RESEARCH PROGRAMS USE ONLY
RESEARCH IDEA NO: **19-017**
DATE OF RECEIPT: **4/30/18**
TOTAL MDT COST W/ICAP: **$83,000**

RESEARCH PROGRAMS

STAGE 2: RESEARCH TOPIC STATEMENT[1]

Submit completed form to mdtresearch@mt.gov. All fields are required, except the last field: XVIII, Sponsor(s). Incomplete forms will not be accepted.

I. TITLE: Evaluation of Thin Polymer Overlays for Bridge Decks

II. TOPIC STATEMENT: Thin composite polymer overlays are a cost-effective method for extending the service life and serviceability of concrete bridge decks by filling concrete cracks and increasing skid resistance. The overlays are a thin (1/4 - 1/2 in.) layer polymer that seals existing cracks and is embedded with aggregate for wear and skid resistance. Based on a survey of all state transportation agencies, thin polymer overlays can provide a service life up to 25 years when constructed on a sound concrete deck (Fowler and Whitney 2011). The Montana Department of Transportation has recently observed varying performance of two different polymer overlay systems applied to three different bridge decks across the state. The two poorest performing bridge decks were located in Kalispell where below-standard skid resistance was measured after only two years.

RELATED RESEARCH SUMMARY FROM STAGE 1: Published field studies by state departments of transportation on the performance of thin polymer overlays have begun to identify specific products and contributing factors related to poor durability and skid resistance. The Oregon Department of Transportation (Soltesz 2009) evaluated eight different overlay systems and found three products wore through to the concrete surface after 1.3 million vehicles, and one product much sooner. For the five products that did not wear through, empirical equations predicted the skid resistance would match that of plane concrete after five months with an average daily traffic volume of 10,000 vehicles per day. The Wisconsin Department of Transportation completed a laboratory and field experimental program to compare the performance of nine different overlay systems (Tabatabai et al. 2016). From three types of aggregate considered, flint rock used with epoxy resin had the highest friction and best overall performance. The lowest friction values were obtained from calcined bauxite aggregate. In a synthesis of recently completed research, CTC and Associates (2012) reported six different states (MO, CA, IL, MI, UT, WY) have stopped using specific types of polymer overlay products where poor performance may have been influenced by traffic volumes, bridge type, and installation procedures. The Washington State Department of Transportation stopped using thin polymer overlays in certain locations after poor skid resistance was observed after only five years of heavy studded tire use.

CTC and Associates, L. (2012). "Ultra-Thin Concrete Polymer Concrete Overlays for Bridge Decks.", 17.

Fowler, D. W., and Whitney, D. P. (2011). *Long-term performance of polymer concrete for bridge decks*, Transportation Research Board.

Soltesz, S. (2009). "Evaluation of thin overlays for bridge decks." Oregon. Dept. of Transportation. Research Section.

Tabatabai, H., Sobolev, K., Ghorbanpoor, A., Nabizadeh, A., Lee, C.-W., and Lind, M. (2016). *Evaluation of Thin Polymer Overlays for Bridge Decks*, Wisconsin Highway Research Program.

RESEARCH PROPOSED: The proposed research is divided into four tasks that will be used to assess the performance of thin polymer overlays on concrete bridge decks in Montana. Task 1 is a literature review investigating the performance of different overlay systems reported by other state departments of transportation. A review of the four polymer systems on MDT's qualified product list and recent skid resistance data for two of these materials will be included. Based on this information, Task 2 will implement an expanded and focused field investigation to measure skid resistance and durability of selected polymer systems. Bridge decks included in the field investigation will represent geographic locations, traffic volumes, and deck conditions that have been reported in the literature to be most closely related to the performance of polymer overlay systems. The application of the polymer overlay systems selected for the field sites will be observed and documented to identify if construction factors are contributing to overlay performance. Task 3 will monitor the selected bridge sites for a minimum of 2 years through site observations, skid resistance and traffic volume data, and weather information (temperature, moisture/snow events). Task 4 will document the polymer overlay performance and contributing factors identified through the collected data

[1] Note: All research topics submitted become public property and submitters are not guaranteed to receive a contract for any work that may result from this topic statement.

for each bridge site during the two-year period. Results of the study will produce recommendations for polymer systems and locations appropriate for their use. Alternative concrete bridge deck maintenance procedures will be recommended for locations and traffic characteristics that are not well-suited for thin polymer overlays.

III. RESEARCH PERIOD (Time to complete research project.): Six months of literature review + 3 months of product installation + 2 years of monitoring = 2.5 years.

IV. IT COMPONENT: Identify if the project includes an IT component (purchasing of IT hardware, development of databases, acquisition of existing applications, etc.). If so, describe IT component in as much detail as possible.
N/A

V. FEASIBILITY, PROBABILITY OF SUCCESS, AND RISK: The feasibility of successfully completing the proposed research is high. Success will be realized by reduced bridge deck maintenance operations through selection of effective polymer overlay systems for geographic-specific bridge locations in Montana.

VI. URGENCY, IMPORTANCE, AND EXPECTED BENEFITS/PAY-OFF: Address urgency, timeliness, and importance of the research. Identify if the research is required for any federal or state initiative or compliance. This section must include a description of how this research will help to meet MDT's mission (i.e., serve the public by providing a transportation system and services that emphasize quality, safety, cost effectiveness, economic vitality and/or sensitivity to the environment).
This research meets MDT's mission by increasing the service life and quality of bridge decks through cost effective thin polymer overlay systems which require less maintenance and improved skid resistance for the travelling public.

VII. IMPLEMENTABILITY, IMPLEMENTATION PLAN, AND RESPONSIBILITY: Address the implementability of the expected results from the proposed project. Identify products that will enhance implementation. Identify any known implementation barriers and how these barriers might be eliminated or reduced. Identify MDT office or entity outside of MDT responsible for implementation. Describe initial implementation plan, include timeframe for implementation.
The anticipated product of this research will be an updated process for selecting and utilizing thin polymer overlays to increase the service life of bridge decks in Montana by sealing cracks and improving skid resistance. This effort will include recommendations to be used internally by MDT personnel to update its polymer overlay operations for specific geographic locations and bridge types. The implementation timeframe may be contingent on the process of adding new polymer overlay systems to the qualified product list.

VIII. MDT PRIORITY FOCUS AREAS: MDT may, as often as annually, identify priority research focus areas. These focus areas will be listed on http://www.mdt.mt.gov/research/unique/solicit.shtml**.** Curre tly, there are no priority focus areas.

IX. TOTAL COST ESTIMATE (If the project proposal comes in at a higher cost, it may require further approval and may be delayed.): $75,000

X. MDT FUNDING SOURCE (If MDT Research, enter SPR): SPR

XI. FUNDING MATCH SOURCE AND AMOUNT: N/A

XII. FUNDING PARTNER(S): N/A

XIII. POTENTIAL TECHNICAL PANEL MEMBERS (At this time, individuals do not necessarily need to be identified; rather, MDT offices and outside entities can be named. However, if known, individuals may be named): Bridge and FHWA

XIV. SUBMITTED BY:

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XV. CHAMPION: Must be internal to MDT, feel strongly that the research will benefit the Department, and is willing to chair the technical panel. Note: If a champion is not identified by you or Research staff, this topic statement will not move forward.

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XVI. SPONSOR(S) (optional): Must be internal to MDT (Division Administrator or higher) and willing to ensure implementation occurs, as appropriate. If a sponsor is not identified, this topic statement will not move forward.

NAME: Click or tap here to enter sponsor name.
TITLE: Click or tap here to enter sponsor title.
AFFILIATION: Click or tap here to enter sponsor affiliation.
ADDRESS: Click or tap here to enter sponsor address.
PHONE NO.: Click or tap here to enter sponsor phone number.
E-MAIL: Click or tap here to enter sponsor e-mail.