





# ELEVATING STEEL AT CALGARY'S WESTBROOK PEDESTRIAN BRIDGE

A hybrid project done right

BY :: MATTHEW BRADFORD

It's an innovative blend of steel and concrete that gives Calgary's Westbrook Pedestrian Bridge its lift. Spanning the city's Bow Trail expressway, the 32-metre structure serves as a stylish connecting point between the Spruce Cliff community and Westbrook Mall, and is a visible example of hybrid projects done right.





The Westbrook Pedestrian Bridge Overpass, which connects Westbrook mall with the community of Spruce Cliff.

Completed in 2019, the Westbrook Pedestrian Bridge was built to replace an existing bridge as part of Calgary's Area Redevelopment Plan (ARP), which envisions a safer and more walkable neighbourhood surrounding the Westbrook LRT Station. It was erected by general contractor Graham Construction based on designs by RJC Engineers.

"We blurred the line between the span and the support and integrated those elements aesthetically so that one flows into

the other," says Geoff Kallweit, Associate with RJC Engineers. "The result is that it doesn't look like a steel span perched on a concrete base, but more like the span and the base flow into one another."

Norfab Manufacturing Inc. supplied the structural steel, and provided and installed the bridge's metal railing. The Edmonton-based fabricator's steel components were key to achieving RJC's vision for a sleek and integrated structure, as they enabled crews to slim down

the connection points where steel meets concrete, making them as seamless as possible.

"Using a steel tied-arch structure for the main span of this bridge also allowed a thin, slender profile to be achieved over Bow Trail and eliminated the need for mid-span pier support," notes Ryan Loewen, Engineer with Graham Construction. "And since there was no need for piling or pier construction in the median of Bow Trail, this reduced the impact to vehicles on Bow Trail significantly."

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Steel's strength was also a factor in the design's success. For example, the compression portion of the bridge's arch – the steel tube – is field-welded to a steel base plate that bears on the concrete where it transitions. By virtue of steel's strength, Kallweit explains, "We were able to make that welded connection very tight in alignment with the outline of the concrete where the two meet, so there is not a big, chunky connection where you need more concrete area to bear the same load."

As for addressing the tension requirements, steel enabled the arch tie components to be embedded right into the concrete part of the end of the span. This makes the elements appear as if they are "growing" out from the concrete.

"We could do that because the component was small enough to fit within the rebar cage and have all the forces transferred through it, even though it's in a smaller area," notes Kallweit.

"Overall, using steel allowed us to make some very streamlined connections between the two materials," he adds.

### Assembly time

Time was of the essence throughout the construction of the Westbrook Pedestrian Bridge. Using steel to completely span Bow Trail allowed the bridge to be fully assembled on site in a nearby field and then transported and lifted into place, thereby accelerating construction.

"With only one full night-time closure of Bow Trail required to transport the completed main span to its final location and lift the bridge in place using a two-crane pick, the impact to traffic users for this main thoroughfare was minimized," Loewen reports.

To ensure a speedy fabrication, Norfab conducted a 3D model of the structure's steel portions, which was used to validate the geometry between the pieces. This model was also used as part of the team's quality control process, in which the steel component designs were checked carefully in Norfab's shop as they were being fabricated to confirm the tolerances of the steel geometry.

This process proved critical to ensuring the pieces would fit as intended by the time they arrived on site for installation.

It also helped the team address some of Westbrook Pedestrian Bridge's most challenging design aspects, including the prefabricated architectural railing design on the curved ramp.

"It was also one of the most compelling challenges for Norfab and the team when it came to matching as-built anchor bolt locations, aligning with the curvature of the concrete curbs and coordinating with electrical conduit locations, all while being hot-dip galvanized," says Kevin Huot, General Manager with Norfab. "On top of that, the slope of the concrete curb and the ramp slope were different by design. That made each post unique to their own location, so no two posts were typical in their fabrication."

To address these challenges, he continues, Norfab provided Graham with templates and layouts for the anchor bolts to ensure locations and spacings were within tolerance: "And, after the anchors were cast in place, we surveyed the locations and imported the data into our





modelling software to produce accurate shop fabrication drawings.”

To further accelerate the installation, Graham marked work points on the steel arches and surveyed to within a few millimetres during assembly. The arch segments were also temporarily supported on shoring towers to achieve the final required geometry before being completely welded together.

“Because we were basically assembling a bridge in a field 150 metres away from its final location, to the precision of within a few millimetres of its final design and as-built abutment geometry, setting up a usable on-site grid system that correlated with

Norfab’s fabrication geometry was critical,” explains Loewen.

Looking back over the entire process, he adds, “Norfab’s on-site assembly crew of ironworkers and welders completed the steel portion of this bridge assembly with expert skill and precision and were a main factor in the success of the project.”

**A unique accomplishment**

The completion of Westbrook Pedestrian Bridge brings Calgary one step closer to bringing its ARP ambition to life. It also gives Graham Construction, RJC and Norfab a stand-out project to add to their portfolio.

Says Loewen, “It took a lot of planning and preparation to build a bridge that consisted of both precast concrete and steel arches and crossbeams, and to support these components so that they not only fit [with] each other, but matched the final geometry of the cast-in-place abutments and architectural components on either end of the bridge. To do so successfully is an amazing feeling of accomplishment.”

“It was certainly one of the more interesting pedestrian bridge design projects that I’ve been a part of,” adds Kallweit. “This hybrid approach was pretty novel and a very interesting engineering challenge that made the whole project exciting.” **AS**

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