A New Link in Calgary's Covered Walkway System

707 Fifth – Manulife Place Pedestrian Bridge is an essential link in Calgary's elevated network of pedestrian pathways. The bridge improves connectivity within the downtown core, adding a new connection from 707 Fifth – Manulife Place to Calgary's +15 covered walkway system, creating a unique architectural expression in downtown Calgary. It was a challenge that required innovative solutions: providing a seamless connection to adjacent buildings while managing subgrade conditions, installation sequences, and non-structural coordination. With a total length of 270 feet 10 inches, the bridge features an elegant structural system known as a suspended lenticular truss, spanning 96 feet 5 inches.

The bridge consists of 5 spans: two end cantilever spans of 27 feet 10inches and 28 feet 2 inches, two side Vierendeel spans of 55 feet 9 inches and 62 feet 8 inches, and a central signature span of 96 feet 5 inches. The structure is supported by pot bearings attached to steel bents roughly 18 feet tall above grade that straddle the adjacent service alleyway. The simple and clean architectural enclosure allows the structure to become a prominent visual feature of the design.

The challenge of providing a seamless connection to adjacent buildings while managing subgrade conditions, installation sequences, and non-structural coordination, required innovative structural solutions to successfully deliver the bridge.

The central signature span is an elegant structural system known as a "suspended lenticular truss." Cable tensioning was undertaken as part of a careful sequence where the arch members are installed after tensioning but prior to the concreting of the floor slab.

The architectural cladding systems were designed to attach directly to the structure and eliminate secondary mullions, requiring all steel to be fabricated to stringent Architecturally Exposed Structural Steel (AESS) 4 finishing specifications. The bridge floor was pre-loaded to take out additional camber before installing the cladding to minimize impacts on the cladding due to movement. The sensitivity of the structure to temperature differentials required a careful calibration of forces between the stainless-steel cables and carbon steel frames to attain a reasonable camber profile.

Skidmore, Owings & Merrill was an Award Winner for the 707 Fifth – Manulife Place Pedestrian Bridge project in the 2020 Annual Excellence in Structural Engineering Awards Program in the Category – New Bridges or Transportation Structures.

The central "suspended lenticular truss" span includes tension cables and compression arches whose geometries follow the moment diagram under self-weight. The cables have been pre-tensioned to minimize loads on the arch and provide camber for the system, resulting in smaller member sizes. An internal stressing method of cable tensioning was undertaken as part of a careful erection sequence where the arch members are installed after tensioning but prior to the concreting of the floor slab. The top and bottom chords are designed to be continuous to control higher mode walking vibrations. The architectural cladding systems were designed to attach directly to the structure and eliminate secondary mullions. And, to minimize impacts on the cladding due to movement, the bridge floor was pre-loaded with a weight equivalent to the floor finishes to take out additional camber before installing the cladding.

Installation during sub-freezing temperatures could result in a higher camber than when installed during warm weather due to the different expansion coefficients of the cables versus steel frames. Pot bearings were also utilized to accommodate thermal movements in service while improving the durability of the supports. Additionally, as the bridge straddles an active service alleyway, the bridge bents are secured by post-tensioned anchor rods to reinforced concrete pedestals designed to sustain a potential vehicular impact.

Due to the limited areas in the downtown core that could serve as a staging area, the bridge components were fabricated off-site, then assembled in the adjacent parking lot and lifted into place on the weekend, requiring a road closure of only two weekend days. The presence of various utilities in the alleyway as well as the proximity of adjacent buildings – including a landmarked theater – necessitated a different configuration for each above-grade support and foundation element for the bridge, in some cases accommodating for future structures from proposed developments.

Due to the lack of secondary mullions, all connections are exposed and therefore require close coordination between the structural engineers, architects, steel fabricators, and contractors. Given that most major structural elements of the bridge are located at eye level with the pedestrian user, special attention was paid to the appearances of welds during the fabrication and assembly processes. In collaboration with cable supplier Pfeifer, the cable fittings and clamps were customized to fit the design aesthetic of the bridge. The vertical struts feature a double-cruciform shape that provides adequate stiffness while creating visual interest.

By agreeing to construct the bridge, the client obtained additional leeway through the Federal Acquisition Regulations (FAR) to provide higher floors in the main office tower of the project, offering clear views of the Canadian Rockies to the west. The bridge is also an essential element in connecting the development to existing as well as future developments, providing benefits to both the public and building tenants. In particular, the bridge integrates a previously isolated portion of the +15 network to the rest of the functioning network.▪