The objective of this session is to present a general introduction of pavement recycling. As per the original FHWA course, page 4-4, Recycling reuses non-renewable resources, hence it should be considered even if the cost of recycling is equal to the cost of conventional rehabilitation. Wouldn’t hurt to mention the FHWA memo at this point either….as you will see later in one of the upcoming slides…

The old course stressed almost in every chapter, when properly designed and constructed, recycled hot mix asphalt (HMA) has proved to be at least equal to conventional HMA mixes.

**Introduction**

I-Note: introduce yourself and state the title of the course.
Driving America for Better Roads

SAVING AMERICA’S CRUMBLING ROADS

America’s Infrastructure Status D - , even with all of our crumbling roads, there is hope.....The Three Legged Stool System™ that ties a solid network level pavement management program to a cost efficient in-place asphalt recycling and eco efficient pavement preservation strategy

MAP 21 Ready Strategy

Driving America for Better Roads

www.drivingamericaforbetterroads.com
Thanks For Taking Time Out of Your Schedule to Join Us TODAY at the 99th ANNUAL PURDUE ROAD SCHOOL!!

INTRODUCTIONS

Video Trailer from www.drivingamericaforbetterroads.com
PAVEMENT PRESERVATION AND PCI (North County)

- LANE MILES
- PCI

- PREV MTC
- RESURFACE
- REHAB/REC ON
- Cost
- PCI

FISCAL YEAR

- 310 UM
- 442 UM
- 363 UM
- 392 UM
- 319 UM

2009-10: 70
2010-11: 72
2011-12: 73
2012-13: $38.6M
2013-14: $33.0 M

$32.6 M
$55.2 M

AVG=365.4 UM-MI
Disclaimer...

- We are not here to promote any one service, product or type of equipment, software or otherwise
- StreetSaver® and MicroPAVER™ are the two most popular software systems in several states, hence their use for educational training purposes during the Purdue Road School
- We teach (IPMA™ Academy, UC Berkeley ITS, Auburn University, KU) and use (TBG) these programs every day but your agency should also know other PMS programs available
Question One

- What do the following two slides have in common and what lesson can we learn from them?
<table>
<thead>
<tr>
<th>Treatment Type</th>
<th>Treatment</th>
<th>Cost/Sq Yd, except Seal Cracks in LF:</th>
<th>Yrs Between Crack Seals</th>
<th>Yrs Between Surface Seals</th>
<th># of Surface Seals before Overlay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crack Treatment</td>
<td>SEAL CRACKS</td>
<td>$0.50</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface Treatment</td>
<td>Reclamite Rejuvenator</td>
<td>$0.75</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Restoration Treatment</td>
<td>Micro with levling</td>
<td>$3.00</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Micro with levling</td>
<td>$3.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ReHEAT HIR</td>
<td>$11.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ReHEAT with Deep Patches 20%</td>
<td>$11.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>FDR Cement w/2&quot; Overlay</td>
<td>$17.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crack Treatment</td>
<td>SEAL CRACKS</td>
<td>$0.50</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface Treatment</td>
<td>Reclamite Rejuvenator</td>
<td>$0.75</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Restoration Treatment</td>
<td>Micro with levling</td>
<td>$3.00</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ReHEAT HIR</td>
<td>$4.50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ReHEAT with Deep Patches 20%</td>
<td>$9.00</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td>FDR Cement w/2&quot; Overlay</td>
<td>$17.00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
City’s ‘worst streets’ repairs include $1.4 million price tag

By Ashley Fuller

Fixing Canton’s 13 “worst streets” will cost $1.4 million to repair, according to city estimates.

The Canton City Council on Thursday night reviewed the costs of making repairs to each street, but took no action.

The issue will be back up for review at the council’s work session on Jan. 6 at Canton City Hall.

The city staff created the list of streets and prioritized their repair based on heavy “alligator” cracking and moderate to heavy traffic use.

The estimates are general, according to the city staff, and include milling, adding permeable asphalt mix to the cracking and laying 1.5 inches of asphalt topping.

Lightfoot Drive, which is considered to be the worst street in the city, will cost an estimated $101,933 to repair.

The other streets on the list, ranked beginning with the worst of the worst, and the costs to repair them are:

- Archer Street (estimated cost of $54,792);
- Winooki Drive ($76,315);
- Bircb Street ($48,649);
- Breeze Hill Court ($26,287);
- Breeze Hill Lane ($80,950);
- Alpine Street ($27,710);
- Brown Street ($33,492);
- Dupree Street ($6,276);
- East Main Street between Brown Street and Breeze Hill ($131,444);
- Marietta Highway ($727,222);
- North Street ($60,900);
- and
- Cherokee Street ($53,449).

The total mileage of all the roads is just more than six miles.

If the repairs are approved, the money would come from the city’s contingency funds.

The council at next month’s work session will talk about what kind of bidding procedure to use.

Councillman Bill Bryan said the city should seek a bid on each of the streets to make sure the staff estimates are good.

“I would like to make sure this $1.4 million is not really $1.9 million or $900,000,” he said.
Question Two

• We are living in a world where use modern technology routinely to benefit our lives *except* when it comes to rehabilitating our roadways and preserving them, why are we still rebuilding them like it is 1956?
Traditionally, highway agencies have allowed the ride quality and structural condition of a pavement to deteriorate to fair to poor condition before taking steps to rehabilitate the pavement. The aim of the rehabilitation is to repair structural damage and restore pavement conditions—a costly, time-consuming activity. This “worst-first” scenario came about for many reasons, including the requirements of Federal-aid funding and maximization of capital growth. But now, by applying a series of low-cost preventive maintenance treatments, each of which lasts a few years, highway agencies can extend the pavement’s service life. This translates into a better investment and a better ride quality. The experience with pavement preservation in a number of States demonstrates this success: Each dollar spent now on pavement preservation could save up to six dollars in the future.

Pavement preservation strategies are not well suited for pavements requiring major rehabilitation or reconstruction. Furthermore, implementation varies with...
Memorandum

U.S. Department of Transportation
Federal Highway Administration

Subject: INFORMATION: Formal Policy on the Use of Recycled Materials

From: Frederick G. Wright, Jr.
Executive Director

To: Core Business Unit Managers
Service Business Unit Directors
Directors of Field Services
Division Administrators Federal Lands Highway Division Engineers

Date: February 7, 2002

For your information and use, we have attached our formal policy on the use of recycled materials in highway applications. The policy outlines the importance of re-using materials previously used in constructing our Nation's highway system, and calls upon us, and the State transportation departments, to explicitly consider recycling as early as possible in the development of every project. In addition, the policy acknowledges that recycling will not be appropriate in all cases, and provides guidance for making that determination.

The implementation of this policy will support our strategic goals of preserving and enhancing the human and natural environment, increasing mobility, raising productivity, and improving safety. Moreover, the new policy has the potential to strengthen the relationship between FHWA and the Environmental Protection Agency, and to forge new partnerships among government, industry, and academia. By providing leadership and technical guidance to the transportation community, FHWA will stimulate advancements in recycling technology and the discovery of new opportunities for the appropriate use of recycled materials.

For additional information or clarification, please contact Byron Lord, in the Office of Pavement Technology at (202)366-1325.

[Signature]
Build slide. Each subsequent click highlights the typical time when different types of activities are undertaken.

• This is a conceptual overview that illustrates the appropriate time to do preventive maintenance, as well as other pavement activities.

• Use this slide to stress that preventive maintenance is applied when the pavement is in good condition.

• As conditions worsen over time, the types of maintenance and rehabilitation activities increase in invasiveness and cost.
Build slide. Use this slide to more specifically demonstrate the consequences of waiting to apply a particular maintenance treatment.

• Introduce the chart by showing a standard “do-nothing” performance curve.

• Next, show the “old” method of applying “reactive” maintenance later in the pavement’s life as a stop-gap maintenance method. Note the relatively small increase in condition and steep slope of the reactive maintenance performance curve as the application buys some, but generally little, time.

• Next, show how conducting rehabilitation later in life instead of reactive maintenance gives you more initial condition improvement and life extension, but it also comes with a much larger price tag.

• Finally, show the concept of preventive maintenance where the “same” treatment (as the reactive maintenance) is applied when the pavement is much younger and in much better condition. Applying the same treatments when the condition is good can buy more life, and better condition, for the same money.

Actual preventive maintenance programs must be “local.” That is, agencies have to learn what these curves look like for their own pavements.
| **Very Good-Excellent**  
| (PCI = 80-100) | Pavements are newly constructed or resurfaced and have few if any signs of distress. |
| **Good**  
| (PCI = 70-79) | Pavements require mostly preventive maintenance and have only low levels of distress, such as minor cracks or spalling, which occurs when the top layer of asphalt begins to peel or flake off as a result of water permeation. |
| **Fair**  
| (PCI = 60-69) | Pavements at the low end of this range have significant levels of distress and may require a combination of rehabilitation and preventive maintenance to keep them from deteriorating rapidly. |
| **At Risk**  
| (PCI = 50-59) | Pavements are deteriorated and require immediate attention including rehabilitative work. Ride quality is significantly inferior to better pavement categories. |
| **Poor**  
| (PCI = 25-49) | Pavements have extensive amounts of distress and require major rehabilitation or reconstruction. Pavements in this category affect the speed and flow of traffic significantly. |
| **Failed**  
| (PCI = 0-24) | Pavements need reconstruction and are extremely rough and difficult to drive. |
Governor McDonnell Announces Pavement Recycling Project
Save Time, Money and Materials During Roadwork

I-81 recycling project wins national award

RICHMOND – Governor Bob McDonnell announced today that the Virginia Department of Transportation (VDOT) is gaining national recognition for using pavement recycling methods to rebuild aging roadways, saving significant time and money.

VDOT and its prime contractor Lanford Brothers Company, Inc. of Roanoke rebuilt a section of Interstate 81 in Augusta County by recycling existing road material back into the new pavement structure. This paving method reduced construction time by about two-thirds and saved millions of dollars, earning VDOT a national award by the asphalt recycling industry.

"Using these pavement recycling methods has the potential to revolutionize how we rehabilitate our aging roads, both in Virginia and nationally," said Governor McDonnell. "We encourage local governments and road builders to consider the benefits of recycling in their road and bridge projects."
Pavement Management Systems

A Pavement Management System (PMS) is a set of tools for providing, evaluating, and maintaining pavements in a serviceable condition over a long period of time – AASHTO

Remember that a network PCI evaluation is the big picture, and that Project level evaluation must still occur
Free PDF online also available for purchase about $65.00

making will be compromised. For example, the PMS may recommend inappropriate treatments, or it may not program the roadway sections most in need of preservation. These “wrong” decisions undermine the effectiveness of, and confidence in, the pavement management process. According to AASHTO (1), “a properly planned and implemented data collection program will significantly increase credibility, cost-effectiveness, and overall utility of the PMS.” To effectively support the pavement management process, the data collection program collects, processes, and records data in a timely fashion, with a level of accuracy and precision adequate for the decision being supported, assuring data consistency and continuity from year to year, and using a consistent location referencing system (1).

To ensure that the quality of the data collected meets the needs of the pavement management process, agencies are
Network Level Evaluation

- The 30,000 FT view
- Entire network of paved roads
- Perhaps even the airfields, and/or gravel roads
- Long term budget forecasting
- No real coring* or NDT
- Drainage concerns
- Top Ten List (TBG)
Project Level

- The work we will do this year, bid lettings
- A blend of PCI roads to be repaired
- Time to take a closer look at specifics like depth, pavement width, widening, elevation changes etc.
MicroPAVER™ Pavement Management System (PMS)

PAVER™ DI Manual

- 1. Alligator or Fatigue Cracking
- 2. Bleeding
- 3. Block Cracking
- 4. Bumps & Sags
- 5. Corrugation
MicroPAVER™ Pavement Management System (PMS)

PAVER™ DI Manual

• 6. Depression
• 7. Edge Cracking
• 8. Joint Reflection Cracking
• 9. Lane/Shoulder Drop Off
• 10. Longitudinal Cracking
11. Patching & Utility Cut Patching
12. Polished Aggregate
13. Potholes
14. Railroad Crossing
15. Rutting
MicroPAVER™ Pavement Management System (PMS)

PAVER™ DI Manual

- 16. Shoving
- 17. Slippage Cracking
- 18. Swell
- 19. Raveling
- 20. Weathering
Pavement Distress

- Fundamental performance indicator
- Characterized by:
  - Type
    - What?
  - Severity
    - How Bad?
  - Extent
    - How Much?
Primary Distress Types

- Cracking
- Surface defects
- Deformation
### Asphalt Pavement Distress

- **Cracking**
  - structural
  - non-structural
- **Surface Distress**
  - flushing / bleeding
  - raveling
  - potholing
- **Deformations**
  - rutting
  - shoving
  - corrugations
Know Your Pavement!
Know Your Pavement!
Table 11: Example of Network Level Sampling Criteria Used By Some Agencies

<table>
<thead>
<tr>
<th>No. of Sample Units in Section (N)</th>
<th>No. of Units to be Inspected (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 5</td>
<td>1</td>
</tr>
<tr>
<td>6 to 10</td>
<td>2</td>
</tr>
<tr>
<td>11 to 15</td>
<td>3</td>
</tr>
<tr>
<td>16 to 40</td>
<td>4</td>
</tr>
<tr>
<td>over 40</td>
<td>10% (round up to next whole sample unit)</td>
</tr>
</tbody>
</table>

Figure 3.9: Example of Systematic Random Sampling.
Depressions - vs - fill

Inlet 2% slope

Unhouse complex 1% slope

Raveling - end of lead segment
## Decision Tree

<table>
<thead>
<tr>
<th>Functional Class</th>
<th>Surface</th>
<th>Condition Category</th>
<th>Treatment Type</th>
<th>Treatment</th>
<th>Cost/Sq Yd, except Seal Cracks in L.F.</th>
<th>Yrs Between Crack Seals</th>
<th>Yrs Between Surface Seals</th>
<th>% of Surface Seals before Overlay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential/Local</td>
<td>AC</td>
<td>I - Very Good</td>
<td>Crack Treatment</td>
<td>SEAL CRACKS</td>
<td>$0.50</td>
<td>6</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Surface Treatment</td>
<td>Reclaim Resealer</td>
<td>$0.75</td>
<td></td>
<td></td>
<td>6</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Restoration Treatment</td>
<td>Micro with leveling</td>
<td>$3.00</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>II - Good, Non-Load Related</td>
<td></td>
<td>Micro with leveling</td>
<td>$3.00</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>III - Good, Load Related</td>
<td></td>
<td>ReHEAT HHR</td>
<td>$11.00</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IV - Poor</td>
<td></td>
<td>ReHEAT with Deep Patches 20%</td>
<td>$11.00</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V - Very Poor</td>
<td></td>
<td>FDR Cement w/2&quot; Overlay</td>
<td>$17.00</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>AC/AC</td>
<td>I - Very Good</td>
<td>Crack Treatment</td>
<td>SEAL CRACKS</td>
<td>$0.50</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Surface Treatment</td>
<td>Reclaim Resealer</td>
<td>$0.75</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Restoration Treatment</td>
<td>Micro with leveling</td>
<td>$3.00</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>II - Good, Non-Load Related</td>
<td></td>
<td>Cape Seal Chip and Micro</td>
<td>$4.50</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>II - Good, Load Related</td>
<td></td>
<td>ReHEAT HHR</td>
<td>$9.00</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>IV - Poor</td>
<td></td>
<td>ReHEAT with Deep Patches 20%</td>
<td>$9.50</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>V - Very Poor</td>
<td></td>
<td>FDR Cement w/2&quot; Overlay</td>
<td>$17.00</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AC/PCC</td>
<td>I - Very Good</td>
<td>Crack Treatment</td>
<td>SEAL CRACKS</td>
<td>$0.65</td>
<td>4</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Surface Treatment</td>
<td>SINGLE CHIP SEAL</td>
<td>$1.20</td>
<td>8</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Restoration Treatment</td>
<td>MILL AND THIN OVERLAY</td>
<td>$10.00</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>II - Good, Non-Load Related</td>
<td></td>
<td>DOUBLE CHIP SEAL</td>
<td>$2.00</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>II - Good, Load Related</td>
<td></td>
<td>HSE Hot Scarify &amp; Overlay</td>
<td>$9.00</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>IV - Poor</td>
<td></td>
<td>HSE Hot Scarify &amp; Overlay</td>
<td>$9.00</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>V - Very Poor</td>
<td></td>
<td>RECONSTRUCT STRUCTURE (AC)</td>
<td>$8.25</td>
<td>3</td>
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<tr>
<td>PCC</td>
<td>I - Very Good</td>
<td>Crack Treatment</td>
<td>DO NOTHING</td>
<td>$0.00</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Surface Treatment</td>
<td>DO NOTHING</td>
<td>$0.00</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>