Champlain Bridge

PROJECT OVERVIEW

MAPEI's carbon-fiber-reinforced-polymer (CFRP) products were used to structurally strengthen edge girders on the Champlain Bridge between Montreal and Brossard, Quebec, as part of emergency repairs initiated in 2013.

PROJECT INFORMATION

Project Category:	Infrastructure
MAPEI Sales Rep:	Michel Lafortune
Project Owner:	The Jacques Cartier and Champlain Bridges Incorporated
Engineer:	Delcan
CFRP Installer:	Construction Interlag, Inc.
Project Manager:	Giovanni Natale, MAPEI
Project Size:	2,800 sq. ft. (260 m^2)

MAPEI PRODUCTS USED

- *Planitop® 15*
- *Planitop 23*
- *MapeWrap™ Primer 1*
- *MapeWrap 11*
- *MapeWrap 31*
- *MapeWrap Uni-Ax 600*
- *Mapelastic™* Silver

Champlain Bridge-Montreal, Quebec

MAPEI's CFRP products used in emergency repairs on bridge girders

With nearly 160,000 daily crossings, the Champlain Bridge is the busiest bridge in Canada. It crosses the Saint Lawrence River and the Saint Lawrence Seaway, connecting the Montreal boroughs of Verdun and Le Sud-Ouest to Brossard on the South Shore.

The bridge has six lanes and measures 24,318 ft. (7 412 m) in length, including approaches. It is a steel truss cantilever bridge with approach viaducts constructed of pre-stressed concrete beams supporting a pre-stressed concrete deck paved with asphalt.

Originally opened in 1962, the bridge has deteriorated over time to the point where engineering studies determined that it should be demolished and replaced by 2024. Corrosion by de-icing salts caused most of the deterioration.

The work to make emergency repairs on the edge girders of the bridge took place during intensive "weekend blitzes" from September 2013 until the end of the year.

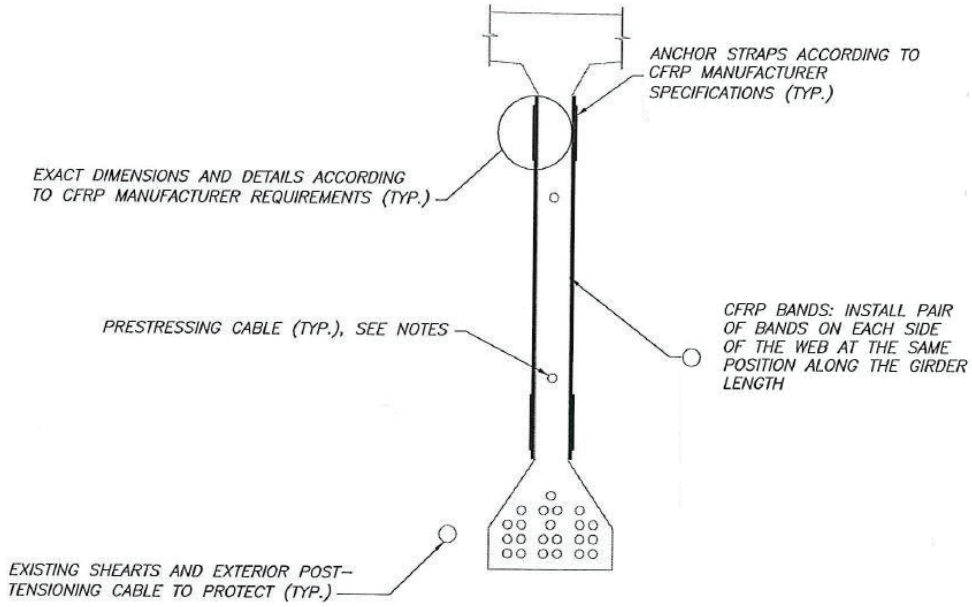
MAPEI's carbon-fiber-reinforced-polymer (CFRP) products were used to structurally strengthen the girders. CFRP is a composite made up of epoxies (the matrix) combined with carbon fiber. CFRP is advantageous because it is lightweight, will not corrode, provides a cost-effective installation and has a small environmental footprint.

The work was done from September to November while temperatures were above 50°F (10°C) (although some tarping was needed for cooler temperatures). The traffic lanes immediately above the girders were closed during the repairs.

The concrete of the girders was sandblasted to a concrete surface profile (CSP) of #3 to #4. The concrete had a minimum tensile bond strength of more than 200 psi (1,38 MPa) and a minimum compressive strength of 2,500 psi (17,2 MPa).

Access to the edge girders and the work site in general was somewhat of a challenge. Currents on the river can attain up to 6 knots, and the rocky-bottomed river is quite shallow.

Boats were used to transport workers and materials to barges where materials and construction trailers were housed. Stairwells were built from the barges, leading the men to suspended scaffolding.



TYPICAL SECTION

The installers (Construction Interlag, Inc.) undertook shear reinforcement of the edge girders with CFRP, applying both vertical bands and horizontal anchoring bands. Two layers of ***MapeWrap C Uni-Ax 600*** uniaxial carbon fiber fabric measuring 18 U.S. oz. per sq. yd. (600 g per m^2) were used to meet the project's requirements.

First, line markers were traced on the sandblasted concrete surface according to the installation plans. Next, a consolidating epoxy-based primer (***MapeWrap Primer 1***) was applied by roller to ensure adhesion of the following layers (*MapeWrap Primer 1* has good penetration and low viscosity, giving other coats the ability to adhere well).

Then, an epoxy putty (***MapeWrap 11***) was applied to fill in honeycombs and provide a smooth, plane surface.

MapeWrap 31 epoxy adhesive was installed by roller over the *MapeWrap 11* putty. As soon as *MapeWrap 31* was installed, the uniaxial carbon fiber fabric was placed over it. This dry layup system was used because it is cleaner and simpler to work with. (In a wet layup

system, the carbon fiber is pre-impregnated in a bath of epoxy, using a pre-impregnating machine for automatic saturation.)

Clean, dry sand was broadcast into the fabric embedded in wet *MapeWrap 31* in order to provide a better grip for the cementitious protective coating.

In the final step, a protective coating of ***Mapelastic*** cementitious membrane was applied in order to provide UV stability, carbonation and salt resistance. More repair work will be done to the bridge to maintain it until its replacement in 2024.

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