

Minnesota State Capitol Window Operability



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**White Paper by
Michael Bjornberg
Associate Vice President
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Introduction

In our preliminary planning work related to the window replacement project, the design team has had discussions about window operability with State staff and Capitol Security, and has taken into consideration comparative experiences of other Capitol buildings. The purpose of this White Paper is to provide information that supports the design team's recommendation for partial (but controlled and monitored) operability of the windows.

Background

The Minnesota State Capitol has 242 exterior wood windows (excluding drum windows, skylights, French doors and interior windows). Of those:

- 233 are double-hung operable windows,
- Six (6) are fixed windows,
- Three (3) are in-swinging casement windows.

The original wood double-hung windows allowed operation of both upper and lower sashes, in order to address fresh air and manage air flow in individual rooms. All but four (4) of the original 242 windows were replaced with aluminum windows in 1973/1974. Both the double hung and casement windows remained operable, but did have locking mechanisms installed.

Security Considerations

Potential security concerns for both the building in general and the windows specifically, have been discussed. Current accepted practice is that the occupants are allowed to operate windows, if they have the required tool. There is no method to monitor windows left open or to restrict the window opening size at this time.

There has also been discussion regarding the need/desire for a higher level of security to protect the building and its occupants from intentional damage to the office/occupant by an individual(s). Increased security measures could include security glazing, window contacts, glass breakage alarms and filtering films (listening or breakage control). Some of these options, such as security glazing, require installation at the time of window replacement, while some require accommodations at the time of replacement or could potentially be added at a later date (e.g., window contacts, glass breakage alarms). Depending on the window replacement selected, other security measures could be added after a need was identified (e.g., filtering films.)

Any security devices such as contacts, alarms, and wiring that would need to part of a total building security system would be best installed/included during the replacement process so that the areas already scheduled to be primed, sealed, painted or refinished are not impacted at a later date. It is of note that any security glazing, such as bullet resistance, needs to address the safety and resistance of the sash and window frames themselves.

Of Note: A recent conversation relative to the State of California Capitol has provided the following information; the California State Capitol has operable wood double hung windows, but building policy is that they are not to be opened. All windows have contact alarms to alert Building Security that a window has been opened.

HVAC Considerations

A well-balanced and managed building HVAC system controls the air and temperature of interior spaces. Typically, this is most effective when the windows are not operable. The opening of windows can introduce a variety of conditions including temperature and humidity fluctuations that can make overall building balancing difficult. However, technology such as smart relay switches and contacts are available that could be utilized to alert an HVAC system that a window is open, and subsequently adjust the system in the immediate area to accommodate the open window. Until the Capitol's current HVAC system is updated or replaced, operable windows may be helpful in providing sufficient fresh air to the building's occupants to meet modern standards..

Operational Advantages

- The ability to open a window and provide fresh air increases human comfort, particularly in an older building with aging mechanical systems. Since the current mechanical system will be in place when windows are replaced, the capability of individually moderating the temperature and humidity fluctuations and supplementing uneven delivery of fresh air and humidity control would be an advantage until the new mechanical systems are in place and balanced.
- An operable window more accurately reflects the historic character and use patterns of the original design.
- An operable window can aid in the window cleaning process.

Operational Disadvantages

- An operable window can be left open, whether intentionally or unintentionally, exposing the building interior to damage from conditions such as intrusion by animals (squirrels, raccoons, birds, etc.), rain water penetration and subsequent water damage, and freezing pipes from cold temperatures.
- An open window can make balancing building HVAC systems difficult, resulting in a slight drop of human comfort.
- A non-operable window provides greater energy performance compared to an operable window, since the perimeter of a fixed window can be sealed more tightly to reduce air infiltration. This lower energy efficiency could require a larger HVAC capability for the building.

Summary

The following provides a summary of points made and is the basis for the design team recommendations.

- An operable window can help to moderate the temperature and humidity fluctuations that currently exist in the building with aging mechanical systems.
- With a new HVAC system, an open window could be considerably less energy efficient unless relays and contacts are included.
- The ability to open a window on a nice day and get fresh air or hear sounds is a human comfort and is not available with inoperable windows.
- Building protection from entry by animals or humans is a consideration of high importance.
- The potential of a window being left open to external elements, causing interior damage, is of significant concern.
- An operable window is less energy efficient than a fixed window.
- Methods to restrict the range of window opening and to provide an alarm/alert when a window is opened (or left open after hours) exists. However, these methods would need to

allow for maintenance staff to fully open the window while hindering occupants from doing so easily.

Summary Recommendation

1. The design team recommends that the new double hung windows provide fixed upper sashes and operable lower sashes, thereby moderating the concerns of energy efficiency with the desire to have fresh air. Fixed windows should remain fixed and casement windows should be operable, but only by maintenance staff.
2. The range of motion of the operable window should be controlled and be limited to minimize the ability of person, animal or natural elements to enter the building.
3. When the new HVAC systems are designed and implemented, the operability and range of opening should be revisited to ensure the new systems can be balanced, and temperature and humidity can be controlled.
4. There should be consideration of window monitoring devices to alert building maintenance when a window is left open after hours, and to interact with electronic controls to allow the HVAC systems to make adjustments after a window is opened.

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