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FORT YORK PEDESTRIAN BRIDGES IN TORONTO. THE TWO FIRST DUPLEX STAINLESS STEEL BRIDGES IN NORTH AMERICA

Juan A. SOBRINO

PhD, PE, PEng, ing.,ICCP
PEDELTA
Toronto, Canada

jsobrino@pedelta.com

Javier JORDAN

MSc, PE, PEng
PEDELTA
Toronto, Canada

jjordan@pedelta.com

Sergio CARRATALA

MSc, PE
PEDELTA
Barcelona, Spain

scarratala@pedelta.com

Diego SISI

MSc. Civil Engineer
PEDELTA
Barcelona, Spain

dsisi@pedelta.com

Summary

In April 2015, the city of Toronto selected a proposal for the Fort York Pedestrian and Cycle Bridge project in a design-build competition. The project provides a key link between Stanley Park to the north and the historic area of Fort York – the birth place of Toronto- crossing two rail corridors. Construction started in August 2016 and completion is expected by the end of 2017.

The connection includes two pedestrian bridges. The awarded design proposal includes an unprecedented technical innovation in North America: the use of Duplex Stainless Steel on the entire structure. This pioneering use of a forefront technology provides premium aesthetics within a unique setting in addition to a safe and durable asset for the community. The structure has an extended life cycle, is more corrosion-resistant and requires less maintenance, reducing its overall cost.

Each bridge is supported by a single arch rib inclining at 18 º to provide a slender, transparent and elegant impression. The two arches tilt in opposite direction, and the overall layout resembles a Yin & Yang shape to emphasize both contrast and continuity, expressing a modern, understated and elegant aesthetic.

Keywords: arch; stainless steel; aesthetics; design and construction

1. Introduction

The new crossing will physically link a series of open spaces that extend from deep within the Niagara Neighborhood right down to the Waterfront in Toronto in the Fort York Area- national historic site and birthplace of Toronto-. Two new bridges over the railway corridors west of Fort York and pathways provide enhanced connectivity through these open spaces, offering cyclists and pedestrians a pleasant alternative to busy City streets. The City of Toronto, through Build Toronto, the City's real estate and development corporation choose a Design-Build procurement model to facilitate and optimal and cost-effective construction of this project. The key design challenge is how to achieve an appropriate landmark quality in this special heritage setting, within a very tight budget.

The awarded design proposal includes an unprecedented technical innovation in North America: the use of Duplex Stainless Steel on the entire structure. The bridges incorporate high quality, durable, natural finish

materials throughout, highlighted by state-of the-art Stainless Steel components, complemented by contrasting traditional materials including wood, weathering steel, and stone.

Fig 1. General View

Fig 2. View on south bridge looking north.

The bridges present substantial curving forms within the landscape that are visually strong in a minimal, understated and elegant way, to touch the historic setting as lightly as possible. The expression is clearly contemporary but incorporates touches of traditional materiality that help complement the railway and Fort York setting. The design has been focused on both structural efficiency and pleasing proportioning of the geometry. Both bridges span the rail corridors almost perpendicularly to minimize the crossing distance, which leads to a 52m span for the North Bridge and 44.5m span for the South Bridge. Also, both bridges use trapezoidal cross sections for girders and triangular cross sections for arch ribs. The span-to-rise ratio is around 6 and the span-to-arch-depth ratio is around 100. To accommodate the 5m elevation difference between the ends of the South Bridge, a curved landing is proposed to gracefully connect the bridge to adjacent paths (Figures 1 and 2). Detailed Design

The Design-Build Team proposed a unique Fort York arch design: a tied stainless steel network arch with a distinctive crossing diagonal hanger pattern and a triangular cross section profile, with a single arch rib inclined at 18 degrees to provide a slender, transparent and elegant structure. The arches tilt in opposing directions for each bridge, to create a more dynamic visual experience for users - structures that are configured differently but still retain a continuity of expression (Figure 3).

The structural system selected for both bridges is similar, with a slightly different geometry.

Fig. 3. View on south approach looking east.

The design has been driven by utilizing less material and energy, providing an extended life span and easy maintenance even if the initial cost is slightly higher. The initial higher construction cost of stainless steel is offset by the extended lifecycle of bridges that are more corrosion resistant, require low maintenance and last longer, which is reducing the overall cost of ownership. This represents a net advantage for the Owner, in addition to improving safety and long term durability.