

METROTOWN SKYTRAIN STATION EXPANSION + RENOVATION

Burnaby | BC | Canada



Fast + Epp

Exterior view of West entry extension. Credit: Ed White.
(Front Cover, Credit: Ed White)



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Fast + Epp was the structural engineering firm for an ambitious expansion of Metrotown Skytrain Station in Burnaby, British Columbia. The result was a fully modernized station which more than doubled in length from 80 meters to 200 meters, with all work being achieved while the station remained fully operational.

The crowning achievement was an expressive “loop truss” which allowed for unobstructed pedestrian flow below, and has ultimately become the signature feature of the station.



INNOVATION

Metrotown Skytrain Station was originally built as part of the 1986 Expo Line. To meet the growing needs of the community, TransLink embarked on an ambitious expansion of the existing station, which included:

- Improve access by adding new entrances at the east and west ends of the existing station, as well as modifying the existing structure to accommodate a new central entrance.
- Design and construct the entire structure while the station remained fully operational.
- Design a structure that “touched down lightly”, so as not to impede pedestrian flow.
- Design an aesthetically pleasing structure which would complement the existing Expo Line.

Photo Credit: Ed White.



INNOVATIVE SOLUTIONS:

1. The three new station entrances were successfully designed and constructed in a phased sequence so as not to interrupt station operations during revenue hours. Once the project was complete, the station more than doubled in length from 80m to 200m.
2. Unimpeded passenger flow at each of the new entrances was the driving force behind all of the structural design decisions, particularly at the east and west entrances. At these entry points the challenge was to construct a roof structure over a fully operational train track, with minimal columns positioned between the inbound and outbound guideway beams. The solution was a double truss configuration, with each truss spanning up to 30m, and minimal columns strategically positioned within the pedestrian concourse area. The columns were constructed as “moment frames” from paired wide flange beams to serve double duty as transverse lateral support to the new roof structure.
3. The crowning achievement was the double trusses at the east and west entry, affectionately nicknamed the “loop truss”. The loop truss configuration was achieved by “flipping” the trusses relative to each other, so that the curved top chord on one span became the curved bottom chord on the adjacent span. Flipping the trusses also solved a number of geometric constraints, including:
 - The truss section over the elevated platform could not extend below the roof soffit due to insufficient headroom. Hence, this truss section extended upwards.
 - Given the large volume below the truss section hovering over the station entrance and faregates, the Architect wanted to fill this space in an aesthetically pleasing way. Flipping the truss so this section extended downwards provided an opportunity to sculpturally occupy this volume, with some describing the experience as being in a steel and glass cathedral.

Photo credit: Fast + Epp

COMPLEXITY

As the saying goes, “it takes hard work to develop a simple solution to a complex problem.” This project was no exception. From TransLink’s initial vision to the strong collaboration with the Architect, the project overcame a number of complexities along the way. Key challenges included:

- Creating an elegant long spanning truss over the new east and west entrances, with minimal column supports. To our knowledge, the “loop truss” configuration is the first of its kind.
- The loop trusses were successfully installed during the very brief non-revenue time period (between 1:50am – 4:50am), and required a high level of design, preplanning, coordination and prefabrication. Ultimately, the truss sections (spanning up to 30m) were each installed in less than an hour.
- Designing and constructing a structure that worked within the geometric constraints of the existing station, including working over and within the existing guideway structure.
- All work was designed and preplanned to ensure that the station remained open during the entire construction period.



ENVIRONMENTAL BENEFITS

From an environmental perspective, preserving and breathing new life into existing infrastructure is generally a more sustainable approach, as compared to demolition and reconstruction.

Metrotown Station is one member of a family of stations that make up the Expo Line, which features a unique “kit-of-parts” character reflective of the period of time it was designed. Preserving the original “look and feel” of the existing station, as well as ensuring that the new east and west entries respected the original design, was paramount.

With that in mind, the structural response for the expansion and upgrade embraced a “minimalist approach”, with strategies including the following:

- Creating a relatively light structure and aesthetically pleasing structure, with the “loop truss” becoming the signature architectural element in the station, thereby negating the need for additional architectural finishes.
- Utilizing the steel HSS columns as direct glazing support, thereby negating the need for additional aluminum curtain wall framing.
- Also utilizing the HSS columns as vertical raceways for electrical conduits (for lighting, CCTV cameras, speakers, etc.), thereby reducing the visual clutter.

ECONOMIC BENEFITS

1. The design of the renovation and expansion allowed the station to remain fully operational during construction.
2. The design represents good value for money and met the budgetary expectations.

SOCIAL BENEFITS

1. The station design respects the visual impact of both passengers and people viewing the station from the adjacent tower blocks.
2. The “loop truss” has become the unifying signature feature of the expansion. The Architect and TransLink have both expressed their delight at the new look of the station.





MEETING THE CLIENT'S NEEDS

When TransLink embarked on this ambitious upgrade and expansion of Metrotown Skytrain Station, they described the project as the largest and most complex station renovation they had ever undertaken to date. All of the Client's expectations were met (and in some cases, exceeded). A summary of the major achievements include the following:

- Station access was significantly improved by adding new entrances at the east and west end of the existing station, as well as modifying the existing structure to accommodate a new entrance at the center of the station.
- The three new station entrances were successfully designed and constructed in a phased sequence so as not to interrupt station operations during revenue hours. This was particularly difficult given the many design and existing geometric constraints.
- The design of the east and west expansion was designed in an elegant and aesthetically pleasing way, which complimented the existing Expo Line Station.
- The public response to their newly upgraded station has been overwhelmingly positive.