



Replacement of the St-Jacques overpass over the Decarie expressway in Montreal

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DECK INSTALLATION
BY LAUNCH

CONTEXT AND INNOVATION

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WIDTH **28 m**
TWO SPANS OF **55 et 65 m**

CONTEXT AND INNOVATION

Located in the heart of Montreal, the original bridge on Saint-Jacques street was a reinforced concrete structure built in 1967 that made it possible to cross the Décarie highway (A15). Although this structure was not at the end of its life, the location of the foundation elements was incompatible with the layout of the new Turcot interchange, forcing its replacement. The location of the bridge also coincided with the Saint-Pierre collector buried in the ground.

In order to replace the structure, the MTQ wanted a bridge with a strong architectural signature marking the entrance to downtown Montreal in this highly visible location from all directions.

The selected structure is an asymmetrical cable-stayed bridge with two continuous spans, of 55 and 65 m long. The deck is an orthotropic box type with variable inertia, entirely made of steel. It is supported by 10 guy lines (5 per span) which are supported by a steel pylon with variable geometry having a height of 55 m.

The structure was designed to allow an installation by launch. This method involves assembling the deck on the ground and moving it to its final location using a series of jacks that move the deck. The launch installation technique made it possible to limit the closure of Highway 15 to four weekends to install the deck.

The imposing deck, entirely made of steel, was transported in sections via land transport. It was assembled on site by welding. This choice, versus the usual bolting method, allows the creation of a deck that is visually continuous, in addition to eliminating water entry points. It also allows the deck to behave in a structurally predictable manner, which gives us a precise calculation of its behavior during the guying.

The foundations of the bridge were constructed using 2.5 m diameter caissons with rock-drilled sockets, arranged to span the existing collector located in the axis of the bridge, below the ground. The central stack is the fixed point of the deck and takes up around 90% of the vertical loads. In order to take up the horizontal seismic loads, two seismic isolators are present at this location. They transfer vertical forces of up to 2,000 tonnes each and limit the horizontal load to 150 tonnes under the effect of an earthquake. These isolators have been laboratory tested at room and winter temperatures (-30 ° C) to ensure optimal performance in the Montreal climate.



COMPLEXITY

A cable-stayed bridge is inherently complex and requires a subtle balance of forces in the tie rods, the pile and the deck. In addition, the Saint-Jacques bridge deck is unconventional by its structural system and its erection method. The design required several analysis models, including refined finite element models. These in-depth analyzes made it possible to carry out an optimized design by targeting the stress concentrations and favoring details that limit the effects of fatigue.

The analysis also had to consider the multiple stages of construction, notably the launch where the deck was under different support conditions depending on its progress. The guy line compensates for the deflection of the deck under dead loads while maintaining a vertical pylon, despite the asymmetry.

Another challenge was the details of bridge assemblies. The structure was to be transported in pieces to the heart of Montreal and finalized on site. To do this, we had to respect the legal dimensional and weight limits allowing transportation by truck. The geometry and the details of the deck were therefore designed considering these constraints.

The foundations of the bridge had to be built without damaging the collector present. To do this, drilled boxes were used. At the level of the pile, the boxes were positioned on either side of the collector and a post-tensioned transfer beam 4 m high was positioned to channel the forces from the stack to the boxes.



SOCIAL AND/OR ECONOMIC BENEFITS

Social and/or Economic Benefits

Linking highways 15, 20 and 720 and providing access to the Champlain Bridge, the Turcot interchange is a highway interchange where more than 300,000 vehicles circulate daily. The Saint-Jacques bridge, located north of this interchange, is an important road link for crossing Highway 15 and avoiding a 1.1 km detour for users (pedestrians and motorists). It also provides quick access to the newly built hospital (MUHC).

The method of placing the bridge by launch made it possible to limit the closure of Highway 15. Traffic flow in one of the busiest places in the country was therefore maintained during the work.

During construction work, the MTQ regularly held neighborly meetings to explain to residents of the sector the progress of the work. Residents were also invited during these meetings to share their questions, comments and suggestions. Statutory site meetings bringing together the MTQ, the design team, the work supervision team and the contractor enabled action to be taken to meet everyone's needs.

The new Saint-Jacques bridge allowed all those involved in the project to develop expertise for a type of structure that is not very common in Quebec. While several major bridges and engineering structures are to be planned over the next few years, the MTQ ensures that it maintains a high level of competence within the province by awarding exceptional mandates like this one.

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ENVIRONMENTAL BENEFITS

ECOLOGICALLY
SENSITIVE
ENVIRONMENT AND
NATURAL HABITAT FOR
THE BROWN SNAKE

Environmental Benefits

The project is part of the reconstruction work of the Turcot interchange. For this purpose, the contractor provided throughout the work a register accounting for the sources of greenhouse gases present. The MTQ has undertaken to compensate the work for obtaining a carbon neutral report on construction activities.

The Saint-Jacques cliff where the bridge is located is an ecologically sensitive environment and a natural habitat for the brown snake. The work area was restricted and exclusion fences were installed to protect the snakes.

The contractor was required to recover at least 80% of the site's residual materials, including demolition debris. In addition, he was required to maintain a register of recovered materials. Consequently, major sorting operations for demolition residues and concrete crushing have been implemented in order to produce aggregates suitable for reuse on MTQ sites.

The Saint-Jacques bridge makes possible the creation of a functional link modifying the route and habits of users. By adding a direct link, the urban fabric is closed and brings a reduction in the pollution caused by transport.

The Saint-Jacques bridge is one of a series of constructions that breathe new life into an environment that once was rather neglected. The new structure has a distinct architecture which reinforces the identity of the place where it is located.

SAINT-JACQUES BRIDGE:

Contemporary visual signature that creates a remarkable gateway to downtown Montreal.

MEETING CLIENT'S NEEDS

Meeting Client's Needs

The Ministère des Transports du Québec wanted to create a signature bridge, built to limit the impact on traffic on Highway 15 and the surrounding area.

The bridge presents a style which is distinguished by the elegance of its steel deck welded on site and entirely smooth, which gives the impression of taking place in one piece, and its pylon with variable geometry and grandiose slenderness.

The construction was carried out in a spectacular way by launching the superstructure in two phases, which allowed the installation of the imposing structure while minimizing the impacts on users.

The new structure has been designed to achieve a minimum service life of 75 years. It presents details and access equipment which are intended to facilitate maintenance and inspection. An operation and maintenance manual for the structure, as well as an inspection program, was provided to the client.

With its many benefits for the community of Greater Montreal, road network users and its benefits for the environment, the Saint-Jacques bridge project has improved the living environment of the metropolis.

The structure is now open to traffic. Its appearance and functionality seem to please the population, to the great satisfaction of the client. We can say loud and clear «Mission accomplished!»

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