Driving Indiana's Economic Growth

2008 ROAD SCHOOL

MEPDG
For Local Governments
Development of the PDG

1. 2002 Pavement Design Guide
2. 200X Pavement Design Guide
3. 20XX Pavement Design Guide
4. MEPDG
**What Is It?**

- Climate
- Materials
- Traffic
- Structure

**Damage Accumulation**

**Time**

**Distress Response**

**HOW DOES IT WORK?**

**Inputs**

- Structure
- Materials
- Traffic
- Climate

Both mean and standard deviations inputs are required.

- Selection of Trial Design
- Structural Responses ($\sigma$, $\varepsilon$, $\delta$)
- Performance Prediction
  - Distresses
  - Smoothness
- Design Reliability

Performance Verification
- Failure criteria

Design Requirements Satisfied?
- No
- Yes

Final Design

Revise trial design
Primary Distresses in MEPDG

- Fatigue Cracking
- Cracking
- Thermal Cracking
- Longitudinal Cracking
- IRI
- Rutting

MEPDG DESIGN

- Level 1
  - Highest Reliability
- Level 2
  - Medium Reliability, but Practical
- Level 3
  - Default Values
Is it For Local Roads & Streets?

- **SUPERPAVE Lesson Learned**
  - Misunderstood in the Late 90’s
  - Meant for **ALL** Roads **NOT** Only Superhighways

- **MEPDG**
  - **ALL** Pavements
  - Structure is Designed for the Traffic, Climate, Materials, and Structure at the Site
**THICKNESS**

**Pavement Cross Section**

- **1.5”**
  - AC 1
- **2.5”**
  - AC 2
- **4”**
  - GB
- **4”**
  - GB
- **6”**
  - Compacted Subgrade

**Natural Subgrade**

**GWT 10 ft**

**Traffic**
TRUCKS

Traffic Mix & Classification

FHWA Vehicle Classes; 1 through 13
TRUCKS

Incremental Fracture Damage & Distortion

(Load-Related Cracking, Rutting, Faulting, Punchouts)

Climate

Weather Station

Precipitation
Temperature

Solar radiation
Wind speed
Relative humidity

Groundwater Table
Depth

PAVEMENT and SUBGRADE
Moisture gradients
Temperature gradients
Freeze/thaw cycles

MATERIAL PROPERTIES
Influence on layer stiffness
Materials

Pavement Cross Section

- 1.5" AC 1
- 2.5" AC 2
- 4" GB
- 4" GB
- 6" Compacted Subgrade
- 10" Natural Subgrade

GWT 10 ft
TREATED SUBGRADE

GRANULAR BASE
HOT MIX ASPHALT

Analysis

Climate Inputs → EICM → Material Properties

Predicted Performance → Transfer Functions

Mechanistic Analysis

Traffic
Structure

MECHANISTIC ANALYSIS

FLEXIBLE

Fatigue cracking
Thermal cracking
Permanent deformations
IRI factor

BRAND X

Faulting and fatigue cracking
Curling and warping
Drying shrinkage
Punchouts
IRI factor
Initial crack width

Structure

Pavement Cross Section

1.5"

2.5"

4"

4"

6"

AC 1

AC 2

GB

GB

Compacted Subgrade

Natural Subgrade

GWT 10 ft
Reliability

90 %

Vs

50 %

Freeze and Thaw

\[ M_r \] (psi)

Frozen State

Equilibrium State

Thawing

1 mil

32 k

16 k
FWD Testing

MEPDG Implementation

- major enhancement to current technology; however the technology is still evolving:
  - Do not expect perfect predictions
    - Need to locally calibrate to actual field performance
    - Need to have a well defined nationally coordinated approach to develop planned model enhancements
Why Local Calibration?

- Climate Regimes
- Construction & Material Specifications
- Maintenance/Preservation Strategies
- Policies

Calibration: Transfer Functions

- Pavement Response
  - Stresses
  - Strains
  - Deflections

- Pavement Distress
  - Fatigue Cracks
  - Rutting/Faulting
  - Thermal Cracks

Calibration is a key.
DARWin ME Development

- Transfer version 1.0 from NCHRP to AASHTO
- Release Darwin ME 2.0 - ?
  - Dependent on Issues Identified
  - Dependent on Funding Level

THE END

THANK YOU