

# MOUNTAIN-PLAINS CONSORTIUM

RESEARCH BRIEF | MPC 20-415 (project 351) | June 2020

## Evaluation of Cost Effectiveness, Performance, and Selection Criteria for Concrete Structures



### the **ISSUE**

State and local governments must address the ongoing need for replacement of short span concrete structures. The structure types used as replacements should be cost effective considering the life-cycle cost of the structures. There has not been a systematic study on the long-term cost effectiveness of different short span concrete structures.

### the **RESEARCH**

Collection and analysis of the cost and performance data for existing short span concrete structures on the South Dakota roadway system was conducted with the help of the South Dakota PONTIS database system. However, the PONTIS database does not have any cost- or maintenance-related information. Bidding records stored by South Dakota DOT were also integrated in the data collection effort for this project, which include both the hard-copy bidding records for projects before 1995 and electronically stored cost records for newer projects. Most of these records kept by DOT only represent state-owned structures. Information on locally owned bridges and culverts was gathered through a survey of county superintendents. The long-term performance of existing concrete structures was investigated through survey of owners, inspectors, and designers. A field trip to a representative bridge and culvert was conducted to record performance problems in detail. A recommendation based on summarized data was made at the end of the project.



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North Dakota State University  
South Dakota State University

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### Project Title

Concrete Structure Design  
Alternatives for Rural State  
and Local Roads

### Sponsors | Partners

USDOT, Research and  
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Administration

## the FINDINGS

It was concluded that the precast concrete culvert is a cost-effective option for structures shorter than 30 feet if the hydrological condition allows. A cast-in-place concrete slab bridge is a good option for longer multi-span applications because it eliminates the problematic joints. Prestressed tee bridges have consistent performance and cost-effectiveness for all span requirements over 30 feet. The newly adopted construction method using precast I girders with cast-in-place bridge decks shows superior performance and cost effectiveness at mid-to-long span applications when compared to prestressed tee bridge. However, both the I-girders with CIP deck and precast culverts have relatively short histories and track records in South Dakota. Their performance should be monitored closely in the future to verify their cost-effectiveness.

## the IMPACT

This research will help state and local agencies select the most cost-efficient options when replacing short span concrete structures.

For more information on this project, download the entire report at <https://www.ugpti.org/resources/reports/details.php?id=990>

For more information or additional copies, visit the Web site at [www.mountain-plains.org](http://www.mountain-plains.org), call (701) 231-7767 or write to Mountain-Plains Consortium, Upper Great Plains Transportation Institute, North Dakota State University, Dept. 2880, PO Box 6050, Fargo, ND 58108-6050.



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