Research Need Statement 646

I. Need Statement Champions and Information

I.A. Need Statement Champion Information

I.A.1. First and Last Name of Research Champion: Tim Andersen
I.A.2. Research Champion's Office: MnDOT Materials & Road Research
I.A.3. Research Champion's Phone Number: 651-366-5455
I.A.4. Research Champion's Email: timothy.lee.andersen@state.mn.us

I.B. Research Co-Champion

I.A.1. First and Last Name of Research Co-Champion:
I.A.2. Research Co-Champion's Office:
I.A.3. Research Co-Champion's Phone Number:
I.A.4. Research Co-Champion's Email:

I.C. Research Needs Title (115 Characters): Improving and Developing Pavement Design Inputs and Performance Functions for Cold Recycled Pavement Layers in Minnesota

I.D. Project Sponsor: Joint MnDOT and Local Road Research Board

II. Research Need Background and Description

II.A. Research Need Background

II.A.1. Describe the problem or opportunity.

Current pavement design procedures, specifically those used in Minnesota, treat cold recycled pavement layers (such as, SFDR, CIR, CCPR) in same manner as aggregate bases, often with slightly increased stiffness. This is true for design procedures used by local agencies in Minnesota as well as MnDOT (MnPAVE). However, these layers usually perform as a bound material, not too dissimilar from asphalt concrete. Pavement test sections, such as MnROAD Cells 2, 3 and 4 have demonstrated that current pavement design approaches may be excessively conservative and may not provide sufficient structural capacity credit to cold recycled pavement layers. Further, hot-mix asphalt wear courses and cold recycled asphalt layers behave in a bonded fashion that significantly reduces fatigue cracking potential with hot-mix asphalt layers.

Current design methodologies treat recycled pavement layers to have a linear elastic response under traffic loading application. Nonetheless, the primary mode of failure for this type of materials is believed to be accumulation of permanent deformation, especially in the early curing stage of the material. For this reason, there is need incorporate necessary transfer functions in pavement design and analysis to improve reliability of rehabilitated pavement

designs. Several hundred miles of cold recycling is conducted in Minnesota each year, larger share on locally owned and managed roadways.

II.A.2. If applicable, describe how this project will build on previous research.

II.A.3. If applicable, include the title/s or previous research.

II.A.4. What is the objective of the proposed research?

The current analysis and design methodologies often result in significantly greater wear coarse thicknesses than necessary, this translates into substantial pavement rehabilitation costs and harm to environment. Lack of necessary equations and models increase risk of premature rutting failure of pavements with cold recycling. Due to these reasons, there is an urgent need to improve current pavement analysis and design methodologies, including MnPAVE, to appropriately treat cold recycled pavement layers. The research should undertake this task using a combination of in-situ field performance from case-studies as well as through use of existing pavement performance datasets.

III. Strategic Priorities, Benefits, and Expected Outcomes

Section III. is for MnDOT sponsored and co-sponsored projects only; all LRRB projects proceed to section IV.

III.A. MnDOT Strategic Priorities

Instructions: Briefly describe how the project aligns with the following MnDOT Research Strategic Priorities. Complete all that apply.

III.A.1. Innovation & Future Needs:

IIIA.2. Advancing Equity:

III.A.3. Asset Management: Current analysis and design methodologies often result in significantly greater wear coarse thicknesses than necessary. Lack of necessary equations and models increase risk of premature rutting failure of the cold recycled layer.

III.A.4. Safety:

III.A.5 Climate Change & Environment:

III.B. Expected Outcomes

Instructions: Check all expected direct outcomes of this research.

- ☒ New or improved technical standard, plan, or specification
- ☐ New or improved manual, handbook, guidelines, or training
- ☐ New or improved policy, rules, or regulations
- ☒ New or improved business practices, procedure, or process
- ☐ New or improved tool or equipment
- ☐ New or improved decision support tool, simulation, or model/algorithm (software)
- ☐ Evaluation of a new commercial product
- ☒ Other. Please specify below:

The benefit is to develop a recycled layer that will not rut or displace by construction or stopped traffic before the wear coarse is paved and still remain flexible. This should decrease the wearing surface thickness by about one inch based on experience.

III.C. Expected Benefits

Instructions: Select all expected benefits that may be realized if the findings and recommendations from this research is adopted or implemented

III.C.1. Construction Savings **Cost savings from reduced materials**

III.C.2.Decrease Engineering/Administrative Costs Choose an item.

III.C.3. Environmental Aspects Choose an item.

III.C.4. MnDOT Policy Choose an item.

III.C.5. Lifecycle Choose an item.

III.C.6. Operations and Maintenance Savings **Reduced materials used**

III.C.7. Reduce Risk Choose an item.

III.C.8. Reduce Road User Cost Choose an item.

III.C.9. Safety Choose an item.

III.C.10. Technology Choose an item.

III.C.11. Other, please describe below:

IV. Technical Advisory Panel

Instructions: Please list the name and affiliation of individuals to consider for the Technical Advisory Panel.

Terry Beaudry – MnDOT Grading and Base Unit

Raul Velasquez – MnDOT Research Unit

Industry Contractor

County Engineer

Consultant Engineer that does stabilized mix designs

MnDOT Materials Engineer

MnDOT Soils Engineer

Your assigned Project Advisor is available to answer questions and provide guidance (assigned by the Office of Research & Innovation).
Your Project Advisor is: Marcus Bekele, (651)366-3903, marcus.bekele@state.mn.us