Shedding Light on Curtain Wall Systems

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Still in widespread use today, traditional windows known as “punched windows,” are built into a building facade. These windows can be operable or fixed and are available in a variety of materials and sizes.

However, punched windows do not always meet functional or aesthetic requirements when it comes to façade articulation. In these cases, storefront systems or curtain wall systems may be considered. Both offer the ability to use large expanses of glass, but standard storefront systems are typically only used in single-story applications and can be load-bearing. On the other hand, multi-story curtain wall systems are used as a building skin that is supported by the building structure, but is not load bearing.

Found primarily in commercial and institutional design, curtain wall systems serve as a design element that can also protect building occupants from the extremes in weather, while moderating the effects of thermal expansion and contraction, building movement and more. First used in the early 20th century, curtain wall construction is not new. Yet where the original curtain wall featured in-fill material made of metal, it was the advent of the glass float process in the 1950s and development of new thermal and construction technologies in subsequent decades that have led to the escalating use of the curtain wall in design today. Now, in addition to metal, in-fill materials can be made of monolithic or insulating glass, stone veneer panels, louvers and even operable or fixed windows and vents.

Although the in-fill material comprises most of the curtain wall system, it is helpful to understand the types of curtain wall systems available as well as some points to consider when designing curtain wall systems.

The Float Process Defined

Invented by Sir Alastair Pilkington in 1952, the float process made it possible to create large areas of glass needed for curtain wall systems. The process, which results in smooth, polished glass with nearly parallel surfaces, involves taking molten glass at approx. 1000°C and pouring it continuously into a shallow bath of molten tin. The glass “floats” on the tin, eventually forming a level surface. The speed at which the hardening glass is drawn off the bath helps control how thick the glass will be. While the original float glass was only 6 mm thick, today, glass can be formed with thicknesses between 0.4 mm and 25 mm.

Source: Pilkington.com

System Types

Five curtain wall types are in use today:

1. Stick System (Figure A). In the Stick system, mullions (sticks) are fabricated in the shop and installed and glazed in the field. Sticks are placed between floors vertically to support individual components such as horizontal mullions, glazing and spandrels. Loads are transferred to the building through connections at the floors or columns.

2. Unit Panel System (Figure B). For large or labor-intensive projects, Unit Panel systems may be a cost-effective alternative to the Stick system. In the Unit Panel system, panels are fabricated and assembled at the shop and may be glazed there as well. The panels are then taken to the field where they are attached to a building structure.

3. Unit and Mullion System (Figure C). Similar to the Stick system, mullions are the first tube to be installed in the Unit and Mullion system. Spandrel and glazing are inserted into the Stick system as a complete unit.

4. Column Cover and Spandrel System (Figure D). While Column Cover and Spandrel systems are similar to Unit and Mullion systems, they differ in that the building frame is emphasized with column covers which act as sticks.

5. Point Loaded Structural Glazing System (Figure E). In this system, the vertical framing member can be comprised of stick, cable, or another custom structure behind the glass. Glass is supported by a system of four-point brackets and the joints are sealed with silicone.

Issues to Consider When Using Curtain Wall

Like any building method, curtain wall presents several issues that must be considered during design and construction. In addition to air infiltration and deflection, non-deflection related stress and thermal conductivity, loads are perhaps the top issue to consider. Because curtain walls are designed to be non-load bearing, any loads placed on the curtain wall – such as those from the curtain wall elements (e.g., mullions, in-fill, etc.), weather (e.g., wind and snow), seismic and blast forces, and thermal – must be transferred back to the structure itself.

Fire safety is another area of consideration. Because gaps between floors do little to impede fire and smoke, fire safing and smoke seals should be located between floors to maximize protection. In addition, tempered knock-out panels, designed to fracture and provide access during a fire, should also be included to reduce safety concerns.

Finally, note that curtain wall systems typically cost more than standard window systems. These costs must be reviewed in conjunction with the need to address special design considerations such as support framing, glazing types, interior vs. exterior systems, shading devices, applied finishes, special in-fill materials, etc.

An Ounce of Prevention

Beyond these issues, a variety of factors can influence the performance of a curtain wall system. Air and water infiltration, the quality of materials and installation, and more can lead to curtain wall failure.

To maintain the life and protection of the curtain wall system, periodic checks of items such as gaskets, seals, system joints and thermal insulation capabilities of vision and insulating panels should be conducted and aluminum frames should be cleaned. Furthermore, perimeter sealants, typically designed to have service life of 10-15 years, should be carefully removed or replaced at the end of their life.

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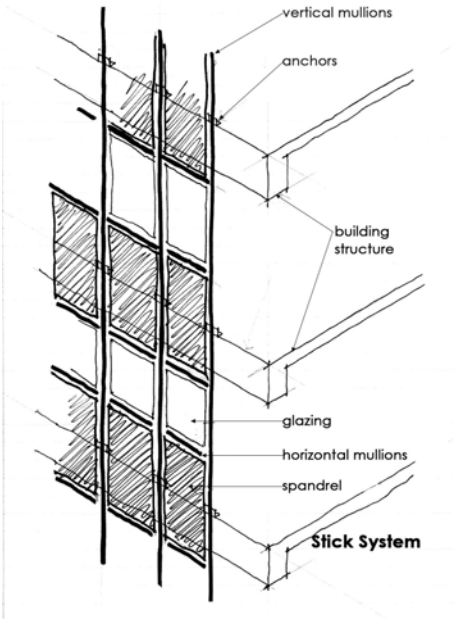

Figure A

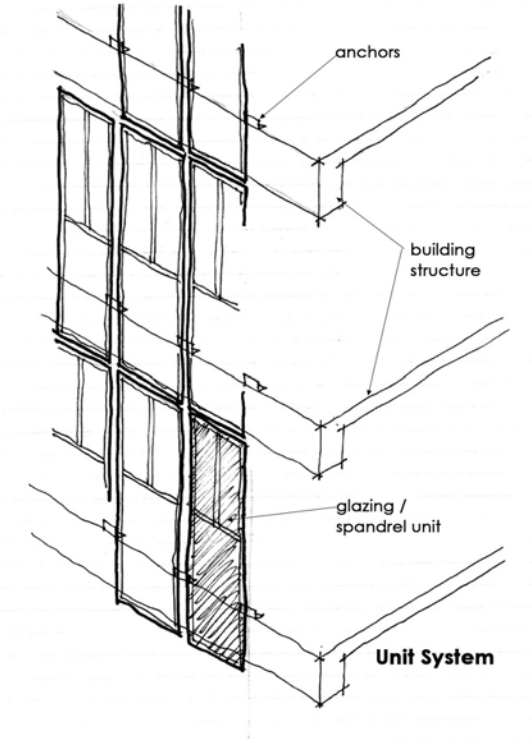

Figure B

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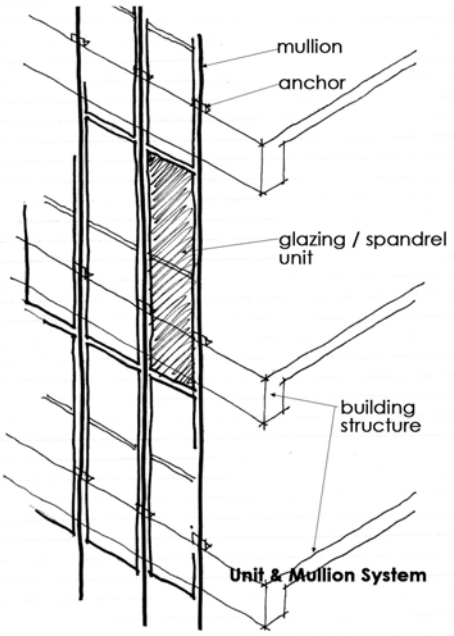

Figure C

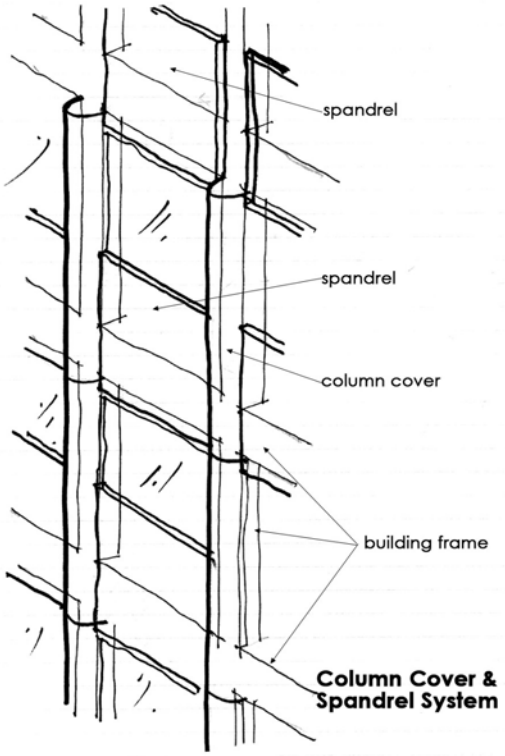

Figure D

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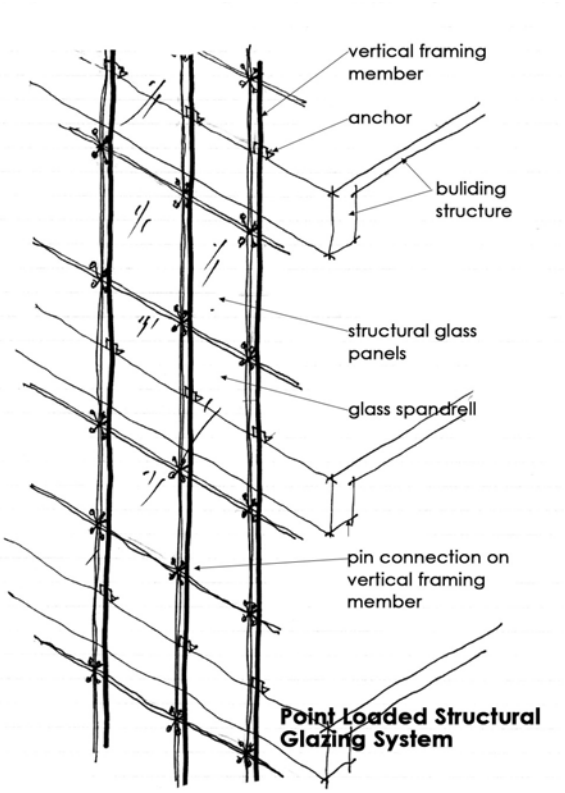

Figure E

References

Sanders, Russell M. “Curtain Wall: Not just Another Pretty Façade.” Buildings. November 2006.

Barista, Dave. “Glass Curtain Wall: Plenty of Light, But is it Soundtight?” Building Design and Construction. May 1, 2006.

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