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# Evaluation of Bolted Single Support Bar Modular Bridge Joint Systems for Infinite Fatigue Life under Simulated Vehicular Loading

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## Abstract

Infinite life fatigue resistance of bolted single support bar modular bridge joint systems (MBJS) was recently evaluated by testing full-scale MBJS subassemblies at the ATLSS Engineering Research Centre of Lehigh University. The test results demonstrated that with adequate bolt pretension, the infinite life fatigue resistance of CB-SB connections in SSB MBJS can be classified as AASHTO Category B. The current AASHTO Specifications classify this detail as Category D. Based on analytical and experimental studies, revisions to the existing AASHTO Specifications for MBJS were proposed.

**Keywords:** modular bridge expansion joints; fatigue; infinite life; full-scale testing; AASHTO specifications

## 1 Introduction

Modular bridge joint systems (MBJS) are especially susceptible to fatigue damage as they undergo cyclic loading from each axle of crossing vehicles, requiring infinite life design. The most fatigue critical detail within a MBJS, as noted from observed cracking in field installations and surveys of bridge owners [1], is the center beam (CB) to support bar (SB) connection. A MBJS can be a single support bar (SSB) system, where each CB is supported by every SB employing a bolted (Figure 1) or welded stirrup connection, or a multiple support bar (MSB) system, where a cluster of SBs is provided at each support for the CBs, with each CB welded to a single SB in each cluster. The MSB systems are more common in the United States, primarily due to the lesser specified fatigue resistance of CB-SB bolted stirrup connections used in SSB systems that was based on limited laboratory fatigue testing in the finite life regime [1], where fatigue cracking from bolt holes was observed. The SSB systems, however, have demonstrated successful long life performance in Europe and other continents. Accordingly, the infinite life fatigue performance of SSB systems was evaluated and compared with the existing specifications in an elaborate research program as presented herein.

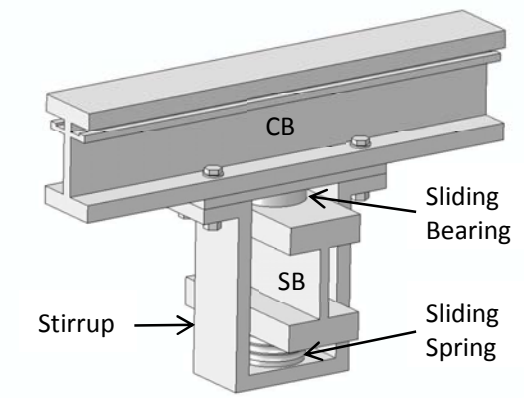


*Figure 1. Bolted CB-SB connection schematic*

## 2 Analytical Studies

A three-dimensional Finite Element Analysis (FEA) of a MBJS subassembly was performed to investigate the behaviour and response characteristics of the system under specified



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