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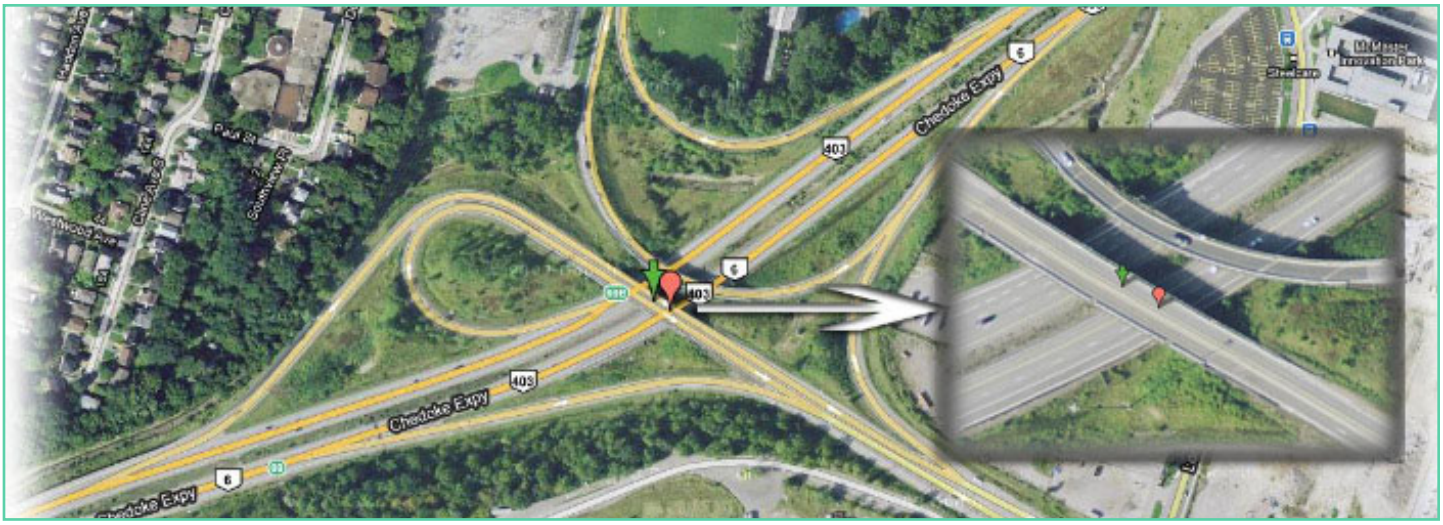
Three-Day Replacement of Multi-span Aberdeen Bridge



Aerial view of the location of the Aberdeen Avenue Bridge replacement, in Hamilton.

The Ontario Ministry of Transportation (MTO) completed a rapid replacement of the Aberdeen Avenue Bridge in the City of Hamilton, over the August 2010 Civic Holiday weekend. The bridge spans Highway 403, a major east-west corridor in Southern Ontario that carries high volumes of commuter and commercial traffic. Aberdeen Avenue in Hamilton serves as a major access to Highway 403 and its replacement marks a new milestone for MTO – the first multi-span highway bridge to be replaced in North America using rapid bridge replacement technology. The ministry has previously completed rapid replacements of single-span bridges in Ottawa on Highway 417 at Island Park Drive (2007) and Clyde Avenue (2008).

The Aberdeen Avenue Bridge was originally built in 1963, as a four-span continuous bridge with spans up to 25m and a conventional multi-span concrete deck on a steel girder structure. A 2008 ministry bridge condition survey along with a life cycle cost analysis determined that the bridge deck and superstructure, including girders, diaphragms and bearings, needed replacement, along with some rehabilitation to the substructure.

Managing existing traffic is one of the biggest challenges facing freeway bridge rehabilitation projects in Ontario. Conventional bridge replacements on urban highways usually take nine to 12 months and involve extensive and costly traffic staging with temporary barriers, lane markings, work zone signs, and lane and shoulder width reductions, which typically result in significant traffic disruption and congestion. Certainly, the main reason the ministry considered the Aberdeen Avenue Bridge as a candidate for rapid bridge replacement, was its potential to minimize traffic disruption to the busy Highway 403. As Aberdeen Avenue is an important access point to Highway 403 for commercial, industrial, institutional and residential traffic, a rapid replacement strategy would benefit the City of Hamilton. In addition, an accessible area was located nearby that could be used for project staging, equipment, and prefabrication of the new bridge structures.

Rapid bridge replacement is a construction technique that involves constructing a new structure in a staging area, while the existing sub-structure is rehabilitated. In general, once the new structure is complete, a Self Propelled Modular Transporter, a unit with many axles, lifts and carries away some portion of the old structure and then moves the new structure into place. The transporters are operated with a computer control system to move extremely heavy objects, similar to the technology used to move NASA's space shuttles.

Using experience gained from its two previous large rapid replacements, the ministry's project team carefully planned an hour-by-hour schedule for the entire weekend of the Aberdeen Bridge replacement. Leading up to the event, the new Aberdeen Avenue Bridge deck sections were prefabricated in the staging area, complete with girders, deck, barriers, and waterproofing.

Beginning at 9:00 p.m., Friday, July 30th, the main lanes of Highway 403 were closed and traffic was detoured around the Aberdeen Avenue Bridge. Upon closure, the two interior spans of the old bridge, weighing 500 tonnes each, were separated from the bridge piers, lifted and rolled away one at a time on the Self Propelled Modular Transporter, to a staging area for demolition. Meanwhile, another transporter moved the new middle spans into place, lifting them onto the renovated piers by early Saturday >

Three-Day Replacement of Multi-span Aberdeen Bridge, *continued*

morning. Highway 403 was re-opened to traffic by 8:00 a.m. that morning; Aberdeen Avenue remained closed while construction crews continued to work on the end-sections.

The old end sections were saw-cut and lifted out with large cranes on Friday night and Saturday morning during the transporting of the middle sections. The new end-sections, prefabricated units constructed on temporary platforms immediately adjacent to the bridge, were slid laterally into position by jack and slide technology. The jack and slide operation involved hydraulic jacks which pushed the new sections into place along tracks installed under the sections during construction.

Once all spans were in place, concrete was poured to connect the four spans together, completing installation of the new structure by Sunday afternoon. Workers began paving the new bridge by Sunday evening, then installed road signs, applied pavement markings, and performed a general cleanup Sunday night. The new Aberdeen Avenue Bridge re-opened to traffic early Monday morning without a hitch and well ahead of schedule. From the time Aberdeen Avenue was closed and re-opened; the entire replacement operation took just over 51 hours, far less than the 80 hours allotted for closure. Old and new spans were transported over a period of about nine hours and end-section jack and slide operations were completed in about four hours.

Using the rapid bridge replacement method provided several significant benefits to road users, construction workers, the local economy and environment. Compared with a conventional replacement, this project minimized traffic disruptions, improved construction site safety, and reduced rehabilitation time.

It should also be noted that MTO implemented an extensive outreach and educational program that provided live coverage of the replacement while underway. The replacement was videotaped around the clock, along with a website link on the MTO public site, to allow the public to view the replacement live during the August long weekend. Ministry staff also used Twitter to post tweets reporting the progress of the work throughout the weekend, as another way to follow the replacement in real time. In addition, the ministry constructed a public viewing area, for spectators to view the replacement from a safe distance without impacting the contractor's operations. MTO has developed an informational video and literature from the coverage to use for future promotional and training purposes.

The Carling Avenue Eastbound Bridge, on Highway 417 in Ottawa, is the ministry's next large rapid bridge replacement, scheduled to take place on the weekend of July 30-31, 2011. •

Construction of the Aberdeen Avenue Bridge over Highway 403 in Hamilton.

This time-lapse video shows night-time construction on the Aberdeen Avenue Bridge.
Video courtesy of Sandy De Lorenzi B.Sc., Supervisor Central Region Traffic Office

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