

ABSTRACT

This project continues the research sponsored by the Project Division of the Iowa DOT and the Iowa Highway Research Board which addresses the numerous bridge problems on the Iowa secondary road system. It is a continuation (Phase 2) of Project HR-382 in which two replacement alternatives (Concept 1 - Steel Beam Precast Units and Concept 2 - modification of the Benton County Beam-in-Slab Bridge (BISB)) were investigated.

Work continued on both of the replacement alternatives in this study, the results of which are presented in two volumes. This volume (Volume 2) presents the results of Concept 2 - Modification of the Beam-in-Slab Bridge, while the continued work on Concept 1 - Steel Beam Precast Units is presented in Volume 1.

In previous research (HR-382) an alternate shear connector (ASC) was developed and subjected to static loading. In this investigation, the ASC was subjected to cyclic loading in both push-out specimens and composite beam tests. Based on these tests, the fatigue strength of the ASC was determined to be significantly greater than that required in typical low volume road single span bridges.

The ASC was also used in the full-scale composite beam specimens tested to determine their service load behavior, ultimate strength and fatigue strength. Two of the specimens had inverted T-beams and one was constructed with an I-beam. Two full-scale two-beam specimens - representing possible bridge systems - were constructed and tested to determine their strength and behavior. These specimens also used the ASC. One of the specimens was very similar to the Canadian steel free deck system, the other - a concrete arch system - was essentially the BISB with concrete removed from the tension side and composite action added.

In all of these tests, the ASC was effective in creating full composite action during the service load tests. None of the specimens experienced a bond failure when loaded to failure. Both the steel-free deck system and concrete arch system - with the ASC for composite action - were determined to meet AASHTO strength and serviceability requirements and thus are viable low volume road bridge systems.

Each of the systems previously described are relatively easy to construct. Use of the ASC rather than welded studs significantly simplifies the work, equipment, and materials required to develop composite action between the steel beams and the concrete deck.