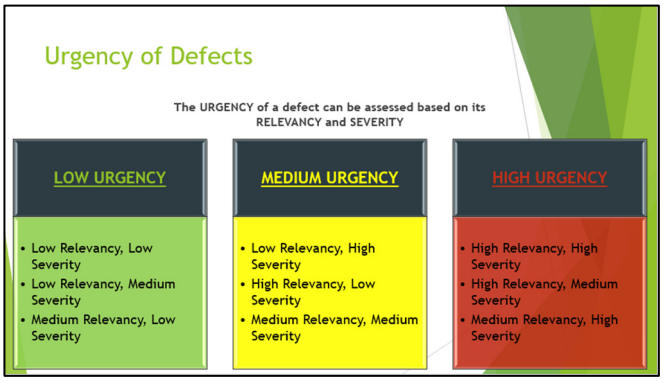
Bridge Inspections: Assessing Defects and Details for Safety

Q & A

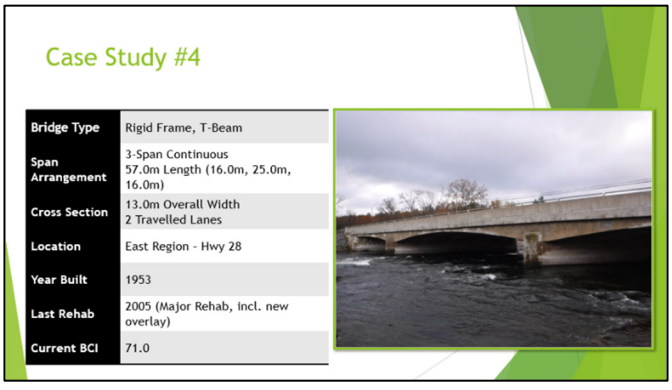
1. Why is loose concrete over traffic not urgent this was in the chart with the urgency?

A: I believe you are referring to slide 9 that said loose concrete on a soffit was Medium Relevancy. Generally, that is probably true, but once the loose concrete is over an area wit h vehicular or pedestrian traffic, it would become high relevancy, because it is highly relevant to the safety of the travelling public. If the loose concrete was over non-navigable water, it would not be highly relevant to public safety in terms of the travelling public or overall bridge safety. In general, our examples referred to relevancy to the safety of the bridge overall, but both apply.



2. Was it determined that the bridge in Case Study #4 was overstressed due to the overlay and new barriers?

A: No, perhaps something done as part of the previous rehabilitation caused this crack to grow due to a global redistribution of loads between the girders, or due to some other modification to the way the structure carries load. The crack only seemed to appear in the years after the rehabilitation, even though the bridge was 70 years old.



3. What goes into making the BCI score?

   A: BCI = Current Value / Replacement Value x 100

   Where:

   Replacement Value = Sum of Element replacement value = Sum of (Element Unit Cost x Element Quantity)

   Current Value = Sum of Current Element Value = Sum of (Element Unit Cost x (1.0*E + 0.75*G + 0.4*F + 0.0*P)

   Where:

   E – quantity of element in excellent condition state

   G – quantity of element in good condition state

   F – quantity of element in fair condition state

   P – quantity of element in poor condition state

4. When calculating BCI, are certain elements given a weighted average considering their level of importance? E.g. barriers/handrails given less weight than girders/supports?

   A: Yes, the weighted value is based on the replacement cost of that specific element. MTO uses standard replacement costs for all elements and does not calculate unit costs on a bridge by bridge basis. Some elements have no cost associated to them, so they do not affect BCI at all.

5. How do Owners know that Consultants performing inspections are using the correct BCI calculation? Costs can vary depending on where you are in the province. Does the MTO publish regional costs for the elements for consultants to use?

   A: MTO has been using the same set of standard element unit costs since around 2009. For MTO, BCI is automatically calculated by our Bridge Management System (BMS). Those values have been published in a document entitled "Bridge Condition Index (BCI) – An Overall Measure of Bridge Condition", MTO, July 2009. Owners may develop their own set of a standard unit costs for each element.

6. Is MTO's new BMS available to municipalities?

   A: MTO's new Bridge Management System can be purchased for use from the vendor, Sixense Inc. Development and customization for use in Ontario has already been completed by MTO and as a result Municipalities and other Owners should be able to purchase BMS from Sixense Inc. for the equivalent of a licensing fee. The Bridge Management System is a COTS (Commercial Off The Shelf) system.

7. I am in Public Works and am not an Engineer who performs OSIM inspections. I would like to start annual maintenance inspections performed not by structural engineers but by the staff who see, fix, and perform repairs daily. What parts of the OSIM manual could be adopted to do this successfully?

   A: It's important to note every bridge must be inspected by a qualified licensed Engineer every 2 years minimum (culverts can be inspected every 4 years if they are in good condition and the condition is not expected to change much before the next inspection). This response assumes the maintenance inspections are additional to the inspections completed by an Engineer (or by someone under the supervision of an Engineer). The intent of OSIM is to provide information on how a detailed close-up inspection should be completed by an Engineer (or someone under the supervision of an Engineer).

   Maintenance inspections are important and should be done in conjunction with regular OSIM inspections. The purpose of regular maintenance inspections is to observe any sudden and/or significant changes in the condition of the structure. The sections on Defects of Concrete, Steel and Timber would be useful knowledge for any maintenance staff performing these inspections so they understand the type of defects they can expect to encounter. Defects that warrant a Poor condition state are particularly important.

   It's also beneficial for maintenance staff to be able to identify performance deficiencies. They may not need to be able to identify which deficiencies need to be addressed urgently, but it is helpful for them to be able to identify them and bring them to the attention of the Engineer responsible for these assets.

8. What about the piers and footings, do they get inspected during OSIM inspections?

   A: Piers are inspected. Footings are generally not visible or accessible, so they are not inspected. However, there is an element called 'foundations' where an inspector can note any observed issues or suspected issues regarding the foundations, which would include footings.

   In some cases, it may be necessary to require additional investigations, and this may include underwater investigations of piers and/or footings, monitoring, etc.

9. How do they get under the bridges to inspect? Boats, belaying equipment, drones, cameras with great zoom lenses?

   A: According to OSIM, a detailed visual inspection is an element-by-element ‘‘close-up’’ visual assessment of material defects, performance deficiencies and maintenance needs of a structure. ‘‘Close-up’’ is defined as ‘‘a distance close enough to determine the condition of the element’’. In many cases, the inspection should be conducted within arm’s length of the element, possibly involving tapping with a hammer or making measurements by hand. In some cases (provided that periodic Enhanced OSIM inspections are done as described in Part 1, Section 1.1.3.2 of OSIM), it may be possible to inspect a portion of the bridge close-up and then estimate the condition of the remaining inaccessible parts by visually comparing them to the partial close-up inspection length whenever feasible.

   Enhanced OSIM inspections involve getting within arms length of all areas of the structure and in many cases requires some specialized equipment or tools to do so. In general, Enhanced OSIM inspections should be done at least every 6 years for bridges older than 30 years and with areas of poor on the critical structural members or at anytime at the discretion of the Engineer. The MTO uses boats, lifts, specialized bucket trucks/equipment (e.g. BridgeMaster), ladders, binoculars and many other tools to complete these inspections. MTO is also doing a research project with Queens University on the use of drones for Bridge Inspections.