SCORING BIG ON FAÇADE WITHOUT SKIPPING A BEAT ON SAFETY

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ABSTRACT

Studio Bell, Home of the National Music Centre (NMC) is located in Calgary's East Village. In addition to musical performance space it houses the Canadian Music Hall of Fame, the Canadian Country Music Hall of Fame and many other music related exhibits. The stringent interior conditions required in the galleries that will showcase NMC's collections coupled with the extremely cold Calgary winters demanded a high performance enclosure. NMC also invested a lot of time and effort in seeking out a unique and impressive design for their new home, including holding an International Design Competition. Consequently, both the building's performance and finished appearance were non-negotiable.

Studio Bell is clad primarily with glazed terra cotta tile, applied in a unique rain screen format. For a majority of the typical wall surface the tile is installed tightly, forming a fully functioning rain screen. However in the regions of glazing, situated behind the rain screen, large spaces were left between tiles forming a varied open porosity within the system, based on visual, solar and aesthetic criteria. These spaces or openings provide an opportunity for wind driven winter precipitation to collect within and behind the rain screen, creating the potential for falling ice, snow, and icicles from wall surfaces. This potential when considered in combination with the pedestrian and vehicular accessible areas at the base of and below the wall surfaces, as the building design included a multi-story pedestrian bridge over a major thoroughfare in the City of Calgary, created a significant concern that required detailed study and performance validation through Mock-up testing in an environmental chamber.

DESIGN AND TESTING

Based on the identified performance concerns for the enclosure, a specialized ice and snow study was sourced early in the design process. The study scope and methodology, which was recommended and carried-out by the ice and snow consultancy firm retained for the project, included a meteorological assessment, general design review, wall design investigation, and the development of mitigations strategies that would address the potential for ice and snow formation and release from the building envelope. Based on this scope, the following actions and outcomes were accomplished:

- An assessment of historical weather data and local microclimate influences was conducted through an analysis of historical wind, snow, and ice in combination with the buildings geometry, site

location, and orientation within its environment, incorporated into an experience-based design consultation;

- The assessment was followed by the identification and layout of mock-up test specimens' (refer to Figures 1 to 3), along with the development of detailed laboratory test procedures that included predeveloped mitigation concepts for investigation and validation;

Figure 1: Mock-up panels on the truck prior to testing.

Figure 2: Mock-up #1 in the laboratory prior to testing.

Figure 3: Mock-up #2 in the laboratory prior to testing.

- The conducting of Nine (9) cold room laboratory tests for two (2) full scale mock-ups representing four (4) wall segments of the facade. Wall segments chosen focused on areas that represented the variations in terra cotta tile patterns, combined with two (2) variations of window sills and base of wall assemblies. Figures 4 and 5 show the wall segments covered with snow mid test. The snow was then melted in a method to replicate either; a sudden raise in air temperature, a cyclical thaw then refreeze, or a slow melt with radiant energy;

Figure 4: Two mock-up sections in the testing lab, with snow build up during testing.

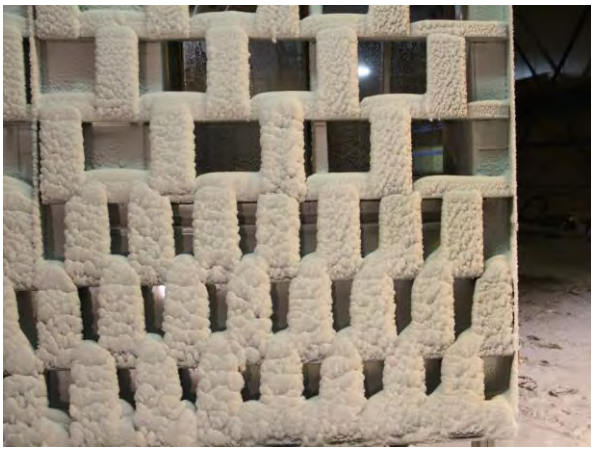

Figure 5: Close up on snow build up on one mock-up during testing.

- The conducting of Five (5) environmental tests that exposed the test specimens to wind, snow, ice, and radiant energy in combination that replicate both the variation and severity of Calgary winter weather and the variations in melting that can contribute to falling ice, hardened snow, and icicles;

- During the environmental tests, various aspects of the mitigation strategies were refined and validated, resulting in detailed guidelines and design recommendations that were incorporated into the project. Some of these mitigation measures include back sloping tile carrying rails, introduction of gutters/drainage channels and additional drip edges.

- Specifically, the test results concluded that the design recommendations tested, and those resulting from the tests, will result in a significant reduction in the most hazardous falling ice potential from the wall segments with spaces between tiles, as well as, accelerate the melting of snow that forms on and within the rain screen elements that are exposed in the spaces between tiles. This will in turn reduce the amount of time that snow formation will remain on surfaces, consequently reducing re-freeze potential and the development of more hazardous ice and icicle formations.

- An additional design feature that was a recommendation based on the test results, was for a robust heated gutter to be included within the design, located at the lower soffit of the pedestrian bridge, providing an additional snow and ice catchment over pedestrian and vehicular areas below.

CONSTRUCTION

Effectively implementing even the most well thought out design features can be a challenge during construction. Transferring the project specific mitigation measures from paper to the building required extensive collaboration between the design and construction teams throughout the process. Multiple iterations of shop drawings and on site mock-ups were completed to ensure the team achieved constructible solutions meeting the performance requirements of the mitigation strategies.

CONCLUSION

As the completed building has only experienced a single winter and the fact that the 2016/2017 winter was relatively mild, the true winter performance under severe, extreme, or non-typical conditions is difficult to determine. However, the following is noted based on the information available to date and the photographs provided in Figures 6 and 7:

- There have been no falling ice and snow incidents reported;
- It is evident that snow and or ice forms within the spaces between tiles as was shown within the environmental tests, however there is no evidence of ice or icicle formation on the façade from melt and refreeze, indicating the façade is performing as intended;
- Snow piles or drifts can be seen on the gutter top surfaces; however there is no indication of snow or ice on the front surface or overhanging, also suggesting that the gutter is performing as intended.

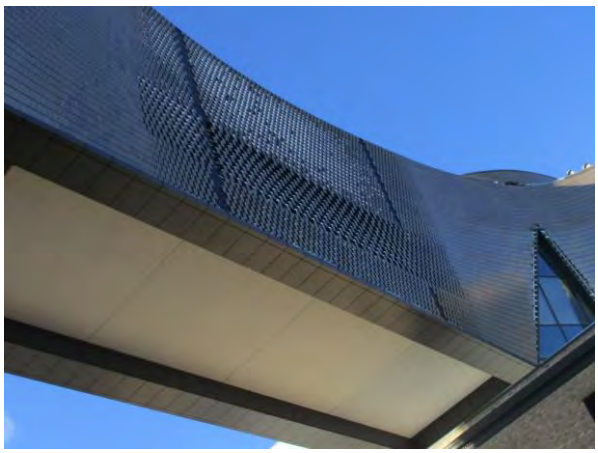

Figure 6: Looking up at the pedestrian bridge, snow build up is visible between the screened tiles.

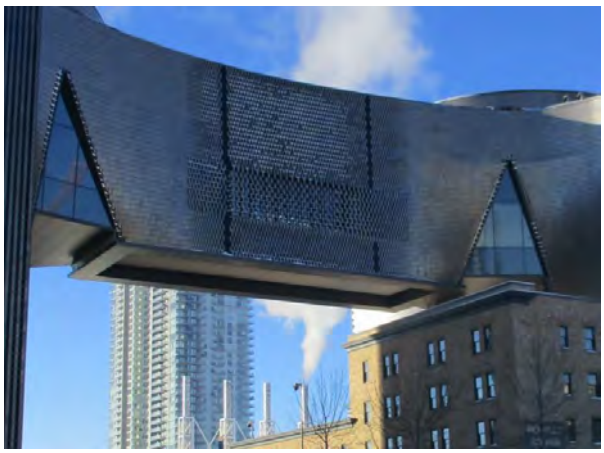

Figure 7: Looking directly at the pedestrian bridge, snow build up is visible between the screened tiles.