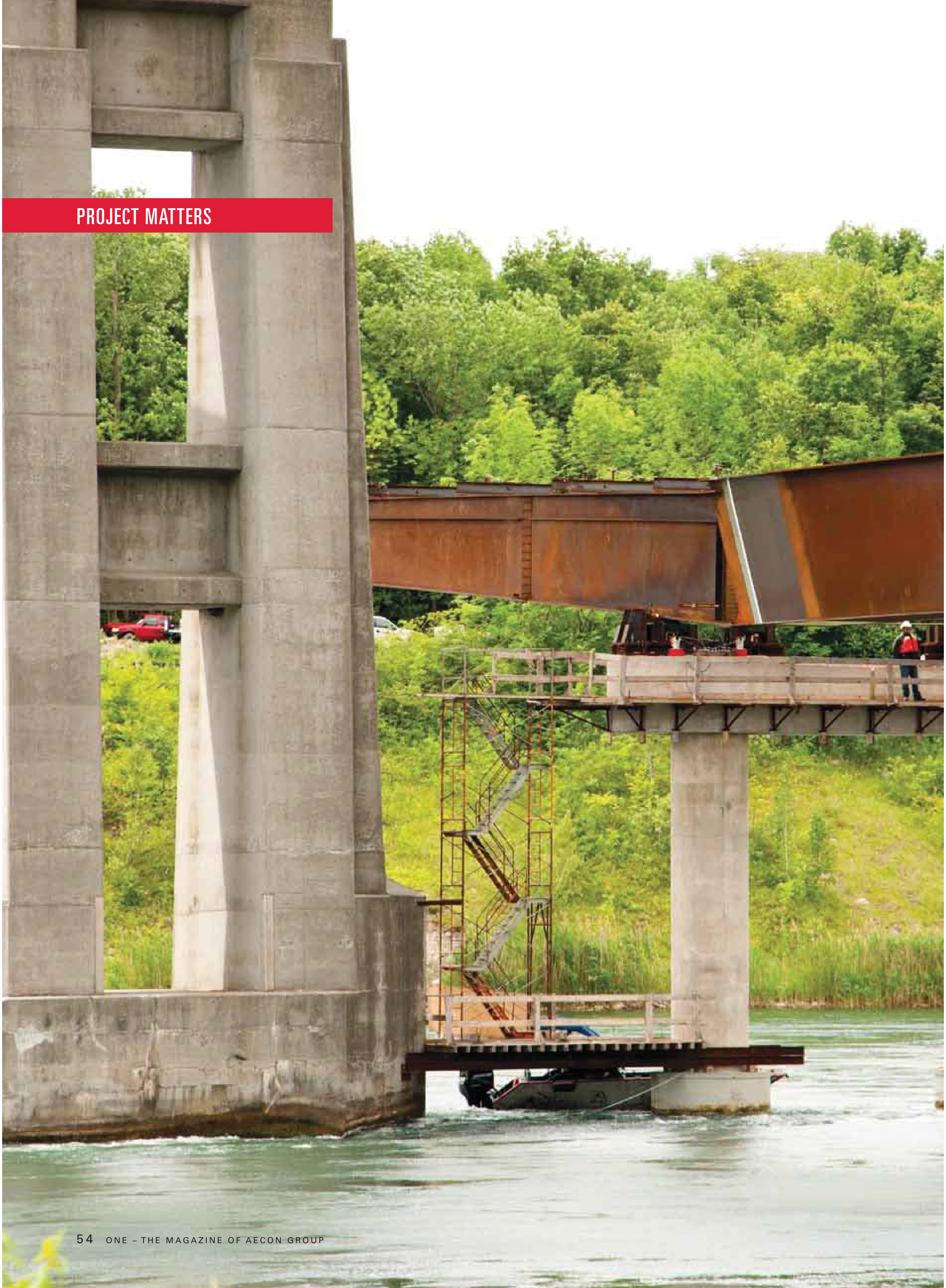
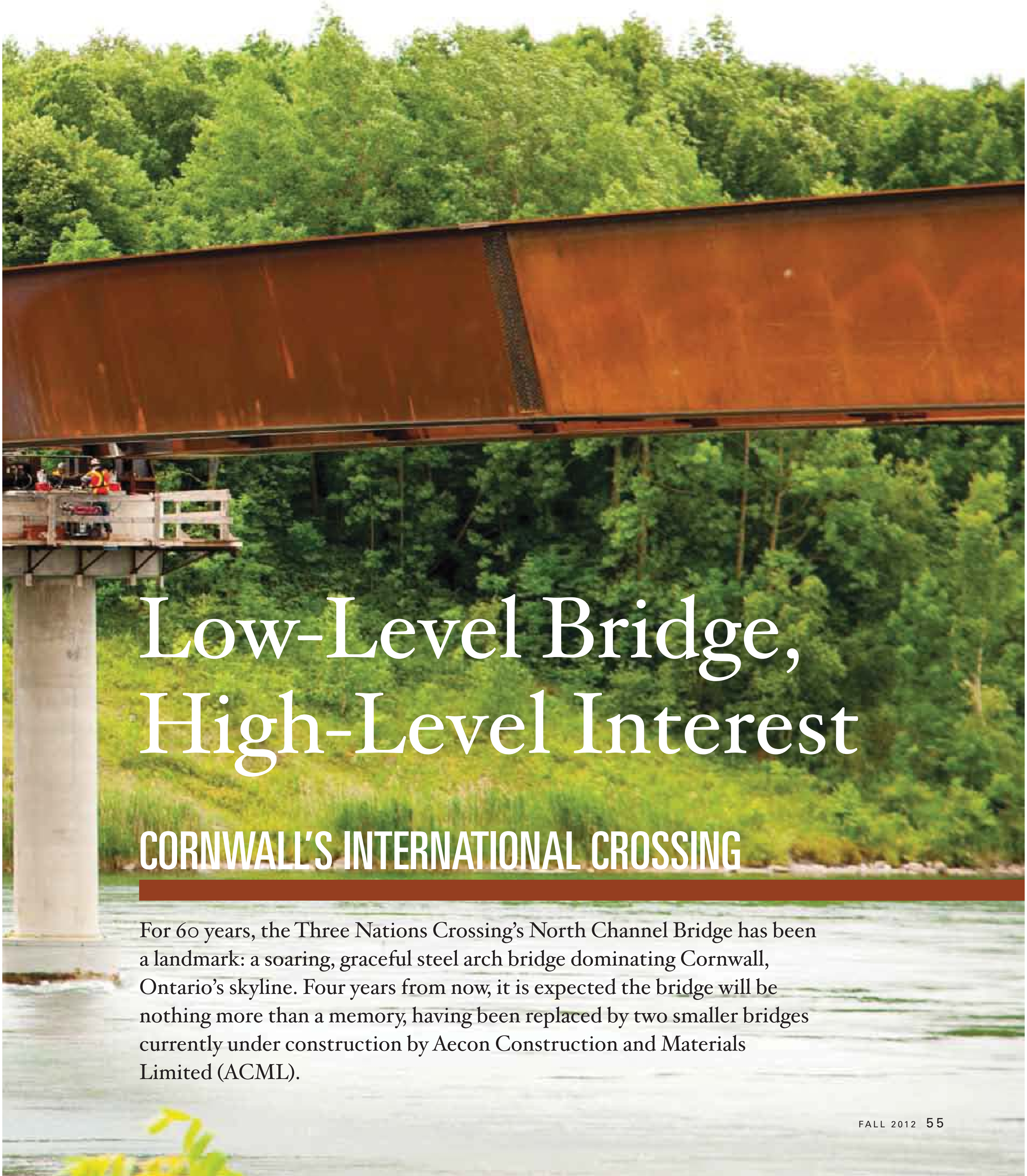
PROJECT MATTERS





Low-Level Bridge, High-Level Interest

CORNWALL'S INTERNATIONAL CROSSING

For 60 years, the Three Nations Crossing's North Channel Bridge has been a landmark: a soaring, graceful steel arch bridge dominating Cornwall, Ontario's skyline. Four years from now, it is expected the bridge will be nothing more than a memory, having been replaced by two smaller bridges currently under construction by Aecon Construction and Materials Limited (ACML).

First opened in 1962, the North Channel Bridge formed part of a two-bridge system that served as the first international crossing between Canada and the U.S. along the St. Lawrence, west of Montreal. The North Channel Bridge carries traffic between Cornwall and Cornwall Island, while the South Channel Bridge spans the St. Lawrence Seaway and connects Cornwall Island to Massena, New York. An estimated two-and-a-half million vehicles use this international crossing annually.

THIS IS ACTUALLY A VERY COMPLEX PROJECT. THE BRIDGE MAY BE SHORT, BUT IT'S VERY WIDE – 26 METRES...

—JOHN ALMEIDA
SENIOR CONTRACTS MANAGER
ACML

At 1,625 metres long and about 50 metres high, the North Channel Bridge is a monumental structure. As it turns out, it is also far bigger than it needed to be. The north channel was never expanded as originally intended, and seaway traffic, which the bridge was designed to accommodate, utilizes the channel to the south.

When the Federal Bridge Corporation Limited decided to replace the aging structure, the bridge owner chose a much more modest crossing: a low-level bridge, just seven metres above the water. And, since the bridge is lower, it is also shorter, at just 355 metres long.

In October 2011, the Federal Bridge Corporation awarded Aecon a contract for the second phase of construction on the new crossing. ACML is building the Low-Level Bridge over the channel, as well as two other bridges: the concrete Canal Bridge, which spans the canal on the north side of the channel, and the prefabricated Pedestrian Bridge, connecting the trail network over the spillway. ACML will also be carrying out some intersection improvements for the access roads.

But this is an integrated Aecon effort and, as such, both Miwel Construction and Aecon Buildings are also involved in the scope of work to be completed. Miwel will replace a combined sewer (which currently sits in the path of the new bridge) with storm and sanitary sewers, at depths of up to 11 metres, while Aecon Buildings

PROJECT FILE

THREE NATIONS CROSSING – NORTH CHANNEL BRIDGE

SCOPE:

// Construction of three bridges: Canal Bridge, Low-Level Bridge and Pedestrian Bridge
// Completion of minor road work: Brookdale Avenue interchange at International Drive
// Deep sewer replacement
// Storm overflow structure rehabilitation

OWNER: Federal Bridge Corporation Limited

LOCATION: Cornwall, Ontario

AECON DIVISIONS:
ACML – General Contractor
Miwel – Sewer work
Aecon Buildings – Structural rehabilitation

TIMING: Q3 2011 to Q4 2013

BRIDGES:

Low-Level Bridge
Span: 335 metres
Width: 15 metres (four lanes)
Height above water: seven metres
Supported on three in-water piers
Construction: concrete arch bridge

Canal Bridge
Span: 30 metres
Width: 26 metres
Height above water: 2.5 metres
Supported on three in-water piers
Construction: concrete deck, steel box girders

Pedestrian Bridge
Span: 40 metres
Width: three metres
Height above water: two metres
Construction: prefabricated steel

NUMBER OF EMPLOYEES: 40 (at peak)

KEY EMPLOYEES:
John Almeida – Senior Contracts Manager
Alexandre Clouthier – Project Manager
Angelo Cornacchia – Senior Structures Superintendent
Gary Kmith – Senior Grading Superintendent
Al Verch – Senior Superintendent (Miwel)
Peter Malek – Project Coordinator
Kate Vaillancourt – Project Administrator
Peter Markes – Student Engineer

WEBSITE: pontcornwallbridge.ca

will rehabilitate a nearby storm overflow structure.

Construction began in September 2011 and is expected to be completed by September 2013. The existing North Channel Bridge will be demolished by 2016 under a separate contract.

THE CANAL BRIDGE – A CONCRETE SOLUTION

At first glance, the 30-metre-long Canal Bridge may not appear to be much of a structure beyond its simple concrete arch. Not so, says John Almeida, ACML Senior Contracts Manager.

"This is actually a very complex project," he maintains. "The bridge may be short, but it's very wide – 26 metres, all told, to accommodate broad pedestrian walkways and turn lanes for access to the customs plaza. It also has four separate concrete arches on each side of the bridge, compared to a typical arch bridge of this size, which may have one or two."

But the most challenging part of this project, notes Almeida, is the concrete itself. It's a new experimental formulation that has never before been used in Canada.

Developed by Dr. Daniel Cusson, Senior Research Officer at the National Research Council's Institute for Research in Construction, this high-performance concrete is designed to minimize shrinkage while maintaining all of its structural properties. It is also designed to be less prone to cracking. Since fewer cracks mean less chloride from road salt seeping into the concrete and corroding the reinforcing steel, this new product could also potentially increase the lifespan of concrete bridges by up to 40 years.

Yet it's not as easy as merely substituting out one type of concrete for another, explains Angelo Cornacchia, ACML Senior Structures Superintendent.

"This is what is known as a high-slump concrete, which means that it flows much more freely than normal concrete. We tried several different trial batches before we were comfortable enough with its performance to start pouring the concrete for this bridge."

Work started on the piles supporting the bridge in February 2012, using a technique known as "duplex drilling" technology. Hollow steel casing, measuring 300 millimetres in diameter by 18 metres long, is drilled into the ground, while, at the same time, an auger removes the dirt from the inside of the casing. The bridge has 21 piles – seven for each of the three bridge piers. Once the casings are in place, they are filled with concrete, after which the concrete pile caps supporting the bridge deck are formed and poured.

Concrete work began in May 2012. The Canal Bridge is expected to be completed by September 2012. The entire bridge will be wired with temperature and strain gauges so that the National Research Council can monitor the performance of this experimental concrete.

THE LOW-LEVEL BRIDGE – COUNTDOWN TO LAUNCH

When ACML arrived at the job site to start its portion of the contract, the first phase of the project – the construction of the three bridge piers in the channel – was already completed.

"Building the piers is known as the 'in-water' phase of the project," notes Almeida, "so I guess we could call our work the 'over-the-water' phase – and getting over the water was definitely a challenge!"

The design of the Low-Level Bridge called for two parallel rows of 11 box girders, supported at either end by a concrete abutment on the bank of the channel and the three concrete piers in the channel. The box girders, in turn, support the bridge deck.

The box girders, made with steel plate up to 60 millimetres thick, measure 3.6 metres wide, 3.2 metres high and about 30 metres long and weigh as much as 85 tonnes. Given the size of the structural elements and the limited room to manoeuvre, Aecon's subcontractor, Structal-Bridges, which fabricated and erected the box girders, chose to push the girders across using what is known as a "launch" technique.

"Basically, the girders are pushed across the gap, rather like pushing a series of box cars in a freight train," explains Almeida. "The only difference is that freight cars have wheels and the girders glide over rollers. After you launch the first girder, the second girder is brought into position and then the third and so on, until the entire assembly has been pushed into place. You then remove the rollers and fasten the assembly to the bearings."

Aecon's first task was to build the concrete bridge abutments on the banks. Its second task was to set up the rollers for the box girder. It was at this stage, Almeida notes, that things got a bit tricky.

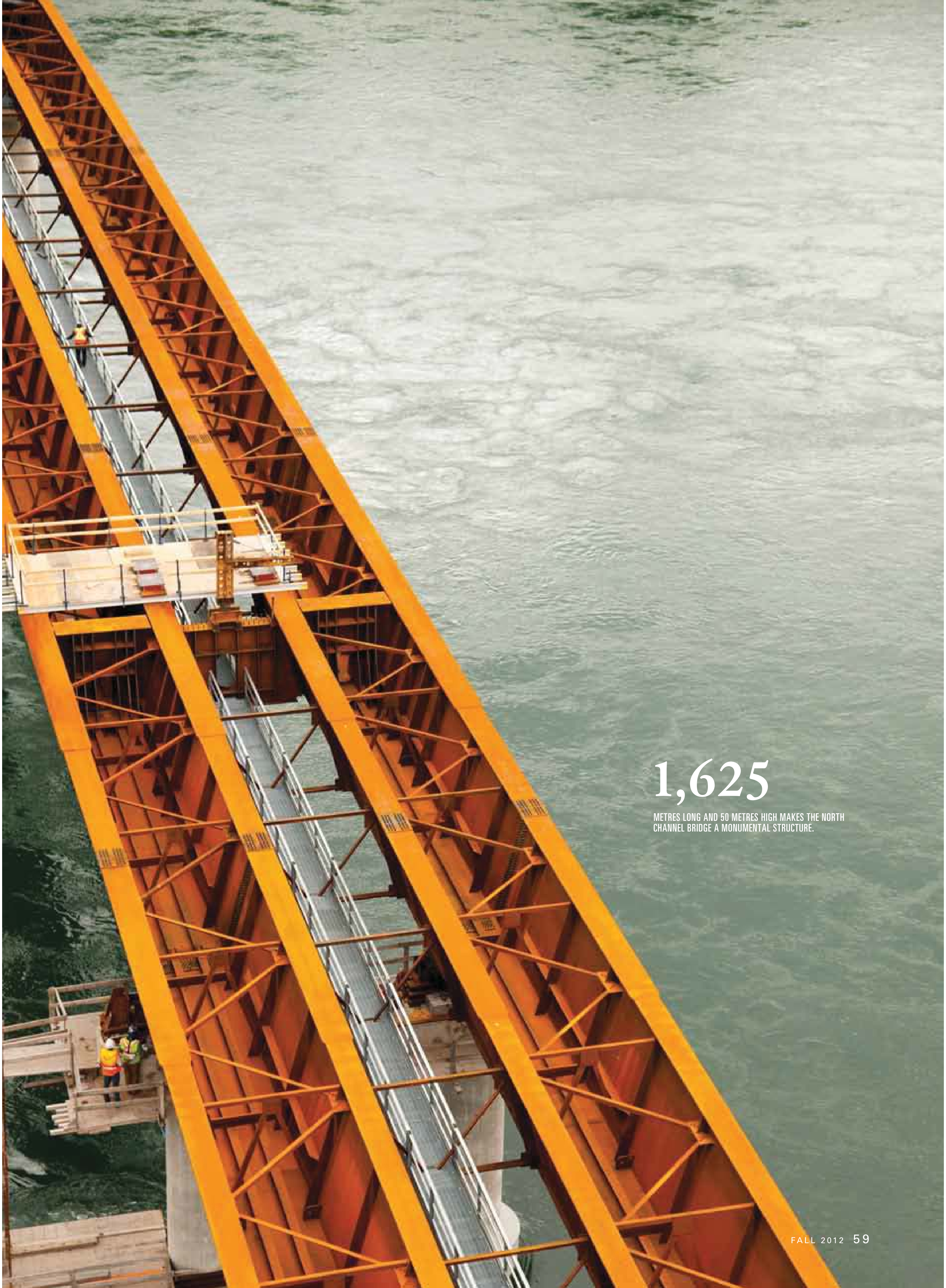
"We had to get across the water to the piers to install the rollers," he explains. "What we didn't count on was how fast the water was flowing through the channel. Without overly exaggerating, I would say it was a bit like whitewater rafting!"

Almeida says Aecon had to bring in a powerful tug in order to build a platform between the piers and the bridge – and then build a staircase from the platform to the top of the pier. "Once we had access to the top of the pier, we carried a small crane, by hand, up to the top so that we could haul up all the components we needed."

Since this was "over-the-water" work, all employees wore life jackets, and a safety boat was on patrol at all times. Signs and channel markers were placed in the river to guide boaters to temporary marine traffic routes well away from the construction.

The launching mechanism was put into place in April 2012, and the first two girders – one for each side of the bridge, tied together by a horizontal catwalk – were launched in mid-June. Launching girders may be similar to building up a freight train, but not when it comes to speed. It took up to one-and-a-half weeks for the hydraulic cylinders to push each set of girders into place. The entire bridge assembly should be in place by the end of August.

Plans call for the concrete bridge deck to be poured next year, after which the deck will be paved and lighting and safety barriers installed.



1,625

METRES LONG AND 50 METRES HIGH MAKES THE NORTH CHANNEL BRIDGE A MONUMENTAL STRUCTURE.