

Buckling Reliability of Deteriorating Steel Beam Ends

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ABSTRACT

Deterioration of steel beam ends due to deicing media is a common problem in colder climates. A primary effect of this deterioration is a reduction in the buckling capacity of the steel beam due to thinning or loss of the web section above the bearing plate. Consequently, this can result in the need to post a reduced allowable load for a bridge possibly resulting in economic losses for nearby industries. It is the authors experience that when faced with this problem, a department of transportation structural analyst may make overly conservative assumptions. These assumptions may result in the posting or even closure of a bridge when it may not necessary. This paper presents the method and results of an alternate reliability-based damage assessment procedure using 1.) existing truckload data recorded at 42 weigh-in-motion (WIM) sites throughout the U.S. state of Michigan as the load and 2.) a detailed finite element model to determine the resistance of the section to buckling. A case study is presented for a selected bridge and varying levels of deterioration are modeled to examine the effect of web thinning on point-in-time (PIT) structural reliability index estimates, which are presented in chart format. Potential applications of such charts are qualitatively discussed including 1) reliability-based damage identification, 2) maintenance scheduling, and 3) integration into lifetime reliability models.
