



20th-Century Building Materials and Suitable Substitutes: Windows (Legacy 13-707)

Abstract

The aim of this project is to provide a useful tool that will assist Department of Defense (DoD) Cultural Resource Managers (CRMs), facility planners, architects, and engineers responsible for the maintenance and repair of historic twentieth-century buildings in complying with Section 106 of the National Historic Preservation Act (NHPA). This project focuses specifically on three window types commonly used during twentieth-century construction of DoD facilities: steel, corrugated wire glass, and glass block. The resulting technical report provides a discussion on the history of the three aforementioned window types; a discussion on common problems encountered with the materials; and identifies suitable substitute replacement materials that meet the Secretary of Interior's Standards for the Treatment of Historic Properties (SOI Standards) and agency regulations and requirements, such as Antiterrorism (AT) and energy. In addition, the report provides a protocol for determining repair versus replacement options for historic window types, and the steps for coordinating associated projects with respective State Historic Preservation Offices (SHPOs) and consulting parties. The conclusions of the study were drawn utilizing archival research, documentary research, and data analysis, as well as case studies of select DoD installations throughout the Mid-Atlantic and Northeast regions. The technical report is supported by a visual guide that is meant to serve as a quick reference guide for CRMs, facility planners, architects, and engineers

Project Specifics

A survey of DoD CRMs in the Mid-Atlantic and New England regions, from Virginia to Maine, identified twentieth-century window types as presenting some of the greatest challenges to maintaining historic twentieth-century DoD buildings. As a result, this document focuses on suitable substitutes for twentieth-century window types identified as character-defining features of historic twentieth-century DoD buildings: steel, corrugated wire glass, and glass block.

The aim of this report is to serve as a useful tool that will assist DoD CRMs, facility planners, architects, and engineers responsible for the maintenance and repair of historic twentieth-century buildings in complying with Section 106 of the NHPA. This report takes preservation standards into consideration, as well as window performance standards. It provides a summary of evaluating repair versus replacement options for historic windows. When replacement is warranted, this report identifies acceptable substitute materials that meet the SOI Standards, as well as measures that are acceptable to respective SHPOs to avoid or minimize adverse effects to historic properties.

This report also presents the history of each particular window type, identifying its unique characteristics, and special circumstances that led to its development, as well as the key manufacturers that historically produced it. When an adverse effect cannot be avoided, the history presented on each particular window type can be utilized to prepare mitigation documentation, such as Historical American Building Surveys/Historical American Engineering Recordations and other associated documentation.

Description of geographic setting: Northeastern United States, from Virginia to Maine.

Principal investigators: Samantha Driscoll, Emma Diehl, and Pamela Anderson (A.D. Marble & Company); Heather McDonald Robbins (Naval Facilities Engineering Command, Mid-Atlantic)

Partners: N/A

Service branch: Navy

Project location: Northeastern United States, from Virginia to Maine

Installation size: N/A

Installation primary mission: N/A

Project dates: September 2013 through October 2014

Project point of contact: Samantha Driscoll, A.D. Marble & Company, 375 East Elm Street, Suite 101, Conshohocken, Pennsylvania 19428; sdriscoll@admarble.com; (484-533-2537)



Steel windows are a character-defining feature of this building at NSF Indian Head, Maryland.



Corrugated wire glass windows are a character-defining feature of this building at the Portsmouth Naval Shipyard, Maine.



The glass block used in the stair tower is a character-defining feature of this building at NSA Bethesda, Maryland.

Purpose/Need

Windows are among the most prominent character-defining features of historic buildings and are also very vulnerable to deterioration. A survey of DoD Cultural Resources Managers (CRMs) in the Mid-Atlantic and New England regions, from Virginia to Maine, identified twentieth-century window types as presenting some of the greatest challenges to maintaining historic twentieth-century DoD buildings. Three twentieth-century window types were identified as most problematic: steel, corrugated wire glass, and glass block. As a result, this document focuses on repair, in-kind replacement and suitable substitutes for these three window types.

Approach

In order to prepare a report that was manageable in terms of approach and budget, the geographical limits of study were confined to the Northeast and Mid-Atlantic regions, from Maine to Virginia; however, it is anticipated that the findings presented will generally be applicable to other geographic areas that use steel, corrugated wire glass, and glass block windows in their historic twentieth-century buildings. In addition, this report focused on exterior materials, which are most susceptible to weather deterioration and regulatory restrictions, such as AT and energy efficiency mandates.

The approach to the project consisted of a six-part methodology that included: (1) a review of existing Legacy reports, National Park Service (NPS) Preservation briefs, and other documentation regarding the rehabilitation or replacement of twentieth-century building materials; (2) development and distribution of a CRM survey questionnaire to identify problematic materials; (3) primary and secondary research online and at key repositories; (4) consultation with multiple SHPOs, as well as other federal agencies, including the U.S. General Services Administration (GSA) and the National Aeronautics and Space Administration (NASA); (5) on-site investigations at various DoD installations; and (6) discussions with individuals and organizations involved in private-sector tax credit projects.

Results

The repair or replacement of historic twentieth-century window types is not without challenges. Aluminum can be substituted for steel, but only if executed in a profile as close to the original as possible. No suitable substitutes were identified for corrugated wire glass and glass block that avoid adverse effects; however, specific treatments and considerations can be applied to minimize the adverse effect to the historic properties. The report also provides a list of manufacturers that can assist with supplying historically sensitive windows. In addition, the report presents the history of the three particular window types that can be used toward the preparation of mitigation documentation.

Benefit

This project will help expedite Section 106 compliance. The report provides a protocol that explains the factors that should be considered in determining repair versus replacement of historic windows, which can be utilized in Section 106 consultation. Information contained within the report can assist in the identification of substitute materials that will result in findings of no adverse effect, which will avoid the need for time-consuming consultations and costly mitigation measures. The project promotes sustainability by facilitating the repair and continued use of existing historic buildings. Regular maintenance and minor repairs can extend the life of historic windows, and when replacement is deemed the most viable options, careful consideration of replacement materials with regard to the impact on the historical integrity of a building is critical. By balancing preservation concerns with federal regulations and program needs, the DoD can continue to ensure the long-term viability of the thousands of historic twentieth-century buildings within its inventory.

Recommendations/Lessons Learned

DoD installations responsible for historic twentieth-century buildings are challenged with balancing preservation needs, future sustainability, and federal regulations. Common issues with each of the three window types were identified. If improperly constructed or maintained, steel windows can corrode, and true replacement in-kind is costly.

Corrugated glass windows that have deteriorated beyond repair cannot be domestically replicated, as the material is no longer produced in the United States. Glass block, although sturdy, may have problems related to cracking, yellowing, mortar failure, or corrosion of framing if not properly maintained. Applicable AT requirements must be met for replacement.

All window projects should evaluate alternatives that avoid replacement of the historic window while meeting the defined project need. Such avoidance measures can include the replacement of individual glass panes within the existing frame; installation of exterior or interior storm windows; installation of reversible improvements; and simple repairs, such as cleaning and painting. When avoidance is not a viable option, minimization efforts, measures to reduce the impact to the historic window and the historic building should be pursued. Examples of such measures include retention of the historic window *in situ*, while new construction either utilizes transparent materials or occurs at the interior; and replicating original features, including overall profile, on the replacement window to the extent feasible. Aluminum windows, if executed in a profile as close to the original as possible, have been deemed acceptable.

When adverse effects cannot be avoided and replacement is the only viable option, mitigation options, including minimization efforts, can include the salvage of original materials and a commitment to retaining examples of the materials at other locations or at specific locations within the building itself. The report also presents the history of the three particular window types, identifying their unique characteristics and special circumstances that led to their developments, and the key manufacturers that historically produced them. This history can be used toward the preparation of mitigation documentation.

Communications

The report and illustrated guidebook will be posted to the DoD Environmental, Safety and Occupational Health Network and Information Exchange website (DENIX) upon approval for release by the DoD Legacy Office.