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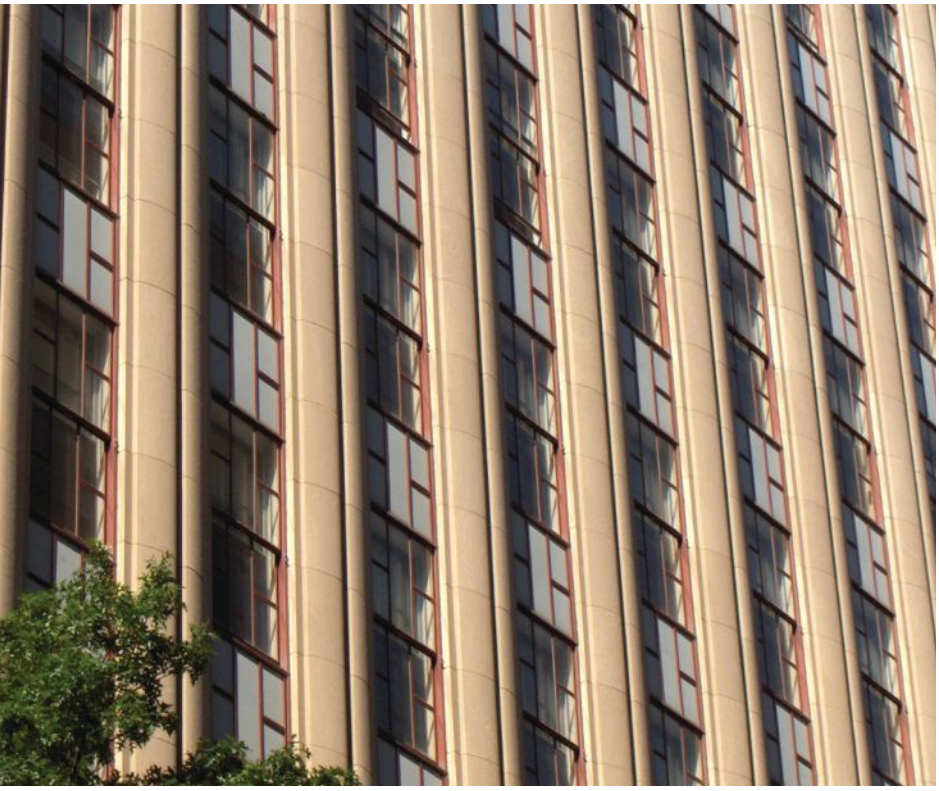
PERFORMANCE CONSIDERATIONS FOR HISTORIC WINDOW REPLACEMENT AND REPAIR



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Richard W. Off, AIA, Project Architect with Hoffmann Architects, has specialized expertise in the restoration and adaptive reuse of historic and landmark structures.

LEARNING OBJECTIVES

After reading this article, you should be able to:

- **EXPLAIN** the principles of window design, including energy and thermal performance, structural considerations, and building envelope integrity.
- **APPLY** window design principles to historic window replacement projects, considering options such as insulating glazing, low-e coatings, and impact and flood resistance.
- **DIFFERENTIATE** among the various types of window testing, and describe how each is used to evaluate the window assembly.
- **IDENTIFY** the challenges to restoring historically significant, irreplaceable windows.

From the stained glass windows that welcome variegated light into cathedrals to the steel-framed geometric designs of Art Deco and the bold leaded glass of the Prairie style, windows have served to define the character of buildings and spaces since the advent of glazed fenestration. Not only do windows establish the aesthetics and ambiance of a structure, they form an integral part of the building enclosure. More than ornament, windows serve a vital role in protecting the building from the elements and in modulating the transfer of heat, moisture, and light from exterior to interior.

As windows age, their components become subject to the ravages of time and weather: sealant crumbles, wood decays, metal corrodes, glass deflects. If not properly maintained, historic windows are in danger of deteriorating to the point where they are no longer salvageable. Even for those windows that have been carefully protected over the years, performance demands may raise considerations for replacement with materials that provide improved efficiency and durability. Determining a

Meeting performance demands while preserving building character presents challenges for historic window projects. Evaluating existing conditions, including anchorage, hardware, wall opening, frame, sealants, coatings, and glazing, allows the design team to determine the best approach for balancing historic integrity with modern performance.

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Samples of original hardware (above, right) facilitate restoration and, where necessary, replacement. Existing historic hardware may be removed and restored (below), then re-installed (above, left).

path for historic window treatment that balances aesthetics and historic integrity with contemporary performance standards can be challenging, particularly if the windows are architecturally significant.

Through thoughtfully designed and executed repairs, some historic windows can realize performance gains that extend their lifespan and improve indoor comfort. However, where deterioration is advanced, or where there is a compelling need to modernize the assembly to meet current performance standards, replacement may be warranted. In such cases, careful consideration of materials and window design is critical to respecting historic character while meeting project requirements. Decisions about wood frames versus metal or composite, insulating glazing versus single-pane, true divided lights versus applied muntins, and historical versus modern anchorage, among other considerations, require expert evaluation of the available options. Testing, both in the laboratory and in the field, is a valuable tool to verify performance and adjust the final design to meet the unique demands of the building and situation.

By applying the principles of window design with a sensitivity to the treatment of historic properties, building owners and project teams can develop window rehabilitation solutions that respect the original building fabric while providing lasting, reliable performance.

WHAT ARE THE PRINCIPLES?

Many of the performance requirements and standards that should be considered when approaching window replacement projects are governed by code. For residential projects, including single-family homes and duplexes of not more than three stories, the International Residential Code (IRC) applies; for all other commercial and residential projects, the International Building Code (IBC) and International Energy Conservation Code (IECC) are the prevailing model codes.

While replacement windows must comply with the performance standards outlined in the codes, in many jurisdictions, historic and landmark buildings are exempt, so long as such windows are replaced in kind, matching historic conditions. However, the IBC still requires that safety glazing be installed in potentially hazardous locations, such as windows at enclosed fire stairs. In general, performance requirements may be organized into three main categories: energy/thermal, structural, and envelope considerations.

EDITOR'S NOTE

Additional reading is required for this course. To earn 1.0 AIA CES HSW learning units, study the article carefully and take the exam posted at: **BDCnetwork.com/WindowRestoreCourse**