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Mammoth Hot Springs Hotel
Seismic Stabilization and Rehabilitation Phase 2
Responses to 12/22/2017 Questions Submitted by Linda Kiisk, Historical Architect WY SHPO

Thank you for the opportunity to answer your questions regarding the proposed Phase 2 of the Mammoth Hot Springs Hotel Seismic Stabilization and Rehabilitation Project.

Question 1: What were the original assumptions regarding the design approach to the historic windows in Phase II? For example, what energy efficiency targets needed to be achieved?

Early project program goals for Phase 2 (Guest Wing) of the Mammoth Hot Springs Hotel Seismic Stabilization and Rehabilitation project resulted in many goals, including:

1. **Preserve historic integrity of Mammoth Hot Springs (MHS) Hotel, maintain historic character and fabric.**
    a. A historical architecture firm (A&E Architects) was contracted by the NPS for project design.
    b. Recommendations within the 2015 Historic Structure Report (HSR) treatment plan for the MHS Hotel were followed during design development. The 2015 HSR treatment plan called for the replacement of the guest wings windows.

2. **Continue year-round use of the hotel by meeting occupancy code requirements including improving building ventilation and natural air circulation and enhancing thermal performance during summer and winter.**
    a. As room-to-hallway transom windows need to be closed/covered to meet fire code requirements, there has been a loss of the historic cross ventilation pattern within the guest rooms.
    b. Guests complain that rooms are excessively hot during the summer with no ventilation. The design team determined this is due to lack of insulation (heat) and lack of passive ventilation (opening top half of double-hung window).
    c. Guests complain that the rooms are excessively cold during the winter.

3. **Improve efficiency of building shell to reduce the energy use in the winter and improve the thermal performance of all interior spaces.**
    a. The hotel was historically designed for use in warmer seasons. Winter use of the hotel began intermittently in the 1960s and then consistently since the late 1970s.
    b. NPS construction and rehabilitation projects such as MHS Hotel rehabilitation are required to design the building to Leadership in Energy and Environmental Design (LEED) Silver minimum standards. Although the building is not technically certified, it is a requirement of the design team to provide a sustainability report supporting the requirements have been met. Specifically, in the Energy and Atmosphere (EA) requirements for energy performance, EA Prerequisites 2 and 3.
    c. NPS is required to meet the Federal Government Energy Independence and Security Act of 2007 as mandated by Congress. EISA 2007 mandates the Federal Government "...Increase the efficiency of products, buildings, and to improve the energy performance of the Federal Government…"
    d. In addition to the energy modeling for LEED, the International Energy Conservation Code (IECC) requires a U-factor on operable fenestrations in climate zone 6 is 0.43.

Question 2: What other energy efficiency and ventilation options were explored to allow the historic windows to be retained, aside from the new HVAC system and storm windows that were already discussed?

Several energy efficiency and ventilation improvement options were examined during project development and review, including:

1. **Mechanical system options**
    a. *Mechanical heating and ventilation system:* Systems considered include (1) non-ducted, variable refrigerant flow system utilizing water cooled condensing units and outdoor dry cooler and (2) 4-pipe fan coil using hydronic hot water and an outdoor chiller. To meet guest comfort requirements, a new HVAC system would require extensive and intrusive impacts to the interior character of all rooms and hallways through reduced height or soffit ceilings throughout. These soffits would obscure the transoms and the tops of windows. Additional piping, branch selector boxes, and visible indoor units would be required. Large mechanical units would be required on the roof or adjacent to the building.
    b. *Mechanical exhausting of attic and corridors (included in the design).* The system would consist of central exhaust fans that are sized to provide continuous ventilation year round. Supply and exhaust grills provide ventilation in the hallways. The guest rooms receive fresh air when the occupant opens the top sash of the double hung windows and code required bathroom ventilation fans provide exhaust of hot air.
2. **Options to maintain existing windows**
    a. *Retrofit kits to eliminate sash weight pockets*: Replacement sash kits contain plastic and tend to be a certain size that requires filling in of the area between the existing stops and parting strip. A&E Architects' previous experience with these products demonstrated they work for only a few years before failing and requiring replacement of windows.
    b. *Awnings* would provide a cooling effect during the summer heat, however they would not address winter insulation requirements or be compatible with maintaining the historic character of the building exterior.
    c. *Low-E film* applied on existing windows scratches and degrades over time and does not accomplish winter insulation objectives.
    d. *Interior window coverings* – Magnetized insulated Roman shades would provide better winter insulation than long insulated drapes, which generate cold drafts due to a reverse-chimney effect. However, both of these options do not allow for passive ventilation or natural light. Additionally, interior condensation can become trapped against the windows behind the drapes, negatively impacting window condition over time.
    e. *Install independent storm window to the interior:* This approach would maintain the historic integrity of the window and the character of the exterior of the building but would eliminate the character at the interior and would not allow for operation of the window for ventilation. The distance between the bottom sash of the window to the face of the trim is about 2". Due to the impacts to the interior and lack of access to ventilation air, this option was determined not acceptable. Additionally, interior condensation can become trapped against the windows.
    f. *Install independent fixed storm and fixed screen to the exterior (changed out seasonally):* Although the historic fabric of the individual windows would be maintained, this option would not meet code requirements for guest access to ventilation air during winter months. Additionally, the separate storm window and summer screen system would extend up to 1" beyond the tapered exterior trim. The overall character of the guest wing exterior would be altered by these 172 window protrusions.

g. *Install independent operable double hung storm window with permanently installed screen to the exterior*: Although this option would allow for the maintenance of individual historic windows and address all guest comfort and energy performance concerns, the historic character of the guest wing exterior façades would be significantly altered. Installation of insulated/operable storm windows would increase the overall thickness of the window assembly. The storm window system would project up to 3" beyond the face of the historic frame and trims. These (172) storm window protrusions would result in a loss of the overall exterior façade character.

3. **Option for in-kind replacement of existing windows (preferred option):** This approach would remove the historic fabric of the wood sash and glass. However, this energy-efficiency and ventilation improvement option best maintains the overall historic and architectural character to both the building interior and exterior, as only the wood sash and glass would be replaced in kind. The rest of the window frame and trim would be retained. Additionally this approach maintains the guest experience of the windows within the historical and architectural context of a passive ventilation system. With this approach historic window glass and sashes would be salvaged for concessionaire use in repair and restoration of other historic properties within the park. The concession Historic Preservation Crew plans to salvage at least half to all of the removed sash, weights, and hardware.

4. **Hybrid Options:** The following options consist of a combination of window repair/restoration and in-kind replacement.
    a. *Restore existing windows that face the core of the historic district (east side) and replace windows on the back side of the building:* To meet guest comfort requirements, a new HVAC system would require extensive and intrusive impacts to the interior character of all rooms and hallways through reduced height or soffit ceilings throughout. These soffits would obscure the transoms and the tops of windows. Additional piping, branch selector boxes, and visible indoor units would be required. Large mechanical units would be required on the roof or adjacent to the building.
    b. *Add fixed storms to restored windows along the first floor (only) while replacing windows on all other floors:* All first floor historic windows would be restored and maintenance crews would seasonally change-out fixed storm windows with fixed screens (which would protrude up to 1" beyond exterior trim). Ventilation requirements would be provided via modified first floor HVAC system would be routed through the crawlspace. The protrusions of the fixed storms and screens along the first floor would alter the overall character of the exterior façade.

Question 3: What data was utilized to reach the conclusion that keeping the historic windows was not feasible?

Yellowstone National Park's highest priority is retention of the historic character of the MHS Hotel while continuing its year-round use by park visitors. Meeting energy-efficiency, ventilation, seismic, fire suppression, and other building code requirements is critical to the continued use of the hotel. Therefore, rehabilitation design solutions that least diminish the historic character of the room interiors and building exterior are preferred.

1. *Preserve Historic Character:* The historic character of the guest wing includes exterior is a result of (1) simple one over one double hung windows, (2) simple repetitive façade composition, and (3) relatively flat expression of siding, trims, and window, which are maximized by maintaining a simple window without projections of window components beyond the existing trims. Primary interior spaces are defined as those designed for public access (e.g. lobby, hallway corridors, and main stairs) and have retained their original

plan and volume, as well as wall, floor, and ceiling finishes. Secondary interior spaces are defined as those originally designed for utilitarian purposes, i.e, spaces not generally seen by the public, and/or spaces that retain their original plan, but have modern finishing materials.

a. While options that propose the use of insulated storm windows allow for retention of individual historic wood sashes and glass, the park cannot achieve ventilation and energy efficiency goals without significant alteration of historic character of the exterior façade as there is insufficient space for these storms and they would protrude up to 3" beyond the exterior trim. All 172 of these storm window protrusions would cumulatively compromise the overall exterior façade appearance, character, and design integrity. For this reason, this option was precluded.
b. Options that propose ventilation and energy efficiency goals be met through mechanical/HVAC systems would require extensive and intrusive impacts to the interior character of the rooms and hallways through reduced height or soffit ceilings throughout. These soffits would obscure the transom windows over the doors and the tops of windows. For these reasons, these options were preluded.

2. *Energy Efficiency:* Window, in and of themselves, are not a requirement of LEED design, however, they are particularly important when modeling the energy consumption in a building. Windows are a significant component of heat loss to the building even when relying only on insulation that would be added to walls. Based on heating loads, the heat loss in the rooms is almost double in rooms with single pane glass versus those with double pane windows. In addition to the energy modeling for LEED, the International Energy Conservation Code (IECC) requires a U-factor on operable fenestrations in climate zone 6 is 0.43. Single pane glass typically has a U-factor of 1.09. The lower U-factor, the better the insulating characteristics of the glass. In addition to the glass, the sash weights on a historic window would be in uninsulated pockets adjacent to the window, thus adding to the overall inefficiency of the wall assembly. For this reason, the option of simply restoring existing windows without any energy efficiency improvements was precluded. Calculations completed by the mechanical engineers indicate thermal needs of the building with the various options of window treatment as indicated below:
    - With restored windows energy use: 946.3 Million BTU / Hr.
    - With restored windows and storms energy use: 622.5 Million BTU / Hr.
    - With compatible new wood window energy use: 478.8 Million BTU / Hr.

3. *Window Condition:* While the windows vary in condition, this was not the driving factor for proposed window replacement for this project. The windows do contain lead-based paint. Please note the process of removing lead paint can have hidden labor-intensive consequences. For example, many layers of lead paint were removed from the original windows at the Lake Hotel. Since the wood had shrunk over the years guests complained the windows rattled in their jambs.

Question 4: If cost played a significant role in the decision making process, what were the cost comparisons between rehabilitating the existing windows to make them more energy efficient versus the removal, disposal, manufacturing, and installation costs associated with the new windows? Was a condition assessment performed for the existing windows? The 2015 HSR does not provide any detailed information on the windows.

Cost did not play a significant role in the process of deciding whether or not to replace windows in kind (see responses to Question 3).

The 2015 HSR did an overall condition assessment of the building. The windows were found to vary in condition (mostly fair condition) and contain lead based paint. However, window condition played a minor role in the decision making process.

Question 5: The existing windows were designed to be repaired. Can the proposed manufactured windows also be easily repaired or will they have to be replaced if any parts or finishes fail?

The proposed new windows are painted wood that can be repaired and maintained just like the original windows. If broken, the thermal unit would have to be replaced in the wood sash just like an original replacement glass. The new thermal unit would have restoration glass on the exterior with a regular glass on the interior. We would also add a low-E film to the inside of the regular glass to cut down on the heat gain during the summer. The film has to be located on the inside of the thermal unit because it scratches easily.

Question 6: What are the calculated greenhouse gas emissions for this project if all of the existing windows are disposed of in the landfill? As part of the planning process what sustainability measures were studied with respect to the windows?

Most window materials (wood sash, glass, hardware, pulleys, etc.) would not go to the landfill. They would be used in the repair or restoration of other historic properties within the park.

The design team is obligated to provide a sustainability report supporting that project goals (included designing the building to LEED Silver minimum standards) have been met. Greenhouse gas emissions for sending only some window materials to the landfill would be minimal.

NOTE: Unrelated, but we noticed that the PEPC number is not yet available on the NPS website. When will the project be available for public comment?

The park will undertake a public review period through PEPC.