Staff Report

(with attachments)

Presented to the

Historic Preservation Commission

July 17, 2024

STAFF REPORT **July 17, 2024**
Historic Preservation Commission

PROJECT NAME

201 LINDEN STREET (LINDEN HOTEL) – DESIGN REVIEW

STAFF

Jim Bertolini, Senior Historic Preservation Planner
Maren Bzdek, Historic Preservation Manager

PROJECT INFORMATION

PROJECT DESCRIPTION: Alterations to the Linden Hotel at 201 Linden Street to include complete replacement of the historic windows.

APPLICANT/OWNER: Linden Street Treehouse, LLC vy OneSeven Advisors, LLC
148 Remington Street, Ste 100
Fort Collins, CO 80524

RECOMMENDATION: **TBD**—Staff does not have sufficient information at this time to make a recommendation.

COMMISSION'S ROLE: Design review is governed by Municipal Code Chapter 14, Article IV, and is the process by which the Historic Preservation Commission (HPC) reviews proposed exterior alterations to a designated historic property for consistency with the *U.S. Secretary of the Interior's Standards for the Treatment of Historic Properties* (the Standards). The HPC should discuss and consider the presented materials and staff analysis. For City Landmarks and properties in City Landmark Districts, the Commission is a decision-maker and can choose to issue, or not issue, a Certificate of Appropriateness (CoA). Issuing a CoA allows the proposed work to proceed.

EXECUTIVE SUMMARY:
This is a request to replace the exterior windows of (between 38 & 41 windows) the Linden Hotel at 201 Linden Street. City Council individually Landmarked the Linden Hotel in 1974 (Ordinance 1974-44), but the property was also later included as a contributing building in the Old Town Landmark District, designated by City Council in 1979 (Ordinance 1979-170, and subsequent 1998-102 and 1998-124). The hotel was additionally listed in the National Register of Historic Places in 1978 as part of the Old Town Historic District – the Hotel is listed as "the central anchor for the district" (see page 7-4).

The proposal before the HPC is to replace the exterior windows of the property. Staff cannot provide specific details about which windows will be replaced, or the dimensions or specific design of a replacement window product, because the materials provided by the applicant's contractor only provide general replacement information. Based on discussion, it is likely the applicant intends to replace upper-level (2nd and 3rd story) windows but this is typically confirmed via a window study, which has not been completed. Staff has engaged an expert to perform a window study, which is anticipated to be complete the first week in August 2024.

Alterations to City Landmarks are subject to the approval process in Municipal Code Chapter 14, Article IV. Contributing properties to the Old Town Landmark District are subject to the same approval process, with more specific approval standards adopted by City Council in the Old Town Design Standards.

ARCHITECTURAL DESCRIPTION:

Nomination documents may describe character-defining features, or those features critical to maintain when approving projects in order to retain an historic property's essential character and reasons for being designated historic. The National Register nomination approved in 1979 includes the following description of the Hotel (page 7-4):

> "*[The Linden Hotel]…is a three-story brick structure and is one of the more architecturally significant buildings in the area. The structure has a mansard roof at the cornice, aureole windows at the corner, and a tower with a mansard roof above the aureole windows at the corner. Both the Walnut and Linden Street facades of this building have been treated architecturally with a series of protruding ornamental brick pilasters and recessed window bays. The façade is not symmetrical for the number of windows in each bay varies. The first story has been altered considerably, in places the original window openings can still be seen. The window openings have segmental arch lintels of stone. The second story windows are treated differently architecturally. These windows have half-arch stone lintels. The third story windows have flat stone lintels. The cornice below the mansard roof is quite elaborate and is of pressed tin. The building has a flat roof and is rectangular in plan, except for the diagonal at the corner. The diagonal is the most significant part of the building as it responds quite favorably to the corner and is the location for the rather ornamental aureole windows and the tower."*

Based on this description, and the 1974 individual Landmark ordinance for the property, this property would be considered historic for both its historic (Standard 1) and architectural (Standard 3) importance. The three-story red brick and native sandstone structure has several notable architectural details, including the prominent corner entry with its double oriel windows. According to previous surveys, there are a total of 51 windows on the second and third floors. Each oriel contains three double-hung wood sash windows, in wood surrounds, with ornate carved decorative wood details. Other than the oriel, the second-floor windows are surrounded with pointed half-arch stone lintels and stone sills. Third floor windows have flat stone lintels and stone sills. Windows on the second and third floors are historic double hung wood windows. Four windows on the west wall of the second floor are non-historic replacement windows; the original windows were lost during the collapse of the west wall associated with the 1994 rehabilitation.

Several features of the building's exterior would be considered "character-defining," including:

- The sandstone and brick exterior, including door and window sills and lintels of varying shapes (arched and segmented arch);
- Metal (historically wood) decorative trim features, including brackets, mullions, and pilasters;
- Wood, inset storefront assemblies on the ground floor;
- Mansard roof at the cornice, now comprised of standing-seam metal
- The prominent aureole windows on the 2nd and 3rd floor at the corner of Linden & Walnut Streets;
- 1-over-1 wood windows on the 2nd and 3rd floor

ALTERATION HISTORY:

<u>Building History</u>

The historic 1882 "Linden Hotel" building at the northwest corner of Walnut and Linden Streets, originally owned by Fort Collins pioneers' Abner Loomis and Charles B. Andrews, was designed by prominent Denver architect William Quayle and constructed by John F. Colpitts just nine years after Fort Collins was incorporated as a town. Until 1917, its first floor housed the Poudre Valley Bank, the oldest banking institution in Larimer County. Other primary uses in its early years included the post office, the Masonic Lodge, a tavern, and the Linden Hotel.

Known alterations of the property to date include:

- 1917 – Remodel & repair (Permit 87)
- 1923 – install 5x14 coal platform
- 1936 – after-the-fact permit for a new 5ft door cut in north wall; 1 30" door in south wall for entrances to 201 & 207 Linden St.
- 1937 – roof of boiler room reinforced with concrete
- 1945 – Remodeling (Permit 8169 & 8361)
- 1945 – Asphalt roof
- 1946 – Remodeling (Permit 9267)
- 1952 – hang neon sign over 12' above sidewalk (200lbs)
- 1994-1995 – Rehabilitation
    - Comprehensive, including restoration of storefronts, interior remodel, elevator addition, stair tower addition, roof replacement, new fire suppression system
- 1999 – Remodel of 3rd floor (interior?); lighting and mechanical modifications
- 2016 – Interior rehabilitation w/ rooftop patios
- 2018 – Stone pilaster repair
- 2018-2019 – Windows
    - CoA not issued by interpretation of CDNS Director; project shifted to repair/modification
- 2021 – Corner stone repair (from Linden Alley accidental damage)
- 2023 – Wood trim & storefront window repair and temporary safety measures (plexiglass covering) for 2nd and 3rd floor exterior windows

HISTORY OF DESIGN REVIEW:

- 1993 – Preservation Leadership Training Institute Assessment
    - the Linden Hotel was selected as the study site for the week-long Preservation Leadership Training Institute sponsored by the National Trust for Historic Preservation and the National Park Service, which brought experts from around the country to examine the structure's rehabilitation needs and its relationship to the revitalization of the historic downtown towards the river beyond Old Town Square.

- 1994-1995 – Major Rehabilitation
    - Comprehensive, including restoration of storefronts, interior remodel, elevator addition, stair tower addition, roof replacement, new fire suppression system
    - Public-private effort, which included a State Historical Fund grant, Downtown Development Authority funding and City Historic Preservation Fund monies totaling $450,000. The National Park Service approved the project's full compliance with the Secretary of the Interior's Standards for Rehabilitation and praised the extensive effort, noting that "local support by the community and the City of Fort Collins make this project unique among the many rehabilitation projects we review within a 16-state region."
    - In 1995, the City of Fort Collins recognized building owners Dave Veldman and Mitch Morgan of Veldman Morgan Commercial with a "Friend of Preservation" Award for their "courageous effort" to rehabilitate the building.

- 2005 – Window Assessment (Edge Architecture)
    - Owner proposed replacing some of the wood windows. In response to that request, a window survey and assessment of 51 windows was conducted by Angie Aguilera, Edge Architecture. The report noted that windows were in relatively good condition for their age and provided three repair and performance improvement options along with two comparative estimates for replacement.
    - Subsequently, the owner neither repaired nor replaced any of the windows.

- 2018 – Interior rehabilitation w/ rooftop patios

- 2018 – Stone pilaster repair on ground floor facade

- 2018-2019 – Windows
    - Change of use from offices to residential on the second and third floors.
    - At that time, the owner indicated an intention to clean and re-glaze the historic windows. As there were no plans for additional work to the windows at that time, the cleaning and re-glazing would comply with the definition of normal maintenance and repair (Ch. 14, Sec. 14-52).
    - The information did not include a request to change the lift system and add extra panes to the windows, which required channeling out significant portions of wood from the sash. This was completed without approval and Preservation staff was made aware on August 22, 2018, by the windows contractor. This included a request to review options for next steps including replacement of the historic windows with a product that the contractor had shared with the architect and owner's representative.
    - Staff accompanied an LPC Design Review Subcommittee to a site visit at the building on September 4, 2018 to examine the condition and operability of the reinstalled historic windows and to examine four windows on the second floor of the west alley elevation. These four windows were installed in association with the reconstruction of the west wall, which collapsed during the 1994 rehabilitation project. Three of the four windows were modern replacements, and the fourth was a historic window with details, sections, shape, and cut lites that indicated it was moved to this location. On October 21, 2018, the applicant received administrative approval to replace those four windows
        - The subcommittee provided a recommendation of approval for the administrative design review regarding replacement of the four windows on the west wall due to their lack of significance, but the subcommittee members directed the matter of the building's historic windows to the full Landmark Preservation Commission for a design review hearing. In referring the matter to the full Commission, the subcommittee members noted that the prior work on the windows had resulted in operability issues and each had concerns about the suitability of the rehabilitation approach that the applicant's contractor had used and the fact that the work had been performed without prior review and approval. They also noted that the historic windows could be further adjusted to improve operability and performance. At the request of the LPC to provide independent analysis of these comments, staff ordered a third-party analysis of the current condition and repairability of the historic windows from Barlow Cultural Resource Consulting, LLC. That report was dated November 29, 2018, and is an attachment. *Note: This study indicated that the removal of the weight-and-pulley system that was done without approval had damaged them, specifically cutting a groove on the vertical sides of each window sash (the stiles) to house a new spiral balance system, making weatherstripping impossible. It was also indicated that a groove was cut in each sash to install a second pane of glass. Ultimately, the finding of this report was that the window sashes could be brought back into function with a full restoration program.*
    - CDNS Director waived requirement for Certificate of Appropriateness for the proposed restoration plan, determining that the modification to the windows was classified as "normal maintenance" (Municipal Code 14-56) and not subject to a CoA approval; noting that if "individual owners of the residential units want to replace the windows in the future, review by the Landmark Preservation Commission and a Certificate of Appropriateness will be required."

- 2021 – Corner stone repair (from Linden Alley accidental damage)

- 2023 – Wood trim & storefront window repair

HISTORY OF FUNDED WORK/USE OF INCENTIVES:
Since 1978, the property has received significant public investment of approximately $ ($ in City and $ in State) to preserve its historic features, including:

- 1994-1995 – Federal Historic Tax Credit
  - 20% of total rehabilitation costs;
- 1994-1995 – Multiple funding sources for comprehensive rehabilitation
  - State Historical Fund, $100,000
  - Downtown Development Authority & City of Fort Collins Historic Preservation Fund, $250,000
- 2011 – DDA Façade Restoration Program, $68,555
  - column and stone base repair
- 2017 – Design Assistance Grant for rooftop modifications

DESCRIPTION OF PROPOSED WORK: The applicant is seeking a Certificate of Appropriateness under Municipal Code 14, Article IV for the following items:

The applicant is seeking replacement of the windows on the building. The applicant did not provide specific details about which windows, or dimensions & details of replacement product. It seems likely that the applicant intends to replace upper floor (2nd and 3rd story) windows but this is not stated explicitly in the application.

REQUESTS FOR ADDITIONAL INFORMATION:
Upon review of the original application, staff has asked the applicant to provide more detail on the following items:

- At a meeting on November 9, 2023, the applicant requested to revisit the question of window replacement based on an updated, independent assessment of their current condition. This assessment was intended to be filled by a new 3rd party contractor without prior involvement in the previous design review process (initiated in 2018). The applicant ultimately chose to provide a brief overview from the contractor who worked on the windows in 2018 instead; therefore staff has engaged a 3rd party with Design Assistance Program funds to perform the study following the *U.S. Secretary of the Interior's Standards and Guidelines for the Treatment of Historic Properties*, including specific window guidance attached to this packet, which is anticipated to be complete the first week in August 2024.

The following changes were made to the proposed work since the last HPC meeting:

- N/A - TBD

PUBLIC COMMENTS SUMMARY
No public comment about this project has been received at this time.

STAFF EVALUATION OF APPLICABLE REVIEW CRITERIA:
Staff notes that Standard 6, regarding repair before replacement, is of key concern when replacement of character-defining historic material is concerned.

Old Town Design Standards

The Old Town Design Standards (OTDS) have been adopted by the City of Fort Collins (via City Council) as the basis for exterior project review on buildings within the Old Town Landmark District, which includes the Linden Hotel at 201 Linden Street. These Standards are not a substitute for the City's adopted general standards, the *U.S. Secretary of the Interior's Standards for the Treatment of Historic Properties*, but rather provide more specific guidance on what can be approved on historic buildings based on the district's and building's specific, defining historic features. Windows are covered on pages 50-54 of the OTDS.

Below is an analysis of the current application based on each of the window-related standards in the OTDS:

Relevant Standards in OTDS

3.8 – Maintain & Repair Historic Windows

- Preserve historic window features including the frame, sash, muntins, mullions, glazing, sills, heads, jambs, moldings, operation, and groupings.
- Repair and maintain windows regularly, including trim, glazing putty, and glass panes.
- Repair, rather than replace, frames and sashes.

- *Staff Analysis: Without documentation (i.e., a Window Study) confirming that window units are beyond repair, staff cannot assess whether this Standard is met, since it is not clear that repair is not possible, and the applicant's window evaluation (Colorado Sash & Door) suggests repair is possible: "If the sash[es] are to be left in place, a wood support block running from the sill up to the bottom of the upper sash could be installed…" presumably also with replaced, reinforced, meeting rails (Assessment p. 7). In the event repair is possible, Standard 3.8 must be met and alternatives that repair, reinforce, and modify the windows based on subsequent standards is required. Staff cannot determine if Old Town Design Standard 3.8 is met due to insufficient information.*

3.9 – Replace a Historic Window with a Matching Design if Repair is not Possible

- Replace with the same material.
- Match the appearance of the historic window design (i.e., if the historic is double-hung, use a double-hung replacement window).
- Maintain the historic size, shape and number of panes.
- Match the profile of the sash, muntin, and its components to the historic window, including the depth of the sash, which may step back to the plane of the glass in several increments.
- Use clear window glazing that conveys the visual appearance of historic glazing (transparent low-e glass is preferred).
- Do not use vinyl and unfinished metals as window replacement materials.
- Do not use metallic or reflective window glazing.
- Do not reduce a historic opening to accommodate a smaller window or increase it to accommodate a larger window.

- *Staff Analysis: Without documentation (i.e., a Window Study) confirming that window units are beyond repair, staff cannot assess whether this Standard is met, since it is not clear that repair is not possible. In the event repair is possible, Standard 3.9 does not apply and Standard 3.8 must be met. Staff does not have sufficient information to determine if Old Town Design Standard 3.9 is met.*

3.10 – Use Special Care when Replacing a Window on a Primary Façade

- Give special attention to matching the historic design and materials of windows located on the façade.
- Also, match the historic design when replacing a window located on a secondary wall.

- *Staff Analysis: Without documentation (i.e., shop drawings) confirming that replacement window units are both necessary, and would match the existing windows, staff cannot assess whether this Standard is met, due to insufficient information. Typically, shop drawings (i.e., a cross-section of the proposed window as well as the historic window to be replaced) is included in a replacement request.*
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3.14 – Enhance the Energy Efficiency of Historic Windows and Doors

- Make the best of historic windows: keep them in good repair and seal all the leaks.
- Maintain the glazing compound regularly. Remove old putty with care.
- Place a storm window internally to avoid the impact upon external appearance.
- Use storm windows designed to match the historic window frame if placed externally.

- *Staff Analysis: With energy performance being cited as a reason for replacement, staff would note that wood windows (sashes and frames) provide higher insulation, when kept in good repair, than most replacement products. With large panes such as these, energy efficiency improvement meeting current International Energy Conservation Code requirements, is possible but can be, and has often been,*

successfully achieved without wholesale replacement. More common treatments are interior or exterior storms, and ensuring good insulation around the window frame inside the wall.

Call-out Box: Alternate Window Material (OTDS, p52)

- If it is not possible to match the historic design and materials of a window, then an alternative design may be considered in the following locations:
  - On a non-primary façade, accessory building or addition
  - On a primary façade if no other option is available
- Alternative window designs shall:
  - Match the general profile and details of the historic window.
  - Use materials that match the historic appearance in dimension, profile and finish.

- *Staff Analysis: Without shop drawings, which are typical in window replacement requests, it is unclear if the proposed aluminum-clad wood windows would match the profile, dimensions, and finish of the existing windows. While aluminum-clad wood windows are a common replacement type, confirmation of the need for replacement, and if so, matching dimensions and profile in the replacement, are typically required to meet the Standards, specifically OTDS #3.8 and Rehabilitation Standard #6 (see below). Staff cannot determine if the Alternate Window Material guidance in the OTDS is met.*

Applicable Code Standard	Summary of Secretary of the Interior Standards Required under City Code 14-54 and Analysis	Standard Met (Y/N)
SOI #1	*A property will be used as it was historically or be given a new use that requires minimal change to its distinctive materials, features, spaces, and spatial relationships;* The upper floors are currently residential units. Residential use for historic hotel space is generally a compatible new use.	**Y**
SOI #2	*The historic character of a property will be retained and preserved. The removal of distinctive materials or alteration of features, spaces, and spatial relationships that characterize a property will be avoided.* As noted above, the windows on the Linden hotel, including the upper floor, 1-over-1 wood sash windows, are a character defining feature and must be retained to meet this standard. This Standard, along with Standard 6, would allow for in-kind replacements, if required. At this time, staff does not have drawings, sketches, or a description of a specific replacement product and cannot definitely assess if Standard 2 is met. The requested detailed report from Deep Roots Craftsmen is intended to provide enough information to provide appropriate findings for consideration of this Standard.	**TBD**
SOI #3	*Each property will be recognized as a physical record of its time, place, and use. Changes that create a false sense of historical development, such as adding conjectural features or elements from other historic properties, will not be undertaken.* Based on the proposed work description, it does not appear that Standard 3 applies to this project.	**N/A**

SOI #4	*Changes to a property that have acquired historic significance in their own right will be retained and preserved.* The proposed scope, relating to window replacement, does not appear to be affecting any historic alterations to the property.	**N/A**
SOI #5	*Distinctive materials, features, finishes, and construction techniques or examples of craftsmanship that characterize a property will be preserved.* As noted above, the one-over-one wood sash windows are a character-defining feature. It is not clear from the application materials whether the windows have deteriorated beyond repair, or what the proposed replacement product would be if so. Staff does not have sufficient information to make an assessment of whether this standard is met. The requested detailed report from Deep Roots Craftsmen is intended to provide enough information to provide appropriate findings for consideration of this Standard.	**TBD**
SOI #6	*Deteriorated historic features will be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature will match the old in design, color, texture, and, where possible, materials. Replacement of missing features will be substantiated by documentary and physical evidence.* It is not clear from the provided materials that wholesale replacement of the upper floor windows is necessary. While deterioration is certainly noted, wood windows such as these are regularly repaired and improved to a level that meets, or comes close to meeting, modern International Energy Conservation Code (IECC) and International Existing Building Code (IEBC) requirements. The latest window study on the property (developed in 2018) indicates that repair is possible for these windows with some modifications. The applicant's own window assessment (2024, Colorado Sash & Door) indicates that repair is possible, with some modifications for stabilization. Energy performance and operability, via modifications like interior storm windows, piggy-back storm windows, window inserts, etc., are all options that have been used to retain historic material, meet energy performance and functionality needs, and avoid landfilling valuable, old-growth building materials that are typically highly repairable compared to products currently on the market. Staff does not have sufficient, current, information to make a recommendation for this Standard. The requested detailed report from Deep Roots Craftsmen is intended to provide enough information to provide appropriate findings for consideration of this Standard.	**TBD**
SOI #7	*Chemical or physical treatments, if appropriate, will be undertaken using the gentlest means possible. Treatments that cause damage to historic materials will not be used.* It does not appear that chemical or physical treatments are proposed. In cases where wood windows are retained and repaired, gentle surface preparation (light sanding) and repainting with hydrating, breathable paint is recommended.	**N/A**

SOI #8	*Archeological resources will be protected and preserved in place. If such resources must be disturbed, mitigation measures will be undertaken.* No excavation is proposed as part of this project.	**N/A**
SOI #9	*New additions, exterior alterations, or related new construction shall not destroy historic materials that characterize the property. The new work shall be differentiated from the old and shall be compatible with the massing, size, scale, and architectural features to protect the historic integrity of the property and its environment.* As noted above, the one-over-one wood windows are a character-defining feature of this property. It is not clear if the historic windows are repairable and should be retained, nor is it clear exactly what type of replacement is proposed. Staff does not have sufficient information to make an assessment regarding this standard. The requested detailed report from Deep Roots Craftsmen is intended to provide enough information to provide appropriate findings for consideration of this Standard.	**TBD**
SOI #10	*New additions and adjacent or related new construction will be undertaken in such a manner that, if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.*	**N/A**

Additional Guidance used by Staff
Staff regularly uses available guidance from the National Park Service that helps interpret the *U.S. Secretary of the Interior's Standards and Guidelines for Historic Properties* (the Standards).

Regarding window repair vs. replacement related to Rehab Standard 6 and documentation requirements, the following guidance is relevant (by staff's judgement), with annotations regarding relevancy in this matter. Each has also been included as an attachment:

- NPS Preservation Brief #9, *The Repair of Historic Wooden Windows*, https://www.nps.gov/orgs/1739/upload/preservation-brief-09-wood-windows.pdf
    - *Includes call for "…careful evaluation of existing physical conditions on a unit-by-unit basis." This is the reason the City typically requires a window study (frequently funded in whole or in part by the Design Assistance Program), prior to approving replacement.*
    - *Develops classification system for window condition:*
        - *Repair Class I: Routine Maintenance; often light sanding and repaint*
        - *Repair Class II: Stabilization; some decay in wood, treated with waterproofing and wood putty*
        - *Repair Class III: Splices and Parts Replacement; some replacement of rotted window parts, etc. involved.*
        - *Anything beyond Repair Class III would be a candidate for replacement.*
- NPS "Evaluating Historic Windows for Repair or Replacement," https://www.nps.gov/subjects/taxincentives/windows-evaluating.htm
    - *This item lays out a requirement to document deterioration, and consider each window in context of how important it is to the historic character of the building (i.e., not every window is necessarily a character-defining feature, such as windows on a secondary elevation, etc.).*
- NPS "Documentation Requirements for Proposed Window Replacement," https://www.nps.gov/subjects/taxincentives/windows-documentation-for-replacement.htm
    - *This item lays out a requirement of clearly photographing existing windows (to show condition), and providing drawings showing existing and proposed windows.*
- NPS "Replacement Windows that Meet the Standards," https://nps.gov/subjects/taxincentives/windows-replacement-meet-standards.htm
    - *Includes guidance for measuring historic significance of windows in context, and notes on how close of a match a replacement needs to be depending on where it is located on a building and how important it is to the character of the building.*

HPC REQUESTS FOR INFORMATION (FROM JULY 10, 2024 WORK SESSION)

1. FOR STAFF: Does the City consider cost of repair vs. replacement?
    - Not typically; The City does not consider economic hardship when considering compliance with most land use/municipal code requirements, although there are some grounds identified for a Waiver of Conditions/Modification of Standard. A Waiver of Conditions in Chapter 14 is very limited to exceptional physical hardship not of the applicant's making, or nominal & inconsequential deviations from standard practice.
    - While data is pre-COVID, generally window repair on wood sash windows has been more cost-effective, long-term, than replacement, due to long-term repairability, and cost of new window units, including with modest energy upgrades (storm windows, weatherstripping, caulking around the frame, etc.). Significant energy performance upgrades would likely be more expensive than replacement, but is also usually not necessary since heat/cooling loss through windows only accounts for roughly 15% of a building's potential energy loss, and is usually lost through or around the frame, not through the glazing (although that may be less true in this case since the windows are fairly large).
    - Financial incentives are available at the local and state level to help offset any additional costs related to labor, custom materials, etc. The City offers 0% interest matching loans up to

$7,500 (on $15,000 of project costs), and the State of Colorado offers a commercial 20-35%, transferable, state income tax credit on projects over $20,000. In both cases, projects ***must*** meet the federal preservation standards in order to qualify.

2. FOR STAFF: Is it typical to specify window treatments on an elevation plan or similar?
    - Generally yes, although something as detailed as elevation drawings are usually not necessary; a clear plan (via a table, marked up photo, etc.) is usually sufficient, provided information on condition is clear and justifies the treatment proposed, for each window (i.e., Class I – Routine Maintenance, Class II – Stabilization, Class III – Splices and Parts Replacement, or full replacement)

3. FOR STAFF – Provide summary on how window treatments were handled on first floor during 1994-1995 rehab for comparison to current request (research needed)
    - Upper floor windows were not modified in the same way the street level was, so a greater degree of reconstruction was needed in 1995; upper floor windows were serviced at that time to bring them into working order.
    - Lower floor windows in the same configuration (1/1 wood sash) were a mix of in-place and repairable, or missing entirely and infilled. The missing 1/1 windows were replaced in-kind using the surviving windows as a template.

4. FOR STAFF & APPLICANT: Please address information on window quote from June in packet; Is this the proposed replacement? (on the assumption that the window quote included in the applicant packet is the proposed replacement material, staff will provide some comments on appropriateness relative to the federal Standards & Guidelines).

    - Existing Windows: From previous documentation, the existing window sashes are generally of 38”x98” rough opening (according to 1994 rehab drawings), with window parts of 1.375” width/thickness for stiles and rails.
    - Assumed Replacement Proposal: In the applicant’s materials, they do refer to a new window unit, the Ultra Clad Sterling XL 1.75” Sash. This product is a double hung window, dual glazed with low-E glass, and pine wood materials clad in aluminum with a fluoropolymer finish (similar to Teflon). The window unit would fit a rough opening of 36.5”x95 9/16”. Specific unit dimensions relative to existing historic windows appear to be close. As noted in the Applicant’s window assessment, the existing windows have a 1 & 3/8 inch part width, while the proposed replacement uses 1.5” parts.
    - Staff Assessment: As noted by the Applicant, staff would agree that aluminum clad wood windows are in common use in the historic preservation community, and have been approved on projects across the country and in the region as a reasonably in-kind replacement for upper floor windows. From staff’s experience, the aluminum-clad units have been approved by local, state, and/or federal historic preservation specialists for the following reasons:
        - Qualified Preservation specialists have determined that none, or most of, the historic windows are not in a condition to be repaired so a wholesale replacement, or at least a wholesale replacement on a certain building level or elevation, is warranted; and
        - Replaced windows are on upper floors away from close view by the public, and the design of the aluminum cladding replicates the historic closely, including any special design features such as beading (not applicable in the Linden Hotel case); and
        - The combination of metal cladding and wood cores combines the thermal performance of wood with the durability and weather performance of the aluminum. However, staff would note that moisture trapping under the aluminum cladding is a known issue. While less of a concern in a dry climate like northern Colorado, and in a multi-story masonry building like the Linden Hotel, it is possible that aluminum clad wood may deteriorate faster than a well-maintained all-wood or all-metal window. Considering the prominence of the building in question, wood replacements, potentially of a harder wood species than original (due to loss of density with newer-growth lumber harvests), might be more advisable.

Based on the current information, Staff would generally conclude that we don't have evidence that windows are beyond repair at this time. The 2018 window study indicated they could be repaired to, or close to, current energy performance requirements. The Applicant's window assessment seems to reinforce that repair is possible on the windows in their current condition. Staff would wait until the revised window study, currently underway by Deep Roots Craftsmen, is complete before determining whether the windows need replaced or not. It seems likely that repair is possible along with energy performance upgrades, at least for most units. If that is the case, then any windows in need of replacement should be replaced in-kind with matching wood windows with dual glazing.

IF the historic windows are beyond repair, then the proposed solution may be acceptable with an adjustment to material (wood only). Staff would likely recommend an all-wood replacement instead, due to the easier repairability in the future, ability of the windows to be painted to match any other trim features should the color scheme of the building be revised, and to ensure a closer preservation of the building's prominent elevations on Walnut and Linden Streets. Furthermore, at this time, the Old Town Design Standards to which this building is subject do not currently allow for substitute materials.

5. FOR APPLICANT: Any more specific information on proposed replacements (dimensions in comparison to historic, material, etc.) and why those are being selected would be appreciated.

6. FOR APPLICANT: What do residential units sell for?

    - Staff would caution the HPC against using any information about unit cost/list price in decision-making; even if a request for a Waiver of Conditions is made, MC 14-5 restricts how staff/the HPC can issue those to:
        - "exceptional physical conditions or other extraordinary and exceptional situations…not caused by the act or omission of the applicant"; and/or
        - "will not diverge from the [Chapter 14] except in nominal and inconsequential ways…"

7. GENERAL DISCUSSION: Consideration of, if the HPC determines there insufficient information and decides to continue the item, what the procedure is for that.

INDEPENDENT EVALUATION SUMMARY

Staff is seeking an independent opinion from a qualified historic window repair specialist, Deep Roots Craftsmen, at this time.

FINDINGS OF FACT:

In evaluating the request for the 201 Linden Street window replacement, staff makes the following findings of fact:

- The property at 201 Linden Street, known as the Linden Hotel, is a City Landmark, designated individually in 1974 and included in the Old Town Landmark District in 1979.
- Exterior alterations to the Linden Hotel are subject to Preservation approval under the City's Municipal Code, Chapter 14, Article IV, and the Old Town Design Standards, adopted by City Council on July 15, 2014 (replacing the 1981 Standards for the same).

Staff cannot make further findings of fact regarding the application, because it is unclear, based on the information provided, that the windows are beyond repair. The information provided suggests that repair, including improvements for energy performance, are possible.

RECOMMENDATION:

Staff does not have a recommendation at this time due to insufficient information in the application.

SAMPLE MOTIONS

SAMPLE MOTION TO PROCEED TO FINAL REVIEW: I move that the Historic Preservation Commission move to Final Review of the proposed work to replace the windows at the Linden Hotel at 201 Linden Street.

SAMPLE MOTION FOR FINAL REVIEW APPROVAL: I move that the Historic Preservation Commission approve the plans and specifications for the window replacement [on the second and third floors?] to the Linden Hotel at 201 Linden Street as presented, finding that the proposed work meets the following *U.S. Secretary of the Interior's Standards for Rehabilitation*: _____.

SAMPLE MOTION FOR FINAL REVIEW DENIAL: I move that the Historic Preservation Commission deny the request for approval for the plans and specifications for the window replacement [on the second and third floors?] to the Linden Hotel at 201 Linden Street as presented, finding that the proposed work does not meet the *U.S. Secretary of the Interior's Standards for Rehabilitation*.

SAMPLE MOTION FOR CONTINUANCE: I move that the Historic Preservation Commission continue this item to the next meeting scheduled August 21, 2024 in order to seek additional information regarding whether the proposed work meets the *U.S. Secretary of the Interior's Standards for Rehabilitation*.

ATTACHMENTS:

1. Application for Design Review (including all attachments)
2. Ordinance 1974-44 and subsequent, designating the Linden Hotel as a City Landmark
3. Excerpt from the Old Town Design Standards (pages 50-53)
4. *U.S. Secretary of the Interior's Standards for Rehabilitation*
5. 2018 Barlow Window Study
6. NPS Preservation Brief #9, *The Repair of Historic Wooden Windows*, https://www.nps.gov/orgs/1739/upload/preservation-brief-09-wood-windows.pdf
7. NPS "Evaluating Historic Windows for Repair or Replacement," https://www.nps.gov/subjects/taxincentives/windows-evaluating.htm
8. NPS "Documentation Requirements for Proposed Window Replacement," https://www.nps.gov/subjects/taxincentives/windows-documentation-for-replacement.htm
9. NPS "Replacement Windows that Meet the Standards," https://nps.gov/subjects/taxincentives/windows-replacement-meet-standards.htm

Design Review Application
Historic Preservation Division

Fill this form out for all applications regarding designated historic buildings within the city limits of the City of Fort Collins. Review is required for these properties under Chapter 14, Article IV of the Fort Collins Municipal Code.

Applicant Information

Linden Street Treehouse, LLC vy OneSeven Advisors,LLC	970.420.8897	
Applicant's Name	Daytime Phone	Evening Phone
148 Remington Street, Ste 100, Fort Collins, CO 80524	CO	80524
Mailing Address (for receiving application-related correspondence)	State	Zip Code
david@onesevenadvisors.com		
Email		

Property Information (put N/A if owner is applicant)

201 Linden Avenue, Fort Collins, CO 80524		
Owner's Name	Daytime Phone	Evening Phone
201 Linden Avenue, Fort Collins, CO 80524		
Mailing Address (for receiving application-related correspondence)	State	Zip Code
Email		

Project Description

Provide an overview of your project. Summarize work elements, schedule of completion, and other information as necessary to explain your project.

201 Linden Avenue is a Fort Collins designated landmark property. The Owners request permission to replace the buildings windows which are one-hundred and forty-two years old, and have begun to fail, sending glass planes crashing to the sidewalk below. The Owners have taken great care to hire an expert who has authored a report (the Wernimont Report) who will replace the windows with materials and in a manner so that the replacements appear virtually identical to the original windows. Please see more details in the attached letter and report.

The following attachments are REQUIRED:

□ Complete Application for Design Review

□ Detailed Scope of Work (and project plans, if available)

□ Color photos of existing conditions

Reminders:
Complete application would need all of checklist items as well as both pages of this document.

Detailed scope of work should include measurements of existing and proposed.

Please note: if the proposal includes partial or full demolition of an existing building or structure, a separate demolition application may need to be approved.

Additional documentation may be required to adequately depict the project, such as plans, elevations, window study, or mortar analysis. If there is insufficient documentation on the property, the applicant may be required to submit an intensive-level survey form (at the applicant's expense).

Detail of Proposed Rehabilitation Work (*Required)
If your project includes multiple features (e.g. roof repair and foundation repair), you must describe each feature separately and provide photographs and other information on each feature.

Feature A Name:	
Describe property feature and its condition: Please see attached Wernimont Report	Describe proposed work on feature: Please see attached Wernimont Report.
Feature B Name:	
Describe property feature and its condition:	Describe proposed work on feature:

Use Additional Worksheets as needed.

Required Additional information

The following items must be submitted with this completed application. Digital submittals preferred for photographs, and for other items where possible.

- ■ At least one current photo for each side of the house. Photo files or prints shall be named/labeled with applicant name and elevation. For example, smitheast.jpg, smithwest.jpg, etc. If submitted as prints, photos shall be labeled
- ■ Photos for each feature as described in the section "Detail of Proposed Rehabilitation Work." Photo files or prints shall be named or labeled with applicant name and feature letter. For example, smitha1.jpg, smitha2.jpg, smithb.jpg, smithc.jpg, etc.

Depending on the nature of the project, one or more of the following items shall be submitted. Your contractor should provide these items to you for attachment to this application.

- ■ Drawing with dimensions.
- ■ Product specification sheet(s).
- ■ Description of materials included in the proposed work.
- ■ Color sample(s) or chip(s) of all proposed paint colors.

□ **Partial or full demolition** is a part of this project.
Partial demolition could include scopes such as taking off existing rear porches to create space for a new addition or removing an existing wall or demolishing a roof. If you are taking away pieces of the existing residence, you are likely undergoing some partial demolition.

David Diehl
boxSIGN 4P7VBZK1-4YZRVI3J

Signature of Owner

Jun 24, 2024
Date

Brownstein Hyatt Farber Schreck, LLP
303.223.1100 main
675 Fifteenth Street, Suite 2900
Denver, Colorado 80202

June 24, 2024

Claire N. Havelda
Attorney at Law
303.223.1194 direct
chavelda@bhfs.com

SENT VIA EMAIL

201 LINDEN AVENUE: WINDOW REPLACEMENT

Ms. Maren Bzdek
Historic Preservation Manager
City of Fort Collins
281 N. College Avenue
Fort Collins, CO 80524
mbzdek@fcgov.com

Ms. Heather N. Jarvis
Assistant City Attorney
City of Fort Collins
300 Laporte Avenue
PO Box 580
Fort Collins, CO 80522
hjarvis@fcgov.com

Dear Ms. Bzdek & Ms. Jarvis:

I am contacting you on behalf of my Client, the owner of the Linden Hotel located at 201 Linden Avenue, Fort Collins, Colorado 80524 ("Linden Hotel Owners" or "Owners") to request approval of their proposed window replacement plan and the issuance of a Certificate of Appropriateness. As one of the windows has now failed and a portion fell from the second story to the sidewalk below, the Owners seek this review of their proposed window replacement strategy.

Given the long and complex history of this project, the purpose of this letter is to: 1) provide a clear background of the window replacement request to date; 2) more fully respond to the City's November 27, 2023 "Legal Memorandum," which contained several factual errors; and 3) supplement the Owner's application request to replace the windows of the building in conformance with the Secretary of Interior's Standards as further described in the attached Colorado Sash and Door, Inc.'s ("Wernimont Report") expert report.

Bottom Line: The recommendations of the Barlow Report were not sufficient to overcome the fundamental flaws in the windows' original design that the size of the components are too small and thus, never appropriate for the size of the window openings.[1] As such, window failure, inferior

[1] Wernimont Expert Report p. 6.

weatherization and energy performance, inoperability and unsustainably expensive maintenance issues have now resulted. At this time, the only solution that meets the goals of safety, operability, energy performance, preservation of historic aesthetics and manageable maintenance costs is replacement with products discussed in the Wernimont Report attached hereto. The replacement product is designed to be virtually visually identical to the original windows, and have the added benefit of safety, operability, robust thermal performance, energy efficiency and sustainable maintenance costs. The proposed changes result in only a one-half inch (or less) difference in the checkrail as the only visible change from the original windows; a modification that would be visually undetectable on second and third story windows.

1. Background.

The Owners of the Linden Hotel have been in conversation with the City of Fort Collins (the "City") for many years seeking to appropriately replace what are windows that do not appropriately function and do not provide the level of safe operability and weatherization performance their residence needs. To date, they have not been able to resolve the matter with the City.

On October 21, 2023, part of a second story window dislodged from the second-floor window of the Linden Hotel and crashed to the sidewalk below. The Poudre Fire Authority was called to respond and aid in securing the windows as they now constituted a safety hazard for all foot traffic below.[2] The City was also immediately contacted to attempt to reach a resolution.

A meeting was held with the City's Historic Preservation Staff ("HPC Staff") on November 9, 2023, to attempt to determine a path forward to replace the windows as soon as possible.

HPC Staff toured the building in late 2023. HPC Staff provided the name of a number of contractors for Owners to contact. After months of attempting contact, those who returned Owner's contact advised that they could not timely inspect the windows or provide a report including considerations of safety, operability, and acceptable performance for the windows.

2. Historical Context.

The Linden Hotel was established in 1882. The majority of windows in the Linden Hotel are believed to be original, and thus, over one-hundred and forty-two years old (142). These windows have not functioned in an acceptable manner since at least 2005 (or almost 20 years). It bears mentioning, that prior to its Landmark designation, the Linden Hotel was in a state of complete and utter disrepair. Tens of thousands of dollars in combined private money has been spent by the owners to rehabilitate

[2] See Poudre Fire Authority Incident Report October 21, 2023.

the building. Rehabilitating the building was such a monumental feat that the then owners of the building were awarded the City's "Friend of Preservation" Award for "courageous effort" to restore it.

The Linden Hotel was in such disrepair that in 1994, four of the Linden Hotel windows were replaced when the west wall collapsed during the rehabilitation project.[3] In 2005, (19 years ago) a window assessment was completed in 2005 which documented the inoperability of the windows and noted that repairs such as adding inner glass storm windows would make all windows inoperable. That same year, the former building owners proposed replacing some of the then one-hundred- and twenty-three-year-old (123) windows. However, this was never approved by the City.

In 2018, the Linden Hotel was remodeled to change from office use to residential use, on the second and third floors. During that approval process, the current Owners informed the City that they intended to clean and re-glaze the windows.[4] In August of 2018, Mr. Wernimont of Colorado Sash and Door, Inc. (the Owner's Window Expert), contacted the then director of the City's Historic Preservation Department (the "Director"). In his August 22, 2018, email correspondence to the Director, he notes multiple areas in which he had concerns regarding the design of the windows and the ability of the balance system to accommodate their weight.[5] He also specifically requests time to meet with the City to discuss these matters. In September of 2018, the Landmark Preservation Commission's Design Review Subcommittee provided a recommendation of approval for the administrative design review regarding replacement of the four windows on the west wall "due to their lack of significance."[6]

In November of 2018, City Staff ordered a historic windows report from Barlow Cultural Resources Consulting, LLC (the "Barlow Report"). However, the entire focus of this report was focused on restoring the appearance of the windows, not on the combined objectives of safety, performance, sustainability and operability of the windows.

The closest the Barlow Report comes to addressing functionality and safety of the windows is to say:

> The existing windows do not perform up to the energy efficiency or noise reduction standards desired. The fact that historic windows do not meet modern standards is not a valid argument for replacement. There are acceptable treatments that can be applied to meet the desired goals while still adhering to historic preservation guidelines.[7]

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[3] *See* December 2018 Staff Report, Items 3. P.3.
[4] *See* December 2018 Staff Report, Item 3 p.3
[5] *See* Email Correspondence from M. Wernimont to Karen McWilliams, August 22, 2018.
[6] See December 2018 Staff Report, Items 3. P.3.
[7] *Barlow Report*, p. 21.

However, the solution proposed is to add storm windows on the inside of the building. Nowhere in that Barlow Report is the issue of operability of the windows, sustainability or the safety ramifications such inoperability satisfactorily addressed.

The Owners expressed grave concerns and objected that the Barlow Report was inaccurate and did not address their very real safety, operability and performance issues. The Owner's expert's opinion that its proposed plan to replace the windows met the Standards for Rehabilitation in 36 Code of Federal Register Section 68.3 because the "existing window frames and sills are severely deteriorated," was rejected. Instead, City Staff recommended denial of the request to replace the Linden Hotel windows, citing the Barlow Report.

3. <u>Correcting the Facts: "Onset" of Window Failure Disputed.</u>

On November 27, 2023, Assistant City Attorney Heather Jarvis issued a legal memorandum ("Legal Memorandum") that contained a number of factual errors and accusations of misconduct on the part of the Owners. The City's Legal Memorandum's claim that the "third-party professional historic window expert the City hired in the autumn of 2018's" observation of the deteriorated condition attributing the "the onset" of the deterioration to repair work done in early 2018, which wholly ignores the fact that the windows were then 136 years old and had not functioned appropriately for at least 20 years prior.

Next, the damage and destabilization to the 142-year-old windows the Legal Memorandum references was not the result of work performed in the Spring of 2018. This is an erroneous statement that essentially makes a legal conclusion as to a violation of City Code Section 14-51 without the due process protections of a full hearing on the matter as required by the Fort Collins' Municipal Code ("Code"). It also disregards the fact that the windows were then 136 years old. In all fairness, there was 136 years' worth of weather damage done and design inefficiencies in place before the current maintenance efforts ever began. To discount this is wildly inappropriate, and any "expert opinion" that says otherwise stretches the bounds of common sense.

The Barlow Report states vaguely that it reviewed the 2018 corrective measures and "suggested corrective measures that would meet the standards while also meeting the stated goals of easier operation with improved energy efficiency."[8] But it does not address the heart of the matter, that the windows do not operate at a level of safety, operability and performance appropriate for a residential dwelling.

[8] July 11, 2019, *Letter from Phillip Barlow to City of Fort Collins*, pg. 1.

3.a. Reliance on the Outdated 2018 Barlow Report.

The Legal Memorandum's claim that the Linden Hotel Owners' failure to follow the recommendations of the 2018 Barlow Report somehow caused the 2023 window failures (where a portion of the second floor window fell to the sidewalk below) misrepresents the facts.

The 2018 Barlow Report states that its entire evaluation consisted for "deconstructing one window to determine the scope of the previous repairs and alterations, and examining all windows visually to determine if conditions were consistent around the building."[9] The Barlow Report further misidentifies the goals of the repairs as being to "meet the goals of energy efficiency and sound reduction,"[10] while completely ignoring goals of operability, sustainability and safety. The Barlow Report then goes on to state that its recommendations are meant to further to Secretary of the Interior's Goals for Rehabilitation.[11] Yet, in many instances, the Barlow Report found that the Secretary of Interior Standards were not met because the proposed window rehabilitation measures did not "address retention of historic materials." What is concerning about this statement is that the "historic materials" that fail to function acceptably are largely located on the interior of the building and replacement of both interior and exterior "historic materials" would have no impact on the appearance of the windows from the outside. The Barlow Report also fails to address the fact that the design of the windows was fundamentally flawed from the beginning.[12]

Subsequently, Mr. Barlow was asked to review mitigation work completed after the 2018 Hearing. Again, the focus of the 2019 Barlow Review of the 2018 work was never to address safety, operability, sustainability and performance issues. Rather, it focused its commentary on prior work completed on the windows and how that work impacted the interior aesthetics of the windows and removing glass panes that were used to improve insulation.

Since the time of the 2018 Barlow Report, six additional years of heavy snow, moisture, extreme cold and a global pandemic (making maintenance extremely difficult) have occurred. Further, additional window restoration was completed in October of 2018 and September of 2019.

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[9] *Barlow Report*, dated November 29, 2018, Summary of Findings. (No page numbers identified – Agenda Packet Item 3 Attachment 13 p. 132).
[10] *Id*. and page. 152.
[11] *Id*.
[12] *Barlow Report*, at packet pg. 137-140

3.b. City's Mischaracterization of the 2019 Certificate of Appropriateness Procedures and Review.

The Legal Memorandum then leaps ahead to February of 2020 wherein it claims a Certificate of Appropriateness for window repair was issued by the City based on recommendations of the 2018 Barlow Report.

In reality, the Linden Hotel Owners had been in ongoing communication with the City regarding requested repairs to/replacement of the windows since 2018. There appears to be some confusion as to whether the general contractor (Dohn Construction) obtained appropriate permissions from the Landmark Preservation Department before engaging Colorado Sash and Door to complete window restoration work in October of 2018. However, in May of 2019, the former Historic Preservation Manager, Ms. Karen McWilliams, was contacted in an effort to get approval for "sample window" work to be performed which needed the Landmark Preservation Commission's approval as a condition precedent to receipt of a Certificate of Occupancy. In July of 2019 she was contacted again.[13]

Ms. McWilliams notified the Owners that the request would need to be approve by the Landmark Preservation Commission (the "LPC") at their next meeting in June. However, Ms. McWilliams never scheduled the matter for June of 2019 and the meeting was cancelled for lack of quorum. In his follow-up email to her to check on the status of approval on July 2, 2019, Mark Wernimont (Owner's Window Expert) resent the proposed scope of work outlined for the windows based on feedback from the City and its experts. In her email apologizing for the confusion Ms. McWilliams stated that "it appeared that the work likely meets the Standards and is straightforward enough that it could be revised at the staff level, rather than at an LPC meeting. I'll be able to confirm this later this week."[14]

On July 12, 2019, Ms. McWilliams completed the review and approves the work via email.[15] For its part, the Barlow group, upon review of this work stated, "Following its review, BCRC ("Barlow") believes that all the scope items either comply with the Secretary of Interior's Standards or had previously been recommended as a reasonable compromise."[16]

On July 15, 2019, the HPM issues a Certificate of Appropriateness ("COA") for "Approval of Plans dated July 1, 2019, to Restore and Rehabilitate 2nd and 3rd Floor Historic Windows, Linden Hotel, 201 Linden Street" and Issuance of a Certificate of Appropriateness. The entirety of the COA is quoted

[13] Letter from Mark Wernimont to Karen McWilliams dated 7/1/2019.
[14] 7/10/2019 email from Karen McWilliams to Mark Wernimont.
[15] 7/12/2019 email from K. McWilliams.
[16] 7/12/2019 Staff Report re: 201 Linden Street, Linden Hotel Windows – Design Review.

below. Nowhere, does it reference the COA as being conditioned upon further modifications outlined in the Barlow Report. Rather, it states in its entirety:

> Dear Mr. Wernimont,
>
> This Certificate of Appropriateness provides you with confirmation that the proposed work to restore and rehabilitate the 2nd and 3rd floor historic windows in the Linden Hotel, 201 Linden Street, has been reviewed and approved by the City's Historic Preservation Division staff. Staff finds that the proposed work meets the criteria and standards in Chapter 14, Article IV of the Fort Collins Municipal Code, including the Secretary of the Interior's Standards for Rehabilitation and the Old Town Historic District Design Standards.
>
> Please note that all ensuring work must conform to the approved plans. Any non-conforming alterations or changes to the plans are subject to stop-work orders, denial of Certificate of Occupancy, and restoration requirements and penalties.
>
> If the approved work is not completed prior to the expiration date noted above, you may apply for an extension by contacting staff at least 30 days prior to the expiration. Extensions may be granted for up to 12 additional months, based on a satisfactory staff review of the extension request.
>
> If you have any questions regarding this approval, or if I may be of any assistance, please do not hesitate to contact me. I may be reached at kmcwilliams@fcgov.com or 970-224-6078.
>
> Sincerely,
>
> Karen McWilliams
>
> Historic Preservation Division Manager

Subsequently, the Owners engaged in rehabilitation and maintenance work to ensure the windows safety. In an abundance of caution, the City and the Owner's representative met to discuss the repairs that were undertaken.

The former Community and Neighborhood Services Director for the City of Fort Collins, Mr. Tom Leeson, clarified to the manager of 201 Linden Street that a Certificate of Appropriateness **was not required** for the repair work the Owners had engaged in. His exact words were:

> I interpret this to mean that if you are not proposing to "replace" the windows, that a Certificate of Appropriateness is not required. Therefore, a Certificate of Appropriateness is not required, and you may proceed with the alterations to the windows as proposed.[17]

Thus, for the City to insinuate that the Owners failed to comply with minimum maintenance requirements and thereby violated City Code section 14-7 and 14-51(d) is inaccurate and unnecessarily hostile.

3.c. Early 2020 to Early 2023.

It is worth pointing out that from early 2020 until early 2023, the City of Fort Collins, (along with the rest of society), was largely shutdown or had greatly reduced productivity due to the COVID-19 Pandemic. (It bears mentioning that the City itself had approximately thirty-percent staff turn-over during this time and development projects and historic reviews were backlogged for extensive periods.) Even if the Linden Hotel Owners had wanted to move forward with additional repair to the windows, it would have been virtually impossible to do so in that time frame.

3.d. Correcting the City's Inaccurate Statements.

The City's Legal Memorandum engages in an inaccurate recitation of the facts and blames the Linden Hotel Owners for the failure of the windows is inappropriate and prejudicial. To argue in the Legal Memorandum that there was "no change in circumstance" because the Linden Hotel Owners did not undertake action in exact conformance with an outdated 2018 Barlow Report is nonsensical. The Barlow Report never addressed the fundamental design flaw that has caused the majority of the resulting safety, operability, and performance issues the one-hundred and forty-two-year-old windows are now exhibiting. For the Legal Memorandum to take that claim a step further and argue that the Linden Hotel Owners failed to comply with the International Property Maintenance Code and use this as a pretense to deny their request to move forward with addressing very real safety, operability and performance claims in their building is a clear violation of the Linden Hotel Owners' due process rights.

4. The Wernimont Expert Report: Moving Forward.

The Linden Hotel Owners received a list of proposed City experts to provide the City with guidance as to how the matter should best proceed with repair or replacement of the dangerous condition the

[17] *Email communication from Tom Leeson*, Community Development and Neighborhood Services Director of February 26, 2020.

current windows may present if not addressed. After months of attempting to reach these experts, none of these proposed experts could take on the project in a timely fashion and none would sufficiently consider the operability, performance and resident safety needs of the windows in their analysis. The Linden Hotel Owners and the residents of the building simply cannot wait any longer to have this matter resolved. Therefore, they reengaged Mark Wernimont to provide a study and assessment in the hopes of finally resolving this matter. The Owners attempted to have the matter heard in June, but the Historic Preservation Commissions schedule could not accommodate this hearing until July 2024.

Mr. Wernimont's expert report takes into account historical relevant Secretary of Interior Standards as well as operability, environmental and safety concerns, which the Barlow Report failed to do.

It is also important to note that the Secretary of the Interior Standards ("SOIS") put forth guidelines intended to promote responsible preservation practices. However, the SOIS website notes that its standards "cannot, in and of themselves, be used to make essential decisions about which features of the historic building should be saved and which can be changed. But, once a treatment is selected, the Standards and Guidelines provide a consistent philosophical approach to the work."[18] Due to the fundamental design flaws of the windows and the very real safety, operability and performance risks they present, as outlined in the Wernimont Report, replacement of the Linden Hotel windows is the appropriate course of action.

5. Secretary of the Interior Standards.

According to the SOIS website, when replacement of portions of historic buildings is necessary, "replacement material must match the old . . . with the exception of hidden structural reinforcement."[19] The Wernimont Report meets this objective by selecting materials and replacement that are visually indistinguishable from the originals. All told, the only visual change to the windows would be a one-half (or less) increase to the chair rail of the windows, which will be visually undetectable on these second and third story windows from the street below.

Even the SOIS "Restoration" standards and the Barlow Report acknowledge that "when the severity of deterioration requires replacement of a distinctive feature, the new feature will match the old in design, color, texture and where possible, materials."[20] This is exactly what the Owners are attempting to achieve.

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[18] https://www.nps.gov/orgs/1739/secretary-standards-treatment-historic-properties.htm
[19] https://www.nps.gov/orgs/1739/upload/treatment-guidelines-2017-part1-preservation-rehabilitation.pdf. Introduction P. 28.
[20] *Id*. and *Barlow Report*, at packet pg. 133. *See* Exhibit 1

With regards to window specific rehabilitation, the SOIS Treatment Guidelines[21] provides that:

- "Replacing in kind an entire window that is too deteriorated to repair 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."

Additionally, the SOIS recommends replacing all components of the glazing system if they have failed because of faulty design or materials that have deteriorated with new mater that will improve the window performance without noticeably changing the historic appearance.

Finally, where replacement is necessary for the entire window, the SOIS recommends using the physical evidence as a model to reproduce the feature. It acknowledges that 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." [22]

6. City Goals and Policies.

6.a. Historic Preservation.

The replacement windows meet the City's stated Historic Preservation goals of building safety, environmental, sustainability, performance, operability and long-term sustainability of historic resources. The City's stated policy declaration for the Historic Preservation Committee states:

> (a) It is hereby declared as a matter of public policy that the protection, enhancement and perpetuation of sites, structures, objects and districts of historic, architectural, archeological, or geographic significance, located within the City, are a public necessity and are required in the interest of the prosperity, civic pride and general welfare of the people.
>
> (b) It is the opinion of the City Council that the economic, cultural and aesthetic standing of this City cannot be maintained or enhanced by disregarding the historical, architectural, archeological and geographical heritage of the City and by ignoring the destruction or defacement of such cultural assets.[23]

[21] https://www.nps.gov/orgs/1739/upload/treatment-guidelines-2017-part2-reconstruction-restoration.pdf. *See* Exhibit 2.
[22] *Id*. *See* Exhibit 3.
[23] Fort Collins Municipal Code Section 14-1.

Fort Collins Municipal Code Section 14-2 outlines purpose of Historic Preservation governance as being to:

- stabilize or improve aesthetic and economic vitality and values of such sites, structures objects and districts;
- promote the use of important historical structures;
- promote the use of architectural sites and structures for the education, stimulation and welfare of the people of the City;
- promote and encourage continued private ownership and utilization of such sites, structures, objects or districts now so owned and used; and
- Promote economic, social and environmental sustainability through ongoing "use" of existing buildings.[24]

Further, replacement of the windows has only a minimal exterior visual impact on the historic character of the building. A less than one-half inch deviation in the chair rail, not visible from the street in the second and third floor windows cannot be credibly claimed to negatively impact the historic architectural character of the building. The same can be said of replacement materials that are visually indistinguishable from original materials. The architectural style, arrangement and perceptible texture of the street facing materials in maintained. The replacement windows would in no way change or destroy the exterior characteristics of the building, but rather would serve to retain the visual integrity and prevent further exterior deterioration. The proposed work, as discussed above meets the SOIS for warranted replacement of historic materials.

Approving the replacement windows meets all of the listed Historic Preservation purposes. To require repair of windows with fundamentally flawed design undermines these policies and ignores other equally important City policies related to life/safety concern, sustainability, private property owner control and maintenance of property, and long-term preservation of historic buildings. A narrow interpretation of the SOIS regarding the priority of replacement of historic materials without consideration of the City's (and property owners') other equally important goals serves only to undermine the longevity of the City's goal to "promote economic, social and environmental sustainability through use of historic buildings."

Simply put, if the City refuses to view needed replacement work to landmarked properties in the appropriate context of serving multiple City and property owner goals, it will continue to

[24] Fort Collins Municipal Code Section 14-2

have a chilling effect on private property owners stepping forward to take on the colossal task of preserving these buildings.

6.b. Safety and Sustainability Goals.

It is critical to recognize that the Historic Preservation Goals do not exist in a vacuum and other, equally important City goals and policies must also be considered in making decisions that impact other City priorities. Specifically, safety and building code compliance, support of private property rights, and climate goals must be taken into account. Common sense building safety would prioritize residential buildings with operable and functioning windows. Requiring repair of the Linden Hotel windows over replacement does not account for this.

The International Code Council section 403.1 that provides guidance on the International Property Maintenance Standards requires that every Habitable Space has at least one openable window. The total openable area of the window in every room shall be equal to at least 45 percent of the minim glazed area.[25] When a private property owner wishes to provide operable windows in its residential buildings to support the buildings long-term utilization, this is a factor that the City should weigh heavily as a recognition of private property owner rights. The same can be said of factoring in the City and private property owners' sustainability goals.

Turning to larger scale sustainability goals, the City of Fort Collins Our Climate Future adopted policy documents recognize that "[a]cting on climate change is urgent and we recognize it will take our community actively working together to address the challenge. . . Our Climate Future expresses our unwavering commitment to mitigating climate change with a systematic approach that is centered in people and community priorities."[26] One of the clearly stated objectives of the Climate Future policy document is to have "Efficient, Emissions Free Buildings."[27] The City espouses similar goals in the creation of a Fort Collins "Our Climate Future Action Guide" of reducing home and business carbon emissions and improving energy efficiency. [28] The buildings in Fort Collins compromise over two-thirds of its carbon emissions to provide for heating, cooling, lighting etc.[29] Demanding strict adherence to the SOIS

[25] International Code Council's International Property Maintenance Standards of the International Property Maintenance Code p. 4. The City has largely adopted the International Residential Building Codes, but only minor edits to the body of that document are available within the Code or on the City's website. Thus, such regulations specifications are inaccessible to average residents.
[26] City of Fort Collins, Our Climate Future Plan p. 4.
[27] *Id*. at p. 25, 42-43.
[28] City of Fort Collins, Our Climate Action Guide p. 7
[29] Our Climate Future Plan p. 42.

Rehabilitation over Replacement standards defeats these goals. The Owners support the City's commitment to these climate action goals and seek to further them through replacing windows at 201 Linden with those that have far superior energy efficiency but are visually virtually indistinguishable from the originals.

Additionally, the replacement windows meet the City's 2024 adopted International Building Codes:

- Item 1015.8 for Window Opening operability for windows 72'' from exterior grade;
- Item 1609.3 Wind Loading. This standard established a required wind loading capability of 140 mph ultimate for sural performance of all exterior items;
- Item 3603.2 Sound Control. This requires the exterior wall assembly meet an STC 39 when within 1,000 feet of an active train line – which the Linden Hotel is; and
- the Dessing Pressure rating for the windows.

The replacement windows serve to protect, enhance and perpetuate the use of the 201 Linden Street property as a residential building. The investment in quality replacement also significantly decreases the ongoing maintenance needs required by the current windows, which, frankly, are unsustainable.

The Owners posit that if the City carefully weighed all applicable City policy goals and objectives and private property owners' rights together, it would conclude that replacement of the 201 Linden Hotel windows is appropriate and far more supportive of the City's long-term goals than never-ending piecemeal rehabilitation efforts.

7. Conclusion.

The Linden Hotel Owners request that this letter be made part of the packet for the Historic Preservation Commission's review and further request a combined Conceptual and Final Review pursuant to Section 14-54[30] of the City Code, the approval of their proposed window replacement and the issuance of a new Certificate of Appropriateness.

At this time, for reasons of safety, operability, and performance, the one-hundred- and forty-six-year-old windows in at 201 Linden Street must be replaced. The Owners are committed to the

[30] The Owners will leave it to Staff's discretion whether HPC review or Staff review is appropriate under Section 14-53.

preservation and maintenance of the entire 201 Linden Street property and the proposed window replacements meet the purpose and policies of the Landmark Preservation and the City as a whole.

To require conformance with the SOIS on rehabilitation for windows that have fundamentally flawed design, when replacement meets the City goals of historic preservation, safety and environmental performance, is poor public policy. The Historic Preservation Commission is encouraged to review the situation wholistically taking into account the City's building standards for safety, operability of windows, weatherization and environmental performance standards and the feasibility of maintaining 201 Linden Street for the next one-hundred years.

Sincerely,

Claire N. Havelda

cc: David Diehl

29722449.1

Poudre Fire Authority
FORT COLLINS, COLORADO

NFIRS Full Report

Basic-Details

Incident Number: PFA232940 039 **NFIRS Number:** 2328711 **Exposure:** 0 **Incident Date:** 10/21/2023

Call Dispatched as: SRVICE **Incident Type:** 460-Accident, potential accident, other

Primary Action Taken: 86-Investigate

Aid Given or Received: None

Fire Service Deaths: 0 **Fire Service Injuries:** 0

Civilian Deaths: 0 **Civilian Injuries:** 0

Basic-Location and Property Info

Incident Street Number: 201 **Incident Street Name:** Linden **Incident Street Type:** ST-Street

Incident City: FORT COLLINS **Incident Postal Code:** 80524

Incident Location Type: 1-Street address **Property Use:** 400-Residential, other

Mixed Use Property: 58-Business and residential use **Incident GPS Location:** 40.588386,-105.075422

Person/Owner Involved

Business Name	Phone Number	Person or Entity Involved Type	Person Involved Title	Person Involved First Name	Person Involved Last Name
Natures Own	(970) 484-9701	5101012-Employee		Brady	Geraghty
Linden Street Treehouse LLC	(970) 420-8897	5101017-Property Manager	MR-Mr.	David	Diehl
Lochland Management Company	(970) 215-1794	5101017-Property Manager	MR-Mr.	Mark	Wimmer

Basic-Times and Apparatus

PSAP Date Time: 10/21/2023 14:16:01 **Alarm Date Time:** 10/21/2023 14:16:51 **Arrival Date Time:** 10/21/2023 14:21:26 **Last Unit Cleared Date Time:** 10/21/2023 15:26:42

Shifts or Platoon: B 4896

Suppression Apparatus: 2 **Suppression Personnel:** 7

EMS Apparatus: 0 **EMS Personnel:** 0

Other Apparatus: 0 **Other Personnel:** 0

Apparatus

Apparatus or Resource ID	Apparatus or Resource Dispatch Date Time	Apparatus or Resource Enroute Date Time	Apparatus or Resource Arrival Date Time	Apparatus or Resource Clear Date Time	Apparatus or Resource Response Mode to Scene

Any fields that are blank in this report did not pertain to this incident

Apparatus or Resource ID	Apparatus or Resource Dispatch Date Time	Apparatus or Resource Enroute Date Time	Apparatus or Resource Arrival Date Time	Apparatus or Resource Clear Date Time	Apparatus or Resource Response Mode to Scene
E01	14:16:51	14:18:14	14:21:26	15:26:42	Non-Emergent

Apparatus Personnel

Personnel Name/ID
Meza, Carlos
Bourdon, Robert
Tete, Caleb

TW01	14:25:16	14:26:31	14:33:06	15:23:11	Non-Emergent

Apparatus Personnel

Personnel Name/ID
Moinester, Justin
Hubbard, Gregory
Newby, Dawson
Russell, Steven

Basic-Resources Utilized

Was this address accessible by type 1 and support apparatus?: Yes-Both

Was an on-call bureau called for on this incident: No

Did you consult with the hazmat team via phone, radio, etc.: No

Basic-Internal Data Collection

Did this call involve known or suspected weapons: No

Was this call related to the homeless population: No

Was a monitor used: No

Fire-Details

Exposure Report: N-No

Hazmat Ops Level Report

Did you consult with the hazmat team via phone, radio, etc.: No

Any fields that are blank in this report did not pertain to this incident

Narratives

Primary Narrative: Dispatched to a report of a service call regarding windows that were falling from the 2nd and 3rd floors at the stated address. Upon arrival, command was established and contact was made with the RP.

RP reported he needed assistance as the windows were beginning to fail and that one pane of glass was about to fall. He stated one window pane had fallen along the east side from the 2nd floor earlier in the day. He also pointed out along the Southside of the building on the 3rd floor a window had already fallen out previously and was missing and another window that had a pain of glass that was not secure and could fall at any moment. The sidewalk was immediately shut down in front of the building. Due to the height of the un-secure window, TWR1 was requested to gain access to remove the pane of glass from the exterior.

TWR1 then arrived on scene and accessed the pane of glass that was un-secure via the aerial. They also checked multiple windows to see their current status and multiple windows showed signs of the exterior frame rotting. E1 crew made access interior and checked the windows from the inside on floor three. No other windows had glass that was insecure though windows showed signs of frame rot.

These findings were passed on to the RP. The RP advised they had been working to get the windows replaced but were having issues dealing with the city as they were considered "historic" windows.

E1 officer then requested a building inspector to respond out through dispatch. Dispatch then advised the building inspector would not be responding out as all they would do was advise the owners to board up and secure the windows and then hire a contractor to fix them. E1 officer advised how the windows were historic windows and dispatch advised the building inspector was not concerned and they just need to hire a contractor.

This information was passed on to the property manager and the manager of the building LLC. They advised they would work on getting the windows secured and replaced. The sidewalk on both the Walnut and Linden sides of the road were taped off in an attempt to secure the area from any other hazards for foot traffic. E1 officer contact info was left for any further communication the RP's needed in replacing the windows. The RP's were advised the PFA crews were not able to check all windows, but that the issue presented a safety hazard and needed to get addressed immediately. If some had already failed, then it was likely that more would soon fail. RP's understood and advised no other assistance was needed. E1 officer also advised the RP's that a Bureau reference would get sent in to see if the Bureau of the PFA could assist in anyway to help them deal with the city in getting these windows replaced as it now presented a safety hazard for the public and the historic criteria was now irrelevant.

With no other needs from the RP's on scene, E1 and TWR1 crews cleared and became available.

Narratives

Additional Narratives

PFA23-20507 | 10/21/2023 14:16:47FCC270 [1] panes of glass from 2nd and 3rd floor windows falling out - staff requesting fire dept assist for public safety | 10/21/2023 14:17:11FCC270 [2] on site employee/Wimmer,Mark ph/9702151794 | 10/21/2023 14:17:59FCC270 [3] they are old historic windows that started falling out today unexpectedly - a couple have already fallen and staff is trying to keep ppl off the sidewalk | 10/21/2023 14:21:26E01 [4] E01 OS at 10/21/2023 2:21:26 PM, Latitude: 40.5879628, Longitude: -105.0752043 | 10/21/2023 14:25:17FCC271 [5] Backed up E01 with TW01 | 10/21/2023 14:31:04FCC271 [6] E01 MAY NEED CITY BLDG INSPECTOR - 2 WINDOWS HAVE FALLED OUT, DOUBLE PANED WINDOWS | 10/21/2023 14:31:17FCC271 [7] E01 WINDOWS ARE HISTORIC | 10/21/2023 14:33:06TW01 [8] TW01 OS at 10/21/2023 2:33:06 PM, Latitude: 40.5882908, Longitude: -105.0758298 | 10/21/2023 14:40:37FCC271 [9] SPOKE WITH BLDG INSPECTOR DAMIAN 970-218-1073 AND HE SAID HE WOULD ONLY GO OUT AND TELL THEM TO BOARD UP THEIR WINDOWS - THEY NEED TO FIND A CONTRACTOR

Apparatus

There are no apparatus narratives

CRR/Outreach

CRR Referral-Please select the Other

Any fields that are blank in this report did not pertain to this incident

appropriate choices below:	
Provide information explaining your referral above:	RP's on scene may need help dealing with the city getting these windows replaced. RP's report they have been trying to get the windows replaced prior to this occurrence but were running into issues dealing with the City as the windows were considered "Historic". WIth the windows now presenting a safety hazard for all foot traffic below, repairs are now needed and a push from Community Risk Reduction to help make this happen may be needed. Perhaps a follow up with the involved parties may be helpful to see if any roadblocks are still being encountered in their process of addressing the issue.

Attachments

Addendums

Authorization

Member Making Report:	1239
Member Making Report - Signature:	Meza, Carlos
Member Making Report - Position or Rank:	Lieutenant
Officer in Charge:	1239
Officer in Charge - Signature:	Meza, Carlos
Officer in Charge - Position or Rank:	Lieutenant

Any fields that are blank in this report did not pertain to this incident

Colorado Sash & Door, Inc,
4521 Endeavor Drive, Unit C
Johnstown, Colorado 80534

Window Assessment
For:

2nd and 3rd Floor Windows At
201 Lindon Street
For Collins, Colorado
80521

Wood Window Restorations
1993/1994
2019/2020

201 Linden Building
Window Information, Past Repairs and Proposed Replacement

201 Linden was built 1n 1882, and the windows have been worked on many times over the years. Prior work that we are aware of was in 1997/1998 where it is not clear if more work was done on them other than scrape or paint. In 2018/2019 a full restoration of the window sashes was completed. At this time the intent was to replace any damaged window parts, make the windows more energy efficient, better sound control and better able to keep air, dirt and insects out of the building. At that point roughly 30% of the upper sash check rails had to be replaced due to sagging and deterioration.

What was making these parts fail were the 1 3/8" thickness and very narrow check rail size.. All of the components used in this building were the same as windows in modest homes of the same time. However the openings in this building are lager than doors in those same structures. The majority of the windows in this project have a 39" x 98" masonry opening. If the components would have been done with 1 3/4" thickness and of larger size, which we have found in similar sized commercial building, the failure of the check rail most likely would have not happened.

After the assessment of the current window conditions, I will provide a drawing that shows what the component sizes used in this building are along the size components in other similar structures as well as the sizing for the replacement window requesting to be used to replace the existing windows.

201 Linden Window Conditions
May 2024

We were asked to go in and review the current conditions of the windows. Since the renovation work was completed, the windows on both floors had an acrylic panel installed to the inside that did not fill the opening to the top as 8' sheets were used. I was told that this was to help control air infiltration and keep dust down. To facilitate this, the metal recessed sash lifts had been removed and a wood stop installed on the sills.

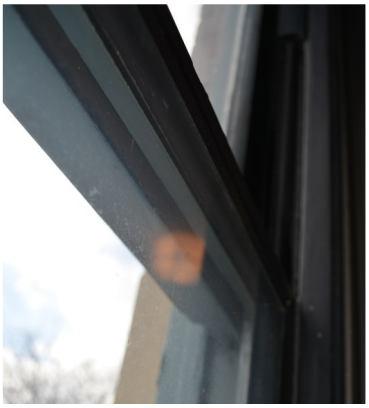
Sill Stop with New Acrylic Panel

Acrylic Panel Removed

Sash Screwed Together

Just prior to our site visit the interior sections of acrylic were removed, believing that we would be able to operate the windows. However, we found that there were no windows that we could operate. In some locations both sash had been screwed together. All of the windows on the 2nd floor were caulked shut and the windows on the 3rd floor were at least painted shut if not caulked shut as well. A few Openings on the 3rd floor had hinged interior Storm Windows installed.

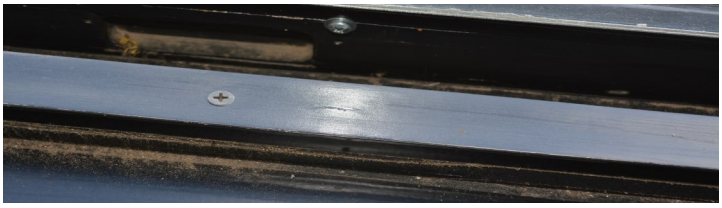
We found that 30% plus of the upper window sash were not fully up in the frame. The meeting of the upper and lower sash did not happen. There were a few gaps between the upper sash and the window frame.



Upper Sash Sitting Below the Lower Sash at the Check Rail

Correct Fitment of Upper Sash

On around 10% of the window sash the RDG panel was not attached to the lower sash. It was Leaning against the acrylic panel or sitting on the sill. The tabs and screws that held them in place were not engaged. In a few spots an additional screw were added in the center of the bottom which seemed like a good solution.



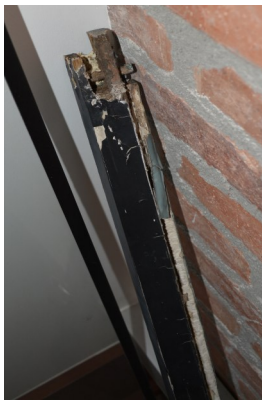
Added Screw for RDG,

Tab Not Engaged, RDG is Loose

The interior of all the window were painted black and this was mostly in good condition. There was some paint removed with taking down the acrylic panels but did not show much issue. However on the exterior the sills in a lot of locations the sills did show paint failure down and including the primer on the frames. A few locations showed failure of the paint on the sash. We were not able to do a full assessment on the exterior with the exterior acrylic in place and needing to close the sidewalk for a lift to get to these windows. However we were able to photos of most of the surfaces prone to failure.

Exterior sill paint failing on all these. Note the exterior acrylic panel in place and in the photo below the interior acrylic panel is still in place.

The one section we did key in on was the upper sash check rail. The check rail is the bottom of the upper sash and top of the lower sash where the two sash meet. We were told that one of the window parts came off and hit the sidewalk. We have photo of this sash and the missing part. With the restoration in 2019/2020 roughly 35% of these parts were replaced.



Part That Fell

Sash With The Missing Check Rail

Replaced Check Rail

Failing Check Rail

These sections are very thin for a window of this size. You can see the parts that were replace in the photos. In the photos attached you will see that there are 1 or 2 rails that show some signs of failing. We are not sure how similar these are to the one that failed but we are almost a year later. These are on the same side and just a few windows away from the one that failed.

Around these sash where the check rail is failing are several that had been replaced with the restoration. These still look in good condition today. If the sash are to be left in place, a wood support block running from the sill up to the bottom of the upper sash could be installed. They would sit in the pocket where the upper sash would have moved down. At the same time the upper sash should be moved fully up in the frame so that the check rails may meet and provide the seal as they were designed.

Along with this work, the exterior needs to be cleaned scraped primed and painted again. This process will most likely need to be done every 5 or so years based on the dark color and amount of sun light these windows are exposed to. I had believed and stated with the window survey done in 2016 prior to the last work, that the component sizes on these windows were sized for use in windows of much smaller openings. I still believe this today. These openings are larger than windows just restored in the Carnegie Building here in Fort Collins for the City, but all of the components are thicker and wider than what is in the 201 Linden Building.

Sample Replacement Window in Storage

A replacement window system that was used on the alley windows had been proposed. This replicated the window dimensions including the daylight openings with in a 1/4" except at the check rail, which is the part that is failing. Along with this all wood option with a factory paint that carries a 10 year warranty, we can replicate the sash, frame and trim in aluminum clad wood. These windows have the same profiles as the all wood units.. The gloss of paint is also the same as painted wood but it provides the owner with a 30 year warranty on the finish. Examples of these are in buildings following. This is a small sample of Historic Approved Buildings with replaced windows.

Insert Window Replacement Information

Pro Quote on Window Options

Information on Ultra Clad Windows

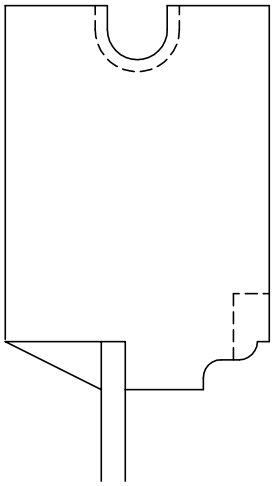
Specifics for Ultra Clad Sterling XL Double Hung Windows

Sections and Special Trim for Windows

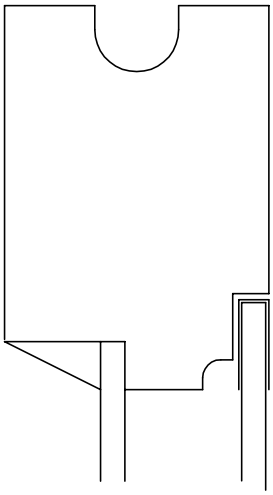
Wind Facts Information for Wind Loading

Th Tivoli Building was replicated with an all metal exterior so painting was not needed. This including the exterior of the sash, frame, brickmould, sills, mull covers and decorative trim blocks. All of this matched the original profiles. Simulated divide lights were done to match the original. This included some sash that had none.

The Windsor Mill was replaced with aluminum clad wood windows. Similar brickmould as this project. The heavy timber sill was replicated as well as the radius trim. The different color top was done to note the section removed by the tornado but the window details are the same. This project has simulated divided lights to match the true divided lights of the original building



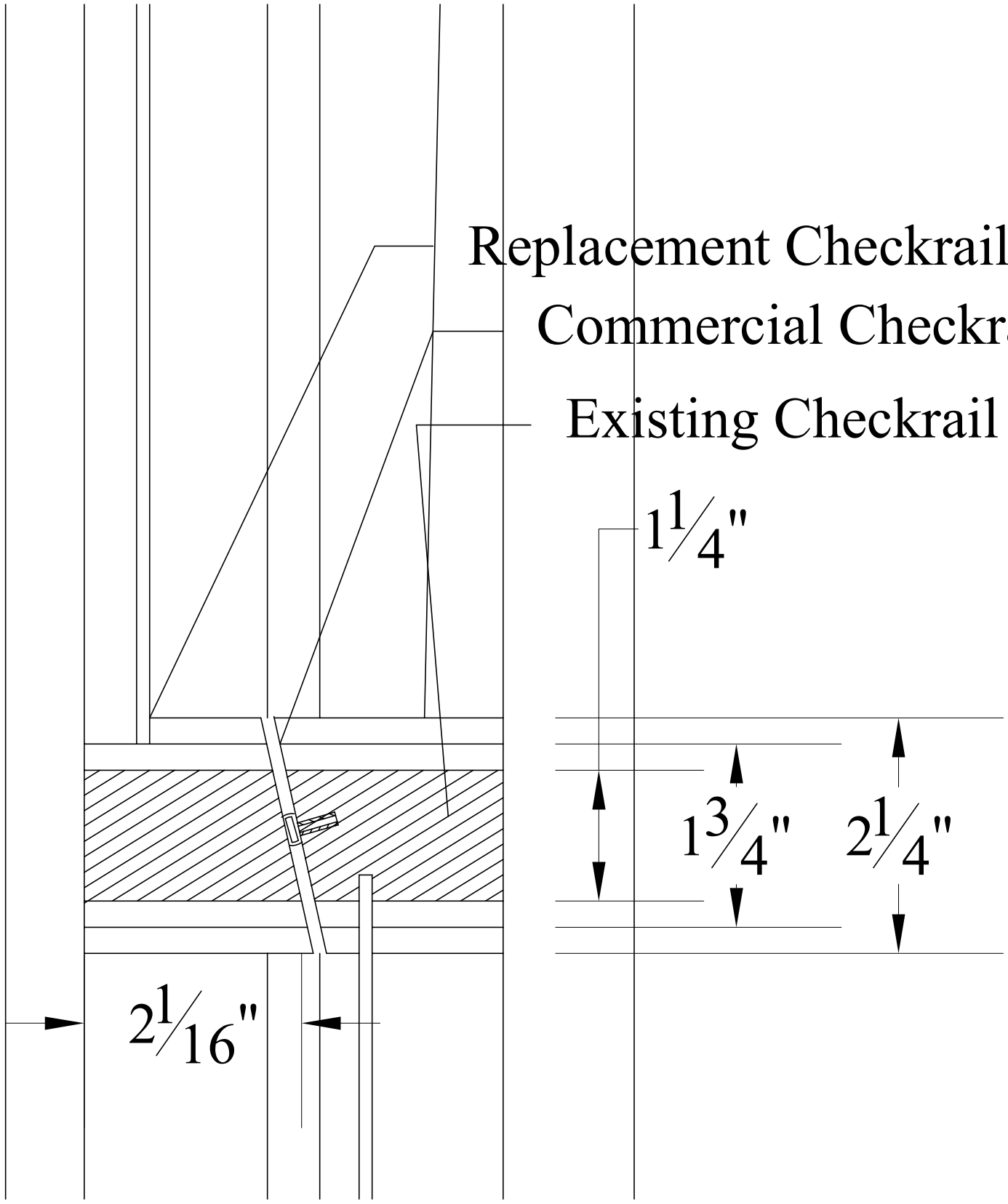
Existing Sash
Set for Rope and Weight
Dash Line Represents Wood Removed



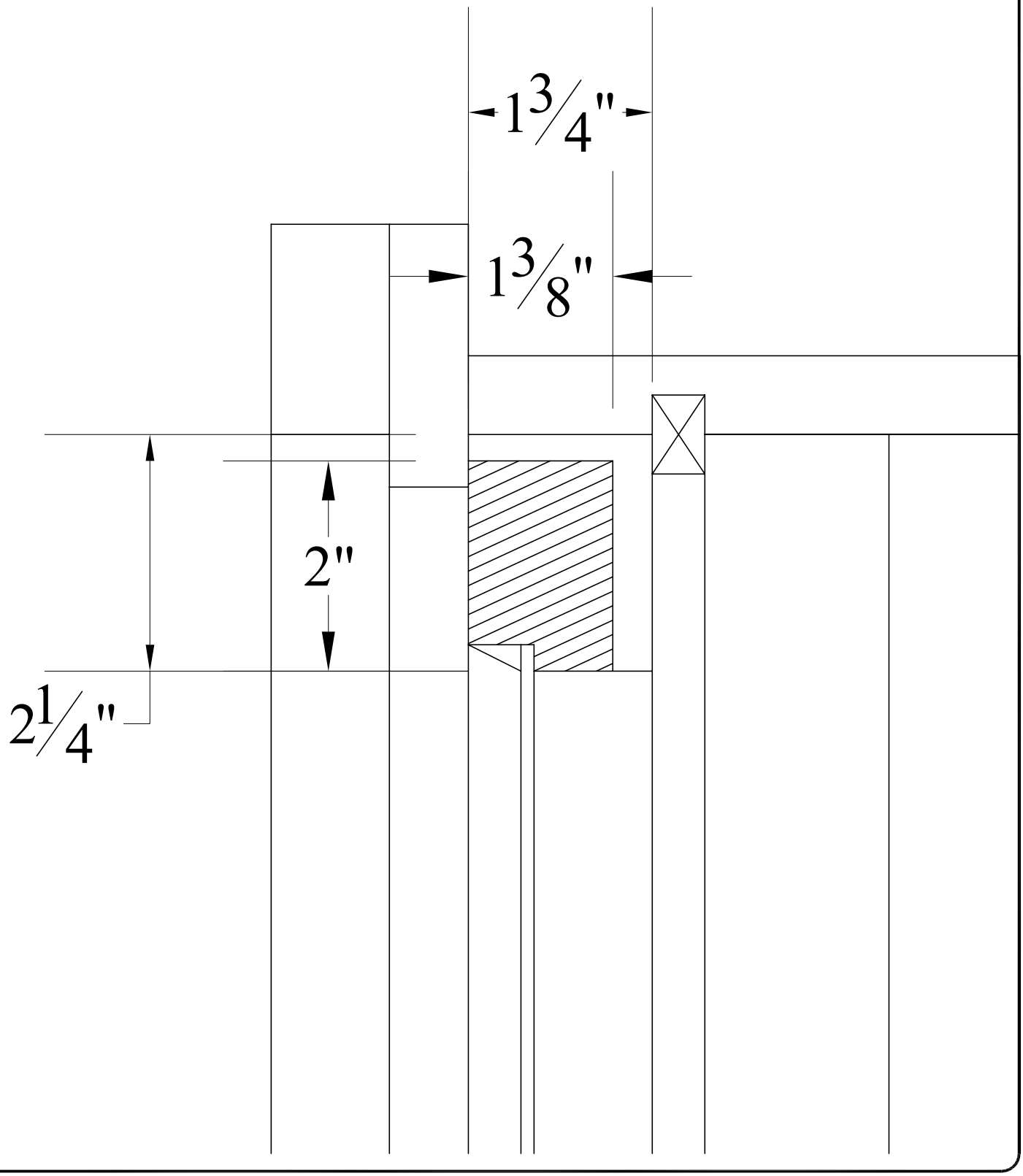
Sash With Prep
For Spiral Balance
and Interior RDG

Note That All Work is On The Interior
Nothing Shows on the Exterior

DRAWN BY: MJW	SCALE: Full Size	ARCHITECT: .	Colorado Sash & Door, Inc.	PROJECT: 201 Linden	PROJECT NO.: 24008
FIRST ISSUE DATE: 06/15/2024		CONTRACTOR:	4521 Endeavor Drive, Unit C Johnstown, Colorado 80534 ph (970) 226-1460, Cell (970) 402-2623 office@colosash.com		DRAWING NO.: 3 of 3
REVISION: 1 . 2 . 3 .		201 Linden Street Fort Collins, Colorado .		TITLE OF DRAWING: Prep for RDG and Spiral Balance	



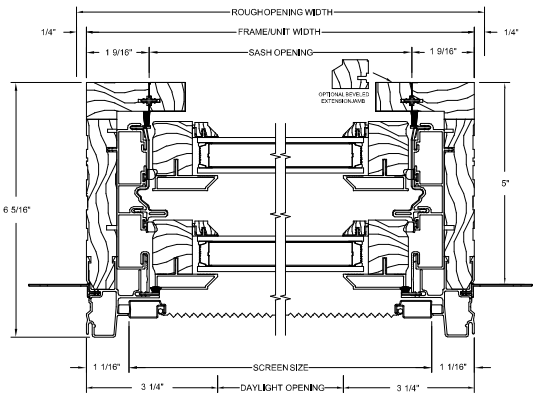
DRAWN BY: MJW	SCALE: 9" = 1'-0"	ARCHITECT: .	Colorado Sash & Door, Inc.	PROJECT: 201 Linden
FIRST ISSUE DATE: 06/15/2024		CONTRACTOR: .	4521 Endeavor Drive, Unit C Johnstown, Colorado 80534 ph (970) 226-1460, Cell (970) 402-2623 office@colosash.com	PROJECT NO.: 24008
REVISION: 1 . 2 . 3 .		201 Linden Street Fort Collins, Colorado .		DRAWING NO.: 2 of 3
				TITLE OF DRAWING: Check Rail at Upper and Lower Sash



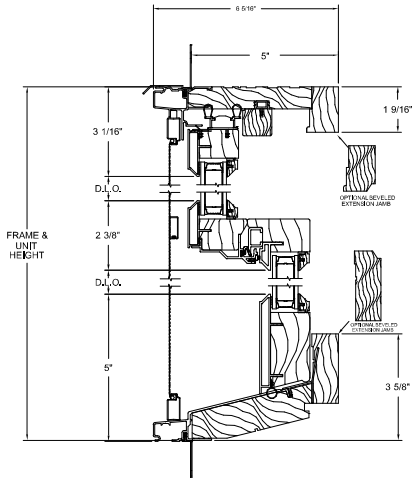
DRAWN BY: MJW SCALE: 9" = 1'-0" FIRST ISSUE DATE: 06/15/2024	ARCHITECT: CONTRACTOR:	Colorado Sash & Door, Inc. 4521 Endeavor Drive, Unit C Johnstown, Colorado 80534 ph (970) 226-1460, Cell (970) 402-2623 office@colosash.com	PROJECT: 201 Linden TITLE OF DRAWING: Sash Side and Head	PROJECT NO.: 24008 DRAWING NO.: 1 of 3
REVISION: 1 . 2 . 3 .	201 Linden Street Fort Collins, Colorado			

XL Sterling Double Hungs | Operating

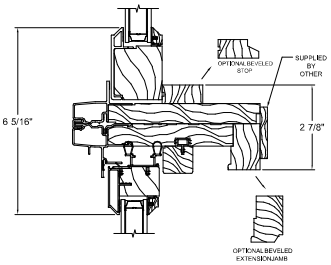
Horizontal Section



Vertical Section

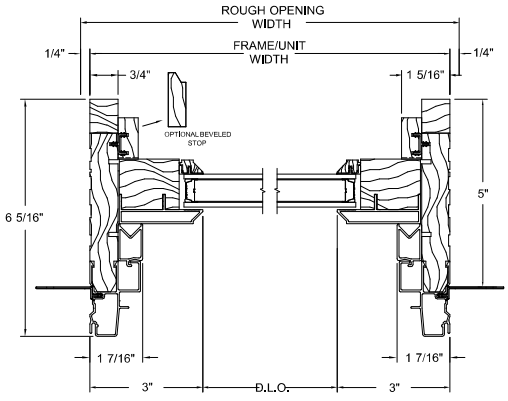


Transom Stacked Above

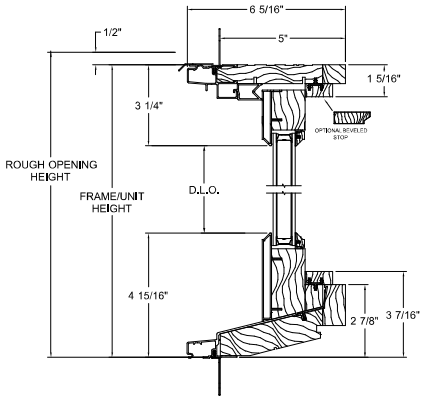


XL Sterling Studio Units

Horizontal Section



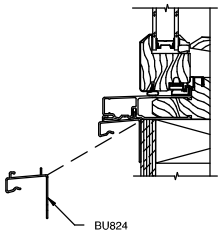
Vertical Section



NOTE: Drawings are not to scale. Brickmould is shown factory-applied. Brickmould may be shipped loose for field application. Some units are shown with optional drip cap or nailing fin. For Ultra accessory or application drawings, see pgs. 206-212. Additional and the most current drawings are available at **www.kolbewindows.com**.

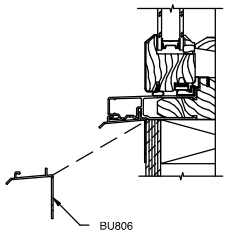
Application Details

Traditional Sill Nosing *(standard)*



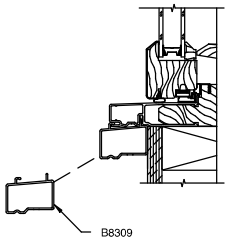
Profile BU824 may be applied to units with 1-15/16" brickmould, 3-1/2" brickmould or 3-1/2" flat casing. Colored to match the unit.

Sill Drip



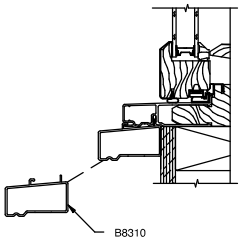
Optional Profile BU806 may be applied to units with 1-15/16" brickmould, 3-1/2" brickmould or 3-1/2" flat casing. Colored to match the unit.

1-5/8" Sill Nosing



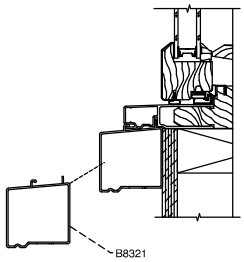
Optional Profile B8309 may be applied to units with 1-15/16" brickmould, 3-1/2" brickmould and 3-1/2" flat casing. Colored to match the unit.

2-1/8" Sill Nosing



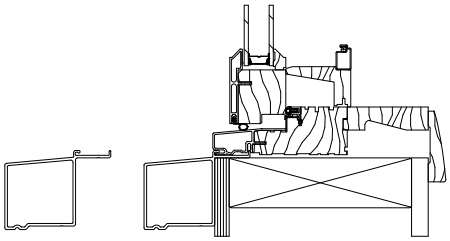
Profile B8310 is a standard application to units with backband, ogee casing and bullnose brickmould. Colored to match the unit.

2-1/8" Historic Nosing



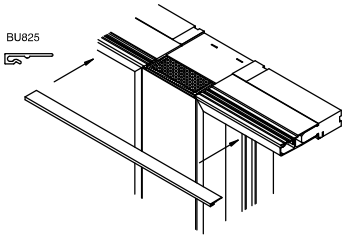
Profile B8321 is a standard application to units with historic brickmould. Colored to match the unit.

Stucco Sill Nosing



Profile B8330 is factory applied as standard and used for Stucco finish applications. Colored to match the unit.

Head & Sill Trim

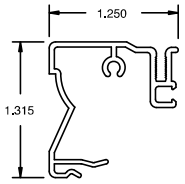


Profile BU825 may be used on spread mulls and stacked units without brickmould. Colored to match the unit.

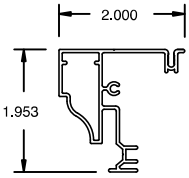
NOTE: Drawings are not to scale. Additional and the most current drawings are available at **www.kolbewindows.com**.

Accessories

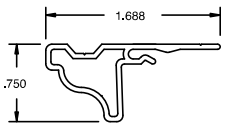
Casing



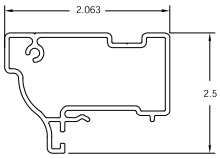
B802
2" brickmould without leg



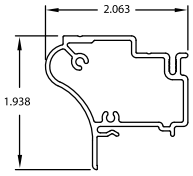
BU834
Receiver trim backband profile



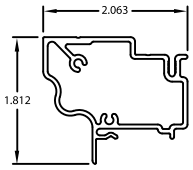
B842
Ogee trim



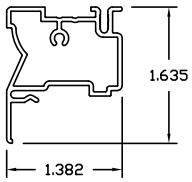
BU864
Pavilion casing



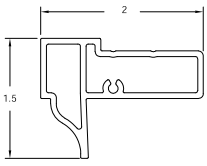
BU865
Bull nose casing



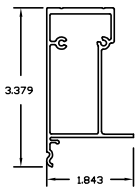
BU866
Historic trim



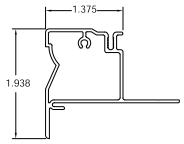
BU900
1-5/8" brickmould



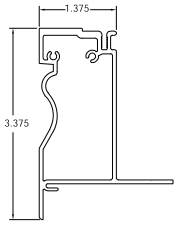
BU905
Backband



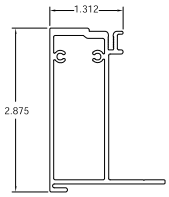
BU917
3-1/2" beaded casing



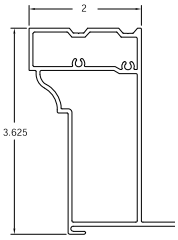
BU919
1-15/16" brickmould with leg



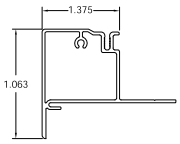
BU920
3-1/2" Brickmould with leg



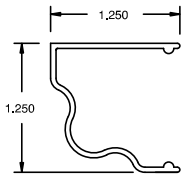
BU921
3-1/2" flat casing



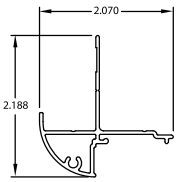
BU922
3-1/2" flat casing with backband



BU924
2" flat casing



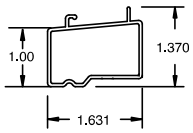
B8304
Chicago brickmould



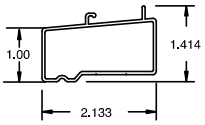
B8329
Stucco casing

NOTE: Drawings are not to scale. Additional and the most current drawings are available at **www.kolbewindows.com**.

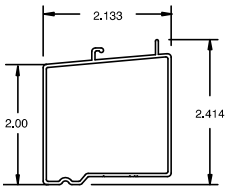
Sill Nosing/Sill Extenders



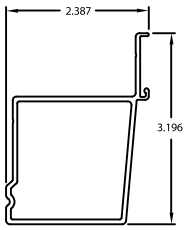
B8309
1-5/8" projected sill nosing



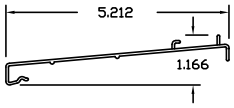
B8310
2-1/8" projected sill nosing



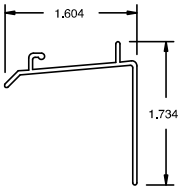
B8321
2-1/8" historic sill nosing



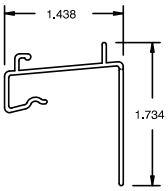
B8330
Stucco trim sill nosing



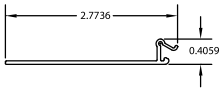
B8332
5-3/16" extended sill nosing



BU806
Sill drip

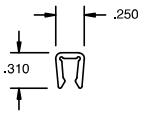


BU824
Traditional sill nosing

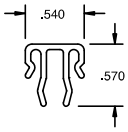


BU839
2-1/2" sill extender

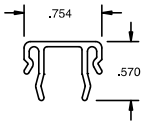
Mull Covers



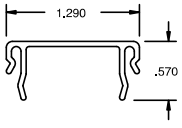
BU805
Mullion & transom splice



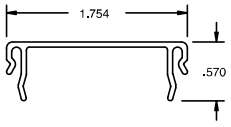
BU817
1/4" mull cover



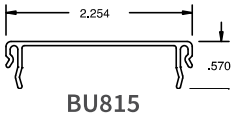
BU813
1/2" mull cover



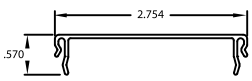
BU818
1" mull cover



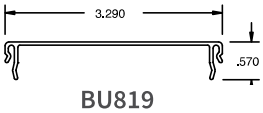
BU814
1-1/2" mull cover



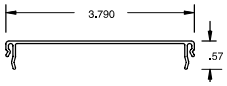
BU815
2" mull cover



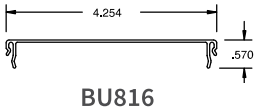
BU875
2 1/2 " mull cover



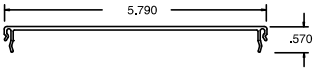
BU819
3" mull cover



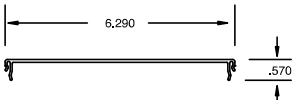
BU829
3-1/2" mull cover



BU816
4" mull cover



BU861
5-1/2" mull cover



BU852
6" mull cover

NOTE: Drawings are not to scale. Additional and the most current drawings are available at **www.kolbewindows.com**.

On Behalf Of: Colorado Sash & Door Inc

Address: 4521 Endeavor Drive, Unit C
Johnstown, CO 80534

Phone: 970-226-1460

Fax: (970) 797-6392

Contact: Mark Wernimont

Email: mwernimont@colosash.com

Address: 4521 Endeavor Drive
Unit C
Johnstown, Colorado 80534

Phone: 970-226-1460

Mobile: 970-402-2623

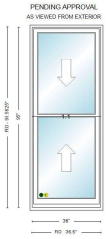
COLORADO
SASH & DOOR, INC

KOLBE
WINDOWS & DOORS
We're for the visionaries.™

Quote 1297838C: 201 Linden - Window Replacement
Project: Commercial
Printed: 6/24/2024 5:21:18 AM

Line	Label	UOM	Quantity	Unit Price	Extended Price
001	**Traditional Double Hung**	**EA**	(1)	**$3,255.12**	**$3,255.12**

PERFORMANCE: Standard Performance, Display Current PG Rating Info., Current Calculated PG Rating: -1, Current Calculated Positive DP Rating: -1, Current Calculated Negative DP Rating: -1, Current Calculated Overall PG Rating: N/A, R&D Test No.: N/A, AAMA/WDMA/CSA 101/I.S.2/A440-22: N/A, AAMA/WDMA/CSA 101/I.S.2/A440-17: N/A, AAMA/WDMA/CSA 101/I.S.2/A440-11: N/A, CSA A440 S1-19: N/A, CSA A440 S1-17: N/A, CSA A440 S1-09: N/A, ASTM E 1886/1996: N/A, TAS 201-94: N/A, TAS 202-94: N/A, TAS 203-94: N/A, Test Report No.: N/A, Hallmark No.: N/A, Texas Dept. of Insurance No.: N/A, Water Penetration Resistance Pressure: N/A, Display Current NFRC Rating Info., U-Value: -, Solar Heat Gain Coefficient (SHGC): -, Visible Transmittance (VT): -, Condensation Resistance (CR): -, NFRC CPD #: -, Energy Star Southern Zone: -, Energy Star South/Central Zone: -, Energy Star North/Central Zone: -, Energy Star Northern Zone: -, Energy Star Door Northern & North/Central Zones: -, Energy Star Door South/Central & Southern Zones: -, Energy Star Door All 50 States: -, Canada Energy Rating (ER): -, Canada Energy Star: -, Metric U-Value: -



Scaled to Fit

Rough Opening:
36 1/2" X 95 9/16"
Frame Size:
36" X 95"
Unit Dimension:
38 3/8" X 97 51/64"

Traditional Sash Does not Meet Structural Performance for this size.

UNIT - Heritage Rectang Sash, Basic Jamb Profile: Square, Even Split

GLASS: Glass Make Up: Glass Preserve / Neat+ Coating: Glass Preserve without Neat+ Coating, Ovolo Glazing Bead

HARDWARE-ACCESSORIES: Clay (Rustic) Hardware, Amount of Check Rail Locks: 1, No Sash Plough, Bottom Sash Lift Handle(s): Traditional Style, Sash Lift Handle Color: Matte Black, Sash Lift Handle Quantity: 2 Per Bottom Sash, Jambliner: Beige, Window Opening Control Device: Black

CASING-JAMBS-TRIM: 2" Beaded Casing , 2" x 2" Sill Nosing , Apply Exterior Casing/Accessories, 4 9/16" Jambs

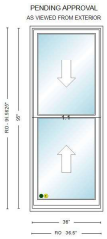
SPECIES-FINISH-COLOR: Leave All Pine, Exterior Frame Finish: K-Kron2, Exterior Sash Finish: K-Kron2, Match All Exterior Colors, 1st Custom Color Exterior, Colored Prefinish Interior Frame, Colored Prefinish Interior Sash, Match All Interior Colors, Coal Black Interior, 1st Custom Exterior Color: Match Existing, Standard Fingerjoints

MANUFACTURER NOTES:
Calculated Design Pressure values of individual units will be verified upon order to Kolbe. Overall Performance Grade of mulls/assemblies may/will be less than computed values of individual units and will also be determined upon order to Kolbe.,
Opening(s) designated by a circled 'E' meet most national building codes for emergency escape and rescue requirements. Check local codes for product compliance for desired application.

For warranty information please click this link or visit https://www.kolbewindows.com/resources/warranties

002 **Sterling 1 3/4" Sash** **EA** (1) **$2,851.36** **$2,851.36**

PERFORMANCE: Standard Performance, Display Current PG Rating Info., Current Calculated PG Rating: -1, Current Calculated Positive DP Rating: -1, Current Calculated Negative DP Rating: -1, Current Calculated Overall PG Rating: N/A, R&D Test No.: N/A, AAMA/WDMA/CSA 101/I.S.2/A440-22: N/A, AAMA/WDMA/CSA 101/I.S.2/A440-17: N/A, AAMA/WDMA/CSA 101/I.S.2/A440-11: N/A, CSA A440 S1-19: N/A, CSA A440 S1-17: N/A, CSA A440 S1-09: N/A, ASTM E 1886/1996: N/A, TAS 201-94: N/A, TAS 202-94: N/A, TAS 203-94: N/A, Test Report No.: N/A, Hallmark No.: N/A, Texas Dept. of Insurance No.: N/A, Water Penetration Resistance Pressure: N/A, Display Current NFRC Rating Info., U-Value: -, Solar Heat Gain Coefficient (SHGC): -, Visible Transmittance (VT): -, Condensation Resistance (CR): -, NFRC CPD #: -, Energy Star Southern Zone: -, Energy Star South/Central Zone: -, Energy Star North/Central Zone: -, Energy Star Northern Zone: -, Energy Star Door Northern & North/Central Zones: -, Energy Star Door South/Central & Southern Zones: -, Energy Star Door All 50 States: -, Canada Energy Rating (ER): -, Canada Energy Star: -, Metric U-Value: -



Scaled to Fit

Rough Opening:
36 1/2" X 95 9/16"
Frame Size:
36" X 95"
Unit Dimension:
38 3/8" X 97 51/64"

UNIT - Heritage Rectangle Dou[illegible]n, Basic Jamb Profile: Square, Even Split

Unit Does Not Meet Structural Requirements based on Size

GLASS: Glass Make Up: Double Glazed, Solar Low-E, Mill Finish Spacer, Glass Preserve / Neat+ Coating: Glass Preserve without Neat+ Coating, Ovolo Glazing Bead

HARDWARE-ACCESSORIES: Lock Style: Signature, Clay (Rustic) Hardware, Bottom Sash Lift Handle(s): Traditional Style, Sash Lift Handle Color: Matte Black, Sash Lift Handle Quantity: 2 Per Bottom Sash, Jambliner: Black, Window Opening Control Device: Black

CASING-JAMBS-TRIM: 2" Beaded Casing , 2" x 2" Sill Nosing , Apply Exterior Casing/Accessories, 4 9/16" Jambs

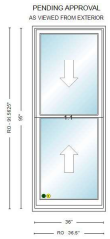
SPECIES-FINISH-COLOR: Leave All Pine, Exterior Frame Finish: K-Kron2, Exterior Sash Finish: K-Kron2, Match All Exterior Colors, 1st Custom Color Exterior, Colored Prefinish Interior Frame, Colored Prefinish Interior Sash, Match All Interior Colors, Coal Black Interior, 1st Custom Exterior Color: Match Existing, Jambliner Cover: Wood Wrapped, Vertical Weatherstrip Color: Black, Standard Fingerjoints

MANUFACTURER NOTES:
Please be aware Retractable Screens and Sash Lifts (supplied by Kolbe or by others) when used together will interfere with unit/screen operation.,
Calculated Design Pressure values of individual units will be verified upon order to Kolbe. Overall Performance Grade of mulls/assemblies may/will be less than computed values of individual units and will also be determined upon order to Kolbe.,
Opening(s) designated by a circled 'E' meet most national building codes for emergency escape and rescue requirements. Check local codes for product compliance for desired application.

For warranty information please click this link or visit https://www.kolbewindows.com/resources/warranties

003 **Sterling XL 1 3/4" Sash** **EA** (1) **$3,189.24** **$3,189.24**

PERFORMANCE: Standard Performance, Display Current PG Rating Info., Current Calculated PG Rating: 60, Current Calculated Positive DP Rating: 60.15, Current Calculated Negative DP Rating: 60.15, Current Calculated Overall PG Rating: +60/-60, R&D Test No.: 15132, AAMA/WDMA/CSA 101/I.S.2/A440-22: -1, AAMA/WDMA/CSA 101/I.S.2/A440-17: -1, AAMA/WDMA/CSA 101/I.S.2/A440-11: LC-PG60 1219x3061 (~48x121)-H, CSA A440 S1-19: -1, CSA A440 S1-17: -1, CSA A440 S1-09: -1, ASTM E 1886/1996: -1, TAS 201-94: -1, TAS 202-94: -1, TAS 203-94: -1, Test Report No.: QCT16-3890.01, Hallmark No.: 413-H-1176, Texas Dept. of Insurance No.: In Process, Water Penetration Resistance Pressure: 470 Pa (9.82 psf), Display Current NFRC Rating Info., U-Value: -, Solar Heat Gain Coefficient (SHGC): -, Visible Transmittance (VT): -, Condensation Resistance (CR): -, NFRC CPD #: -, Energy Star Southern Zone: -, Energy Star South/Central Zone: -, Energy Star North/Central Zone: -, Energy Star Northern Zone: -, Energy Star Door Northern & North/Central Zones: -, Energy Star Door South/Central & Southern Zones: -, Energy Star Door All 50 States: -, Canada Energy Rating (ER): -, Canada Energy Star: -, Metric U-Value: -



Scaled to Fit

Rough Opening:
36 1/2" X 95 9/16"
Frame Size:
36" X 95"
Unit Dimension:
38 3/8" X 97 51/64"

Energy Performance Not Tested

UNIT - Heritage Rectangle Double Hun , Basic Jamb Profile: Square, Ship Sash Loose, Even Split

GLASS: Glass Make Up: Double Glaze reserve / Neat+ Coating: Glass Preserve without Neat+ Coating, Ovolo Glazing Bead

HARDWARE-ACCESSORIES: Lock Style: Signature, Clay (Rustic) Hardware, Jambliner: Black, Window Opening Control Device: Black, Class 5 Balance

CASING-JAMBS-TRIM: 2" Beaded Casing , 2" x 2" Sill Nosing , Apply Exterior Casing/Accessories, 5" Jambs

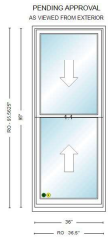
SPECIES-FINISH-COLOR: Leave All Pine, Exterior Frame Finish: K-Kron2, Exterior Sash Finish: K-Kron2, Match All Exterior Colors, 1st Custom Color Exterior, Colored Prefinish Interior Frame, Colored Prefinish Interior Sash, Match All Interior Colors, Coal Black Interior, 1st Custom Exterior Color: Match Existing, Jambliner Cover: Wood Wrapped, Vertical Weatherstrip Color: Black, Standard Fingerjoints

MANUFACTURER NOTES:
Calculated Design Pressure values of individual units will be verified upon order to Kolbe. Overall Performance Grade of mulls/assemblies may/will be less than computed values of individual units and will also be determined upon order to Kolbe.,
Per Product Bulletin #682 dated 6/8/2015, XL Sterling have non-tiltable sash and interior visual differences from Sterling.,
As standard sash will be shipped loose.,
Opening(s) designated by a circled 'E' meet most national building codes for emergency escape and rescue requirements. Check local codes for product compliance for desired application.

For warranty information please click this link or visit https://www.kolbewindows.com/resources/warranties

004 **Ultra Clad Sterling XL 1 3/4" Sash** **EA** (1) **$3,518.01** **$3,518.01**

PERFORMANCE: Standard Performance, Display Current PG Rating Info., Current Calculated PG Rating: 60, Current Calculated Positive DP Rating: 65.16, Current Calculated Negative DP Rating: 65.16, Current Calculated Overall PG Rating: +60/-65, R&D Test No.: 14104, AAMA/WDMA/CSA 101/I.S.2/A440-22: -1, AAMA/WDMA/CSA 101/I.S.2/A440-17: -1, AAMA/WDMA/CSA 101/I.S.2/A440-11: LC-PG60 1219x3048 (48x120)-H, CSA A440 S1-19: -1, CSA A440 S1-17: -1, CSA A440 S1-09: -1, ASTM E 1886/1996: -1, TAS 201-94: -1, TAS 202-94: -1, TAS 203-94: -1, Test Report No.: ESP018721P-1665, Hallmark No.: 413-H-1129, Texas Dept. of Insurance No.: WIN-2184, Water Penetration Resistance Pressure: 440 Pa (9.19 psf), Display Current NFRC Rating Info., U-Value: 0.32, Solar Heat Gain Coefficient (SHGC): 0.27, Visible Transmittance (VT): 0.50, Condensation Resistance (CR): 53, NFRC CPD #: KKM-K-23-01519-00001, Energy Star Door Northern & North/Central Zones: N/A, Energy Star Door South/Central & Southern Zones: N/A, Energy Star Door All 50 States: N/A, Canada Energy Rating (ER): +15, Metric U-Value: 1.82



Scaled to Fit

Rough Opening:
36 1/2" X 95 9/16"
Frame Size:
36" X 95"
Unit Dimension:
38 5/8" X 98 1/2"

Structural Performance and Energy Testing Done.

UNIT - Ultra Rectangle Double Hung - Complete Unit, XL Sterling, Vintage: #1117, Extruded Sash, Basic Jamb Profile: Square, Ship Sash Loose, Even Split

GLASS: Glass Make Up: Double Glazed, Solar Low-E, Mill Finish Spacer, Glass Preserve / Neat+ Coating: Glass Preserve without Neat+ Coating, Ovolo Glazing Bead

HARDWARE-ACCESSORIES: Lock Style: Signature, Clay (Rustic) Hardware, Jambliner: Black, Window Opening Control Device: Black, Class 5 Balance

CASING-JAMBS-TRIM: 2" Beaded Casing (BU947) , Casing Placement: Head and Sides, Historic 2" x 2" Sill Nosing (B8321) , Apply Exterior Casing/Accessories, Nailing Fin, 5" Jambs

SPECIES-FINISH-COLOR: Leave All Pine, Exterior Frame Finish: 70% Fluoropolymer, Exterior Sash Finish: 70% Fluoropolymer, Exterior Casing Finish: 70% Fluoropolymer, Match All Exterior Colors, 1st Custom Color Exterior, Colored Prefinish Interior Frame, Colored Prefinish Interior Sash, Match All Interior Colors, Coal Black Interior, 1st Custom Exterior Color: Match Existing, Jambliner Cover: Wood Wrapped, Vertical Weatherstrip Color: Black, Standard Fingerjoints

MANUFACTURER NOTES:
Calculated Design Pressure values of individual units will be verified upon order to Kolbe. Overall Performance Grade of mulls/assemblies may/will be less than computed values of individual units and will also be determined upon order to Kolbe.,
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Click to view more: kolbewindows.com/gallery

Double Hungs

Quality details adorn the classic design of Ultra Series double hung windows. Sterling double hung sash can be removed from the inside of the home for easy cleaning. Replace older windows with unique cottage-style, radius-top, or XL Sterling units, choosing options like divided lites, hardware, screens, or triple pane glass, to enhance style or performance.

Sterling Double Hungs | XL Sterling Double Hungs | Cottage Style & Reverse Cottage Style Units
Studio & Transom Units | Picture Combination Units | Segment Head & Half-Circle Top Units | Single Units

Photo © Anice Hoachlander

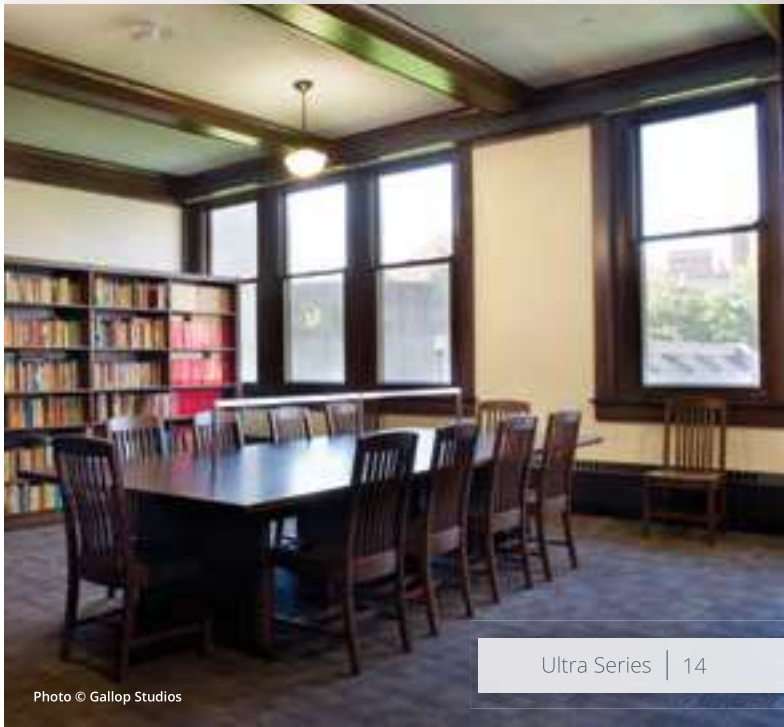


Photo © Gallop Studios

Sterling Double Hungs

Sterling double hungs are made to blend seamlessly with the grandest décor. A patented interior wood cover conceals the jambliner, giving the windows a rich, all-wood appearance. The award-winning XL Sterling double hung expands the architecturally-correct design and high performance of a Sterling double hung. Quality components combined with thoughtful product design allow the XL Sterling double hung to be the perfect fit for any oversized commercial or residential opening. *Patents: 7,296,381 | 7,448,164 | 8,196,355 | 8,429,856*

Standard Features – Sterling Double Hung

- 1-3/4″ thick sash
- Overall jamb depth is 4-9/16″ *(basic box depth is 4-9/16″)*
- Frame thickness is 3/4″ at side jambs and head
- Sill thickness is 1-3/16″; slope is 14°
- Constructed of pine, with pine interior stops and wood mull casings on mulled units
- Exterior wood parts are treated
- Extruded aluminum exterior finished with a 70% PVDF fluoropolymer coating *(meets performance requirements of AAMA 2605)*
- Energy efficient, insulating Solar Low-E glass
- Glazed to the interior with beveled wood glazing beads
- Wood interior head parting stop
- Clay-colored heavy duty Signature sash lock
- Spring-loaded block-and-tackle mechanical balances to carry the sash weight
- Concealed balance system
- Patented wood wrapped jambliner closure on the interior *(unless interior is prefinished white or primed, then jambliner will be white)* and extruded aluminum jambliner closure on the exterior hides the balance system
- Nailing fins with head drip caps*

Standard Features – XL Sterling Double Hung *(includes sterling double hung standard features, with the exception of the following substitutions):*

- Overall jamb depth is 5″ *(basic box depth is 5″*
- Class 5 balances capable of carrying heavier loads

Options – Sterling Double Hung/XL Sterling Double Hung *(custom options are also available)*

- Class 5 balances** available for commercial specifications or larger units
- Extension jambs *(up to 12″ applied, over 12″ shipped loose for field application)*
- Segment head, cottage style segment head, half-circle top, and cottage style half-circle top units†
- Sash limiters for safety
- Galvanized steel installation clips
- Full or half aluminum insect screen with aluminum, BetterVue® or UltraVue® fiberglass mesh; retractable insect screen kit with beveled or square cover
- Factory-installed Window Opening Control Device (WOCD)
- High performance or impact performance modifications

View **Style Options & Technical Data ▸**

(Click to view hardware, glass, divided lites, finishes, and more, as well as performance and specification details.)

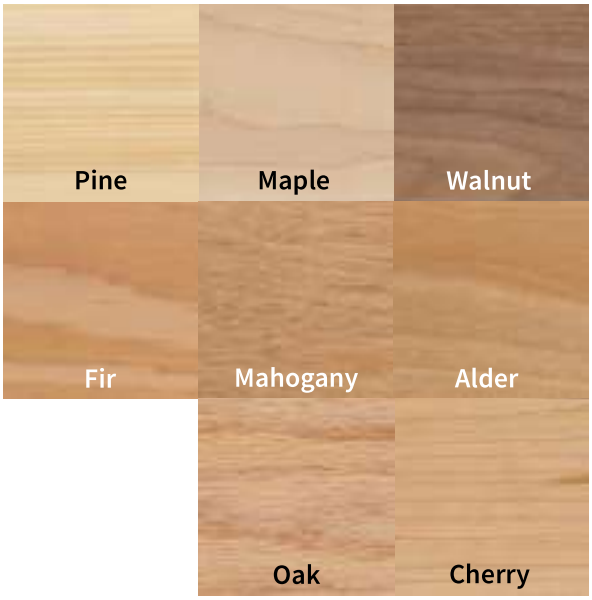
NOTE: All measurements are nominal.
* Standard only on units without brickmould.
** Not available on XL Sterling double hung.
† Units may not carry certification. See Kolbe dealer for details.
BetterVue® and UltraVue® are registered trademarks of PHIFER INCORPORATED.

Finish Options

Interior Wood Species

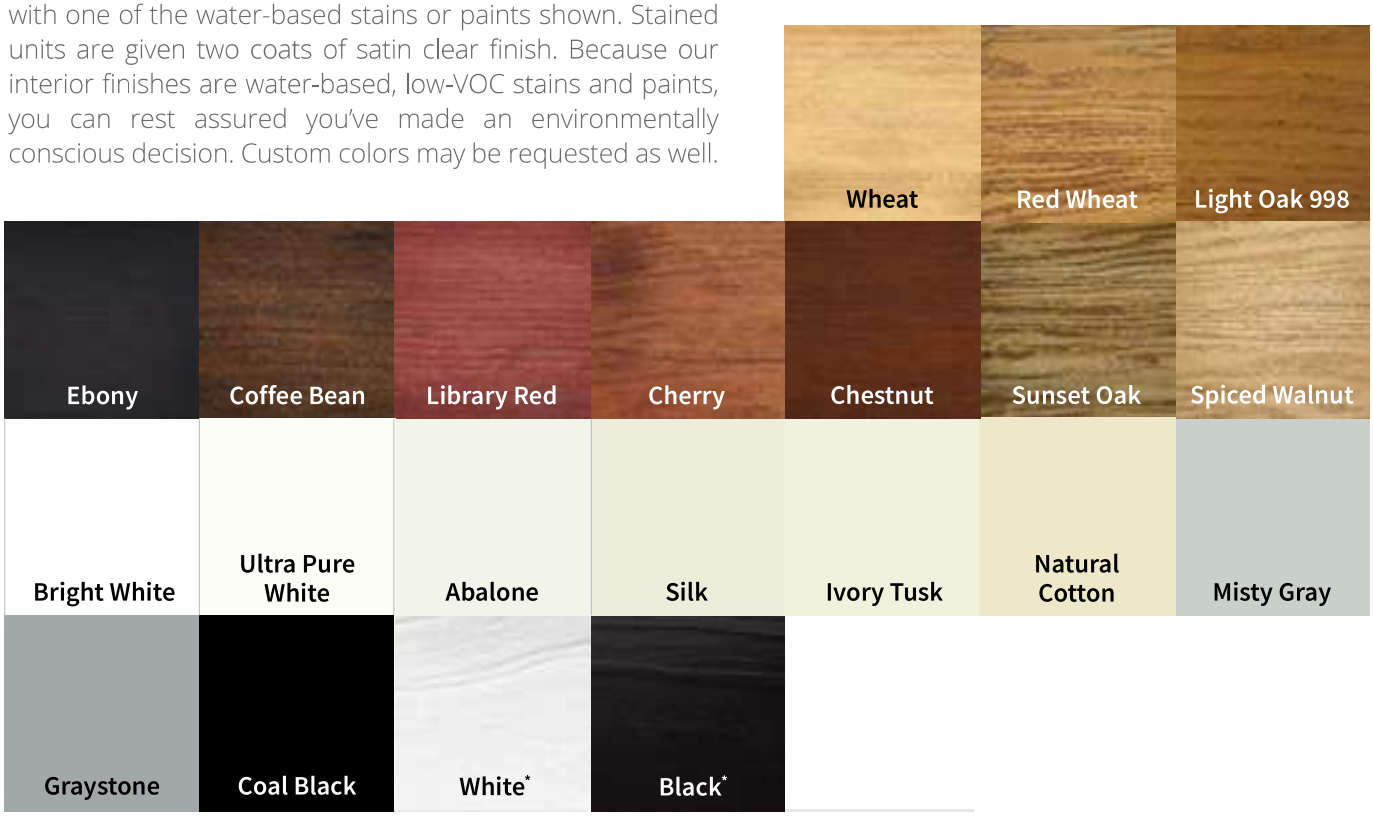
In addition to the standard pine, Ultra Series windows and doors can be constructed of other optional wood species that enhance their look. Pine and other wood species are sourced from managed forests. The Forest Stewardship Council® (FSC®)-certified wood species are also available for green building projects (FSC® license code FSC®-C019541).

Ask about the availability of additional wood species.



Interior Finishes

For units that are ready to install upon delivery, Kolbe's Ultra Series windows and doors can be prefinished on the interior with one of the water-based stains or paints shown. Stained units are given two coats of satin clear finish. Because our interior finishes are water-based, low-VOC stains and paints, you can rest assured you've made an environmentally conscious decision. Custom colors may be requested as well.



*Applied as a single coat of paint, with some visible wood grain.

Some options for our products may have limited color offerings or may incur a nominal charge. Check with your Kolbe dealer for further details on pricing and availability. Stain colors are shown on pine. Since no two trees are identical, wood can be expected to differ both in color and graining. These factors will influence the stain's final color.

Printed images of wood species and stain options will vary from actual product colors. Selections should be made based on color samples available from your Kolbe dealer. Stain colors are shown on pine. A double coat clear finish is also offered. Since no two trees are identical, wood can be expected to differ both in color and graining. These factors will influence the stain's final color.

Color-matched interior paint is available through any Sherwin-Williams retail store in the United States and Canada. The color formula for Kolbe's interior paint finishes is in their National Account System.

Exterior Colors

Kolbe's Ultra Series products are finished with a 70% PVDF fluoropolymer coating, an ideal choice for durability and resistance to chemicals, abrasion, corrosion, and weathering. In addition to the standard palette, custom colors can be specified, as well as Anodized aluminum and Mica* fluoropolymer finishes.

* Mica finishes are 70% PVDF fluoropolymer as standard. Fluoropolymer coatings meet performance requirements of AAMA-2605 and are recommended for coastal applications. Please see your Kolbe dealer for details.

Some options for our products may have limited color offerings or may incur a nominal charge. Check with your Kolbe dealer for further details on pricing and availability. Printed images of exterior finishes may vary slightly from actual colors. Selections should be made based on actual color samples available from your Kolbe dealer.

There is a "color range" with anodized colors. That is, there is an acceptable "light" to "dark" color range that can be experienced on any job. According to AAMA 611-98 specifications, Section 8.3, the range may be up to 5 Delta E's. We can provide from our anodized vendor color samples of this color range if requested. The color range is due to numerous variables which include (but are not limited to) the shape of the parts, alloy variations and time in the anodizing process. This could mean that a sash part may appear slightly different in color than a frame part. This is/will be acceptable. Even the samples that may be provided may vary from the final product due to the variables. You must be aware of this as this will be considered acceptable.

KOLBE
WINDOWS & DOORS

Ultra Series

We're for the visionaries.®

We're for people who take building to new levels.

We're for people who are passionate about design, who care about the big picture and the smallest detail. We're for people who aren't satisfied with mainstream choices... who push the limits of what's possible with the options and innovations that can only be found in Kolbe windows and doors.

We're for quality craftsmanship.

We're for a tradition of excellence that outlasts the latest design trend. The Kolbe story began with a family and a vision. More than 75 years after the Kolbe brothers began their commitment to producing premium quality windows and doors, products bearing their family name can be found in some of North America's most impressive homes and businesses.

We're for expertise.

We're for people who dream of a personalized design experience. That's why you can't find Kolbe windows and doors in the aisles of a home center. Our products are only available through a Kolbe dealer, because they are as passionate about windows and doors as you are about bringing your vision to life. And they will work with you to make your dream a concrete reality.

We're for possibilities.

We're for people who won't settle for "standard." We're for limitless options and custom solutions that can only be found in Kolbe's made-to-order products. Our team members are craftspeople who focus on building one window or door at a time, to create distinctive products that fulfill your unique vision.

We're for innovation.

We're for people who want to take building to new levels, with advancements in not only extraordinary sizes and shapes, but also ground-breaking products. We're for creative thinking that redefines what's possible, constantly reimagining our windows and doors to elevate style, performance and functionality.

Let us bring your vision to life.


© Ema Peter Photography

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The Ultra Series

Designed for versatility, durability & performance – with an array of options.

Kolbe's Ultra Series windows and doors can mimic the traditional style of wood windows and doors with a warm wood interior and intricate exterior trim details, or it can accommodate modern design needs. Choose from an extensive palette of exterior colors, interior wood species, finishes, divided lite profiles, and more.

The Ultra Series provides:

- Durable extruded aluminum exterior in 50+ standard colors & finishes, plus custom hues
- Warm wood interior in familiar to exotic species, with 20+ standard pre-finishes, plus custom finishes
- Versatile styling, from traditional to modern architectural details
- Enhanced energy efficiency & impact performance options to meet climate demands
- Divided lite profiles & patterns
- Low-E, performance, & specialty glass
- Hardware options & finishes to match any décor
- Automation options for ease of operation

© Ema Peter Photography

© Dean J. Birinyi

Capabilities

Craftsmanship and artistry are hallmarks of Kolbe products. We build innovative windows and doors with a wide array of options. But don't let the standard options limit your imagination.

At Kolbe, we love a good challenge. We welcome projects that require special wood species, custom divided lite patterns, unique shapes, custom finish colors, unusual mulling configurations – you dream it, we'll build it. Our windows and doors are built to order, so you can choose the options that best suit your design and vision. We offer multiple product lines with distinct characteristics and a full breadth of capabilities for customization and personalization.

© Christian Klugmann

Capabilities

Energy Efficiency

In addition to superior craftsmanship, Kolbe windows and doors offer superior performance. Our products undergo independent testing to ensure the highest quality available. Participation in the Window & Door Manufacturers Association (WDMA) Hallmark Certification and ENERGY STAR® programs ensures that our products are tested to industry standards, allowing them to meet and exceed today's stricter building codes and standards for energy efficiency.

Many of the Ultra Series products can also meet California's Title 24 Building Energy Efficiency Standards, as well as Passive House Institute US (PHIUS) verification. Kolbe's numerous products and glass options help meet these stringent energy efficiency requirements.


© Kat Alves Photography

Sustainability

Whether building a new house or updating an existing one, thoughtful choices create enduring homes that are beautiful, comfortable and instill peace of mind. We prioritize resilient design, supported with durable materials and high-performance products.

Our wood species are renewable resources sourced from managed forests, and our standard glass contains 25-30% recycled content. We can also provide The Forest Stewardship Council® (FSC®)-certified wood species for many products (FSC® license code FSC®-C019541).


© Marco Zecchin/Image Center

Kolbe demonstrates a commitment to providing accurate energy data by having products independently simulated, tested, inspected and listed in the NFRC certification program, and making that data available at **kolbewindows.com** and on window labels.

Energy performance data and air, water, structural data is updated on a continuous basis.
For the most current information, contact your local Kolbe dealer.

International Code Council's
International Property Maintenance Standards

I. Overview

The nation's model housing or property maintenance code is the International Property Maintenance Code (IPMC). The IPMC is managed by the International Code Council (ICC). Two states – New York and Virginia – and more than 600 local jurisdictions have adopted the IPMC with modifications.

The International Code Council (ICC) published the first edition of the *International Property Maintenance Code* in 1998. ICC's three charter members of the International Code Council – Building Officials and Code Administrators International, Inc. (BOCA), International Conference of Building Officials (ICBO) and Southern Building Code Congress International (SBCCI) – developed the IPMC as a comprehensive set of regulations for existing buildings that was consistent with the existing model property maintenance codes at the time.. A new edition is promulgated every three years.

The *International Property Maintenance Code* is founded on principles that the IPMC must:

1. Adequately protect public health, safety and welfare;
2. Not unnecessarily increase construction costs;
3. Not restrict the use of new materials, productions or methods of construction; and
4. Not give preferential treatment to particular types or classes of materials, products or methods of construction.

Adoption

The *International Property Maintenance Code* is available for adoption and use by jurisdictions internationally. Its use within a governmental jurisdiction is intended to be accomplished through adoption by reference. At the time of adoption, jurisdictions should insert the appropriate information in provisions requiring specific local information, such as the name of the adopting jurisdiction. These locations are shown in bracketed words in small capital letters in the code and in the sample ordinance.

To find out whether the *International Property Maintenance Code* or any of the other ICC Codes have been adopted in your community, go to www.iccsafe.org/government/adoption.html.

Maintenance

The *International Property Maintenance Code* is kept up to date through the review of proposed changes submitted by code enforcing officials, industry representatives, design professionals and other interested parties. Proposed changes are carefully considered through an open code development process in which all interested and affected parties may participate. The contents of the code are subject to change both through the Code Development Cycles and the governmental body that enacts the code into law. For more information regarding the code development process, contact the Code and Standard Development Department of the International Code Council.

While the development procedure of the *International Property Maintenance Code* assures the highest degree of care, ICC and the founding members of ICC—BOCA, ICBO, SBCCI—their members and those participating in the development of the code do not accept any liability resulting from compliance or noncompliance with the provisions because ICC and its founding members do not have the power or authority to police or enforce compliance with the contents of the code. Only the governmental body that enacts the code into law has such authority.

One advantage of the IPMC is this process of ongoing improvement. Communities that adopt the IPMC often simply update their code to incorporate the latest version of the IPMC. In contrast, most local codes do not have a regular process for improvement and refinement. These communities often lack the

resources to undergo a careful review and political factors lock in the existing code unless serious problems arise.

Relationship to Other ICC Codes

The *International Property Maintenance Code* is complements and is fully compatible with all the *International Codes* ("I-Codes") published by the International Code Council (ICC), including the:

1. International Building Code;
2. ICC Electrical Code;
3. International Energy Conservation Code;
4. International Existing Building Code;
5. International Fire Code;
6. International Fuel Gas Code;
7. International Mechanical Code;
8. ICC Performance Code;
9. International Plumbing Code;
10. International Private Sewage Disposal Code;
11. International Residential Code;
12. International Urban-Wildland Interface Code; and
13. International Zoning Code.

All but three other states have adopted one or more of these model codes – most likely the International Building Code.

II. IPMC's Provisions Related to Healthy Homes

EXTERMINATION. The control and elimination of insects, rats or other pests by eliminating their harborage places; by removing or making inaccessible materials that serve as their food; by poison spraying, fumigating, trapping or by any other approved pest elimination methods.

HABITABLE SPACE. Space in a structure for living, sleeping, eating or cooking. Bathrooms, toilet rooms, closets, halls, storage or utility spaces, and similar areas are not considered habitable spaces.

INFESTATION. The presence, within or contiguous to, a structure or premises of insects, rats, vermin or other pests.

302.1 Sanitation. All exterior property and premises shall be maintained in a clean, safe and sanitary condition. The occupant shall keep that part of the exterior property which such occupant occupies or controls in a clean and sanitary condition.

302.2 Grading and drainage. All premises shall be graded and maintained to prevent the erosion of soil and to prevent the accumulation of stagnant water thereon, or within any structure located thereon.

302.5 Rodent harborage. All structures and exterior property shall be kept free from rodent harborage and infestation. Where rodents are found, they shall be promptly exterminated by approved processes which will not be injurious to human health. After extermination, proper precautions shall be taken to eliminate rodent harborage and prevent reinfestation.

304.2 Protective treatment. All exterior surfaces, including but not limited to, doors, door and window frames, cornices, porches, trim, balconies, decks and fences shall be maintained in good condition. Exterior wood surfaces, other than decay-resistant woods, shall be protected from the elements and decay by painting or other protective covering or treatment. Peeling, flaking and chipped paint shall be eliminated and surfaces repainted. All siding and masonry joints as well as those between the building envelope and the perimeter of windows, doors, and skylights shall be maintained weather resistant and water tight. All metal surfaces subject to rust or corrosion shall be coated to inhibit such rust and corrosion and all surfaces with rust or corrosion shall be stabilized and coated to inhibit future rust and

corrosion. Oxidation stains shall be removed from exterior surfaces. Surfaces designed for stabilization by oxidation are exempt from this requirement.

304.5 Foundation walls. All foundation walls shall be maintained plumb and free from open cracks and breaks and shall be kept in such condition so as to prevent the entry of rodents and other pests.

304.6 Exterior walls. All exterior walls shall be free from holes, breaks, and loose or rotting materials; and maintained weatherproof and properly surface coated where required to prevent deterioration.

304.7 Roofs and drainage. The roof and flashing shall be sound, tight and not have defects that admit rain. Roof drainage shall be adequate to prevent dampness or deterioration in the walls or interior portion of the structure. Roof drains, gutters and downspouts shall be maintained in good repair and free from obstructions. Roofwater shall not be discharged in a manner that creates a public nuisance.

304.14 Insect screens. During the period from [DATE] to [DATE], every door, window and other outside opening required for ventilation of habitable rooms, food preparation areas, food service areas or any areas where products to be included or utilized in food for human consumption are processed, manufactured, packaged or stored, shall be supplied with approved tightly fitting screens of not less than 16 mesh per inch (16 mesh per 25 mm) and every swinging door shall have a self-closing device in good working condition.

> **Exception:** Screens shall not be required where other approved means, such as air curtains or insect repellent fans, are employed.

304.17 Guards for basement windows. Every basement window that is openable shall be supplied with rodent shields, storm windows or other approved protection against the entry of rodents.

305.1 General. The interior of a structure and equipment therein shall be maintained in good repair, structurally sound and in a sanitary condition. Occupants shall keep that part of the structure which they occupy or control in a clean and sanitary condition. Every owner of a structure containing a rooming house, housekeeping units, a hotel, a dormitory, two or more dwelling units or two or more nonresidential occupancies, shall maintain, in a clean and sanitary condition, the shared or public areas of the structure and exterior property.

305.3 Interior surfaces. All interior surfaces, including windows and doors, shall be maintained in good, clean and sanitary condition. Peeling, chipping, flaking or abraded paint shall be repaired, removed or covered. Cracked or loose plaster, decayed wood and other defective surface conditions shall be corrected.

307.1 Accumulation of rubbish or garbage. All exterior property and premises, and the interior of every structure, shall be free from any accumulation of rubbish or garbage.

308.1 Infestation. All structures shall be kept free from insect and rodent infestation. All structures in which insects or rodents are found shall be promptly exterminated by approved processes that will not be injurious to human health. After extermination, proper precautions shall be taken to prevent reinfestation.

308.2 Owner. The owner of any structure shall be responsible for extermination within the structure prior to renting or leasing the structure.

308.3 Single occupant. The occupant of a one-family dwelling or of a single-tenant nonresidential structure shall be responsible for extermination on the premises.

308.4 Multiple occupancy. The owner of a structure containing two or more dwelling units, a multiple occupancy, a rooming house or a nonresidential structure shall be responsible for extermination in the public or shared areas of the structure and exterior property. If infestation is caused by failure of an occupant to prevent such infestation in the area occupied, the occupant shall be responsible for extermination.

308.5 Occupant. The occupant of any structure shall be responsible for the continued rodent and pest-free condition of the structure.

Exception: Where the infestations are caused by defects in the structure, the owner shall be responsible for extermination.

403.1 Habitable spaces. Every habitable space shall have at least one openable window. The total openable area of the window in every room shall be equal to at least 45 percent of the minimum glazed area required in Section 402.1.

Exception: Where rooms and spaces without openings to the outdoors are ventilated through an adjoining room, the unobstructed opening to the adjoining room shall be at least 8 percent of the floor area of the interior room or space, but not less than 25 square feet (2.33m2). The ventilation openings to the outdoors shall be based on a total floor area being ventilated.

403.2 Bathrooms and toilet rooms. Every bathroom and toilet room shall comply with the ventilation requirements for habitable spaces as required by Section 403.1, except that a window shall not be required in such spaces equipped with a mechanical ventilation system. Air exhausted by a mechanical ventilation system from a bathroom or toilet room shall discharge to the outdoors and shall not be recirculated.

403.4 Process ventilation. Where injurious, toxic, irritating or noxious fumes, gases, dusts or mists are generated, a local exhaust ventilation system shall be provided to remove the contaminating agent at the source. Air shall be exhausted to the exterior and not be recirculated to any space.

403.5 Clothes dryer exhaust. Clothes dryer exhaust systems shall be independent of all other systems and shall be exhausted in accordance with the manufacturer's instructions.

503.4 Floor surface. In other than dwelling units, every toilet room floor shall be maintained to be a smooth, hard, nonabsorbent surface to permit such floor to be easily kept in a clean and sanitary condition.

505.4 Water heating facilities. Water heating facilities shall be properly installed, maintained and capable of providing an adequate amount of water to be drawn at every required sink, lavatory, bathtub, shower and laundry facility at a temperature of not less than 110ºF (43ºC). A gas-burning water heater shall not be located in any bathroom, toilet room, bedroom or other occupied room normally kept closed, unless adequate combustion air is provided. An approved combination temperature and pressure-relief valve and relief valve discharge pipe shall be properly installed and maintained on water heaters.

602.2 Residential occupancies. Dwellings shall be provided with heating facilities capable of maintaining a room temperature of 68ºF (20ºC) in all habitable rooms, bathrooms and toilet rooms based on the winter outdoor design temperature for the locality indicated in Appendix D of the *International Plumbing Code*. Cooking appliances shall not be used to provide space heating to meet the requirements of this section.

Exception: In areas where the average monthly temperature is above 30°F (-1°C), a minimum temperature of 65°F (18°C) shall be maintained.

602.3 Heat supply. Every owner and operator of any building who rents, leases or lets one or more dwelling unit, rooming unit, dormitory or guestroom on terms, either expressed or implied, to furnish heat to the occupants thereof shall supply heat during the period from [DATE] to [DATE] to maintain a temperature of not less than 68ºF (20ºC) in all habitable rooms, bathrooms, and toilet rooms.

Exceptions:

1. When the outdoor temperature is below the winter outdoor design temperature for the locality, maintenance of the minimum room temperature shall not be required provided that the heating system is operating at its full design capacity. The winter outdoor design temperature for the locality shall be as indicated in Appendix D of the *International Plumbing Code*.

2. In areas where the average monthly temperature is above 30ºF (-1ºC) a minimum temperature of 65ºF (18ºC) shall be maintained.

603.2 Removal of combustion products. All fuel-burning equipment and appliances shall be connected to an approved chimney or vent.

Exception: Fuel-burning equipment and appliances which are labeled for unvented operation.

603.5 Combustion air. A supply of air for complete combustion of the fuel and for ventilation of the space containing the fuel-burning equipment shall be provided for the fuel-burning equipment.

603.6 Energy conservation devices. Devices intended to reduce fuel consumption by attachment to a fuel-burning appliance, to the fuel supply line thereto, or to the vent outlet or vent piping therefrom, shall not be installed unless labeled for such purpose and the installation is specifically approved.

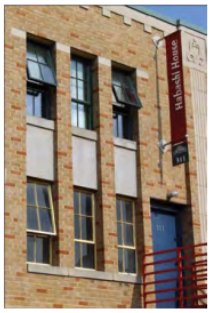
607.1 General. Duct systems shall be maintained free of obstructions and shall be capable of performing the required function.

Standards for Preservation

1. A property will be used as it was historically, or be given a new use that maximizes the retention of distinctive materials, features, spaces and spatial relationships. Where a treatment and use have not been identified, a property will be protected and, if necessary, stabilized until additional work may be undertaken.
2. The historic character of a property will be retained and preserved. The replacement of intact or repairable historic materials or alteration of features, spaces and spatial relationships that characterize a property will be avoided.
3. Each property will be recognized as a physical record of its time, place and use. Work needed to stabilize, consolidate and conserve existing historic materials and features will be physically and visually compatible, identifiable upon close inspection and properly documented for future research.
4. Changes to a property that have acquired historic significance in their own right will be retained and preserved.
5. Distinctive materials, features, finishes and construction techniques or examples of craftsmanship that characterize a property will be preserved.
6. The existing condition of historic features will be evaluated to determine the appropriate level of intervention needed. Where the severity of deterioration requires repair or limited replacement of a distinctive feature, the new material will match the old in composition, design, color and texture.
7. Chemical or physical treatments, if appropriate, will be undertaken using the gentlest means possible. Treatments that cause damage to historic materials will not be used.
8. Archeological resources will be protected and preserved in place. If such resources must be disturbed, mitigation measures will be undertaken.

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.



[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.

WINDOWS

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.	
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.*	
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.	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. 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.

WINDOWS

RECOMMENDED	NOT RECOMMENDED
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.	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. 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.
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.*	
Removing Existing Features from Other Historic Periods	
Removing windows or window features from other historic period, such as the glazing pattern or inappropriate shutters.	Failing to remove a window or window feature from another period, thereby confusing the depiction of the building's appearance from the restoration period.
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.	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.
Recreating Missing Features from the Restoration Period	
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.	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.

From: Mark Wernimont <mwernimont@colosash.com>
Sent: Wednesday, August 22, 2018 6:49 AM
To: Karen McWilliams <KMCWILLIAMS@fcgov.com>
Cc: Dawn Oglesby <dawn@oglesby-design.com>; Stephani Unfug <sunfug@dohnconstruction.com>
Subject: Windows at 201 Linden

Karren,

As you may have noticed we have put back the sash in the 2nd and 3rd floor of the Linden Hotel. The owners wanted to have the building, at least from the exterior, looking not under construction but more complete for all the functions going on downtown this summer. This is good as it has given everyone a chance to see and operate the restored windows early on in the process. One of the area's that is of concern is the three windows that are in the prominent corner of the building on both floors. As it looks, the window jambs seem to be supplying most of the structural support to this area. The framing is a little suspect, but we just replaced the broken jambs as needed. For all the other windows we have done the work as outlined in our write up that I believe you had seen. This is similar to what we had done for the Northern Hotel years back. This work included removing the sash, taking to our shop and adding a second pane of glass to the inside to help with thermal issues and sound control. We also have added weather stripping on the lower operable sash at the check rail, bottom rail and to the sides. The remaining frames, since they were worked on in the late 90's got just a scrape, prime and paint. The conditions of the sill, brickmould and frame remained other than a few jambs as noted in the corner units.

Based on the weight of the sash now being doubled by the extra glass, we needed to change the balance system from the ropes and weights to something else. We were limited due to the thickness of the sash being only 1 3/8", and the original windows were hung off 1/4" rope with pulleys. This is the thickness of a normal house sash and not what we find for windows in commercial buildings or openings of this size even in some homes. With this we did not have the room for the larger weights, or the correct pulleys to use chain. Our option was to use a spiral balance. This allowed us to insulate the weight pockets which has helped with both air infiltration, thermal performance and sound control. However, based on the size the sash with the second layer of glass, the sash now weigh almost 60#'s on the 3rd floor and 55#'s on the 2nd floor. We have installed balances that can be adjusted to take up to 35# each (a pair per sash) however with this, when they are adjusted so the sash lifts easily they are almost impossible for the owners to close. If we adjust the other way they close easily but are almost impossible to open. I had felt that we could make this option perform ok for the application, however this is not the case.

So after several weeks of adjusting and talking we would like to sit down and have a conversation with you as to what our options could be. I have taken the architect and owners rep to the windows we installed at the Empire Grange that are similar sized to these. We have recently used this same system for the new windows at Ginger and Baker, the original structure of the Washington's Music Building as well as the double hung windows in the Music District Building. As we have demonstrated in the past, we can match the details of the windows and can get the sight lines down to match the original windows. We can provide the units as all wood windows, factory prefinished in the correct color. The balance system is fully hidden and based on this there is a double balance system on each side so the operation is something that can work. With this we can also re-frame the corner units to support everything from the roof down to the covering below the floor and not rely on the window jambs to do this work.

I have been asked to set up a meeting later this week or early next week so that we can sit down and talk through our options. We do have a short window as the owners rep is leaving next Thursday and I as well as the architect are out from September 3rd thru the 11th. So if you can check your schedule and find 30/60 min of time for us, I would appreciate it. As usual, cell phone and e-mails get to me the quickest so let me know when we could meet.

Thanks

Mark Wernimont

Colorado Sash & Door, Inc.
4521 Endeavor Drive, Unit C
Johnstown, Colorado 80534
(970)226-1460 office
(970)402-2623 cell

July 1, 2019

City of Fort Collins
Landmark Preservation Office
201 North College Avenue
Fort Collins, Colorado 80521

Attn: Karen McWilliams
Re: 201 Linden – Historic Windows

Karen,

After talk with the owners, contractor and design staff they have asked Colorado Sash & Door, Inc. to propose the following work on the historic windows on the Linden and Walnut Street side of 201 Linden. We are proposing that we remove the sash from the openings, probably in groups of 3 to 6 openings at a time and install temporary protection, material to be determined. Take the sash to our shop and remove the RDG panel installed prior. Remove the interior finish to expose the raw wood and install a replica wood part to rebuild the sash profile. Fill in the groove in the lower sash for the spiral balance. Once the sash has been repaired, we will review any exterior putty glazing or finish that needs attention and replace and paint as needed. The interior will be primed and painted the same black to match the work done to the frames.

The existing metal sill covers will be replaced where removed. No other real work would be done on the frame other than re-installing the parting stop and interior stops. The weight pocket will be left insulated and we will install tape balances in the pocket of the original pulleys. The wood stop to limit operation will be again installed so that sash opens 16” +/-. All pockets for pulls will be filled in the shop and finger lifts similar to the photo would be installed to clear the new wood sills being installed. We will use the brush and leaf weather stripping as in the current mock up and install sash locks and receivers using what originals we have and similar reproduction as needed.

4521 Endeavor Drive, Unit C, Johnstown, Colorado 80534
(970) 226-1460 CELL (970) 402-2623

Attached with this letter are sections of the upper and lower sash, as well as photographs that point out all the changes to be made to the sash. If you have any questions or need some additional information please let us know.

Respectfully

Mark J. Wernimont
President
Colorado Sash & Door, Inc.

4521 Endeavor Drive, Unit C, Johnstown, Colorado 80534
(970) 226-1460 CELL (970) 402-2623

Mark Wernimont

From: Karen McWilliams <KMCWILLIAMS@fcgov.com>
Sent: Wednesday, July 10, 2019 3:43 PM
To: Stephani Unfug; Maren Bzdek
Cc: Jeff Johnson; Mark Wernimont
Subject: RE: 201 Linden - LPC Cancelled Meeting
Attachments: Re: Window Sash Work - 201 Linden (10.2 KB)

Hi, Stephani – I apologize, I did not realize that there was an expectation on your part that the window repairs would be on the July meeting or I would have informed you of the cancellation when it occurred. I received the submittal from Mark on July 2, after the meeting deadline. However, upon my quick scan of the proposed work at that time, it appeared that the work likely meets the Standards and is straightforward enough that it could be reviewed at the staff level, rather than at an LPC meeting. I'll be able to confirm this later this week, once I get a few other reviews completed and can turn my attention to this.

If the proposed work does need to proceed to the LPC for review, either because of the nature of the work or if there is an appeal of the staff decision, the submittal deadline for the August LPC meeting is Monday, July 29. The August LPC work session would be on August 14, and the meeting itself on August 21. - Karen

Karen McWilliams
Historic Preservation Manager | City of Fort Collins
kmcwilliams@fcgov.com | 970.224.6078

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From: Stephani Unfug <sunfug@dohnconstruction.com>
Sent: Wednesday, July 10, 2019 2:46 PM
To: Karen McWilliams <KMCWILLIAMS@fcgov.com>; Maren Bzdek <mbzdek@fcgov.com>
Cc: Jeff Johnson <jjohnson@dohnconstruction.com>
Subject: 201 Linden - LPC Cancelled Meeting

Karen –
Following up on my voicemail.
I was made aware the LPC meeting for this month has been cancelled.
I am concerned as to what this means for the review of our submission for the windows at 201 Linden.

Thank you,

Stephani Evans | Project Manager
Dohn Construction, Inc.
o 970.490.1855 | f 970.490.6093 | m 970.305.0914
2642 Midpoint Drive | Fort Collins, CO | 80525
sunfug@dohnconstruction.com

www.dohnconstruction.com

Mark Wernimont

From: Karen McWilliams <KMCWILLIAMS@fcgov.com>
Sent: Friday, July 12, 2019 5:39 PM
To: Mark Wernimont; 'Stephani Unfug'; Maren Bzdek
Cc: 'Jeff Johnson'
Subject: RE: 201 Linden - LPC Cancelled Meeting

Hi, all – Just to let you know that I've completed my review of Mark's proposed work to repair and restore the windows, and find that the work meets the Standards in Chapter 14, Article IV of the Municipal Code, including the Secretary of the Interior's Standards and the Old Town Design Standards, and that the work will substantially restore the windows to their prior condition without causing further damage. I'll send you an electronic copy of my report on Monday, and mail the official copy with the Certificate of Appropriateness.

Unless appealed, this is a final decision, and the application does not need to go to the LPC. However, because of the controversy surrounding the original work, I think it would be good public relations to report back to the LPC on staff's decision, and have Mark present (and other team members if desired). This would likely occur at the LPC's August 21 regular meeting. Do you wish to do this?

Have a good weekend. - Karen

Karen McWilliams
Historic Preservation Manager | City of Fort Collins
kmcwilliams@fcgov.com | 970.224.6078

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From: Mark Wernimont <mwernimont@colosash.com>
Sent: Friday, July 12, 2019 7:33 AM
To: Karen McWilliams <KMCWILLIAMS@fcgov.com>; 'Stephani Unfug' <sunfug@dohnconstruction.com>; Maren Bzdek <mbzdek@fcgov.com>
Cc: 'Jeff Johnson' <jjohnson@dohnconstruction.com>
Subject: RE: 201 Linden - LPC Cancelled Meeting

Karen,

I am back in town, so if you have some questions just let me know.

Thanks
Mark Wernimont

From: Karen McWilliams [mailto:KMCWILLIAMS@fcgov.com]
Sent: Wednesday, July 10, 2019 3:43 PM
To: Stephani Unfug; Maren Bzdek
Cc: Jeff Johnson; Mark Wernimont
Subject: RE: 201 Linden - LPC Cancelled Meeting

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Mark on July 2, after the meeting deadline. However, upon my quick scan of the proposed work at that time, it appeared that the work likely meets the Standards and is straightforward enough that it could be reviewed at the staff level, rather than at an LPC meeting. I'll be able to confirm this later this week, once I get a few other reviews completed and can turn my attention to this.

If the proposed work does need to proceed to the LPC for review, either because of the nature of the work or if there is an appeal of the staff decision, the submittal deadline for the August LPC meeting is Monday, July 29. The August LPC work session would be on August 14, and the meeting itself on August 21. - Karen

Karen McWilliams
Historic Preservation Manager | City of Fort Collins
kmcwilliams@fcgov.com | 970.224.6078

Click here to tell us about our service, We want to know!

From: Stephani Unfug <sunfug@dohnconstruction.com>
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To: Karen McWilliams <KMCWILLIAMS@fcgov.com>; Maren Bzdek <mbzdek@fcgov.com>
Cc: Jeff Johnson <jjohnson@dohnconstruction.com>
Subject: 201 Linden - LPC Cancelled Meeting

Karen –
Following up on my voicemail.
I was made aware the LPC meeting for this month has been cancelled.
I am concerned as to what this means for the review of our submission for the windows at 201 Linden.

Thank you,

Stephani Evans | Project Manager
Dohn Construction, Inc.
o 970.490.1855 | f 970.490.6093 | m 970.305.0914
2642 Midpoint Drive | Fort Collins, CO | 80525
sunfug@dohnconstruction.com

www.dohnconstruction.com

From: David Diehl <david@onesevenadvisors.com>
Sent: Friday, June 21, 2024 9:25 AM
To: Havelda, Claire NL. <chavelda@bhfs.com>; Mark Wernimont <MWernimont@colosash.com>; Mark Wimmer (markwwimmer@msn.com) <markwwimmer@msn.com>
Subject: FW: 201 Linden

David Diehl
OneSeven Advisors, LLC | 148 Remington Street, Suite 100, Fort Collins, CO 80524 | 970.416.1222 office | 970.420.8897 cell

From: Tom Leeson <tleeson@fcgov.com>
Sent: Wednesday, February 26, 2020 4:58 PM
To: David Diehl <david@onesevenadvisors.com>
Cc: sevans@dohnconstruction.com; jjohnson@dohnconstruction.com; markwwimmer@msn.com; Darin Atteberry <DATTEBERRY@fcgov.com>; Jeff Mihelich <jmihelich@fcgov.com>; Caryn M. Champine <cchampine@fcgov.com>
Subject: 201 Linden

Dear David – thank you for taking the time to meet with Darin and me at the 201 Linden building. I enjoyed meeting you and Mark, and I appreciate having the opportunity to see the window issue first hand.

I wanted to let you know that I had the opportunity meet with Karen McWilliams to look closely at the code language that regulates proposed alterations to designated historic resources. The code language states that a Certificate of Appropriateness is required for "exterior alterations, including windows and siding replacement..." I interpret this to mean that if you are not proposing to "replace" the windows, that a Certificate of Appropriateness is not required. Therefore, a Certificate of Appropriateness is not required and you may proceed with the alterations to the windows as proposed.

The initial interpretation that a Certificate of Appropriateness was needed was based upon the request for replacement and the concern that the work that was done to the windows may have resulted in weakening their structural integrity. To address this request, the City hired a windows expert who developed a workable solution for repairs meeting the Secretary of Interior Standards. That solution remains available to you for future implementation.

Also, it should be noted that if individual owners of the residential units want to replace the windows in the future, review by the Landmark Preservation Commission and a Certificate of Appropriateness will be required.

Good luck with the project and please let me know if you have any questions.

Cheers,

Tom Leeson, AICP
Community Development and Neighborhood Services Director
City of Fort Collins
970.221.6287 (O)
970.846.2133 (C)
tleeson@fcgov.com

LinkedIn profile

...cor JAN 3 '80 at 10:41 ... T...
Reception No. 344579 James P. Thompson

ORDINANCE NO. 170, 1979
OF THE COUNCIL OF THE CITY OF FORT COLLINS
DESIGNATING PROPERTY WITHIN THE CITY OF FORT COLLINS
AS THE OLD TOWN FORT COLLINS HISTORIC DISTRICT PURSUANT
TO CHAPTER 69 OF THE CODE OF THE CITY OF FORT COLLINS

WHEREAS, on September 26, 1979 the Cultural Resources Board of the City of Fort Collins, ex-officio the Fort Collins' Landmark Preservation Commission, held a public hearing concerning the proposed local designation of the Old Town Fort Collins Historical District comprising a portion of the "Triangle" area of the Old Town section of Fort Collins; and

WHEREAS, pursuant to said public hearing, the Cultural Resources Board has affirmatively recommended to the City Council of the City of Fort Collins that the Old Town Fort Collins Historic District be created pursuant to Chapter 69 of the Code of the City of Fort Collins; and

WHEREAS, such a district would be created for the following purposes:

1. To encourage public knowledge and appreciation of the architectural character of Old Town and the history of Fort Collins.

2. To promote the public welfare by strengthening the cultural and educational life of the City, stimulating the enrichment of human life by developing educational and cultural dimension while making Fort Collins a more attractive and desireable place to live.

3. To preserve and protect the beauty and quality of Old Town Fort Collins because it reflects distinctive features of Fort Collins' growth and development by defining and maintaining an appropriate image and atmosphere to enhance Old Town as a cultural resource for this and future generations.

4. To foster economic growth through redevelopment without disrupting the beauty of Historic Old Town by encouraging appropriate use, by restraining environmental influences adverse to such purposes due to pressures resulting from population growth and development, and by encouraging private efforts in support of such purposes.

5. To prevent misguided improvements and to encourage the mitigation of previous incompatible improvements.

NOW, THEREFORE, BE IT ORDAINED BY THE COUNCIL OF THE CITY OF FORT COLLINS AS FOLLOWS:

Section 1. That that certain property whose description appears on Exhibit "A" attached hereto, and by this reference incorporated herein, be, and it hereby is, designated as a Landmark District pursuant to Chapter 69 of the Code of the City of Fort Collins.

Section 2. That said district shall be known as the Old Town Fort Collins Historic Landmark District.

Section 3. That this designation shall take effect at such time as a certified copy of this Ordinance has been recorded in the Office of the Clerk and Recorder of Larimer County.

Introduced, considered favorably on first reading, and ordered published this 4th day of December, A.D. 1979, and to be presented for final passage on the 18th day of December, A.D. 1979.

Mayor

ATTEST:

City Clerk

Passed and adopted on final reading this 18th day of December, A.D. 1979.

Mayor

ATTEST:

City Clerk

National Designation
Aug 2, 1978
Local Designation
Dec 16, 1980

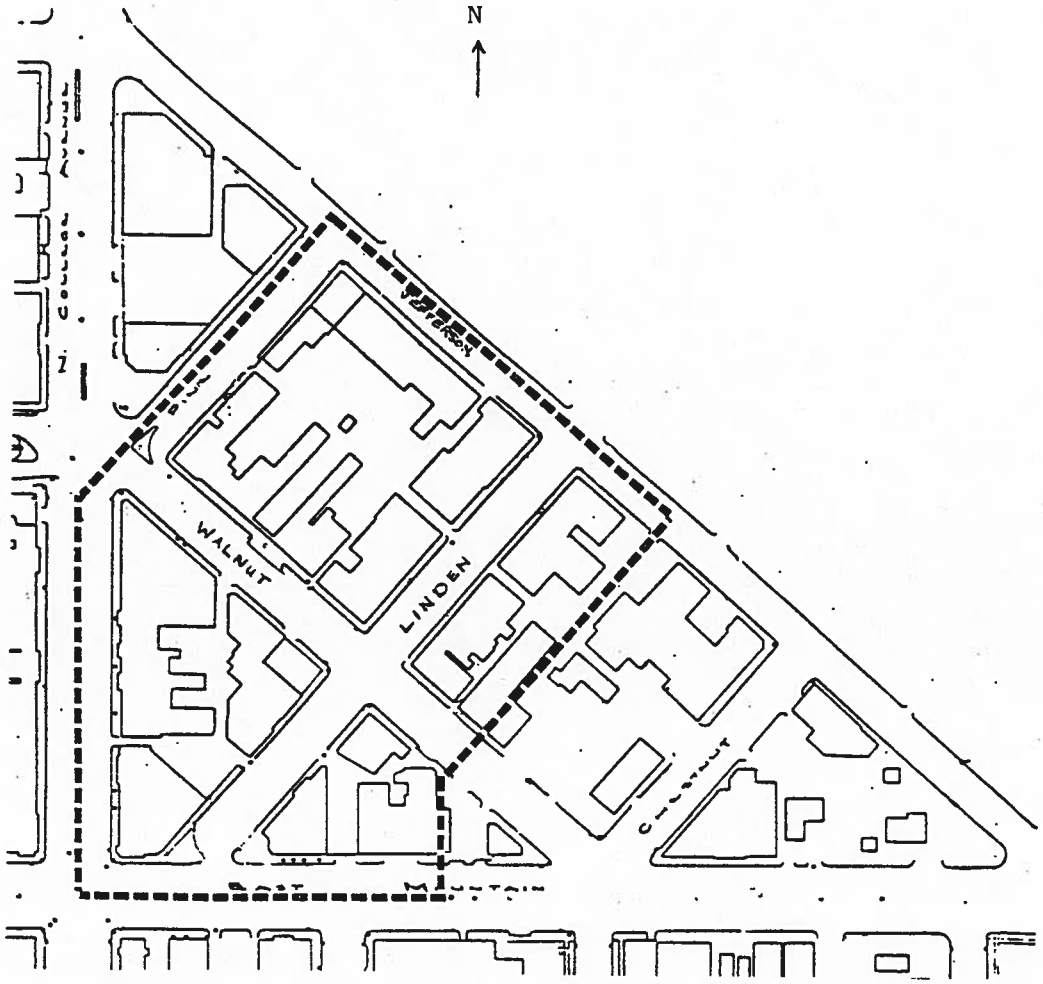
EXHIBIT "A"

LEGAL DESCRIPTION OF HISTORIC OLD TOWN
FORT COLLINS LANDMARK DISTRICT

Lots 11, 12, 13, 14, 15 and 16 of Block 12, Block 13, Block 18, and Lots 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 and 21 of Block 19, in the City of Fort Collins, County of Larimer, State of Colorado.

NOTICE IS HEREBY GIVEN that a hearing will be held before the Cultural Resources Board of the City of Fort Collins at 8:00 O'clock on the 26th day of September, 1979 at City Council Chambers, New Municipal Building, 300 Laporte Avenue, Fort Collins, Colorado for the purpose of considering the designation of the property described below as an hisoric landmark district.

District Boundaries are illustrated on map below.



OWNER-LINDEN SQ
PARTNERSHIP II

RCPTN # 85059145 11/19/85 15:47:39 # OF PAGES - 1 FEE - $3.
J. ULVANG, RECORDER - LARIMER COUNTY, CO. DOC. FEE- $.00

ORDINANCE NO. 44, 1974
BEING AN ORDINANCE DESIGNATING CERTAIN PROPERTY AS A LANDMARK

WHEREAS, the Landmark Preservation Commission has, by Resolution, recommended to the City Council, the designation of the property hereinafter described as a landmark; and

WHEREAS, the owners of said property have consented to the designation of the same as a landmark; and

WHEREAS, the City Council has reviewed the recommendation of the Landmark Preservation Commission and has heard a report by the members of said Commission and desires to accept such recommendation and designate said property as a landmark.

NOW, THEREFORE, BE IT ORDAINED BY THE COUNCIL OF THE CITY OF FORT COLLINS that the structure known as the Linden Hotel, located on lands described as follows, to-wit:

A portion of Lots 2 and 4, Block 13, City of Fort Collins, also known as 201 Linden Street, Linden Hotel Building;

be and the same hereby is designated as a landmark in accordance with the Ordinances of the City of Fort Collins.

Introduced, considered favorably on first reading and ordered published this 1st day of August, 1974, and to be presented for final passage on the 13th day of August 1974.

Mayor

ATTEST:

City Clerk

Passed and adopted on final reading this 15th day of August, 1974.

Mayor

ATTEST:

Deputy City Clerk

CONSENT TO DESIGNATION AS HISTORIC LANDMARK

TO: Fort Collins Landmark Preservation Commission

The undersigned owner(s) hereby consents that the following property be designated by the Fort Collins Landmark Preservation Commission as a historic landmark. The legal description of said property is described as follows:

PORTION OF LOTS 2 AND 4 BLOCK 13
CITY OF FORT COLLINS ALSO KNOWN AS
201 LINDEN ST. LINDEN HOTEL BUILDING

I understand that should the Commission designate the property as a historic landmark the property will be subject to certain controls. I understand that upon designation I will be requested to notify the Secretary of the Landmark Preservation Commission prior to any of the following:

1. Selling or leasing the property or improvements,
2. Preparation of plans for reconstruction or alteration of the exterior of the improvements, or
3. Preparation of plans for construction of or addition to or demolition of improvements on the property.

I further understand that if I apply for a building permit for any one of the following:

1. Alteration or reconstruction or addition to the exterior of any improvements,
2. Demolition of improvements, or
3. Construction or erection of or additions to improvements,

and if I have not obtained prior consent from the Commission, the building inspector will, within seven days, notify the Commission of my application for a building permit. The Commission will have a period of ninety days after filing of the application for a building permit to develop, with my consent, either alternate plans or appropriate public or private uses of the property. If an agreement cannot be worked out within the ninety day period my application for a building permit will then be processed as if the designation of historic landmark did not exist.

Dated at Fort Collins, Colorado, this 22 day of June, 1979

Veterans of Foreign Wars
Rocky Mountain Post 1781
Bill Tearsat Trustee
Ray McFarrell Quartermaster
OWNER

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Historic Window Components

Window components include:

- Sash
- Frame
- Number of lights (panes)
- Shutters
- Security Devices (bars and screens)
- Insect screens
- Storm windows

Before rehabilitation: upper story windows in need of repair.

After rehabilitation: repaired windows.

WINDOWS

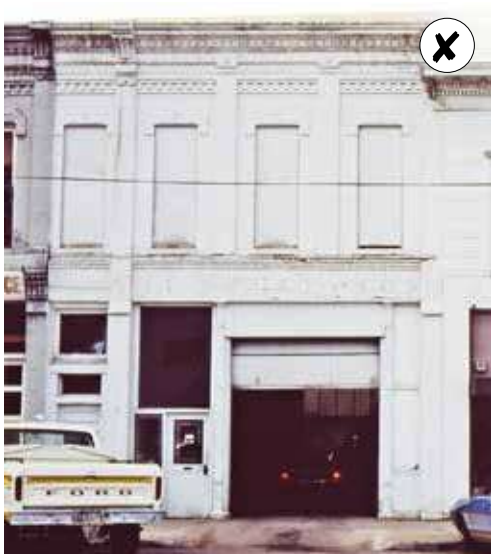
Historic windows help convey the significance of historic structures, and shall be preserved. They can be repaired by re-glazing and patching and splicing elements such as muntins, the frame, sill and casing. Repair and weatherization also is often more energy efficient, and less expensive, than replacement. If a historic window cannot be repaired, a new replacement window shall be in character with the historic building.

3.8 Maintain and repair historic windows.

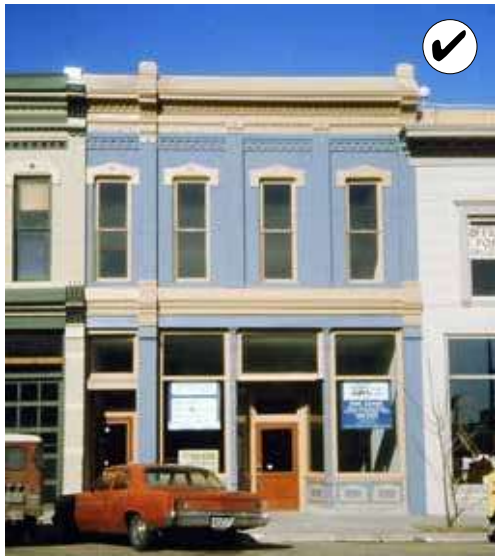
- Preserve historic window features including the frame, sash, muntins, mullions, glazing, sills, heads, jambs, moldings, operation and groupings of windows.
- Repair and maintain windows regularly, including trim, glazing putty and glass panes.
- Repair, rather than replace, frames and sashes.
- Restore altered window openings to their historic configuration.

3.9 Replace a historic window with a matching design if repair is not possible.

- Replace with the same material.
- Match the appearance of the historic window design (i.e., if the historic is double-hung, use a double-hung replacement window).
- Maintain the historic size, shape and number of panes.
- Match the profile of the sash, muntin and its components to the historic window, including the depth of the sash, which may step back to the plane of the glass in several increments.
- Use clear window glazing that conveys the visual appearance of historic glazing (transparent low-e glass is preferred).
- Do not use vinyl and unfinished metals as window replacement materials.
- Do not use metallic or reflective window glazing.
- Do not reduce a historic opening to accommodate a smaller window or increase it to accommodate a larger window.



Before rehabilitation: historic windows are missing.



After rehabilitation: historic openings are restored.

Match the appearance of a historic window design (i.e., if the historic is double-hung, use a double-hung replacement window).

Replace historic windows (top) with a matching design (bottom), if repair is not possible.

Do not reduce a historic opening to accommodate a smaller window or increase it to accommodate a larger window.

Alternative Window Material

If it is not possible to match the historic design and materials of a window, then an alternative design may be considered in the following locations:

- On a non-primary façade, accessory building or addition
- On a primary façade if no other option is available

Alternative window designs shall:

- Match the general profile and details of the historic window.
- Use materials that match the historic appearance in dimension, profile and finish.

3.10 Use special care when replacing a window on a primary façade.

- Give special attention to matching the historic design and materials of windows located on the façade.
- Also, match the historic design when replacing a window located on a secondary wall.

3.11 Design a storm window to minimize its visual impacts.

- If a window did not historically have a storm window, place a new storm window internally to avoid exterior visual impacts.
- Use storm windows designed to match the historic window frame if placed externally.
- Use insect screens with painted wooden frames where wood windows exist.

3.12 Restore a historic window opening that has been altered.

- Restore a historic window opening that previously existed.
- Place a new window to fit within the historic opening.

For More Information

See web link to *Preservation Brief 9: The Repair of Historic Wooden Windows*

http://www.nps.gov/tps/how-to-preserve/briefs/9-wooden-windows.htm

See web link to *Preservation Brief 13: The Repair and Thermal Upgrading of Historic Steel Windows*

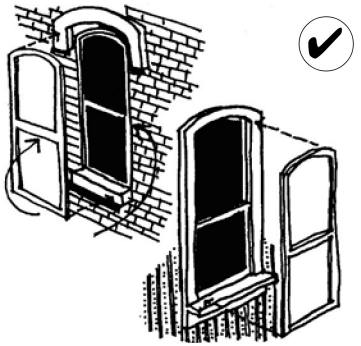
http://www.nps.gov/tps/how-to-preserve/briefs/13-steel-windows.htm

See web link to window retrofit article from the National Trust for Historic Preservation web site

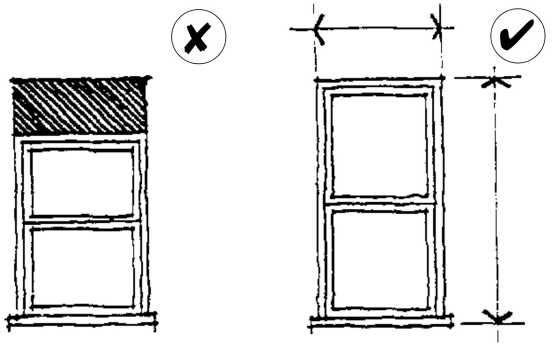
http://www.preservationnation.org/who-we-are/press-center/press-releases/2012/new-windows-study.html

Web link to window treatments National Park Service Tech Notes. Scroll down page to window to secure links

http://www.nps.gov/tps/how-to-preserve/tech-notes.htm



Place storm windows internally to avoid exterior visual impacts (right). Use storm window inserts designed to match the historic frame if placed externally (left).



Preserve the size and proportion of a historic window opening.

ARTICLE

The Secretary of the Interior's Standards for the Treatment of Historic Properties: Rehabilitation as a Treatment and Standards for Rehabilitation

Rehabilitation as a Treatment

Rehabilitation is defined as the act or process of making possible a compatible use for a property through repair, alterations, and additions while preserving those portions or features which convey its historical, cultural, or architectural values.

Standards for Rehabilitation

1. A property will be used as it was historically or be given a new use that requires minimal change to its distinctive materials, features, spaces and spatial relationships.
2. The historic character of a property will be retained and preserved. The removal of distinctive materials or alteration of features, spaces and spatial relationships that characterize a property will be avoided.
3. Each property will be recognized as a physical record of its time, place and use. Changes that create a false sense of historical development, such as adding conjectural features or elements from other historic properties, will not be undertaken.
4. Changes to a property that have acquired historic significance in their own right will be retained and preserved.
5. Distinctive materials, features, finishes, and construction techniques or examples of craftsmanship that characterize a property will be preserved.
6. Deteriorated historic features will be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature will match the old in design, color, texture and, where possible, materials. Replacement of missing features will be substantiated by documentary and physical evidence.

7. Chemical or physical treatments, if appropriate, will be undertaken using the gentlest means possible. Treatments that cause damage to historic materials will not be used.
8. Archeological resources will be protected and preserved in place. If such resources must be disturbed, mitigation measures will be undertaken.
9. New additions, exterior alterations, or related new construction will not destroy historic materials, features, and spatial relationships that characterize the property. The new work will be differentiated from the old and will be compatible with the historic materials, features, size, scale and proportion, and massing to protect the integrity of the property and its environment.
10. New additions and adjacent or related new construction will be undertaken in such a manner that, if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.

The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring & Reconstructing Historic Buildings

- Introduction, Historical Overview, Preservation Standards & Guidelines, Rehabilitation Standards & Guidelines (pp.1-162, PDF) (https://www.nps.gov/orgs/1739/upload/treatment-guidelines-2017-part1-preservation-rehabilitation.pdf)
- Restoration Standards & Guidelines and Reconstruction Standards & Guidelines (pp.163-241, PDF) (https://www.nps.gov/orgs/1739/upload/treatment-guidelines-2017-part2-reconstruction-restoration.pdf)

☑ **Important Note about the Standards for Rehabilitation**

The **Secretary of the Interior's Standards for the Treatment of Historic Properties (36 CFR Part 68, 1995)** consists of four treatment standards—Preservation (https://www.nps.gov/articles/000/treatment-standards-preservation.htm), Rehabilitation (https://www.nps.gov/articles/000/treatment-standards-rehabilitation.htm), Restoration (https://www.nps.gov/articles/000/treatment-standards-restoration.htm), and Reconstruction (https://www.nps.gov/articles/000/treatment-standards-reconstruction.htm)—and are regulatory for NPS Grants–in–Aid programs. The Secretary of the Interior's Standards for Rehabilitation (https://www.nps.gov/subjects/taxincentives/secretarys-standards-rehabilitation.htm) **(36 CFR Part 67, 1990)**, which are included in the Treatment Standards, are regulatory for the

Federal Historic Preservation Tax Incentives program (https://www.nps.gov/subjects/taxincentives/index.htm) and are the criteria used to determine if a project qualifies as "a certified rehabilitation." The 1990 and the 1995 versions of the Rehabilitation Standards convey the same intent and provide the same guidance, although they are worded slightly differently, and "shall" replaces "will" in the 1995 version. **The Secretary of the Interior's Standards for the Treatment of Historic Properties**, in particular the Standards for Rehabilitation, are intended as general guidance for work on all historic properties, are widely used, and have been adopted at the Federal, State, and local levels.

Choosing Rehabilitation as a Treatment

In **Rehabilitation**, historic building materials and character-defining features are protected and maintained as they are in the treatment Preservation. However, greater latitude is given in the Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings (https://www.nps.gov/orgs/1739/upload/treatment-guidelines-2017-part1-preservation-rehabilitation.pdf) to replace extensively deteriorated, damaged, or missing features using either the same material or compatible substitute materials. Of the four treatments, only Rehabilitation allows alterations and the construction of a new addition, if necessary for a continuing or new use for the historic building.

When repair and replacement of deteriorated features are necessary; when alterations or additions to the property are planned for a new or continued use; and when its depiction at a particular time is not appropriate, Rehabilitation may be considered as a treatment. Prior to undertaking work, a documentation plan for Rehabilitation should be developed.

The Guidelines for the Treatment of Historic Properties (https://www.nps.gov/orgs/1739/upload/treatment-guidelines-2017-part1-preservation-rehabilitation.pdf) illustrate the practical application of the Standards for Rehabilitation to historic properties.

History of the Standards

Read a History of The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring & Reconstructing Historic Buildings. (https://www.nps.gov/articles/000/treatment-standards-history.htm)

TAGS

secretary's standards | technical preservation services

Last updated: February 1, 2024

Was this page helpful?

Yes

No

WINDOW EVALUATION

FOR

201 LINDEN STREET

FORT COLLINS, CO 80524

PREPARED FOR:

CITY OF FORT COLLINS
OFFICE OF HISTORIC PRESERVATION
281 NORTH COLLEGE
FORT COLLINS, CO 80524

PREPARED BY:

PHILLIP BARLOW
HISTORIC PRESERVATION SPECIALIST
BARLOW CULTURAL RESOURCE CONSULTING LLC
4576 TANGLEWOOD TRAIL
BOULDER, CO 80301

EVALUATION DATE: NOVEMBER 29, 2018

TABLE OF CONTENTS

SUMMARY OF FINDINGS:

Located in the Old Town Historic District in Fort Collins, the Linden Hotel at 201 Linden Street was constructed in 1883 and designed by William Quayle. Originally housing the Poudre Valley National Bank on the street level with a Masonic Lodge above, the building became the Linden Hotel in 1904.[1] A good example of late 19th century commercial architecture, the Linden Hotel features a clipped corner entry with full-height oriel above, crowned with a pyramidal hood. The building utilizes a tripartite division of the facade, dividing the building into the ground level storefront, a central level characterized by arched stone lintels over the windows, and capped by a third level featuring a metal bracketed cornice.

The City of Fort Collins contracted with BCRC LLC to evaluate the windows in their existing condition to determine if recent alterations rendered them unsalvageable and in need of replacement. The evaluation consisted of deconstructing one window to determine the scope of the previous repairs and alterations, and examining all windows visually to determine if conditions were consistent around the building. Photo documentation of the interior and exterior of each window and a layout of the window numbering system is available in the appendix.

The deconstruction of the test window revealed that the original weight and pulley balance system had been discarded and a modern spiral balance system, which relies on spring tension to balance the sash, had been installed. To install this system a groove was cut on the vertical sides of the window sash (the stiles) to house the mechanism. This groove weakened the stiles and made weatherstripping on the sides of the sash impossible. A pane of glass was installed on the interior face of the upper and lower sash. To install this pane of glass flush with the interior face of the sash a groove was cut into the sash. Repairs made during this restoration phase appear to be minimal and many major repairs remain to be addressed. Paint and glazing putty were not fully removed from the sash. Lead paint remains on a least one sash that was tested.

The final finding is that, despite the destructive nature of the alterations made, these window sash can be brought back to full function by following a full restoration program, the full details of which can be found in the body and appendix of this report. To meet the goals of energy efficiency and sound reduction, preservation appropriate modifications are detailed, including a weatherstripping program and storm windows.

As a historic building, modifications to character defining features like the window system should be compliant with the Secretary of the Interior's Standards for Rehabilitation. To establish a baseline of information, these standards are stated in full in the following section. Throughout the report these standards will be referenced to illustrate how the proposed work will be fully compliant.

Thank you for the opportunity to visit this property. If you have any questions or comments please contact me at 303-746-1602, or barlowpl@gmail.com

Regards,

Phillip Barlow, Owner
BCRC LLC
(303)746-1602

[1] Noel, T. J. (2002). *Buildings of Colorado*. New York: Oxford University Press. Pg. 225

National Park Service
U.S. Department of the Interior
STANDARDS FOR REHABILITATION

"Rehabilitation is defined as the act or process of making possible a compatible use for a property through repair, alterations, and additions while preserving those portions or features which convey its historical, cultural, or architectural values.

The Standards will be applied taking into consideration the economic and technical feasibility of each project.

1. A property will be used as it was historically or be given a new use that requires minimal change to its distinctive materials, features, spaces and spatial relationships.
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7. Chemical or physical treatments, if appropriate, will be undertaken using the gentlest means possible. Treatments that cause damage to historic materials will not be used.
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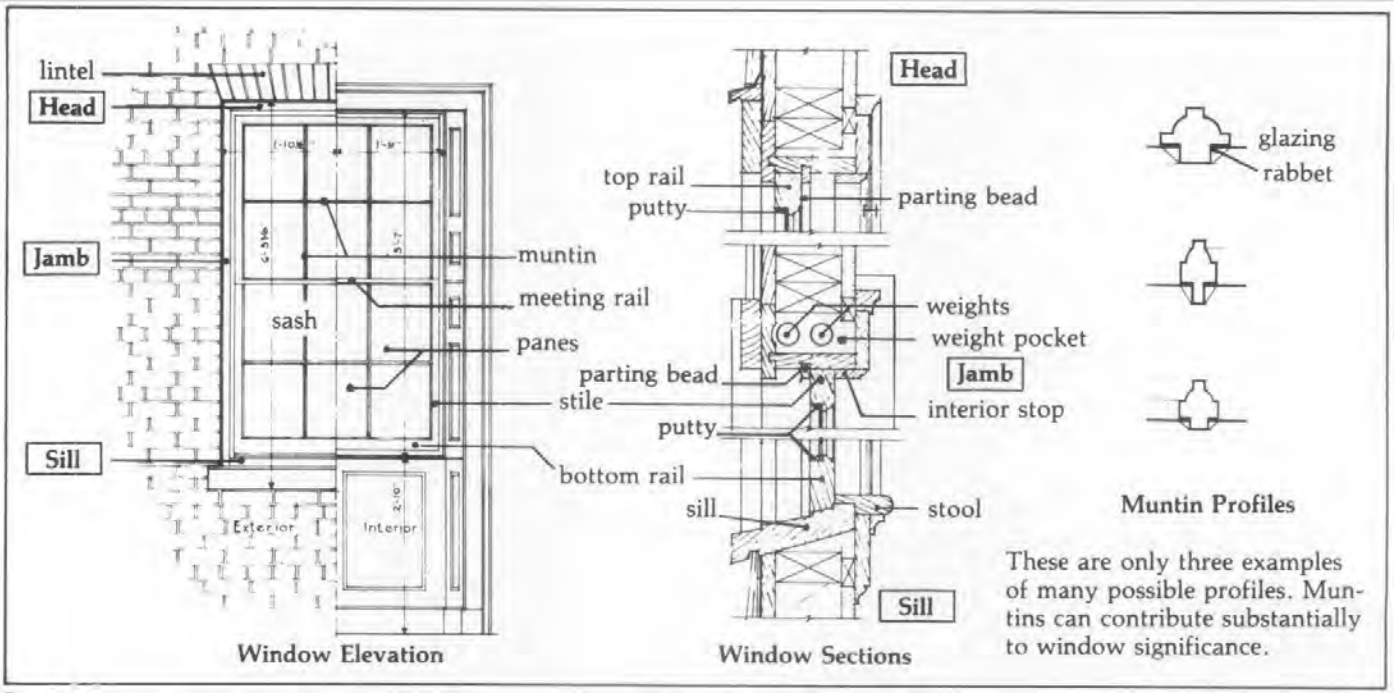
Rehabilitation as a treatment

When repair and replacement of deteriorated features are necessary; when alterations or additions to the property are planned for a new or continued use; and when its depiction at a particular period of time is not appropriate, Rehabilitation may be considered as a treatment." [2]

[2] https://www.nps.gov/tps/standards/four-treatments/treatment-rehabilitation.htm

DESCRIPTION OF THE TYPICAL WOOD DOUBLE-HUNG WINDOW SYSTEM



3

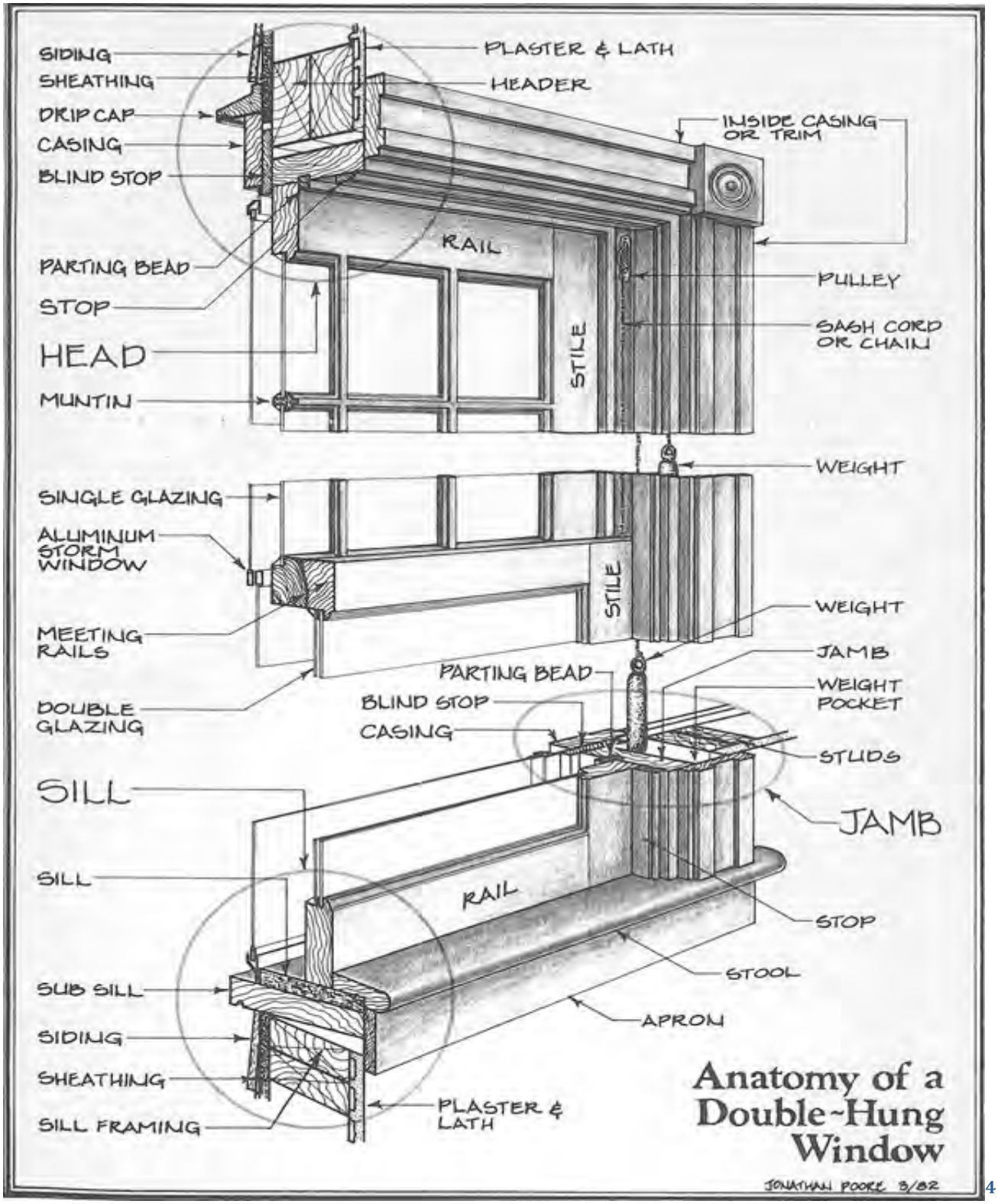
The typical double-hung wood window system consists of the jamb, which are the sides and upper portion of the window that remain static within the wall. At the bottom of the jamb is the sill, which slopes to the exterior of the building to allow for drainage. On the interior, the stool projects into the room and is the flat decorative trim that abuts the lower sash and is typically not sloped.

The illustration above shows the sash, which are the wood frames that hold the window glass and are the only parts of the window that move. The sash of the Linden Hotel are 1/1, which means that there is a single pane of glass in the upper sash and a single pane of glass in the lower sash. The upper sash has four components; the upper rail, which is the top of the sash, the meeting rail, which is the bottom of the sash that "meets" the same rail on the lower sash, and the left and right stiles, which are the vertical members that connect the upper rail and the meeting rail. The lower sash has the meeting rail at the top of the sash, a lower rail at the bottom of the sash which is typically taller than the other sash members, and a left and right stile.

Double-hung operation means that both the upper and the lower sash are designed to move. This is a common configuration because it allows for natural air flow, with the hot air leaving through the top and cooler air coming in through the bottom. The Linden Hotel utilized a rope-and-pulley counterbalance system to allow for ease of operation and to ensure that the windows stay open when desired. This system consists of a rope or chain that is attached to each side of the sash which goes over a pulley which is mortised into the top of each side of the jamb. There is an open space on each side of the jamb that allows room to house the window weights. These weights each weigh half the weight of the sash so that the window can easily open and then stay where ever the occupant desires. The rope or chain that was attached to the sash and brought over the pulley is connected to the weights and the system is balanced.

[3] Myers, J. H. (1981) "Preservation Briefs: 9 The Repair of Historic Wooden Windows" U.S. Dept. of Interior, Heritage Preservation Services, Pg. 2

Between the upper and lower sash is a piece of trim called the "parting stop", and on the interior side of the jamb is a strip of trim called the "interior stop" which keeps the lower sash in place and tight to the parting stop.



[4]

[4] Old House Journal "Repairing Hopeless Windows" April 1982, pg. 87

REVIEW OF CONDITIONS

Defect 1:

Window sash do not operate easily. The original balance system would have consisted of window weights, ropes, and pulleys. The windows were altered by adding a second pane of glass on the interior, increasing the weight. A modern spiral balance system was installed with the intention that it would provide the necessary counterbalance for the additional weight. This system has not proven effective. When this system was introduced the weight pockets were filled with blown-in insulation and the window pulleys and weights were presumably discarded.

Image 1: Note missing window pulley. A cover, visible at the bottom of the image, was milled to prevent the window from opening fully, to cover the space left by the removed pulley, and to cover the end of the spiral balance.

Image 2: Cover in place. Black plastic tube houses the spiral balance mechanism.

Proposed Solution:

The best solution would be to return the window pulleys and weights to the window system. This may not be possible if these components have already been discarded. A good solution at this point would be to utilize spring balances. Unlike spiral balances, the spring balance uses the existing pulley mortises and does not require any additional removal of wood from the window sash. Spring balance technology also has a long track record and has proven to be durable.

Note: Specific products and manufacturers are noted in this report as examples of currently available products and are not recommendations. The author has no business or personal relationship with any of the noted companies. It is the responsibility of the contractor and architect to research all options and choose the products that best fit the needs of the project.

One supplier of spring replacement balances that has a good history with historic windows is the Pullman Manufacturing Corporation. https://www.pullmanmfg.com/window-balances-standard-balances/

These balances can accommodate sash up to 105 pounds and can be installed with minimal mortise work in the existing openings. The blown-in insulation can stay in place with this recommendation.

These balances are ordered based on the weight of the sash and the length of sash travel. In my experience, it is best to order the tape long to allow for easier operation. If the upper sash are not scheduled for operation, there is no need to install any operating hardware on these sash and they can simply be blocked and caulked in place.

Image 3: Pullman balance installed in place of a window pulley. Photo courtesy of the Pullman website

Compatibility with the Secretary of the Interior's Standards for Rehabilitation:

Previous treatment

The removal of the traditional balance system and installation of a modern spiral balance does not comply with standards 5 and 6, which address the retention of historic materials and the importance of repair versus replacement. If a treatment, like adding a secondary pane of glass, necessitated the removal of traditional materials then it should not have been considered.

Proposed treatment

If the original weights and pulleys can be located then their reintroduction into the window system is fully in compliance. The introduction of the spring balance is not ideal, as it is not the original design. However, it is an alteration that has been found acceptable when the original balance system has been lost.

Defect 2:

The introduction of a spiral balance system necessitated the cutting of a channel into the left and right stiles of each sash to house the hardware. On the examined window, this channel was 5/8" in width with a rounded bottom with max depth of 1/2". This left approximately 1/4" of material on one side of the groove and 7/16" on the other. The sides of the channel had already split in some places and will continue to fail going forward.

Image 4: Groove cut into one stile. White arrows notate the groove.

Image 5: Attachment hardware was added to the bottom of the sash for the spiral balance

Image 6: Note the split that has already developed as a result of the removal of supporting material. In addition, note the thinly filled epoxy repairs that are adjacent

Proposed Solution:

The following are two options for addressing the lost material which has degraded the integrity of the window sash. The Dutchmen solution is likely the most stable and durable, but it does mean that more of the historic window sash is lost. However, it will enhance the structural stability of the remaining material and retain the look and feel of the historic sash. The epoxy solution will retain all of the existing historic material, but it may be more prone to failure and will essentially "glue" many components of the window together.

Dutchmen Solution

- Remove all spiral balance hardware from the sash
- Determine the max depth of the channel as it may vary due to how the cut was made.
- Make notes if the depths vary
- Make notes of where the sash cord knot hole and channel were
- Make notes on the full width of the meeting rail in case any portion of it will be cut
- Cut the sides of the sash down even with the depth of the channel
- Cut new wood slightly thicker than the sash stile and as wide as the previous channel-depth measurement
- Glue the new wood to the sides of the sash and clamp on. Use high quality indoor/outdoor carpenters glue. Allow to dry according to manufacturers specifications
    - Note: If full reversibility is desired, then the new wood should be screwed tightly onto the sash without the use of glue
- If the original weights and pulleys are to be used, route a groove and drill a knot hole according to the previously recorded measurements
- If spring balances are to be used, follow the manufacturer's installation instructions
- If any portion of the meeting rail profile as removed then cut a matching piece per the recorded measurements and attach
- Sand and/or plane the portions of the new wood that are not flush with the original sash to create a smooth appearance

Epoxy Solution

- Remove all spiral balance hardware from the sash
- Make notes of where the sash cord knot hole and channel were
- Select an epoxy system. The following are three epoxy systems that have been used successfully on historic properties
    - https://www.abatron.com/
    - https://www.westsystem.com/
    - http://www.conservationtechnology.com/building_repair.html
- Prep the wood according to manufacturers recommendations
- Fill the groove with the selected epoxy
- Sand the epoxy back to the smooth finish and down to the original dimensions of the window
- If the original weights and pulleys are to be used, route a groove and drill a knot hole according to the previously recorded measurements
- If spring balances are to be used, follow the manufacturer's installation instructions

Compatibility with the Secretary of the Interior's Standards for Rehabilitation:

Previous treatment

The installation of a modern spiral balance required the removal of substantial historic material and altered the original design of the window. This does not comply with standards 5 and 6, which address the retention of historic materials and the importance of repair versus replacement. If a treatment, like adding a secondary pane of glass, necessitated the removal of traditional materials then it should not have been considered.

Proposed treatment

Both of the proposed treatments focus on preserving as much of the original material as possible. The Dutchmen repair is more appropriate as it is a replacement in-kind, although it does have the drawbacks noted above. If completed with screws and no glue, then the Dutchmen repair has the added benefit of being reversible.

Defect 3:

Glass panes were added to the interior of the upper and lower sash with the goal of reducing sound transference and improving energy efficiency. A groove was cut into the interior face of the sash to a depth of approximately 3/16" and a width of 3/8" for the glass to fit into. The glass is held in place with four turn button clips. During inspection the panels did not fit tight into this groove and rattled when pressed against. In some locations the glass panels had slipped out of the groove leaving air gaps. The lack of a seal negates significant noise reduction or improved energy efficiency. If a better seal is achieved, then there is a risk that condensation will be exacerbated on the interior face of the primary glazing, which will then be trapped in between the two layers of glass and hasten deterioration of the historic sash. The glass pane on the upper sash covers the historic location of the sash lock.

Image 7: Groove cut to house glass panel. The open space underneath the sash is due to the sill and stool being missing, presumably awaiting restoration.

Image 8: Note that glass panel does not fit tight in groove

Image 9: Glass panel is slipping. Fit is loose

Proposed Solution:

Remove the added glass panes. The benefit they provide is negligible and their presence makes operation of the window difficult. Energy efficiency will be addressed in a separate section. Unfortunately the groove that

was cut for the glass to set in is likely best left alone. If a repair to return the window sash to their original look is desired then strips of wood will need to be glued into the channel and custom router bits manufactured to allow the profile to be recreated on the sash. However, this solution would require complete disassembly of each window sash, and as such may not be practical. The most realistic way forward may be to consider this groove as a part of the windows history.

Compatibility with the Secretary of the Interior's Standards for Rehabilitation:

Previous treatment

The addition of a glass panel caused the destruction of historic materials and led to other incompatible alterations, which is prohibited by Standard 9.

Proposed treatment

The removal of the glass panel will return the window to its original condition as closely as possible, which is in compliance with the Standards.

Defect 4:

Standard practice for restoring historic wood sash is the removal of, at a minimum, loose and flaking paint so that new paint has a solid surface to adhere to. Better practice is to completely remove all paint layers so that the wood can be fully evaluated for defects that would need to be addressed. During evaluation it was noted that paint was not removed in any significant way from the sash and many needed repairs to the sash were left untreated.

A 3M LeadCheck product was used on the lower sash of window 003-12. The test came back positive for lead paint.

Image 10: Note the condition of the lower rail and the built-up paint

Image 11: Note flaking paint

Image 12: 3M LeadCheck test. Red indicates the presence of lead. Many paint layers were visible when scoring down to bare wood

Proposed Solution:

All of the sash should be stripped of all paint down to bare wood. Each sash should then be evaluated to determine if additional repairs are needed.

Compatibility with the Secretary of the Interior's Standards for Rehabilitation:

Previous treatment

Leaving the paint on the sash and performing minimal repairs is acceptable per the Standards. However, more maintenance will soon be necessary as the windows continue to degrade.

Proposed treatment

Removing all paint layers is an acceptable practice as part of the restoration process. No historic material is lost via this process. If a record of the historic paint layers is desired, then samples can be collected from a variety of locations before the windows are removed for stripping.

The EPA Renovation, Repair and Painting Program (EPA RRP) likely applies to this project. Please ensure that all activities that disturb paint follow the guidelines specified by the EPA, which are available online at: https://www.epa.gov/lead/renovation-repair-and-painting-program

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Defect 5:

Standard practice for restoring historic wood sash is the removal of failed glazing compound and replacement with a comparable putty that replicates the look of the original and, to the extent possible, the performance. Some of the sash did not have putty removed, presumably because it was still in good condition. The condition of the old putty cannot be verified due to the paint layer on top. Many sash have a white compound applied which appears to be a DAP window glazing caulk, although this cannot be verified without a submittal from the contractor. This DAP product is acceptable, as are other caulk-tube extruded glazing compounds, however it was applied leaving a concave surface and was applied quite thinly in several areas which will lead to premature failure. Finally, several of the windows were overpainted onto the glass significantly. While this is not a structural or performance concern, it negatively impacts the aesthetic of the window and reduces occupant enjoyment.

Image 13: Note the concave surface of the glazing compound. This is less effective at shedding water and does not replicate the historic appearance

Image 14: Note how the new glazing compound does not come up to the edge of the bed and has a ragged edge

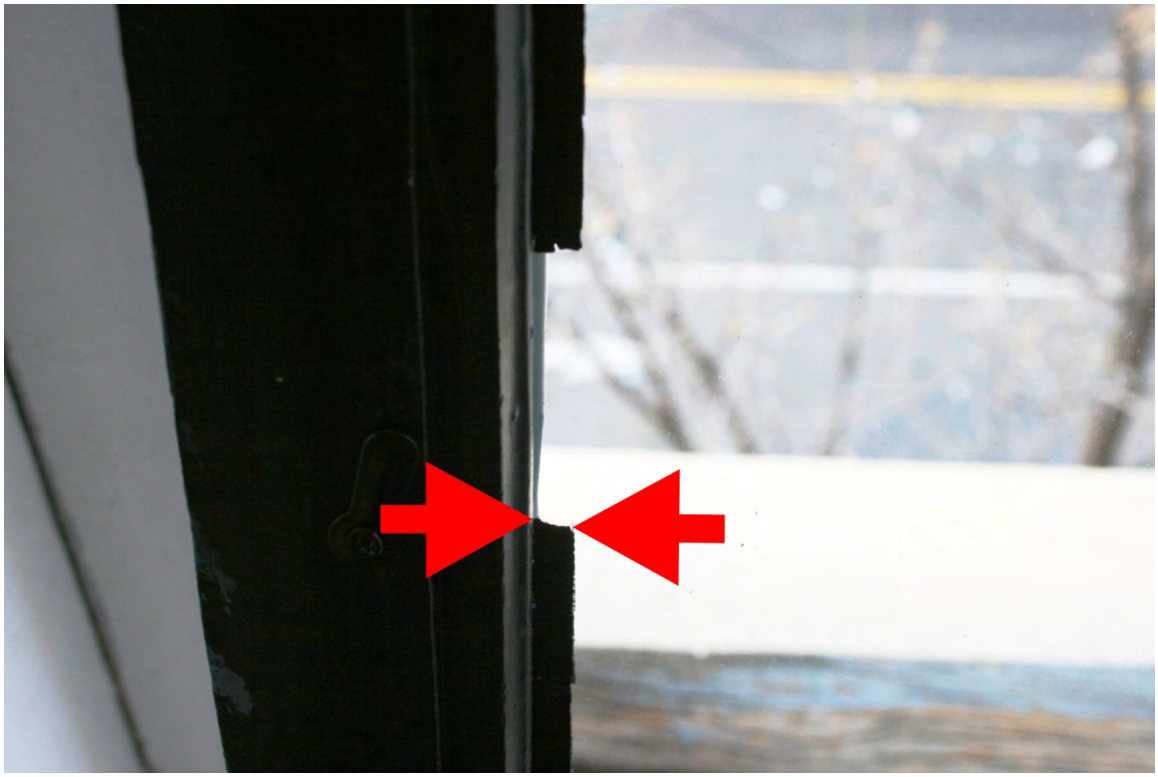

Image 15: Evidence of overpainting. A section of paint was removed to show where the paint should have ended. The area between the arrow points is over painted

Proposed Solution:

As part of the paint removal process, all glazing putty should be removed as well. The glass should be removed from the sash, cleaned, and reset in a new bed of glazing compound with new points. All efforts should be made to save original glass whenever possible. Only one pane of original glass was noted during the evaluation, located on the lower sash of window 003-3.

There are a variety of window putties available that are appropriate for historic windows. Please conduct research to determine the best fit for skill level and application. The following are two examples of glazing putty products that have been successfully used on historic wood windows.

Advanced Repair Technology's Glaze-Ease 601
http://www.advancedrepair.com/glazing_glaze_ease_601.html

Sarco's Multi-Glaze Type M Putty (Available online from a variety of suppliers)
https://www.srshardware.com/product/sarco-multi-glaze-type-m-putty/

Compatibility with the Secretary of the Interior's Standards for Rehabilitation:
Previous treatment
The durability of the current glazing is unknown but suspected to be relatively short. More information about the product used would be necessary to determine if it does not meet the Standards.

Proposed treatment
Reglazing with a product designed for historic wood windows is fully compliant with the Standards.

Defect 6:
The window sash weatherstripping consists of a pile weatherstripping applied to the exterior face of the interior stop so that it seals against the lower sash when the window is closed. There is also bulb weatherstripping applied to the exterior face of the lower-sash meeting rail to seal the upper sash to the lower sash when the window is closed. Finally, there is also bulb-seal applied to the bottom of the lower sash to seal with the sill. The bulb seals are all appropriate and within standard practice for weatherstripping historic wood sash. The pile weatherstripping, while acceptable, isn't sealing the window to the extent desired.

Proposed Solution:
T-rail metal weatherstripping is a traditional system that is still in use today and would have been available at the time of the building's construction. The system consists of metal strips that are affixed to the jamb that have a protrusion that interfaces with a 5/32" x 7/16" groove cut into the side of the sash. For additional sealing and smoother operation, it is recommended that single-sided glazing tape be affixed to the back of the metal strip to seal between it and the jamb. This method of weatherstripping is compatible with the spring balances described earlier. The bulb seals that are currently in place at the meeting rail and the bottom rail should stay as they are, although some of the meeting rail bulb seals may need to be replaced as they were damaged during lock installation.

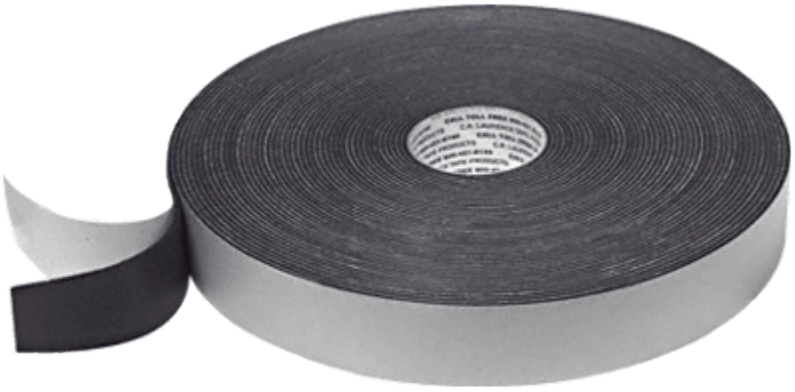

Image 16: Example of single-sided foam glazing tape

Image 17: Damaged seal at meeting rail

Image 18: Image from Accurate Weatherstripping. The sill strip can be omitted in the described application

There are a variety of similar options to the described approach. Please conduct research to determine the best fit for the situation at hand.

As an example, Accurate Metal Weatherstrip Co. Inc. has a variety of products that have successfully been installed in historic buildings. The product closest to what has been described, and installation instructions, can be viewed online at:
http://metalstrips.accurateweatherstrip.com/product/window-weatherstrips/s-series-no-10-up-1-3-8-or-1-3-4-double-hung-sash-

Compatibility with the Secretary of the Interior's Standards for Rehabilitation:
Previous treatment
The previous treatment is compatible with the Standards

Proposed treatment
The proposed treatment is adding new material to the window system, but it is reversible without causing damage or loss of historic materials which is compatible with the Standards. The proposed treatment is also a well-established protocol for historic windows with a track record of durability.

Defect 7:
Structural repairs were treated with a skim-coat of epoxy when dutchmen repairs would have been more appropriate. Some meeting rails on the upper sash are slipping, which should have been addressed during the most recent restoration. The following list of items is not comprehensive and consists only of what was noticed during the evaluation. All paint layers should be removed so that the full extent of necessary repairs can be discerned.

Window 2-6: Lower sash, crack in lower rail
Window 2-7: Upper sash, meeting rail is slipping
Window 2-9: Lower sash, left stile is cracked
Window 2-10: Upper sash, meeting rail is slipping
Window 2-14: Upper sash, meeting rail is slipping
Window 2-20: Lower sash, lower rail may need replacement
Window 2-25: Lower sash, lower rail may need replacement
Window 3-4: Lower sash, lower rail may need replacement
Window 3-14: Lower sash, lower rail may need replacement
Window 3-15: Lower sash, lower rail may need replacement
Window 3-18: (Interior window, sealed off on one side) Upper sash, upper pane is broken

Image 19: Window 002-6, note crack in lower rail

Image 20: Window 002-11, note meeting rail slipping down

Image 21: Window 002-21 deterioration at the upper sash stiles and meeting rail left untreated

Proposed Solution:

Following the removal of paint and glazing putty, all of the sash should be evaluated for repairs. If Dutchmen repairs are determined to provide a more durable repair, then that approach should be taken. The use of epoxy is appropriate for filling in checks and cracks, but should not be applied as a skim coat as it would then trap moisture. The use of epoxy to replace rotted mortise and tenon joinery is also not appropriate as these joints were designed to move and the epoxy will eventually crack and fail.

For a full description of the proposed restoration process please refer to appendix items titled:
REPAIR PROCESS FOR: WOOD DOUBLE-HUNG, CASEMENT, AND FIXED WINDOWS
and
PRESERVATION BRIEF 9: THE REPAIR OF HISTORIC WOODEN WINDOWS

Compatibility with the Secretary of the Interior's Standards for Rehabilitation:

Previous treatment

The previous repair work, aside from the addition of a glass pane and replacement of the balance system, is compatible with the Standards. Additional work is necessary to fully stabilize the window system.

Proposed treatment

The proposed treatments are compliant as they focus on repairs rather than replacement, and utilize products that are compatible with preservation standards.

Defect 8:

The existing windows do not perform up to the energy efficiency or noise reduction standards desired. The fact that historic windows do not meet modern standards is not a valid argument for replacement. There are acceptable treatments that can be applied to meet the desired goals while still adhering to historic preservation guidelines.

Proposed Solution:

In combination with the repairs and installation of additional weatherstripping described above, the installation of an operable interior storm window will greatly improve the energy efficiency and noise reduction of the window system.

There are many storm window manufacturers. As an example, an Allied Window product is detailed in this report to show one of the options available. Coordination with the architect, contractor, manufacturer, and building owner will be necessary to determine the best option to achieve the clients goals.

Allied Window #MOL-OP, operating magnetic one-lite storm window with screen. This storm window mounts on the interior of the window in the ample space available.

Image 22: Red lines indicate plane where a storm window would be installed

The upper panel of the storm window is fixed, and the lower panel is operable. A screen option is also available. These storm windows can be custom colored to match any sample given, and the entire system can be removed for cleaning the window glass. There are several glazing options that address UV reduction, noise reduction, and other considerations. For additional information, including all options available and detailed drawings, please visit:
https://catalog.alliedwindow.com/item/interior-magnetic-storm-windows/operating-magnetic-one-lite-mol-op-with-screen-2/item-1057?&bc=100|1064

Many studies have been conducted on the subject of historic windows and energy efficiency. The common take-away is that historic windows, when properly repaired and weatherstripped, with the combination of a storm window, can achieve similar energy efficiency performance as a replacement window and provide a better return on investment then wholesale replacement.

Links below provided via the National Park Service Technical Preservation Services. Please click on the title for access to the full reports

https://www.nps.gov/tps/sustainability/research.htm

A Comparative Study of the Cumulative Energy Use of Historical Versus Contemporary Windows—A 2010 study by Boston professionals funded by the Boston Society of Architects. Life cycle costs were calculated and compared for a typical wood double-hung window with an added Low-E storm window and a new vinyl replacement window. Using modeling and adapting previous field studies to a Boston location, it was determined that the thermal performances of the two window systems are similar; and taking all costs into account, the historic window with a storm has a much lower life-cycle cost throughout a 100-year period. It does not seem, however, that the sources used for air leakage numbers take into account the infiltration that can occur between the window unit and the wall assembly and how that may differ between the historic window/storm and the new window.

The Effects of Energy Efficiency Treatments on Historic Windows—Published in January, 2011, by the Center for Resource Conservation in Boulder, Colorado. This study focuses on empirical testing of the energy efficiency and economy of a range of options for upgrading the energy performance of historic windows. It involved retrofitting windows in a test home in a historic district in Boulder, Colorado as well as testing in a laboratory facility developed for the study. Summary tables cover the eleven different preservation treatment options that were investigated and then compared to a new vinyl window. Most of the proposed treatments were able to outperform a new vinyl window. The study has lots of technical information and the results from both field and lab testing. While there is not a great deal of detail about the cost of the various options, there is enough cost information to provide relative payback savings.

Field Evaluation of Low-E Storm Windows— A study conducted in Chicago in 2007 by Lawrence Berkeley National Laboratory. While based on only six homes in the Chicago area, data collected from field monitoring for this study indicates a consistent benefit to using storm windows. Clear glass storm windows reduced the heating load by 13% with a 10-year simple payback. Low-e storm windows also showed an additional improvement on top of the clear glass benefits, amounting to 21% heating savings and an average payback of less than five years. Pointed out as an ancillary benefit of installing storm windows is reduced air infiltration.

Measured Winter Performance of Storm Windows—A 2002 study completed by Lawrence Berkeley National Laboratory. In testing under actual winter weather conditions, the study finds that a north-facing, wood, double-hung, single-glazed (AND intentionally leaky), sash in combination with a low-E storm window, performed very similarly to the standard low-E vinyl replacement window.

Testing the Energy Performance of Wood Windows in Cold Climates—A 1996 study which showed that window replacement will not necessarily reduce energy costs more than an upgrade utilizing the existing sash. It found that effectively sealing between the window frame and rough opening was important in reducing the infiltrative thermal losses associated with any window renovation. Storm windows, either existing or replacements, were found to be effective in reducing both infiltrative and non-infiltrative losses. This study was funded by the State of Vermont Division for Historic Preservation utilizing a grant received from the National Center for Preservation Technology and Training of the National Park Service.

Thermal Performance of Traditional Windows—Published in 2008 by Glasgow Caledonian University for Historic Scotland. This study investigated various options for reducing heat loss through windows. Among the options tested were secondary glazing systems (storm windows), insulating shades, and more traditional window treatments like shutters and curtains. Although secondary glazing was found to be the most effective option (reducing heat loss by 63%), timber shutters were also found to be effective (reducing heat loss by 51%.) Findings indicate that the most effective reductions in heat loss were attained by combining several treatments.

Links below provided via the California State Parks Office of Historic Preservation. Please click on the title for access to the full reports

http://www.ohp.parks.ca.gov/?page_id=25935

A report produced by the National Trust for Historic Preservation Green Lab provides cost guidance for homeowners weighing the financial and energy tradeoffs between replacing or repairing older, less efficient windows. This report, "**Saving Windows, Saving Money: Evaluating the Energy Performance of Window Retrofit and Replacement**", builds on previous research by examining multiple window improvement options, comparing them to replacement windows across multiple climate regions.

"Window Repair, Rehabilitation and Replacement" , Peter Baker, P.E.
This report was prepared for Building America, Building Technologies Program, Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy to evaluate advanced retrofit measures. A balanced approach is presented to guide contractors and homeowners to decide whether to repair or replace considering many factors, one of which is historic preservation. November 2011

"Thermal Assessment of internal Shutters and Window Film Applied to Traditional Single Glazed Sash and Case Windows" by John Currie, Julio Bros Williamson, Jon Stinson & Marie Jonnard, Historic Scotland Technical Report 23 assesses the effectiveness of two inexpensive and minimally invasive methods for improving the thermal performance of single glazed windows. This technical paper demonstrates that a range of options, including minimally invasive and inexpensive methods, can play a worthwhile role in the overall thermal improvement of buildings.

"Of Paint and Windows - Replace or Repair" by Bob Yapp

"Thermal Performance of Historic Windows" by Chris Wood, www.buildingconservation.com (England)

"An Analysis of the Thermal Performance of Repaired and Replacement Windows", PDF, Robert Score and Bradford Carpenter, APT Bulletin 40:2, 2009

Window Energy Analysis, Keith Haberern, P.E.

"Replacement Windows and Furnaces in the Heartland: Indiana's Energy Conservation Financial Assistance Program" by William H. Hill. This is the 1990 study that demonstrates a four hundred year payback using replacement windows.

"Building Regulations and Historic Buildings: balancing the needs for energy conservation with those of building conservation" The English Heritage Interim Guidance article touches on all parts of preservation and conservation of power and fuel, and the chapter on windows is very relevant.

"Repair or Replace Windows in Historic Buildings: Arriving at a Sustainable Solution" The Heritage Canada file contains two articles, one from Andrew Powter and Craig Sims discussing how to arrive at a decision to replace or repair original windows, and Susan Turner explains the sustainable nature of window repair rather than replacement.

"Life Cycle Of Window Materials - A Comparative Assessment" by Asif, Davidson and Muneer. A comparative life cycle assessment of the environmental impact of different window materials is included for its interesting materials energy cost analysis.

"Domestic Retrofitting Strategies in the UK: Effectiveness vs. Affordability" is an interesting presentation of the effectiveness of different energy retrofitting strategies, including shutters.

"What Replacement Windows Can't Replace: The Real Cost of Replacing Historic Windows" Walter Sedovic and Jill Gotthelf provide an excellent discussion of the comparative value of window replacement versus repair. Many aspects of sustainability are considered.

"Lincoln Hall Windows Research Report: A Case Study of Options for Treatment for Windows at Lincoln Hall, University Of Illinois, Urbana Champaign" This report provides empirical data to assess window repair or replacement options for a proposed LEED Gold project, addressing the existing windows in terms of energy consumption.

Compatibility with the Secretary of the Interior's Standards for Rehabilitation:

Previous treatment

N/A

Proposed treatment

The introduction of a storm window is an approved preservation practice and fully reversible with minimal damage to historic materials. Therefore, the proposed treatment is compatible with the Standards.

APPENDIX

Example of Full Restoration process for: Wood Double-Hung, Casement, and Fixed Windows

On-Site Method of Procedure

Window Sash Removal:

1.) When required per EPA regulations, place poly-sheeting on the floor at the work area to collect any dust or debris created during the sash removal process. The sheeting will extend 10 feet from the window opening towards the interior of the room and 6 feet on either side of the opening. If these minimum distances cannot be achieved, the sheeting will extend as far as possible into the room as well as side to side in front of the window opening.
2.) Remove the left and right sash from the opening by removing the hinge pins or by unscrewing the hinge from the jamb
3.) Number each sash for each opening according to the window schedule using a "Sharpie" to write the corresponding number on the unfinished side of the stile of each sash. Where multiple sashes are present in one opening, a dash (-) followed by a sequential numbering system will be used. For example; a window opening designated 236C has 4 total sashes. There are two upper sashes and two lower sashes. As viewed from the interior, if sash removal will begin in the lower left hand corner of the opening: The lower left hand sash will be labeled 236C-1, the upper left hand sash will be labeled 236C-2, the lower right hand sash will be labeled 236C-3, and the upper right hand sash will be labeled 236C-4. This system will be utilized in the same order where transom windows are present. The interior stop will be labeled with 236C and differentiated by an "L," "C," or "R" to designate its original location (Left, Center, or Right). The parting stop is not typically labeled or restored as it is most often time damaged beyond repair during the removal process and new parting stop will be fabricated to match the existing for every opening.
4.) When required per EPA regulations, bag or wrap all components; including sash, interior stop, parting stop and trash in heavy duty poly-sheeting or poly-bags to assure containment of any dust or debris during transport.
5.) When required per EPA regulations, cleaning verification will be provided following a thorough cleaning of the area using damp wipes and/or HEPA vacuums; including, but not limited to, all sills, stools, floors, weight pockets, poly-bags and poly-sheeting.

Installation of Temporary Enclosures:

1.) The material selected for use as the temporary enclosure, "Verolite" or similar, will be cut to fit inside the existing opening whenever possible. If not specified, plywood or OSB will be utilized. When required, the perimeter of the Verolite, plywood, or OSB will be wrapped in foam tape in an effort to create the most effective weather seal possible. The wood backing for this will be screwed to the existing frame where the interior stop and/or parting stop was located. The screw holes created will be hidden by the interior stop or parting stop upon reinstallation of the restored components and causes little to no damage to the frame. The verolite will then be attached to this backing material utilizing screws.

Existing Frame Restoration:

1.) Loose and flaking or failed paint is removed following the National Park Service Preservation Brief number 10. A "wet method" utilizing chemical strippers, carbide scrapers, or HEPA approved mechanical sanders (or a combination of all three) will ensure that no lead based paint dust is created. Following the paint stripping process, a thorough visual and tactile examination of the existing wood substrate will be performed.

2.) If there are any pieces or components that have shifted or become loose on the frame, counter-sunk coated screws and/or galvanized brad nails will be utilized to restore the integrity of the components.
3.) If it is determined that the existing substrate is beyond repair through the use of epoxy, the deteriorated wood will be "cut" out of the existing frame and a replacement piece fabricated to replicate the removed component, commonly referred to as a "Dutchman," will be installed in its place. After all of the Dutchmen have been installed, epoxy will be utilized to make any other repairs that are deemed necessary.
4.) When the epoxy has dried, it will be sanded to shape. A thorough review by our staff will determine if any additional epoxy consolidate is required.
5.) All window frame components will then be primed, and an additional review completed to ensure that we have achieved the acceptable criteria set forth by the "Mock-up Review." If more consolidation is deemed necessary, the primer at that location will be removed and steps 5-7 will be repeated.
6.) A modified polyurethane sealant will then be applied to any and all areas that require it. The sealant will either be color matched and/or paintable. It will be a low-modulus elastomeric product.
7.) A minimum of two finish coats of paint will then be applied and given ample drying time before the restored sash will be installed.

Sash Installation:

1.) The sash will be delivered pre-finished to site and will be installed per the plans and specifications. Depending on the specifications, metal interlocking weather stripping will be utilized in conjunction with compression bulb weatherstripping for casement sash. The sashes are installed in a manner which attempts to balance the ease of operation while still maintaining the best possible seal against air infiltration.
2.) The locking hardware will then be installed.
3.) All necessary caulking and paint touch up will be preformed after installation to provide a clean and seamless finished product.
4.) After the owner and architect have reviewed the finished product, all necessary punch-list items will be corrected.

Off-site Method of Procedure

Receiving Sash:

1.) When the sashes and interior stop arrive at the "Shop" the window designation numbers are "stamped" into the sash at the same location. This is to ensure that the number is not inadvertently removed during the restoration process.

Glazing Putty, Glass Removal, and Glass Cleaning:

1.) Steam ovens are utilized to soften the historic glazing putty and all existing putty is removed. This ensures a wet method technique that is non-invasive and is the best method to avoid breakage of the glass during this process.
2.) When the glass has been removed, the corresponding sash number is written on a piece of tape and applied to the surface of the glass.
3.) This number will be removed temporarily when the glass is cleaned, but will be reattached after the cleaning is complete. Typical glass cleaners such as Windex are utilized. All glass that can be reused will be reused. Existing scratches on the glass that were not created during the removal or cleaning process will not dictate replacement of the glass unless directed by the architect and/or owner.
4.) When the sash has completed the restoration process in the shop, the original piece of glass will be installed in the same location from which it came.

Sash Restoration:

1.) All sashes, after they have been stripped, are re-squared prior to applying epoxy consolidates. This is achieved by clamping the sash and when 90 degree internal angles are achieved, dowels are utilized to maintain the shape.
2.) Before the glass is set and bedded, and after the sanding of the epoxy is completed, the glazing rabbit is primed.
3.) After sanding the epoxy consolidates, kerfs are cut for future installation of the bulb seal and, when specified, t-rail weather stripping.

Sash Replication:

1.) Where window sash are missing the jambs are carefully measured, including the diagonals to allow for adjustments for out-of-square openings and with careful notation of hinge and hardware location.
2.) Lumber is selected to match the existing wood, with care being taken regarding grain direction to prevent warping or twisting.
3.) Using the existing sash as a template, new sash are constructed mimicking the stile and rail dimensions, joinery details, and profiles
4.) Once constructed, the replica sash join the restored sash at the sanding phase and continue through the same steps in the Glazing and Painting and Staining processes.

Interior Stop Restoration:

1.) This process is similar to the Existing Frame Restoration section but may include some new fabrication to replace pieces which were damaged beyond repair during the sash removal process.

Parting Stop Fabrication:

1.) All parting stop will be fabricated to match existing and will be prefinished in the shop prior to installation on-site.

Glazing Process:

1.) Dap Glazing compound is applied to the glazing rabbit and the glass is installed using push points when traditional glazing putty is utilized. Push points are not used when glass stops (wood or other) are utilized.
2.) The residual Dap compound that “oozes” out is cleaned from the glass and wood sash surfaces.
3.) When the Dap has “set-up” Glazing putty or wood glass stop is applied.
4.) The sash is then placed vertically in a drying rack.
5.) Depending on the type of glazing compound utilized, dry time can range from a little as a few days to as long as 6 weeks.

Painting and Staining Process:

1.) The sashes are masked to protect the glass but still allow the finish paint to extend very slightly beyond the glazing bed to create a seal.
2.) They are transferred to painting racks, and the primer and two finish coats are applied with an airless or a HVLP paint sprayer.
3.) When the finish coat is dry, the masking is removed, the bulb seal installed, glass cleaned, and the sash delivered to the site for installation.

U.S. Department of the Interior
National Park Service
Cultural Resources
Heritage Preservation Services

Preservation Briefs: 9
The Repair of Historic Wooden Windows

John H. Myers

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 (see figure 1). 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.

Figure 1. *Windows are frequently important visual focal points, especially on simple facades such as this mill building. Replacement of the multi-pane windows here with larger panes could dramatically change the appearance of the building. The areas of missing windows convey the impression of such a change. Photo: John T. Lowe*

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.

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 (see figure 2).

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 pro-

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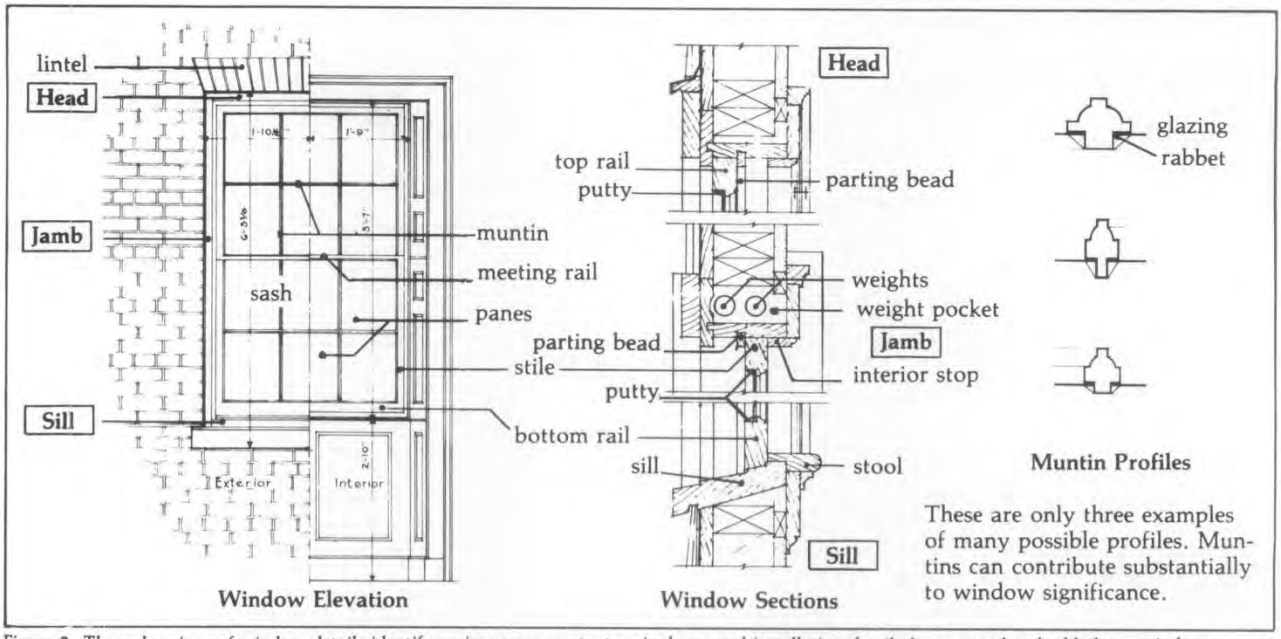

Figure 2. *These drawings of window details identify major components, terminology, and installation details for a wooden double-hung window.*

ceed with planning appropriate treatments, beginning with an investigation of the physical condition of the windows.

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 run-off, 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 (see figure 3). 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 end-grain 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 sec-

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Figure 3. *Deterioration of poorly maintained windows usually begins on horizontal surfaces and at joints where water can collect and saturate the wood. The problem areas are clearly indicated by paint failure due to moisture. Photo: Baird M. Smith, AIA*

tion 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.

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.

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 double-hung wooden window (see figures 4a-f), 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. Several techniques such as scraping, chemical stripping, and the use of a hot air gun are discussed in "Preservation Briefs: 10 Paint Removal from Historic Woodwork" (see Additional Reading section at end).

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 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 (see figure 4b). 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 (see figure 4c), the glass should be removed or protected from the sudden temperature change which can cause breakage. An

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Figure 4a. *The following series of photographs of the repair of a historic double-hung window use a unit which is structurally sound but has many layers of paint, some cracked and missing putty, slight separation at the joints, broken sash cords, and one cracked pane. Photo: John H. Myers*

Figure 4b. *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. To avoid visible scarring of the wood, the sash can be raised and the stop pried loose initially from the outer side. Photo: John H. Myers*

Figure 4c. *Sash can be removed and repaired in a convenient work area. Paint is being removed from this sash with a hot air gun while an asbestos sheet protects the glass from sudden temperature change. Photo: John H. Myers*

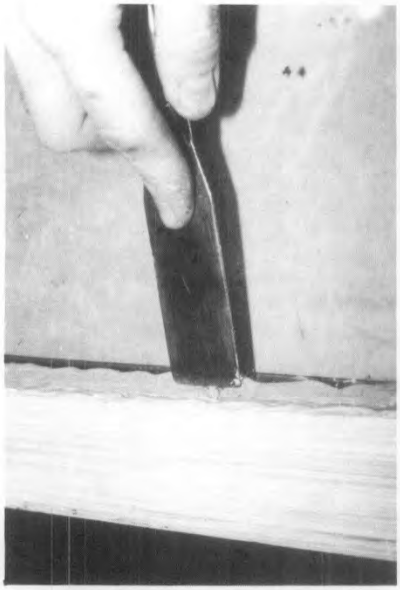

Figure 4d. *Reglazing or replacement of the putty requires that the existing putty be removed manually, the glazing points be extracted, the glass removed, and the back putty scraped out. To reglaze, a bed of putty is laid around the perimeter of the rabbet, the pane is pressed into place, glazing points are inserted to hold the pane (shown), and a final seal of putty is beveled around the edge of the glass. Photo: John H. Myers*

Figure 4e. *A common repair is the replacement of broken sash cords with new cords (shown) or with chains. The weight pocket is often accessible through a removable plate in the jamb, or by removing the interior trim. Photo: John H. Myers*

Figure 4f. *Following the relatively simple repairs, the window is weathertight, like new in appearance, and serviceable for many years to come. Both the historic material and the detailing and craftsmanship of this original window have been preserved. Photo: John H. Myers*

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 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 (see figure 4d). 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 weathertight 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 (see figure 4e). 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.

The operations just discussed summarize the efforts necessary to restore a window with minor deterioration to "like new" condition (see figure 4f). 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.

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 semi-rigid epoxies which saturate the porous decayed wood and then harden. The surface of the consolidated wood can then be filled with a semi-rigid epoxy patching compound, sanded and painted (see figure 5). Epoxy patching compounds can be used to build up

Figure 5. *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: John H. Myers*

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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. Technical Preservation Services has published *Epoxies for Wood Repairs in Historic Buildings* (see Additional Reading section at end), which discusses the theory and techniques of epoxy repairs. 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.

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.

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.

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

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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.

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.

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.

Additional Reading

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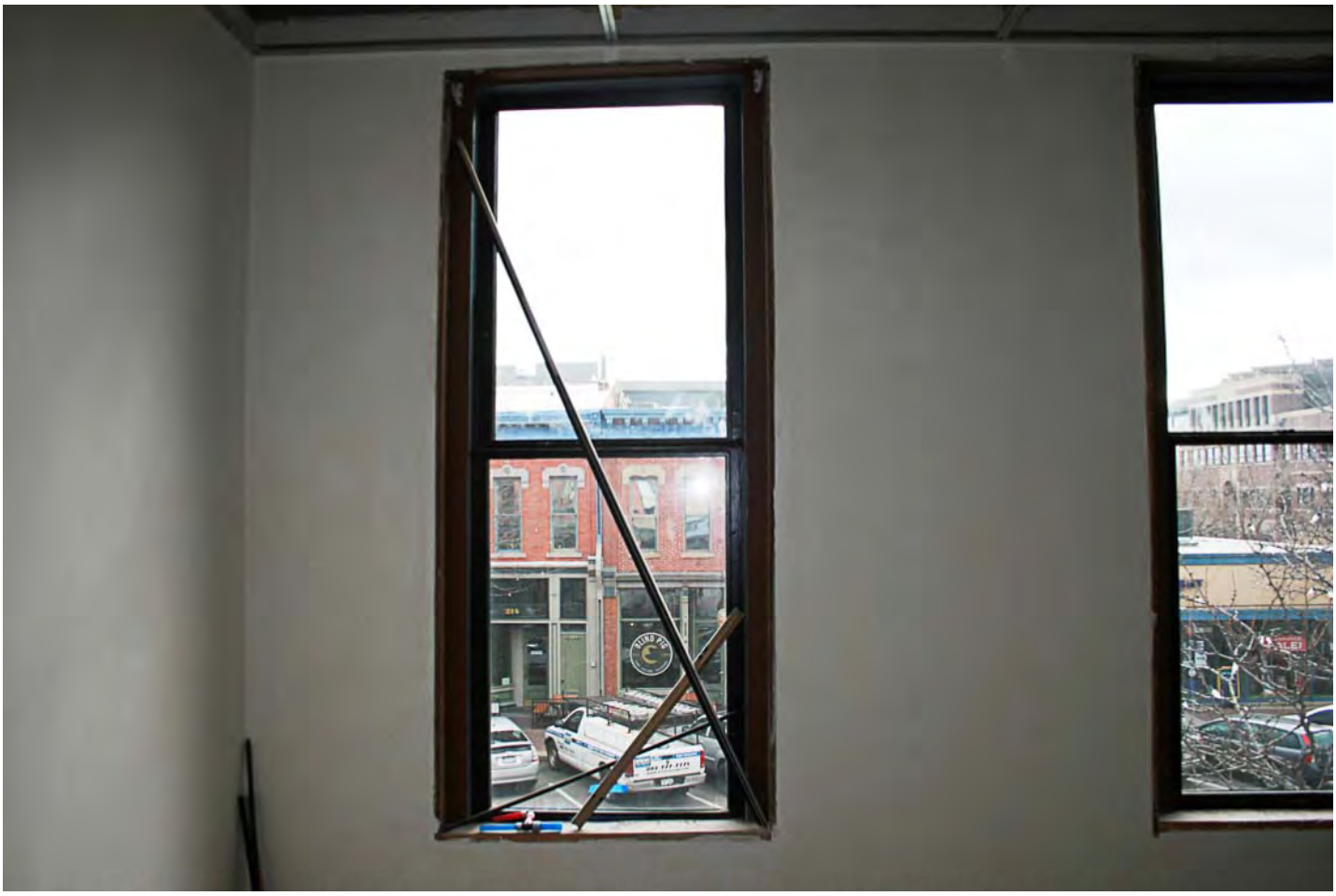
Photo Documentation

Image 23: Linden Street Elevation

Image 24: Walnut Street Elevation

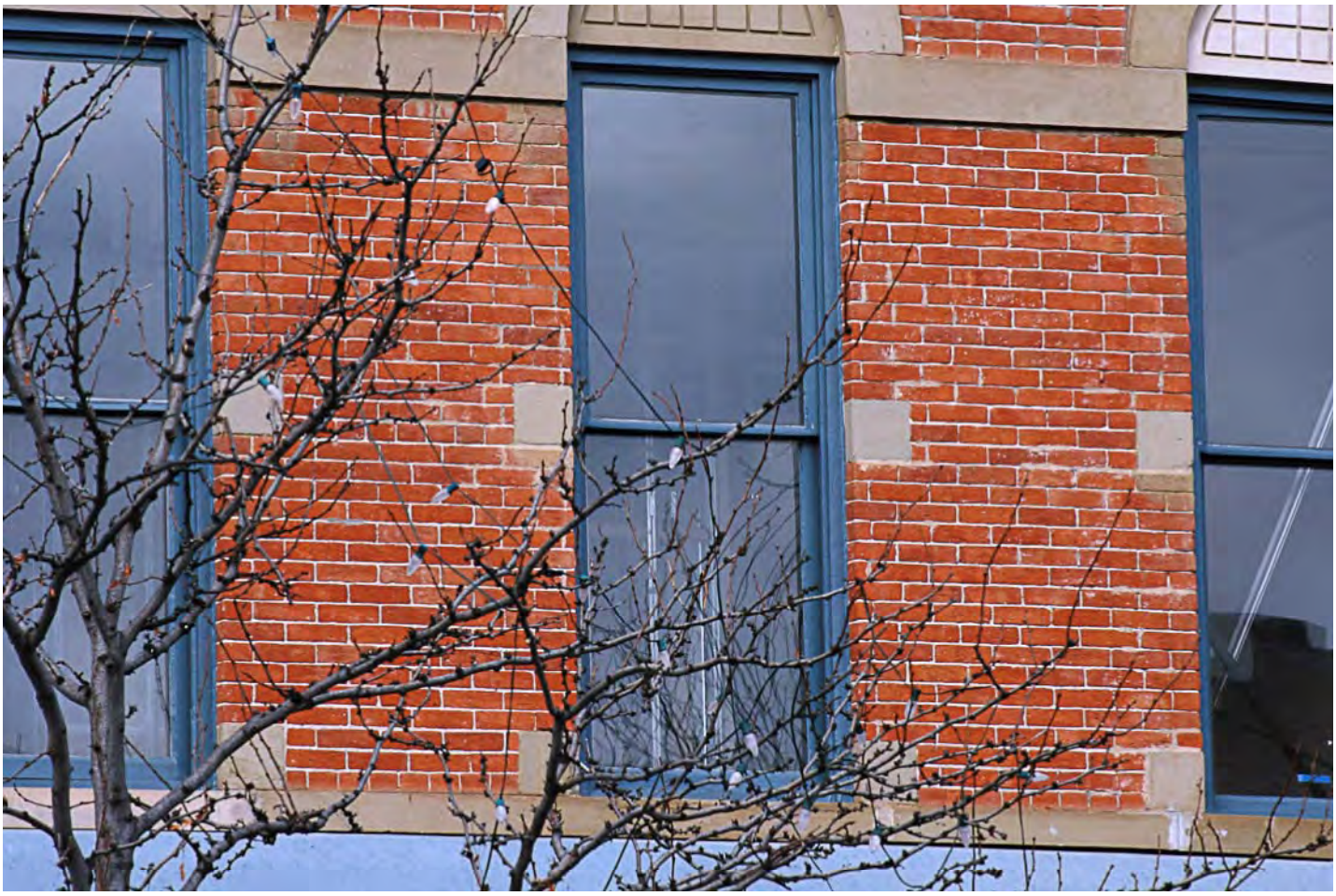
Image 25: Corner of Linden and Walnut

002-1-Exterior



002-1-Interior

002-1-Interior Detail 1



002-2-Exterior

002-2-Interior

002-2-Interior Detail 1

002-2-Interior Detail 2

002-3-Exterior

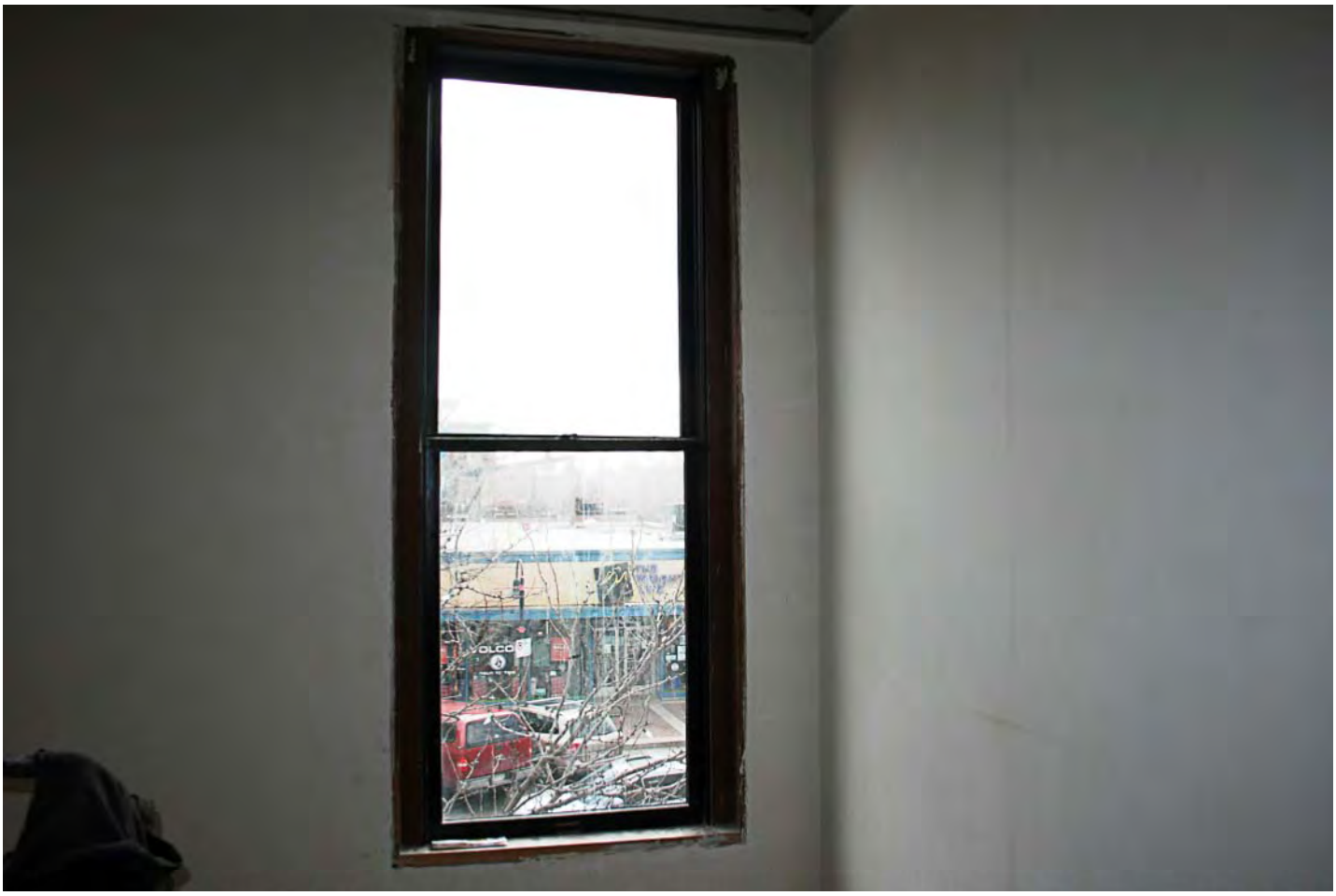
002-3-Interior

002-3-Interior Detail 1

002-3-Interior Detail 2

002-3-Interior Detail 3

002-4-Exterior



002-4-Interior

002-4-Interior Detail 1

002-4-Interior Detail 2

002-4-Interior Detail 3

002-5-Exterior

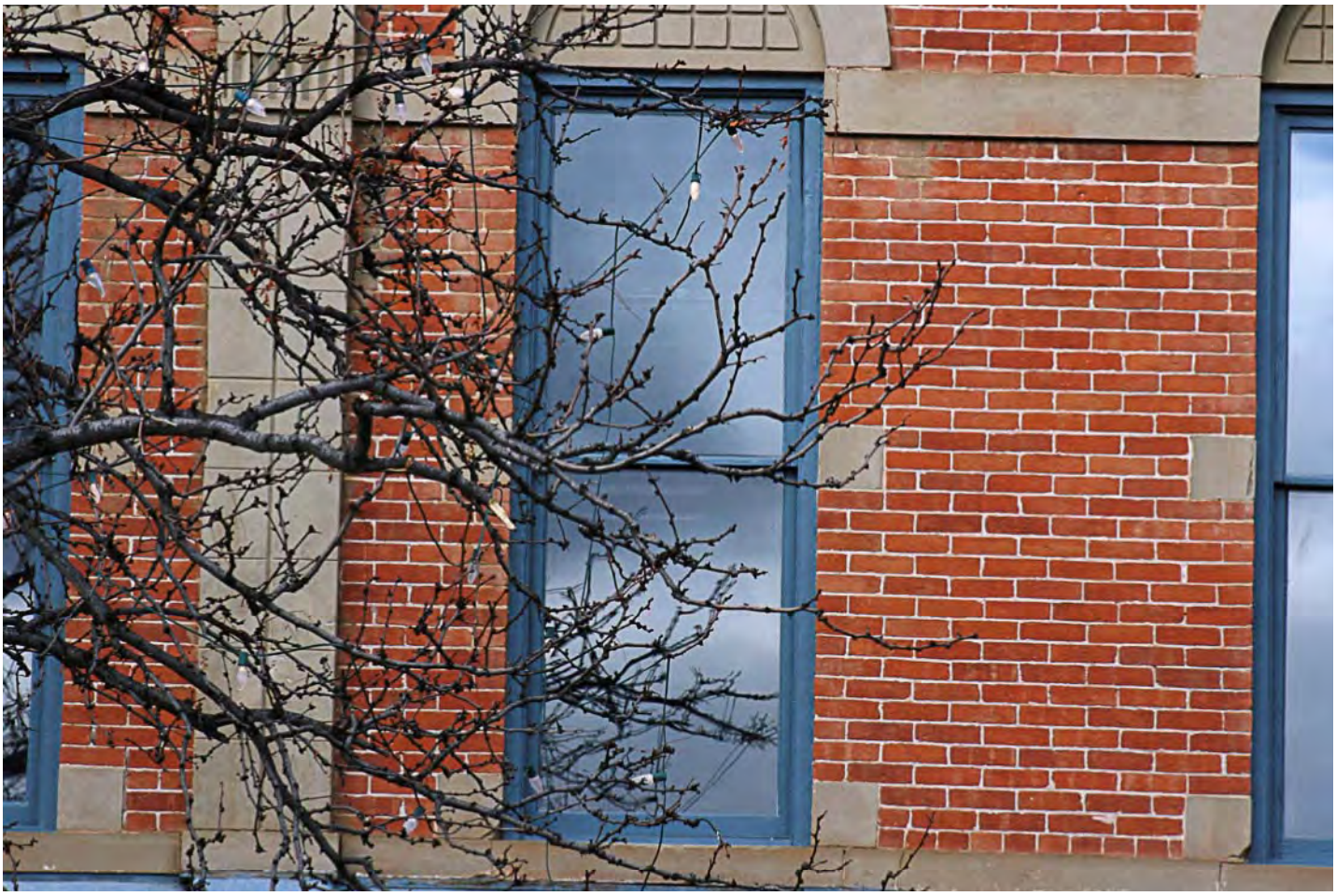
002-5-Interior

002-5-Interior Detail 1

002-6-Exterior

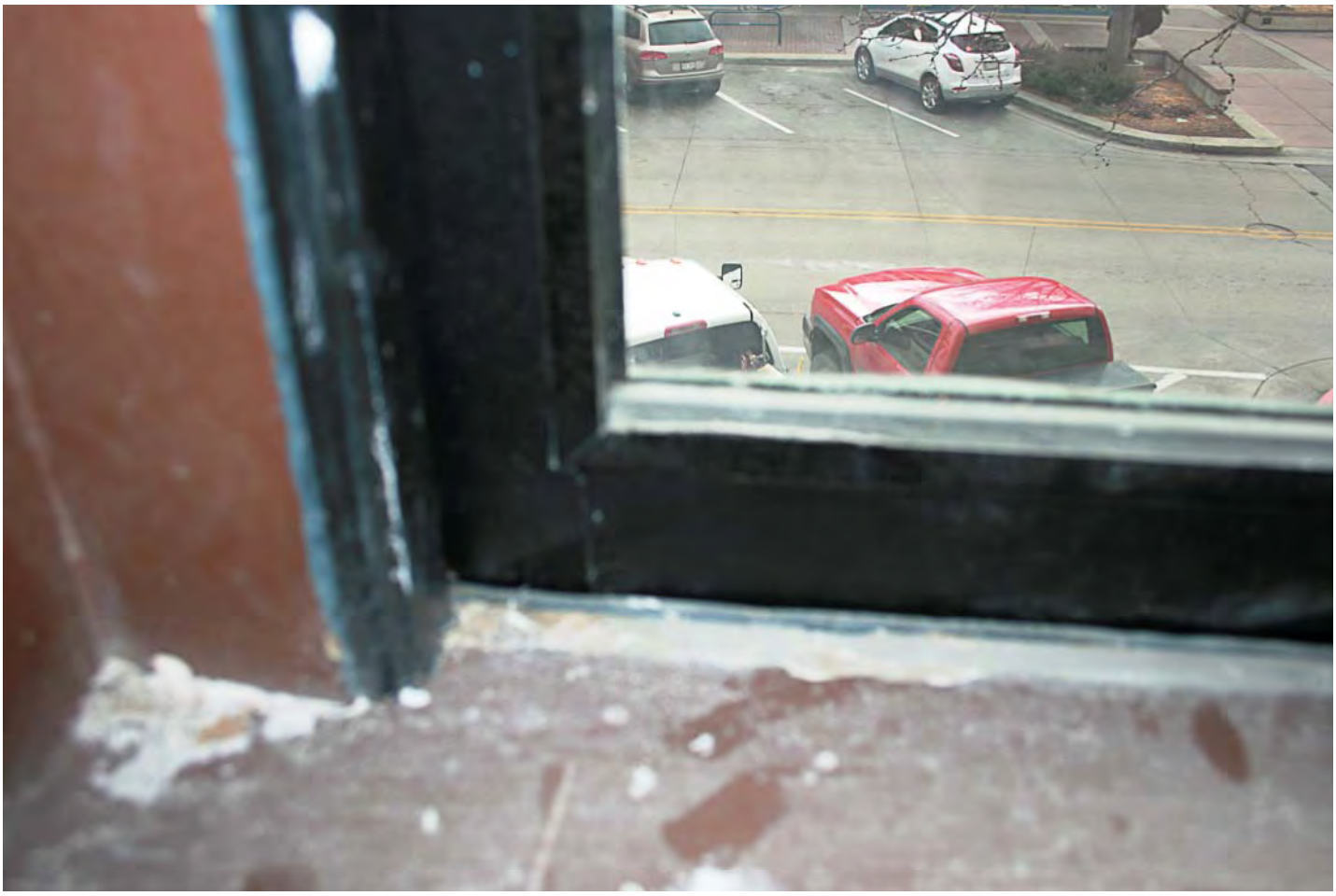
002-6-Interior

002-6-Interior Detail 1



002-7-Exterior

002-7-Interior



002-7-Interior Detail 1

002-7-Interior Detail 2

002-7-Interior Detail 3

002-8-Exterior

002-8-Interior

002-8-Interior Detail 1

002-8-Interior Detail 2

002-9-Exterior

002-9-Interior

002-9-Interior Detail 1

002-9-Interior Detail 2

002-10-Exterior

002-10-Interior

002-10-Interior Detail 1

002-10-Interior Detail 2

002-10-Interior Detail 3

002-11-Exterior

002-11-Interior

002-11-Interior Detail 1

002-11-Interior Detail 2

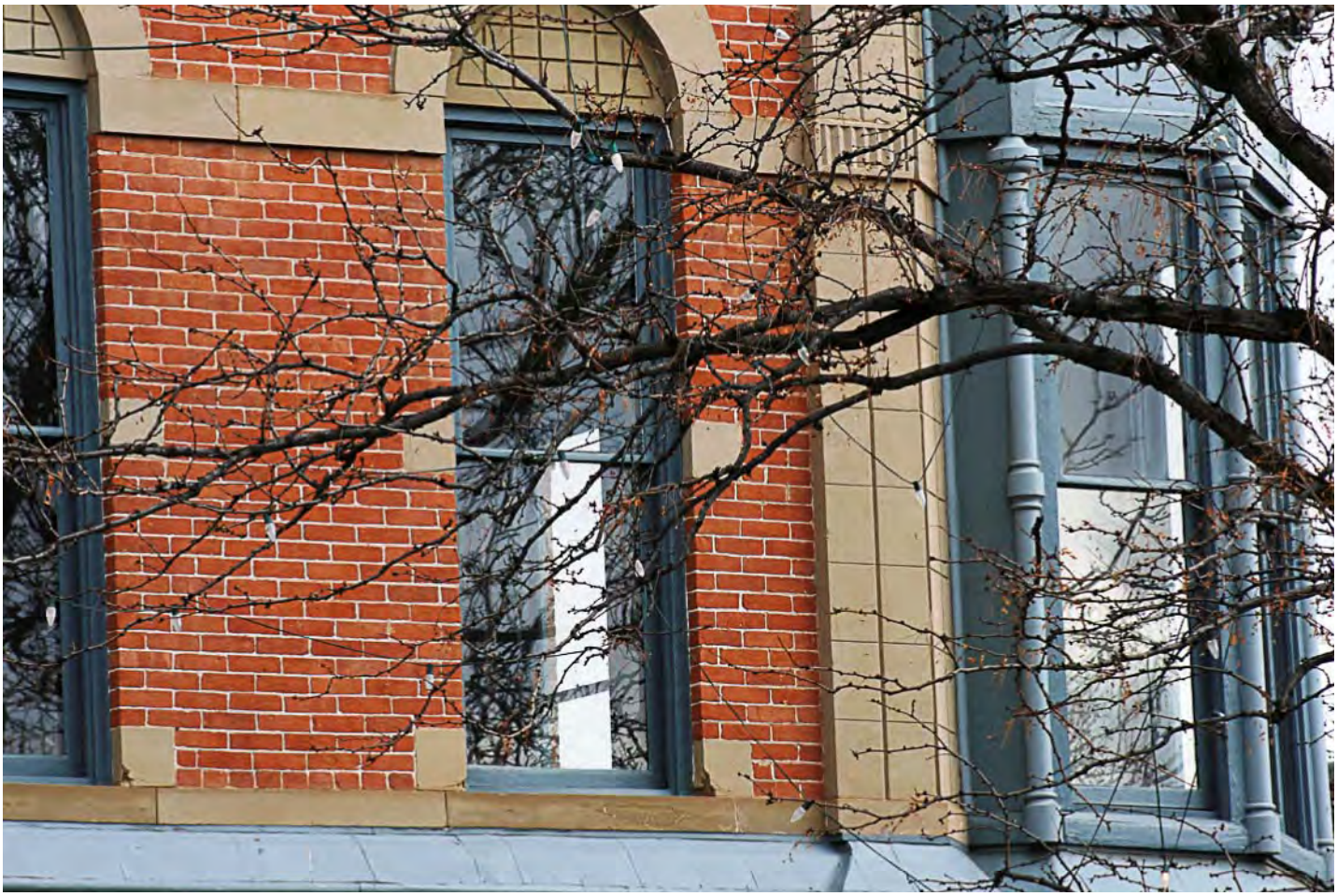
002-12-Exterior

002-12-Interior

002-12-Interior Detail 1

002-12-Interior Detail 2

002-12-Interior Detail 3



002-13-Exterior

002-13-Interior

002-13-Interior Detail 1

002-13-Interior Detail 2

002-14-Exterior

002-14-Interior

002-14-Interior Detail 1

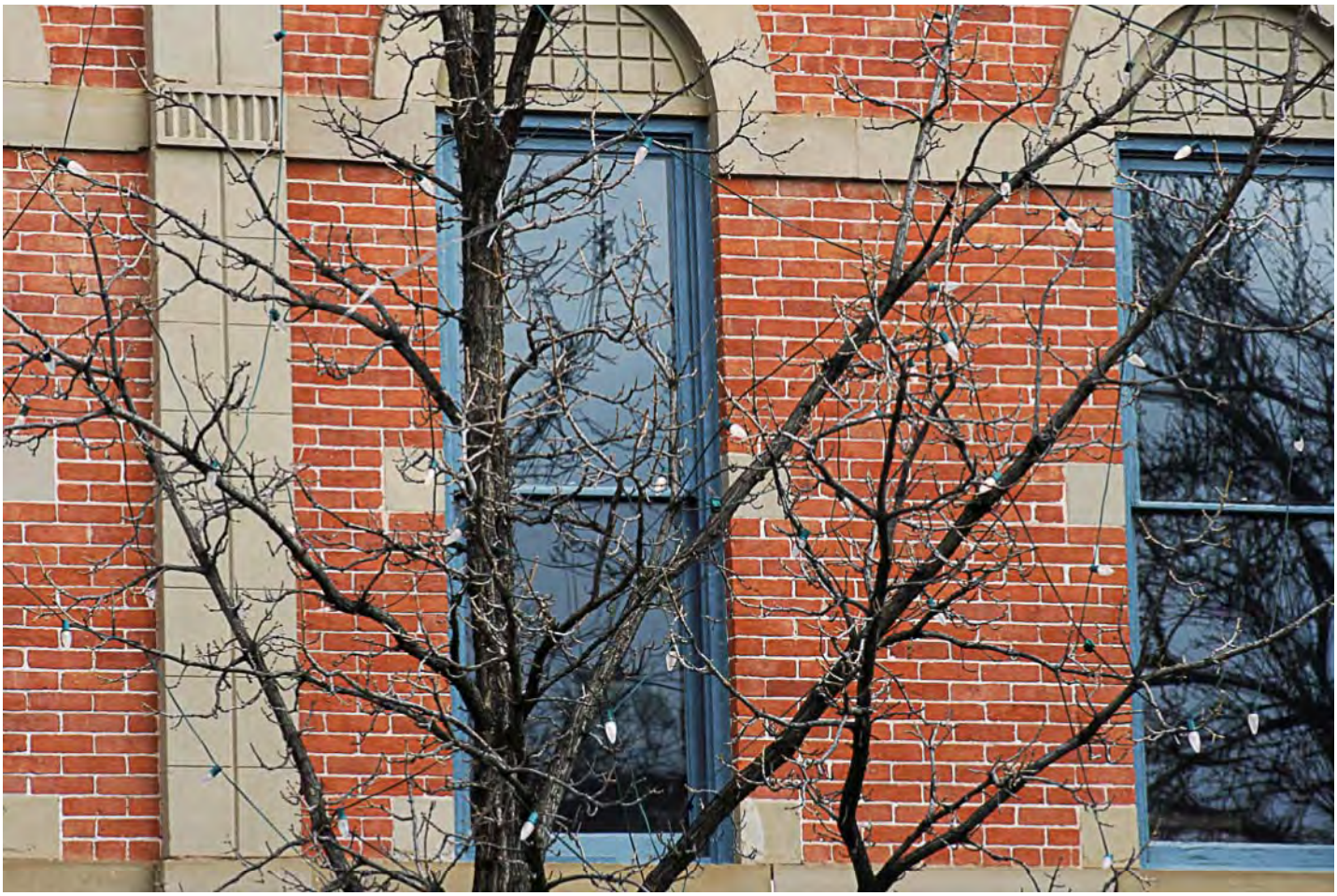
002-14-Interior Detail 2

002-15-Exterior

002-15-Interior

002-15-Interior Detail 1

002-15-Interior Detail 2



002-16-Exterior

002-16-Interior

002-16-Interior Detail 1

002-17-Exterior

002-17-Interior

002-17-Interior Detail 1

002-17-Interior Detail 2

002-18-Exterior

002-18-Interior

002-19-Exterior

002-19-Interior

002-19-Interior Detail 1

002-19-Interior Detail 2

002-20-Exterior

002-20-Interior

002-20-Interior Detail 1

002-20-Interior Detail 2

002-21-Exterior

002-21-Exterior Detail 1

002-21-Interior

002-21-Interior Detail 1

002-21-Interior Detail 2

002-21-Interior Detail 3

002-22-Exterior

002-22-Interior

002-22-Interior Detail 1

002-22-Interior Detail 2

002-22-Interior Detail 3

002-22-Interior Detail 4

02-23-Exterior

002-23-Interior

002-23-Interior Detail 1

002-23-Interior Detail 2

002-24-Exterior

002-24-Interior

002-24-Interior Detail 1

002-24-Interior Detail 2

002-25-Exterior

002-25-Interior

002-25-Interior Detail 1

002-25-Interior Detail 2

003-1-Exterior

003-1-Interior

003-1-Interior Detail 1

003-2-Exterior

003-2-Interior

003-2-Interior Detail 1

003-2-Interior Detail 2

003-3-Exterior

003-3-Interior

003-3-Interior Detail 1

003-4-Exterior

003-4-Interior

003-5-Exterior

003-5-Interior

003-5-Interior Detail 1

003-5-Interior Detail 2

003-6-Exterior

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003-6-Interior Detail 1

003-6-Interior Detail 2

003-7-Exterior

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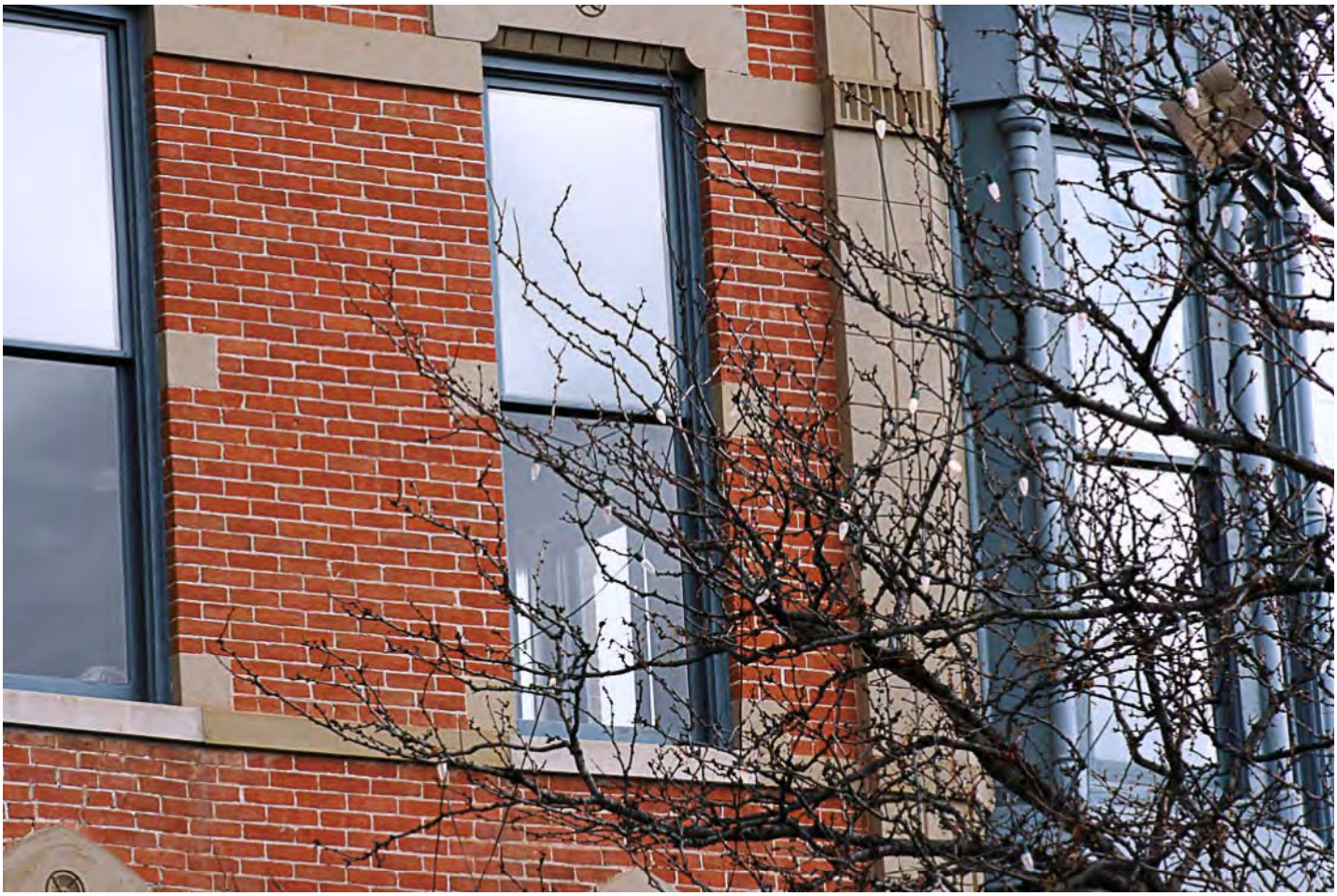
003-7-Interior Detail 1

003-7-Interior Detail 2

003-8-Exterior

003-8-Interior

003-8-Interior Detail 1



003-9-Exterior

003-9-Interior

003-9-Interior Detail 1

003-9-Interior Detail 2

003-9-Interior Detail 3

003-10-Exterior

003-10-Interior

003-10-Interior Detail 1

003-10-Interior Detail 2

003-11-Exterior

003-11-Interior

003-11-Interior Detail 1

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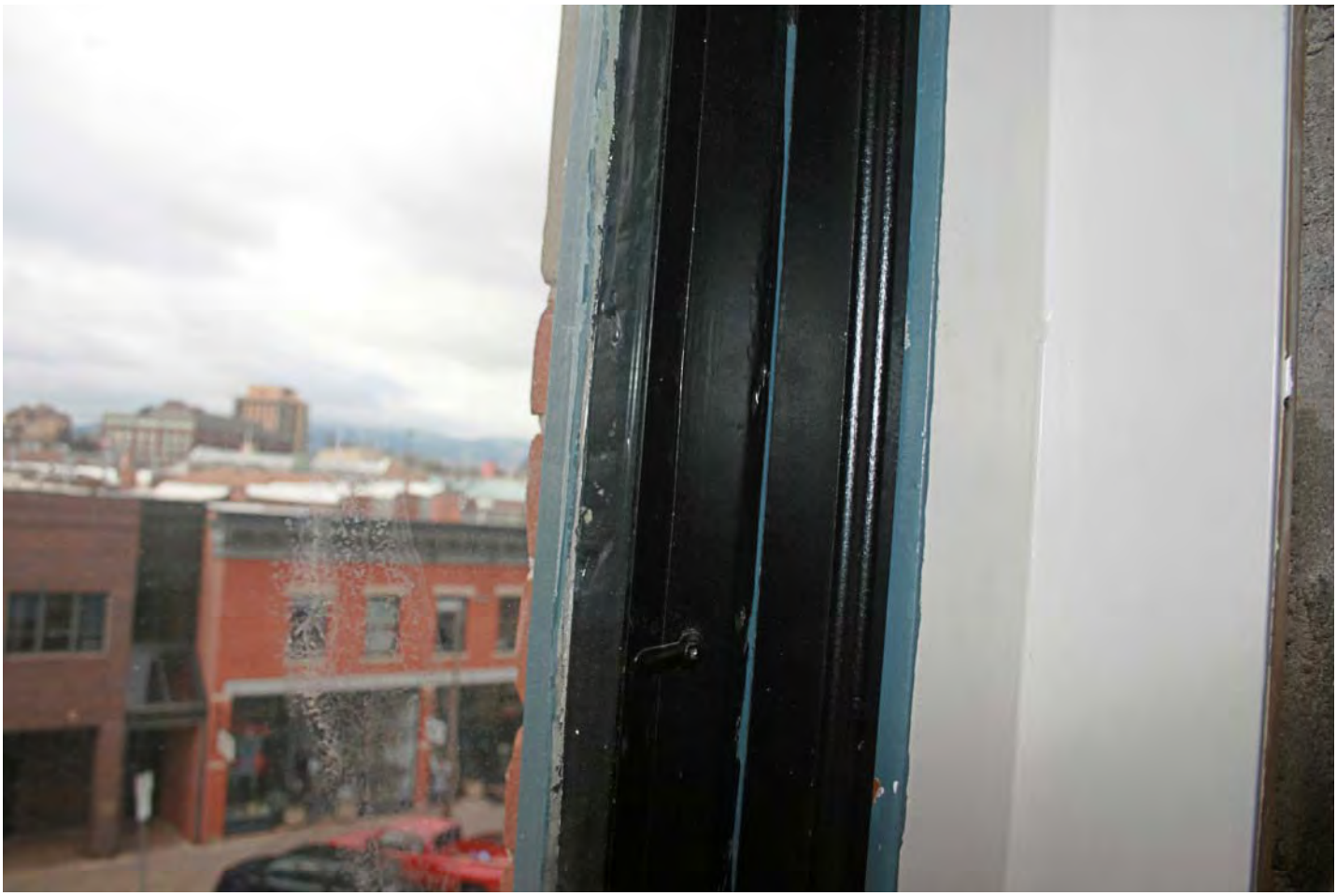
003-13-Interior Detail 1



003-13-Interior Detail 2

003-14-Exterior

003-14-Interior

003-14-Interior Detail 1

003-14-Interior Detail 2

003-14-Interior Detail 3

003-14-Interior Detail 4

003-14-Interior Detail 5

003-14-Interior Detail 6

003-14-Interior Detail 7

003-15-Exterior

003-15-Interior

003-16-Exterior

003-16-Interior

003-17-Exterior

003-17-Interior

003-18-Interior

003-18-Interior Detail 1

Corner of Linden and Walnut

Linden Street Elevation_Faces Southeast

Walnut Street Elevation, Faces Southwest

Replacement windows_Northwest elevation_Alley 2

Replacement windows_Northwest elevation_Alley

U.S. Department of the Interior
National Park Service
Cultural Resources
Heritage Preservation Services

Preservation Briefs: 9
The Repair of Historic Wooden Windows

John H. Myers

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 (see figure 1). 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.

Figure 1. *Windows are frequently important visual focal points, especially on simple facades such as this mill building. Replacement of the multi-pane windows here with larger panes could dramatically change the appearance of the building. The areas of missing windows convey the impression of such a change. Photo: John T. Lowe*

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.

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 (see figure 2).

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 pro-

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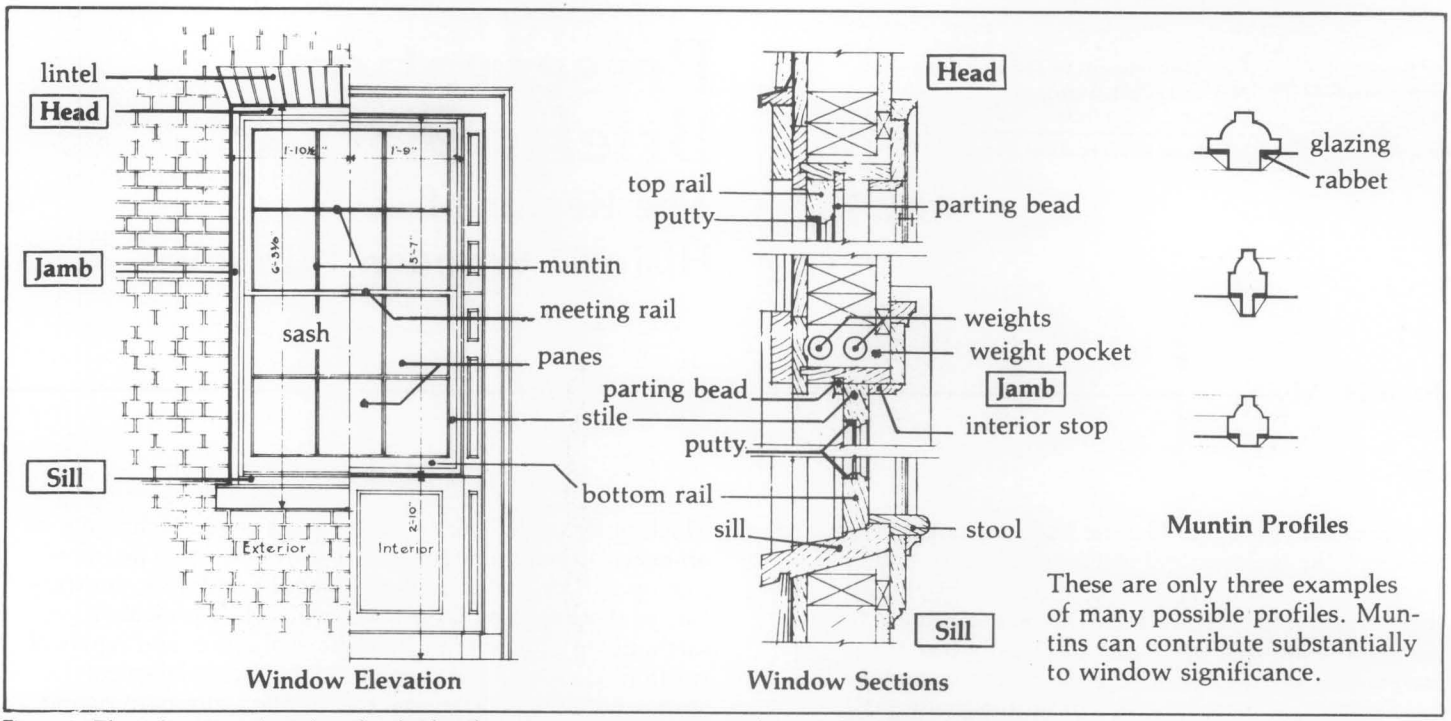

Figure 2. *These drawings of window details identify major components, terminology, and installation details for a wooden double-hung window.*

ceed with planning appropriate treatments, beginning with an investigation of the physical condition of the windows.

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 run-off, 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 (see figure 3). 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 end-grain 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 sec-

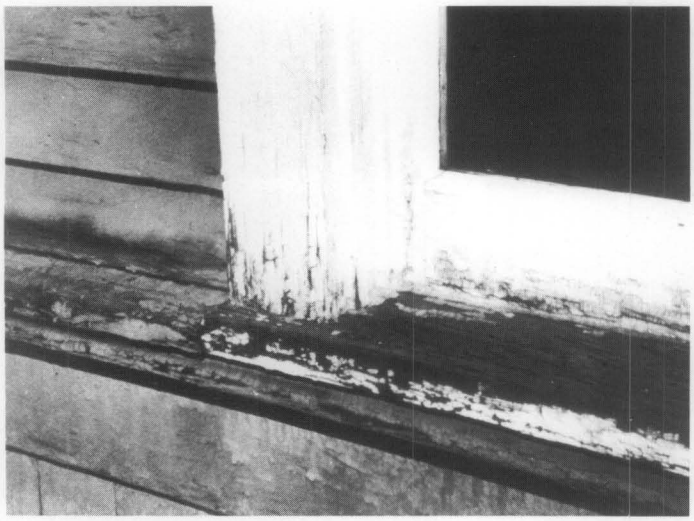

Figure 3. *Deterioration of poorly maintained windows usually begins on horizontal surfaces and at joints where water can collect and saturate the wood. The problem areas are clearly indicated by paint failure due to moisture. Photo: Baird M. Smith, AIA*

tion 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.

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.

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 double-hung wooden window (see figures 4a-f), 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. Several techniques such as scraping, chemical stripping, and the use of a hot air gun are discussed in "Preservation Briefs: 10 Paint Removal from Historic Woodwork" (see Additional Reading section at end).

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 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 (see figure 4b). 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 (see figure 4c), the glass should be removed or protected from the sudden temperature change which can cause breakage. An

Figure 4a. *The following series of photographs of the repair of a historic double-hung window use a unit which is structurally sound but has many layers of paint, some cracked and missing putty, slight separation at the joints, broken sash cords, and one cracked pane. Photo: John H. Myers*

Figure 4b. *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. To avoid visible scarring of the wood, the sash can be raised and the stop pried loose initially from the outer side. Photo: John H. Myers*

Figure 4c. *Sash can be removed and repaired in a convenient work area. Paint is being removed from this sash with a hot air gun while an asbestos sheet protects the glass from sudden temperature change. Photo: John H. Myers*

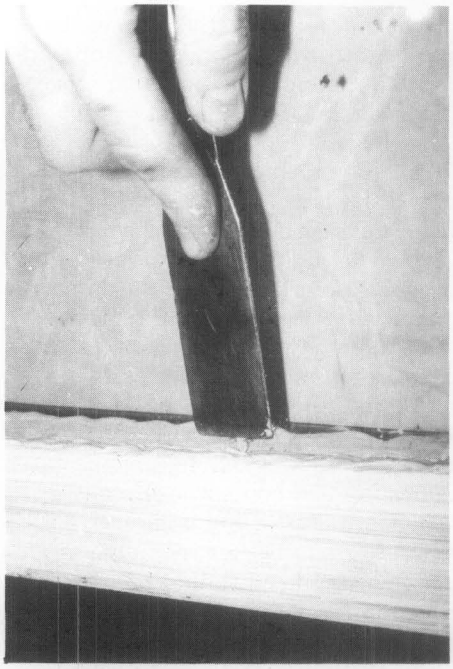

Figure 4d. *Reglazing or replacement of the putty requires that the existing putty be removed manually, the glazing points be extracted, the glass removed, and the back putty scraped out. To reglaze, a bed of putty is laid around the perimeter of the rabbet, the pane is pressed into place, glazing points are inserted to hold the pane (shown), and a final seal of putty is beveled around the edge of the glass. Photo: John H. Myers*

Figure 4e. *A common repair is the replacement of broken sash cords with new cords (shown) or with chains. The weight pocket is often accessible through a removable plate in the jamb, or by removing the interior trim. Photo: John H. Myers*

Figure 4f. *Following the relatively simple repairs, the window is weathertight, like new in appearance, and serviceable for many years to come. Both the historic material and the detailing and craftsmanship of this original window have been preserved. Photo: John H. Myers*

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 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 (see figure 4d). 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 weathertight 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 (see figure 4e). 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.

The operations just discussed summarize the efforts necessary to restore a window with minor deterioration to "like new" condition (see figure 4f). 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.

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 semi-rigid epoxies which saturate the porous decayed wood and then harden. The surface of the consolidated wood can then be filled with a semi-rigid epoxy patching compound, sanded and painted (see figure 5). Epoxy patching compounds can be used to build up

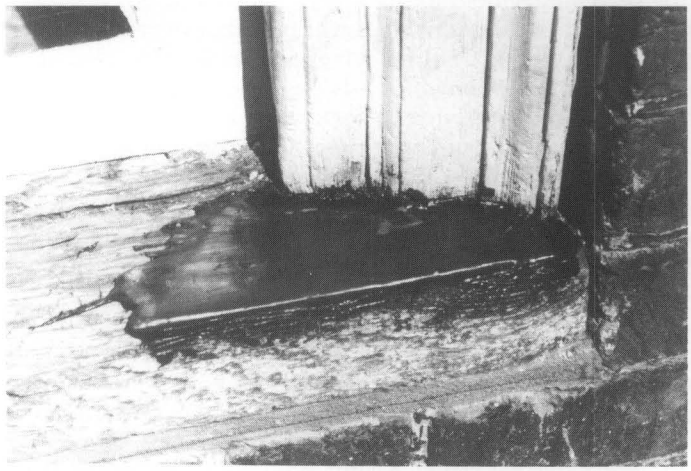

Figure 5. *This illustrates a two-part epoxy patching compound used to fill the surface of a weathered sill and rebuild the missing edge. When the epoxy cures, it can be sanded smooth and painted to achieve a durable and waterproof repair. Photo: John H. Myers*

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. Technical Preservation Services has published *Epoxies for Wood Repairs in Historic Buildings* (see Additional Reading section at end), which discusses the theory and techniques of epoxy repairs. 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.

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.

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.

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.

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.

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.

Additional Reading

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Historic Preservation Tax Incentives

Evaluating Historic Windows for Repair or Replacement

Determinations concerning the treatment of historic windows begin with Standard 6 of the Secretary of the Interior's Standards for Rehabilitation: (https://www.nps.gov/subjects/taxincentives/secretarys-standards-rehabilitation.htm) "Deteriorated historic features shall be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature shall match the old in design, color, texture, and other visual qualities and, where possible, materials. Replacement of missing features shall be substantiated by documentary, physical, or pictorial evidence."

Repair should be the first option considered. Repair can include renewal of finishes, material repair using epoxies, replacement of component parts and additions such as weather stripping. While it may be possible to repair even severely deteriorated windows, repair of deterioration beyond a certain level is not practical or reasonable and replacement becomes the appropriate treatment.

The Standards also require, "The removal of historic materials or alterations of features and spaces that characterize a property shall be avoided." While most windows are significant to the character of a property, every window on all properties is not, and it is in these cases that considerations beyond deterioration as described below are appropriate.

Documentation of deterioration

Determination as to when deterioration is sufficiently severe to justify replacement must be based on documentation of the condition of the windows. What constitutes effective documentation may vary with the circumstances of the project, but at minimum must include enough good quality photographs to clearly depict the full range of conditions. When a project involves a great many deteriorated windows, general quantification of the specific aspects of the deterioration may substitute for photographs and descriptions of every window. A full window survey should only be needed in limited instances.

Questions about the feasibility of repair or the quality of the repaired window can usually be best answered by doing a sample repair. The appearance, the cost of the repair, and other factors may be considered. Where particular performance levels are critical, testing of the repaired window may provide information useful in evaluating the viability of repair.

Considerations beyond deterioration

While condition is the primary determinant in decisions regarding the treatment of historic windows, the importance of the windows to the historic character of the building can also be taken into account. The design and location of windows and their relationship to the design of the building can affect their role in the character of a building. Windows that are distinctive features or exemplify fine craftsmanship are more critical to retain and repair than those that play a lesser supporting role in the design of the building or are simple manufactured units. The more important the elevation, feature or space of which the windows are a part, the more important it is to retain the historic windows.

While factors including occupant operation, presence of hazardous materials, code requirements, or energy performance, if taken individually, are not reasons to replace windows, they may be issues to consider in conjunction with deterioration in establishing a need for window replacement. In many cases these requirements can be met without losing the historic windows. For example, studies have shown that the energy performance of historic windows can be significantly improved by adding storm windows and weatherstripping or by replacing the glazing or the sash.

The number of windows being replaced is a consideration that may allow for window replacement that does not depend on deterioration. It may be possible that the replacement of a few windows may have only an inconsequential effect on the character of an elevation with many windows. Thus, where a need such as egress can be achieved with little change to the appearance of the building, a few windows may be replaced irrespective of their condition.

Some areas have code requirements in response to severe weather conditions. Mandates such as impact resistance may make it impossible for a building to have any compliant occupancy with the historic windows in place, particularly on taller buildings. In these cases, replacement of the historic windows will not be dependent on documentation of deterioration.

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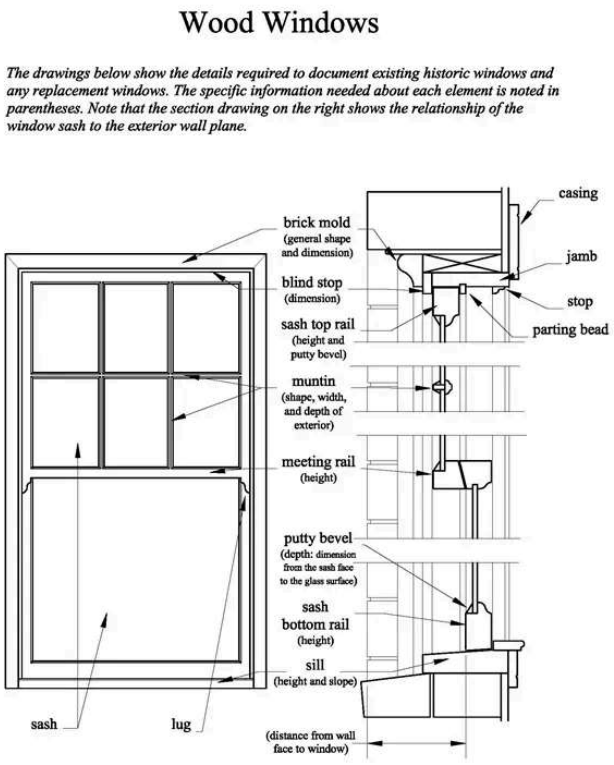
Historic Preservation Tax Incentives

Documentation Requirements for Proposed Window Replacement

Property owners are encouraged to repair and retain existing historic windows. Yet, there are projects where replacement of the existing windows is an appropriate treatment. In order to review proposed replacement windows for conformance with the Secretary of the Interior's Standards for Rehabilitation, the State Historic Preservation Office and the National Park need the following minimum documentation:

- **Clear photographs of existing windows.** When windows are boarded over, remove boards from typical windows in order to take photographs.
- **Drawings showing the elevation and horizontal and vertical sections of existing historic windows.** Include muntins, mullions, transoms, and other window components. For historic steel industrial windows that contain operable units, drawings must include this feature.
- **Drawings showing the elevation and horizontal and vertical sections of proposed replacement windows.** In the case of a hung window, provide section drawings of both the upper and lower sash, including meeting rail. For replacement steel windows, include sections of both operable and fixed units. See note below regarding manufacturers' standard cut sheets.



Elevation and sections of a wood window.

Drawings should be at the same scale and large enough to clearly show construction details. Scale should be provided, measurements noted, and materials indicated for the main components of the window. Drawings of the existing historic window should be accurate, based on field measurements.

Replacement windows must accurately replicate the appearance of existing historic windows. Manufacturers' standard cut sheets usually are not an adequate substitute for detailed drawings since they are not drawn specifically for the proposed window replacement and do not show custom applications or installation details required for the project. In small projects where windows are being replaced and the historic or existing window is simple in design, manufacturers' standard cut sheets may be substituted for

actual section drawings of the proposed window provided there is sufficient detail for review.

Window sections must show the profiles of muntins, meeting rails, sash, frames, moldings, and other features. Construction details must be apparent, including joinery. For all projects, the window's relationship to the existing wall plane must also be provided for both the existing historic windows, when present, and the proposed replacement window.

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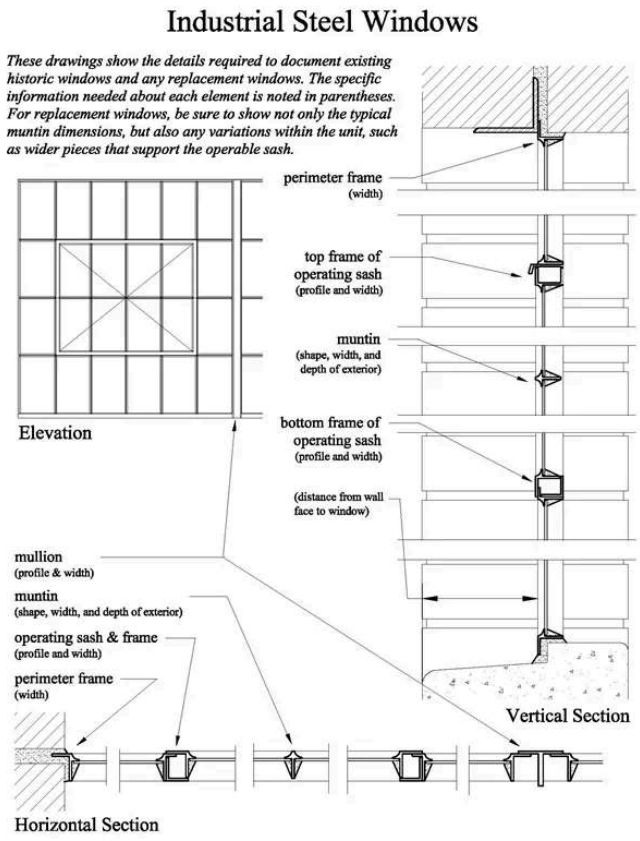

Elevation and sections of an industrial steel window

Last updated: September 17, 2022

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Historic Preservation Tax Incentives

Replacement Windows that Meet the Standards

The decision-making process for selecting replacement windows divides into two tracks depending on whether historic windows remain in place or no historic windows survive.

Replacement of Existing Historic Windows

When historic windows exist, they should be repaired when possible. When they are too deteriorated to repair, selection of the replacement windows must be guided by Standard 6. Design, visual qualities, and materials are specific criteria provided by the Standard that are pertinent to evaluating the match of a replacement window. Evaluating the adequacy of the match of the replacement window involves the consideration of multiple issues.

How accurate does the match need to be?

The more important a window is in defining the historic character of a building the more critical it is to have a close match for its replacement. Location is a key factor in two ways. It is usually a consideration in determining the relative importance of a building's various parts. For example, the street-facing facade is likely to be more important than an obscured rear elevation. The more important the elevation, feature or space of which the window is a part, the more important the window is likely to be, and thus, the more critical that its replacement be a very accurate match. Secondly, the location of the window can affect how much of the window's features and details are visible. This will affect the nature of an acceptable replacement. For example, windows at or near ground level present a different case from windows in the upper stories of a tall building.

Using the hierarchy of a building's features and taking into account the window's visibility, some general guidance can be drawn.

- Replacement windows on primary, street-facing or any highly visible elevations of buildings of three stories or less must match the historic windows in all their details and in material (wood for wood and metal for metal).
- Replacement windows on the primary, street-facing or any highly visible elevations that are part of the base of high-rise buildings must match the historic windows in all their details and in material (wood for wood and metal for metal). The base may vary in the number of stories, but is generally defined by massing or architectural detailing.
- Replacement windows on the primary, street-facing or highly visible elevations of tall buildings above a distinct base must match the historic windows in size, design and all details that can be perceived from ground level. Substitute materials can be considered to the extent that they do not compromise other important visual qualities.
- Replacement windows on secondary elevations that have limited visibility must match the historic windows in size, configuration and general characteristics, though finer details may not need to be duplicated and substitute materials may be considered
- Replacement windows whose interior components are a significant part of the interior historic finishes must have interior profiles and finishes that are compatible with the surrounding historic materials. However, in most cases, the match of the exterior of a

replacement window will take precedence over the interior appearance.

- Replacement windows in buildings or parts of buildings that do not fit into any of the above categories must generally match the historic windows in all their details and in material (wood for wood and metal for metal). Variations in the details and the use of substitute materials can be considered in individual cases where these differences result in only minimal change to the appearance of the window and in no change to the historic character of the overall building.

How well does the new window need to match the old?

The evaluation of the match of a replacement window depends primarily on its visual qualities. Dimensions, profiles, finish, and placement are all perceived in relative terms. For example, an eighth of an inch variation in the size of an element that measures a few inches across may be imperceptible, yet it could be more noticeable on the appearance of an element that is only half an inch in size. The depth of a muntin or the relative complexity of a brick mold profile are more often made visually apparent through the shadows they create. Thus, while comparable drawings are the typical basis for evaluating a replacement window, a three-dimensional sample or mock-up provides the most definitive test of an effective visual match.

The way a historic window operates is an important factor in its design and appearance. A replacement window, however, need not operate in the same manner as the historic window or need not operate at all as long as the change in operation does not change the form and appearance of the window to the point that it does not match the historic window or otherwise impair the appearance and character of the building.

Factors to consider in evaluating the match of a replacement window

- **Window unit placement in relation to the wall plane;** the degree to which the window is recessed into the wall. The location of the window affects the three-dimensional appearance of the wall.

- **Window frame size and shape.** For example, with a wood window, this would include the brick mold, blind stop, and sill.
  - The specific profile of the brick mold is usually less critical than its overall complexity and general shape, such as stepped or curved.
  - Typical sight lines reduce the importance of the size and profile of the sill on windows high above ground level, especially when the windows are deeply set in the wall.
  - Though a blind stop is a small element of the overall window assembly, it is a noticeable part of the frame profile and it is an important part of the transition between wall and glass.
  - Steel windows that were installed as a building's walls were constructed have so little of their outer frame exposed that any replacement window will necessitate some addition to this dimension, but it must be minimal.

- **Glass size and divisions.** Muntins reproduced as simulated divided lights – consisting of a three-dimensional exterior grid, between-the-glass spacers, and an interior grid – may provide an adequate match when the dimensions and profile of the exterior grid are equivalent to the historic muntin and the grid is permanently affixed tight to the glass.

- **Sash elements width and depth.** For example with a wood window, this would include the rails, stiles and muntins; with a steel window, this would include the operator frame and muntins.
  - The depth of the sash in a double-hung window, or its thickness, affects the depth of the offset at the meeting rail of a hung window. This depth is perceived through the shadow that it creates.
  - Because of its small size, even slight differences in the dimension of a muntin will have a noticeable effect on the overall character of a window. Shape, as well as depth, is important to the visual effect of a muntin.

- The stiles of double-hung historic windows align vertically and are the same width at the upper and lower sashes. The use of single-hung windows as replacements may alter this relationship with varying effects on the appearance of a window. In particular, when the distinction between the frame and the sash is blurred, details such as lugs may be impossible to accurately reproduce.
- Meeting rails of historic windows were sometimes too narrow to be structurally sound. Reproducing a structurally-inadequate condition is not required.
- The operating sash of a steel window is usually wider than the overall muntin grid of the window. In addition, the frame of the operating sash often has slight projections or overlaps that vary from the profile of the surrounding muntins. The shadow lines the muntins create add another important layer to the three-dimensional appearance of the window.

- **Materials and finish.**
  - While it may be theoretically possible to match all the significant characteristics of a historic window in a substitute material, in actuality, finish, profiles, dimensions and details are all affected by a change in material.
  - In addition to the surface characteristics, vinyl-clad or enameled aluminum-clad windows may have joints in the cladding that can make them look very different from a painted wood window.
  - Secondary window elements that do not match the finish or color of the window can also diminish the match. Examples include white vinyl tracks on dark-painted wood windows or wide, black, glazing gaskets on white aluminum windows.

- **Glass characteristics.**
  - Insulated glass is generally acceptable for new windows as long as it does not compromise other important aspects of the match.
  - The clarity and reflectivity of standard clear window glass are significant characteristics of most windows. Because these characteristics are often diminished for old glass, new glass equivalent to the original should be the basis for evaluating the glazing proposed for new windows. Color should only be a noticeable characteristic of the new glass where it was historically, and any coating added must not perceptibly increase the reflectivity of the glass.
  - Where the glazing is predominantly obscure glass, it may be replaced with clear glass, but some evidence of the historic glazing must be retained, either in parts of windows or in selected window units.

Replacement Windows Where No Historic Windows Remain

Replacement windows for missing or non-historic windows must be compatible with the historic appearance and character of the building. Although replacement windows may be based on physical or pictorial documentation, if available, recreation of the missing historic windows is not required to meet the Standards. Replacement of missing or non-historic windows must, however, always fill the original window openings and must be compatible with the overall historic character of the building. The general type of window – industrial steel, wood double-hung, etc. – that is appropriate can usually be determined from the proportions of the openings, and the period and historic function of the building. The appearance of the replacement windows must be consistent with the general characteristics of a historic window of the type and period, but need not replicate the missing historic window. In many cases, this may be accomplished using substitute materials. There may be some additional flexibility with regard to the details of windows on secondary elevations that are not highly visible, consistent with the approach outlined for replacing existing historic windows. Replacing existing incompatible, non-historic windows with similarly incompatible new windows does not meet the Standards.

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