Development of a National SPS-2 Pavement Preservation Experiment

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IGGA-- Director of Engineering and Research
ACPA—Director of Pavement Innovation
Why Concrete Pavement!
Bellefontaine, Ohio 1925

Main Street paved in 1890.
1st Concrete Street in America
Bellefontaine, O.
Bellefontaine, Ohio 2012

120 Years Old
Two Directional Texture
Purpose of Concrete Pavement Preservation

- Used early when pavement has little deterioration.
  - Repairs isolated areas of distress.
  - Repairs some construction defects.
  - Manages the rate of deterioration.
Full Depth Repairs
Slab Stabilization-Jacking
Joint and Crack Resealing
So Why A National SPS-2 Pavement Preservation Experiment
Why LTPP and Why SPS-2
Structural Factors for Concrete Pavements
LTPP’s GOAL is...

to provide answers to **HOW** and **WHY** pavements perform as they do!
Long Term Pavement Performance (LTPP)
Designed to Evaluate Relative Influence of 5 Design Factors and 3 Site Factors on Long Term Performance

- Concrete Thickness (8” & 11”)
- Base Type (LCB, DGA, PATB, PATB/DGA)
- Flexural Strength (550 & 900)
- Lane Width (12’ & 14’)
- Drainage (with and without)

Site Factors
- Temperature
- Precipitation
- Subgrade
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<tr>
<th>Drainage</th>
<th>Base Type</th>
<th>Thickness (mm)</th>
<th>14-day Flexural Strength (MPa)</th>
<th>Lane Width (m)</th>
<th>PCC</th>
<th>Climatic Zones, Subgrade</th>
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**SPS-2 Experimental Design Matrix**
### SPS-2 Experiment--What Really Got Built

#### Pavement Structure

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<tr>
<th>Drainage</th>
<th>Base Type</th>
<th>PCCP Thickness (inches)</th>
<th>Flexural Strength 14-D (psi)</th>
<th>Lane Width (ft)</th>
<th>Clastic Zones, Subgrade</th>
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#### Drainage Options
- **No**
- **Yes**

#### Base Type Options
- **DGAB**
- **LCB**
- **PATB**

#### Strength Options
- **Fine**
- **Coarse**

#### Lane Width Options
- **12 ft**
- **14 ft**

#### PCCP Thickness Options
- **550 inches**
- **900 inches**

#### Flexural Strength Options
- **8 psi**
- **11 psi**

#### Climatic Zones, Subgrade Options
- **WET**
- **FREEZE**
- **NO FREEZE**

#### Strength Levels
- **J**
- **K**
- **L**
- **M**
- **N**
- **O**
- **P**
- **Q**
- **R**
- **S**
- **T**
- **U**
- **V**
- **W**
- **X**
- **Y**
States with Seasonal Monitoring Sites
Test Section Layout

Base Types
- Dense Graded Aggregate Base (4" & 6")
- Permeable Bituminous Treated Base (4") Note: These are the only Sections with Edge Drains
- Lean Concrete Base (6")
- Bituminous Treated Base (4")

Shoulder Types
- 12 ft Shoulder Width
- 14 ft Shoulder Width

LTPP
- 900 psi Flexural Strength
- 550 psi Flexural Strength
- State Supplemental @550 psi Flexural Strength

Un Dowelled Sections
SPS-2 Test Section Layouts

Kansas

LTPP

213
600psi
Stab Base

210 211 212 208 207 205 206 202 201 204 203

Colorado

LTPP

216 213 214 215 218 219 217 220 224 221 222 223 259

CDOT Supp

650psi

North Dakota

Supplemental LTPP Supplemental LTPP Supplemental LTPP Supplemental LTPP

260 261 215 216 214 213 217 218 220 262 219 223 263 264 224 221 222 259
Turning Back Time on SPS-2
Map of SPS-2 Pooled Fund States
Some SPS-2 “Show Me Your DATA”
Lessons Learned from National Experiment

- Base Type Effects Resulting Distresses
- Widened Slab Improves Performance (13ft)
- Longitudinal Cracking Influenced by Base Type and thickness
- Thicker Slabs Resulted in More Initial Roughness than Thinner Slabs
- Sections with Drainage Exhibited Less Roughness Development than Sections Without Drainage
- 900 psi Sections Exhibited Map Cracking
- Most Distress Exhibited on Sections with LCB Base
What are the Opportunities--Design

- Validation of Design Procedures
- Consideration of Changes in Properties Over Time in the Design and Selection of Preservation Strategies
- Comparison of Doweled to Undoweled Performance
- Consideration of Texture Wear, Safety, etc.
Comparison of LTPP 550 and 900 Mix Cylinder Strengths at 28 Days
SPS-2 Friction Results

- 550 Mix
- 900 Mix
- R = Ribbed Test Tire
- S = Smooth Test Tire
- Longitudinally Tined

Friction (FN40)

- Delaware (1996)
- Michigan (1993)
- Wisconsin (1997)
- Iowa (1994)
- Kansas (1992)
- Arizona (1993)
- California (2000)
900 PSI Test Site
550 PSI Test Site Aggregate Armoring Effect
What are the Opportunities--Smoothness

- Impact of Initial Smoothness on Pavement Performance
- Impact of Design Features on Initial Smoothness and Rate of Progression of Roughness Development
- Increase in Fuel Consumption as a Result of Smoother Roads
- Improved Ride Quality Over the Project Life
Results of FHWA Study

- Initial Pavement Smoothness Does **NOT** Impact Long Term Roughness Progression (i.e. rate of increase) — Note Projects < 10 yrs
- Base Type Affects Both Initial Smoothness and Rate of Progression
- Rate of Increase Varies but Can Range Between 0.5 to 3 inches per year
- None of the Projects were Constructed with an Initial Pavement Smoothness Below 60 in/mi
NCC Survey of State Smoothness Specifications

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MRI/IRI (inches per mile)

100% Payment
Incentive Applied
Disincentive Applied
What are the Opportunities--PMS

- Development of Appropriate Intervention Points
- Validation/Determination of Pavement Life Extension
- Most Comprehensive Set of Data in Existence to Research From
What are Potential Opportunities

- Development of the Best Preservation Techniques and Materials
- US Scanning Tour of the SPS-2 Performance
- Evaluation of Non Destructive Test Devices
- Extending Environmental Monitoring Test Results
- Improving the Current SPS-2 Experiment
20 Year Old Silicone Sealed Joint
Guide for Participation

In the

2013

ASCE-LTPP International Contest on LTPP Data Analysis

Prepared for

Task Committee on the LTPP Contest
The Transportation and Development Institute of ASCE
InfoPave

Announcements
- Introducing LTTP InfoPave (Beta) - Online Access to the World’s Largest Pavement Performance Database
- LTTP InfoPave - Access to Everything LTTP
- LTTP InfoPave (Session 1 - Design Details)
- Improving Public Access to LTTP Data
In Summary

- History in the Making for Concrete Pavement Preservation
- Fund will probably consist of two phases:
  - Phase 1 - What is Out there and What Can We Do
  - Phase 2 - Execute the Recommended Workplan
The End

Any Questions?