



Concrete slab bridges are a cost-effective option for short-span crossings and standard bridge design plans can increase cost savings for the counties that build them.

# RESEARCH SOLUTIONS

## Exploring standard plans for short-span concrete slab bridges for Iowa counties

Faced with thousands of aging short-span bridges that will eventually need to be replaced, Iowa bridge engineers seek efficient and cost-effective solutions. To avoid excessive stream disturbance, Iowa DOT recognized short-span concrete slab bridges as a potential alternative to concrete box culverts and box beam bridges. Though the agency has standard plans for three-span concrete bridges, none existed for single-span bridges. Understanding needs, characteristics, and costs of building concrete slab bridges was an important step for the development of standard bridge design plans.

### THE NEED

Iowa is home to more than 12,000 bridges that are less than 70 feet in length. Of these, about 30% were built prior to 1960 and will likely need replacement in the near future. Recent federal requirements to minimize stream disturbance make concrete box culverts a problematic alternative. Concrete slab bridges

can be a cost-effective option to box culverts or steel beam bridges for shorter stream crossings.

Iowa DOT has standard plans for three-span continuous concrete bridges that are between 70 and 150 feet long but not for shorter, single-span bridges. While counties have been building short-span

concrete-slab bridges on a case-by-case basis, standard plans would save time and money on design and construction. Iowa DOT wanted to understand best practices, preferred characteristics, costs, and benefits of short-span concrete slab bridges to inform the development of standard designs.

(continued)



**“Standard plans for short-span concrete slab bridges will be a big help—and provide savings on design and construction costs—for the counties who build and maintain them.”**

**— BRIAN MOORE,**  
Iowa DOT Secondary Roads Research Engineer

## RESEARCH APPROACH

An inventory of short-span bridges in Iowa identified structure types and characteristics. Examining the designs of three existing concrete slab bridges, investigators identified variations in skew, slab thicknesses, and reinforcement patterns. A review of bridge design manuals and standards plans of other state departments of transportation (DOTs), primarily those in the Midwest, identified a range of existing standard short-span bridge designs.

Iowa county engineers answered survey questions about preferred short-span bridge features including abutment types, railing types, and maximum span length. Responses also included construction methods and cost information, as well as opinions concerning the benefits and drawbacks of concrete slab bridges.

Preliminary analysis determined the appropriate concrete slab thickness and reinforcement requirements for different span lengths and roadway widths. Based on these criteria, estimated costs of material and labor for concrete slab bridge construction enabled a comparison with the costs of other short-span bridge types. Lastly, investigators produced initial design criteria for developing short-span concrete slab bridge standard plans and recommendations to move forward.

## WHAT IOWA LEARNED

Most of the 64 county engineers who responded to the survey wanted short-

span concrete slab bridge standard plans. Just over half reported they currently build single-span bridges under 60 feet long, though bridge types and costs varied considerably. Preferred abutment types, skews, and railings differed among engineers, indicating ranges the design standards might include.

Reported advantages of short-span concrete slab bridges compared with concrete box culverts included less right of way requirements, improved hydraulic performance, and less debris that culverts typically catch. Disadvantages identified by the survey included the need for guardrails and potentially longer construction time. Additionally, some respondents raised cost concerns related to the need for concrete falsework.

Short-span concrete slab bridges are widely used by other states. At least four state DOTs—Kentucky, Ohio, Texas, and Wisconsin—have standard plans, providing examples of skew ranges, span lengths, and railing types.

The costs to build short-span slab bridges are competitive with concrete box culverts and are less expensive than box beam bridges. Recommending Iowa DOT proceed with developing standard bridge plans, investigators identified the slab thicknesses for span lengths up to 50 feet and suggested design criteria include specifications for:

- Skews between 0 and 45 degrees.
- Open concrete bridge rails, single slope barriers, and side-mounted

guardrails.

- Integral and high abutments.

## PUTTING IT TO WORK

Standard bridge plans for single-span concrete slab bridges will be a valuable tool for cost-effective replacement of aging short-span bridges. Iowa DOT and researchers have begun a second phase of this project to develop the final design standards for cast-in-place single-span concrete bridges.

## ABOUT THIS PROJECT

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**PROJECT CHAMPION:**  
**James Hauber, P.E.**  
Bridge Rating Engineer  
Iowa DOT  
[james.hauber@iowadot.us](mailto:james.hauber@iowadot.us)  
515-239-1290

**TECHNICAL ADVISORY COMMITTEE:**  
Brian Moore and Steve Seivert.

**PROJECT MANAGER:**  
**Vanessa Goetz, P.E.**  
State Research Program Manager  
Iowa Highway Research Board  
Iowa DOT  
[vanessa.goetz@iowadot.us](mailto:vanessa.goetz@iowadot.us)  
515-239-1382

**PRINCIPAL INVESTIGATOR:**  
**Fouad Daoud, P.E., S.E.**  
WHKS and Company  
[fdaoud@whks.com](mailto:fdaoud@whks.com)  
641-423-8271

**IOWA DOT RESEARCH:**  
[iowadot.gov/research](http://iowadot.gov/research)  
[ideas.iowadot.gov](http://ideas.iowadot.gov)

