

Edmonton Bridge Contractors Straighten Buckled Girders

04/08/2015 By Scott Van Voorhis

Edmonton city officials are overseeing a review by a structural consultant on what caused four deep steel girders on a new bridge being built over a busy thoroughfare to buckle soon after their placement March 16.

The structure has been stabilized but the project delays are costly, at more than \$300,000, and could grow much worse.

Among the factors being examined, city officials say, are bracing that supported the girders, erection procedures and high winds during the weekend when the placement began.

The 40-ton girders were part of a \$32-million project that started a year ago. The girder depth is 4.2 meters at their ends, where they are encased on concrete abutments. The bridge span is about 100 meters.

The project's contracting team, which includes Los Angeles-based AECOM and Calgary-based Graham Construction, placed the girders at 2:15 a.m., but by the next morning the team shut down the busy commuter thoroughfare beneath the steel.

Edmonton-based Supreme Steel's bridge division is the project steel fabricator and erector.

Graham could not immediately be reached for comment, and officials of AECOM and Supreme Steel declined to comment citing restrictions placed on them by the city.

"We don't see many of these types of failure," said Carlos Cruz Noguez, assistant professor of structural engineering at the University of Alberta.

The girder deflection, which Cruz Noguez and other engineers attribute to torsional lateral buckling, is shown in many photos, including a website project camera. "It's visually amazing," said Cruz Noguez.

Construction crews stabilized the structure with temporary bracing and supported it with cranes. The deflections, which measured several feet, gradually disappeared. Construction crews then removed the temporary bracing and slipped into place permanent cross-bracing.

More details should become available as the episode is investigated and studied.

A key test was passed yesterday, when Edmonton officials reopened Groat Road, which is crossed by the bridge. The four-lane road is a major east/west artery into the city's downtown business district. Contractual penalties for the road closing of \$15,000 a day came to an end.

Must Girders Be Replaced?

Now comes the hard part: Determining whether the girders will need to be replaced and what factor or combination of factors caused the steel to warp.

But that does not necessarily mean the girders can be saved, with the structural consultant hired by the city expected to closely examine and test the 40-ton structures for fractures and other flaws, Cruz Noguez said.

"Further detailed analysis of the girders will be required to determine what corrective measures will be required for the girders," according to a statement by the city's engineering department.

In a written description for an Edmonton newspaper, Cruz Noguez said he couldn't immediately recall any instances of girders that were reused after buckling in such dramatic fashion.

"Even if they can make it (the girders) perfectly straight, a very serious study of the steel still needs to be done," Cruz Noguez said. "Geometry is not everything."

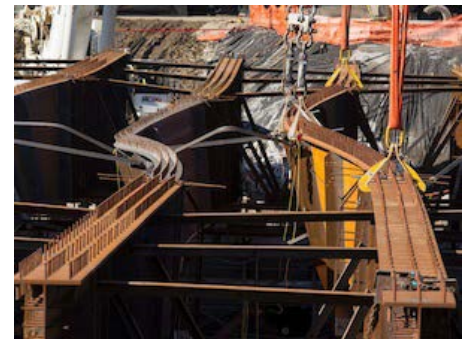


Photo Courtesy of [EarthCam](#)
Buckling columns in the days after installation on a bridge in Edmonton, Alberta

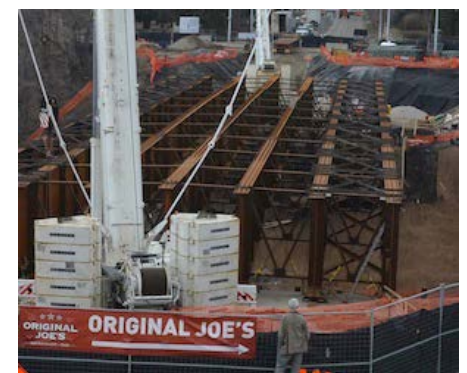


Photo Courtesy of [EarthCam](#)
Within days, bracing and cranes hooked to the girders helped eliminate the deformation in the deep bridge girders.

Bridge Opening in Peril

Replacing the girders could add another 9 to 12 months to the bridge project, said Laura McNabb, spokeswoman for the city's transportation department. That, in turn, could push off the opening of the new bridge, which had been slated for the fall of 2015, into the latter half of 2016.

A long delay, in turn, could have major ramifications for the team of contractors building the Edmonton bridge, which will replace an aging structure built in the early 1900s.

There are also penalties that kick in if the project is delivered after its contractual completion date, although city officials declined to give more details.

Liability for consequential delays is another multimillion-dollar question for all involved.

Edmonton officials say they are probing a range of causes, including environmental, with high winds reported during the early morning hours of Monday, March 16, when the girders buckled.

Construction crews actually started installing the girders on Friday night, but had to stop work on Saturday night due to high winds, according to city engineering officials.

When work finally resumed in the early morning hours of Monday, winds were up to 70 kilometers an hour and may have reached 120 kilometers per hour in the area of the bridge, which sits in a river valley that can act like a wind tunnel, according to a staffer for Edmonton Councilor Michael Oshry, who was briefed on the review.

Investigation of Causes

The city's structural consultant is trying to "cross-tabulate" the impact of high winds with other potential factors, such as fabrication problems. The review is also looking at whether the designs were correct and whether the load being placed on the beams was distributed evenly, the councilor's staff member.

The city's consultant is also looking closely at both the design of the braces used as the girders were bolted into place and erection procedures during the installation, city engineering officials confirmed.

However, doing the necessary tests and examinations of the girders and the bridge project won't be easy given the bustling commuter roadway beneath. About 40,000 vehicles use the road each day.

That means engineers and other consultants brought in to investigate the incident will have limited hours to work within, either over the weekends or late at night, long after commuters have reached home, city officials say.

Given the restrictions, it could take weeks for the review to be completed.

"The contractors will continue working on a plan for a detailed analysis of the girders and lay out a new schedule for the project," said Barry Belcourt, Edmonton's manager of road design and construction, in a statement. "We will know more in the weeks ahead how construction will move forward."