

**South Dakota Department of Transportation
Request for Proposals
Project SD2022-07**

Title: Measurement and Correction of Warp and Curl in Jointed Concrete Pavement

Problem Description: Warp and curl in Jointed Concrete Pavement (JCP) arise from interactions among factors relating to design, materials, construction, and environment. Warp, generally associated with moisture gradients in pavement slabs, typically curves slabs concave upward, while curl, generally associated with temperature gradients, typically curves slabs concave downward during the day and upward at night. The magnitude of curvature can vary by season and time of day but typically grows steadily for years after construction.

Warp and curl reduce ride quality and can shorten the service life of the pavement. Although warp and curl are sometimes detected in SDDOT's annual automated condition surveys, the severity is not fully assessed, in part because of the seasonal and diurnal variation and in part because the International Roughness Index is more sensitive to roughness affecting passenger vehicles than roughness affecting trucks.

SDDOT attempts to restore smoothness to JCP road surfaces by diamond grinding but lacks a comprehensive approach. While grinding can significantly reduce roughness, it may not completely eliminate curl and warp or prevent their continued development. In an attempt to achieve the best results, SDDOT has tried a few test projects by grinding only during spring and fall, from midnight to 10 am when pavement temperatures are coldest, but these restrictions may not be optimal or even appropriate for every situation and may elevate the cost of the work.

To better manage its concrete pavements, SDDOT needs better methods to detect warp and curl, assess their severity, and devise effective, project-specific grinding strategies to reduce their impact on road users.

Importance: Smooth pavement is a major focus for the Department and is highly important to road users based on survey results. Rough pavement causes unnecessary pavement damage and prematurely wears out components on vehicles. A reliable method to smooth pavement with predictable and measurable results will help optimize the Department's investment in pavement improvement.

Urgency: This research should be a high priority. There is a high incidence of roads with warp and curl across the state. Developing an effective method to smooth these roads will benefit the Department by lowering pavement repair costs. Road users will benefit from smoother roadways and reduced vehicle repair costs.

Research Objectives:

- 1) Evaluate the effectiveness of prior SDDOT grinding projects, specifications, special provisions, and project-specific plan notes pertaining to warped and curled pavements.
- 2) Develop a method to identify warp and curl on JCP during the annual automated pavement condition survey.
- 3) Develop a method to analyze the severity of existing warp and curl in terms of impact to passenger and commercial vehicles.
- 4) Develop a method to predict the improvement achievable through grinding specific segments.
- 5) Develop a method to identify optimal grinding strategies for specific pavement segments, in consideration of the segments' progressive, seasonal, and diurnal warp and curl behavior.

Research Tasks:

- 1) Meet with the project's technical panel to review the project scope and work plan.
- 2) Perform an extensive literature and technology review pertinent to detecting, evaluating, and mitigating warp and curl in JCP, including consideration of environmental factors that affect pavement profile.

- 3) Design, for approval of the project's technical panel, a survey or interview procedure to query state highway agencies regarding methods for detecting, evaluating severity, and correcting warp and curl.
- 4) Submit and present to the technical panel a technical memorandum summarizing tasks 2 – 3.
- 5) Perform the survey or interview developed in task 3 and summarize the results.
- 6) Analyze available data and interview SDDOT personnel, trucking industry representatives, and grinding contractors to evaluate the constructability, cost, and effectiveness of projects ground under SDDOT's prior grinding specifications, special provisions, and plan notes.
- 7) Submit and present to the technical panel a technical memorandum summarizing tasks 5 – 6.
- 8) Propose and demonstrate a method to identify warp and curl using the existing SDDOT equipment during the annual automated pavement condition survey.
- 9) Propose and demonstrate a method to evaluate the impact on passenger and commercial vehicles of existing warp and curl and reduced warp and curl after grinding.
- 10) Submit and present to the technical panel a technical memorandum summarizing the results of tasks 8 – 9.
- 11) Develop a method to devise optimal grinding strategies for specific JCP segments, in consideration of their progressive, seasonal, and diurnal warp and curl behaviors.
- 12) Submit and present to the technical panel a technical memorandum summarizing the results of task 11.
- 13) In conformance with *Guidelines for Performing Research for the South Dakota Department of Transportation*, prepare a final report summarizing the research methodology, findings, conclusions, and recommendations.
- 14) Make an executive presentation to the South Dakota Department of Transportation Research Review Board at the conclusion of the project.

Potential Implementation: If this project is successful, SDDOT will be able to detect warped and curled pavement segments earlier, evaluate their severity in terms of impacts to passenger and commercial vehicles, devise effective project-specific grinding strategies, and predict the degree of improvement that grinding will achieve.

SDDOT Involvement: Staff of Materials & Surfacing, Project Development, Transportation Inventory Management, and some Area offices will be needed for interviews and to supply data from recent grinding projects. Onsite IRI data collection may be necessary by Materials & Surfacing and Transportation Inventory Management staff.

Available Funding: \$175,000 **Anticipated Start Date:** June 15, 2023 **Duration:** 24 months

Terms of Payment: Payment for study services will be made upon SDDOT's acceptance of key project deliverables. For this study, percentages of total project cost will be paid upon satisfactory completion of the following tasks:

Task	% of Total Cost
4	15%
7	20%
10	20%
12	15%
All Tasks	30%
Total	100%

General Information: The South Dakota Department of Transportation solicits proposals from colleges, universities, research institutes, foundations, consultants, federal, state, and local agencies, and others with demonstrated capability and experience in the subject area.

The South Dakota Department of Transportation provides services without regard to race, color, gender, religion, national origin, age, or disability, according to the provisions contained in South Dakota Codified Law (SDCL) 20-13, Title VI of the Civil Rights Act of 1964, the Rehabilitation Act of 1973, as amended, the Americans with Disabilities Act of 1990 and Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, 1994. Any person who has

questions concerning this policy or who believes he or she has been discriminated against should contact the Department's Civil Rights Office at (605)773-3540.

Proposals must remain valid for at least 120 days after the submission deadline. All submitted proposals become the property of the South Dakota Department of Transportation. SDDOT has the right to use all information presented in any proposal unless it is specifically annotated as being proprietary. SDDOT considers all information contained in proposals to be privileged and reserves the right to maintain its confidentiality.

South Dakota state statute requires the winning proposal, with proprietary information redacted, to be posted online along with the corresponding contractual agreement.

SDDOT reserves the right to reject any proposals submitted. SDDOT may negotiate with a selected proposer to address specific weaknesses in the selected proposal prior to contract award.

SDDOT is not responsible for any costs, including proposal preparation, incurred by researchers prior to the execution of a contract.

Certification Relating to Prohibited Entity: For contractors, vendors, suppliers, or subcontractors who enter into a contract with the State of South Dakota by submitting a response to this solicitation or agreeing to contract with the State, the bidder or offeror certifies and agrees that the following information is correct:

The bidder or offeror, in preparing its response or offer or in considering proposals submitted from qualified, potential vendors, suppliers, and subcontractors, or in the solicitation, selection, or commercial treatment of any vendor, supplier, or subcontractor, is not an entity, regardless of its principal place of business, that is ultimately owned or controlled, directly or indirectly, by a foreign national, a foreign parent entity, or foreign government from China, Iran, North Korea, Russia, Cuba, or Venezuela, as defined by South Dakota Executive Order 2023-02. It is understood and agreed that, if this certification is false, such false certification will constitute grounds for the State to reject the bid or response submitted by the bidder or offeror on this project and terminate any contract awarded based on the bid or response. The successful bidder or offeror further agrees to provide immediate written notice to the contracting executive branch agency if during the term of the contract it no longer complies with this certification and agrees such noncompliance may be grounds for contract termination.

Restriction of Boycott of Israel: For contractors, vendors, suppliers, or subcontractors with five (5) or more employees who enter into a contract with the State of South Dakota that involves the expenditure of one hundred thousand dollars (\$100,000) or more, by submitting a response to this solicitation or agreeing to contract with the State, the bidder or offeror certifies and agrees that the following information is correct:

The bidder or offeror, in preparing its response or offer or in considering proposals submitted from qualified, potential vendors, suppliers, and subcontractors, or in the solicitation, selection, or commercial treatment of any vendor, supplier, or subcontractor, has not refused to transact business activities, has not terminated business activities, and has not taken other similar actions intended to limit its commercial relations, related to the subject matter of the bid or offer, with a person or entity on the basis of Israeli national origin, or residence or incorporation in Israel or its territories, with the specific intent to accomplish a boycott or divestment of Israel in a discriminatory manner. It is understood and agreed that, if this certification is false, such false certification will constitute grounds for the State to reject the bid or response submitted by the bidder or offeror on this project and terminate any contract awarded based on the bid or response. The successful bidder or offeror further agrees to provide immediate written notice to the contracting executive branch agency if during the term of the contract it no longer complies with this certification and agrees such noncompliance may be grounds for contract termination.

Proposal Deadline: Proposals are due to the SDDOT by 5:00 pm CDT on Friday, March 17, 2023. This deadline is firm. Extensions will not be granted.

Proposals must be submitted as an e-mail attachment in Portable Document Format (PDF) not exceeding 14MB. The email must be addressed to michael.border@state.sd.us and andy.vandel@state.sd.us. Proposers should send the e-mail using “Delivery Receipt” and “Read Receipt” options to verify successful delivery.

Proposal Guidelines: Proposals must fulfill the requirements listed in the document entitled *RESEARCH PROPOSAL PREPARATION, SUBMISSION, AND EVALUATION* and dated October 28, 2022.

Proposal Evaluation: Proposals will be evaluated by a technical panel knowledgeable in the problem area. Selection will be made in consideration of criteria listed in *RESEARCH PROPOSAL PREPARATION, SUBMISSION, AND EVALUATION*.

Proposers will be notified of the results of the selection no later than May 31, 2023.

Project Management: Mike Border is responsible for the management of this project and can be reached at michael.border@state.sd.us to answer inquiries.