INDIANA'S LTAP ASSET MANAGEMENT

REMINDERS FOR TODAY

Location of the exits in the event of an emergency.

Restroom locations.

Set your cell phones to silent mode and if you need to take a call, please step outside.

Make sure you sign in today to receive credit.

You have two forms to fill out:

1. Road Scholar/CEU participant form
2. Course Evaluation Form

Wi/Fi login is: **???

NATIONAL LTAP/TTAP

LTAP/TTAP Centers
2014 Effort:

- 6128 training sessions
- 177,768 participants
- 1,022,584 participant hours
- Communicate with 185,000 local contacts; and
- Share more than 500,000 informational materials.
Indiana's LTAP

Indiana LTAP
- Affiliated with Purdue University in West Lafayette
- Provides Indiana Counties, Cities, and Towns with:
  - Training Programs, Workshops, and Conferences
  - Information Clearinghouse
  - New and Existing Technology Updates
  - Newsletters, Directories, and Publications

Some of Indiana LTAP's technical assistance efforts
- HELPERS PROGRAM: Works to reduce roadway crashes by identifying safety concerns and offering low-cost solutions. 226 assistant cases in 2013.
- EQUIPMENT LOAN: Offers traffic safety equipment and other technology to local agencies free of charge.
- RESEARCH: Funds research projects that benefit local agencies, such as Railroad Flatcar Bridges, Trail Maintenance, and Internally Cured Concrete Bridge Decks.
- PUBLICATIONS: Produces quarterly newsletters, an annual directory, research reports, and instruction manuals. Currently expanding into digital publications and resources, including a smartphone app of the popular directory and a Purdue University E-Pubs collection.
Indiana LTAP works hard to serve:

- City & Town Street Commissioners and Street Department employees
- County Highway Engineers, Supervisors, and Employees
- City Mayors & Town managers
- County Commissioners
- County Surveyors
- INDOT
- MPOs/RPOs
- Police Organizations
- Consultants
- Contractors

Indiana’s LTAP Training Program 2016

2016 Training Program

- Aug 25, 2016 (ISCA) CC#3 Local Highway and Street Funding
- June 1, 2016 (IACHES) CC#6 Basics of a good Road
- May 12 & 19, 2016 CC#8 Manual of Uniform Traffic Control Devices
- Nov 30, 2016 (IACC) CC#12 Estimating Construction Cost/Quantities
- Jun 16, 2016 Pavement Preservation Workshop
- Aug 3, 2016 Concrete Pavement Workshop
- Sep 8, 2016 Asphalt Pavement Workshop
- Sep 22, 2016 IT Workshop
- Oct 19, 2016 County Bridge Conference
- Nov 27, 2016 CEPDS

Today’s Agenda 8:00 - Noon

Asset Management - PASER 2016

Module 1 - Intro & Resources
Module 2 - Asset & Pavement Management
Module 4 - Pavement Distress
  - Break 15 minutes 10:00 – 10:15
Module 6 - PASER Rating Tips
Module 7 - Asphalt PASER Rating Exercise
Module 8 - Concrete PASER Rating Exercise
Module 9 - Sealcoat & Chip seal PASER Rating Exercise
Module 10 – Demonstration of Online Training

Pavement Management Software (Can discuss after the training)
Pavement Distress Solutions (Can discuss after the training)
Indiana Local Road Conditions

Indiana Local Road Conditions

Indiana local roads are deteriorating and available funding has not kept pace. Indiana LTAP has been asked to report on the condition of the local road network. How do we rate 86,000 miles of local roadway?

Indiana Local Road Conditions

We need a report that tells the story of our local road condition. The report should use pavement condition rating systems based on sound engineering principles.
Indiana Local Road Conditions

2009 Indiana LTAP Needs Assessment reported a $5.3 Billion shortfall and $838 million per year thereafter for Indiana local roads. Indiana MPO council report states current funding can only support 18% of the existing road network.

Indiana Local Road Conditions

Indiana LTAP Needs Assessment Report
Local Roads % Poor by 2012 - 8 County Extrapolation

Indiana Local Road Conditions

Indiana LTAP investigated other states and other state LTAP’s efforts to rate and report on local roads.
- Utah – Developed (TAMS) rating system, no longer LTAP support available, not able to convert to other method.
- INDOT – uses (Dayton 100-1) system? – requires engineering support to rate roads, and Agile Assets software program to manage and house data.
- Wisconsin - WISLR – PASER based – D.O.T. online data input – Wisconsin agencies only.
### Indiana Local Road Conditions

Michigan – This may be it!

![Michigan](image)

### Michigan Paved Federal Aid Roads

2014-2015 Condition – Percent Lane Miles

<table>
<thead>
<tr>
<th>Condition</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>30%</td>
<td>35%</td>
</tr>
<tr>
<td>Fair</td>
<td>15%</td>
<td>10%</td>
</tr>
<tr>
<td>Poor</td>
<td>5%</td>
<td>5%</td>
</tr>
</tbody>
</table>

### Graph

![Graph](image)
HB 1001 Summary

HB 1001 Summary

HB 1001 Summary

1. Establishes the Local Road and Bridge Matching Grant Fund.
2. Authorizes an eligible municipality (population greater than 10,000) to impose a municipal motor vehicle license excise surtax and a municipal wheel tax.
3. Doubles the rates of the wheel tax and excise surtax (LOHUT) that a county can adopt if they have an Asset Management Plan.

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(j) This SECTION expires June 30, 2017.

SECTION 22. [EFFECTIVE JULY 1, 2016] (a) There is appropriated for the state fiscal year beginning July 1, 2016, and ending June 30, 2017, five hundred thousand dollars ($500,000) from the motor vehicle highway account to the Indiana department of transportation. The funds appropriated under this SECTION shall be used by the local technical assistance program established under IC 8-23-2-5(a)(6) to do the following:

1. Study issues related to the development and operation by local governments of transportation asset management plans and pavement management plans.
2. Assist local governments in Indiana in developing and operating transportation asset management plans and pavement management plans.

(b) The calculation of the other distributions to be made from the motor vehicle highway account under IC 8-14-1-3 in the state fiscal year beginning July 1, 2016, and ending June 30, 2017, shall be made after deducting the amount appropriated under this SECTION.
HB 1001 Summary

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HB 1001 - Local Road and Bridge Matching Grant Fund

The Local Road and Bridge Matching Grant Fund will be administered by INDOT and disbursed through an application process.

It requires a local agency to have an INDOT approved Asset Management Plan in order to be able to participate.

An "INDOT Approved" Asset Management Plan template for pavements is available at the Indiana LTAP website.

HB 1001 - Local Road and Bridge Matching Grant Fund

The fund requires a 50% match from the local agency. The match has to come from at least one of the following sources:

1. funds from an increase in wheel tax/excise surtax after June 30, 2016
2. funds from the special distribution from the local option income taxes (SB 67)
3. funds in the local agency rainy day fund.
HB 1001 - Local Road and Bridge Matching Grant Fund

In FY 2017, approximately $185 million will be distributed in the fund from the state's excess reserves.
In FY 2018, 14.286% (1/7) of the gasoline use tax on fuels will be distributed in the fund (estimated at $69.2 million).
Thereafter, 21.42% (1.5/7) of the gasoline use tax on fuel will be distributed in the fund (estimated at $104.9 million).

Pavement Asset Management Plan

Indiana LTAP worked with several local agencies and association representatives to develop the pavement asset management plan templates
- A committee was developed comprised of representatives from the LTAP advisory board to propose a draft asset management plan to INDOT
- The pavement asset management plan template establishes the minimum requirement for a approved asset management plan
- INDOT approved the plan on March 2016
Pavement Asset Management Plan

The plan's main requirements are contained in two tables. Table 1 is to be used for reporting the complete pavement inventory.

<table>
<thead>
<tr>
<th>Designation</th>
<th>Roadway</th>
<th>From</th>
<th>To</th>
<th>Length</th>
<th>Width</th>
<th>Surface Type</th>
<th>Rating</th>
<th>Ye a r</th>
<th>Rated Functional Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>CR 200-01</td>
<td>CR 200</td>
<td>CR 400</td>
<td>CR 450</td>
<td>0.50</td>
<td>18</td>
<td>Asphalt</td>
<td>6</td>
<td>2016</td>
<td>Rural</td>
</tr>
<tr>
<td>CR 200-02</td>
<td>CR 200</td>
<td>CR 450</td>
<td>CR 500</td>
<td>0.50</td>
<td>18</td>
<td>Asphalt</td>
<td>5</td>
<td>2016</td>
<td>Rural</td>
</tr>
<tr>
<td>Main 01</td>
<td>Main St</td>
<td>Rose St</td>
<td>Elm Blvd</td>
<td>0.15</td>
<td>24</td>
<td>Asphalt</td>
<td>7</td>
<td>2016</td>
<td>Principal Arterial</td>
</tr>
<tr>
<td>Main 02</td>
<td>Main St</td>
<td>Elm Blvd</td>
<td>SR 25</td>
<td>0.20</td>
<td>24</td>
<td>Asphalt</td>
<td>7</td>
<td>2016</td>
<td>Minor Collector</td>
</tr>
<tr>
<td>Main 03</td>
<td>Main St</td>
<td>SR 25</td>
<td>CR 250</td>
<td>0.25</td>
<td>24</td>
<td>Chip Seal</td>
<td>6</td>
<td>2016</td>
<td>Minor Collector</td>
</tr>
</tbody>
</table>

Table 2 summarizes the treatments planned for the next 5 years.

<table>
<thead>
<tr>
<th>Year</th>
<th>Rating</th>
<th>Treatment</th>
<th>Used Estimated Cost per Mile</th>
<th>Estimated Miles</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>7-10</td>
<td>Crack Seal</td>
<td>$4,000</td>
<td>50</td>
<td>$200,000</td>
</tr>
<tr>
<td>2016</td>
<td>5-6</td>
<td>Chip Seal</td>
<td>$20,000</td>
<td>25</td>
<td>$500,000</td>
</tr>
<tr>
<td>2016</td>
<td>3-4</td>
<td>2” Overlay</td>
<td>$75,000</td>
<td>5</td>
<td>$150,000</td>
</tr>
<tr>
<td>2016</td>
<td>1-2</td>
<td>Reconstruction</td>
<td>$225,000</td>
<td>2</td>
<td>$450,000</td>
</tr>
<tr>
<td>2017</td>
<td>7-10</td>
<td>Crack Seal</td>
<td>$4,100</td>
<td>50</td>
<td>$205,000</td>
</tr>
<tr>
<td>2017</td>
<td>5-6</td>
<td>Chip Seal</td>
<td>$22,000</td>
<td>22</td>
<td>$484,000</td>
</tr>
<tr>
<td>2017</td>
<td>3-4</td>
<td>2” Overlay</td>
<td>$78,000</td>
<td>4</td>
<td>$312,000</td>
</tr>
</tbody>
</table>

Additional requirements outside these tables are:
(1) Define performance goals and expected level of service
(2) Define pavement rating system used
(3) Describe the process used to develop the treatment plan
(4) Describe your monitoring program; and
(5) Describe drainage and right-of-way conditions.
Pavement Rating Methods
LTAP Resources

LTAP will be distributing these requirements to locals through the LTAP website, INDOT LPA program and local associations.
http://rebar.ecn.purdue.edu/LTAP1/Home/

Pavement Rating Methods
LTAP Resources 2016

Indiana LTAP Asset Management Training (Pavement Management)
- Indiana LTAP Pavement Preservation Workshop – June 2016
- Indiana LTAP Concrete Pavement Workshop – August 2016
- Indiana LTAP Asphalt Pavement Workshop – September 2016
- IT Workshop/PASER Meeting – September 2016
- County Bridge Conference – October 2016
- APAI Winter Conference – December 2016

Pavement Rating Methods
LTAP Resources 2016

Working Together and Supporting the Same Cause

KEEP CALM AND BEAT IU
Pavement Rating Methods
LTAP Resources 2016

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Pavement Rating Methods
LTAP Resources 2017

Indiana LTAP Asset Management Training
- RS Core Course #1 Asset Management – March 2017
- PASER Training Workshops – 6 locations - March 2017
- Indiana LTAP Pavement Preservation Workshop – June 2017
- Indiana LTAP Concrete Pavement Workshop – July 2017
- Indiana LTAP Asphalt Pavement Workshop – August 2017
- PASER Conference – September 2017
- County Bridge Conference – October 2017
- APAI Winter Conference – December 2017

Pavement Rating Methods
LTAP Resources

Indiana LTAP 2016 PASER Training
- 4/26/16 Fort Wayne
- 4/27/16 South Bend
- 4/28/16 Merrillville
- 5/4/16 Ferdinand
- 5/5/16 Clarksville
- 5/10/16 Evansville
- 5/11/16 Bloomington
- 5/18/16 Winamac
- 6/7/16 Carmel
- 6/8/16 Danville
- 6/9/16 Greenfield
- 6/12/16 Terra Haute
- 6/22/16 Richmond
- 6/23/16 West Lafayette
- 8/24/16 ISCA Conference Plymouth
Pavement Rating Methods
LTAP Resources

PASER Rating for Beaches?

PASER Rating for Beaches?
Asset Management

What do we have in common?
• Inadequate funding for preserving asset conditions
• Primarily “reacting” to conditions
• Do not have all the information needed to “tell our story” in a way that resonates with decision makers

Asset Management

How can asset management help?
• Develop an inventory and rate the condition it is in.
• Determine what level of service is needed, balances funding vs risks.
• Defines the cost to achieve your desired level of service? Identifies what your options are.
• Demonstrates what the consequences are if repairs aren't made. (CDP, RSL, ESL).

Asset Management
Asset Management

Transportation Assets within our agency:

1) Roads 7) Fleet and Equipment
2) Bridges 8) Facilities and Equipment
3) Culverts
4) Water/Sewer/Drainage Infrastructure
5) Signs 9) Parks
6) Guardrail 10) Jails
11) Material Inventory
12) Personnel

Asset Management

We must be able to measure the condition of our roads and be able to look at our roads on a network level.

Performance Metrics:

“Measurement is the first step that leads to control and eventually to improvement.

• If you can’t measure something, you can’t understand it.
• If you can’t understand it, you can’t control it.
• If you can’t control it, you can’t improve it.”

H. James Harrington
Former Chairman and President of the International Academy for Quality
American Society of Quality Control

Asset Management Definition.

“An ongoing process of maintaining, upgrading, and operating physical assets cost effectively, based on a continuous physical inventory and condition assessment”

**Asset Management**

**Example: HVAC Systems**

**Common Issues:**
- A/C Failures in the summer months.
- Heating systems fail in the winter months.
- Expensive to repair.
- Manage many types of systems.
- In need of upgrades to energy efficient systems.

**Asset Management**

**Example: HVAC Systems**

**Asset Manage Solutions:**
- Inventory of all HVAC units, gather detailed information on each system, (make/model, size of unit, age, location, history).
- Create a condition rating, contact a HVAC professional to assist.
- Develop a plan for preventive maintenance, recommended replacement and upgrades.
- Define the cost to achieve the desired level of service.
- Demonstrate cost of doing nothing vs funding the HVAC plan.

**Transportation Asset Management**

So how does this apply to local agency transportation?

MAP 21:

A strategic and systematic process of operating, maintaining, and improving physical assets, with a focus on engineering and economic analysis based upon quality information, to identify a structured sequence of maintenance, preservation, repair, rehabilitation, and replacement actions that will achieve and sustain a desired state of good repair over the lifecycle of the assets at minimum practical cost.
Transportation Asset Management

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Transportation Asset Management

Transport Scotland, Road Asset Management Plan:
A plan for managing the asset base over a period of time in order to deliver the agreed Levels of Service and Performance Targets in the most cost-effective way.

APWA:
Pavement management can simply be defined as the process of maintaining the pavement infrastructure cost-effectively. (APWA)

Transportation Asset Management

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Transportation Asset Management

Summary:
Asset management is a systematic method for routinely collecting, storing, and retrieving the kind of decision-making information needed to make maximum use of limited maintenance and construction dollars.

Indiana LTAP version:
A system wide plan that consists of setting goals and treatment plans in order to manage transportation assets to maximize your limited funding. — Pat Conner, Indiana LTAP

Transportation Asset Management

FHWA 6 Essential Components of an Asset Management Plan:
1. A summary listing of the pavement and bridge assets including a description of the condition of those assets
2. Asset management objectives and measures
3. Performance gap identification
4. Lifecycle cost and risk management analysis
5. A financial plan
6. Investment strategies

Minimum requirements in the Asset Management Plan approved by INDOT as defined in HB 2001

Transportation Asset Management

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Transportation Asset Management

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These are the concepts of Asset Management that Indiana LTAP will continue to teach and promote.

Transportation Asset Management

7 Steps in Designing a Asset Management Process
1. Create an Inventory of your Assets
2. Collect Condition Data
3. Predict Condition
4. Select Treatments
5. Report Results
6. Select an Asset Management Tool
7. Keep the Process Current

Katie Zimmerman, PE, Applied Pavement Technology

Transportation Asset Management

Benefits to a transportation asset management plan
• Creates a centralized location for asset inventory, quantities, condition information, construction, maintenance, and rehabilitation records.
• Analyze the consequences of various funding levels on assets.
• Scheduling work items to reduce excessive costs.
• Decision making tool in optimizing rehabilitation, maintenance, and trade off options.
Transportation Asset Management

Benefits to an transportation asset management plan

• Answer “What-if” type of questions regarding repair programs and funding levels.
• Justifying budget needs and expenditures to elected officials, public and other stakeholders.
• Report to elected officials, media and the public on the overall condition of roads, bridges, other assets.

Transportation Asset Management

Benefits to an transportation asset management plan

• Inventory and condition can aid in reimbursement for FEMA funds.
• Federal aid funds may be available for pavement and bridge preservation, *(FHWA requires agency must have an asset management plan).*
• Funds available in HB 1001 and SB 67 requires an agency to have an asset management plan.

Transportation Asset Management

TAM is simply just communicating the problems and the solutions.

- Technical Staff ↔ Management
- Management ↔ Elected Officials
- Elected Officials ↔ The Public

In a common language to describe the condition of our pavements that everyone understands.
Pavement Management

Pavement Management Principles.
- Take Inventory and Assess Current Condition
- Mix of Fixes Analysis
- Predict Future Condition
- Develop Policies, Targets and Measures
- Conduct Tradeoffs and Identify Candidates
- Set Priorities and Develop Multi-Yr. Program
- Report Results


Pavement Management

Simplified . . . For Pavements

Keep the Good Roads In Good Condition!
- Right Fix
  - in the
- Right Place
  - at the
- Right Time
This side is a County road agency that uses PASER and has a crack sealing program to go with it.

This side is a County road agency that does NOT!

Pavement Management

Questions to Understand Pavement Management
• How long will the pavement likely last?
• What takes away from the life of the pavement?
• Are there treatments that can restore life to the pavement?
• Are there options to salvage or rehabilitate part of the pavement to retain value?
• At what point is replacement necessary?

Pavement Management

Key Pavement Management Definitions

CDP - Critical Distress Point - The CDP is the point when pavement distress changes from needing preventive maintenance to needing structural improvement. (PASER rating 4)
RSL - Remaining Service Life - RSL is the time in years from the present until the pavement reaches the CDP.
DSL - Design Service Life - DSL is the design life of the pavement to the CDP. On day 1 it should equal RSL. But does it?
ESL - Extended Service Life - ESL is the time in years added to the current RSL based on the type of fix used. It does not represent the longevity of the treatment.
Pavement Management

Pavement Deterioration Terms

Years Since Construction

Pavement Management

Pavement Deterioration Terms

Years Since Construction

Pavement Management

Pavement Deterioration Terms

Years Since Construction

Sealcoat Applied

Treatment applied
### Pavement Management

**Window of Opportunity**

#### Pavement Treatment Terms

- **Excellent**
  - Preventative Maintenance

- **CDP**
  - Heavy Maintenance
  - Light Rehab

- **Poor**
  - Heavy Rehab
  - Reconstruction

### Pavement Management

#### Cost Effectiveness of Treatments

<table>
<thead>
<tr>
<th>Fix Type</th>
<th>Cost $ per Lane Mile</th>
<th>Added Life ESL</th>
<th>Cost per Year of Added Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crack Seal</td>
<td>$4,000</td>
<td>1 yr.</td>
<td>$4,000</td>
</tr>
<tr>
<td>Seal Coat &amp; Crack Seal</td>
<td>$20,000</td>
<td>4-9 yr.</td>
<td>$5,000</td>
</tr>
<tr>
<td>Overlay</td>
<td>$100,000</td>
<td>8-12 yr.</td>
<td>$12,500</td>
</tr>
<tr>
<td>Crush &amp; Shape</td>
<td>$150,000</td>
<td>14 yr.</td>
<td>$10,700</td>
</tr>
<tr>
<td>Reconstruction</td>
<td>$300,000</td>
<td>15 yr.</td>
<td>$20,000</td>
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</tbody>
</table>

### Pavement Management

#### Rehabilitation at 14 Years - Cost $150,000

- **Crush and Shape**
  - Year 14
Pavement Management

Sealcoat at 10, Overlay at 18 - Cost $120,000
Sealcoat Year 10
Overlay Year 18

Pavement Management

Where is the “Bang for the Buck”?  
- Example 1  
  - 30 years  
  - 1 Rehab  
  - Cost $150,000  
  - Condition Below CDP
- Example 2  
  - 30 years  
  - Overlay & Sealcoat  
  - Cost $120,000  
  - Condition Above CDP

Pavement Management

Sealcoat at 10, 16 and 22 - Cost $60,000
Sealcoat Year 10  
Sealcoat Year 16  
Sealcoat Year 22  

Pavement Management
Pavement Management

Approaches To Managing Assets

Worst First
• Select worst roads
• Little or no preventive maintenance
• Reconstruct
• Rehabilitation

Reactive!

Mix of Fixes
• Select roads in good shape
• Many miles of Low cost PM treatments
• Reconstruction if money permits

Proactive!

Pavement Management

Balanced Approach

Pavement Management
Pavement Management

Cost Effectiveness of Treatments

<table>
<thead>
<tr>
<th>Fix Type</th>
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<th>Cost per Year of Added Life</th>
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<td>$4,000</td>
</tr>
<tr>
<td>Seal Cost &amp; Crack Seal</td>
<td>$20,000</td>
<td>5-9 yr.</td>
<td>$4,000</td>
</tr>
<tr>
<td>Overlay</td>
<td>$100,000</td>
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<tr>
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<td>15 yr.</td>
<td>$20,000</td>
</tr>
</tbody>
</table>

Pavement Management

Which Approach is Likely to Work Best for Pavements?

Worst First
- Select worst assets first for treatment
- Focus on rehabilitation and replacement of failed assets
- Little or no preventive maintenance on “Good” assets

Mix of Fixes
- Maintenance first before its “broken”
- Maximize low cost fixes or preventive treatments
- Replace or rehabilitate the asset as money permits

Pavement Management

The Mix of Fixes for Pavements
- Applying the right fix at the right time in the right place
- Extensive preventive maintenance – Priority
- Rehabilitation when really needed.
- Reconstruction is No Longer the priority.
- Long term view - No knee-jerk reactions.
- Capitalizes on “windows of opportunity”
Pavement Management
Simplified . . . For Pavements
   Keep the Good Roads In Good Condition!
   Right Fix
   in the
   Right Place
   at the
   Right Time

Pavement Management
NCPP - Quick Network Health Check
   Most Basic—Service Cycle
   How many lane miles in your road network?
   How many lane miles of work each year?
   (Rehab and reconstruction only)

Pavement Management
NCPP - Quick Network Health Check
   Most Basic—Service Cycle
   Divide
   Lane Miles in your road network
   By
   Lane Miles of Work Each Year
   =
   Years to Reconstruct the Entire Network
   Compare to Life of Pavement
**Pavement Management**

**NCPP - Quick Network Health Check**

**Most Basic—Service Cycle**
850 centerline miles x 2 = 1700 lane miles
1700 lane miles / 30 lane miles of reconstruction
= 57 years to reconstruct entire network

- If an asphalt pavement last 20 years and that 15 years is in good or fair condition or CDP
- 57-15 = 42 Divide 42 years in poor condition /57 years until we replace it, now we can assume 74% of the life of that pavement was in poor condition

---

**Calculate:**
Subtract Annual Loss of RSL
Every year, every lane mile loses at least 1 year of RSL
Add ESL Gained from Treatment
Are you gaining ground? Or Loosing Ground?

---

**Michigan Example—625 Lane Mile Network**

Lost 625 Lane Mile Years – Deterioration
Gained 204 Lane Mile Years – Treatments
- 625 + 204 = - 421 Years
Recovered less than 33%
### Pavement Management
**NCPP - Quick Network Health Check**

#### Michigan Example—625 Lane Mile Network

<table>
<thead>
<tr>
<th>Programmed Activity</th>
<th>Fix Cost per Lane Mile</th>
<th>ESL Years</th>
<th># of Lane Miles Fixed</th>
<th>Lane Mile ESL</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reconstruction</td>
<td>$530,000</td>
<td>15</td>
<td>60</td>
<td></td>
<td>$2,120,000</td>
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<tr>
<td>Rehabilitation</td>
<td>$170,000</td>
<td>14</td>
<td>84</td>
<td></td>
<td>$1,020,000</td>
</tr>
<tr>
<td>Mill &amp; Overlay</td>
<td>$68,000</td>
<td>8</td>
<td>40</td>
<td></td>
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</tr>
<tr>
<td>Non Struc. OvL</td>
<td>$32,000</td>
<td>2</td>
<td>14</td>
<td></td>
<td>$224,000</td>
</tr>
<tr>
<td>Crack Seal</td>
<td>$4,800</td>
<td>1</td>
<td>6</td>
<td></td>
<td>$28,800</td>
</tr>
</tbody>
</table>

**Total Cost:** $3,732,800

---

**Pavement Management**
**NCPP - Quick Network Health Check**

#### Michigan Example—625 Lane Mile Network

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**Total Cost:** $2,672,800

---

**Pavement Management**
**NCPP - Quick Network Health Check**

#### Alternative Michigan Example—625 Lane Mile Network

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**Total Cost:** $2,672,800
### Pavement Management
**NCPP - Quick Network Health Check**

#### Alternative Michigan Example—625 Lane Mile Network

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\[
\text{Lost 625 Lane Mile Years – Deterioration} \quad \text{Gained 395 ESL/Lane Mile Years – Treatments} \\
- 625 + 395 = -230 \quad (\text{vs. -421}) \\
\text{Recovered 61\% vs. 32\%} \\
\text{Spent $152,000 Less}
\]
Tier 1: Basic Excel spreadsheet system of storing information

Pros:
A) Easily reproducible
B) Easily editable
C) Easily add additional information

Cons:
A) More difficult to follow row/column format rather than a map when updating condition ratings.
B) Doesn’t meet FHWA essential components of AMP.
### Tier 1: Basic Electronic System of Storing Information

**Transportation Asset Management**

### Tier 2: GIS

**Pros:**
- A) Easily reproducible
- B) Easily editable
- C) Easily add additional information
- D) Easy to see visually location of Assets

**Cons:**
- A) Doesn’t meet FHWA essential components of AMP.
- B) No performance gap identification.

### Pavement Management Tools - Software
Pavement Management Tools - Software

Tier 3: Combination of GIS and Excel spreadsheet

Pros:
A) Easily reproducible
B) Easily editable
C) Easily add additional Information
D) Easy to see visually location of Assets

Cons:
A) Dependent on the knowledge of GIS and spreadsheets.
B) Can be hard to transfer to other people.
**Tier 4: RoadSoft program**

**Pros:**

A) Mobile tools for adding and editing condition rating  
B) Scenario/Budget Builders  
C) Established Software and can add additional assets  
D) Predict future condition rating  
E) Cost ($5,995 + $1,495/yr)

**Cons:**

A) Cost ($5,995 + $1,495/yr)  
B) Doesn’t automatically build a work schedule.
Tier 5: Cartograph

Pros:

A) Mobile tools for adding and editing CR
B) Scenario/Budget Builders
C) Private Software Company w/ long history
D) Predict future condition rating
E) Additional assets
F) Customer Complaint platform
G) Inventory/Personnel Manager

Cons:

A) Cost ($$$) Depends on population & platforms
B) Exclusive to PCI Pavement Conditions – No PASER
Pavement Distress
What Destroys A Pavement?

Water
• Weakens structure

Traffic
• Excessive loading
• Excessive volumes

Environment
• Temperature extremes
• Oxidation

Pavement Distress
What Destroys A Pavement?

Typical Pavement Layers

Asphalt
Gravel Base
Sand Sub-Base
Native Soil (sub-grade)
Pavement Distress
What Destroys A Pavement?

Load Distribution

Pavement Distress
What Destroys A Pavement?

Structural Failure

Pavement Distress
What Destroys A Pavement?

Fatigue Cracking (Alligator Cracking)
Pavement Distress
What Destroys A Pavement?

Wheel Path Cracking & Rutting

Wheel Path Rutting (Mix Failure)

Environment
Pavement Distress
What Destroys A Pavement?

Environment

Pavement Distress
What Destroys A Pavement?

Water Intrusion
Becomes a Structural Distress (PASER 4)

Structural Distress Propagation (PASER 3 or Less)
Asphalt Pavement

Pavement Distress

Asphalt Distress Types

1) Structural Distresses
   • Rutting
   • Cracking in wheel path
   • Alligator cracking

2) Age-related Distress
   • Transverse cracking
   • Longitudinal joint cracking
   • Block cracking

3) Surface Distresses
   • Raveling
   • Flushing
   • Polishing
   • Bleeding

4) Limited extent (generally)
   • Slippage cracks
   • Shoving & rippling
   • Heave & settling

5) Others
   • Potholes and patches

Rutting
Less Than ½ Inch

Transverse Cracks >10 Spacing

Longitudinal Joint Cracks Present

Block Cracking
Moderate Progression

Rutting Less Than ½ Inch

Block Cracking
Moderate Progression
Deep Rutting

Pavement Distress

Surface (mix) Rutting

Pavement Distress
Structural Distress
Signs of Rutting

Range of depths

\( \frac{1}{2}'' \) to 1"

1" to 2"

> 2"

Structural Distress Rutting

Structural Distress
Longitudinal Cracking in Wheel Path
Shear Cracking

Structural Distress
Longitudinal Cracking in Wheel Path

First Sign

Structural Distress
Longitudinal Cracking in Wheel Path

Progressed
Structural Distress
Edge Cracking

Progressed
Structural Distress
Alligator (Fatigue) Cracking

First Sign

Severe

Percentage of Worst Lane

12' 4'
Transverse cracking

Longitudinal joint cracking

Block cracking

Primary Age-related Distresses

Primary Aging Distress
Transverse Cracking

Spacing
Greater > 40'
10' to 40'
Less < 10'
More Than Just a Transverse Crack.....

Innovative Crack Repair?

Primary Aging Distress
Longitudinal Joint Cracking
Common Construction Joint

Second Pass
First Pass (unconstrained)
Asphalt
Gravel Base

Longitudinal Construction Joint (Tapered)

Asphalt
Gravel Base

Primary Aging Distress
Longitudinal Joint Cracking

Tight
Primary Aging Distress
Longitudinal Joint Cracking

Severe Joint Deterioration

Primary Aging Distress
Block Cracking

Block Sizes
6' to 10'
1' to 5'
Less than 1'

Primary Aging Distress
Block Cracking

First Sign
Surface Distress
Raveling - Moderate

Surface Distress
Raveling - Severe

Surface Distress
Flushing / Bleeding
Limited Extent Distress
Heave & Settling

Pavement Distress

Concrete Distress Types

1) Deformations
   - Faulting
   - Blowups
   - D-cracking
2) Joint Distress
   - Transverse joint
   - Longitudinal joint
   - Spalling
3) Cracking
   - Transverse cracking
   - Meander cracking
   - Corner cracking
4) Surface Distress
   - Polishing
   - Scaling
   - Map cracking
   - Pop outs
   - Shallow reinforcement

Deformations - Blowups
Non-compressible Material
Faulting

Joint Distress - Spalling

Incompressible Material Causes Joint Spalling
Partial Depth Joint Repair

Dowel Bars (load transfer)

Full Depth Needed
Settlement – Utility Trench

Cracking - Meander Crack

Cracking - Corner Break and Crack
<table>
<thead>
<tr>
<th>Surface Distress - Shallow Reinforcement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrosion</td>
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Surface Distress - Scaling

Surface Scaling

Surface Distress - Scaling

< 25%
25% to 50%
> 50%