U of Minnesota's independent study of the I-35W bridge collapse results parallel NTSB report

November 20 2008

Preliminary results of the University of Minnesota's independent academic study of the I-35W bridge collapse suggest that lack of robustness in the bridge's original design, additional load from bridge improvements over the years, weight from construction materials and stresses induced by temperature changes contributed to the collapse of the I-35W bridge on Aug. 1, 2007.

The preliminary results of the yearlong study by civil engineering researchers at the University of Minnesota were released last night to a crowd of about 400 people attending the university's Institute of Technology public lecture "Investing in Infrastructure." The university's findings are consistent with the National Transportation Safety Board's final report summary and the report prepared by Wiss, Janney, Elstner Associates (consultants retained by the Minnesota Department of Transportation).

Highlights of the U of M academic study revealed the following:

-- Some of the gusset plates in the I-35W bridge were not designed to withstand the design loads with an acceptable safety factor.

-- Construction on the bridge in the 1970s and 1990s, including the addition of thicker road beds and guard rails, added significant weight on the bridge. The resulting forces stressed these gusset plates beyond

acceptable limits.

-- Additional weight from the construction on Aug. 1, 2007 produced substantial additional forces on the already compromised critical gusset plates. The construction material and equipment most likely initiated the collapse.

-- Temperature changes on the day of the collapse, coupled with partially frozen bridge bearings, may have also introduced additional stresses to the gusset plates.

"The gusset plates at the time of collapse were in a state of instability. In essence the demand on them was equal to their capacity, and they simply gave way," said civil engineering professor and department head Roberto Ballarini.

Researchers involved in the study include civil engineering faculty Roberto Ballarini, Taichiro Okazaki, Ted Galambos and Arturo Schultz.

The researchers conducted their study of the gusset plates in two stages. In the first stage, they created two-dimensional and three-dimensional computer models representing the whole bridge. The second stage consisted of applying the forces calculated in these models to a detailed computer model of the node of the bridge that involved the suspected gusset plate.

"Our computer simulation shows a pattern of very high stresses within the gusset plate that are consistent with the locations and directions of the tears observed in photos of the fractured gussets," Ballarini said.

The researchers plan to publish their final results in an academic research paper within the next six months. The University of Minnesota study was funded by a grant from the National Science Foundation, the

university's Center for Transportation Studies and the university's Department of Civil Engineering.

Source: University of Minnesota