The Role(s) of Pavement Management

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Presentation Outline

1. FHWA
   a. Current Efforts in Pavement Management
   b. PM Roadmap / Implementation

2. Roles of Pavement Management
FHWA’s Current Efforts in Pavement Management

1. Program Support
   Technical Assistance & Training for State DOTs and others
   LTPP – Long Term Pavement Performance

2. Participation in National Efforts
   AASHTO, TRB, ASCE, and more
   Measurement of Smoothness, Faulting, Cracking

3. Research and Development
   PM Roadmap, RWD, Pavement Health Track
FHWA Pavement & Materials Program

Process to Deliver National Pavement Network That Is:

- Safe
- Cost Effective
- Long Lasting
- Effectively Maintained

Develop Plan → FHWA Pavement and Materials Program → Deliver Results
Pavement Management Roadmap (2010)

Developed 23 Short-Term Research Needs Statements with projects valued at about $6.5 Million.

Developed 24 Long-Term Research Needs Statements with projects valued at about $8 Million.
Pavement Management Roadmap (2010) Project Team

SAIC
• Eric Perry (Task Manager)

Applied Pavement Technology, Inc.
• Katie Zimmerman (Principal Investigator)
• David Peshkin
• Linda Pierce

National Center for Pavement Preservation
• Doyt Bolling – Larry Galehouse
• Patty Hahn – John Hooks
Pavement Management Roadmap (2010)

Top 5 Short-Term Needs:

1) Communicating Pavement Management Information and Benefits
2) Development and Use of Effective Performance Measures
3) Improving Skills of Pavement Managers
4) Development of Automated Condition Data Processing Tools
5) Methods to Quantify the Benefits of Pavement Management
Theme Areas in the Roadmap

1. Use of existing tools and technology
2. Institutional and organization issues
3. The broad role of pavement management
4. New tools, methodologies, and technology
The audience can be divided into 3 primary groups:

1. **Decision makers** for funding and direction of research program
2. **Practitioners** who are directly involved in pavement management activities and would directly benefit from the products of Roadmap projects.
3. **Researchers** who would conduct Roadmap projects.

The overarching message for the Roadmap marketing is that the Roadmap spells out a clear, logical, and practical path to more efficient and effective pavement management practices.

By implementing the Roadmap, the industry will:

 ✓ Enhance the skills of pavement managers.
 ✓ Improve the use of existing technology and tools.
 ✓ Promote the concepts of pavement management among decision makers and the public.
 ✓ Expand the data considered in a pavement management analysis.
 ✓ Explore the use of new tools and technology to improve the current approaches to data collection and analysis.
1. FHWA
   a. Current Efforts in Pavement Management
   b. PM Roadmap / Implementation

2. Roles of Pavement Management
Functions vs. Roles of Pavement Management

**Primary function:**
- Assessing and reporting pavement condition
- Prioritizing capital improvements
- Estimating funding needs

**Broader role:**
- Support asset management
- Analysis of preservation options
- Calibrate mechanistic-based models
Changes in Pavement Management

- Emphasis on performance monitoring
- Use in planning and programming
- Advancements in data collection and analysis
- Asset management

Goals & Policies
System Performance
Economic / Social & Env.

Safety???
Roles of Pavement Management

1. Money
2. Performance
   a. Long-Life Pavements
   b. Effectiveness/Efficiency (Mix of Fixes!)
3. Safety (Friction)
4. Environment
   a. Recycle / Reuse
   b. Mix of Fixes
   c. Noise
   d. Emissions
5. Asset Management
   a. Planning
   b. Trade-off analysis
Money!

*It’s always about the money.*

We have 4 Million centerline miles of roads and 600,000 bridges to take care of…

please collect the data and do the analysis, then let the decision makers know what it costs, and present the information so that they have a clear understanding!

Be **DATA DRIVEN!**
The Costs of Deferring Maintenance

- Bay Area PCI Goal = 75
- Current investment in maintenance insufficient:
  - 23 point reduction in PCI
  - 230% increase in repair backlog by 2032
- Benefit to Cost ratio of maintenance investment is 5:1

Theresa Romell & Sui Tan
ICPP Conference, Newport Beach
April, 2010
Importance of Preventive Maintenance

Scenario Comparison - Deferred Maintenance and PCI

Theresa Romell & Sui Tan
ICPP Conference, Newport Beach
April, 2010
Cost of Delaying Maintenance

Teeth Cleaning: $75

Root Canal: $1,000
Performance
Long-Life Pavements
Effectiveness / Efficiency
(Mix of Fixes!)
Focus the Federal aid program on the following national goals:

1) SAFETY
2) INFRASTRUCTURE CONDITION
3) CONGESTION REDUCTION
4) SYSTEM RELIABILITY
5) FREIGHT MOVEMENT / ECONOMIC VITALITY
6) ENVIRONMENTAL SUSTAINABILITY
7) REDUCED PROJECT DELIVERY DELAYS
Pavement Condition Data Collected

Question: What pavement condition data does your agency collect?

- **Surface Distress**: 98.2% Network Level, 58.9% Project Level
- **Smoothness**: 94.6% Network Level, 66.1% Project Level
- **Structural Capacity**: 16.1% Network Level, 71.4% Project Level
- **Frictional Properties**: 33.9% Network Level, 55.4% Project Level
Distress Data Collected

Question: What pavement distress data does your agency collect?

- Rutting: 100%
- Transverse Cracking: 93%
- Fatigue Cracking: 89%
- Longitudinal Cracking: 88%
- Map/Block Cracking: 77%
- Raveling: 64%
- Faulting: 64%
- Spalling: 54%
- Bleeding/Flushing: 54%
- Edge Cracking: 46%
- Other: 36%
- Punch-outs: 32%
- Shattered Slab: 30%
- Durability Cracking: 27%
- Pumping: 21%
"It's the latest innovation in office safety. When your computer crashes, an air bag is activated so you won't bang your head in frustration."
SAFETY

Poor Friction

Rutting
SAFETY

Rumble Strips and Rumble Stripes?

Crash Costs?

-Fatalities?
-Injuries?
-Property Damages?
SAFETY

Medians / Median Barriers
In Asset Management
Each and every person working in transportation has the power to save lives. This means YOU.
FHWA’s “3 E’s”

ENGINEERING

• Use Good Engineering Design to Assure Long-Life Pavements and Assets.

ECONOMICS

• Use Life-Cycle Cost Analysis for Project Selection.

ENVIRONMENT

• Consider Recycling First
• Be Good Stewards of the Environment
The Greenhouse Effect

Some of the infrared radiation passes through the atmosphere but most is absorbed and re-emitted in all directions by greenhouse gas molecules and clouds. The effect of this is to warm the Earth’s surface and the lower atmosphere.

Solar radiation powers the climate system.

Some solar radiation is reflected by the Earth and the atmosphere.

About half the solar radiation is absorbed by the Earth’s surface and warms it.

Infrared radiation is emitted from the Earth’s surface.
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<th>GWP</th>
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<tbody>
<tr>
<td>CO₂</td>
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</tr>
<tr>
<td>CH₄*</td>
<td>21</td>
</tr>
<tr>
<td>N₂O</td>
<td>310</td>
</tr>
<tr>
<td>HFC-23</td>
<td>11,700</td>
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<tr>
<td>HFC-32</td>
<td>650</td>
</tr>
<tr>
<td>HFC-125</td>
<td>2,800</td>
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<td>HFC-134a</td>
<td>1,300</td>
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<td>HFC-143a</td>
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<td>140</td>
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<td>HFC-227ea</td>
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<td>HFC-236fa</td>
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<td>SF₆</td>
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</table>
Figure 2.1: Total U.S. Greenhouse Gas Emissions: 1990-2007

Quantifying CO$_{2e}$ Emissions

In 2007, U.S. GHG emissions were 7,150 teragrams of CO2 equivalent (T$_g$CO$_{2eq}$).

The dominant gas emitted is CO2, mostly from fossil fuel combustion.

- Electricity generation (34%),
- Transportation (28%) and
- Industry (19%).
Figure 2.2: U.S. GHG Emissions Allocated to Economic Sector

“Greenroads” – LCA in HMA

An example of LCA processes, inputs and outputs to consider for HMA paving.
Energy Use Per Tonne Of Material Laid Down

Source: The Environmental Road of the Future, Life Cycle Analysis by Chappat, M. and Julian Bilal. Colas Group, 2003, p.34

Ministry of Transportation
Ministère des Transports

Ontario
Life-cycle data is gathered in six environmental categories and depicted on an ecological footprint. The data are then weighted and aggregated to obtain an overall environmental impact.

**Parameters considered**
- Raw Materials
- Energy consumption
- Land Use
- Emissions
- Toxicity
- Risk potential

**Ecological footprint**
- Energy Consumption
- Land Use
- Emissions
- Raw Materials
- Toxicity Potential
- Risk Potential

1.0 = greatest environmental burden

**Ecological advantage**
- Relative environmental impact
  - High
  - Low

**Products**
- Product 1
- Product 2
- Product 3

*Courtesy of BASF*
Evolution of IRI
Smoothness Impacts on GHG

IRI = 1
IRI = 2.5

Consumption Increase by 1.5%
Asset Management Levels

Strategic
Funding Allocation
Communication

Network Level – Long-Term
Project Level – Short-Term
Project Design

“A PMS doesn’t design pavements, nor does it fix potholes”
Dr. Roger Smith
MPO’s – Stronger Partners in Pavement Management and Asset Management at the Strategic Level and Network Level?
A Metropolitan Planning Organization (MPO) is a federally required transportation planning body comprised of elected and appointed officials representing local, state and federal governments or agencies having interest or responsibility in transportation planning and programming.

An MPO is responsible for the development of:

- a Long Range Transportation Plan (LRTP),
- the Transportation Improvement Program (TIP), and
- a Unified Planning Work Program (UPWP) for its metropolitan planning area.

The adoption of these documents is a prerequisite for the receipt of both federal transit and federal highway funding.

http://www.smtcmpo.org/mpo.asp
MPO’s are a Federal Requirement

Each urbanized area in the United States with a population of 50,000 or more is required by the federal government to have a metropolitan planning organization (MPO). The Federal Government wants to ensure that the transportation planning process and resulting transportation network are cohesive and functional for areas that have grown together. In other words, transportation planning needs to be regional in scope because transportation systems cut across governmental boundaries.

http://www.campo.in.gov/what_is_an_mpo.php
What Does An MPO Do?

The MPO discusses and votes on multi-modal transportation issues of region-wide significance, and decides which local transportation projects should be implemented.

http://www.smtcmpo.org/mpo.asp
Metropolitan Transportation Planning

Metropolitan transportation planning is the process of examining travel and transportation issues and needs in metropolitan areas. It includes a demographic analysis of the community in question, as well as an examination of travel patterns and trends. The planning process includes an analysis of alternatives to meet projected future demands, and for providing a safe and efficient transportation system that meets mobility while not creating adverse impacts to the environment. In metropolitan areas over 50,000 population, the responsibility for transportation planning lies with designated Metropolitan Planning Organizations (MPO).

The Transportation Planning Capacity Building (TPCB) Metropolitan Planning Resources page offers MPOs and transportation professionals legislative, regulatory, and general guidance, technical resources, and relevant links to address metropolitan transportation planning issues.

Please click on the links below to access the metropolitan transportation planning resources.

Related Topics
Legislation, Regulations, and Guidance: Find detailed information on state and Federal laws, regulations, and guidance pertaining to transportation planning and Federal requirements related to the formation of new MPOs.

Technical Resources
Find detailed information on state and Federal laws, regulations, and guidance pertaining to metropolitan transportation planning and Federal requirements related to the formation of new Metropolitan Planning Organizations.

1. Publications
2. Case Studies
3. Briefing Notebook for Transportation Decisionmakers

Related Sites
Use the resource index to view all websites related to metropolitan transportation planning.

For more information contact Susan.Grosser@dot.gov at FHWA (202-366-2825), or John.Sprowls@FTA (202-366-5362).
<table>
<thead>
<tr>
<th>Plan Type</th>
<th>Who Develops?</th>
<th>Who Approves?</th>
<th>Time Horizon</th>
<th>Content</th>
<th>Update Requirements</th>
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<tr>
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<td>MPO</td>
<td>MPO</td>
<td>1 or 2 Years</td>
<td>Planning Studies and Tasks</td>
<td>Annually</td>
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<td>MPO</td>
<td>MPO</td>
<td>20 Years</td>
<td>Future Goals, Strategies, and Projects</td>
<td>Every 5 Years (4 years for nonattainment and maintenance areas)</td>
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<td>TIP</td>
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<td>MPO/Governor</td>
<td>4 Years</td>
<td>Transportation Investments</td>
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<td>STIP</td>
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<td>US DOT</td>
<td>4 Years</td>
<td>Transportation Investments</td>
<td>Every 4 Years</td>
</tr>
</tbody>
</table>
14 MAJOR POLICY AND PLANNING ISSUES

Air Quality
Congestion Management Process (CMP)
Financial Planning and Programming
Freight Movement
Land Use and Transportation

Performance Measures
Planning and Environment Linkages
Public Involvement
Safety
Security

System Management and Operations (M&O)
Technology Applications for Planning: Models, GIS, and Visualization
Title VI/Environmental Justice (EJ)

Transportation Asset Management
What are some examples of system management and operations tools?

Intelligent Transportation Systems (ITS) are technological tools that can help to facilitate better system M&O. For example, roadway video surveillance allows better responses to changes in network conditions, such as clearing an accident faster to keep traffic moving. ITS technologies also can be used to collect real-time data, like travel speeds, which can be used to monitor system performance over time.

Other examples of system M&O tools include:

- Metropolitan traffic management centers;
- Traffic signal coordination;
- Freeway/arterial corridor management;
- Incident management programs;
- Preferential treatment for transit/ride-shares;
- Special event traffic management;
- Emergency management strategies;
- Pricing of transportation services;
- Customer information services;
- ITS applications for transit;
- Traveler information; and
- Commercial vehicle programs.

These M&O strategies and tools focus on optimizing the performance of the transportation system. It is essential to mention that M&O does not include traditional maintenance activities, such as lawn cutting, pothole repair, or resurfacing.
How Many MPO’s Are There?

http://www.bts.gov/external_links/government/metropolitan_planning_organizations.html

382 TOTAL

http://www.cartosoft.com/lab/ampo/index.htm
Census Bureau Data – Metropolitan Areas


366 Metropolitan Statistical Areas – 257.4 Million
  • There are additional “Micropolitan Areas”
52 have more than 1 million people – 168.4 Million
2010 Total US Population = 309.8 Million

54% of Americans live in the 52 largest Metro Areas!
168.4 Million People in 52 largest metro areas

Northwest Pavement Management Association  October 25, 2012
Roles in Pavement Management

1. Money
2. Performance
   a. Long-Life Pavements
   b. Effectiveness/Efficiency (Mix of Fixes!)
3. Safety (Friction)
4. Environment
   a. Recycle / Reuse
   b. Mix of Fixes
   c. Noise
   d. Emissions
5. Asset Management
   a. Planning
   b. Trade-off analysis
1. FHWA’s Current Efforts in Pavement Management

2. Roles of Pavement Management
   a) Quick Check Guide
   b) Shout-Out to Don Newell from 2006 NWPMA meeting.
A Quick Check of Your Highway Network Health

by Larry Galehouse, Director, National Center for Pavement Preservation and Jim Sorenson, Team Leader, FHWA Office of Asset Management
A QUICK CHECK OF THE HEALTH OF YOUR HIGHWAY NETWORK

Current Condition

Percent of Network Pavement

Pavement Remaining Service Life (Years)

Northwest Pavement Management Association    October 25, 2012
Condition - One Year Later

Percent of Network Pavement

Pavement Remaining Service Life (Years)
“A QUICK CHECK OF YOUR HIGHWAY NETWORK HEALTH”

Agency Highway Network = 

______________ lane-miles

Each year the network will LOSE 

______________ lane-mile years.
“A QUICK CHECK OF YOUR HIGHWAY NETWORK HEALTH”

Agency Highway Network = 250 lane-miles

Each year the network will LOSE 250 lane-mile years.
“A QUICK CHECK OF YOUR HIGHWAY NETWORK HEALTH”

RECONSTRUCTION PROJECTS

______ Lane Miles x 20 Year Design Life = __________

REHABILITATION PROJECTS

______ Lane Miles x 10 Year Design Life = __________

PRESERVATION PROJECTS

______ Lane Miles x 5 Year Design Life = __________

Highway Agency Work ADDS

______________ Lane-Mile Years
“A QUICK CHECK OF YOUR HIGHWAY NETWORK HEALTH”

RECONSTRUCTION PROJECTS

2 Lane Miles x 20 Year Design Life = 40

REHABILITATION PROJECTS

5 Lane Miles x 10 Year Design Life = 50

PRESERVATION PROJECTS

20 Lane Miles x 5 Year Design Life = 100

Highway Agency Work ADDS

190 Lane-Mile Years
Each year the network will lose 250 lane-mile years. Highway Agency Work adds 190 Lane-Mile Years. Each year the network is losing 60 lane-mile years.
“A QUICK CHECK OF YOUR HIGHWAY NETWORK HEALTH”

RECONSTRUCTION PROJECTS

\[ \text{2 Lane Miles} \times \text{20 Year Design Life} = 40 \]

REHABILITATION PROJECTS

\[ \text{5 Lane Miles} \times \text{10 Year Design Life} = 60 \]

PRESERVATION PROJECTS

\[ \text{20 Lane Miles} \times \text{5 Year Design Life} = 150 \]

To “Stay Even” the Highway Agency

Work MUST ADD 250 Lane-Mile Years
This simple tool does **NOT** replace a Pavement Management System, But it is great for decision makers to get a “feel” for your pavement management and pavement preservation programs!
Bench Marking Your PMS

PMS 102

Don Newell
Multnomah County, Oregon
(Home of the Tonya Harding trials)

2006 NWPMA Meeting Presentation
An Analogy

Process is continuous and inevitable

The rate of water flow increases as condition decreases

The effort to pump water increases with decreasing condition

Seal = $.50 / sq yd

Overlay = $5 / sq yd

Reconstruct = $15 / sq yd

Copyright 1996 DEIGHTON ASSOCIATES LIMITED
Maintained vs Non-Maintained County Road
Cost per Mile for 2 Lane Road Over 55 years

The poorer the road, the greater the liability.

http://www.co.multnomah.or.us/dbcs/LUT/road_maintenance/

Multnomah County, Oregon
DCS - Transportation
Thank You for the Invite!

Northwest Pavement Management Association
Pavement Condition

Time

Right Treatment...

...Right Road... Right Time.

Preventive Maintenance

Reactive Maintenance

USE PMS

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Partnerships Are Required

- FHWA
- Academia
- State DOTs
- Local Governments
- Private Sector
Questions?