Local Calibration of the MEPDG Using Pavement Management

FHWA Project DTFH61-07-R-00143

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Project Overview

1. Project Team
2. Project Objectives
3. Project Approach and Status
4. State Selection Process
Project Team

- **Prime - Applied Pavement Technology**
  - Katie Zimmerman, Principal Investigator
  - Tom Freeman, APTech Team Leader
  - Kurt Smith, Senior Engineer

- **Subcontractor – Stantec Consulting, Ltd.**
  - Khalad Galal, Stantec Team Leader

- **Subcontractor – Fugro Consultants, Inc.**
  - Mark Gardner, Fugro Team Leader
Project Objectives

- Establish a framework for collecting and storing data needed for calibration
- Demonstrate the application of the framework in one state highway agency
- Document the framework
- Develop outreach tools to disseminate research results
Project Approach and Status

Phase 1
Develop the Framework
Oct 2007 to Dec 2009

Phase 2
Conduct Outreach Activities
Jan to Mar 2010
Project Tasks – Phase I

A: Literature Review
   - Completed

B: Three State Selection
   - On-going

C: Preliminary Framework Development
   - On-going

D: Selection of a Single State
   - Summer 2008
Three State Selection Criteria

❖ Level of Commitment
  ○ Plans to implement MEPDG
  ○ Degree of commitment to implementation
  ○ Evidence of calibration activity

❖ Availability and Quality of Data
  ○ Design and performance data for all pavement types
  ○ Materials, traffic, construction, climate, and environmental data at levels 1 and/or 2
  ○ Data quality and objectivity
Three State Selection Criteria

- **Required Level of Effort**
  - Level of data collection intensity
  - Anticipated IT work required
  - Extent of effort to acquire additional data

- **Data Format**
  - Compatibility with MS Windows products for importing and exporting
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</table>
Three State Selection Process

- Selection criteria used to compare the eight state highway agencies evaluated by Hudson et al. in an earlier study
- Three states were recommended to FHWA for participation in the study
- Upon approval from FHWA, site visits will be made to each of the three states
- One state will be selected to demonstrate the calibration framework being developed
Results will be beneficial to other agencies as they begin to calibrate their models.
Making an Effective PMS for the MEPDG Implementation
Presentation Topics

- **Issues**
  - Database issues
  - Performance issues
  - Organizational issues

- **Recommendations**

- **Concluding Points**
**MEPDG requires detailed inputs:**
- Traffic
- Material characteristics
- Subgrade properties
- Construction considerations
- Climatic conditions

**Pavement management databases typically contain data used for network-level analysis:**
- Inventory information
- Condition data
- Last treatment summary
- Traffic data (or surrogates)
Project Versus Network Issues

Number of Assets

Level of Detail

Unreliable

Infeasible

Detailed Project Information

MEPDG

PMS

Project Selection Information

Program Development

From Hudson et al. DTFH61-05-C-00011
Database Issue – Availability

- Data used in pavement design are not always stored electronically.
- As-built construction data are not typically stored in an electronic format that is easily accessible.
- Maintenance and rehabilitation histories are not always available and may not be linked to historical performance data.
• Some agencies have difficulty linking data because multiple referencing systems are used.
• Performance data can not always be matched to test results for layer thickness and material properties.
• Maintenance data can not always be linked to pavement management sections because of the way it’s reported.
Distress definitions and measurement units for the MEPDG models may not match pavement management condition survey definitions or approach.

- MEPDG calibrated using LTPP Distress definitions
- Pavement management data may use different definitions
- Method of collection may impact results
- Survey approach may impact results
Performance Issue - Relevance

- MEPDG models predict performance that can not easily be collected as part of a network-level pavement condition survey
  - Rutting in individual layers versus total rutting
  - Top-down and bottom-up load-related cracking versus total load-related cracking
<table>
<thead>
<tr>
<th>MEPDG Distress Types</th>
<th>SDDOT Pavement Management Distress Types</th>
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<tbody>
<tr>
<td>Fatigue Cracking (top-down and bottom-up)</td>
<td>Fatigue Cracking (assumed to be bottom-up)</td>
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<tr>
<td>Thermal Cracking</td>
<td>Transverse Cracking</td>
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<tr>
<td>Permanent Deformation (rutting in AC layer and total)</td>
<td>Rutting (total rutting)</td>
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</table>
There are other considerations that may limit the usefulness of network-level survey results for establishing links to design, construction, and material data:

- Surveys may be conducted in one lane only.
- Location of samples may not be linked to other data properties.
- Only aggregated data for a section may be stored in the pavement management system.
- Deflection measurements not available at a network level.
- Pavement management typically uses family modeling approaches
- Calibration activities will require individual performance histories matched to specific inputs
Performance Issue - Preservation

- Preservation treatments are not yet incorporated into the MEPDG models
- Predicted performance assumes preventive maintenance treatments are not applied
Organizational Issues

- Breaking down stovepipes (organizational barriers)
- Closer coordination between pavement management and other agency functions
- Addressing referencing issues
Establishing Links To Data

- Traffic
- Design
- Pavement Management
- Materials
- Construction
- Maintenance
Recommendations

- Establish a multi-disciplined implementation team
  - Stay abreast of new developments
  - Define responsibilities
  - Define implementation approach & schedule
  - Identify data needs
  - Match data needs to existing data sources
  - Develop a plan for acquiring missing data
Recommendations

- Evaluate data requirements carefully
  - Conduct a sensitivity analysis
  - Develop recommended input levels
  - Evaluate strategies for acquiring missing data
  - Strive for using Level 1 and 2 data as much as possible
Recommendations

- Start slowly
  - Calibrate MEPDG models for the most common designs first
  - Consider regional calibration of models if designs are similar enough
Recommendations

- Develop a calibration database
  - Monitor pavements designed with the new MEPDG
  - Input design and as-built information immediately
  - Monitor load-spectrum information over time
  - Link to pavement management
  - Limit the number of times the same data are entered
Agencies Will Be Able to Better:

- Understand performance characteristics influencing pavement performance
- Predict the effect of changes in traffic, material, design, or construction on pavement performance
- Respond to anticipated changes in HPMS requirements
- Coordinate pavement design and management activities