Improper Use of Storefront Window Systems Leading to Costly Repairs:

A CASE STUDY

By Jason Popovich

Building enclosure consultants or experts are often tasked to assist clients with specifying the correct products for their building or conducting peer reviews on products chosen by others for a project. On occasion, professionals with building enclosure expertise are called in after the fact to conduct a leak investigation. Many times, the cause of leaks can be attributed to the improper use of a system to meet the cost or aesthetic expectations of the building owner or design professional of record.

Misconceptions about aluminum-framed storefront window systems can lead to improper use of these systems. This case study will discuss one such situation, the issues that arose from the improper placement and design of a storefront window system, and the recommended corrections to address them.

BACKGROUND

In early 2021, members of a church in Minneapolis, Minnesota, were frustrated after experiencing years of issues dealing with water infiltration below the church windows, which had caused the plastic-laminate sills to visibly swell as they took on water (**Fig. 1**).

In their multiple attempts to alleviate the problem, the church members had contacted several commercial window installers as well as the windows manufacturer. Multiple installers came out to inspect the system, determine the cause of the problem, and recommend strategies that they thought would best address the issue. The storefront windows were approaching 20 years old, and the consensus among the installers was that the sealant connecting to the frame had broken down and needed to be replaced.

The church members were informed that the best possible remedy would be to remove the external trim and strip and replace the original caulking that connected with the frame. However, none of the installers contacted, including the original contractor, believed

Figure 1. Visible moisture damage of the plastic laminate sills. Photo courtesy of Inspec.

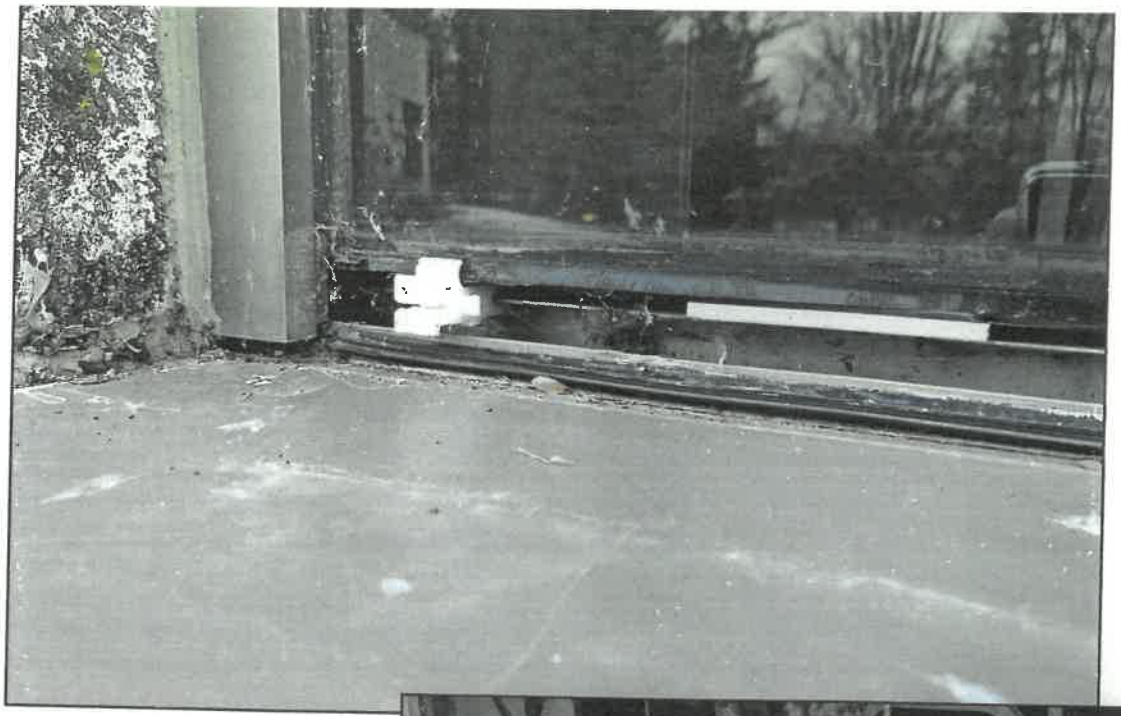

Figure 2. Plastic clips secured the aluminum to the glazing gaskets, allowing movement and water entry. Photo courtesy of Inspec.

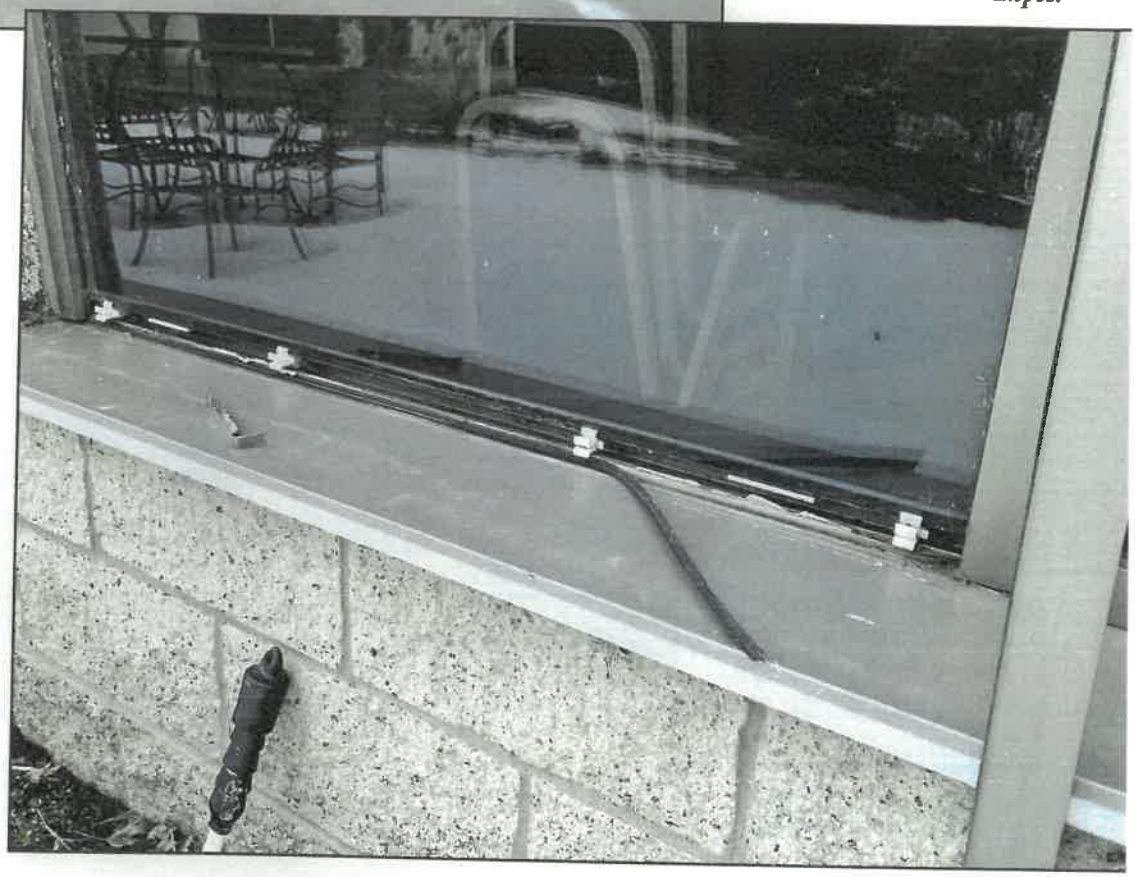

Figure 3. The window frames did not incorporate a sill pan to direct water to the exterior. The flashing shown stopped at the front of the window, where it met the gasketing and no end dams were incorporated. Note the previous attempt to seal the window system from the outside where the flashing met the gasketing. Photo courtesy of Inspec.

this repair would completely alleviate the issue. After following the installers' recommendations to have the windows resealed from the outside, church members soon realized that the repairs failed to mitigate the problem. In fact, the amount of moisture gathering below the windows seemed to be worse than before. At this point, the church members decided to reach out to a building enclosure consultant. Inspec was brought in to determine the cause and recommend a solution fitting the situation and the church's budget.

INVESTIGATION

The consultant's first step was to gather some background information along with photos to get a better understanding of the current window system. The consultant immediately recognized that the system installed was an aluminum-framed storefront window system. As the name indicates, these systems are designed for use in storefronts. However, aluminum-framed storefront systems, which are generally less expensive than other available systems (such as curtainwall), are also often used in larger window applications when building owners are trying to minimize the construction budget.

Storefront window systems are designed to control water, not to be waterproof. In general, storefront systems manage water within the window frame and therefore need extra steps to direct that water back to the exterior at the sill. During a storm, the positive or negative pressures on a building will cause the glass panes to push away from the glazing gaskets, allowing water to penetrate the system. The plastic clips of the church's storefront system (**Fig. 2**) secured the exterior aluminum with the glazing gaskets, allowing the aluminum to move. This movement caused gaps in the gasketing, allowing water to enter the mullion system. This water then needed to be managed.

In a proper application, the water will drain down vertical mullions and collect at the sill. An installed sill pan collects and diverts the water to the exterior, where it is drained through a series of weeps. This method is similar to gutters and downspouts of a roof system. Given the method of water expulsion, there can be confusion regarding the location of the primary seal on a storefront system. Many think that the primary seal is the exterior seal. However, because the system is designed to allow a certain amount of water to travel within the frame where it is managed, the primary seal is actually on the interior. This interior seal is critical to the watertightness of the window

Figure 4. There was no evidence of existing weep holes, which would have provided drainage of water to the exterior. Photo courtesy of Inspec.

system (**Fig. 3**). To achieve watertightness and prevent water from entering the building, the sill pans, end dams, and flashing at the bottom of the window system must be properly designed to catch water and divert it to the exterior.

Upon removing the trim, the consultant determined that there was no sill pan beneath the frame to direct intruded water that would run down the vertical channels back to the exterior (Fig. 3). The flashing over the sloped block on the exterior terminated at the front of the sill where the gasketing is located. Without a sill pan and end dams, water within the system was able to enter the interior space below the sill. The previous attempts to seal the window system from the outside further prevented moisture within the system from escaping.

Even if water is directed to the exterior, it still needs a means to escape. Therefore, proper weeps must be incorporated. In their further review of the church windows, the consultant also found a lack of existing weep holes (**Fig. 4**).

The consultant determined that the lack of a proper collection and drainage system was the cause of the initial water infiltration. The addition of sealant to the exterior further inhibited the drainage of water. These combined factors resulted in an abundance of water that collected below the sill, leading to the damage to the sills and the framing beneath.

To further complicate matters, the storefront windows located on the ground floor were simply wrapped with aluminum cladding. Because the storefront windows located in this area were close to the finished grade,

Figure 5. Because the storefront window system lacked proper sill pans and end dams, water could escape into the wall below the sill, causing damage to stacked wood framing. Photo courtesy of Inspec.

they were susceptible to additional moisture from surface runoff. The lack of any protective membrane or other means of waterproofing resulted in even more extensive damage to the stacked wood frames, as is evident in **Fig. 5**.

RECOMMENDATIONS

Once we determined the cause of the water intrusion, the firm could propose a proper means of repair. The consultant noted that existing storefront windows were approaching the end of their service life, and some of the larger openings were more suited for a window system that would be less susceptible to movement at the exterior gasketing. The consultant estimated that removing the existing windows, resizing the openings to incorporate a sill pan, and reinstalling windows would prove to be more expensive than simply installing a new system better suited for the application.

This combination of factors led the consultant to recommend replacing the existing larger openings with a curtainwall system, which would incorporate a pressure bar with gasketing that is fastened to the mullions to resist the movement that allows water in. There were two options for the windows located at the smaller openings: they could be replaced with an alternative aluminum system that is glazed from the interior so that the exterior gasketing is fixed and less susceptible to that same type of movement, or a curtainwall system similar to that recommended for the larger openings could be used.

SUMMARY

Although aluminum storefront window systems have many uses, proper placement and design must be incorporated to avoid costly problems. Attempts to use these systems in applications for which they may not be suited continue to be uncovered. Although installing storefront systems may reduce the owner's initial investment, improper use of these systems can lead to the need for repairs that are much more costly than the initial savings.

Please address reader comments to chamaker@iibec.org, including "Letter to Editor" in the subject line, or IIBEC, **IIBEC Interface** ***Journal, 434 Fayetteville St., Suite 2400, Raleigh, NC 27601.***

Jason Popovich

Jason Popovich joined Inspec, an independent building enclosure consulting firm, in 2019 and brought with him over 15 years of experience in the commercial building industry. While primarily serving in a business development role, his experience—particularly in commercial roofing, fluid-applied coatings, sealants, and architectural metals—gives him the knowledge needed to assist on projects when needed. He has consulted on a large variety of projects all over the Midwest and Southern portions of the country. Popovich has published several articles and case studies, and he has assisted in updating Spray Polyurethane Foam Alliance specifications for the restoration of closed-cell SPF roof systems. He has been involved with many industry organizations throughout his career and sits on the IIBEC editorial peer review committee. He also has served as a guest lecturer at the University of Minnesota–Duluth, developed and given many continuing education presentations, and provided expert testimony in litigation cases.