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

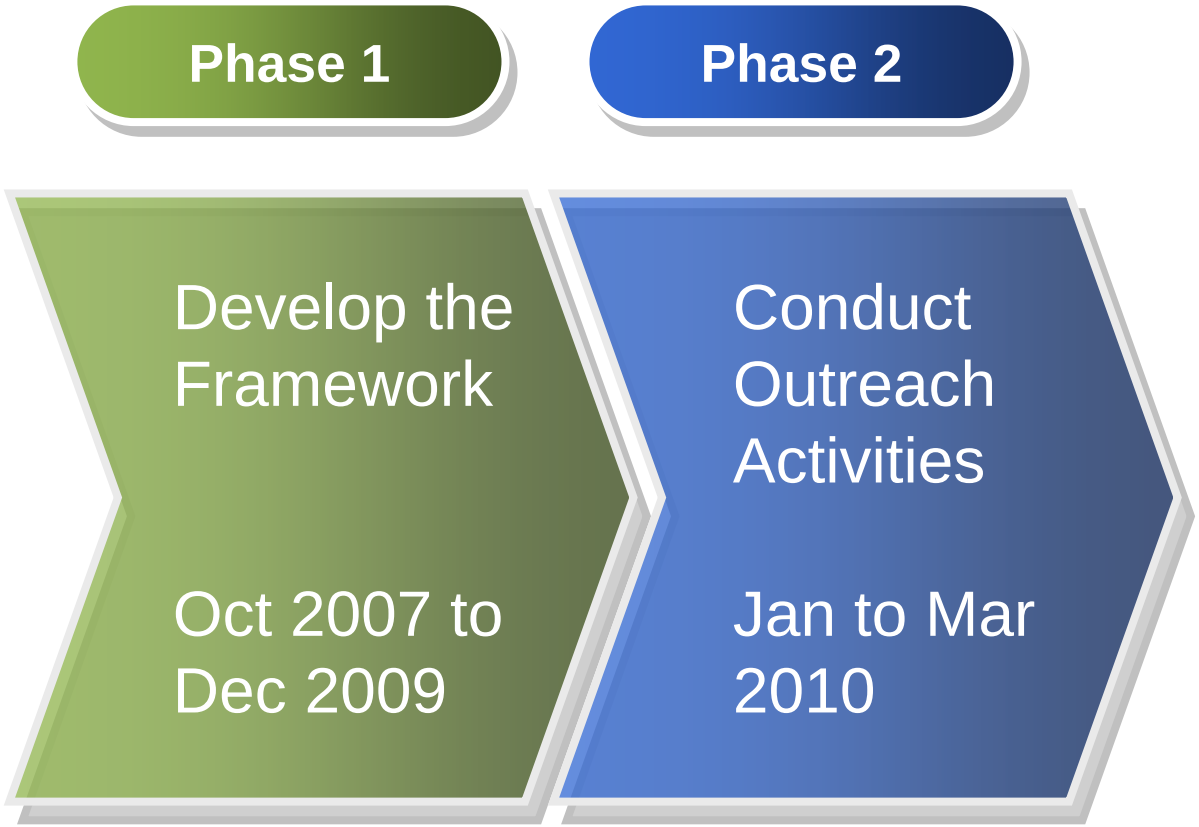
Project Team

- 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

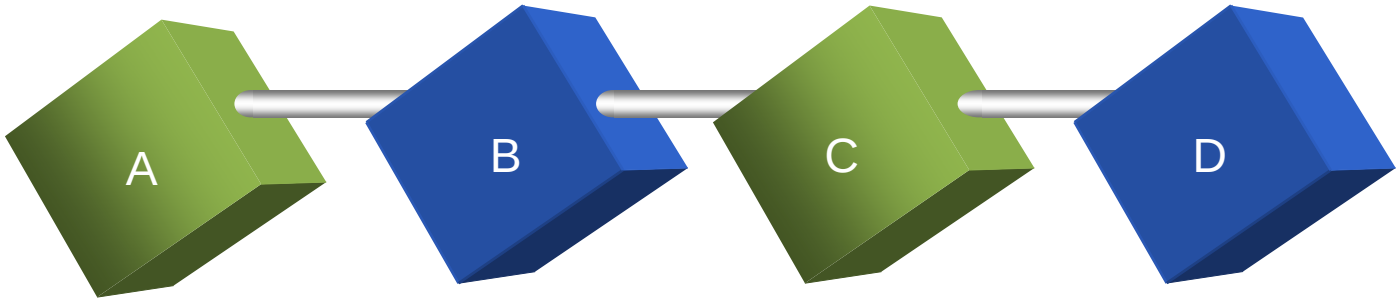
Project Objectives

- 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

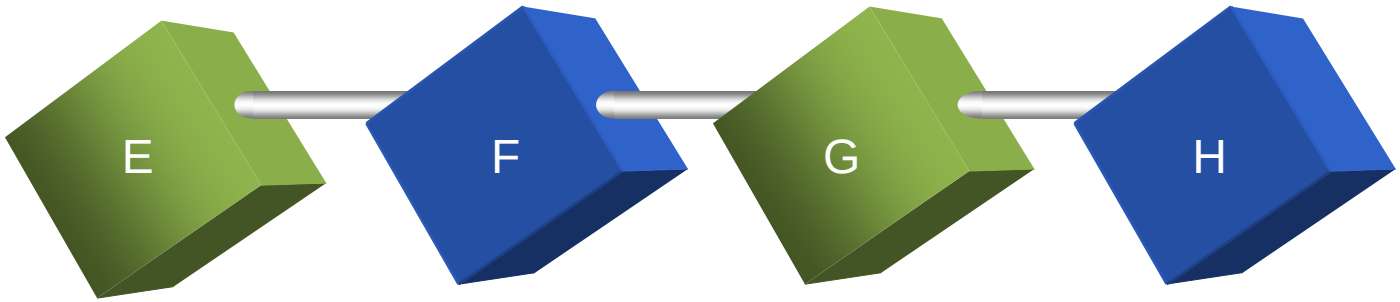


Project Tasks – Phase I



A	B	C	D
Literature Review	Three State Selection	Preliminary Framework Development	Selection of a Single State
Completed	On-going	On-going	Summer 2008

Project Tasks – Phase I (cont)



E	F	G	H
Final Framework Development Late 2008	Verification Summer 2009	Final Work Plan Implementation Fall 2009	Draft and Final Reports Late 2009

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

Selection Approach

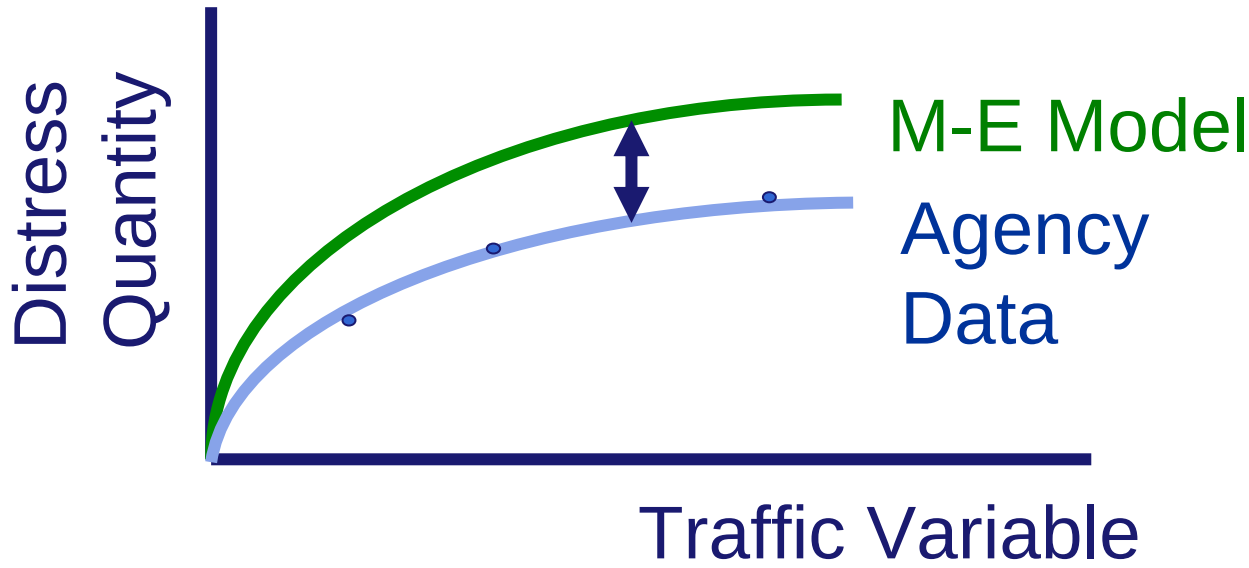
	Rating (1-10)	Weight	Individual Score	Category Score	Total Score
Category I		5		105	177
Item 1	5		25		
Item 2	9		45		
Item 3	7		35		
Category II		4		72	
Item 1	10		40		
Item 2	8		32		

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

Concluding Comments

- Results will be beneficial to other agencies as they begin to calibrate their models



Making an Effective PMS for the MEPDG Implementation

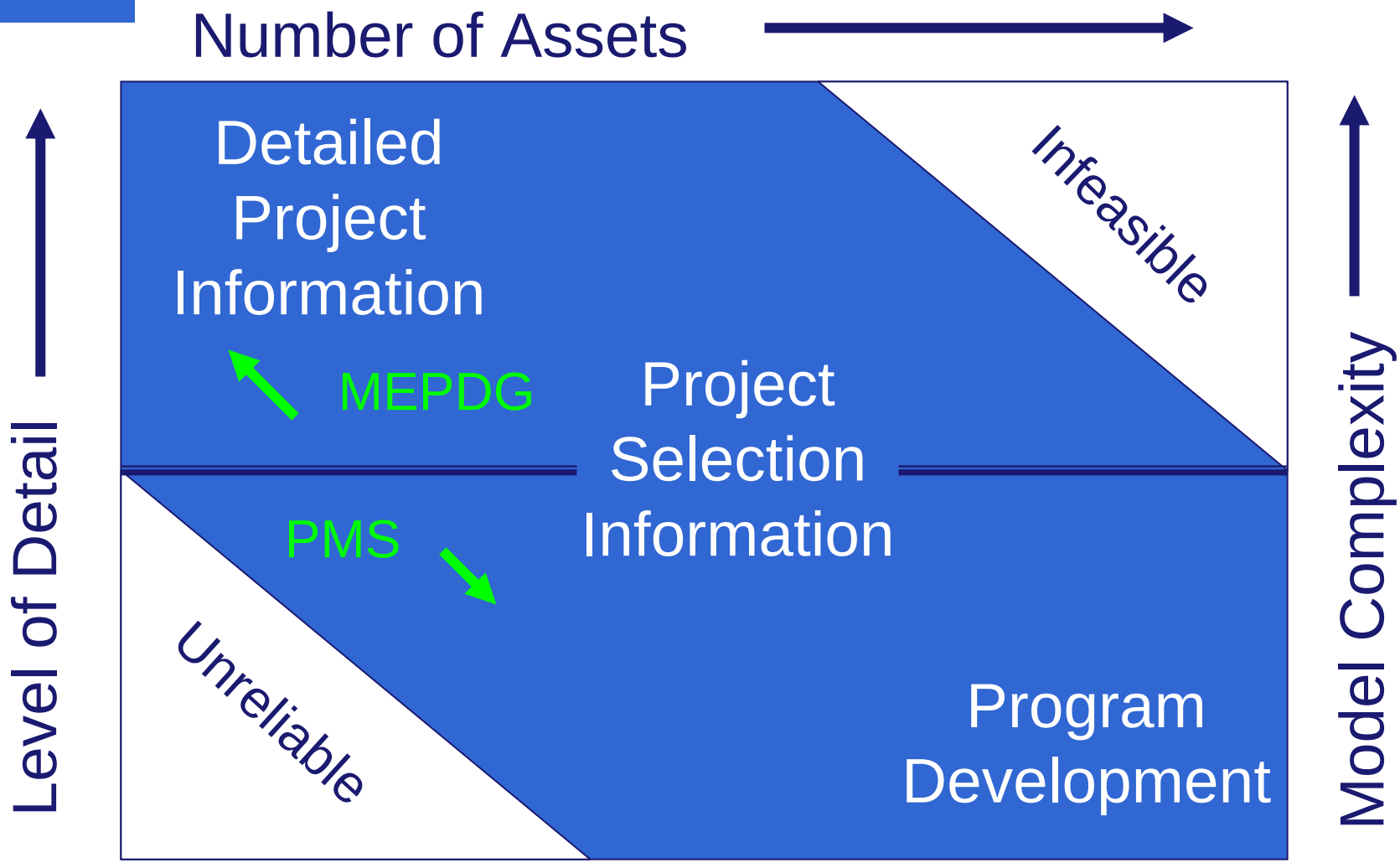
Presentation Topics

- Issues
  - Database issues
  - Performance issues
  - Organizational issues
- Recommendations
- Concluding Points

Database Issue – Level of Detail

- 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



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

Database Issue - Integration

- 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

Performance Issue - Definitions

- 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

Sample Comparison – Flexible

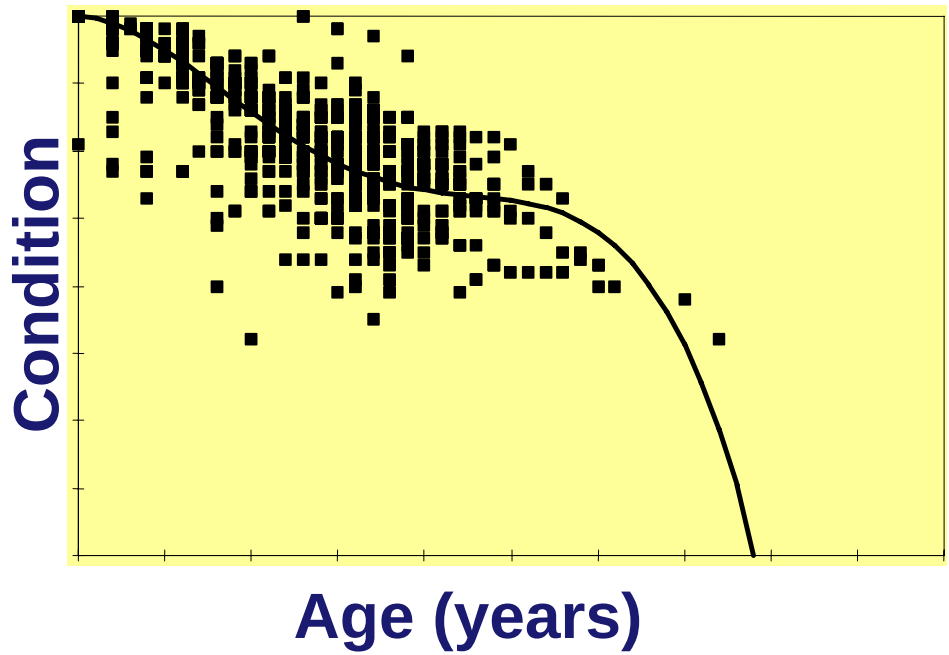
MEPDG Distress Types	SDDOT Pavement Management Distress Types
Fatigue Cracking (top-down and bottom-up)	Fatigue Cracking (assumed to be bottom-up)
Thermal Cracking	Transverse Cracking
Permanent Deformation (rutting in AC layer and total)	Rutting (total rutting)
IRI	IRI

Performance Issue – Survey Type

- 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

Performance Issue - Modeling

- Pavement management typically uses family modeling approaches
- Calibration activities will require individual performance histories matched to specific inputs



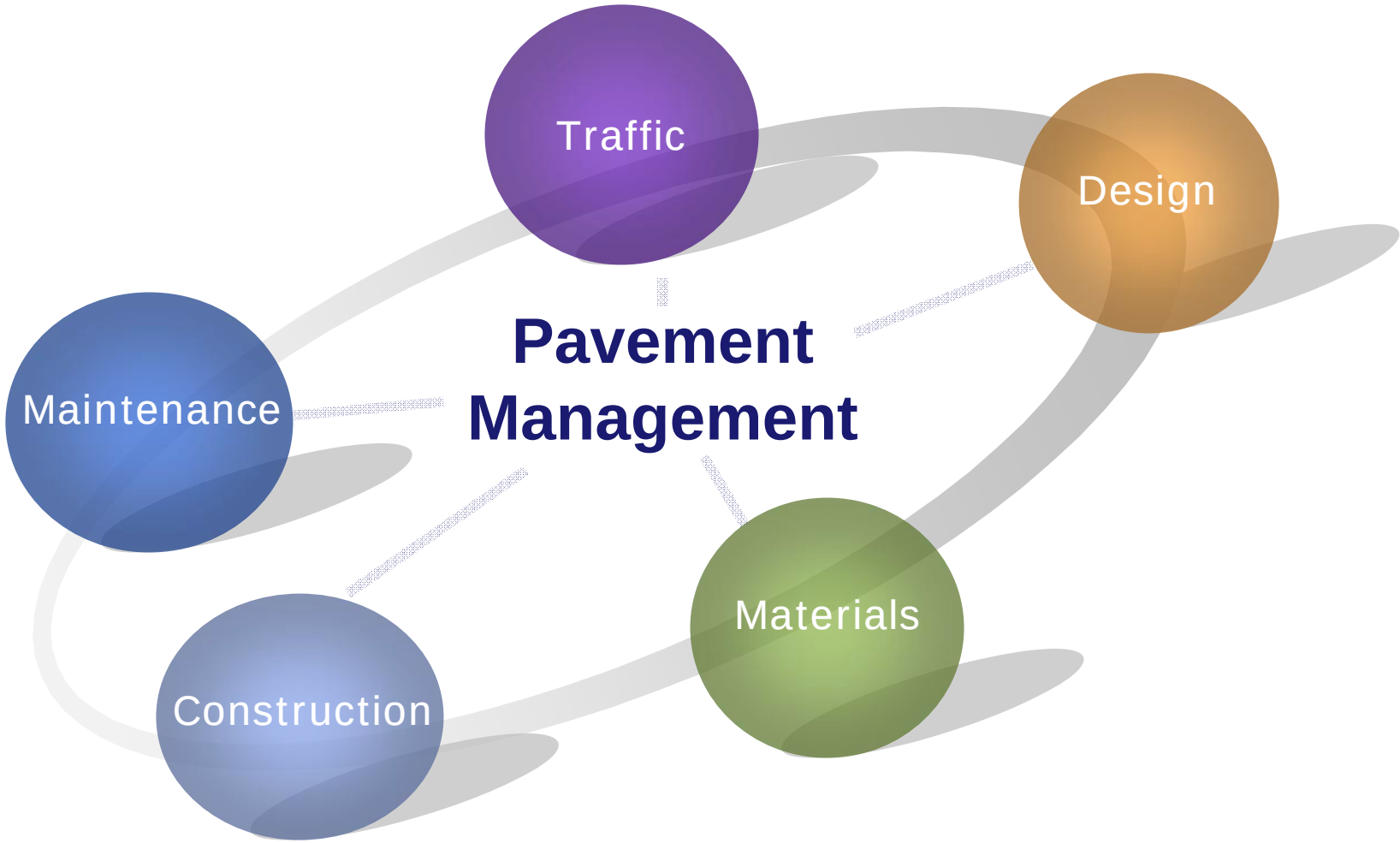
Performance Issue - Preservation

- 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



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