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An inexact science

Bridge inspections need their own upgrade

By Anil K. Agrawal

The collapse of the Interstate 35W bridge in Minnesota is a wake-up call about how this nation invests in its bridges. But will the rush to find deficient bridges uncover problems that might have been overlooked?

Evidence suggests that because of the way inspections are conducted and bridge-rating information is used, emergency in-depth inspections in the wake of the accident might not be any more effective than routine inspections.

(Photo — Minneapolis: The fallen I-35W bridge last week. / USA TODAY)

Current bridge inspection procedures are largely visual. They rely purely on the judgment of human inspectors and the condition of their eyesight.

A detailed Federal Highway Administration (FHWA) study in 2001 concluded that "in-depth inspections are unlikely to correctly identify many of the specific types of defects for which this type of inspection is frequently prescribed."

The study reported that when inspectors checked welding points, for instance, only 3.9% of them correctly identified the presence of cracks. "Furthermore ... a significant proportion of in-depth inspections will not reveal deficiencies beyond those that could be noted during a routine inspection," the study said.

Difficult conditions

External factors also can influence an inspector's judgment, the report found. Issues such as fear of traffic, level of experience, visual acuity, complexity of the bridge's structure, access to various parts of bridge, and amount of time for inspection can all complicate the job.

A bridge's sufficiency ratings are calculated on a scale of 0 to 100 using a complex formula that adds a weighted score for three criteria — structural adequacy and safety, serviceability and functional obsolescence, and essentiality for public use — while subtracting for a fourth, special reductions (based on detour lengths, traffic safety features and structure types). Thus, a bridge with satisfactory ratings for the condition of its superstructure and substructure can be rated structurally deficient, yet still is completely safe to cross.

The Minneapolis bridge had a history of problems, most notably its so-called non-redundant truss design, a 2001 Minnesota Department of Transportation study found. A failure of any member of the truss could have led to the bridge's collapse. Generally, bridges are designed to have a high level of redundancy so that loads can be redistributed in case of failure of any load-carrying member. This probably didn't happen in this case.

Possible causes

That study of the Minneapolis bridge concluded that secondary effects, such as catenary action of slabs (slabs behaving like suspended cable), would help distribute the weight, thus strengthening the bridge. But there is no evidence that this was done.

It is also possible that the bridge's stability was compromised because of [maintenance work being done on one side of the bridge](#).

Even so, the assumption in the case of the Minneapolis bridge is that the tragedy could have been avoided if a thorough structural analysis was done along with in-depth inspection. But as the 2001 FHWA study shows, an in-depth inspection might not have uncovered any more than a routine inspection would have.

So what's the answer? New approaches are being introduced to inspect bridge components reliably, such as [ultrasonic scanning](#), [infrared cameras](#), [piezoelectric sensors](#) and [structural health monitoring](#).

Let's hope this event forces us to invest more in our infrastructure and use these technologies to improve safety. There is an urgent need to develop guidelines using new approaches so that bridges can be inspected more reliably.

After all, as the collapse of the Interstate 35W bridge shows, merely complying with federal inspection requirements isn't enough.

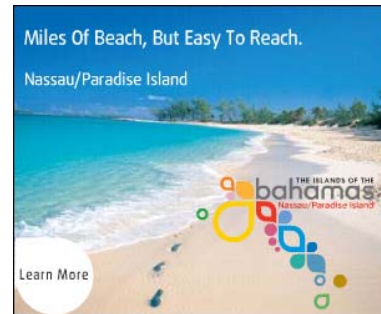
Anil K. Agrawal, Ph.D., is professor of civil engineering for The Grove School of Engineering at The City College of New York.

Posted at 12:15 AM/ET, August 08, 2007 in [Forum commentary](#), [Ground transportation - Forum](#) | [Permalink](#)

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**Ronald David** wrote: 11h 17m ago

So what is expected? Disasters happen. Investigations follow. Recriminations and blame are parsed. The dead are mourned. Life and mistakes go on. The cycle is repeated. Disasters happen. Investigations follow. Recriminations and blame are parsed. The dead are mourned. Life and mistakes go on. So what is expected?

[Recommend](#) | [Report Abuse](#)**dmadi** wrote: 2h 8m ago

First, this is not a partisan issue, this is a disaster that can and probably will happen again through out the nation. Here in MN however, we haven't had a Governor that wasn't bought and paid for by special interest since Arne Carlson. Jesse had is own agenda and squandered the surplus that Arne left him, I believe I got a whole \$200.00 back that could have been spent else where say like infrastructure or the University of MN or public schools, you get the picture. Since 1993 my property taxes have tripled because the State has not been funding counties and cities, Gov. feeplenty and the tax payers league have set this agenda of NO NEW TAXES unless of course it's a new "user fee" . There is enough blame here to go around and yet we were damn lucky, especially looking at the comparatively low death count. My parents didn't like paying high taxes, but they did and as a result I got the privilege of growing up in a great state with great schools and infrastructure. Those days are long gone because Americans keeping buying into propaganda that somehow supporting the whole is a bad thing and it's better to keep every little penny in your individual little pocket. The freeway system between St. Cloud and Alexandria was put in place when I was in Jr. high school in the late 60's and has not been updated since, and yet the states population has tripled since that time. We reap what we sow and that's what happened with the bridge, it started and ended with tight fistted people whose priorities do not mirror those of a generation that lived through a depression and a WWII. Until we the people re-think our selfishness and greed, be assured more of the same WILL happen.

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