Improved Load Rating Procedures for Deteriorated Unstiffened Steel Beam Ends

AUTHORS: Aidan Provost, Georgios Tzortzinis, Shahrukh Islam, Simos Gerasimidis, Sergio Breña
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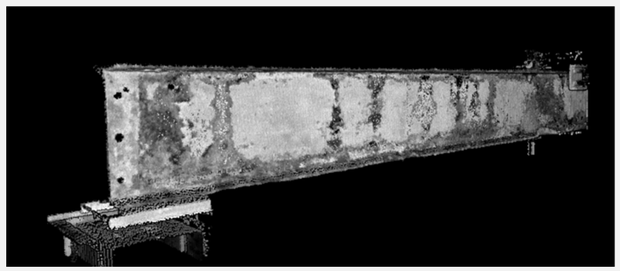
ABSTRACT

Infrastructure deterioration is a major problem facing the entire United States and the world. Across New England's steel bridge structures, water and de-icing agents causes significant structural deterioration in the form of beam end corrosion. This project represented a comprehensive assessment of corroded beam end inspection and remaining capacity evaluation in the New England region.

The first task of the project was to collect and compile bridge inspection reports and compare the corrosion patterns across the New England States. Following this task, corroded bridge girder specimens were selected from existing structures to be documented and experimentally tested for their remaining capacity in the structural testing facility at UMass Amherst. The final goal of this project was to evaluate the load rating procedures across all the New England states and recommend updates to the procedures based on our experimental and analytical results.



ACKNOWLEDGMENTS

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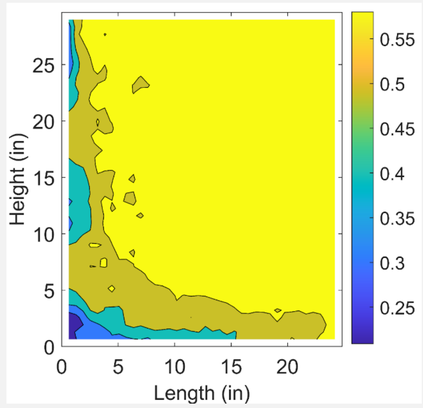
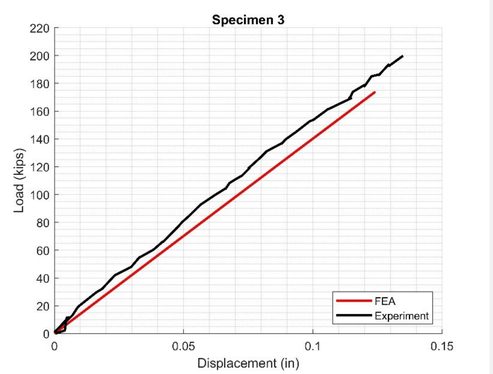
DATA

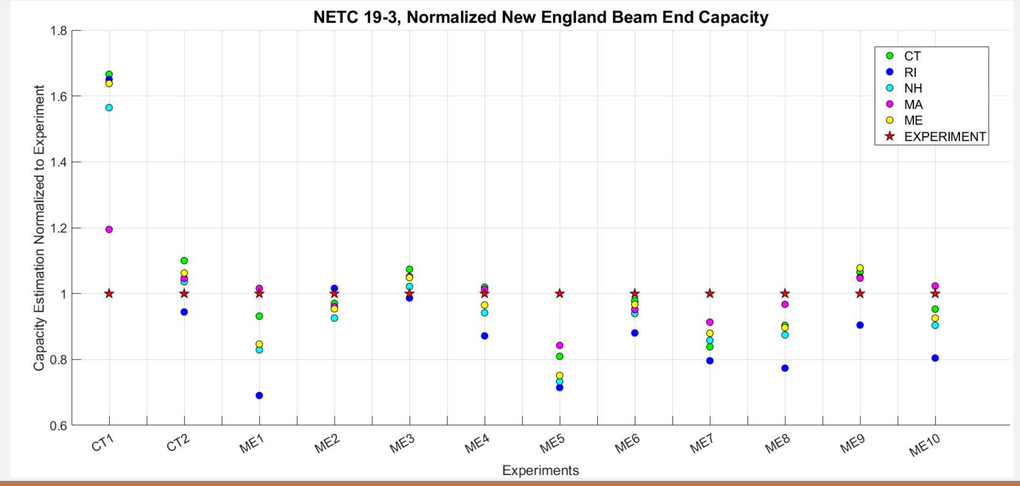
3D scanning and in-house developed algorithms allowed the team to capture section loss profiles. The beam specimens were loaded to test their remaining capacity. Using additional in-house made algorithms, the section loss profile was input into ABAQUS to replicate the experiment via finite element analysis.





ANALYSIS

Each corroded beam end was documented and tested like the specimen above. Following this, the team used each of the New England state's capacity provisions for corroded ends to evaluate their accuracy against experimental results. For each of these evaluations, the 3D scanning data captured made it very easy for the team to calculate the average thickness in the critical region of the beam end. The graph to the right shows the performance of these state provisions normalized to the experimental results.



CONCLUSIONS

There were many conclusions drawn over the study that spans from inspection techniques, to evaluating corrosion, to load rating evaluation. The research team found that beam specimens from the same bridge exhibit similar corrosion profiles. By scanning the ends, the resulting data allowed the team to evaluate each state's capacity estimation methods for corroded beam ends. After conducting this analysis, the team found that the current MassDOT provisions based on past research provide the most comprehensive evaluation and most accurate predictions for the capacity of the corroded end specimens. Utilizing scanning technologies provides a fast and accessible way to capture vast amounts of detailed data. Additionally, implementing or updating each state's provisions to the most accurate evaluation methods would provide greater accuracy and certainty in the capacity estimation of corroded beam ends.