

Developing Short-Span Alternatives to Reinforced Concrete Box Culvert Structures in Kansas

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Introduction

Concrete box culvert floor slabs are known to have detrimental effects on river and stream hydraulics. Consequences include an aquatic environment less friendly to the passage of fish and other organisms. This has prompted environmental regulations restricting construction of traditional, four-sided box culvert structures in rivers and streams populated by protected species. The box culvert standard currently used by the Kansas Department of Transportation (KDOT) is likely to receive increased scrutiny from federal and state environmental regulators in the near future.



Additionally, multiple-cell box culverts present a maintenance challenge, since passing driftwood and debris are frequently caught in the barrels and around cell walls. As more structures reach the end of their design lives, new solutions must be developed to facilitate a more suitable replacement. Since construction can cause significant delays to the traveling public, systems and techniques that accelerate the construction process should also be considered.

Project Description

This report documents development of a single-span replacement system for box culverts in the state of Kansas.

Project Results

Solutions were found using either a flat slab or the center span of the KDOT three-span, haunched-slab bridge standard. In both cases, the concrete superstructure is connected monolithically with a set of abutment walls, which sit on piling. The system provides an undisturbed, natural channel bottom, satisfying environmental regulations.

While both superstructural systems were found to perform acceptably, the haunched section was chosen for preliminary design. Rationale for selection of this system is explained. Structural modeling, analysis, and design data are presented to demonstrate viability of the system for spans ranging from 32 to 72 feet. The new system is expected to meet KDOT's needs for structural, environmental, and hydraulic performance, as well as long-term durability.

Project Information

For information on this report, please contact Dr. Robert J. Peterman at the Kansas State University Department of Civil Engineering; 2133 Fielder Hall; Manhattan, Kansas 66506; 785.532.7612; bob@ksu.edu.

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