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Technologist

A bridge to safety

Infrastructure investment
better than after-the-fact lawsuits



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A bridge to safety

Infrastructure investment better than

In September 2006, a 20-metre section of a three-lane overpass on Boulevard de la Concorde in Laval collapsed onto Montreal's Autoroute 19, crushing two vehicles and killing five occupants, and seriously injuring six others.

A subsequent inquiry identified inadequate inspections, inattention to the warnings of local citizens, lack of redundancy in the design, contractor error, substandard materials, and a lack of co-ordination between various public sector entities as reasons behind the disaster.

Less than a year later, an eight-lane, steel truss bridge, which carried 140,000 vehicles a day on Interstate 35W across the Mississippi River in Minneapolis collapsed, killing 13 people

and injuring 145. Among the reasons cited for the collapse were the design of a metal plate that was too thin to serve as a junction of several girders, a lack of redundancy, and earlier repairs for stress cracking of the cross girders.

The most significant contributing factor, however, may have been the 575,000 pounds of construction equipment and supplies parked on the bridge as four of the lanes were being resurfaced.

Can it happen here, in Ontario? It already has, although not to the same catastrophic effect.

Commuters using Lakeshore Boulevard in Toronto have at times had to dodge falling concrete from the Gardiner Expressway. And a 19-year-old woman was killed in May 2006



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steel rebar to protect against freeze/thaw cycles and the application of winter salt.

Referring to Montreal and Minneapolis, Bruce McQuaig, Ontario's Deputy Minister of Transportation (MTO) said, "Whenever one of these events occurs in other jurisdictions, we very carefully take a look to see what the causal factors were, what we can learn from that, and if there are issues that we need to take steps on, here in Ontario."

The Residential and Civil Construction Alliance of Ontario (RCCAO) commissioned a report on the state of Ontario's bridge infrastructure in 2007, in the wake of the Quebec tragedy. Conducted by Marshall Macklin Monaghan, now MMM Group, the report estimated there are 12,000 municipal bridges and 5,400 culverts larger than 3 m in Ontario, in addition to 2,270 provincially owned structures. The report concluded: "There is good reason to believe that the provincial bridge system is safe, but reliable centralized data that would allow us to conclude the same for municipal bridges does not exist."

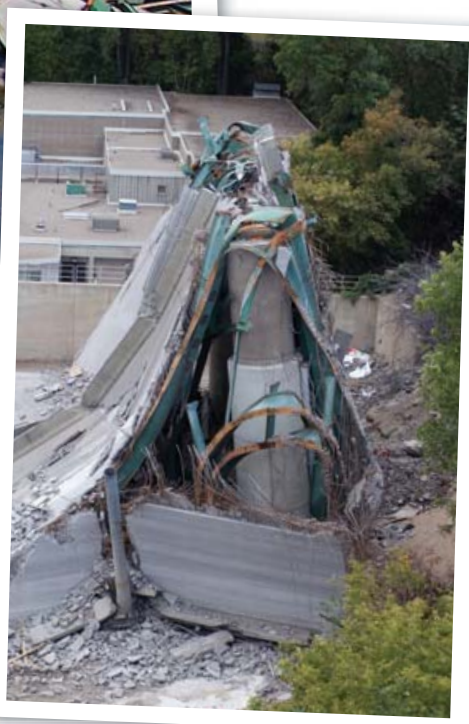
Andy Manahan, executive director of the RCCAO, encapsulated the key recommendations: "Aside from a central repository of bridge condition data for municipal structures, we recommended MTO ensure all municipal inspections

are completed in the two-year time frame, that a status report identify the 'now' and one- to five-year bridge needs for all Ontario bridges, and that a sustainable, multi-year funding program be established to address the backlog."

The 2009 annual report from Ontario's Auditor General sounded an alarm that insufficient funding and a lack of comprehensive information about municipal bridges had potentially negative implications for public safety. A joint provincial-municipal working group has yet to submit a report on the inventory of municipal bridges and will need until 2011 to sort out roles and responsibilities.

Provincial leadership

The province has shown leadership on the infrastructure it controls. Made-in-Ontario bridge inspection processes, including the MTO's Ontario Structure Inspection Manual (OSIM) have been adopted by Saskatchewan, Manitoba, Nova Scotia, P.E.I. and, in 2008, Quebec. McQuaig declared, "Year after year, Ontario's roads have been found to be the safest in North America. →



after-the-fact lawsuits

when her car crashed into a crater on Municipal Road 3, just off the TransCanada Highway in Worthington, west of Sudbury. After heavy rains, fill had penetrated the walls of a 4.7 m corrugated culvert below the turbid water line, where acidic stream water had corroded the steel, causing the culvert to collapse and leading to a 1 m deep sinkhole.

When public safety is at risk

Aging infrastructure is a critical challenge in Ontario. Most of our bridges and culverts were built in the post-WWII era and are nearing the end of their useful life. Structures built prior to the 1970s did not use air-entrained concrete and coated



Our outstanding record is due to a combination of factors including legislation, infrastructure, planning, design, education and enforcement.”

MTO has a multi-year plan in place for bridge repair and rehabilitation, supported by comprehensive inspection reports. It distinguishes between safety-related concerns and non-emergency maintenance. As Gerry Chaput, chief engineer and director of highway standards explains, “Our inspectors are advised that if there is any safety issue, they take immediate action, and that may even mean closing a highway.”

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But McQuaig and Chaput are talking about provincial assets only. The same cannot be said for the bridges and culverts under municipal or private responsibility.

Municipal challenges

In the 1990s, the province downloaded thousands of bridges to municipalities without the corresponding funding to care for those assets. Today 67 per cent of all government-owned capital infrastructure assets are owned by municipalities, compared to 38 per cent in 1961. The Public Transportation and Highway Improvement Act R.S.O. 1990 (PTHIA) requires them to conduct thorough bridge inspections every two years under the direction of a professional engineer and in accordance with OSIM. But there is no agency responsible for ensuring these inspections are carried out and the rehabilitation work is performed.

Smaller and rural municipalities are particularly disadvantaged in meeting their PTHIA obligations. As the RCCAO report outlines, “Bridge repair and replacement is expensive due to the spans involved, structural elements, specialized construction equipment, technical expertise, traffic/environmental protection as well as the complex nature of the work itself.” Most small municipalities don't have an engineering department and lack the funding to handle much more than routine maintenance.

With a population of 157,000, Sudbury is hardly a small community. Yet a review following the culvert death revealed 21 culverts in urgent need of repair and 39 more in need of replacement within three years. The 21 were repaired in 2006 at a cost of \$12 million. More than \$10 million is required for the remainder. A court award may add to the bill – the victim's family is suing the City of Greater Sudbury for \$2 million.

While the Ontario government will have invested \$1.65 billion in repair and restoration of its bridges between 2006 and 2013, municipalities are hard-pressed to come up with infrastructure funding amid their other spending priorities such as health and social services.

RCCAO observed that “the tax base of many municipalities cannot accommodate the bridge rehabilitation and reconstruction funding needs without the support of the federal and provincial governments.” The recent announcement by Prime Minister Harper and Premier McGuinty of \$138 million for 43 designated highway, bridge and local road projects across Ontario was dismissed as a “drop in a big bucket” by Mississauga mayor Hazel McCallion. Mississauga alone faces an estimated repair bill of \$1.5 billion for its bridges over the next 20 years.

Exacerbating the inadequacy of federal and provincial funding for municipal bridge repairs is the problem of timing.

The recent \$138 million approval for Ontario within the Infrastructure Stimulus Fund under Canada's \$4 billion Economic Action Plan requires the funds to be spent by March 2011. As the RCCAO points out, “One-time government funding programs are simply not the most efficient means to get the work done. They do not allow for the proper planning and programming that bridge infrastructure rehabilitation requires.”

Progress is being made on the all-important step of establishing a record of all the bridge structures in the province and capturing reliable inspection data. Manahan observed, “The provincial government allocated \$750,000 through the Municipal Data Works (MDW) program to help the Ontario Good Roads Association (OGRA) expedite the creation of the database.” Municipalities signing onto the initiative can use the MDW program to create a full inventory of their assets, track life cycles, monitor their condition and develop asset management plans.

Brampton: Managing on its own

The provincial government’s massive budget deficit does not bode well for municipalities looking to Queen’s Park for help in funding their infrastructure gap. The City of Brampton turned to its own property tax base to address its bridge workload. “We approached Council,” explained Bill Guy, senior operations technician and OACETT member, “and they were very supportive. They understood the safety concerns.”

Out of its inventory of 177 road and park bridges and culverts, Brampton repaired or rebuilt 51 bridges and nine concrete culverts between 2000 and 2009, at a cost of \$12.6 million. It has dealt with all its bridges in serious need of attention and has no safety-critical structures. The rest are being addressed over the next one to five years.

While Brampton is an exemplary municipality in bridge safety, there are still challenges. “Property taxes are not a viable solution for the long term,” Guy admits. “That’s why I’m a proponent of the gas tax. But it should not go to general revenue – it should be put back into roads and transportation infrastructure.”

Brampton has garnered awards from the Ready Mixed Concrete Association of Ontario for rehabilitation of its Church Street Bridge and for a heritage-designated bowstring arch bridge over the Credit River originally constructed in 1928.

In 2008, Anskon Contracting Inc. built a full-depth deck replacement with partial-depth concrete girder repairs. The \$1.8 million project involved protecting and relocating gas, water main and telephone utilities, with all the attendant complexities of co-ordinating multiple agencies. Led by OACETT members Andy Scandolari, C.E.T., Jason Scandolari, C.E.T., and Matthew D’Ovidio, Anskon successfully maintained traffic flow in both directions throughout the 80-day project. They used the saw- and-lift method for demolition of the bridge deck to protect the utilities, and built a temporary access and debris platform over the creek bed to prevent environmental damage.

The importance of inspections and testing

Inspections are the vital link between preventative maintenance and public safety. There are four kinds of inspections a bridge undergoes throughout its lifetime, following the OSIM guidelines: detailed visual inspection every two years; general maintenance inspection in the spring and fall; regular road patrol inspection to spot potential safety issues; and, emergency inspections after vehicle collisions or natural disasters.

Inspectors employ various technologies when testing bridge

components. Techniques include: an ultrasonic and magnetic particle test for non-visible cracks; internal technology testing, where samples of concrete or steel are removed for lab tests; bridge load capacity tests using a special truck with concrete blocks while instruments attached to the bridge record its movements; and, invasive testing involving drilling to the rebar.

The PTHIA calls for inspections to be supervised by a professional engineer. However, Guy believes there are multiple roles for OACETT members in dealing with Ontario’s infrastructure repairs: “Engineering Techs should do the initial inspection, where their expertise with technology can make a difference. They can bring anomalies to the attention of the engineer for

“Engineering technicians and technologists can also be important assets in the inspection of large structures...”

further analysis.” Engineering technicians and technologists can also be important assets in the inspection of large structures, such as St. Catharines’ Garden City Skyway on the QEW or the Yonge Street Bridge on the 401 in Toronto, where the size and complexity of the inspection require a team working over several days.

Looking down the road

New funding models will undoubtedly be part of the solution to our infrastructure gap. Provincial agency Infrastructure Ontario is looking to Alternative Financing & Procurement (AFP) as a method for delivery of public buildings and other structures. One such project is the Windsor-Essex Parkway, the single largest highway investment in Ontario’s history. It will connect Highway 401 to a new international crossing over the Detroit River to Interstate 75 in Michigan.

The benefits of AFPs and public/private partnerships (P3s) include access to private sector capital and expertise, faster completion of projects, and transfer of risk to the private sector. They have been used successfully for roadways in the state of Missouri to bundle the design, construction, financing and maintenance for a holistic approach to asset management.

With some of the busiest highways in North America, bridges are a crucial link in our transportation infrastructure which, in turn, is crucial to this province’s economic competitiveness. It does not make it any easier to find the billions of dollars needed to address our aging infrastructure, of course. But when public safety is at risk, can there be a higher priority?

Preventative expenditures will always cost less than the complicated aftermath of neglect. The last word goes to Manahan: “Governments would be better advised to invest money in infrastructure rather than deal with lawsuits after-the-fact.” ■■■

George Scott is a communications consultant based in Richmond Hill, Ontario.