

**State of Wisconsin/Department of Transportation**  
RESEARCH PROGRESS REPORT FOR THE QUARTER ENDING: March 31, 2007

<b>Program: TPF-5(119) FFY99</b>	<b>Part: II Research and Development</b>
<b>Project Title:</b> North Central Pavement Research Coordination Partnership (Frozen Four)	<b>Project ID:</b> 0092-06-40
<b>Administrative Contact:</b> James McDonnell	<b>Sponsor:</b> WHRP
<b>WisDOT Technical Contact:</b> Laura Fenley	<b>Approved Starting Date:</b> February 22, 2006
<b>Approved by COR/Steering Committee:</b> \$25,000 <b>Project Investigator (agency &amp; contact):</b> Hussain Bahia, UW-Madison	<b>Approved Ending Date:</b> February 22, 2008

**Percent Complete:** 60% for overall project

**Project Description:** The purpose of this pooled fund project is to maximize the coordination activities of four states in the upper Midwest. Those states include Wisconsin (the lead state), Minnesota, Michigan and Illinois. This purpose will be accomplished through three activities. Those activities are...

- 1) Development and maintenance of a Frozen Four website
- 2) Coordinate quarterly teleconferences
- 3) Coordinate face-to-face meetings

**Progress This Quarter:**

(Includes project committee mtgs, work plan status, contract status, significant progress, etc.)

A face to face meeting was held March 28 in Madison. The following topics were discussed.

- 1) This meeting marked the one year point for the group. The first topic of discussion was centered around what the group wanted to accomplish in year two of the pooled fund.
- 2) No quarterly teleconferences have yet to be scheduled. The reason for this is because it was decided by the group that the partnership should meet at least one more time in person to clearly define the tasks and the responsibilities for each partner necessary to make the project successful. It is expected that teleconferences will be held once the general operations of the program have been established
- 3) The details of the December 5 meeting have been posted on the Frozen Four website. The meeting minutes have also been attached to provide a detailed summary of the meeting. In summary, there were five major areas discussed:
  - a. General discussion of Goals for next year. It was decided that the group would focus on collaboration by facilitating communication between researchers investigating common problems in different states, share project data, and discuss topics of interest. It was also decided that a research symposium would be held by the group in the next year.
  - b. General update regarding ME Design Inputs/Implementation/Sensitivity Analysis Efforts. The meeting was well attended by state and university representatives. Discussion led to a need to share data in the results of our analysis to improve the robustness of models developed through the research and get a better grasp on how ME Design can be used by states
  - c. Common areas of interest: Specific areas of interest, not directly related to ME Design were defined and discussed. In addition a letter of support was sent by the Frozen Four with Michigan Tech's Proposal to the EPA focused on the application of recycled materials to pavements.
  - d. Analysis of the problem statement database. Analysis of the problem statement database was presented. The analysis will be reviewed by the Frozen Four members and developed into a final document. Analysis linking the Concrete Pavement Roadmap to completed and in progress research was completed and provided to the states as a tool. A similar analysis is underway for the Asphalt pavement roadmap.
  - e. Opportunities to expand the Frozen Four. It was decided that the Frozen Four would not be expanded at this time. The only state that will be solicited for participation is Iowa. Academia from all participating states will be invited to subsequent meeting. Industry will not yet be invited.

**Work Next Quarter:**

- 1) A well defined summary of the work required leading up to the next meeting can be found in the action items section of the attached meeting minutes. The next meeting will focus on discussion of collaboration activities, discussion of the research symposium, and application of the analyses of research and problem statement databases, and the Asphalt Roadmap.
- 2) No quarterly teleconferences have yet to be scheduled.
- 3) The next face-to-face meeting has been scheduled for June 12 in East Lansing, MI on the MSU campus.

**Circumstances Affecting Progress/Budget:**

None.

<b>Summary of Expenditures</b>	
<b>Annual Budget</b>	<b>\$25,000.00</b>
<b>Expense</b>	<b>Amount</b>
Other Expenditures	\$ (3,583.87)
Subconsultant Expenditures	(\$4,525.00)
<b>Total Expenditures</b>	<b>(\$8,108.87)</b>
<b>Remaining Budget</b>	<b>\$16,891.13</b>
<b>Percent Budget Used (FY 06)</b>	<b>32%</b>

<b>Summary of Other Expenditures</b>	
Domestic Travel	\$ 2,526.20
Indirect Cost	\$ 1,057.67
<b>Total Expenditures</b>	<b>\$ 3,583.87</b>

<b>Summary Subconsultant Invoices</b>			
<b>Invoice Number</b>	<b>Jrnl ID</b>	<b>Jrnl Date</b>	<b>Amount</b>
Purchase Order	PO00000080	10/18/2005	\$5,250.00
FF 2006-01	MW10731015	8/11/2006	(\$1,450.00)
FF 2006-02	MW12702006	12/5/2006	(\$2,125.00)
FF 2006-03	MW12702006	12/5/2006	(\$950.00)
		<b>Subcontract Budget</b>	<b>\$5,250.00</b>
		<b>Total Expenditures</b>	<b>(\$4,525.00)</b>
		<b>Remaining Budget</b>	<b>\$725.00</b>
		<b>Percent Budget Used</b>	<b>86%</b>

**Meeting Minutes**  
**North Central Pavement Research Coordination Partnership (Frozen Four)**  
**Engineering Centers Building 1045**  
**1405 Engineering Drive, Madison, WI**  
**December 5, 2006**

**Attendees:**

Mike Eacker	MDOT	Nikki Hatch	WisDOT
Ben Worel	MNDOT	Neeraj Buch	MSU
Roger Olson	MNDOT	Zhangping You	MI Tech
Bernard Izbekhai	MNDOT	Beth Hoy	MI Tech
Andrew Eller	MNDOT	Hussain Bahia	WHRP
Laura Fenley	WisDOT	Andrew Hanz	WHRP
Irene LeBarca	WisDOT	Pat Casey	CTC and Assoc.
Ann Pahnke	WisDOT	Matt Mullins	CTC and Assoc.

**I. Approval of December Minutes/Other Issues**

- Minutes were reviewed and approved pending a change to Bullet Point III for Michigan. Changed to Sensitivity Analysis is on-going. The minutes with these changes will be distributed.
- Other Issues: Due to staffing issues, Illinois needs to scale back their participation. They will remain involved, but IDOT personnel will not be attending meetings or contributing to tasks. They will participate by monitoring meeting minutes and submitted quarterly research summaries to Andrew. In a conference call with Ill DOT staff, it was indicated they are considering assigning a person from the university (UILUC) to attend the meetings on their behalf.

**II. General Discussion of Goals**

- What do we hope to accomplish in year two of the pooled fund?

A general discussion was held to discuss the goals of the group for year two. The discussion identified two distinct areas of interest:

- Start a small project as a Beta Test:
  - Use Frozen Four as a mechanism to share ME Design Inputs and run Sensitivity Analysis.
  - Coefficient of Thermal Expansion (CTE) – Round Robin Testing Program
- Focus on sharing information:
  - Don't need a project to be successful. Need to share information to help each other.
  - Hold a two day Research Symposium

After much discussion, it was decided that the following should be the focus of the group:

1. Assess and prioritize common research objectives. (Objective 3 on website).
2. Share and review the results of research projects of common interest. (Obj. 5)
3. Share issues, research needs, data, and solutions on an ongoing basis. (Obj. 8)
4. Focus on difficulties/interim findings of research in progress.

### III. General Update about ME Design Inputs/Implementation/Sensitivity Analysis Efforts

Each state gave a general update regarding their activities in quantifying ME Design Inputs, Sensitivity Analysis, and ME Design Implementation. Discussions were mostly centered on how the individual activities of each state could be better coordinated to benefit everyone. The following is a summary of the ideas discussed.

#### ▪ **ME Design Inputs**

- General discussion identified three common areas of interest for MI, MN, and WI. The following is a quick summary of the discussion for these areas:

##### 1. **Resilient Modulus ( $M_R$ ):**

- All states have past and/or research in progress looking at the  $M_R$  of both subgrades and bases. This presents an opportunity to pool test data for validation of models.
- MI and WI are both working towards use of  $M_r$  for Level 2 ME Design.
  - WI: Empirical model using physical soil properties to predict  $M_r$ .
  - MI: Regional  $M_r$  database.

##### 2. **Coefficient of Thermal Expansion (CTE):**

- WI has completed a study that catalogued CTE values for mixes using different aggregates in Wisconsin. There is interest by the department for to conduct more testing. Other states are interested in well in discussing/comparing test procedures used and sharing data.

##### 3. **Dynamic Modulus of HMA ( $E^*$ )**

- WisDOT has one project wrapping up (0092-04-07) and one starting on October 1 that will develop a catalog of  $E^*$  for common aggregate structures used in the state. Shong Tao Dai at MNDOT and Michigan Tech have also been studying  $E^*$ . Presents an opportunity for information sharing and analysis amongst researchers and group discussion with researchers and agencies to discuss plans for how the data will be used.

- **Action Item:** To start collaboration it was decided that all states would submit the names of the researchers and any reports/findings they have. Andrew will summarize the results of past research and ongoing efforts for the group. The researchers will also be contacted to ask if they would like more data to include in their analysis. An update of how this effort is progressing will be given at the next meeting.

#### ▪ **Sensitivity Analysis**

- The following researchers have been involved in past/current sensitivity analysis efforts:
  - MN: Lev Khazanovich – University of Minnesota (In-Progress)

- WI: Hussain Bahia and Teresa Adams – University of Wisconsin – Madison (Complete – Report will be distributed shortly)
- MI: Neeraj Buch: Michigan State University (In-Progress)

➤ **Action Items:**

- Andrew will work with the Frozen Four members to obtain methodologies and results from the studies listed above. The information will be summarized and presented at the next Frozen Four meeting. This will identify the different approaches used by each state to sensitivity analysis and examine if these approaches identified common inputs as sensitive.
- Summarize the challenges and recommendations for next steps from the researcher and distribute to the group. It is hoped that this will facilitate discussion between researchers.

▪ **ME Design Calibration**

- UW –Madison has developed a database that summarizes the ME Design Inputs and Pavement Performance Data necessary of for regional calibration of the performance models. WI asked if there was any interest from the group in maintaining this database.
- The comment was made that maintaining this database at a low level effort would be of great benefit to the group.
  - Academia: Yes this type of data is exactly what is needed for calibration.
  - Agency: Yes, but as a low level activity. Gathering the data is very time consuming. Need to be sure dataset is comprehensive and of high quality for it to be useful.

➤ **Action Items:**

- Andrew will review format of database and send out it to the Frozen Four Partners.
- Frozen Four Partners will review database and send comments back to Andrew.
- Andrew will address the comments and the decision will be made if everyone would like to continue populating the database.

▪ **MEPDG Implementation**

- Wisconsin currently has a contract with ARA Inc. to determine how to WisDOT should implement MEPDG. No other states have engaged in implementation activities, but are interested to see how it works for Wisconsin.

**IV. Common Areas of Interest – Opportunities for Partnerships**

- The group has previously identified common areas of interest, the following is a summary of discussion on how we can collaborate on these issues. For more information, please refer to the survey of common interest areas included in the meeting packet.
  - **White-Topping**
    - MN is the lead state for a pooled fund project “White Topping – Data Mining.” Has also developed in-house design procedures and special provisions for whitetopping projects.
    - TRB Synthesis on Whitetopping
    - WI study beginning on October 1, 2007.

- **Reflective Cracking/Pre-Overlay Prep/Rubblization**
  - **Reflective Cracking:** Big issue, but none of our states are working on it. Instead we are investigating ways to delay reflective cracking. Is Illinois doing anything to prevent reflective cracking?
  - **Pre-Overlay Preparation:** FFY 2008 Research Project for WisDOT (continuation of previous study). Wisconsin will summarize their current specification and modify the work plan for the upcoming research project to include a summary of practice for pre-overlay prep in all four states.
  - **Rubblization:** Recently completed research project by WI includes an Appendix with a recommended specification for rubblization. Will distribute for the group's information.
- **QC/QA of Unbound Materials**
  - All states use different criterion for in-place acceptance:
    - WI: Proof Rolling
    - MI: Nuke Gauge
    - MN: DCP
  - Research report from UM about Proof Rolling that WisDOT should use.
  - Lift Thickness: Planned WI Research project. As part of the research could summarize current specifications for each state.
- **Long Life Concrete Pavements**
  - MI is hoping to build one soon. WI and MN use similar pavements designs (more thickness, stainless steel dowels). MN also has experimented with hollow dowel bars.
  - Sources of Literature Available:
    - FHWA Reports
    - TRB Paper: Jeff Roesler – Univ. of Illinois
  - **Intelligent Compaction**
    - MN has been heavily involved in IC. Wisconsin is starting a project and should work with MN to obtain their intelligent compaction specification and related research reports.
- **Recycled Materials – (Newly Added to Topics of Interest)**
  - Discussed EPA Region 5 Open Solicitation to Address Recycling.
    - Michigan Tech has taken the lead and is planning on submitting a proposal with letters of support from MN and the Frozen Four.
  - In general more information is needed to determine how each state uses different recycled materials in pavements and bases and the effects of these materials on constructability or performance.

➤ **Action Items**

- Andrew will develop a summary and tracking system for collaboration to ensure all aspects of the discussion in meetings are considered and followed up on. Please suggest the addition of anything I may have missed to this section of the minutes.
- Upon approval of the summary, data collection and compilation will begin. Contacts will also be made to incorporate a summary of the practices of all states into upcoming research projects.

## **V. Review and Application of Problem Statement Analysis**

- Matt Mullins provided a summary of his efforts in categorizing the problem statements that were submitted by each state. Problem statements were categorized in efforts of finding possible opportunities for collaboration. It was decided that the summary table should be reformatted and the categorizing of projects reviewed by each state. Once the problem statements have been correctly categorized, links to past research will be made.

### ➤ **Action Items**

- Matt and Pat will work to refine the problem statement summary and categories.
- Draft will be sent to the states for review to ensure projects are in the correct categories.
- Data will be used in further analysis to be presented at next meeting.

## **VI. Concrete and Asphalt Road Map Results – Next Steps?**

- Application of the results of the Asphalt and Concrete Road Map analysis was discussed. The Concrete Road Map TSR was accepted and is now available for use by the states.

### ➤ **Action Items**

- Asphalt Road Map
  - Draft will be sent out to the states for review and comment.
  - Comments will be considered in final analysis.

## **VII. Opportunities for Expanding the Frozen Four**

- Frozen four expansion was discussed and it was decided to not attempt to solicit participation from the rest of the states in our AASHTO Region. However, it was decided that Iowa should be asked to join again immediately.
- It was also decided that the Frozen Four should try to organize a research symposium and invite researchers to discuss our topics of interest.

### ➤ **Action Items**

- Contact Iowa.
- Start planning symposium, discuss theme at next meeting.

## **VIII. Questions Posed by MN – Do other states have construction specs for:**

- Pervious HMA and/or PCC Pavements: Neeraj will send Ben contact information.
- Intelligent Compaction for HMA: None – WI hopes to get that out of an upcoming research project.

## **XI. Business Meeting**

The business meeting had two main agenda items:

- **Budget Update:** Andrew presented a budget summary reflecting our expenditures as of the December 5 meeting. Thus far we have spent 37% of the \$25,000 committed for year one of the pooled fund. The trend of the group not using the amount of travel funds budgeted continued. It was decided to give UW the flexibility to move funds from the travel budget to the pay CTC to perform more analysis. Any budget shifts will be cleared by the group before being executed.

- **Industry/Academia Involvement?:** It was decided that at the meetings will be open to academia, but at their own expense. Academia will be invited to participate in the discussions during the meeting, not be a separate agenda item. The meetings still will not be open to industry yet.

## X. Next Meeting

The next meeting will be held **on June 12, 2007 at the Dean's Conference Room on the Michigan State University Campus**. The following is a summary of the tasks we have for next meeting.

### 1. ME Design Input/Sensitivity Analysis/Calibration Collaboration

- Inputs:** States provide Andrew with researcher contact information and any reports/findings for the design inputs of interest by **April 30<sup>th</sup>**. Andrew will summarize results and contact researchers to see if they would like to collaborate. An update will be given at the **June 12<sup>th</sup> meeting**.
- Sensitivity Analysis:** MN and MI will send any interim, quarterly, or final reports for their projects to Andrew by **May 7**. Andrew will then summarize each analysis in terms of methodology and results. This analysis will be sent to the group by **June 6**.
- Calibration:** Andrew will send the database out for review and comment by **April 25**. States will submit comments back and notify Andrew if they are interested in maintaining the database at a low level of effort (one or two sections/year) by **May 14**. Comments will be summarized and the topic will be discussed at the next meeting.

### 2. Common Areas of Interest – Opportunities for Partnerships

- Andrew will use list created in final version of minutes to create a summary of collaboration activities discussed. A draft version of the summary will be sent out by **May 15<sup>th</sup>**.
- Once the list has been approved contacts will be made to begin compiling and sharing different resources from states. The possibility will also be explored to modify the workplans of researchers to include the state of practice for each member of the group. Progress/results will be presented in the **June 12<sup>th</sup> meeting**.

### 3. Concrete and Asphalt Roadmap Results

- Andrew will send out draft document to states by **April 19<sup>th</sup>**. Comments/revisions should be forwarded to Matt by **May 5**.

### 4. Opportunities for Expanding the Frozen Four

- Hussain and Andrew will contact Iowa by **May 14**.
- Everyone involved should begin thinking about Symposium regarding topics, timeline, location, etc.