Evaluation of Member Level Redundancy in Built-up Steel Members

Robert J. Connor
Professor, Lyles School of Civil Engineering
Director of S-BRITE Center
Purdue University

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129 DeBartolo

Built-up steel girders were a primary fabrication method used for bridges until the early 1960’s. Many bridges in the transportation inventory from this era consist of built-up two-girder systems. Because built-up members are mechanically fastened instead of welded, there is a discontinuity between individual components. There is ample anecdotal evidence which illustrates that these members have significant ability to resist crack propagation from one component to another and therefore are able to resist complete member fracture in the event that a single component suddenly fractures. However, due to the lack of experimental and analytical evidence, current regulations require that built-up members be conservatively considered susceptible to catastrophic failure in the event of a single component failure and prohibit member-level redundancy from being explicitly exploited in design or evaluation. Recent experimental testing on large-scale bridge girders shows that for members with typical proportioned components, failures of a single component does not propagate into adjacent components. Further, guidance has been developed on how to evaluate built-up members to ensure appropriate application of member-level redundancy and set a rational inspection interval.

Dr. Connor has over twenty years of experience in the fatigue and fracture evaluation of steel bridges. He is currently a Professor in the Lyles School of Civil Engineering and Director of the S-BRITE Center at Purdue University. During his career, he has researched fabrication flaws, fatigue cracking, and brittle fractures, and developed repair strategies for structures for a variety of agencies including state DOT, rapid transit authorities, construction companies, and structural consultants.