

Selecting the Appropriate Operation for Your Replacement Window

Condo Management

June 2004

Selecting the appropriate operation type for replacement windows is critical to the success of a project and the satisfaction of the end user. Although operation types are usually an afterthought to designers and building owners, selecting them can be as important as the windows' air and moisture resistance, thermal performance and weather sealing. Regardless of operation, most windows perform very specific functions, such as providing natural light, ventilation and emergency egress, in addition to contributing to the building's aesthetics. Since windows perform many functions, it is usually desirable to have replacements provide as many of these functions as possible, while still remaining cost effective. While all window operations are capable of providing the simplest of functions, such as natural light, building limitations can affect or limit the desired functions.

Window Operation Types

Windows are available in a variety of materials, construction variations, frame dimensions, performance grades and operation types. This article will focus on selecting the best operation for your replacement windows. The main window types and a brief description of their operations are as follows:

- Awning (project out) – the operable sash projects horizontally away from the user
- Hopper (project in) – the operable sash projects horizontally towards the user
- Casement (roto or free swing) – the operable sash projects vertically towards or away from the user
- Double- or single-hung – the operable sash slides vertically up or down within the window frame
- Slider – the operable sash slides horizontally left or right
- Pivot – the operable sash pivots vertically or horizontally
- Fixed – there are no operable units

With all of the window types listed, it is understandable that the most experienced designers, architects and owners could become overwhelmed and confused as to which is best for their building. When too many choices are presented, the type that is most familiar is usually selected, but this may not be the most appropriate choice. To assist the designer or owner, the following factors should be taken into account.

Building use and occupant restrictions

Perhaps the best starting point for determining the type of window is building use. Building use often goes hand-in-hand with occupant restrictions. Therefore these two considerations have been combined as one. Determining the building use is usually not sufficient to establish the desired or required window type. Some commercial or industrial-use facilities may require fixed windows that will not cause disruptions in the building's mechanical heating and cooling systems.

Access to the window sash

Restricted access to the window sash can greatly reduce the types of window operations that would be deemed acceptable. Restricted access can include excessively thick walls; difficult-to-reach window openings; and exterior or interior obstructions in front of window openings, such as columns, partition walls, desks, or counters. These factors restrict the reach to the window sash or limit the operation of the sash. Abnormally thick walls typically encountered at bay windows or furnishings between the user and the window sash make operation of the window sash difficult. In these instances, a hung and slider type window would not be appropriate as the long reach coupled with the breakforce required in operating the sash would make operation difficult. Awning-type windows would also be discouraged because although the cam handle is accessible, the user would not be able to push the sash farther than their reach, which may only be a few inches. The best choice of window to be installed in these instances is a casement unit, since the units are opened with a simple turning of the crank handle. In some instances, project-in units may also be acceptable since the windows are usually light and only require turning the handle and pulling the operable sash towards you. They are also easy to close but they let in less air when opened. Stairwell windows in overhead location and out of reach of users.

Other setups that can impact window selection are when the windows are installed at ceiling level. The window in this photo is a sliding unit and is installed at the top of a staircase. When windows are out of reach, using hung, slider, casement and project-out type windows would be inappropriate. Only two types of windows would be appropriate for this situation: a project-in window or a fixed-in-place unit that never needs to be opened. For the project-in unit to function, it must be adapted with special hardware so the unit can be opened and closed with a pole. Spring-loaded latches that are easily pulled open or pushed closed work best in this situation. Each unit should have no more than one latch per sash, as two or more poles are difficult to use at once.

Existing wall opening dimensions

Existing wall opening dimensions often limit the operation of the window. Small or narrow dimensions may make including an operable sash within the window frame impossible due to dimension requirements of the window manufacturers. Sash units that are too small cannot have the appropriate hardware applied to them due to space limits. In most cases, it is not economical to enlarge the window opening to meet the

minimum window sash dimension because this requires costly renovations to the structural framing and interior and exterior wall systems.

Emergency exits requirements

Most local, state and national building codes require specific room occupancy types, such as sleeping quarters, to have a minimum of two exits. Where rooms contain only one door, the second exit is usually a window. To be considered acceptable, the clear unobstructed opening must meet the specific dimensions for a person to fit through in the event of an emergency. Designers and owners must take into account that the sash is usually limited to how wide it may open and should consult with a window manufacturer prior to selecting the type of window operation. Projected units cannot be made to allow for emergency exit due to the way the sash operates. In most instances, the window that easily meets the specific requirements is the casement unit since these units typically open the widest. Sliding, pivot and hung units provide less than half the possible width or height of the opening and usually require larger openings to be considered acceptable. Building owners and designers are strongly encouraged to determine all requirements pertaining to emergency exit windows prior to completing their design.

Ventilation requirements

Building codes require that all occupied space within a building must be vented either mechanically or naturally. When provided through the window unit, ventilation requirements will impact the size of the sash. For example, a 12' x 12' room, requiring a minimum opening to the outside of 4 percent of the floor area, will need almost a 6 square foot opening. The square footage will double if this room is a primary form of ventilation to an adjoining space of equal size.

Historical restrictions

Historically significant buildings are often limited when it comes to window replacement options because protecting the original appearance of these buildings is crucial. When renovating buildings that are on the National Register of Historic Places or located within historic districts, the replacement windows must be replicas of those used during the original construction.

Input from owners

After making sure your replacement windows meet the requirements of building codes, historical mandates and existing opening restrictions, pleasing the owners is often overlooked. Owners should always be consulted when preparing a replacement window design because they are the most affected by the choices. The owners may have a specific type of window **they prefer. Of course, you must take into account the project budget and possible number of operable units allowed.**

Exterior and interior impediments

Exterior and interior impediments can include air conditioners, partition walls, columns

and screens. Window mounted air conditioners often cause the most havoc to a window design. Limited window openings coupled with emergency exit requirements may make accommodating air conditioners impossible. Even if the new windows are thermally improved, most people are adamant about having their own air conditioner. Unfortunately, air conditioners cannot be installed in emergency exit windows.

If there were partition walls or interior columns in front of a window, project-in or pivot windows would be a poor choice since the interior impediment could restrict how far the window opens. Just as interior impediments restrict how far a window would open inward, exterior impediments such as security screens can restrict how far a window opens outward. In these situations, providing windows that slide and don't project away from the opening are recommended.

Safety concerns

Safety concerns are in addition to emergency exit requirements and pertain to walking into open windows or protecting against vandalism. Building codes have provisions for items that project into walkways or hallways. For example, window units should never project into walking areas where a person may not see the sash. In these instances, projecting units should not be used but if they are, they must not project beyond the surface of the interior wall. This is also true for windows that swing outward and into sidewalks or driveways.

One way to discourage vandalism is to install security screens that cover the window openings on the exterior of the building. The security screens will protect the windows from vandalism. However, they are typically exterior mounted, which limits the type of window operation that can be used. In these instances, any window that pivots or projects outward is not feasible.

Ingenuity Can Overcome Limited Operation Choices

Establishing all of these factors for your building can be difficult and in some instances still not lead to a viable replacement window operation type. If it seems that no specific type fits perfectly within each opening, a variety may be used. This need-specific approach should be encouraged, and with proper and creative design, the building's façade will provide an aesthetically pleasing appearance while meeting all requirements.

A Case Study

Refer to the photo of the building elevation; note that some window units contain air conditioners. In addition, this building had emergency exit windows in the sleeping areas. It appears as though the current window configurations consisting of fixed and casement window units function acceptably—the windows open, have accommodations for air conditioners and are the acceptable size for emergency egress. However, the air conditioners were installed through fixed window openings. These units, while large

enough to hold the air conditioners, make it extremely difficult for the residents to install their own air conditioners since the glass of the aluminum window system needs to be removed. Also, their air conditioners may be too large or too small for the openings. If the unit is too small, a barrier needs to be installed around the air conditioner to prevent air and moisture infiltration. The windows at this building do accept air conditioners but the facilities manager was required to install each unit. Since each unit needed to be removed and installed every year, the window frames were being damaged from constantly removing and installing the window glass and air conditioners.

In addition to meeting emergency egress requirements, the replacement windows needed to accommodate air conditioners that the residents could remove and install at their discretion. This means that the windows had to be hung type units, which are the easiest windows for installing air conditioners. However, due to the height of the opening and the height of the window above the finished floor, hung type window units would not meet the emergency egress requirements. The best windows to meet the emergency egress requirements were sliding and casement units, both of which do not easily accommodate air conditioners. In addition, the kitchen windows were above the sink, making them difficult to reach. For this setup, a casement window was the ideal choice.

After reviewing our design factors for this building, we determined that sliding, casement and hung window units were required but none of them were acceptable alone. Our only course of action was to design both casement and hung type window units. Sliding units were not versatile enough to meet all the requirements that were needed and therefore were not used. Our design was actually very similar to the existing configurations with the only difference being that the middle unit of the window opening was a double hung window, was opposed to a fixed unit. The two units on either side of the hung unit remained casements while the bottom of the window remained fixed. The dimension of each unit changed slightly to ensure egress requirements were met. In the end, we provided more ventilation, emergency egress and a hung unit that easily accommodates air conditioners.