings.
Using corrosion-resistant roof fasteners (e.g., nails and clips) to repair a roof to help extend its longevity.	
<i>The following work is highlighted to indicate that it represents the greatest degree of intervention generally recommended within the treatment Preservation, and should only be considered after protection, stabilization, and repair concerns have been addressed.</i>	
Limited Replacement in Kind	
Replacing in kind extensively deteriorated or missing components of windows when there are surviving prototypes, such as frames or sash, or when the replacement can be based on documentary or physical evidence. The new work should match the old in material, design, scale, color, and finish.	Replacing an entire window when limited replacement of deteriorated or missing components is appropriate. Using replacement material that does not match the historic window.

WINDOWS

RECOMMENDED	NOT RECOMMENDED
<p>Identifying, retaining, and preserving windows and their functional and decorative features that are important to the overall character of the building. The window material and how the window operates (e.g., double hung, casement, awning, or hopper) are significant, as are its components (including sash, muntins, ogee lugs, glazing, pane configuration, sills, mullions, casings, or brick molds) and related features, such as shutters.</p>	<p>Removing or substantially changing windows or window features which are important in defining the overall historic character of the building so that, as a result, the character is diminished.</p> <p>Changing the appearance of windows that contribute to the historic character of the building by replacing materials, finishes, or colors which noticeably change the sash, depth of the reveal, and muntin configurations; the reflectivity and color of the glazing; or the appearance of the frame.</p> <p>Obscuring historic wood window trim with metal or other material.</p> <p>Replacing windows solely because of peeling paint, broken glass, stuck sash, or high air infiltration. These conditions, in themselves, do not indicate that windows are beyond repair.</p>
<p>Protecting and maintaining the wood or metal which comprises the window jamb, sash, and trim through appropriate treatments, such as cleaning, paint removal, and reapplication of protective coating systems.</p>	<p>Failing to protect and maintain window materials on a cyclical basis so that deterioration of the window results.</p>
<p>Protecting windows against vandalism before work begins by covering them and by installing alarm systems that are keyed into local protection agencies.</p>	<p>Leaving windows unprotected and subject to vandalism before work begins, thereby also allowing the interior to be damaged if it can be accessed through unprotected windows.</p>
<p>Making windows weathertight by recaulking gaps in fixed joints and replacing or installing weatherstripping.</p>	
<p>Protecting windows from chemical cleaners, paint, or abrasion during work on the exterior of the building.</p>	<p>Failing to protect historic windows from chemical cleaners, paint, or abrasion when work is being done on the exterior of the building.</p>
<p>Protecting and retaining historic glass when replacing putty or repairing other components of the window.</p>	<p>Failing to protect the historic glass when making window repairs.</p>

WINDOWS

RECOMMENDED	NOT RECOMMENDED
Sustaining the historic operability of windows by lubricating friction points and replacing broken components of the operating system (such as hinges, latches, sash chains or cords) and replacing deteriorated gaskets or insulating units.	Failing to maintain windows and window components so that windows are inoperable, or sealing operable sash permanently. Failing to repair and reuse window hardware such as sash lifts, latches, and locks.
Adding storm windows with a matching or a one-over-one pane configuration that will not obscure the characteristics of the historic windows. Storm windows improve energy efficiency and are especially beneficial when installed over wood windows because they also protect them from accelerated deterioration.	
Adding interior storm windows as an alternative to exterior storm windows when appropriate.	



[18] The historic metal storm windows in this 1920s office building were retained and repaired during the rehabilitation project.



[19] Installing a mockup of a proposed replacement window can be helpful to evaluate how well the new windows will match the historic windows that are missing or too deteriorated to repair.



[20 a-d] The original steel windows in this industrial building were successfully repaired as part of the rehabilitation project (left).

WINDOWS

RECOMMENDED	NOT RECOMMENDED
Installing sash locks, window guards, removable storm windows, and other reversible treatments to meet safety, security, or energy conservation requirements.	
Evaluating the overall condition of the windows to determine whether more than protection and maintenance, such as repairs to windows and window features, will be necessary.	Failing to undertake adequate measures to ensure the protection of window features.
Repairing window frames and sash by patching, splicing, consolidating, or otherwise reinforcing them using recognized preservation methods. Repair may include the limited replacement in kind or with a compatible substitute material of those extensively deteriorated, broken, or missing components of features when there are surviving prototypes, such as sash, sills, hardware, or shutters.	Removing window features that could be stabilized, repaired, or conserved using untested consolidants, improper repair techniques, or unskilled personnel, potentially causing further damage to the historic materials. Replacing an entire window when repair of the window and limited replacement of deteriorated or missing components are feasible.
Removing glazing putty that has failed and applying new putty; or, if glass is broken, carefully removing all putty, replacing the glass, and reputtying.	
Installing new glass to replace broken glass which has the same visual characteristics as the historic glass.	
Replacing in kind an entire window that is too deteriorated to repair (if the overall form and detailing are still evident) using the physical evidence as a model to reproduce the feature or when the replacement can be based on historic documentation. If using the same kind of material is not feasible, then a compatible substitute material may be considered.	Removing a character-defining window that is unrepairable or is not needed for the new use and blocking up the opening, or replacing it with a new window that does not match. Using substitute material for the replacement that does not convey the same appearance of the surviving components of the window or that is physically incompatible.

WINDOWS



[21] The windows on the lower floor, which were too deteriorated to repair, were replaced with new steel windows matching the upper-floor historic windows that were retained.

RECOMMENDED	NOT RECOMMENDED
Modifying a historic single-glazed sash to accommodate insulated glass when it will not jeopardize the soundness of the sash or significantly alter its appearance.	Modifying a historic single-glazed sash to accommodate insulated glass when it will jeopardize the soundness of the sash or significantly alter its appearance.
Using low-e glass with the least visible tint in new or replacement windows.	Using low-e glass with a dark tint in new or replacement windows, thereby negatively impacting the historic character of the building.
Using window grids rather than true divided lights on windows on the upper floors of high-rise buildings if they will not be noticeable.	Using window grids rather than true divided lights on windows in low-rise buildings or on lower floors of high-rise buildings where they will be noticeable, resulting in a change to the historic character of the building.
Ensuring that spacer bars in between double panes of glass are the same color as the window sash.	Using spacer bars in between double panes of glass that are not the same color as the window sash.
Replacing all of the components in a glazing system if they have failed because of faulty design or materials that have deteriorated with new material that will improve the window performance without noticeably changing the historic appearance.	Replacing all of the components in a glazing system with new material that will noticeably change the historic appearance.
Replacing incompatible, non-historic windows with new windows that are compatible with the historic character of the building; or reinstating windows in openings that have been filled in.	
<i>The following work is highlighted to indicate that it is specific to Rehabilitation projects and should only be considered after the preservation concerns have been addressed.</i>	
Designing the Replacement for Missing Historic Features	
Designing and installing a new window or its components, such as frames, sash, and glazing, when the historic feature is completely missing. It may be an accurate restoration based on documentary and physical evidence, but only when the historic feature to be replaced coexisted with the features currently on the building. Or, it may be a new design that is compatible with the size, scale, material, and color of the historic building.	<p>Creating an inaccurate appearance because the replacement for the missing window is based upon insufficient physical or historic documentation, is not a compatible design, or because the feature to be replaced did not coexist with the features currently on the building.</p> <p>Installing replacement windows made from other materials that are not the same as the material of the original windows if they would have a noticeably different appearance from the remaining historic windows.</p>



(a)



(c)



(b)

[22] **Not Recommended:** (a-b) The original wood windows in this late-19th-century building, which were highly decorative, could likely have been repaired and retained. (c) Instead, they were replaced with new windows that do not match the detailing of the historic windows and, therefore, do not meet the Standards (above).



[23] (a) This deteriorated historic wood window was repaired and retained (b) in this rehabilitation project.



WINDOWS

RECOMMENDED

NOT RECOMMENDED

Alterations and Additions for a New Use

<p>Adding new window openings on rear or other secondary, less-visible elevations, if required by a new use. The new openings and the windows in them should be compatible with the overall design of the building but, in most cases, not duplicate the historic fenestration.</p>	<p>Changing the number, location, size, or glazing pattern of windows on primary or highly-visible elevations which will alter the historic character of the building.</p> <p>Cutting new openings on character-defining elevations or cutting new openings that damage or destroy significant features.</p> <p>Adding balconies at existing window openings or new window openings on primary or other highly-visible elevations where balconies never existed and, therefore, would be incompatible with the historic character of the building.</p>
<p>Replacing windows that are too deteriorated to repair using the same sash and pane configuration, but with new windows that operate differently, if necessary, to accommodate a new use. Any change must have minimal visual impact. Examples could include replacing hopper or awning windows with casement windows, or adding a realigned and enlarged operable portion of industrial steel windows to meet life-safety codes.</p>	<p>Replacing a window that contributes to the historic character of the building with a new window that is different in design (such as glass divisions or muntin profiles), dimensions, materials (wood, metal, or glass), finish or color, or location that will have a noticeably different appearance from the historic windows, which may negatively impact the character of the building.</p>
<p>Installing impact-resistant glazing, when necessary for security, so that it is compatible with the historic windows and does not damage them or negatively impact their character.</p>	<p>Installing impact-resistant glazing, when necessary for security, that is incompatible with the historic windows and that damages them or negatively impacts their character.</p>
<p>Using compatible window treatments (such as frosted glass, appropriate shades or blinds, or shutters) to retain the historic character of the building when it is necessary to conceal mechanical equipment, for example, that the new use requires be placed in a location behind a window or windows on a primary or highly-visible elevation.</p>	<p>Removing a character-defining window to conceal mechanical equipment or to provide privacy for a new use of the building by blocking up the opening.</p>

WINDOWS

RECOMMENDED

NOT RECOMMENDED

<p>Identifying, retaining, and preserving windows from the restoration period and their functional and decorative features. The window material and how the window operates (e.g., double hung, casement, awning, or hopper) are significant, as are its components (including sash, muntins, ogee lugs, glazing, pane configuration, sills, mullions, hardware, casings or brick molds) and related features, such as shutters.</p>	<p>Altering windows or window features from the restoration period.</p> <p>Failing to document window features from the restoration period, which may result in their loss.</p> <p>Applying paint or other coatings to restoration-period window features, or removing them, if such treatments cannot be documented to the restoration period.</p> <p>Changing the type of paint or coating or the color of restoration-period windows, unless the work can be substantiated by historical documentation.</p> <p>Stripping windows of sound historic material (such as wood or metal) from the restoration period.</p>
<p>Conducting an in-depth survey of the condition of existing windows from the restoration period early in the planning process so that repair, upgrading, and, if necessary, possible replacement options can be fully explored.</p>	<p>Replacing windows from the restoration period solely because of peeling paint, broken glass, stuck sash, or high air infiltration. These conditions, in themselves, do not indicate that windows are beyond repair.</p>
<p>Protecting and maintaining the restoration-period wood or metal which comprises the window jamb, sash, and trim through appropriate surface treatments such as cleaning, paint removal, and reapplication of the same protective coatings.</p>	<p>Failing to protect and maintain window materials from the restoration period on a cyclical basis so that deterioration of the window results.</p>
<p>Protecting windows from the restoration period against vandalism before work begins by covering them and by installing alarm systems that are keyed into local protection agencies.</p>	<p>Leaving windows unprotected before work begins, thereby also allowing the interior to be damaged if it can be accessed through unprotected windows.</p>
<p>Installing impact-resistant glazing, when necessary for security, so that it is compatible with the historic windows from the restoration period and does not damage them or negatively impact their character.</p>	<p>Installing impact-resistant glazing, when necessary, for security that is not compatible with the historic windows from the restoration period and damages them or negatively impacts their character.</p>

WINDOWS

RECOMMENDED

NOT RECOMMENDED

Protecting restoration-period windows when working on other features of the building.	Failing to protect restoration-period windows when working on other features of the building.
Protecting and retaining historic glass from the restoration period when replacing putty or repairing other components of the window.	Failing to protect historic glass from the restoration period when making repairs.
Sustaining the historic operability of windows from the restoration period by lubricating friction points and replacing broken components of the operating system (such as hinges, latches, sash chains or cords) and replacing deteriorated gaskets or insulating units.	Failing to maintain windows and window components from the restoration period so that windows are inoperable, or sealing operable sash permanently. Failing to repair and reuse window hardware from the restoration period, such as sash lifts, latches, and locks.
Evaluating the overall condition of windows from the restoration period to determine whether more than protection and maintenance, such as repairs to windows and window features, will be necessary.	Failing to undertake adequate measures to ensure the protection of window features from the restoration period.
Repairing window frames and sash from the restoration period by patching, splicing, consolidating, or otherwise reinforcing them using recognized preservation methods. Repair may include the limited replacement in kind or with a compatible substitute material of those extensively deteriorated, broken, or missing components of windows when there are surviving prototypes (such as sash, sills, hardware, or shutters) or when the replacement can be based on physical or historic documentation. The new work should match the old in material, design, scale, color, and finish.	Replacing an entire window from the restoration period when repair of materials and limited replacement in kind are appropriate. Removing a window from the restoration period that is unrepairable and not replacing it, or replacing it with a new window that does not match.



[9] Historic window and shutter hardware such as that shown here should be retained and repaired in a restoration project.

WINDOWS

RECOMMENDED	NOT RECOMMENDED
<p>Replacing in kind an entire window from the restoration period that is too deteriorated to repair (if the overall form and detailing are still evident) using the physical evidence as a model to reproduce the feature or when the replacement can be based on historic documentation. If using the same kind of material is not feasible, then a compatible substitute material may be considered. The new work may be unobtrusively dated to guide future research and treatment.</p>	<p>Removing a window from the restoration period that is unrepairable and not replacing it, or replacing it with a new window that does not match.</p> <p>Using substitute material for the replacement that does not convey the same appearance of the surviving components of the window from the restoration period or that is physically incompatible.</p>
<p><i>The following Restoration work is highlighted to indicate that it involves the removal or alteration of existing historic masonry features that would be retained in Preservation and Rehabilitation treatments; and the replacement of missing window features from the restoration period using all new materials.</i></p>	
<p>Removing Existing Features from Other Historic Periods</p>	
<p>Removing windows or window features from other historic period, such as the glazing pattern or inappropriate shutters.</p>	<p>Failing to remove a window or window feature from another period, thereby confusing the depiction of the building's appearance from the restoration period.</p>
<p>Documenting window features dating from other periods prior to their alteration or removal. If possible, selected examples of these features or materials should be stored for future research.</p>	<p>Failing to document window features from other historic periods that are removed from the building so that a valuable portion of the historic record is lost.</p>
<p>Recreating Missing Features from the Restoration Period</p>	
<p>Recreating a missing window or window feature that existed during the restoration period based on documentary and physical evidence; for example, duplicating a hoodmold or shutter.</p>	<p>Constructing a window feature that was part of the original design for the building but was never actually built, or constructing a feature which was thought to have existed during the restoration period but cannot be documented.</p>