National Pavement Management Conference

SESSION 1A: PMS TO SUPPORT THE NEW MEPDG

PMS Data Needs for MEPDG Calibration

by Pim Visser

PMS Data Needs for MEPDG Calibration

Based on FHWA Project "Using PMS Data to Calibrate & Validate the New Design Guide"

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Availability of Required Data in PMS and other Databases

DOTs Contacted

In first phase of project:

- Mississippi,
- Washington,
- Kansas, and
- Florida

As result of strong State interest project was expanded to include:

- North Carolina,
- Pennsylvania,
- Minnesota, and
- New Mexico

Project Timeline

- **Febr 2005 – Start of Project**
- **Nov 2005 – Visits to 8 States completed**
- **Aug 2006 – Final Report and Research Recommendations**
- **Sept 2006 – Webcast with Connecticut DOT**
- **May 2007 – Norfolk PMS Conference**

Input Parameters for MEPDG

1. **General Inputs:** Project name, ID, Dates, Design life, Limits & Reliability for Performance, Distress.
2. **Traffic Inputs:** Projected AADT, Growth, Volume adjustment, Axle load distribution, Etc
3. **Predicted Climate Inputs from ICM**
4. **Structural Inputs:** PCC design features, Drainage & surface properties, Layers, **Material properties,** Thermal cracking, Distress potential

A total of at least 150 parameters are required

Input Parameters for Calibration

1. **General Inputs:** Project name, ID, Dates, Design life, Annual Data on Performance, Distress, Deflection
2. **Traffic Inputs:** Annual data for AADT, Growth, Volume adjustment, Axle load distribution, etc
3. **Actual Climate Inputs from ICM**
4. **Structural Inputs:** Actual surface & drainage properties, Actual layer thicknesses, As-built & aged **Material properties,** Actual Thermal cracking

A total of several 100 parameters are required

Example for Asphalt Materials

- L1: Test Range of Dynamic Moduli E* for selected frequencies & temperatures, master curve at 70°F
- L2 & L3: Predict E* from mix gradation, voids, binder content and binder properties
- L1 & L2: Binder test data after RTFOT for
  - Superpave – test at 1 freq + range of 7 temps for G & δ
  - Conventional – 3 pen values and 3 viscosity values
- L3: Binder values estimated from viscosity or pen and R&B values using correlations (Nomographs)
- L1, L2 & L3: General properties
  - Reference temp, Poissons Ratio
  - Volumetrics, Thermal conductivity, Heat capacity

Synthesis of Findings from Eight State DOTs

One of the main challenges in using the MEPDG and validating and calibrating the design method and its various prediction models, is to access / collect / find / measure / organize the many input parameters for the system

Input Parameters from PMS

- Class, location, direction, design life, dates
- Performance – limits and reliability values
- Distresses – limits and reliability values
- Behavior, structural response (deflections)

Plus a Selection of Data for:

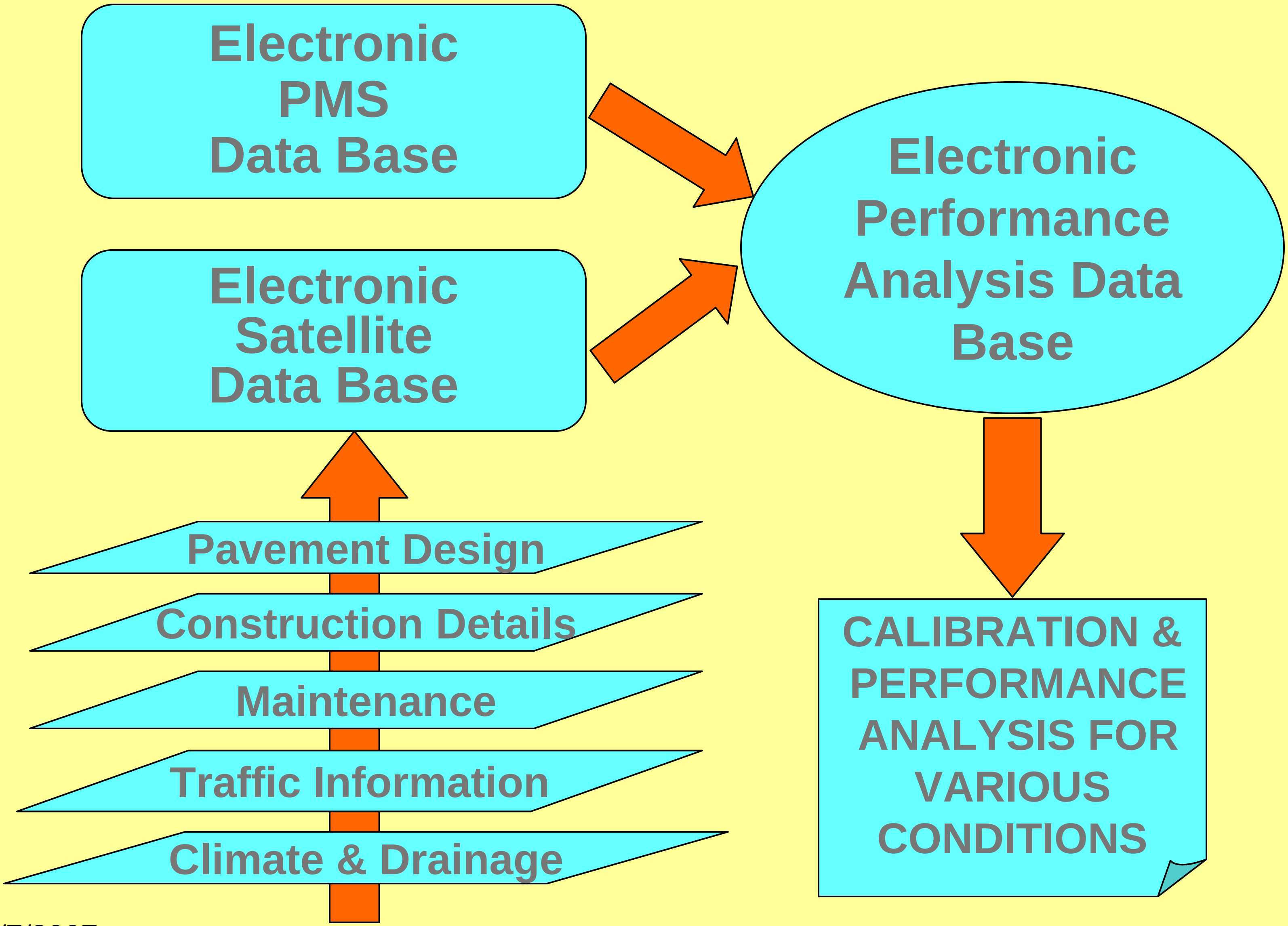
  - Materials characterization
  - Traffic and loads
  - Designed structure
  - As-built structure
  - Maintenance and rehab

Need for Satellite Database

To store and manage following pavement data:

- **Additional Pavement Management Data for Projects designed with MEPDG**
  - Compatible with existing PMS Data
- **Additional data used as design and as-built inputs from following sources:**
  - Traffic Section
  - Pavement Design Section
  - Materials Testing Section
  - Construction Section
  - Maintenance Section

Concept for Linking Databases



Purpose of Satellite Database

- Provide methodology to preserve and access relevant data for sections designed with MEPDG on a project-by-project basis
- Provide a more formal Interface for Pavement Management and Pavement Design
- Provide a mechanism for storing electronic materials, construction & maintenance data (designed & as-built) with annual follow-up as appropriate

Calibration/Validation

No need to supplement existing Sections. New data fields needed only for new Sections designed and built using the New Guide:

- Design values for all relevant parameters
- As-constructed values for the same parameters
- Annual measurements and records of traffic load spectra
- Maintenance activities
- Annual weather data or tie to NOAA

Advantages of Concept

- Existing pavement network used as Road Test:
  - Evaluate New Design methods, materials, techniques, etc
  - Produce more accurate Performance Prediction Models
- Pavement preservation done more accurately
- Data entered only once, and complete data set allows easier storage, retrieval, linking, analysis and reporting.

Matrix with State Findings

- **Matrix provides methodology to compare and summarize current efforts and capabilities of 8 states to implement & calibrate the MEPDG**
- **Rows cover desired & minimum input data levels and information from eight states**
- **Columns in the matrix represent groups of input parameters, current state plans & organization**

Rows in the Matrix

- **Column Headings with Input Parameters**
- **Desired Data Level**
  - Data used for initial pavement design
  - Data collected from as-built and from annual data on performance, traffic, climate, etc
- **Minimum Data Level**
  - Essential data required for calibration, at least Level 2
- **Eight Rows for Information from States**

Columns in the Matrix

- **Input parameters from PMS (9)**
- **Design- & Annual Traffic & Axle Loads (5)**
- **Structural Design and As-built Inputs (4)**
- **Unbound & Stabilized Materials, Designed & As-built (3)**
- **Bound Materials, Designed & As-built (2)**
- **Climate Data (3)**
- **State Plans for Implementation and Calibration (2)**
- **Current State Organizational Structure (1)**

Example of Matrix Column

Group	**Materials Data, Designed & As-built**
Subgroup	**Flexible – Asphalt Pavements**
Desired data level (DL)	General: layer thickness, unit weight, voids Poissons ratio, Ref.temp, therm.prop, etc Asph.binder: L1/L2 – Test data after aging Asph.mix: L1 – Test data of E*, etc
Minimum data level (ML)	General: as above Asph.binder: L3 – Superpave/conv/pen Asph.mix: L2/L3 – Correlate modulus, etc
Info from states	6 of 8 states at ML, 1 state no data available, 1 state developing db for E*

Existing Strengths

- **All eight states have an active Pavement Management System**
  - Performance and distresses are closely monitored
  - Deflection testing is increasingly used, mainly at Project Levels
- **States are increasingly storing materials data electronically**
- **Progress is being made with electronic storage of construction data**

Existing Challenges

- Several states monitor distresses only over a small area at the mile post
- Three states do not measure deflections at the network level
- Only one state is equipped to measure E*
- All states are using ESALs instead of Traffic Spectra
- None of the states have accessible data on as-builts
- Only 1 state has info on maintenance in PMS
- Most states do not yet store all data required electronically

Organizational Hurdles

- Resistance to organizational change
- Fear for loss of control at group levels in DOTs with integrated data collection
- Lack of funds and/or personnel
- Problems to standardize performance indices
- Fear that data are misused or that confidential data show up outside the DOT
- Resistance to shift from Mainframes to Servers by IT Department

Conclusions

- Most states do not yet store all data required for calibration of MEPDG electronically
- PMS database should provide essential data for use in MEPDG and calibration of models
- Additional data required should reside in Satellite Database, linked to PMS
- This will provide a mechanism for storing all required electronic data with annual follow-up as appropriate