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MINNESOTA BRIDGE COLLAPSE

COULD THIS HAPPEN IN ARIZONA?

Close monitoring a must for safety

The failure of the bridge in Minneapolis on Wednesday is a harsh reminder of the status of our nation's aging infrastructure.

Mo Ehsani
STRUCTURAL ENGINEER

Much of the interstate system was constructed in the 1950s and '60s. Although at the time the system was the envy of much of the world, many years of use and lack of proper maintenance have resulted in a decaying system that deserves major attention.

In colder climates, de-icing chemicals are sprayed on bridges to prevent the roadway from freezing. These chemicals enter the concrete through microcracks and cause corrosion of the reinforcement or the steel beams that support the concrete deck. Furthermore, the freeze-thaw cycles lead to damage in the concrete deck.

In warmer and humid coastal regions, salt in the air leads to corrosion of steel.

The warm, dry climate and relatively young age of bridges in Arizona means

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Close monitoring a must to ensure safety

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our bridges are in better shape than most other states'.

Although it is unlikely for a bridge to fail from a single heavy load, repeated application of smaller loads could ultimately cause failure of the bridge by fatigue. In steel bridges, for example, fatigue loading can cause cracking of the connections. If repairs are not carried out in a timely manner, these could lead to failure of structural elements or an entire bridge.

The University of Minnesota conducted a survey of the Interstate 35W bridge in 2001. Among its conclusions were that the bridge had little redundancy and that some details in the trusses were showing signs of fatigue cracking.

Redundancy is a way by which engineers add safety to structures. Redundancy is the ability of the structure to find other paths for the load to be resisted, once a member fails. For example, a redundant bridge may be able to support its own weight after one or more piers of the bridge have been washed away during a flood. Such was the case in at least one bridge in Tucson during a 1983 flood. After the loss of the piers, the center span appeared to have doubled in length. But the piers in the adjacent spans supported the bridge for many days until repairs could be completed.

The failure of the Minnesota bridge was especially chilling because it occurred in a brittle and sudden manner. Engineers design structures so that, if they fail, the failure will be ductile. Ductility is a measure of deformation prior to failure. Such failures will provide warning through large deflections, giving people time to safely vacate the structure.

The causes of this brittle failure undoubtedly is one of the questions that must be answered.

Bridges are not the only part of our infrastructure in a state of disrepair. The water- and wastewater-distribution systems, railroads and the like also require major investments.

It is unfortunate that a failure such as this bridge may be the necessary wake-up call to demand proper investment in our infrastructure.

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