

Curtain wall cladding

Curtain wall cladding systems are almost universally used as the building envelope for high-rise buildings.

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A CURTAIN WALL is a thin, usually aluminium-framed wall containing panels of glass, thin stone or thin composite metal face panels. The framing is attached to the building structure and does not carry floor or roof loads. Typically, the wind and gravity loads of the curtain wall are transferred to the building structure at the floorline.

Types of curtain wall systems

Aluminium-framed wall systems date back to the 1930s and developed rapidly after World War II when the supply of aluminium became available for non-military use. There are a wide range of curtain wall options:

- Stick systems where glass panels or aluminium-sheathed thin panels are fitted into aluminium or steel glazing sections that are fixed to the structural frame of the building usually at each floor level - also described as a framed system.
- Unitised curtain wall systems consisting of a series of units manufactured off site, typically 1 storey high, that are installed with purpose-made jointing extrusions.
- Semi-unitised systems, which are a combination of stick and unitised systems.
- Point-fixed glass systems where the glass panels are mechanically fixed to the structure using stainless steel fixings housed in counter-sunk holes, which means a conventional framework is not required. Joints between glass panels are formed with silicone sealant.
- Structural glazing where the glazing is adhered to the aluminium curtain wall members with the joints between the glass sealed.
- Pressure-equalised open-jointed engineered rainscreen systems. ➤

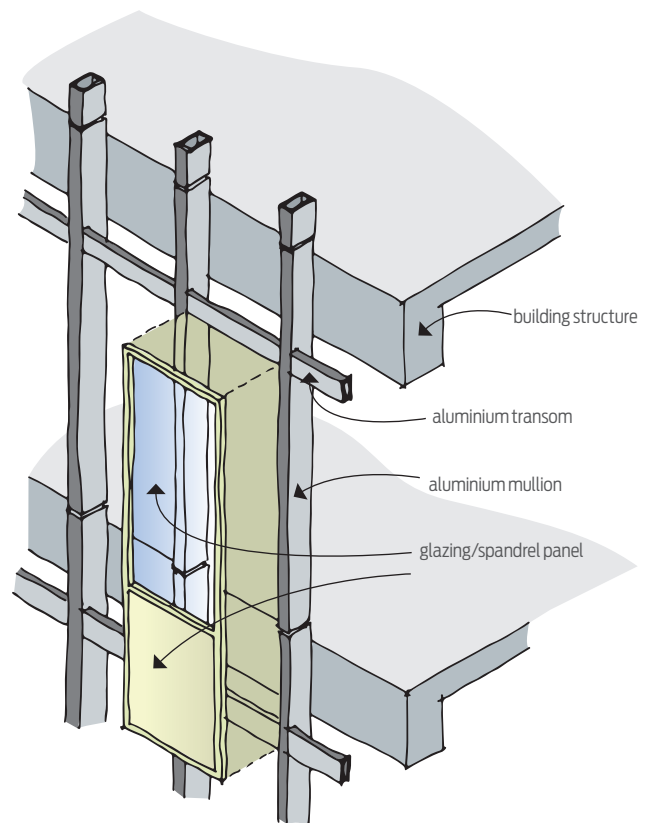


Figure 1: Stick system curtain wall cladding.

Stick or framed systems

A stick system curtain wall (see Figure 1) consists of aluminium members - sticks - cut and machined in a factory and delivered to site as unassembled aluminium mullions and transoms, essentially in a kit format.

These are attached to the building with brackets at slab edges spanning 5-7 m each and to mullions above and below via internal sleeves. Stick systems rely on the frame members to carry all loads acting on the cladding.

Transoms are then fitted to the vertical mullions at the predetermined and machined points via brackets, and infill panels are fitted into the rectangular openings created by the mullions and transoms. These are typically fixed glass but can also be any combination of opening sashes, composite aluminium sheet or even stone.

They are fitted with external pressure plates attached to the mullions and transoms at engineered centres before being covered with a cosmetic external cover cap. Sometimes these plates are continuous and the infill panels are held in by glazing gaskets, such as with most New Zealand windows.

The benefit of a stick system curtain wall is the capital cost, as it can be supplied competitively due to its simplicity.

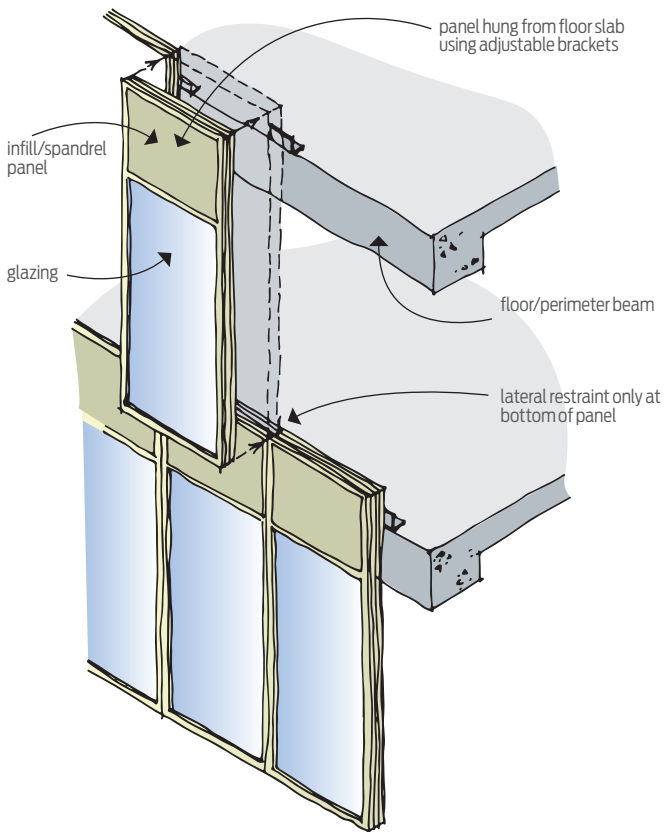


Figure 2: Unitised system curtain wall cladding.

The disadvantages are that these systems require a large amount of site work, which can begin to erode the cost advantages. They also require stringent QA processes as the sealing and joining integrity is determined by the quality of the labour and systems on site, as well as the weather.

Unitised curtain wall systems

Unitised curtain wall systems consist of a series of units, typically 1 storey high and a modular width - typically 1200-1500 mm (see Figure 2). These join to adjacent units above and alongside with male/female designed extrusions complete with pressure-equalised cavities for performance (see Figure 3).

The units start at the floor slab line or the next transom above and are hung on brackets at that spandrel or floor area. They hang down through the spandrel area and vision glass of the floor below and fit into the head of the unit below.

Unitised curtain wall systems offer several advantages:

- Quality control - because the units are manufactured and glazed in factory conditions, the finish of the product is of a higher standard.
- Speed of installation - the unitised nature of the product makes it remarkably fast to install on site. Given time costs as a commodity

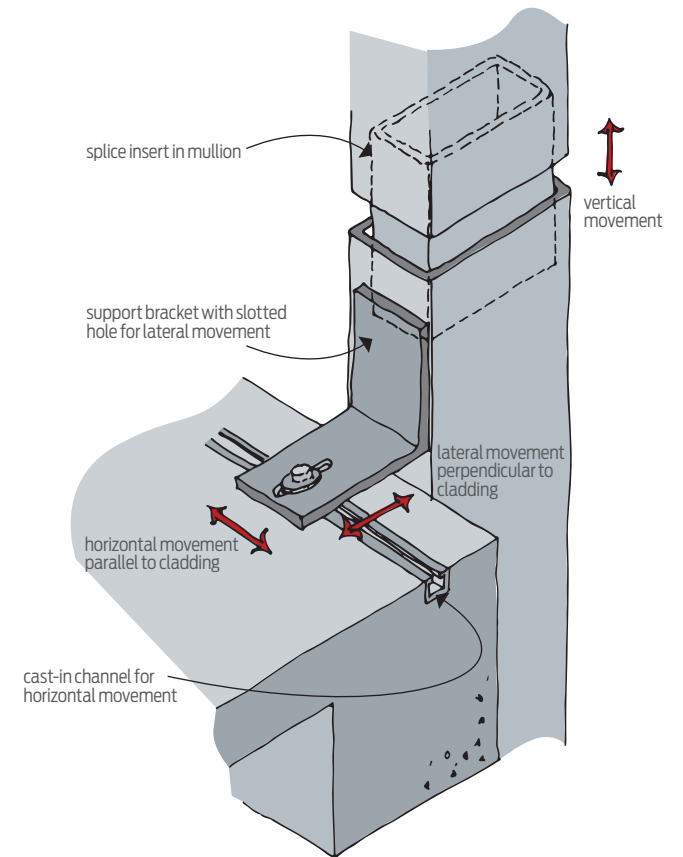


Figure 3: Support accommodating movement in three directions.

on a construction site, this makes a unitised system more competitive than the capital cost first suggests.

- Performance - due to the introduction of pressure-equalised systems and the split mullion/split transom arrangements, unitised systems have superior performance parameters under building movement conditions.

Point-fixed glazing systems

Many buildings have a component of engineered glass, structural glass or point-fixed glass systems, all meaning essentially the same thing.

The glass is the only barrier between inside and out and is usually constructed of single-glazed tempered glass, supported by stainless steel clamps in the corners or edges. The stainless steel is usually bolted to and supported by structural steel either inside or out.

Contemporary designs have recently focused on tension wires and cable trusses in conjunction with glass fins to achieve the same thing as the structural steel and give a building or a foyer of a building architectural impact.

Structural glazing

In many projects, the glass is structurally glazed to the aluminium curtain wall members where the sealant and spacers between the glass and the frame transmit wind loads to the structure. The flexibility of the sealant and spacers allows the glazing system to withstand flexure, tension, compression and differential thermal shear stresses.

Structural glazing can be one of two systems:

- A two-sided system where either the vertical or the horizontal joints are bonded to the structure and support the live load while the remaining sides are either mechanically fixed and support the dead load or are not structurally supported. Two-sided systems are often done on site.
- A four-sided system where the structural silicone bonds all four sides with the dead load either supported mechanically by a supporting fin or by the silicone alone. These should be factory built.

With any structural glazing system specification, compliance and QA procedures surrounding structurally glazed systems are critical and are generally detailed in a façade performance specification at time of tender.

Pressure-equalised rainscreen systems

Pressure equalised systems incorporate a rigid air barrier fixed over the primary structure to which the support for the open-jointed pressure-equalised rainscreen cladding system is attached.

Compliance and certification criteria

Most curtain walls are specifically designed and engineered to meet

prescribed performance parameters, which include building dimensional tolerances and movements, wind load and deflection allowances.

Curtain wall manufacturers should design their product to comply with the above parameters, incorporating compliance with AS/NZS 1170 *Structural design actions*. This should be recognised as compliant by the issuance of a PS1 design producer statement and a PS2 design review producer statement.

Testing the structural findings as well as air leakage and water ingress may be required and is most likely to be carried out to the requirements outlined in AS/NZS 4284:2008 *Testing of building facades*.

Design considerations

Specialised designers, generally employed by the curtain wall manufacturer, prepare shop drawings for the manufacture of the curtain wall cladding systems.

Curtain wall systems require an integrated design approach including:

- an appropriate structural support system
- weathertight detailing of joints
- the inclusion of thermal and solar control
- the effects of reflectance and shading
- the aesthetic appearance of the building.

In addition, designers must consider other factors that may affect the design of the curtain wall cladding including:

- the building height and area of external walls
- floor-to-floor heights
- the size of the units for transportation
- access onto site - for large vehicles and cranes
- lifting equipment
- on-site storage - if required.

Various aesthetic effects

Different aesthetic effects can be achieved depending on the type of system used. With the stick system, mullions and transoms are generally visible on the building exterior.

With a unitised system, a modular appearance may be achieved by fixing glazing with glazing beads to give a framed effect. Alternatively, a sealed glazing system can be used where the glass is structurally bonded to the frame creating the appearance of continuous glazing.

Range of glazing

Glazing units may include different types of glass for solar gain or heat-loss control or the transmission of natural light. A range of opening components and options are available, and different types of sun screens, louvres and fins can be incorporated to provide shading.

All these aspects must be considered to ensure the design and installation of an effective curtain wall cladding system. ◀