Volume 4 March 2011

Keystone Bridge Management Corp.

Keystone News

Buried Bridges, They're Everywhere!

Are you burying your bridges? You mean culverts? No, bridges!

Some of the earliest bridges in Ontario were constructed as small, reinforced concrete, and often single lane structures with safety curbs. Many were short span reinforced concrete slab type bridges. Others were slightly longer span concrete T-beam type bridges. Most were constructed before 1940.

As traffic grew and roads were improved many of these early bridges were buried. How, you might ask?

Most commonly, these bridges were widened with culvert type extensions. Their curbs were removed. The road grade was raised. And the small dignified bridge was relegated to ignominy buried under a metre of fill and sandwiched between culvert extensions.

In another common scenario, these bridges were adequate for two lanes of traffic, however the road grading standards demanded less sag over the structures. The bridge curbs worked well as retaining walls. So why not bury the bridge to the top of the curbs to improve the vertical alignment?

Today these buried bridges reside in every corner of this Province. But are they safe?

Consider this. A six metre span bridge eight metres wide with 0.5 m depth of fill is surcharged with 54 tonnes of dead load. The design engineer intended those 18" high curbs as safety barriers, and not retaining walls!

In all likelihood, most if not all of these buried bridges are not capable of the loading requirements of the current bridge code. Only a structural evaluation can determine their actual capacity.

There are significant challenges to performing a structural evaluation on a buried bridge. Usually there are no design drawings for the bridge. The condition of the deck surface can not be viewed as it is covered in fill.

What does a municipality do about its buried bridges? The first step is easy. Recognize

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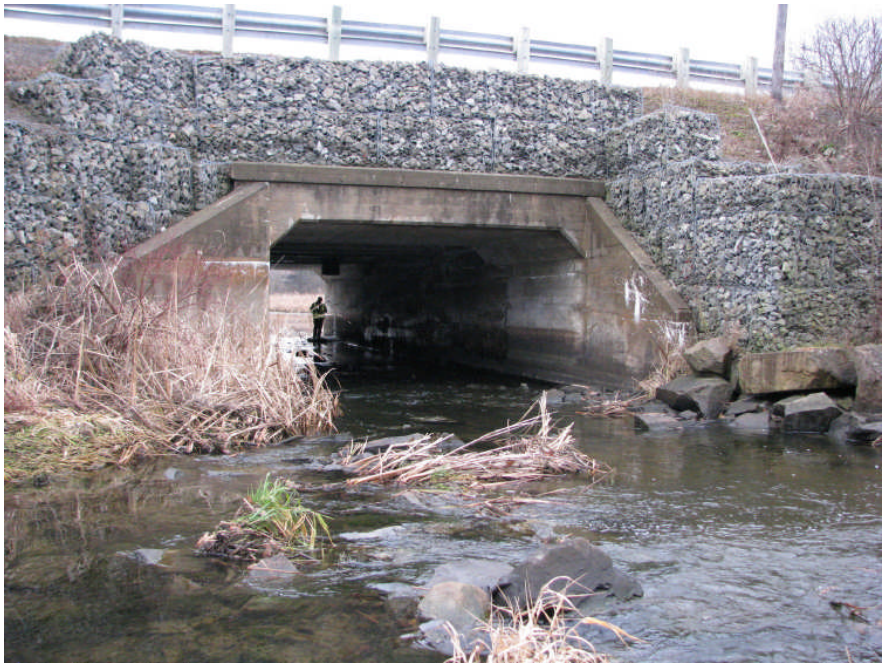

An interesting example of a buried bridge on former Provincial Hwy 2. The oldest centre section is a T-beam bridge that was widened with rigid frame extensions. The grade appears to have been raised twice in its history.

Keystone Bridge Management Corp. offers:

- Specialized bridge asset management services
- Municipal bridge inspections
- Bridge management software solutions
- Training in bridge asset management and bridge inspection
- Bridge rehabilitation or replacement planning and design services
- Bridge load testing
- Quality Verification Engineering

Inside this issue:

Keystone is your Bridge Asset Management Specialist!

Steve Reid

Keystone Bridge Management Corp. is very pleased to welcome Steve Reid, C.E.T. to its staff. Steve, pictured to the right, joined late last year after nine years with MTO's Eastern Region Structural Section, and three years with G.D. Jewell Engineering.

Steve is a highly talented and versatile technician experienced in every aspect of bridge and culvert design, project management, drafting, GIS, and MS Access. Steve graduated in 1998 as a Civil Engineering Technologist from Loyalist College of Applied Arts and Technology, Belleville.

Steve expands Keystone's ability to deliver small bridge replacement designs, and increases our capacity to take on more bridge inspection work.

Buried Bridges Cont'd.....

Much to the credit of these early bridge designs, they are often surprisingly tolerant of overloading.

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which of your structures are buried bridges. Identify those bridges where the curbs are re-tasked as retaining walls. Determine which culverts started out originally as small bridges that were lengthened with culvert extensions. You may be in for a shock.

The second step requires a detailed inspection to detect structural distress from overloading. Much to the credit of these early bridge designs, they are often surprisingly tolerant of overloading.

A municipality however cannot turn a blind eye to overloading. The responsible course of action is to restrict these bridges with appropriate load postings. Only a qualified structural engineer can advise of the appropriate load posting.

Keystone Bridge Management Corp. excels at identifying buried bridges and providing practical solutions to dealing with them.

Buried bridge in the GTA, T-beam with open railings.

Keystone Fleet Addition

Keystone Bridge Management has invested in a new vehicle to support its bridge assessment activities. The 2011 Toyota Sienna shown below can be configured with only two front seats and leaves enough room for a full sheet of plywood to lay flat with the rear hatch closed. This way Keystone can easily carry all of the equipment required to properly perform a bridge inspection. This includes extension ladders, step ladders, clearance measuring pole, hip waders, and all of the small stuff . Standard safety equipment on board includes magnetic mounted dual amber strobe lights and safety cones.

When you see this vehicle parked beside a bridge you can be assured that structure is being assessed to the highest standards with all of the appropriate equipment available.

Bridge & Culvert Maintenance Tips

By the time you receive this newsletter it will be appropriate to begin your basic bridge and culvert maintenance schedule.

Here are some maintenance tips that will help extend the life and serviceability of your bridge and large culvert assets. They are in no particular order:

- Open deck drains on bridges;
- Clear large debris that may have lodged at culvert inlets;
- Watch for ice jamming;
- Clean debris from bridge seats and the surfaces of girders;
- Power wash the bottom chord areas, floor system, and abutment seat areas of truss bridges;
- Power wash painted steel bridge railing systems to remove salt laden debris;
- Flush expansion joint seals;
- Sweep the bridge decks;
- Call for Proposals for your mandated biennial inspection of bridges and large culverts if your two years are up this year.

Perforated girder end resulting from lack of cleanliness.

913 Front Rd.
Kingston, ON
Canada
K7M 4M2

To be added to or removed from the mailing list, or if you wish to comment or require further information please contact the publisher:

Harold Kleywegt, P.Eng.
Phone: 613-384-3272
Cell: 613-449-3272
E-mail: harold@keystonebridge.ca
Alternate E-Mail: harold.kleywegt000@sympatico.ca

Check out the web site at:
www.keystonebridge.ca

Leopard frog encountered during large culvert inspection in the City of Pickering. Aquatic life such as this amphibian demonstrate environmentally healthy streams.

Rehabilitate or Replace? How to Decide

There are about 700,000 publicly funded highway bridges in North America. About half of these were built in the three boom decades after WW2. This aged cohort of bridges is now front and centre on the North American infrastructure radar screen.

The challenge facing bridge asset managers is determining the most cost efficient approach to sustaining this critical transportation network infrastructure. Is it more sensible to rehabilitate a bridge or should it be replaced?

When rehabilitating or replacing a bridge the contemporary adage "Get in, Get out, Stay out." applies. That is, provide a comprehensive fix in the shortest possible duration that has the longest possible service life. It makes no sense to repair a bridge deck in one year, only to come back five years later to upgrade the barriers or expansion joints.

Replacing a bridge is a very expensive endeavor. Usually a bridge is forced to be replaced because of functional obsolescence. For example, in 1957 the muddied fields north of Toronto were cluttered with rigid frame bridges under construction. None of these remain today.

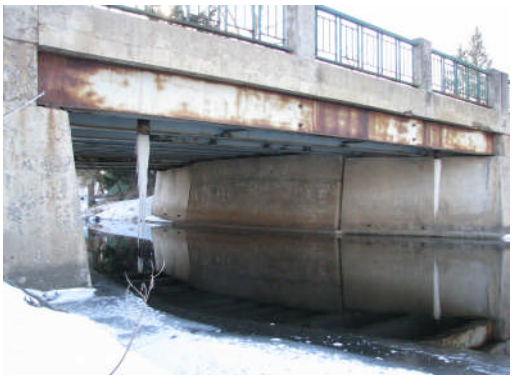
Rehabilitating some bridges can be like upgrading a sow's ear to a silk purse. For example, delaminated and spalled prestressed girder ends are notoriously hard to repair effectively. A chloride contaminated deck is still a chloride contaminated deck after rehabilitation.

One strategy that warrants consideration is referred to by the writer as "*Rust* in Peace." Instead of rehabilitating a bridge to preserve its condition, it is allowed to live out the remainder of its service life with a view to eventual full replacement. This strategy naturally has risks. For example not upgrading a railing system to current standards may increase liability. These risks must be balanced against the potential savings from deferring a major expenditure.

Modern asset management practices include financial analysis of competing alternatives to determine which option has the least life-cycle cost. Life-cycle costing coupled with risk assessment techniques are the decision support tools that must be employed.

Keystone Bridge Management Corp. takes exceptional pride in having the capabilities to utilize life-cycle costing and risk management to help municipalities make fiscally sound and sustainable decisions respecting their bridges.

The Principal of Keystone Bridge Management Corp., Harold Kleywegt, P.Eng., teaches Asset Management to 3rd year Civil Engineering Technology students at St. Lawrence College, Kingston. He also lectures two-day seminars on Bridge Management and Bridge Inspection for Dalhousie University College of Continuing Education.



Example of a bridge near Kingston, ON where rehabilitation now or replacement later is not obvious.