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Project Title

Bridge Structure Alternatives for Local Roads

University

South Dakota State University

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Research Needs

South Dakota local governments own 1,959 bridges 40 feet or less in length and nearly half need replacement soon. The South Dakota Department of Transportation's Local Government Assistance office provides local government access to federal funding, technical expertise, and administrative assistance with bridge replacement projects, but current funding limits only allow assistance with approximately 30 bridge replacements statewide per year. Local government bridge replacement projects funded with federal aid must comply with current SDDOT design standards and federal regulations. Some federal requirements significantly increase a project's construction time and cost, but if federal funds are not used, short span bridge projects could waive some requirements and potentially have significantly lower cost without compromising safety, structural capacity, or durability.

Due to current federal funding limitations and increasing replacement needs, local governments are forced to make selective replacement decisions and delay many other bridge replacements by imposing load limits and closing bridges. Once the Local Government Assistance office has helped program a local bridge in the Statewide Transportation Improvement Plan (STIP), there is up to a ten year wait before a bridge will be replaced. Many bridges cannot wait for replacement without forcing local government decision makers to post load limits or close bridges. Local governments have an immediate need for low life-cycle cost bridge replacement alternatives.

Knowledge of available alternatives and construction planning processes could enable South Dakota local governments to replace more structurally deficient local bridges with limited funds. Research is needed to develop guidance identifying applicable South Dakota local government bridge construction techniques, materials, and construction planning and administration process requirements to enable South Dakota local governments to more efficiently and cost effectively replace short span bridges.

NCHRP Report 327, Cost-Effective Practices for Off-System and Local Interest Bridges, provides insight into the current condition of local bridges, maintenance and rehabilitation practices, bridge replacement alternatives, and construction administration used across the United States. The Minnesota Local Road Research Board synthesis TRS 1203, Innovative Bridge Construction for Minnesota Local Roads, explored several recent Minnesota projects outlining accelerated bridge construction techniques that offer

potential construction schedule and cost savings. The Iowa County Engineers Research Focus Group has multiple reports outlining techniques that have proved beneficial in Iowa. Little work has been done to identify bridge construction techniques, materials, and construction planning and administration process requirements for South Dakota local government bridges. These reports will be one of the main focuses for literature review in this study.

In South Dakota, Grant County has experienced success replacing short span bridges without federal aid, averaging three low-cost replacements per year with their in-house bridge construction team. Many techniques used in Grant County could be performed by local contractors throughout South Dakota. Developing guidance for available local bridge construction alternatives, construction planning, and administration processes may hold considerable potential for South Dakota local governments to economically replace structurally deficient short span bridges. Interviews with Grant County officials will also be an important aspect of data collection for this project.

Research Objectives

1) Develop a catalog describing locally available bridge construction techniques and materials that can be performed by local contractors and local government workforces.
2) Develop construction planning and administration process guidance for local government bridge replacement.

Research Methods

Through extensive literature review of research articles, reports, and existing practices within and outside South Dakota, a comprehensive list of short span bridge construction techniques that are suitable to implement at local government level will be established. The list will only include alternatives that are achievable through local contractors, and provide useful information regarding each alternative, including approximate cost, equipment and site requirements, and existing experiences.

A thorough review of federal and local regulations on construction planning and administration related to local bridge replacement will be conducted. A guideline document will be developed to help local officials decide viable funding mechanism for bridge replacement projects. The guideline will also help decision makers to identify low-cost alternative replacement method when it is applicable.

Expected Outcomes

A guideline for using different materials and methods local government bridge projects will be developed based on performance and cost-effectiveness. This information will allow local governments to more efficiently use limited local and federal funding available for bridge replacements. Results are anticipated to increase replacement of structurally deficient bridged on the South Dakota local road system.

Relevance to Strategic Goals

The expected outcomes of this project are directly related to the following goals: 1) State of good repair and 2) Economic competitiveness.

Educational Benefits

This project will provide a valuable learning experience to one undergraduate or graduate student. Results from the study can be incorporated into a training workshop for local government officials.

Work Plan

1) Through literature review and surveys of other DOT's local government assistance offices, identify low life-cycle cost, innovative bridge construction materials and techniques that perform well and are applicable in South Dakota.
2) Identify construction techniques and materials available by contacting fabricators, suppliers, and the South Dakota Associated General Contractors Structures Task Group.
3) Develop a catalog describing construction techniques and materials applicable to local government bridge construction that can be constructed by local contractors and local government forces in South Dakota.
4) Summarize installation, durability, maintenance needs, and any pertinent factors associated with catalogued construction techniques and materials applicable to South Dakota local government bridge construction.
5) Estimate agency costs of materials and techniques described in the catalog.
6) Identify the construction planning and administration process requirements allowing local governments to replace structures without SDDOT assistance by interviewing the Grant County Highway Department, SDDOT Local Government Assistance office, and Federal Highway Administration Bridge personnel.
7) Develop a simple evaluation procedure—including a checklist of construction planning and administration process requirements—to allow selection of the appropriate construction techniques and materials for local government bridges.
8) Prepare a final report and executive summary of the research methodology, findings, conclusions, and recommendations.

Project Cost

Total Project Costs:	$50,000
MPC Funds Requested:	$22,500
Matching Funds:	$27,500
Source of Matching Funds:	South Dakota DOT

Project Duration

15 months

TRB Keywords

Bridge girders; Short span bridges; Bridge selection.

References

[1] American Association of State and Highway Officials (AASHTO) (2010) "AASHTO-LRFD Bridge Design Specifications" Fifth Edition. Washington, D.C.

[2] Klaiber F.W., Wipf T.J., and Russo F.M. (2004) "Cost-Effective Practices for Off-System and Local Interest Bridges, Synthesis 327" Transportation Research Board, Washington DC.

[3] Minnesota Department of Transportation (2012) “Innovative bridge construction for Minnesota local roads” Minnesota Department of Transportation, St. Paul, MN.