4. Remove flaking, chalking, cracking, blistering, and otherwise failing paint to next sound layer using light and gentle hand scraping methods. Be sure to scrape away excess paint that has migrated into the sash track or sash stops, as this will allow for freedom of sash movement while eliminating gaps. Complete paint removal is acceptable but may not be needed unless there are deep cracks or severe blistering and peeling down to bare wood level.

Most wood windows can be repaired. Depending on the condition of the window, it may be necessary to remove the sash and/or the affected parts of the jambs and have a carpenter or woodworking mill repair or reproduce the damaged or missing parts.

Making the Window Weathertight

5. Sash should tightly fit jamb, maintaining minimal to no air gap.
6. Before reinstalling glass, a bead of glazing compound or linseed oil putty should be laid around the rabbet to cushion and seal the glass. The final glazing compound or putty should be applied and beveled to complete the seal.
7. Remove any old caulk between exterior window jambs and exterior wall surface, and re-caulk.
8. Install weatherstripping between rails, sash, and jambs to reduce infiltration.

These photos show a damaged wood casement window prior to repair (top) and after a comprehensive repair was completed (bottom).

Other Issues/Repainting

9. If sashes are to be operable, the ropes, pulleys, and other mechanisms should be replaced or repaired as needed, and the window should operate smoothly and easily once work is completed. Replace damaged or missing stops in kind.
10. If sash cords or chains will not be reinstalled on a double-hung window and the window will be reinstalled in fixed position, window sashes should be installed in original staggered position.
11. Historic hardware should be retained and cleaned. Any new hardware should match existing as closely as possible.
12. All wood components should be dry, clean, free of chalking, and dirt- and mildew-free prior to repainting. All wood components

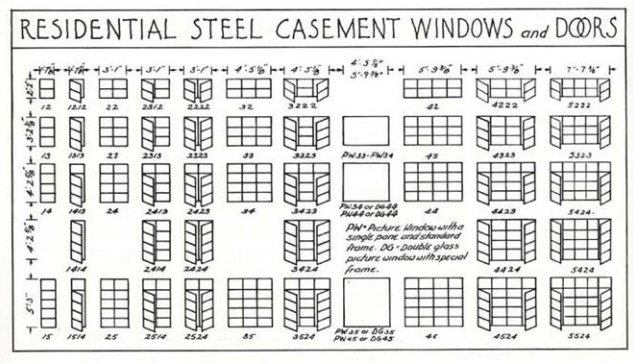
of the windows should be primed and painted with high-quality exterior paint or stain/sealant. If old paint layers remain, new products must be compatible and adhere tightly to earlier paint layers (which are typically oil-based). Apply paint onto glass about 1/8" to seal glazing compound.

B. Metal Windows

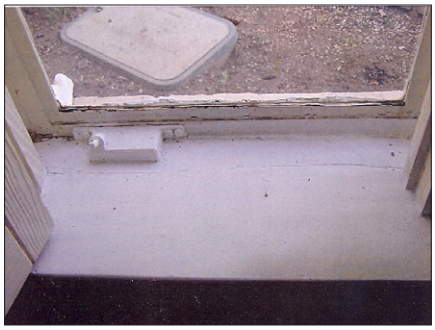
Most metal windows, including those with distortion of frame, excessive paint build-up, failed hinges and fittings, and rust, can be rehabilitated.

Overall Repair Approach

1. Perform a careful evaluation of the condition of each window unit, including any corrosion, number of layers and condition of paint, bent sections, condition of glass and glazing compound, presence and condition of hardware, and the condition of sills and surrounds. If this evaluation reveals that the windows are in basically sound condition, then repair is the appropriate option.
2. Remove rust and excess paint from all moving parts and components, including hinges, using either chemicals (but not hydrochloric acids) or a hand-held mini-grinder or rasping file. Well-bonded paint can remain, although the edges should be feathered by sanding.
3. Gently clean off any remaining rust, debris, and loose paint with a wire brush.
4. Patch depressions with epoxy compounds containing a high steel fiber content, plumber's epoxy, or auto body patching compound. If there is severe corrosion in select areas, you can torch out bad sections and then weld in and grind smooth new pieces with the window unit in place.
5. Prime exposed metal with a rust-inhibiting primer and repaint with up to two light finish coats. Paint should overlap glass at



Residences during the post-World War II era used steel casement windows with many different muntin patterns, as shown in this illustration from the 1956 edition of Architectural Graphic Standards.



The windows shown above have problems that are common to many steel casements—peeling paint, broken glass, stuck sash, missing hardware, air infiltration, and rust.

least 1/8" to form a seal over glazing compound.

6. Replace cracked or broken glass, remove glazing compound (where needed), and apply new compound formulated for metal windows.
7. Clean, oil, and lubricate hinges and all working parts. Repair damaged or lost hinges, fittings, screws, and fasteners.

Making the Window Weathertight

8. Window should fit tightly in frame, and all bent sections should be straightened to eliminate air gaps.
9. Ensure all glazing is in good condition and caulk the masonry surrounds and sills with a high quality elastomeric caulk suitable for metal.
10. Install weatherstripping between rails, sash, and jambs to reduce infiltration.

C. Leaded Light Windows

It is important to remember that only specialists should clean or work on stained glass, and some repairs to leaded lights, such as re-leading, may also benefit from their assistance.

Before de-glazing frames with leaded lights, a useful recommendation is to cover both sides with a "cling-film"-type plastic; this sticks lightly to the glass and will help prevent the lights from falling apart in the process. However, if a light does need remaking, all the original glass should be kept for reuse and labeled, not thrown away.

Inevitably some work will be required following removal—the belief that a leaded light can be reglazed without any repair work and not leak is a myth. Even if the leaded lights do not need re-leading, the perimeter lead will usually need to be replaced. In most instances the lead cement which holds the glass will also need repairing or replacing entirely.

The same windows shown on the opposite page are shown again during (top) and after (bottom) repair. As part of the repair process, the windows were upgraded with 3/16" glass to increase energy efficiency and reduce noise.

The repair of stained, leaded, or figured glass is best performed by an experienced window specialist.

REPLACEMENT OPTIONS

Wherever possible, it is better to repair historic windows than to replace them. However, it is recognized that in some cases repair will not be feasible because the windows are damaged, deteriorated, or missing, or because the cost of repair significantly exceeds that of replacement. Guidelines for considering replacement or a combination approach of repair and replacement are delineated below. The guidelines are split into two sections, addressing both Tier 1 and Tier 2 windows.

Tier 1 Windows

Because they are highly visible, Tier 1 windows are a high priority for preservation. They are defined as follows:

- *For single-story buildings on interior lots*, Tier 1 windows are those on the front of the building and at first-room depth on each side (see illustration at bottom right).

- *For buildings on corner lots*, Tier 1 windows are the same as above but also include all windows that face a side street.

- *For multi-story buildings*, Tier 1 windows are the same as on single-story buildings but also include additional windows on the upper stories, if they are readily visible from a front or side street.

Note: Tier 1 windows that are almost entirely obscured from the street by fences, wingwalls, or other building features may be reclassified as Tier 2 windows. Windows obscured by vegetation will still be classified as Tier 1 windows.

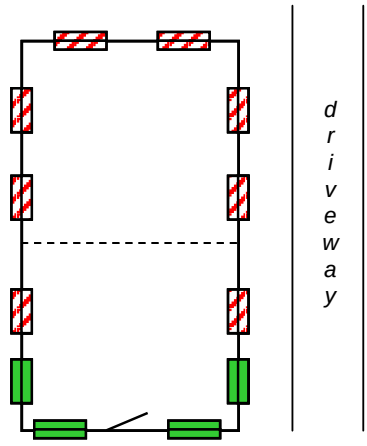
Recommended

1. Tier 1 windows may be replaced if the historic windows are missing. If this is the case, **DO** provide photographs showing

What You Should Know about the Historic Design Review Process Before You Start Your Project:

There are two factors to consider when contemplating a window replacement project: **1) the need for replacement** *and* **2) compatibility.** *Projects which follow the "Recommended" approaches can be approved as a Certificate of No Effect by Historic Preservation Office staff. Projects which follow a combination of "Recommended" and "Acceptable" approaches will require a Certificate of Appropriateness hearing but are likely to be approved. Projects which propose "Not Recommended" approaches are less likely to gain approval. Refer to pages 16-17 for more guidance on this issue.*

Please note that properties with conservation easements may be subject to additional requirements not stated in this guide. Property owners should consult with Historic Preservation staff to determine how their projects will be affected by the additional requirements. Furthermore, properties that are receiving the State Historic Property Tax Reclassification for Owner-Occupied Homes are required to have their plans reviewed by the State Historic Preservation Office prior to the commencement of work. Failure to do so may result in the property being removed from the tax program.



front of single-story house (interior lot)

= Tier 1 Windows (Retain and Repair)

= Tier 2 Windows (Possible Replacement)

the missing windows along with any historic windows that still remain.

2. Tier 1 windows may be replaced if they are in poor condition or if the cost of repair significantly exceeds the cost of replacement. In this case, **DO** provide a report containing the following information:

    - Photographs of each window proposed for replacement.

    - Detailed information on the condition of each window.

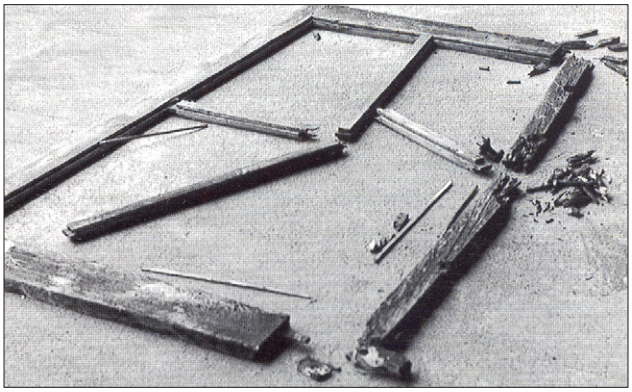
    - Cost estimates for repair vs. replacement, with the replacement costs based on windows that meet either the "Recommended" or "Acceptable" guidelines on pages 12-16.

    For window replacement to be approved on the basis of cost, the report should verify that the cost of repair will significantly exceed that of replacement (i.e., it will be at least 1.5 times higher). The report should be prepared by a window repair specialist or a licensed contractor with demonstrated experience rehabilitating historic buildings. The property owner should also provide a brief statement explaining why the financial incentives available for repair cannot be used to offset the higher cost of repair.

    Note: The requirement for a full contractor's report may be waived if the Historic Preservation Officer determines the pictorial evidence is sufficient to justify the need for replacement.

If either Item 1 or Item 2 above is met, then replacement may be allowed. The remaining requirements are to ensure that the new Tier 1 windows will be compatible with the historic windows, the overall historic character of the property, and the general character of the historic district.

In the example above, the top photo was sufficient pictorial evidence to show that one of the front windows was nonhistoric and that its replacement (shown in bottom photo) should match the window that still remained.



The window above is badly deteriorated and is a candidate for replacement.

Recommended

3. **DO** install new windows that fit precisely into the historic window openings (i.e., within ½" on each side).
4. If the historic windows were recessed within the openings, **DO** install new windows that are recessed to match. If the historic windows were not recessed, then the new windows should not be recessed.
5. **DO** install new windows with an overall visible light transmittance rating of 0.5 or higher.
6. **DO** install new windows with rails, stiles, and jambs that match those of the historic windows in profile and dimensions. The rails, stiles, and jambs should generally be within 1/2" of the originals.
7. **DO** install new windows with muntins that match those of the historic windows in profile and dimensions. The muntins should generally be within 1/4" of the originals and should follow the same pattern (i.e., 1/1 replacing 1/1, 6/1 replacing 6/1). True divided lights are preferred; however, simulated divided lights with interior and exterior grids and spacer bars between the glass may also be used (see examples at top and middle right).
8. **DO** install new windows that utilize the same material as the historic windows (i.e., wood for wood, steel for steel, aluminum for aluminum) or a highly compatible material (defined as either fiberglass or aluminum with a painted or coated finish for either steel or wood).
9. **DO** install new windows that have the same method of operation as the historic windows (i.e., casement for casement, double-hung for double-hung). Note: Single-hung windows may be substituted for double-hung windows and vice versa.

Acceptable

10. If the same material or a highly compatible material cannot be used, then **DO** use an

The dual-pane replacement windows shown above have true divided lights, with the muntins extending all the way through the glass. This type of window is recommended because it closely replicates the look of a historic window.

The dual-pane replacement window shown above has simulated divided lights, with muntin-like grids on the outside and inside of the glass and a spacer bar between the glass. While true divided lights are preferred, this type of window is a recommended alternative.

This new wood window utilized the same material as the window it replaced, as well as the same muntin pattern.