Asphalt Pavement Preservation: Evaluation, Maintenance & Rehabilitation

Pavement Preservation Concept

Issues for Consideration
- What is pavement preservation?
- How does it differ from pavement preventive maintenance?
- When should each be applied?
- Is preventive maintenance effective?
- If so, then why isn’t everyone doing it?

Terms to be Defined
- Routine (Corrective) Maintenance
- Preventive Maintenance
- Pavement Rehabilitation
- Pavement Preservation
- Pavement Reconstruction

Routine Maintenance
- Reactive in nature (not planned)
- Performed to correct deficiencies on pavements that are distressed
- Does not usually contribute to long-term performance
- Often performed under harsh conditions
- Repairs often perform poorly

Preventive Maintenance
The planned strategy of cost effective treatments to an existing roadway system and its appurtenances that preserves the system, retards future deterioration, and maintains or improves the functional condition of the system (without increasing structural capacity).

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-- AASHTO’s Standing Committee on Highways
Pavement Rehabilitation

- Restores serviceability of existing pavement
- Extends service life of existing facility
- May include milling and/or surface recycling of existing pavement
- May include placing of a surface course or multiple courses
- Could include other work (drainage; patching; etc)
- Returns pavement & shoulders to condition of structural or functional adequacy
- More extensive than Preventive Maintenance

Pavement Preservation

- The sum of all activities undertaken to provide and maintain serviceable roadways
- Includes the following:
  - Routine (corrective) maintenance
  - Preventive maintenance
  - Minor pavement rehabilitation projects
- Excludes the following:
  - New construction or reconstruction
  - Major pavement rehabilitation projects

Pavement Reconstruction

- Construction of the equivalent of a new pavement structure
- Usually involves complete removal and replacement of existing pavement structure
- Includes new and/or recycled materials
- Not a part of Pavement Preservation

Some Thoughts on Preventive Maintenance

- Preventive Maintenance is the foundation of a Pavement Preservation system
- Understanding PM is essential

The Concept of Preventive Maintenance

- $1.00 for preventive maintenance here . . .
- ...delays spending $4.00 to $5.00 on more extensive treatments here.

Typical Pavement Performance Curve
Importance of Preventive Maintenance

- Maintenance has had a variable role
- Focus is no longer on new construction but on preserving the existing system
- Preventive maintenance plays an essential role in this preservation
- We can’t afford to keep doing things the same way—such as “worst first”

Philosophy of Preventive Maintenance

Applying the right treatment
   . . . To the right pavement
   . . . At the right time

Benefits of a Preventive Maintenance Program

- Higher customer satisfaction
  – Roads serve traveling public—our “customers”
- Better informed decisions
  – Information from PM program helps make those decisions
- Improved strategies and techniques
  – Correct deficiencies in existing procedures and develop improved treatments

Benefits of a Preventive Maintenance Program (cont.)

- Improved pavement condition
  – PM helps to preserve a pavement and improve its performance
- Cost savings
  – Less expensive treatments when timely
  – Longer pavement life = long term savings
- Increased safety
  – Improved surface friction & fewer defects
  – Less traffic disruptions due to repair work

Preventive Maintenance for Asphalt Pavements includes...

- Maintenance of drainage features
- Crack filling/sealing
- Fog seals
- Slurry seals
- Micro-surfacing
- Chip seals
- Cold in-place recycling
- Hot in-place recycling
- Milling (planing)
- Thin HMA overlays
- Newer technologies
So much for Preventive Maintenance...

Now for a look at the Pavement Rehabilitation Part of “Pavement Preservation”

Pavement Rehabilitation with Asphalt Pavement includes...

• Thicker one-course overlays
• Multi-course overlays

Pavement Rehabilitation with Asphalt Pavement also includes...

• Milling and overlay or inlay
• Milling and recycling with overlay or surface treatment

Pavement Rehabilitation

• Major Pavement Rehabilitation projects are not part of Pavement Preservation

Keys to Successful Programs

• Establish simple, measurable goals
• Document the benefits from programs & research
• Promote the benefits
• Obtain dedicated funding
• Develop guidelines for implementing programs

More Keys to Successful Programs

• Improve the application of available treatments
• Develop and implement innovative practices
• Identify and benefit from leaders & role models
• Obtain support of top management
Introduction to Asphalt Pavements

Any questions?

Learning Objectives

• Describe the types of hot mix asphalt (HMA) pavements
• Identify the role of each pavement layer
• Discuss key issues related to pavement performance
• Describe HMA pavement response to traffic and environmental loading

Types of HMA Pavements

• HMA
  – with unbound (granular) base
  – with bound (stabilized) base
  – Full-Depth HMA
• Composite
  – HMA over PCC base

Asphalt Pavement Terminology

• Asphalt cement / binder
• Hot-mix asphalt (HMA)
• Structure:
  
  | HMA Layer(s) | Base Course (Bound or Unbound) | Subbase Course (Usually Unbound) | Subgrade Soil |
  
  | Surface / Wearing Course | Intermediate / Binder Course |

Role of Pavement Layers

4 Surface Roles:

- Structural Strength
- Frictional Resist.
- Smooth Ride
- Moisture Barrier
- Drainage
- Load Bearing
Pavement Performance

- **Functional Performance**
  - Providing of a safe and comfortable ride to users
- **Structural Performance**
  - Ability to withstand traffic and environmental loadings

Desired performance affects determination of appropriate rehab treatments

Factors Affecting Pavement Performance

- Subgrade Soil
- Traffic
- Environment
- Materials
- C&M Variation
- M&R

HMA Pavement Response to Traffic & Environment

- Tensile & compressive strains resulting from wheel loads (stresses) due to traffic
- Changes in material properties resulting from changes in the environment
- These responses lead to pavement deterioration

Rutting Mechanism

- Wheel Load
  - HMA Surface
  - Base
  - Subbase
  - Subgrade Soil

Fatigue Cracking Mechanism

- Wheel Load
  - HMA Surface
  - Base
  - Subbase
  - Subgrade Soil

Thermal Cracking Mechanism

- Crack or Cold Joint
  - Tensile Stress
  - Location Along HMA Surface
  - Friction on Underside of HMA Surface
  - Contraction
Top-Down Cracking Mechanism

- Surface-Initiated Crack
- Oxidation Penetration
- HMA Pavement Thickness
- Interface Between Lifts

Stripping Mechanism

- Separation of asphalt binder from aggregate
- Appears mostly in pavts. subject to long periods of high moisture

Reflection Crack Mechanism

- Wheel Load
- Tension
- Shear
- Underlying Joint
- Subbase Course
- Subgrade Soil

Other Distress Mechanisms

- Frost heave
- Strength loss (due to moisture)
- Soil swelling
- Oxidation

ODOT Specifications

- 2005 orange book has replaced 2002 black book

ODOT Specifications for HMA – 2005

- 301 Asphalt Concrete Base
- 302 Asphalt Concrete Base (Large Stone)
- 304 Aggregate Base
- 308 Asphalt Treated Free Draining Base
- 401 Asphalt Concrete Pavements—General
- 402 Asphalt Concrete Mixing Plants
- 403 Asph Conc Quality Control & Acceptance
- 424 Fine Graded Polymer Asphalt Concrete (Smoothseal) – new in 2005
**Superpave…A System**

- A product of the Strategic Highway Research Program (SHRP)
- New asphalt binder specification and test procedures using “Performance Grades”
- New asphalt mixture design system using the gyratory compactor
- Mixture analysis and pavement performance prediction systems still being developed
- System software for binder and mix

**Common Asphalt Binder Grades**

- **PG 58-28**
  - Similar to AC-10
- **PG 64-22**
  - Most commonly used grade; similar to AC-20
- **PG 64-28**
  - Used in ODOT intermediate courses
  - More resistant to low temperature cracking
- **PG 70-22**
  - More resistant to high temperature & deformation
  - PG 70-22M is polymer modified (SBR or SBS); used in Type 1H mix & Superpave surface course
- **PG 76-22M**
  - Polymer modified (SBS only) used in high stress areas

**Superpave Mixtures**

<table>
<thead>
<tr>
<th>Size Designation</th>
<th>Maximum Size Aggregate</th>
<th>Use</th>
<th>Normal Course Thickness</th>
</tr>
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<tbody>
<tr>
<td>9.5mm</td>
<td>12.5mm (1/4&quot;)</td>
<td>Surface</td>
<td>1&quot; - 1 1/4&quot;</td>
</tr>
<tr>
<td>12.5mm</td>
<td>19mm (1&quot;)</td>
<td>Surface (Heavy Traffic)</td>
<td>1 1/4&quot; - 2 1/4&quot;</td>
</tr>
<tr>
<td>19mm</td>
<td>25mm (1&quot;)</td>
<td>Intermediate</td>
<td>1 3/4&quot; - 3&quot;</td>
</tr>
<tr>
<td>25mm</td>
<td>37.5mm (1 1/2&quot;)</td>
<td>Base</td>
<td>3&quot; - 6&quot;</td>
</tr>
<tr>
<td>37.5mm</td>
<td>50mm (2&quot;)</td>
<td>Base (Large Stone)</td>
<td>4&quot; - 7 1/2&quot;</td>
</tr>
</tbody>
</table>

25mm & 37.5mm mixes are not currently used by ODOT
Cross Section of Superpave Mixes

<table>
<thead>
<tr>
<th>Thickness</th>
<th>Aggregate Size</th>
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<tbody>
<tr>
<td>4.75 (3/16&quot;)</td>
<td>9.5 (3/8&quot;)</td>
</tr>
<tr>
<td>12.5 (1/2&quot;)</td>
<td>19.0 (3/4&quot;)</td>
</tr>
<tr>
<td>25.0 (1&quot;)</td>
<td>37.5 (1½&quot;)</td>
</tr>
</tbody>
</table>

Thickness of layer..... determines mixture maximum aggregate size.

Lift Thickness Range
for Dense-graded Mixes

Introduction to Asphalt Pavements

Questions on Asphalt Pavements or Superpave?

THE END