RESEARCH

Research Notes

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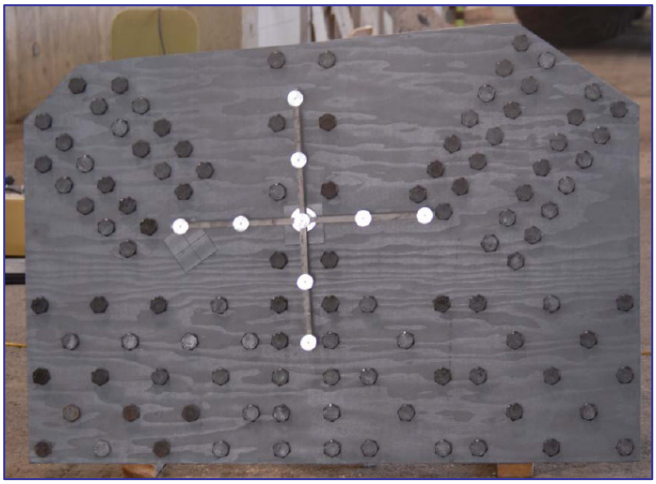
Faster Load Rating for Steel Truss Bridges

After the collapse of the I-35W Bridge in Minneapolis, the Federal Highway Administration mandated that owners of steel truss bridges include calculations for gusset plates as part of the capacity analysis. Although the steel truss members of these bridges were load rated, the connections joining the members together were not analyzed. Unfortunately, under-capacity gusset plates connecting the truss members on the I-35W Bridge were what contributed to the tragedy.

Analysis software for gusset plates is commercially available, but these programs require as-built dimensional and condition data for each connection. Acquiring these field data typically requires bridge inspectors to access each connection on a bridge, measure the pertinent dimensions, and record each measurement on paper. Load rating engineers then use the measurements as input into capacity analysis programs. Though Oregon has relatively few steel truss bridges, the new load rating requirements would entail a significant effort to obtain the data needed to comply with the new regulations.

Traditional method of acquiring dimensional data for a truss connection



Mock-up of a gusset plate used for developing the photographic procedure

The Oregon Department of Transportation (ODOT) Bridge Engineering Section recently completed a project with Oregon State University to develop a viable, more cost-effective alternative to the manually collected field measurement procedure. The new method employs a computer application to acquire the dimensional data from photographs of gusset plates. The general steps of the method are as follows.

1. Attach a reference target to the plate.
2. Take a picture of the plate and reference target.
3. Use the computer application to correct and scale the image.
4. Electronically record dimensional measurements from the rectified image.

These measurements can then be exported easily to computer-aided design software to create drawings for the gusset plates.

The photographic approach enables rapid collection of field measurements as compared to traditional methods and limits the likelihood of data entry errors. The procedure uses readily available technology and can be practicably employed in the field and the office by personnel with common bridge inspection and engineering skills. Dimensional measurements from the rectified photos have been found to be as good as conventional field measurements and are within tolerances for gusset plate connection capacity evaluations. Also, a photographic record is created to document the current condition of each connection.

The Bridge Engineering Section is implementing the photographic method into its steel truss bridge inspection and analysis procedures. As a result, ODOT will have a tool that will help bridge inspectors and load rating engineers efficiently check the connection capacity of ODOT's steel truss bridges.

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The final report for this project was published in March 2009 and is available on the Research Unit web page:
http://www.oregon.gov/ODOT/TD/TP_RES/docs/Reports/2009/Gusset_Plate.pdf