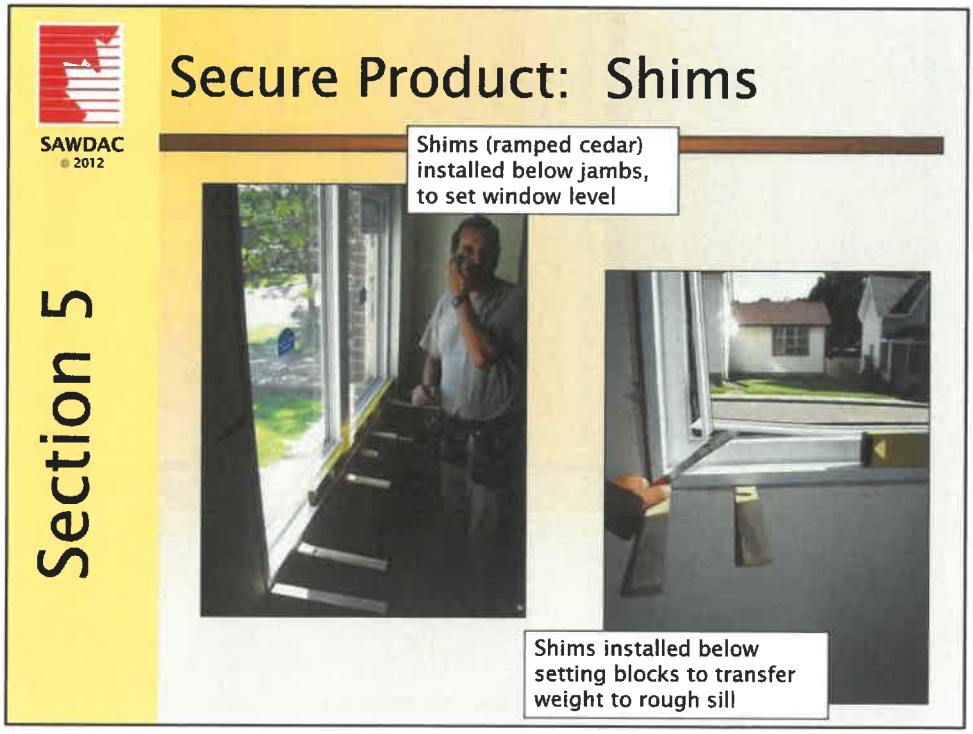
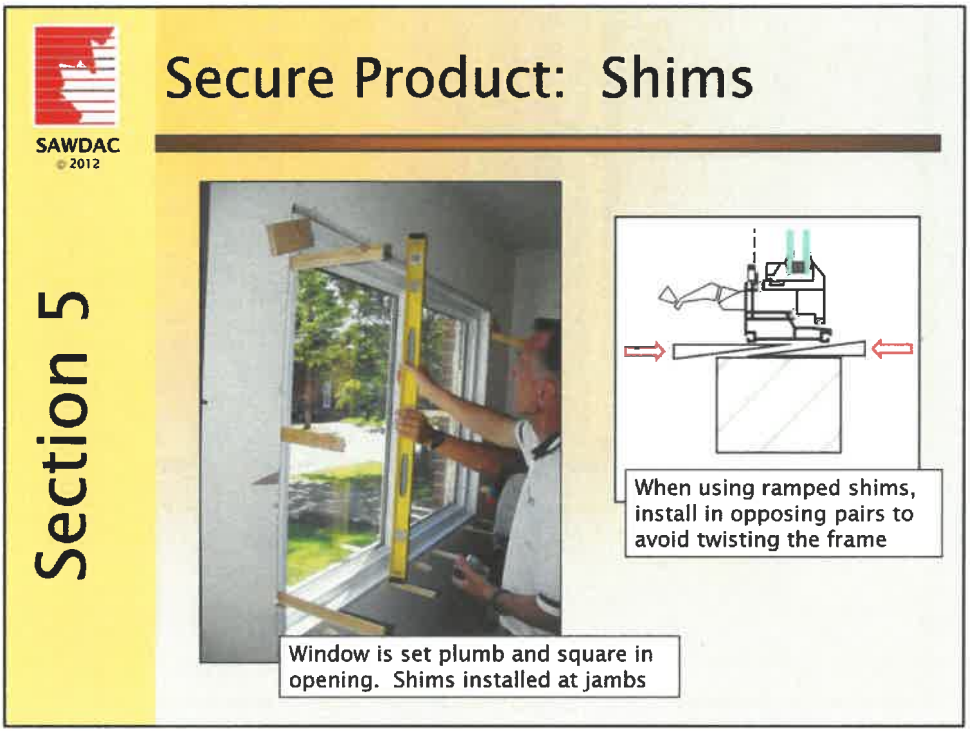


Secure the Product: Shims and Anchors

In these photos, the windows are shimmed at the sill, as follows:

- Beneath jambs.
- Beneath the insulating glass unit setting blocks. The middle photo shows how the contractor lifted the interior stops to confirm the position of the setting blocks. The rule-of-thumb is that setting blocks should be located at ¼ points of the width of the unit. However, they can be located at 1/8 points in very wide units windows to reduce bending on the frame (because very wide units are heavier). The window manufacturer could also recommend other locations. So the installer must check the location on site.



Secure the Product: Shims and Anchors

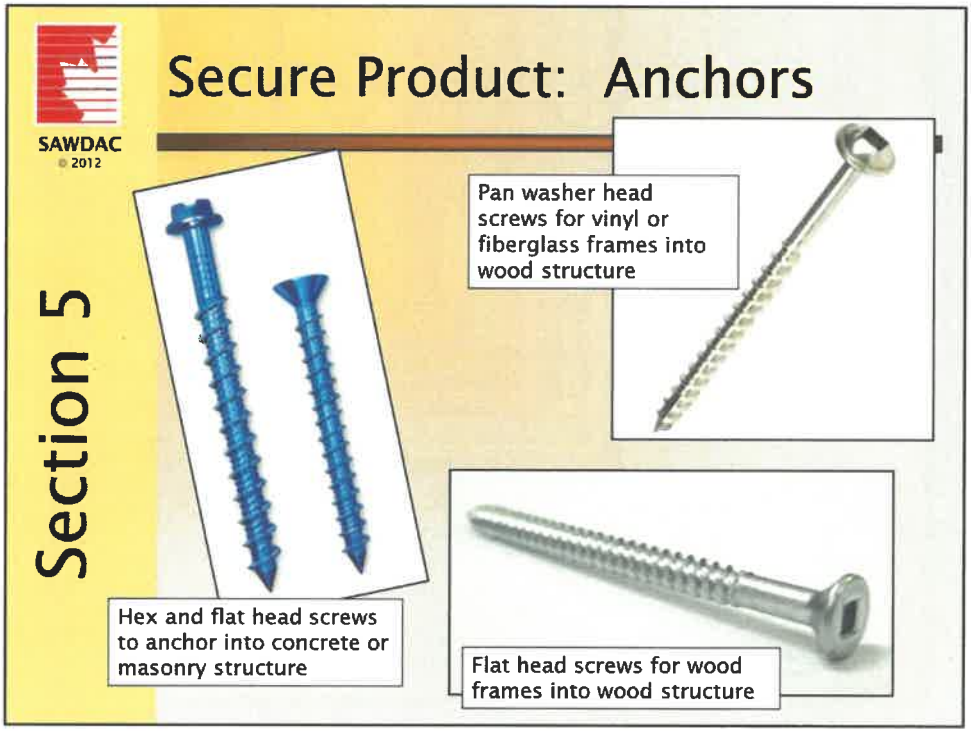
In these photos, the windows are shimmed at the jambs, below the head, above the sill, and between, based on the dimensions given in the chart in CSA-A440.4-07. There are no shims at the head.

Some manufacturers pre-drill their frames and do not follow the shim and anchor placement rules in CSA-A440.4-07. That is permitted: the NBCC requires windows be installed in accordance with manufacturer's instructions and CSA-A440.4-07. The standard is self-limited as being 'supplementary' to manufacturer instructions. Nevertheless, be careful to avoid 'packing' corners with shims. More on this later.

CSA-A440.4-07 defines a shims as "a thin, flat-, or wedge-shaped piece of wood or other suitable material". Shims must be:

- Hard enough to permanently support the frame without changing shape.
- A good thermal separator.
- Resist decay.
- Allow for anchoring through the shim.

CSA-A440.4-07 does not specify a minimum size for shims. Cedar shingles and shakes may be used complying with the CSA-O118.1 or O118.2 standards.

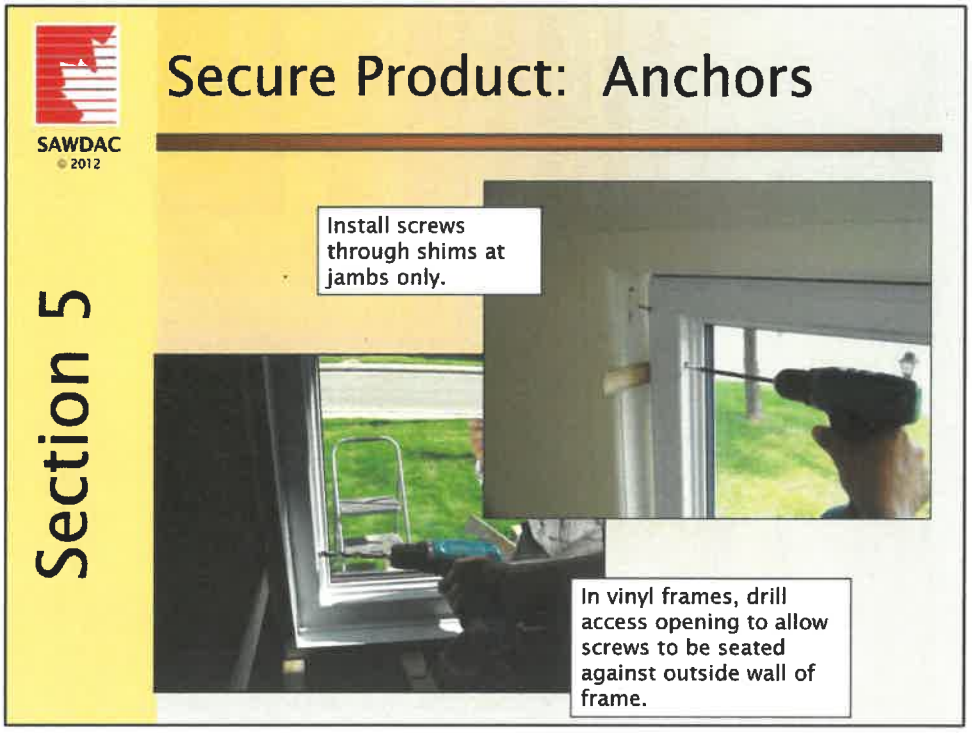


Secure the Product: Shims and Anchors

CSA-A440.4-07 allows "screws or any other equivalent mechanical means" to anchor windows, doors and skylights to the building structure. Screws are most commonly used by installers. Three types are shown in the slide, for wood and masonry structures. Required characteristics include:

- "Sufficient strength and quality to perform their designated function".
- Compatibility with the frame and surrounding structure, so they will not cause galvanic corrosion (rust) in the anchor, frame or structure.
- Non-corroding, so they will not rust or otherwise fall apart over time. Anchors may be coated to provide corrosion resistance. This is particularly important if fasteners are installed in acidic woods (redwood, western red cedar, or yellow Cypress) of installed in preservative treated wood (ACQ).
- Fastener length shall be sufficient to penetrate a minimum of 25 mm (1 in) into the structure.
- If an anchor is required at the head, it must allow for (vertical) movement between the head and structure above (see earlier discussion regarding shims at the head). Use screws with a long shank without threads.

Typically, installers use #8 nickel plated (usually silver in colour) or cadmium plated (usually gold in colour) steel wood screws or, if anchoring into masonry, 3/16 in. (5 mm), plated or painted (both usually blue in colour) steel masonry screws.



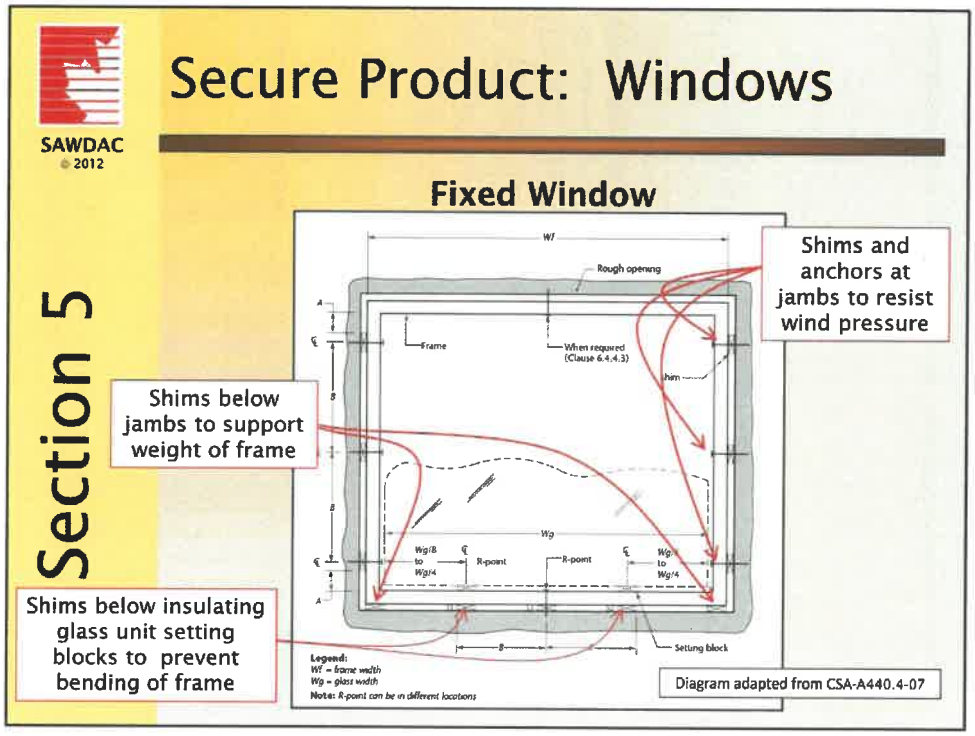
Secure the Product: Shims and Anchors

After shims are installed, screws are installed. In hollow, cellular / closed back frames such as vinyl and some fiberglass, the screw head should be seated against the outer wall, directly next to the rough opening gap, to avoid dimpling the frame and so that the shims are tightly clamped. An access hole must be drilled through the exposed, inner wall, large enough for the screw head. After installation of the screw, close the hole with a plastic plug.

In hollow, open-back frames (aluminum and some fiberglass), screws are placed against the exposed face of the frame, usually concealed from view by interior stops or sashes. The screw should be supported through the depth of the hollow frame by inserting wood blocking in the frame or adding a back-up plate across the open end (unlikely for residential windows, but available for some commercial windows). See 'Prepare the Product' for more information.

In solid frames (wood), screws would be seated directly on the frame. Screws should be counter-sunk and covered with a wood plug, or concealed from casual view within sash tracks.

These slides show installation of screws from the interior. CSA-A440.4-07 does not allow screws or other anchors to be installed at the outside of the frame.



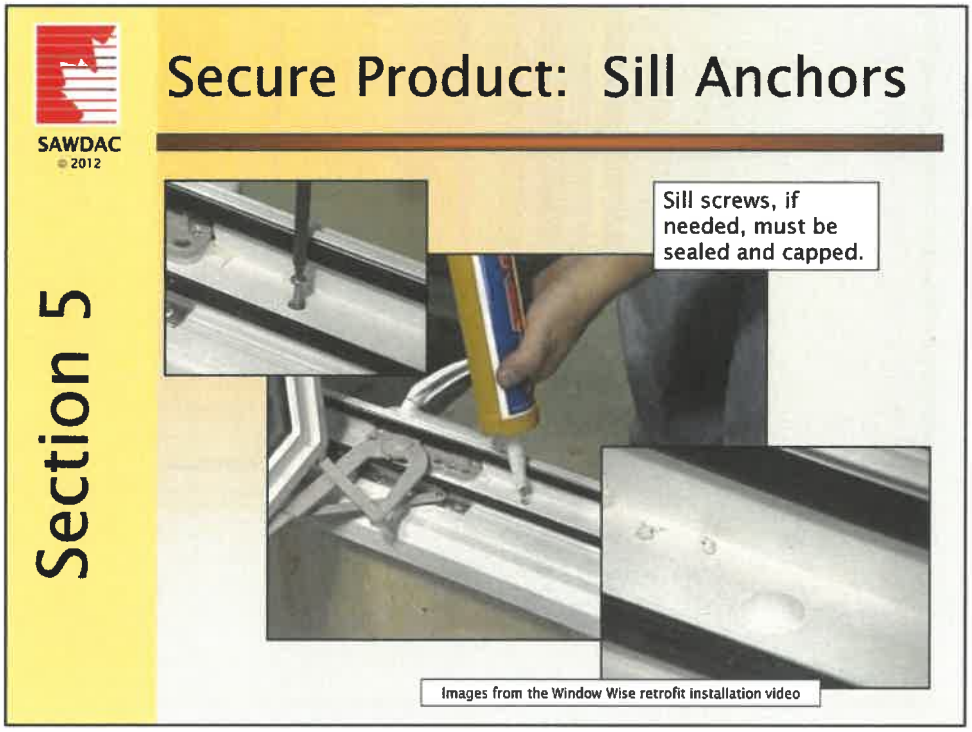
Secure the Product: Shims and Anchors for Fixed (Picture) Windows

For fixed windows, shim at the following locations:

- Below the jambs to support the weight of the frame and transfer it to the wall structure below.
- Below the setting blocks of an insulating glass unit to transfer the weight of the unit through frame to the rough sill. If not shimmed, the frame may sag under the weight of the unit.
- Below the sill, so the maximum spacing of shims is not more than 400 mm (16 in.) on centre maximum for vinyl windows, 800 mm (30 in.) on centre maximum for wood, fiberglass and aluminum.
- At the jambs, below the head and above the sill, and between if the window is tall enough (refer to the table in the previous slide for dimensions).

In general, for all windows, place anchors as follows:

- In the jambs at the shims, to transfer wind load to the jack studs.
- In the head, if needed to support against wind, with an anchor without threads through the depth of the head, to allow the anchor to slide downward without grabbing the head, if the structure moves. No shims at the anchor!



Secure the Product: Sill Anchors

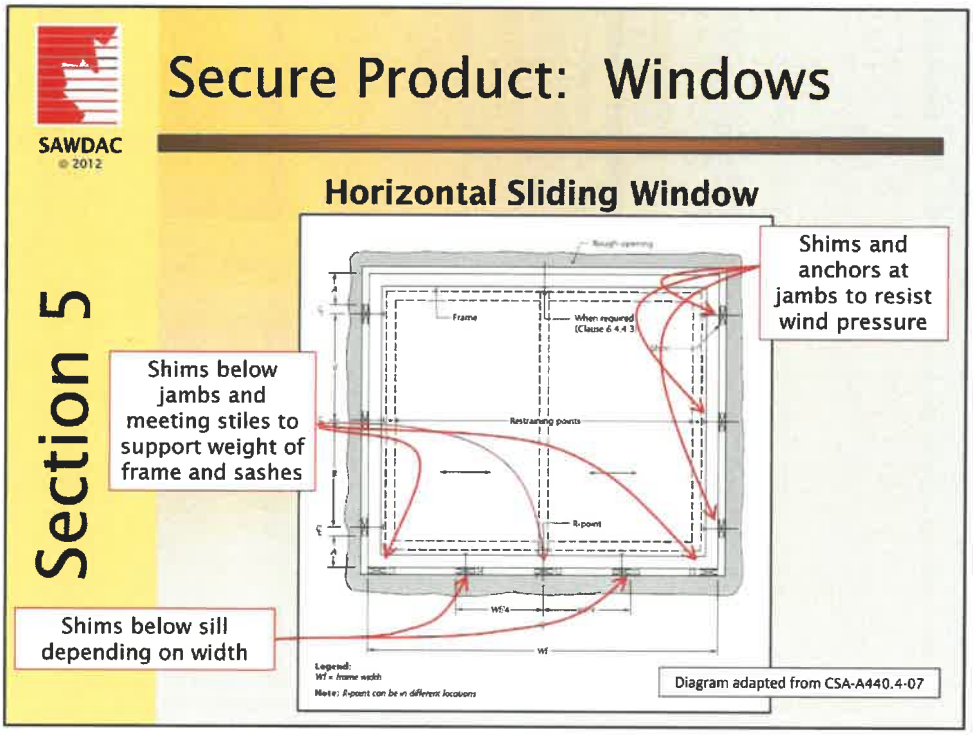
Anchors may be required in the sill for added support against wind load, as follows:

- Vinyl windows: when the sill is over 1600 mm (64 in.) in width.
- Wood, fiberglass and aluminum windows: when the sill is over 2000 mm (78 in.) in width.

CSA-A4490.4-07 requires that sill screws:

- Not be installed through exterior sill tracks. This is impossible in sliding windows with a single set of sashes (usually glazed with insulating glass units). If the frame has an accessory groove, an alternative to putting a screw through the a sill is to use a heavy-gauge steel or aluminum clip at the inside face of the frame, inserted into the accessory groove and screwed to the rough sill below.
- Be sealed against water leakage. Bedding in sealant and filling the opening afterward is the usual method, as shown in this slide.
- Not penetrate horizontal flashings. Where sub-sill flashings are required, 'peel and stick' membranes can self-seal around the fastener. Confirm with the membrane manufacturer.

Don't forget, shim at the sill screws!



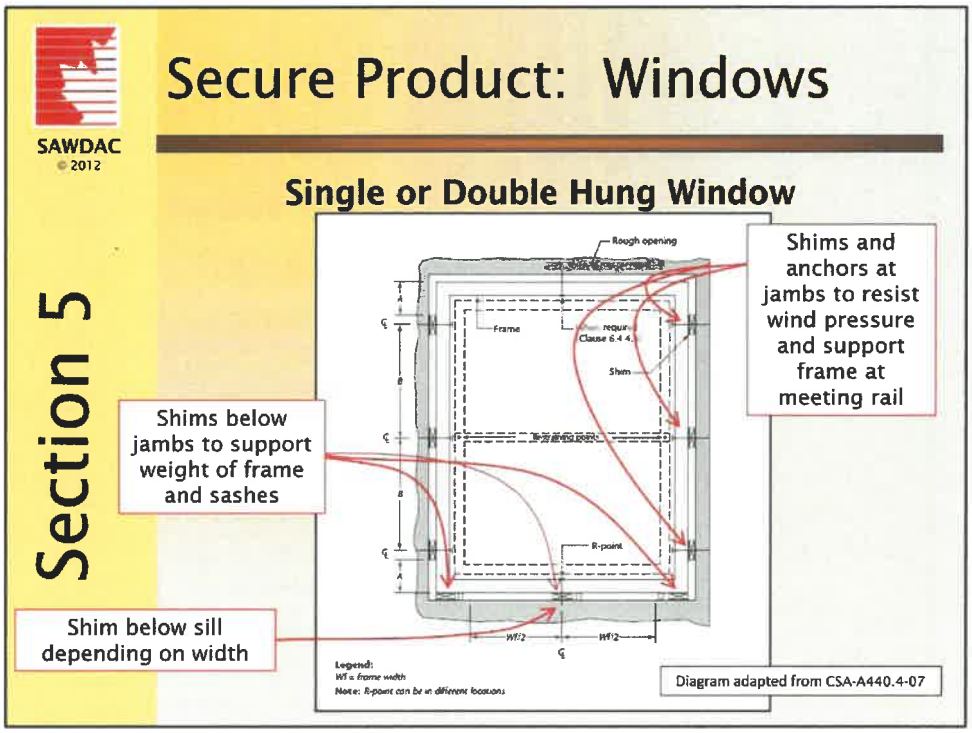
Secure the Product: Shims and Anchors for Horizontal Sliding Windows

Place shims:

- Below the jambs and sliding sash meeting stiles, to support the weight of the frame and sashes when closed (this assumes the sashes are on rollers, located near the meeting and jamb stiles).
- Below the sill to prevent sagging, at 400 mm (16 in.) maximum for vinyl frames, 800 mm (30 in.) on centre maximum for wood, fiberglass or aluminum frames.
- At the jambs above the sill, below the head, and between if the window is tall enough (check the dimension chart).

Place anchors:

- In the jambs at the shims.
- In the sill, for 1600 mm (64 in.) wide or more for vinyl windows, 2000 mm (78 in.) wide or more for wood, fiberglass or aluminum windows.



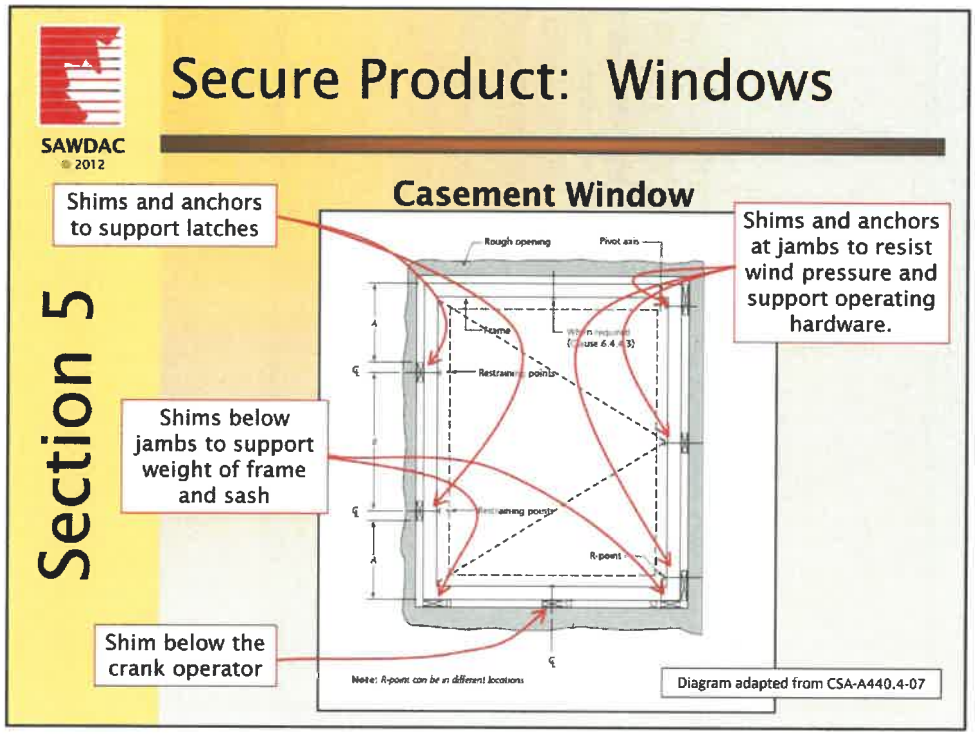
Secure the Product: Shims and Anchors for Vertical Sliding Windows

Place shims:

- Below jambs to support the weight of the frame and sashes.
- Below the sill to prevent sagging, at 400 mm (16 in.) maximum for vinyl frames, 800 mm (30 in.) on centre maximum for wood, fiberglass or aluminum frames.
- At the jambs above the sill and below the head (check the dimension chart).
- At the jambs, as close as possible to the meeting rails of the sashes, where there will be some strain on the frame from operating and locking the sashes, particularly if they tilt-in for cleaning.

Place anchors:

- In the jambs at the shims.
- In the sill, for 1600 mm (64 in.) wide or more for vinyl windows, 2000 mm (78 in.) wide or more for wood, fiberglass or aluminum windows.



Secure the Product: Shims and Anchors for Casement Windows

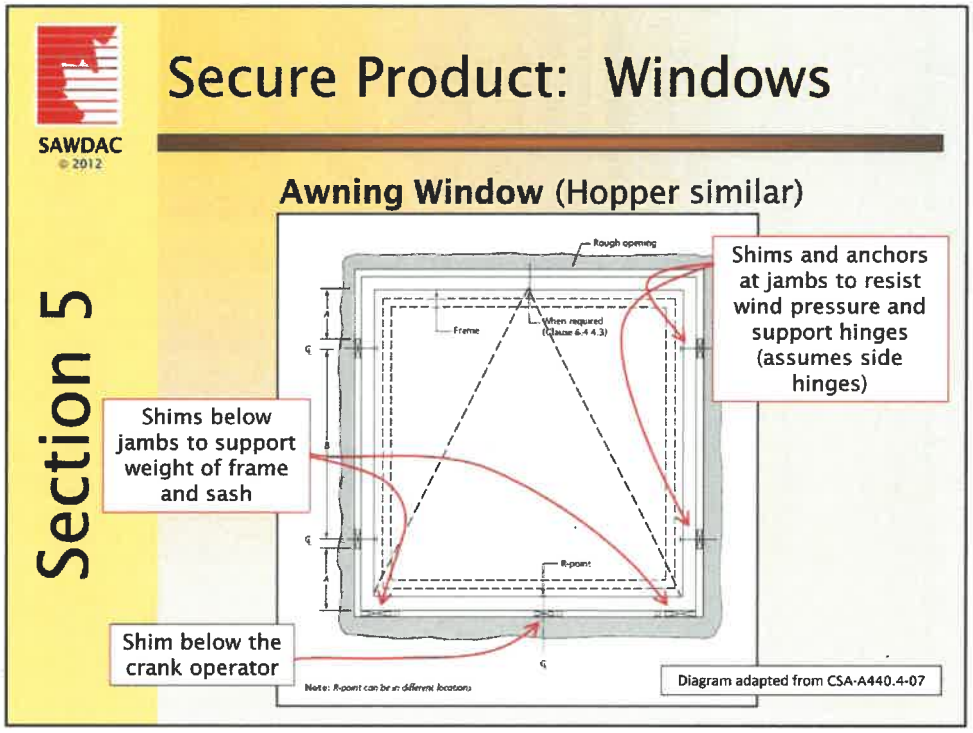
Place shims:

- Below the jambs to support the weight of the windows.
- Below the sill at the roto operator. Since casements are usually narrow, it will likely not be necessary to put in additional shims to support against sagging.
- At the jambs to support strain from the locking and hinge hardware.

Screws are placed:

- In the jambs at the shims.
- In the sill, at the roto operator, to support strain from hardware operation and push and pull of wind load against the operator. Remove one of the screws anchoring the operator to the sill and drive a longer screw through operator hole and frame into rough sill below. Bed the screw in sealant to prevent water leakage.

To support the frame against strain from the operating hardware, at the hinge side, at the jambs, shims and anchors are located as close as possible to the head and sill, with one or more shims and anchors between as necessary for the height of window. Shims and anchors should also be placed at the roto operator. This prevents expansion of the head and sill toward the hinge jamb. To compensate, shims on the opposite, latch side should be raised up to give some more flexibility for movement. Locate the shims at the hardware latching points where strain will be greatest.



Secure the Product: Shims and Anchors for Awning or Hopper Windows

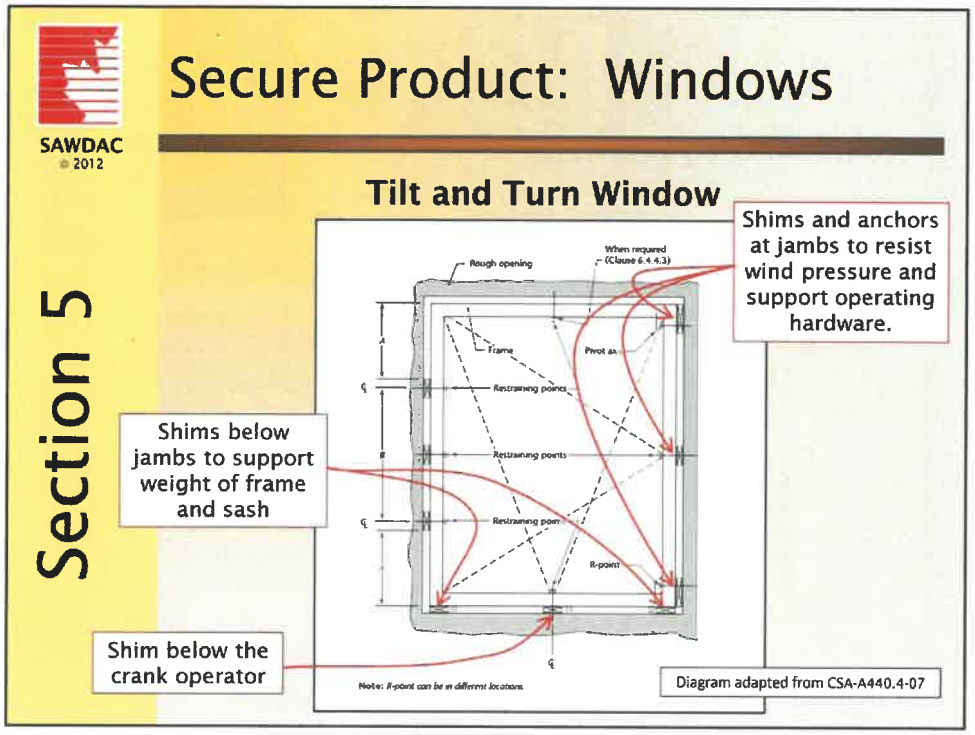
Shim and anchor placement is similar for awning and hopper windows. Awning is shown in this slide. For hopper, the shim and anchor place at the sill should be located at the head. This is not ideal since it does not allow for downward movement of the building structure. Avoid using hopper windows, if at all possible.

Place shims:

- Below the jambs to support the weight of the windows.
- Below the sill to prevent sagging, at 400 mm (16 in.) maximum for vinyl frames, 800 mm (30 in.) on centre maximum for wood, fiberglass or aluminum frames.
- At the jambs to support strain from the locking and hinge hardware.

Screws are placed:

- In the jambs at the shims.
- In the sill, at the roto operator, to support strain from hardware operation and push and pull of wind load against the operator. Remove one of the screws anchoring the operator to the sill and drive a longer screw through operator hole and frame into rough sill below. Bed the screw in sealant to prevent water leakage.



Secure the Product: Shims and Anchors for Tilt and Turn Windows

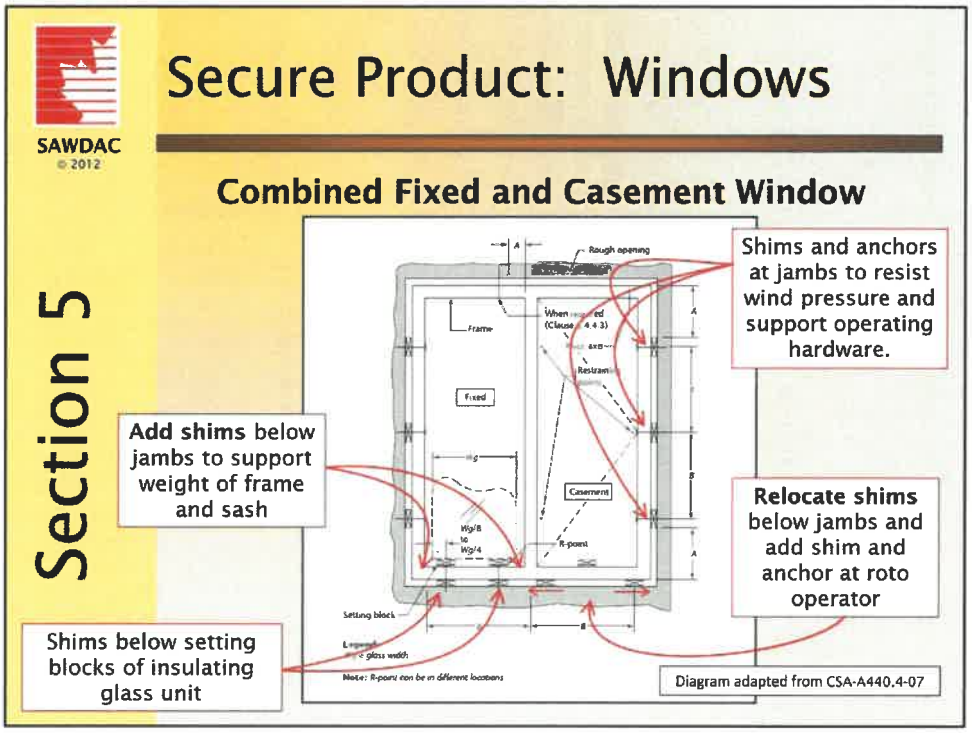
Place shims:

- Below the jambs to support the weight of the windows.
- Below the sill at the roto operator. Tilt and turn windows are usually narrow, like casements, so it will likely not be necessary to put in additional shims to support against sagging.
- At the jambs to support strain from the locking and hinge hardware.

Screws are placed:

- In the jambs at the shims.
- In the sill, at the roto operator, to support strain from hardware operation and push and pull of wind load against the operator. Remove one of the screws anchoring the operator to the sill and drive a longer screw through operator hole and frame into rough sill below. Bed the screw in sealant to prevent water leakage.

Similar to casements, expansion of head and sill are restrained by locating shims at the hinge jamb in line with the head and sill. To compensate, jambs on the opposite, latch side should be raised up to give some more flexibility for movement. Additionally, locate the shims at the hardware latching points where strain will be greatest.



Secure the Product: Shims and Anchors for Combined Fixed and Casement Window

Place shims:

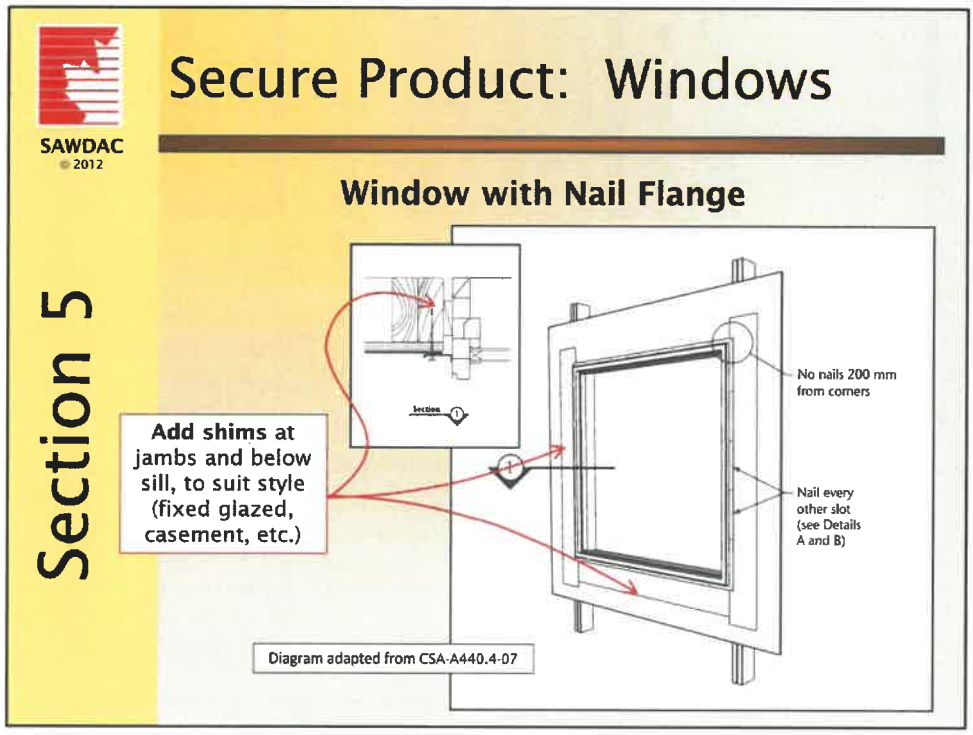
- At the fixed window, below the insulating glass unit setting blocks, to support the sill against bending.
- At the casement window, below the sill near the jamb and centre mullion to support the weight of the casement frame.
- At the jambs to support strain from the locking and hinge hardware.

This is not the best placement of shims. Recommended changes:

- Add shims below the jambs of the fixed unit
- Relocate the shims beneath the casement sill to beneath the jambs, to support the weight of the frame and sash.
- Relocate the upper and lower shims at the casement closer to the head and sill, consistent with the earlier shimming diagram for a single casement window.
- Add shims at the casement crank operator for the casement.

Place anchors:

- Through jamb anchors.
- In the sill, at the roto operator, to support strain from hardware operation and push and pull of wind load against the operator.

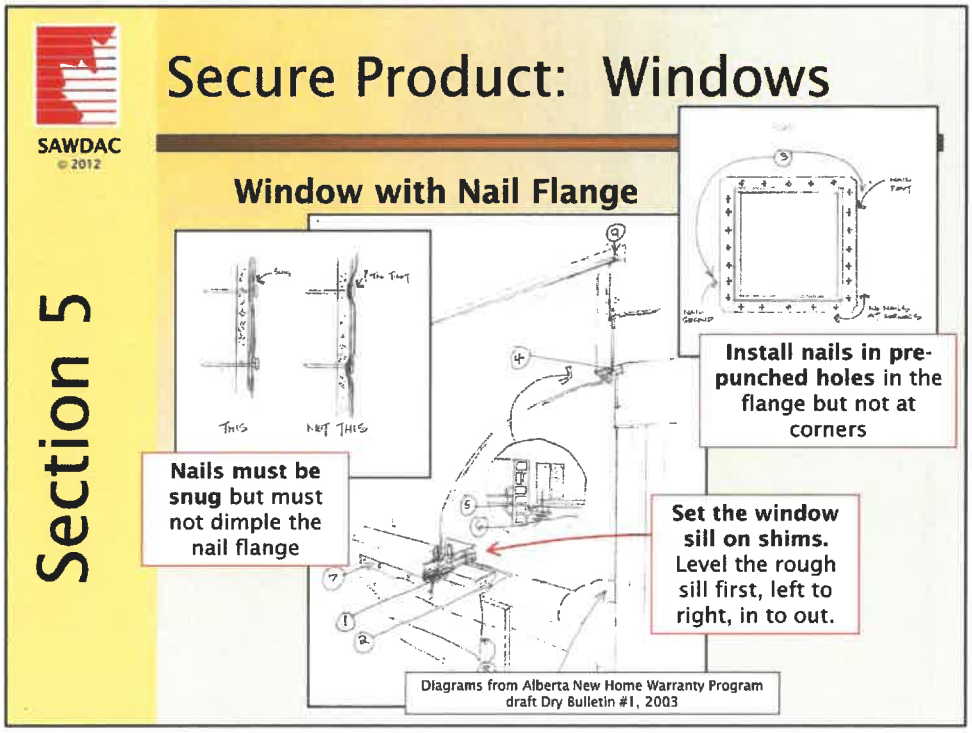


Secure the Product: Shims and Anchors for Nail Flange Windows

CSA-A440.4-07 allows use of nail flange windows, although shim and anchorage requirements are not well described. The illustrations in the standard were developed by the Alberta New Home Warranty Program (ANWHP) in 2003, based on their experience with widespread use of nail flange windows in that province.

The intent is that the rough sill would be set level, a series of shims installed across the rough sill, the frame set on the shims, and the window secured through the nail flange only into the wood frame behind. There would be no shims and anchors through the frame, into the jack studs. Nails would be installed through the flange, through the sheathing and into the jack studs only. The nail heads must be snug but without dimples the nail flange, to allow for side-to-side and up-and-down movement of the window relative to the building structure.

Nail flanges are typically pre-punched with holes for nails. Many nail flanges are narrow, about 1 ¼ in. (32 mm). If nails are too close to the edge of the jack studs, the studs could split, reducing the strength of the connection. ANHWP recommended the rough opening gap not exceed 3/8 in. (9 mm) (opening not more than ¾ in. (19 mm) wider than the frame). This is the minimum allowed under CSA-A440.4-07. If wider, anchor through the frame instead, as described previously.

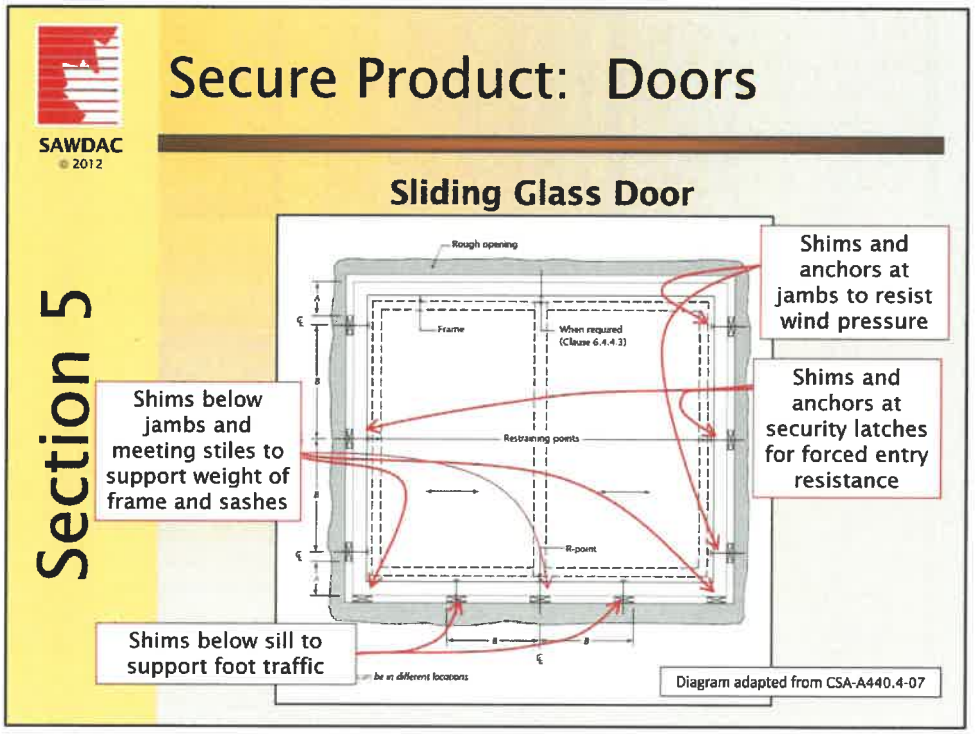


Secure the Product: Shims and Anchors for Nail Flange Windows

This slide shows more detail for installation of nail flange windows, from the Alberta New Home Warranty Program (ANHWP) draft guidelines, 2003. These details are applicable to windows with a nail fin that is part of the window frame extrusion, and where the nail fin is approximately in line with the glazing. When the nail fin is fastened to the wall sheathing, the position of the nail fin allows the weight of the frame and glazing to be transferred to the wall structure, so shims and anchors through the frame to the rough sill and jack studs are not necessary.

On windows with nail fins added separately, snapped into the accessory groove on the exterior face of the window, the connection is weaker than the integral nail fin. The accessory nail fin is also often outboard of the glazing so the weight of the glazing can cause the frame to twist. Shims and anchors through the frame are necessary properly support this type of window.

This is an important difference that is not recognized in CSA-A440.4-07. When installing windows with integral nail flanges, follow the manufacturers instructions.



Secure the Product: Shims and Anchors for Sliding Doors

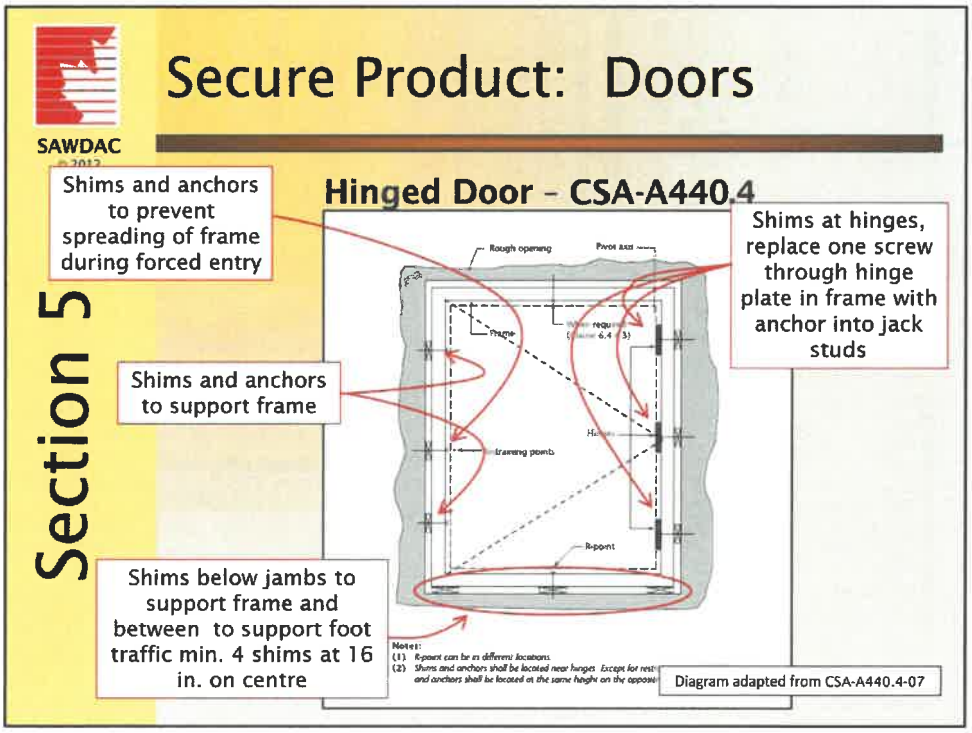
Sliding doors are treated like very large, horizontal sliding windows, with some additions:

Place shims:

- Below the jambs and sliding sash meeting stiles, to support the weight of the frame and sashes when closed (this assumes the sashes are on rollers, located near the meeting and jamb stiles).
- Below the sill to support foot traffic, 400 mm (16 in.) maximum for vinyl frames, 800 mm (30 in.) on centre maximum for wood, fiberglass or aluminum frames.
- At the jambs above the sill, below the head, and between (check the dimension chart). For a standard 80 in. (2000 mm) tall opening, it is likely that 5 sets of shims would be required, including at the latches (see following item).
- At both jambs, at the latches, to prevent spreading of the frame, disengagement of latches and unwanted entry.

Place anchors:

- In the jambs at the shims only. Never in the sill. Water loading on the sill can be expected to be much higher than for windows, therefore the risk of leakage is much greater.



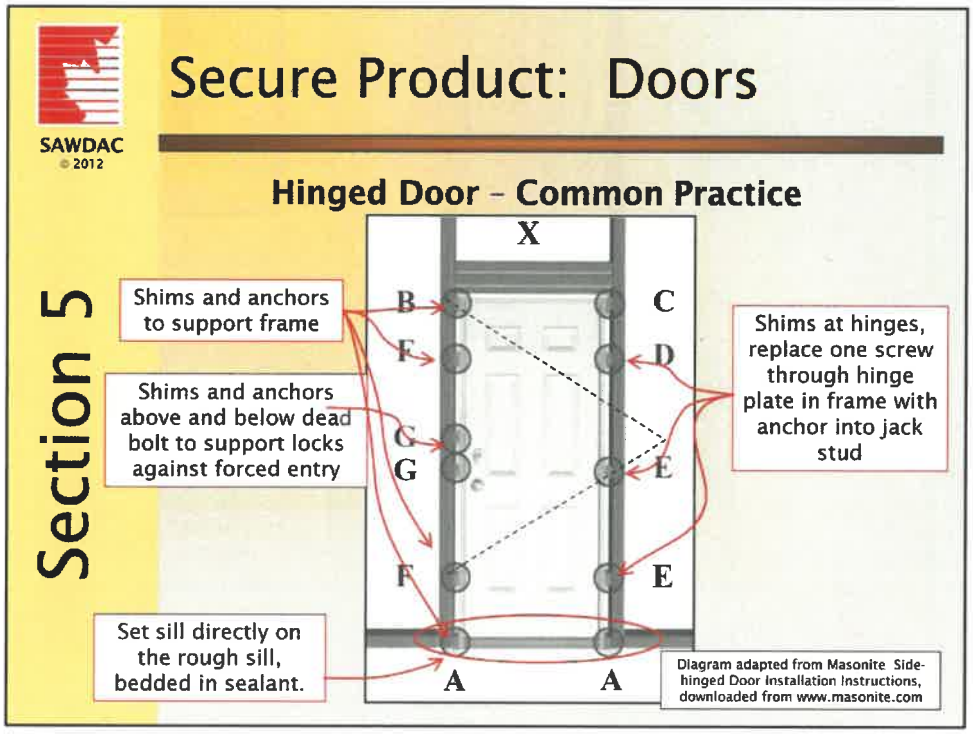
Secure the Product: Shims and Anchors for Hinged Doors

CSA-A440.4-07 requires shim and anchor placement for hinged doors similar to a casement window, except that:

Place shims:

- At the lock jamb above the sill, below the head, and between, as necessary to support the frame. The usual dimension rules need not be followed.
- At the lock jamb, at the lock, to prevent spreading of the frame, disengagement of latches and unwanted entry.
- At the hinge jamb, at each hinge, to support the frame against rotation caused by door operation.

CSA-A440.4-07 shows shims below the sill. This is good practice particularly if sub-sill flashing is required. However, the number of shims should be increased to at least 4, not more than 400 mm (16 in.) apart to support foot traffic.



Secure the Product: Shims and Anchors for Hinged Doors

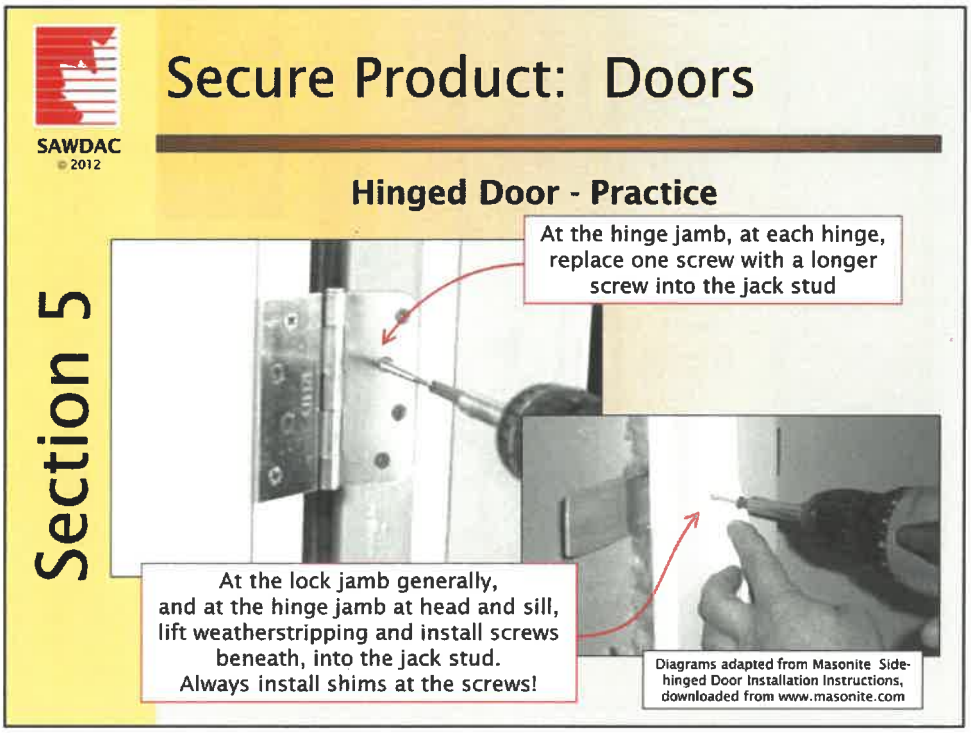
A different arrangement of shims and anchors is shown in this illustration from Masonite. Manufacturers and installers who follow this approach claim it allows for easier installation and ensures the door slab remains square to the frame in the long run, better that the CSA-A440.4-07 method.

Shims:

- No shims beneath the door. Apply three (3), parallel beads of sealant to the rough sill, continuously from jack stud to jack stud. Set the door directly on the sealant beads. If sub-sill flashing is required, set the door on shims as shown in the previous slide.
- Place shims in sequence from A through G. In contrast to windows, shims are placed at the ends of the head and sill. This prevents movement during service.

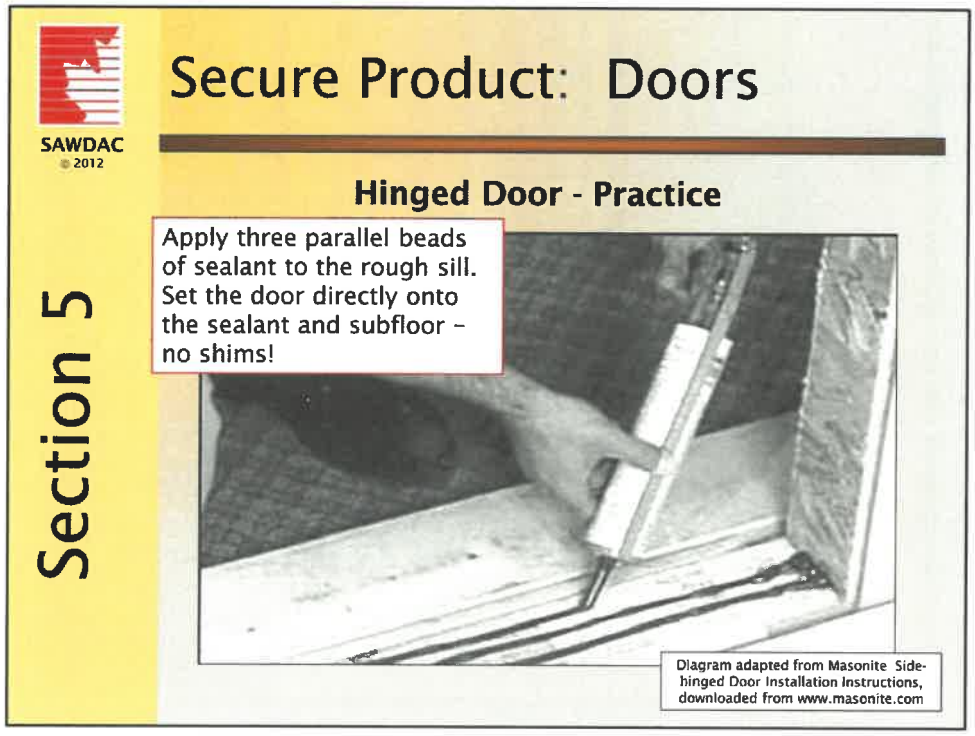
Anchors:

- At D and E, remove a screw from the hinge plate on the jamb and replaced with a screw into the jack stud.
- At F, install screws through the frame material into the jack stud.
- At G, install screws through the deadbolt strike plate into the jack stud.



Secure the Product: Shims and Anchors for Hinged Doors

This slide shows installation of anchors (screws) through jambs into the wood frame.

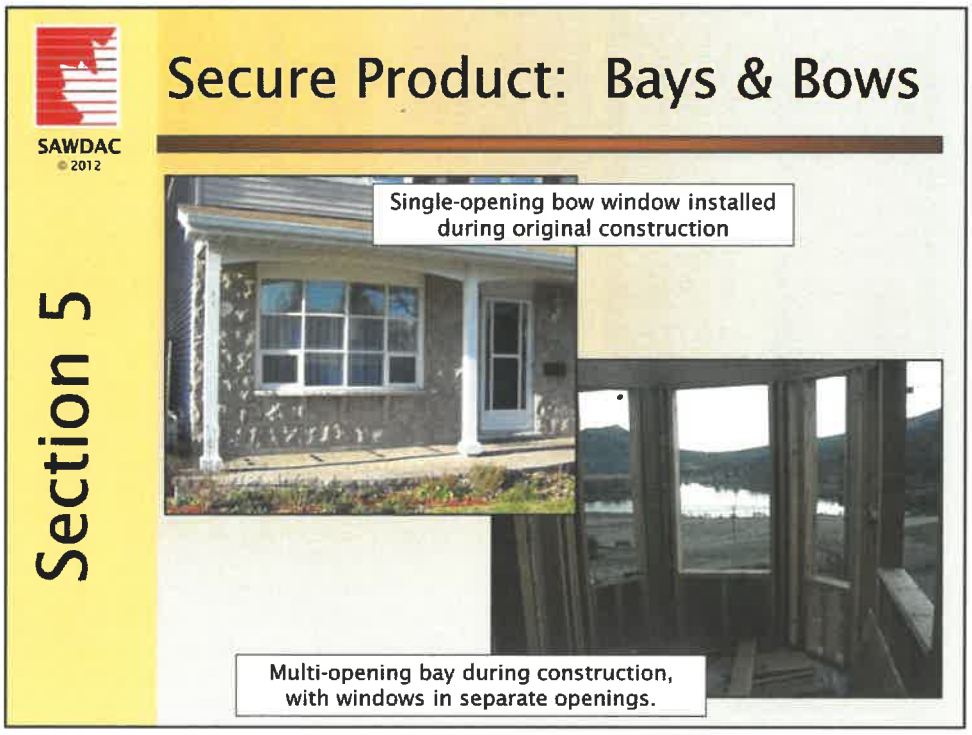


Prepare the Opening: Doors

This slide shows common practice for the installation of entry doors, to seal the rough opening gap between the door sill and the subfloor. This method assumes the subfloor is level. If not, it needs to be corrected by inserting shims or by other means, prior to installing the door.

The pictured method has become controversial. A door fully exposed to the weather (without a storm door or a protective porch roof) may get very wet from wind-driven rain and snow and ice melt water. CSA-A440.4-07 includes for installation of a sub-sill flashing to provide additional protection against leakage, for walls with 'two planes of protection' (a drained cavity behind the cladding). Sub-sill flashing installation is described in more detail in a later section.

Either way, do not installed fasteners through the sill!



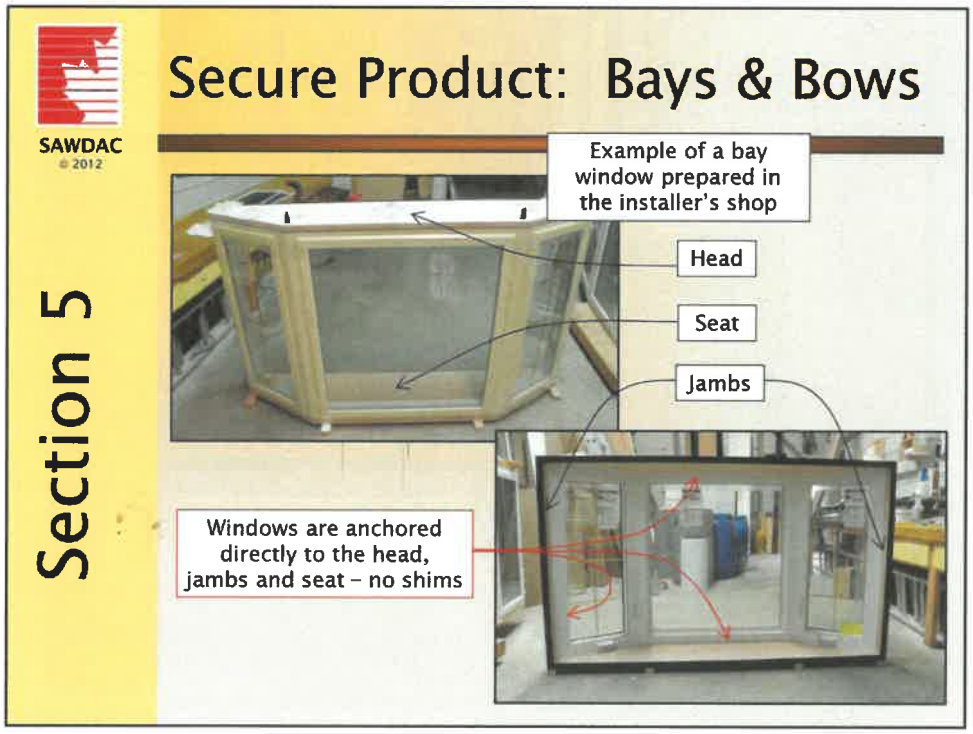
Secure the Product: Bays and Bows

These windows consists of a three (bay) or more (bow) windows grouped together, projecting beyond adjacent walls:

Multi-opening:
- Each section is a separate window in its own rough opening.
- Part of the original construction of a building.
- Supported with a knee wall directly below, following the profile of the window.

Single opening:
- Windows are joined together with a common seat, head and jambs, in one rough opening.
- May be part of the original construction of the building or installed later to replace an original, 'straight' window.
- Typically project beyond the face of the wall below.

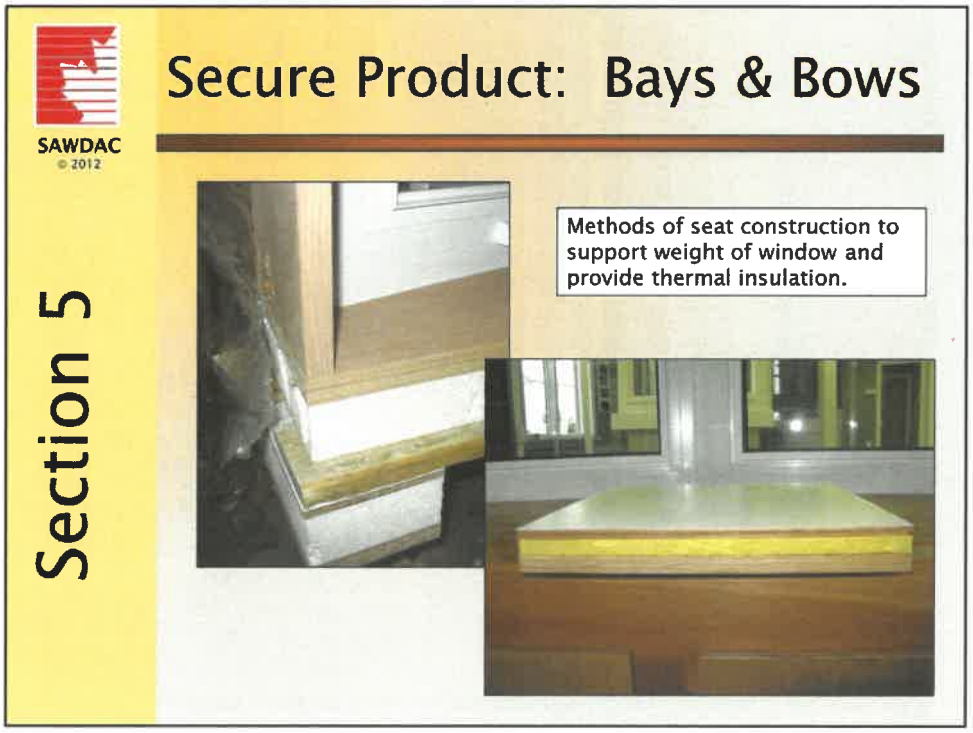
In a multi-opening bay or bow, each opening is prepared and the window secured as described previously. In a single-opening bay or bow, the entire opening is prepared and the bay or bow is installed as a unit. CSA-A440.4-07 does not describe installation of single-opening bays and bows.



Secure the Product: Bays and Bows

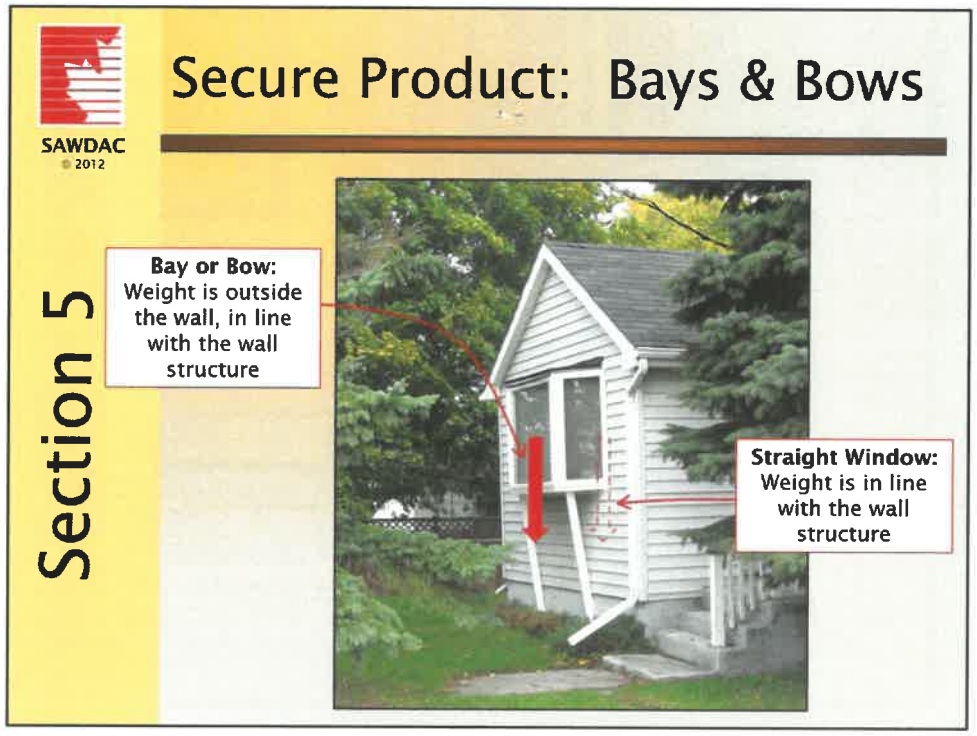
The following slides describe construction and installation of single-opening bay or bow windows.

Single opening bays and bows are fixed directly to the common seat, head and jambs. There are no shims – the window units are placed directly against the seat, head and jambs to make the overall structure as stiff as possible. Screws are driven directly through the window frames into the head and seat in all units, and through the jambs at side units. Place screws in the head and sill as close to the jambs of the individual windows as possible. Place screws through the jambs of the side units at similar locations as shown in in the shim and anchor locations previously shown, to suit the window type.



Secure the Product: Bays and Bows

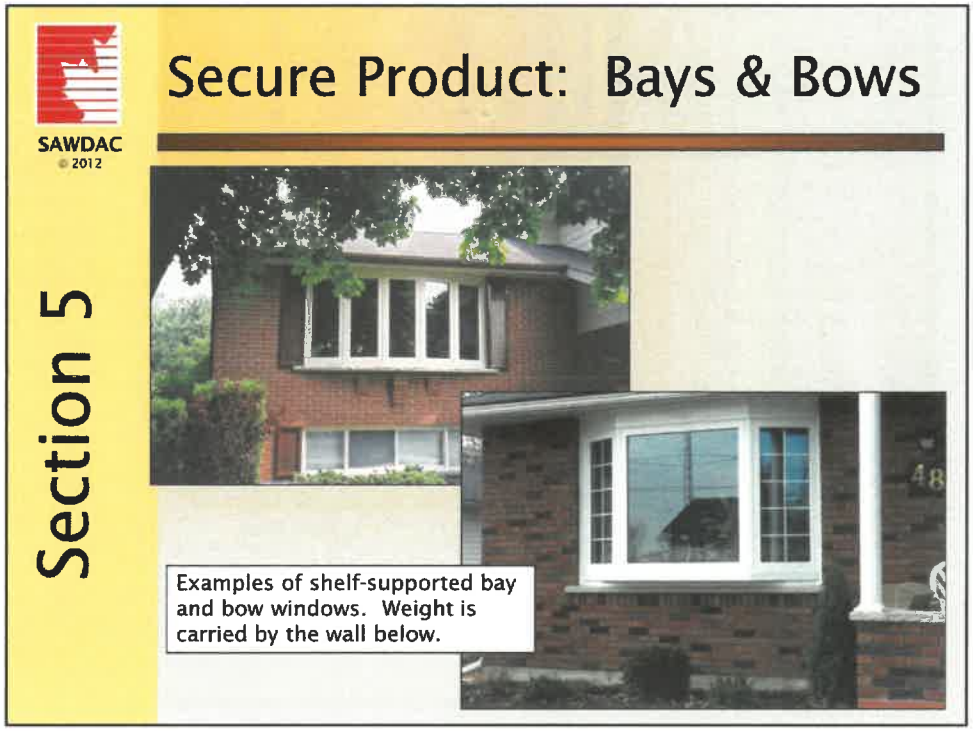
The head and seat should be at least 19 mm (3/4 in.) thick plywood, to support the windows when installed. Insulation is required to prevent the head and seat being chilled in the winter. A 'sandwich' panel with a layer of rigid, foam plastic insulation between layers of plywood can be used, as shown in this slide.



Secure the Product: Bays and Bows

Single opening bays and bows projecting beyond the face of the wall below require support. The weight of a 'straight' window installed within the thickness of a wall is aligns with the wall structure (dashed arrow). If it is correctly shimmed and anchored to the walls, it should keep its shape. Most of the weight of a projecting bay or bow is – literally – outside the wall (solid red arrow). Structural engineers call this an 'eccentric' load. Even if correctly shimmed and anchored to the walls, the weight outside of the walls will pull outward and downward on the bay or bow, causing the unit to sag and racking the side units, as shown in the photo. The weight must be supported from below or from above to prevent sagging.

The braces shown in this photo were added after the window had already started to sag. The idea is right – brace back to the wall below – but it was too little, too late.

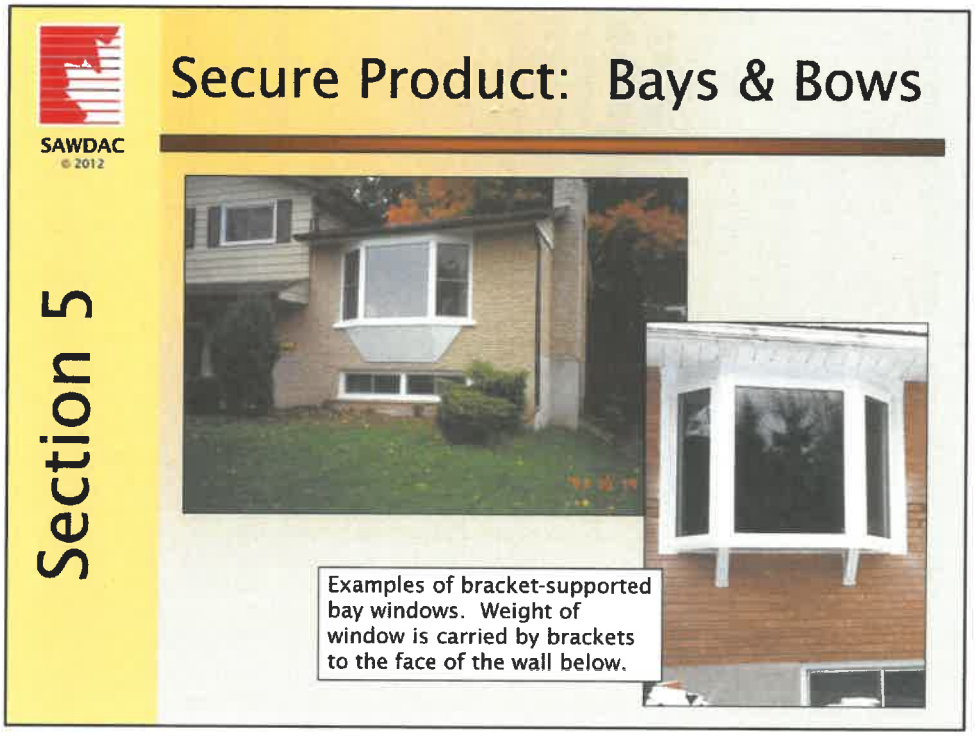


Secure the Product: Bays and Bows

There are three ways to support and secure a bay or bow window to the surrounding wall structure:

- Shelf support.
- Framed support.
- Suspended support.

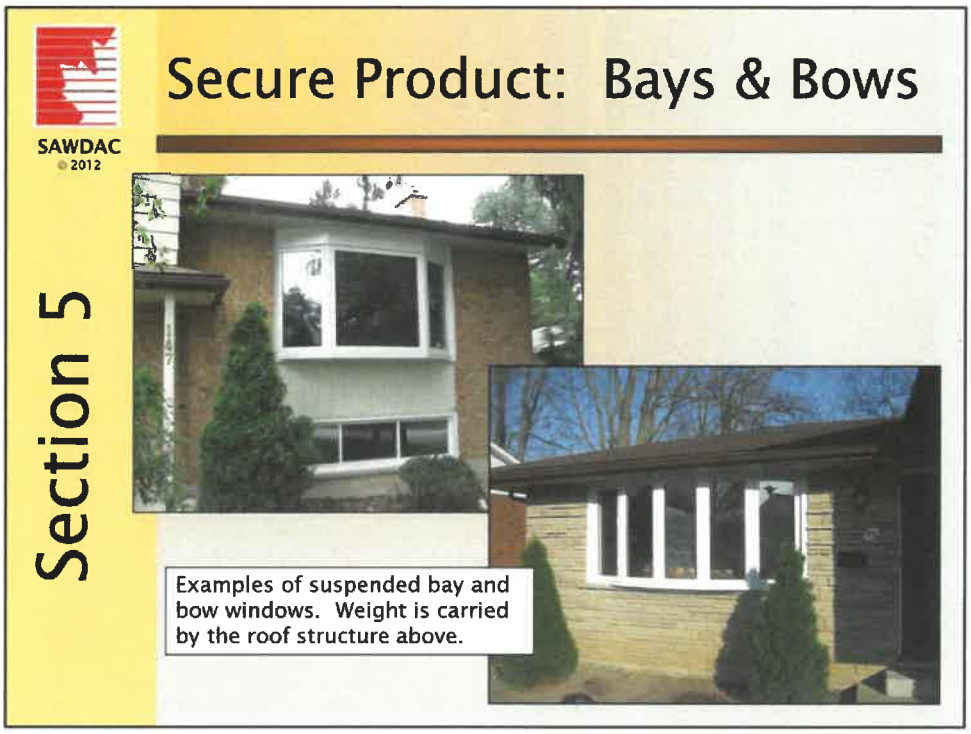
Two examples of shelf support are shown in this slide. The concept is simple: the weight of the bay or bow assembly is supported by a projecting element in the wall below. The upper photo shows a bow windows supported on a cut stone sill with brick masonry brackets (corbels) below. The lower photo shows a bay window resting on a cut stone sill on the brickwork below. This is probably the best kind of support.



Secure the Product: Bays and Bows

The photos in this slide show examples of framed support: triangular wood brackets beneath the seat, against the surface of the wall below. In the upper slide, the brackets are enclosed with siding, likely with insulation filling the enclosed space, to keep the seat warm. In the lower slide, the seat is exposed. The seat should include a layer of insulation to keep it warm.

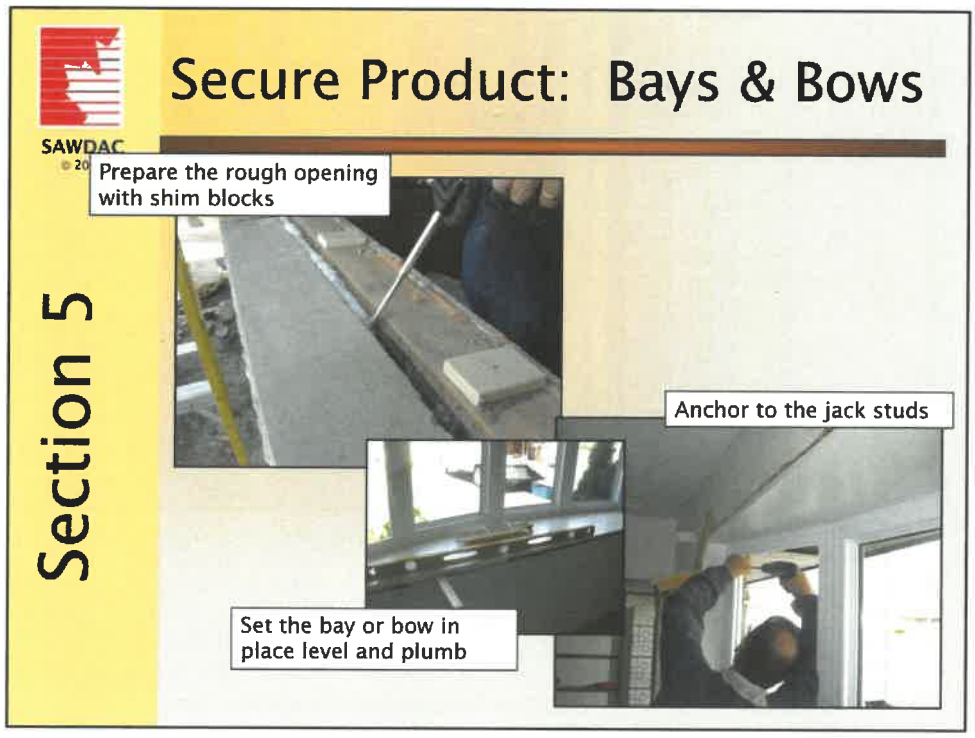
The brackets should be spaced evenly between the jambs. In bay windows, the brackets should be beneath the mulled jambs of the side and centre windows where the weight of the windows is greatest. The brackets must be located over the studs in walls clad with aluminum or vinyl siding, stucco, and other sheet or panel products. In brick-clad walls, the brick can spread the load so bracket location is less critical.



Secure the Product: Bays and Bows

The photos in this slide show examples of suspended support. Some of the weight of the window is supported from the wall below, and some from above, by steel cable extending from the seat, between mulled jambs, to the roof overhang. Various methods are available, some developed by window manufacturers and others by installers.

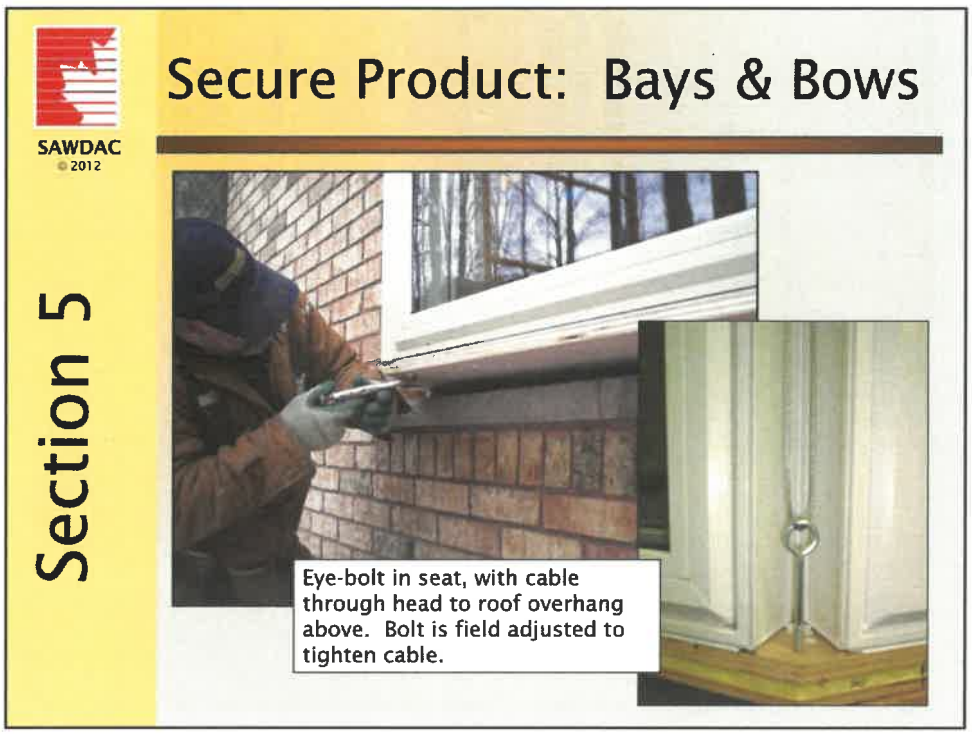
SAWDAC has developed a suspension method with the assistance of a structural engineer, shown in the following slides. It is for openings no more than 12 feet wide and 6.5 feet high. The window must be located under a roof overhang. The overhang must extend beyond the face of the window by a minimum of 100 mm (4 in.) to protect the window below from snow and ice melt water and rain water run-off.



Secure the Product: Bays and Bows

Clean and prepare the rough opening as for a 'straight' window. At the sill, fasten 38 x 89 mm (2 x 4 in.), 9 mm (3/8 in.) thick, plywood shims at 400 mm (16 in.) maximum across the rough sill. If the rough sill isn't level (bowed or twisted), shims of varying thickness and/or tapered shims will be needed to create a level bearing surface.

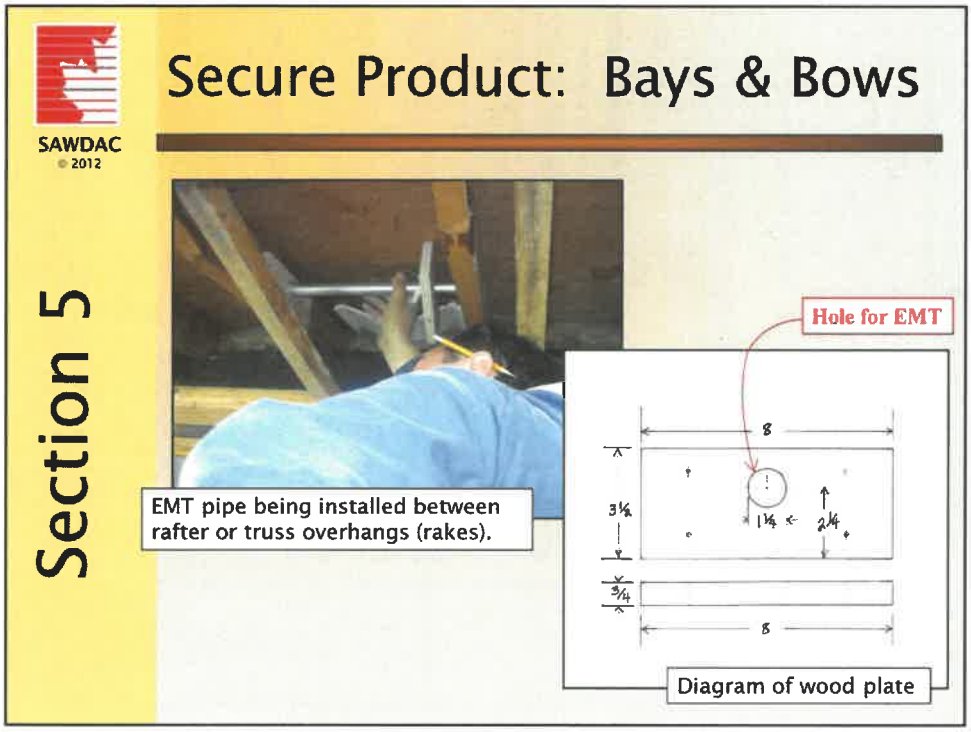
Set the bay or bow window on the shims in the prepared rough opening. Set the window with jambs plumb. Insert shims between the jambs and jack studs at the head. Install #8, x 89 mm (3 1/25 in.) minimum wood screws through the jambs and shims into the jack studs. Shim and anchor each bottom corner in the same way. Finally, shim and anchor the jambs at two equally spaced locations between the top and bottom anchors.



Secure the Product: Bays and Bows

To prevent sagging, the window outside of the wall is hung from the roof above with braided wire rope, minimum 3 mm (1/8 in.) diameter. Secure to the seat with 8 mm (5/16 in.) eye-bolt, installed through the seat to nuts on washers beneath. The bolt should extend a minimum of three (3) threads below the nut. The nuts can be field-tightened during installation to help tighten the suspension cable. Wire rope, eye bolt, nuts and washer must be protected against corrosion.

A thimble should be used to prevent crushing of the wire rope through the eye bolt.

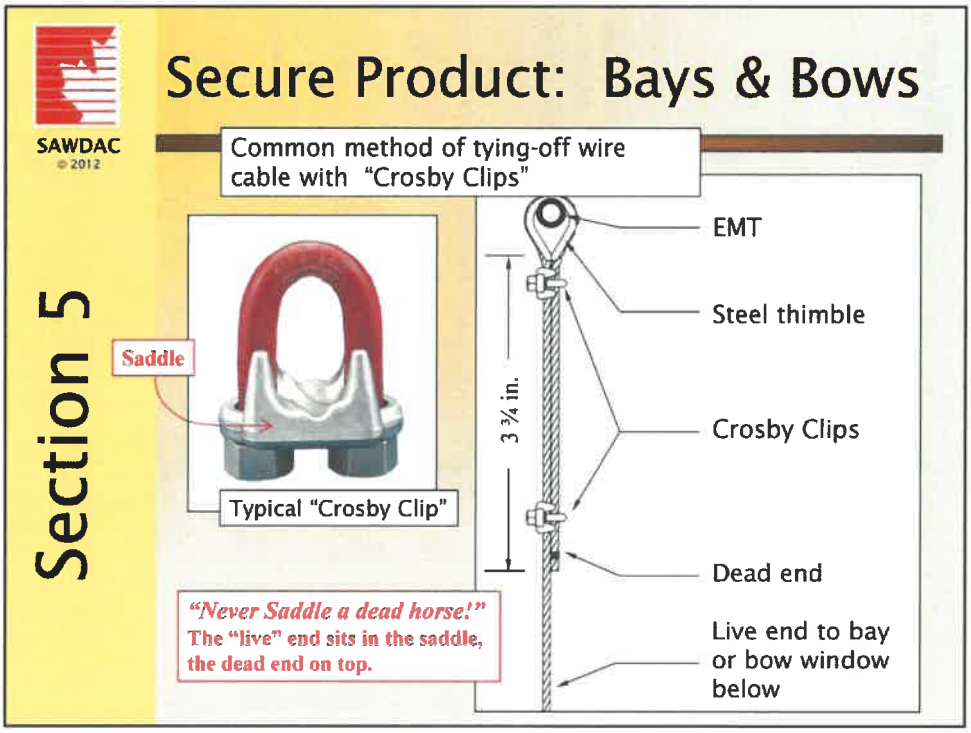


Secure the Product: Bays and Bows

The weight of a bay or bow must be carried in a vertical line to the roof structure above. If the overhang (rake) of a roof rafter or truss is directly in line with the cable, a ring bolt can be secured to one side of the rafter or truss overhang, as close to the roof sheathing as possible, the cable looped through the ring, the cable tightened and clamped. The cable must not be looped through a hole drilled in the overhang. The hole will weaken the overhang, and the wood below will crush over time. Fasten to the sides of the overhang only.

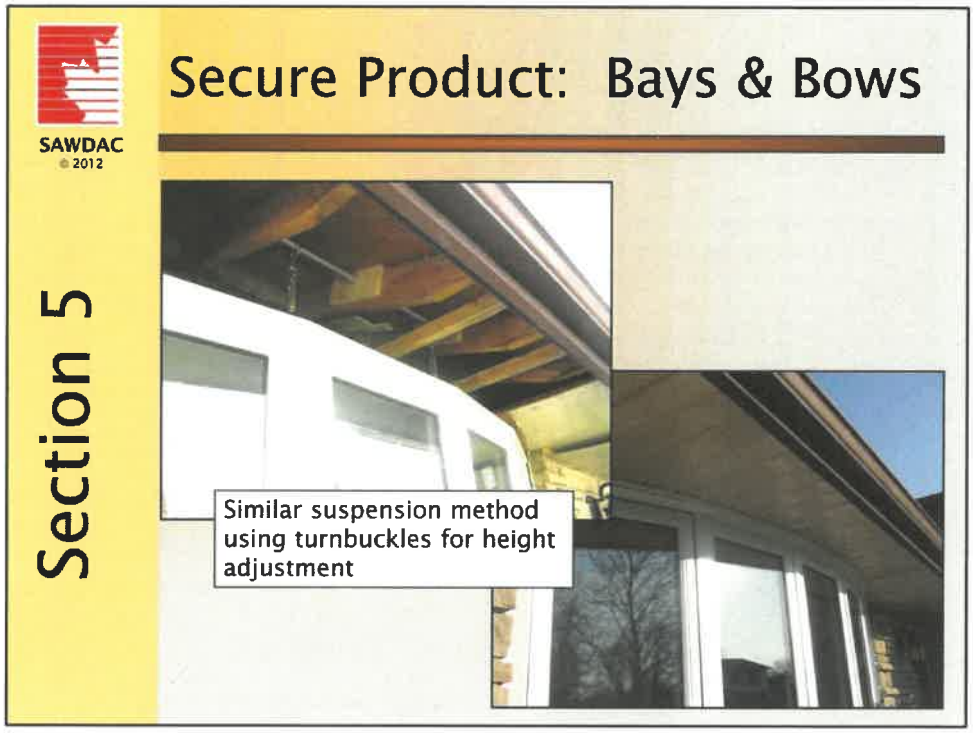
If the a rafter or truss overhang is not in line with the wire rope, a bridge must be installed between rafters or trusses to either side and the wire rope connected to it. A bridge can be made from 25 mm (1 in.) diameter galvanized steel electrical conduit (EMT), cut to fit tight between the rafters or trusses. This conduit is supported by two custom made plywood blocks, anchored to the sides of the rafters or trusses with 4, #8 x 63 mm (2 ½ in.) wood screws. The wire rope is looped over the EMT, pulled tight and clamped, as shown in the following slide.

As necessary, the nuts for the eye bolt in the sill are turned to adjust the cable to set the bay or bow level from inside to outside.



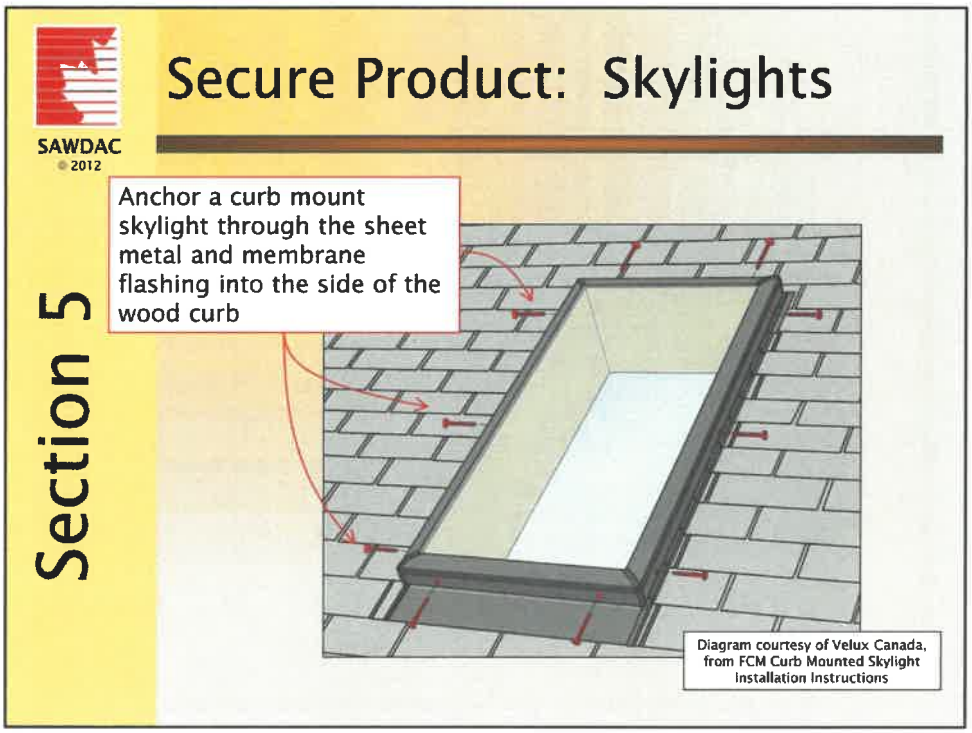
Secure the Product: Bays and Bows

Secure the end of the wire rope with 'Crosby Clips'. The correct method is shown in this slide. A minimum of two 'Crosby Clips' should be used. A thimble is good practice to prevent the rope from bending too tightly which could reduce its strength, especially at the seat eye bolt.



Secure the Product: Bays and Bows

The finished suspension is shown in this slide – sort of. The left slide actually shows a turnbuckle hooked to a steel ring on the EMT. At the lower end, the turnbuckle is attached to a hook on a threaded steel rod in the mulled corner, which in turn extends to through the seat and is bolted underneath. That is an another way of suspending a bay or bow. The turnbuckle allows vertical adjustment.



Secure the Product: Curb-mount Skylights

The rough opening is prepared as described earlier, with membrane and sheet metal flashings. The skylight is installed on the curb and the frame is fastened directly to the curb with nails or screws through pre-punched holes, around the full perimeter. Usually, shims are not used, but may be necessary if the roof sheathing and structure are not flat, to avoid twisting the skylight.

As for windows and doors, CSA-A440.4-07 requires that fasteners penetrate a minimum of 25 mm (1 in.) into the roof structure below (truss top chord or rafter, don't include the thickness of the roof sheathing). Fasteners must be appropriate for the loads to be resisted. For the Velux curb-mount or inset-mount skylight pictured, Velux recommends #8 x 1½ in., pan-head, stainless steel nails.