IMPLEMENTATION PLAN AND PROJECT PROPOSAL

TITLE OF PROJECT:
Implementation of Recycled Unbound Base Material Properties for MnPAVE

PROJECT PROPOSED BY: Dave Van Deusen and Hyung Jun Ahn

POSITION AND MNDOT OFFICE OR DISTRICT: Office of Materials and Road Research, MnROAD Engineer

TOTAL BUDGET $75,000

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>AMOUNT</th>
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<tbody>
<tr>
<td>MnDOT State Research Funds</td>
<td>$</td>
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<tr>
<td>Office or District Funds</td>
<td>$</td>
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<tr>
<td>Federal SP&amp;R (___%)</td>
<td>$</td>
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<tr>
<td>LRRB</td>
<td>$</td>
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<td>Other:</td>
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OVERALL PROJECT SCHEDULE

DATE PLAN COMPLETED: March 2017 (allow time for review, approval and contract process)
PROJECT START DATE: July 2017
PROJECT LENGTH (MONTHS): 16 months

PROJECT OVERVIEW AND GOALS

Minnesota has a long history of using recycled materials in pavement construction. They have been utilized in all layers of the pavement, from the surface down to the unbound supporting layers. Accordingly, MnDOT performed several research studies to understand their material properties (e.g., strength, stiffness, unsaturated properties, etc.).

Although a set of default recycled material property (e.g., Cold-Inplace Recycling, Rubblized Concrete, etc.) inputs embedded in the MnPAVE are available for application, they cannot reflect the partial use of recycled materials in conjunction with virgin aggregate as base materials. Furthermore, the findings from the previous studies have not been fully utilized and implemented into MnPAVE software. There is a need for implementation of unbound and conventional base material properties into design procedures to better predict pavement performance in Minnesota.

The implementation of the locally-calibrated recycled unbound and conventional base material properties for MnPAVE will lead to a more cost-effective pavement design procedure in Minnesota. Furthermore, the successful implementation will ensure the service life of road infrastructure in Minnesota and lower road maintenance costs.

MnDOT PROJECT MANAGER OR TECHNICAL LIAISON
Dave Van Deusen
Office of Materials and Road Research
Maplewood, MN 55109
Dave.VanDeusen@state.mn.us
651-366-5524

APPROVALS

OFFICE DIRECTOR OR DISTRICT ENGINEER
Office or District: Office of Materials and Road Research
I hereby certify sufficient staff time will be scheduled for the Project Manager and staff to complete the project as outlined in the attached work plan, and commit any Office or District funds as listed above.

Signature of Office Director or District Engineer:

__________________________
Glenn Engstrom
Date:

DIRECTOR OF RESEARCH SERVICES SECTION
Approval of work plan and any MnDOT State Research Program funds as listed above.

Signature of the Director of Research Services:

__________________________
Date:
### IMPLEMENTATION PLAN AND PROJECT PROPOSAL
#### INNOVATION ROADMAP INFORMATION

1) **What are the expected benefits to MnDOT from implementing the results of the project? What is the impact on the department?**
   
   The implementation of the locally calibrated recycled unbound base material properties for MnPAVE will lead to a more cost-effective pavement design procedure in Minnesota. Furthermore, the successful implementation will ensure the service life of road infrastructure in Minnesota and lower road maintenance costs.

   **Decrease Lifecycle Costs**
   **Environmental Aspects (Pollution, hazardous waste reductions, recycling)**
   
   The quantitative benefits of using recycled materials can be estimated by conducting life-cycle analysis and life-cycle cost analysis on pavements consisting of conventional and recycled materials for a highway project in Minnesota. According to previous researches conducted on the benefits of using recycled materials can result in a life-cycle cost savings of 21%.

2) **What transportation problem is this project solving? What has been attempted in the past to solve this problem and what remains to be solved?**

   The transportation problem is the partial use of recycled materials in conjunction with virgin aggregate as base materials. There is a need for implementation of unbound and conventional base material properties into design procedure to better predict pavement performance in Minnesota.

   There are several research studies conducted to understand the performance of recycled materials in pavement construction; however, the findings from the previous studies have not been fully utilized.

3) **Additional information about the project and goals:**

   (Provided on page 1.)

4) **How does the proposed project build upon previous research? If further research is proposed, why does similar previous research not solve the Minnesota transportation problem being addressed and why is further research needed?**

   Improvement and Validation of Mn/DOT DCP Specifications for Aggregate Base Materials and Select Granular (MN/RC 2005-32)
   Resilient Modulus and Strength of Base Course with Recycled Bituminous Material (MN/RC 2007-05)
   Strength and Drainage in Aggregates Mixed with Recycled Materials (MN/RC 2009-32)
   Best Value Granular Material for Road Foundations (MN/RC 2012-01)
   Recycled Unbound Materials (MN/RC 2012-35)
   Recycled Materials in Unbound Aggregate Base Layers in Minnesota (TRS 1604)
   Forensic Studies on Cell 16-23 from MnROAD Phase II

5) **How will the results of the completed project be put into practice and deployed by MnDOT? Who needs to make a formal decision to implement and deploy, and who would be responsible for implementation and deployment?**

   A decision to implement and deploy rests with the MnDOT Pavement Engineer (Curt Turgeon).

   The project will develop the following end-user products:
   - Develop a new design process or method
   - Improve or modify an existing design method
   - Updated MnPAVE database and design manual
Technical advisory panel or project steering committee:
- Curt Turgeon
- Tim Anderson
- Terry Beaudry
- John Siekmeier
- Bruce Tanquist
- 1 Resident Engineer
- 1 District Materials or Soils Engineer
- 1 State Aid Engineer
- 1 Local Agency Engineer

MnDOT specialty offices:
- OMRR Pavement, Geotechnical, and Research Sections

MnDOT Districts and District functional groups:
- All Districts, Materials Engineers

Additional key practitioners or management champions:

Management group:
Practitioner committee:
- Materials Engineers Organization, informed by Dave Van Deusen

Other cooperating program or agency:

Other stakeholders:
- MnDOT State Aid Office

Others who may be interested, not listed above:
- Local Agency Engineers

MnIT involvement (software, data management, or technology devices): N/A

Items for State contract or Approved Products list: N/A

Intellectual Property or licensing: N/A

6) What future efforts or steps will be needed to derive full benefits from the expected results of this project?

MnDOT is committed to the following future steps:
- Update MnPAVE database
- Update Pavement Design Manual

7) Communication Plan

Catch phrase for marketing: MnPAVE Upgrade

Target audience for early communication (in addition to those named above): see TAP

Early Communication plan:
- Small group discussions
- Facilitated focus groups
- Online survey
- Videoconference meeting
Target audience for rolling out the innovation:
- MnDOT materials engineers
- City/county users of MnPAVE

Roll-out message, methods and activities:
- Presentation to a conference
- Presentation to a technical group
- Internal office meeting
- Webinar
- Workshops

Roll-out timing and responsibilities:
- Dave Van Deusen will get the word out
- These meetings, conferences, etc. are scheduled by others throughout the year

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**PROJECT WORK PLAN INFORMATION**

**BACKGROUND:** Include any background information or history pertinent to the project that has not been provided above.

**SCOPE:** Briefly summarize the scope of work of this project. This includes an overall description of how the project will be conducted. Please summarize coordination with other projects or other work that is necessary for completion of this project, such as specialized help or input including data, materials, equipment, facilities, etc.

Project Cost: $75,000
Project Length (months): 16 months including final report
The contractor will be selected between Braun Intertec and American Engineering Testing, Inc., as they are deemed to have expertise as well as previous research experience on this subject.
*Project cost and length are based on previous project and the scope. The proposed research project does not involve any field or laboratory testing.*

**TASKS:** List the major tasks in the sequence necessary to complete the project, including the elements listed below.

The tasks in the proposed scope of work include:

1. Based on the finding from the previous research studies and MnROAD/MnDOT Database, determine the resilient modulus values for Minnesota's recycled unbound base materials.

2. Verify and validate the predetermined resilient modulus input parameters that are accurate and representing actual conditions in the field.

3. Implement a comprehensive Minnesota recycled unbound base material resilient modulus data for input into MnPAVE.

4. Write draft report, TAP review, and final report publication.

**SCHEDULE SUMMARY:** List each task, start and end dates, or attach a Gantt chart.
16 months, task schedule TBD
# DETAILED BUDGET FOR ENTIRE PROJECT

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<th>DOLLAR AMOUNT (OMIT CENTS)</th>
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<th>FY 2018</th>
<th>FY 2019/20</th>
<th>TOTALS</th>
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<td>CONSULTANT, CONTRACTOR AND TESTING COSTS (list each contract and its expected cost)</td>
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<td>$5,000</td>
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<td>TOTAL PROJECT COSTS</td>
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<td>$5,000</td>
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## BUDGET BY SUMMARY TASK AND CONSULTANT/VENDOR:

(List task number and dollar value for each task in the work plan. If the project includes consultant contract or vendor P.O., provide breakdown of task budget. Insert additional rows as necessary.)

<table>
<thead>
<tr>
<th>Task Number</th>
<th>Task Description</th>
<th>Consultant, Vendor or Contractor Name</th>
<th>Cost</th>
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<td>1 – 4</td>
<td>TBD (Braun or AET)</td>
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## COMMENTS/JUSTIFICATION