



# Maintenance of Recreational Trails



Presented by: SRF Consulting Group, Inc.

2011RIC05, November 2011

# Local Road Research Board (LRRB) Mission

The LRRB serves local road transportation practitioners through:

- Development of new initiatives,
- Acquisition of and application of new knowledge, and
- Exploration and implementation of new technologies.



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Stewart Crosby, SRF Consulting Group

# Presentation Objectives

1. Understand the importance of planning for trail corridor maintenance
2. Identify trail corridor maintenance activities
3. Provide insight about asset management for trails
4. Provide information and tools to city and county staff that will assist in educating decision makers on the importance of this issue

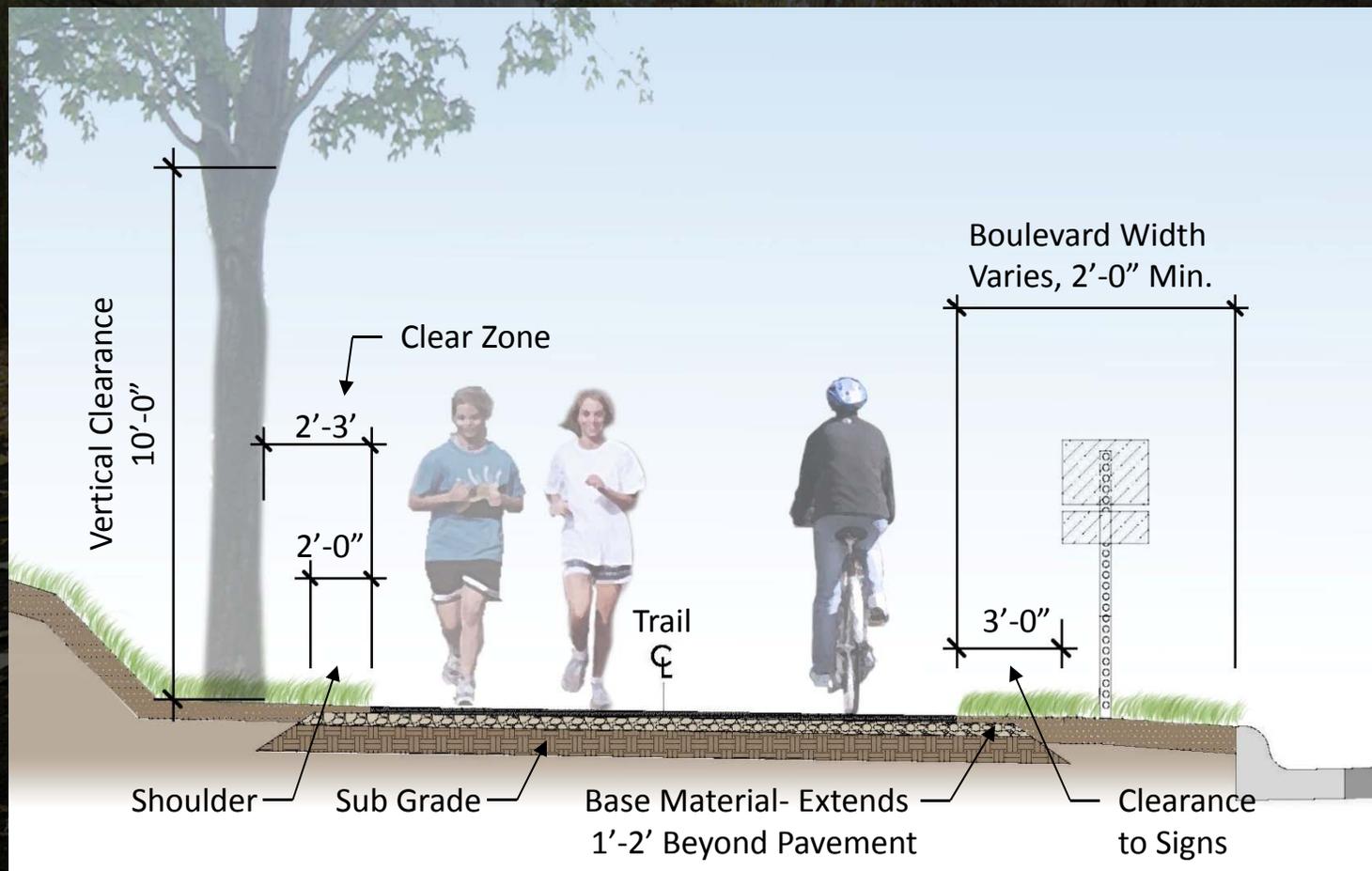
# Presentation Outline

- Operational Maintenance Activities
- Trail Pavement Management
- Asset Management
- How to Build a Trail Maintenance Schedule
- Multi-Use Trail Maintenance Recap
- References

# Why is Trail Management Important?

- Trail user safety
- Trail preservation
- Maintenance is cost-effective in the long run
- Community expectation- comparable level of service to other public amenities
- Requirement of all federally funded trails

# Example of a Cross-Section for a “Designed” Trail



# Presentation Outline

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# Operational Maintenance Activities

## Section Overview

- Maintenance Schedule
- Inspection Form
- General Maintenance
- Vegetation
- Drainage
- Structures
- Amenities
- Spring/Fall
- Winter

# Operational Maintenance Activities

## Trail Maintenance Schedule

Maintenance Activity	Optimal Frequency							Notes
	Weekly	Monthly	Quarterly	Annually	Spring/Fall	After Storm	Other	
<b>General</b>								
1 Safety inspection	X					X		
2 General debris and trash pickup	X					X		
3 Vandalism inspection	X							
4 Encroachments							Ongoing	
<b>Pavement</b>								
1 Pavement survey					X			Conduct Spring and Fall surveys
2 Crack sealing							Reactionary	
3 Patching							As needed	
4 Fog seal							As needed	Lifespan approximately 4-6 years
5 Sealcoat							As needed	Lifespan approximately 6-10 years
6 Slurry seal							As needed	Lifespan approximately 8-10 years
7 Overlay							As needed	Lifespan approximately 15 years
8 Reconstruct							As needed	
9 Inspect pavement markings				X				
10 Repaint pavement markings							As needed	
<b>Vegetation</b>								
1 Mowing- clear zones, trailhead areas	X	X						
2 Brush trimming/overhead trimming				X				Spring activity
3 Clear zone weed control							As needed	Noxious weed spraying/removal
4 Sight line trimming at intersections		X						Roads, other trails, driveways, etc.
5 Tree removal						X	As needed	Storm cleanup
6 Rain garden maintenance		X				X		
7 Trail sweeping/blowing					X	X	As needed	Up to weekly frequency in Fall
8 Seeding				X	X			Spring activity
9 Root cutting							As needed	Monitor root activity along trail
<b>Drainage</b>								
1 Erosion repair			X		X	X		After spring snowmelt, storm cleanup
2 Culvert/catch basin clearing			X			X		Storm cleanup
3 Ditch maintenance (clear of debris, trash, branches)				X		X		Spring activity
4 Standing water repair				X		X		

# Operational Maintenance Activities

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5 Tree removal							X	As needed
6 Rain garden maintenance		X					X	Storm cleanup
7 Trail sweeping/blowing						X	X	As needed
8 Seeding				X		X		Up to weekly frequency in Fall Spring activity
9 Root cutting								As needed
<b>Drainage</b>								
1 Erosion repair			X		X		X	After spring snowmelt, storm cleanup
2 Culvert/catch basin clearing			X				X	Storm cleanup
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# Operational Maintenance Activities Trail Inspection Template

Trail Name: \_\_\_\_\_

Trail Segment: \_\_\_\_\_

Inspection Date: \_\_\_\_\_

Inspector Name: \_\_\_\_\_

**PAVED TRAIL INSPECTION TEMPLATE**

Follow-up Performed By: \_\_\_\_\_

Follow-up Date: \_\_\_\_\_

Inspection Items:		✓ if "Yes"	Inspection Comment/Location	✓ if Maintenance is Complete	Follow Up Comments	Photos Taken During Inspection: Y/N
1	Pavement condition a. Are there cracks, surface pitting, potholes, heaves or other deficiencies in the trail surface condition?					
2	Pavement markings a. Are pavement markings fading or chipping?					
3	Overhead tree/brush trimming a. Is there less than 10-feet of vertical clearance across the trail and clear zones? b. Do the trail clear zones need to be cleared of woody vegetation?					
4	Intersection sight lines (road, driveway, other trail, sidewalk) a. Does vegetation within the trail corridor need to be cleared to maintain sightlines from/to trail?					
5	Rain gardens a. Is there standing water more than 48 hours after a rain event? b. Are there weeds/volunteer plants growing in the rain garden? c. Is sediment accumulating anywhere in the rain garden? d. Do any rain garden plants need to be replaced? e. Is more mulch needed? f. Is there erosion or gullyng? g. Is there trash or debris in the rain garden?					
6	Erosion evidence/damage a. Is there any erosion damage to the trail or shoulders?					
7	Drainage structures & culverts a. Are any culverts clogged with debris? b. Are any catch basins clogged or blocked? (trailhead parking lots) c. Is there any erosion near culverts?					
8	Ditch clearing a. Is there debris in the ditches? (trash, branches, sediment, etc.) b. Is there standing water in the ditches? c. Do ditches need mowing?					

# Operational Maintenance Activities

## General Trail Maintenance

- Non-programmed activities
- Check for unsafe conditions
  - Trip hazards, etc.
- General debris and trash pickup
- Vandalism inspection
- Encroachments
  - Private uses on public property such as equipment storage



# Operational Maintenance Activities

## Vegetation Maintenance

- Mowing  
(clear zones, trailhead areas)
- Overhead trimming
- Tree removal
- Weed control



# Operational Maintenance Activities

## Vegetation Maintenance

- Rain garden maintenance
- Maintain sightlines (intersections, signs, other trails)
- Sweeping/blowing
- Root cutting
- Know what to mow



# Operational Maintenance Activities

## Drainage

- Clean culverts & catch basins
- Standing water repair
- Ditch maintenance
- Rodent damage repair
- Erosion repair
- BMP maintenance
  - Infiltration basins, vegetated filter strips, etc.



Courtesy of Three Rivers Park District



Courtesy of Three Rivers Park District

# Operational Maintenance Activities

## Structures

- Bridge/boardwalk inspection (non-engineering visual inspection)
- Other structures inspection (tunnels, railroad crossings, retaining walls)
- Structural inspection by a licensed engineer at regular intervals (for example, every 2 years)



# Operational Maintenance Activities

## Amenities

- Inspect rest stops
  - Concrete pads
  - Benches
  - Bike racks
  - Waste receptacles
  - Picnic tables
- Inspect kiosks



Courtesy of Three Rivers Park District

# Operational Maintenance Activities

## Amenities

- Refill pet stations
- Inspect lighting
- Inspect fencing



# Operational Maintenance Activities

## Spring/Fall

- Blowing/sweeping the trail
- Inspect for winter-use damage
- Turn on/off seasonal water
- Erosion repair



Snowmobile tread damage on a bituminous trail

# Operational Maintenance Activities

## Winter

- Install winter-use signage
- Install snowmobile protection on bridge decks and trail crossings
- Plow trails and trailheads
- Groom winter-use trails (if applicable)



# Presentation Outline

- Operational Maintenance Activities
- **Trail Pavement Management**
- Asset Management
- How to Build a Trail Maintenance Schedule
- Multi-Use Trail Maintenance Recap
- References

# Trail Pavement Management

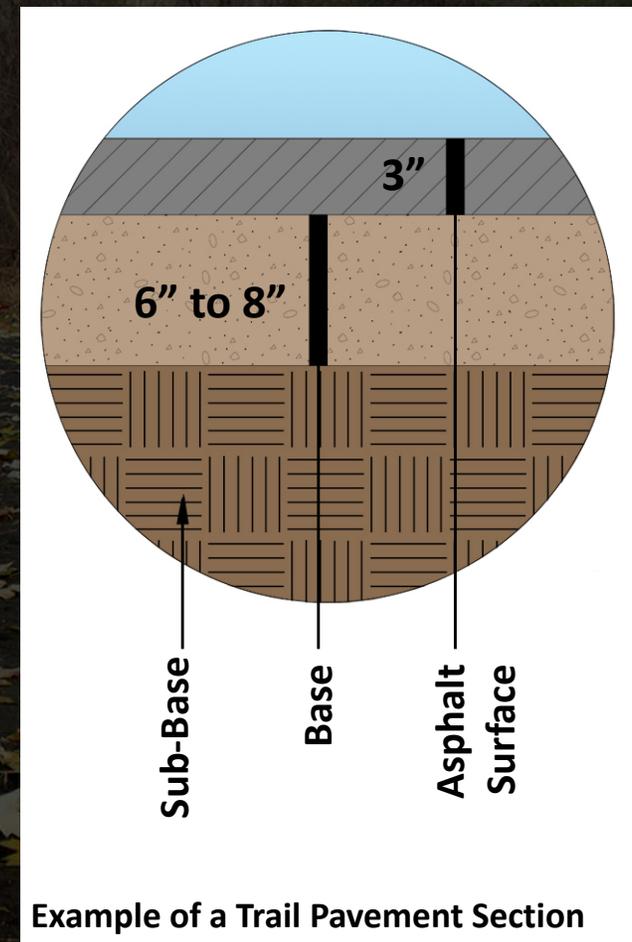
## Section Overview

- Build it Right the First Time
- Pavement Life Cycle
- Causes of pavement failure
- Typical trail pavement failure types & treatments

# Trail Pavement Management

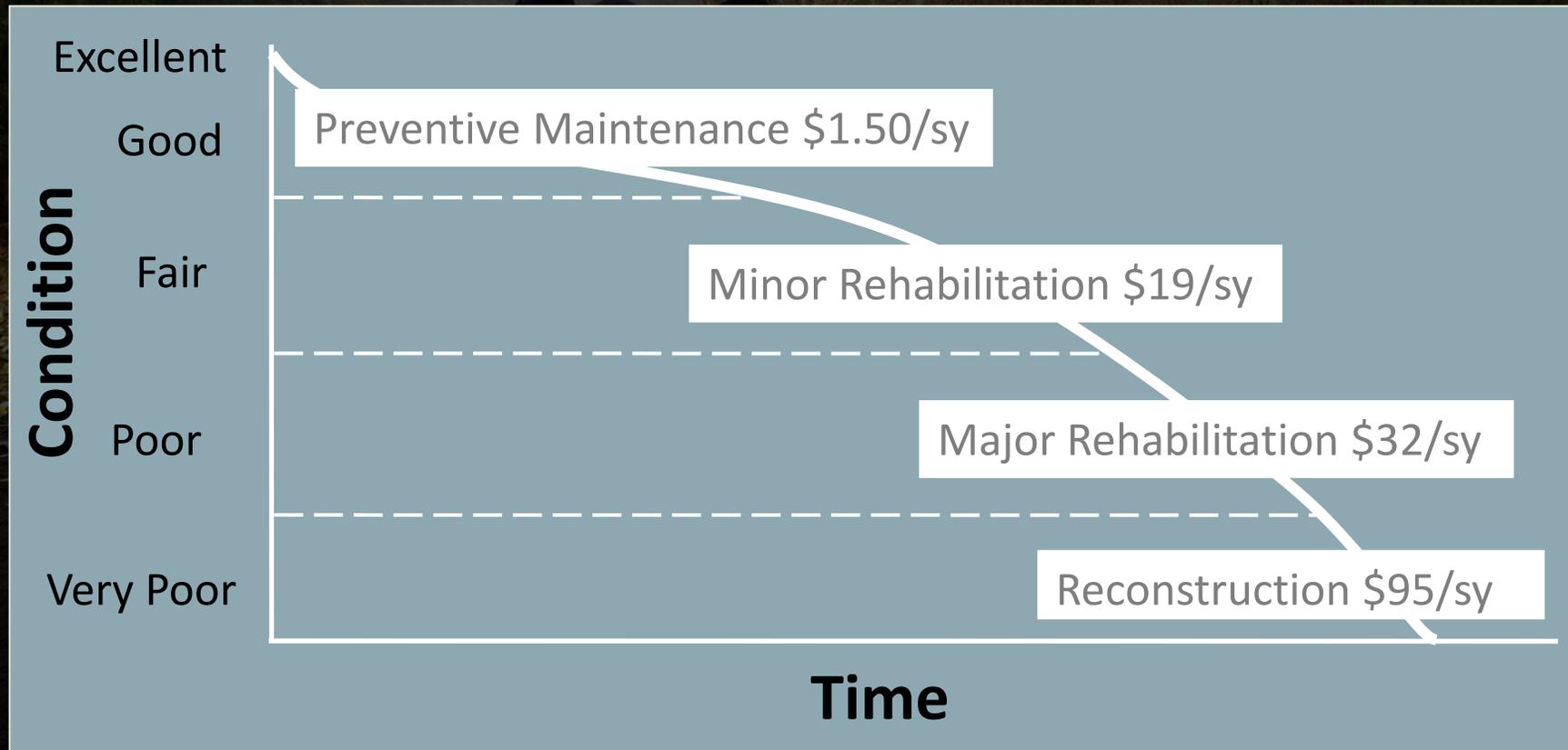
## “Build it Right the First Time”

- Proper initial construction saves money over the life of a trail
- Review plans for trail construction by developers or other agencies to confirm the proper specifications are being followed
- Inspect trail construction



# Trail Pavement Management

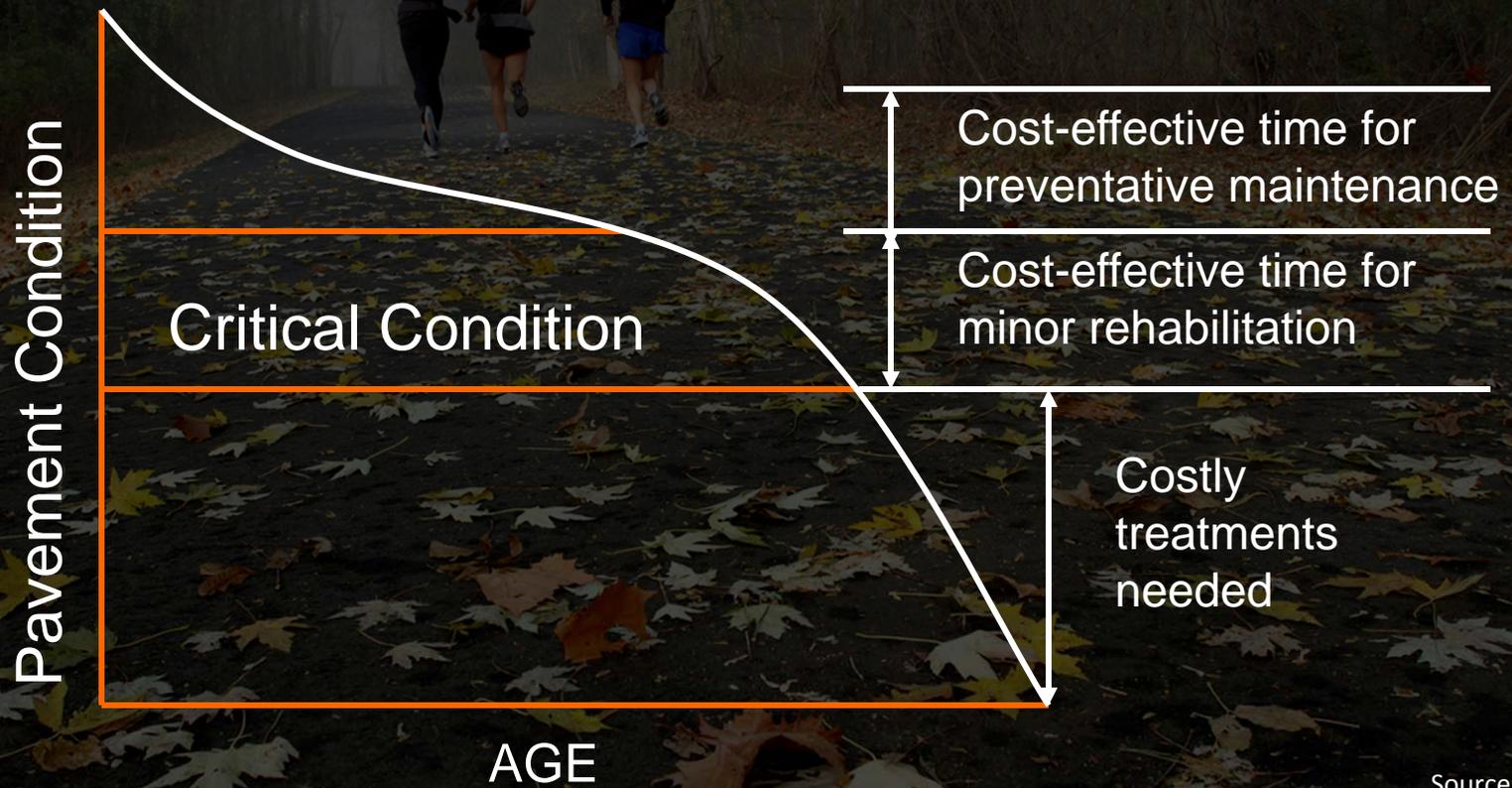
## Pay Now or Pay More Later



Source: LRRB

# Trail Pavement Management

## Pavement Life Cycle



Source: LRRB

# Trail Pavement Management

## Causes of Trail Pavement Failure

- Environmental
  - Damage caused by sunlight, oxidation, water and/or thermal cycling, age of trail, vegetation
- Traffic (Type & Frequency)
  - Maintenance equipment, emergency vehicles, utility vehicles, wear, seasonal weaknesses
- Improper Trail Construction
  - Designed trail vs. built-up trail
  - Quality of materials and/or construction

# Trail Pavement Management

## Issue #1: Cracking

### Problems

- Longitudinal cracks
  - Cracks parallel to the direction of traffic typically caused by heavy loading or by lateral movement of the sub-grade.
- Transverse cracks
  - Cracks perpendicular to the direction of traffic often caused by thermal cycling.
- Edge cracks
  - Cracks parallel to the outer trail edge or scalloped which are typically caused by loading or insufficient width of sub-grade support under trail edge
- Cracks from vegetation
  - Cracks caused by root growth or sprouting seeds.



# Trail Pavement Management

## Issue #1: Cracking

### Treatments

- Crack filling/sealing

A maintenance procedure that involves placing an elastic material (for sealing) and a rigid material (for filling) into cracks to prevent infiltration of water and other substances into the pavement structure. Overbanding should be less than 1" wide, less than 1/16" thick and routing, if done, should be less than 1/2" wide.

- Lifespan: 3-5 years
- Cautions: Application dependent, soft in hot weather
- Benefits: Reduce pavement deterioration, extend pavement life
- Cost: \$\$\$\$



Courtesy of LRRB and Mn/DOT Office of Materials and Road Research



Courtesy of LRRB and Mn/DOT Office of Materials and Road Research

# Trail Pavement Management

## Issue #1: Cracking (Caused by Vegetation)

### Treatments

- **Root barriers**

Placing a physical barrier in the ground to block roots from getting under the trail pavement

- **Full-depth patching**

A pavement repair treatment that involves saw cutting and removing damaged asphalt and filling with a hot-mix bituminous mixture



# Trail Pavement Management

## Issue #2: Surface Deterioration

### Problems

- Aging surface
  - The asphalt surface is several years old and the process of oxidation has started.
- Raveling
  - Progressive disintegration of the surface downward caused by the loss of binder and dislodged aggregate.



# Trail Pavement Management

## Issue #2: Surface Deterioration

### Treatments

- Fog seal

Diluted asphalt emulsion without a cover aggregate which is used to seal and protect the asphalt pavement surface.

- Lifespan: 4-6 years
- Texture: Smooth
- Benefits: Seals asphalt from oxidation and wear, improved aesthetics
- Open for users: One day after application
- Cost: \$\$\$\$
- For product information, see LRRB Report 2009-25 (<http://www.lrrb.org/pdf/200925.pdf>)



Courtesy of LRRB and Mn/DOT Office of Materials and Road Research



# Trail Pavement Management

## Issue #2: Surface Deterioration

### Treatments

- Sealcoat (chip seal)

An application of asphalt emulsion followed immediately with an aggregate cover which seals the asphalt pavement, provides additional protection from wearing and increases the frictional characteristics of the surface.

- Lifespan: 6-10 years
- Texture: Dependent on aggregate size (a small aggregate size is more suitable for multi-use trails)
- Benefits: Seals asphalt, improved aesthetics
- Open for use: After sweeping (24-48 hours after application)
- Cost: \$\$\$
- For product information, see LRRB Report 2009-25 (<http://www.lrrb.org/pdf/200925.pdf>)



# Trail Pavement Management

## Issue #2: Surface Deterioration

### Treatments

- Slurry seal

A mixture of liquid asphalt emulsion, aggregate and additives applied in a liquid form to provide a new pavement surface.

- Lifespan: 8-10 years
- Texture: Typically smoother than chip seal but it is dependent on aggregate size
- Benefits: Provides new surface, fills small cracks and depressions, improved aesthetics
- Open for use: 24 hours after application
- Cost: \$\$\$
- For product information, see LRRB Report 2009-25 (<http://www.lrrb.org/pdf/200925.pdf>)



# Trail Pavement Management

## Issue #2: Surface Deterioration

### Treatments

- Micro surfacing

A mixture of asphalt emulsion, aggregate and chemical additives applied in a liquid form to provide a new pavement surface. Faster cure time than slurry seal.

- Lifespan: 8-10 years
- Texture: Similar surface to a slurry seal
- Benefits: Provides new surface, fills small cracks and depressions, improved aesthetics
- Open for use: 1 hour after application
- Cost: \$\$\$\$
- For product information, see LRRB Report 2009-25 (<http://www.lrrb.org/pdf/200925.pdf>)



# Trail Pavement Management

## Issue #2: Surface Deterioration

### Treatments

- Overlay

A layer of hot-mix asphalt typically two inches or greater placed over the existing pavement surface to improve the non-structural condition of the pavement.

- Lifespan: 15 years
- Texture: Smooth
- Benefits: Fills small depressions and cracks, new trail surface
- Open for use: Typically 24 hours after application
- Cost: \$\$\$\$



# Trail Pavement Management

## Issue #3: Potholes & Depressions

### Problems

- Potholes

- Deformation in the pavement usually caused by moisture intrusion or heavy loads

- Depressions

- Low points or settling in the pavement which may be caused by water infiltration, a failed patch, an improperly compacted base or settlement



Courtesy of Three Rivers Park District

# Trail Pavement Management

## Issue #3: Potholes & Depressions

### Treatments

Two bituminous patch types, 1 of 2:

- Temporary

A cold mix repair that will eventually crumble or pull out and may not be flush with the trail.

- Lifespan: Less than one-year
- Texture: May be uneven
- Benefits: Temporary patch option when something needs to be done for a short-term fix.



# Trail Pavement Management

## Issue #3: Potholes & Depressions

### Treatments

#### Two bituminous patch types 2 of 2:

- Permanent

A pavement repair treatment that involves saw cutting and removing damaged asphalt and replacing with a high quality bituminous mixture.

- Lifespan: 15 years with proper preparation and installation
- Texture: Smooth
- Benefits: Replaces problem areas with surface that should last as long as original asphalt



# Presentation Outline

- Operational Maintenance Activities
- Trail Pavement Management
- **Asset Management**
- How to Build a Trail Maintenance Schedule
- Multi-Use Trail Maintenance Recap
- References

# Asset Management

## Asset Management is an Industry Trend That is Now Being Applied to Trails

- Proactive maintenance improves trail safety, extends life of trail surface
- Helpful for projecting current and future maintenance costs for budgeting
- Potential to incorporate trails into existing asset management program

# Asset Management

## An Asset Management System Should:

- Provide a systematic, consistent approach to evaluate the present condition of each asset
- Identify and prioritize maintenance and rehabilitation needs
- Provide information to the public and elected officials
- Can remove biases and political decisions

# Asset Management

## Benefits of an Asset Management System:

- More accurate and accessible information on assets
- Ability to monitor performance
- More efficient use of available resources
- Ability to justify funding needs

# Asset Management

## Asset Management is a Dynamic Process

- Initial cost of the software
- Initial cost of the pavement inventory and data entry
- Periodic cost of pavement inventory to keep the database current and valid

# Asset Management Software

- ICON (Goodpointe Technology)
- PAsERware (WisDOT)
- Micropaver (APWA/Corps of Engineers)
- PAVEMENT View Plus (Cartegraph)
- In-house Spreadsheet or database

# Asset Management Software

	Software (Provider)					
	Micropaver (APWA / Corps of Engineers)	PAVEMENTview Plus (Cartègraph)	ICON (Goodpointe Technology)	PavePRO Manager (IMS)	RoadMatrix (Stantec)	PASERWARE (WI TIC LTAP)
<b>1.0 COST</b>						
1.1 Initial Cost of Software	\$995 for APWA members \$1095 for non-APWA members	\$1,000 - \$5,000	\$1,000 - \$10,000+	\$10,000+	\$5,000- \$8,000	Free for WI agencies \$100 for non-WI agencies
1.2 Annual Technical Support Costs	<ul style="list-style-type: none"> <li>● First year</li> <li>● Renewable annually for \$500 for APWA members \$650 for non-APWA members</li> </ul>	●	<ul style="list-style-type: none"> <li>● for one authorized user</li> <li>● \$250 for each additional user</li> <li>● Value-added infrastructure management consulting services, cost varies with number of hours (\$1,000 - \$4,000)</li> </ul>	●	● \$2,500- \$5,000	○
1.3 Vendor Data Collection Costs						
1.3.1. Automated	○	○	\$25 - \$215/mile	\$300+/mile <sup>1</sup>	\$50 - \$200/mile	○
1.3.2. Manual	○	○	\$25 - \$250/mile	Included in cost for Automated	\$100 - \$200/mile	○
1.3.3. Hand-held/PDA/Tablet PC	○	\$20 - \$50/mile	\$100 - \$250/mile	Included in cost for Automated	○	○
<b>2.0 DATA INPUTS</b>						
2.1 Segment, Begin and End Points	●	●	●	●	●	●
2.2 Spatial location (GPS Location)	●	●	●	●	●	○
2.3 Segment Width and/or Area	●	●	●	●	●	●
2.4 Pavement (Layer) Data	●	●	●	●	●	●
2.5 Age	●	●	●	●	●	●
2.6 AADT	○	●	●	●	●	●
2.7 ESAL's	○	●	●	●	●	○

● Standard – Included in Standard Software Cost    ● Optional – Available for an Additional Cost    ○ Not Available

<sup>1</sup> Data collection includes surface data, deflection testing, digital images, and GIS linkage.

# Asset Management Software

## Types of Data

- Section identification
- Construction, maintenance and rehabilitation history
- Pavement characteristics
- Pavement condition data
- Others

# Asset Management Software

Additional information on asset management and asset management software can be found at: [www.lrrb.org](http://www.lrrb.org)

# Asset Management Trail Maintenance Case Studies

- Three Rivers Park District
- Stearns County Parks
- Eden Prairie Parks & Recreation

# Asset Management Trail Maintenance Case Studies

## Three Rivers Park District



- Miles of trails: 150
- Asset management software: PASER rating system combined with an in-house GIS database
- Pavement preservation treatments: Slurry seal, crack sealing and filling
- Surface treatment rationale:
  1. Chip sealing was too rough for in-line skaters
  2. Slurry seal is not perfect but it protects the pavement and is smooth enough for their users
  3. Prolongs the life of the trail

# Asset Management Trail Maintenance Case Studies

## Stearns County Parks

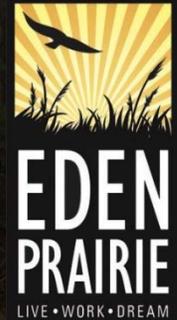
- Miles of trails: 60
- Asset management software: Excel spreadsheet
- Pavement preservation treatments: Crack filling
- Surface treatment rationale:
  1. Increase user safety
  2. Preserve the pavement
- Additional information: Stearns County Parks will be starting a program of fog sealing trails every five years to protect the trail surface and prolong the life of the trail.



# Asset Management Trail Maintenance Case Studies

## Eden Prairie Parks & Recreation

- Miles of trails: 128
- Asset management software: ICON system
- Pavement preservation treatments: Chip seal, crack sealing and crack filling
- Surface treatment rationale:
  1. More durable trail surface to handle winter maintenance equipment
  2. Extends useful life of trail
  3. Coordinate trail and roadway chip sealing for cost savings
- Additional Information: 1/8" trap rock is used for the chip seal



# Asset Management

## What are Your Trail Priorities?

- Reduce long-term trail maintenance costs
- Allocate trail expenditures over life of trail (reduce frequency of reconstruction cost spikes)
- Provide a user-friendly surface for users
- Maintain durable surfaces for use during multiple seasons
- Extend the life of the trail

# Asset Management

## What is the Best Management Tool for Your Trail System?

- Factors to Consider:
  - Available funding
  - Staff resources
  - Trail system size
  - Cost of software
  - Initial and routine data collection costs and staff requirements

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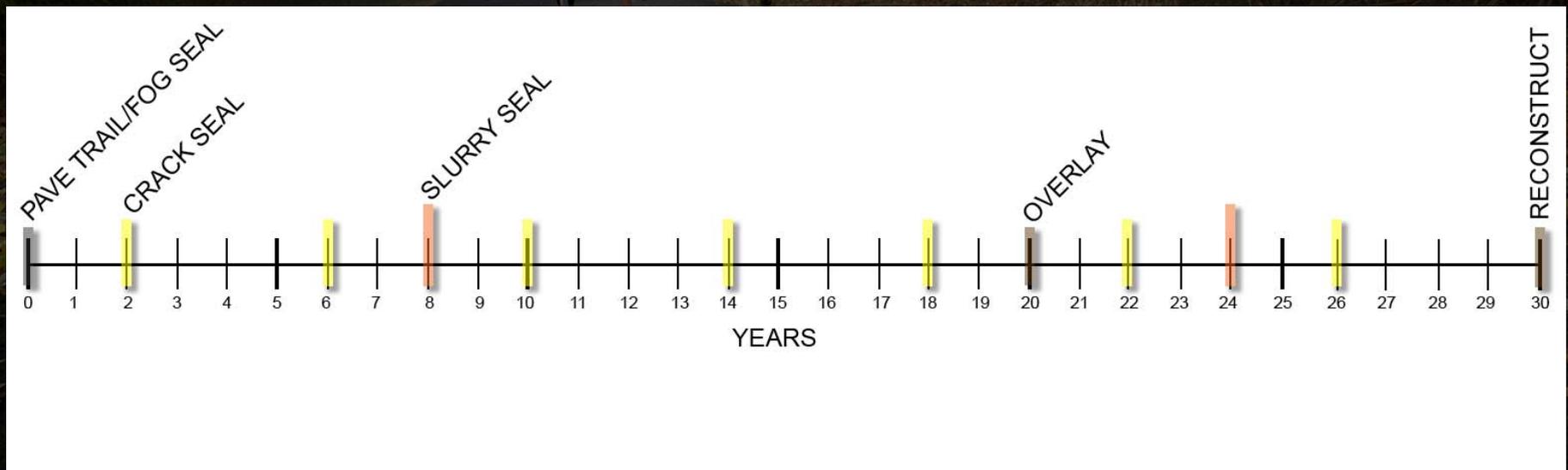
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# How to Build a Trail Maintenance Schedule

- Examples of:
  - Slurry seal schedule
  - Fog seal schedule
  - Crack seal, overlay and reconstruct schedule
- Schedules based on:
  - General industry estimates for life spans
  - Trail specific environment, usage and desired level of service
  - Requires on-going monitoring and adjustments

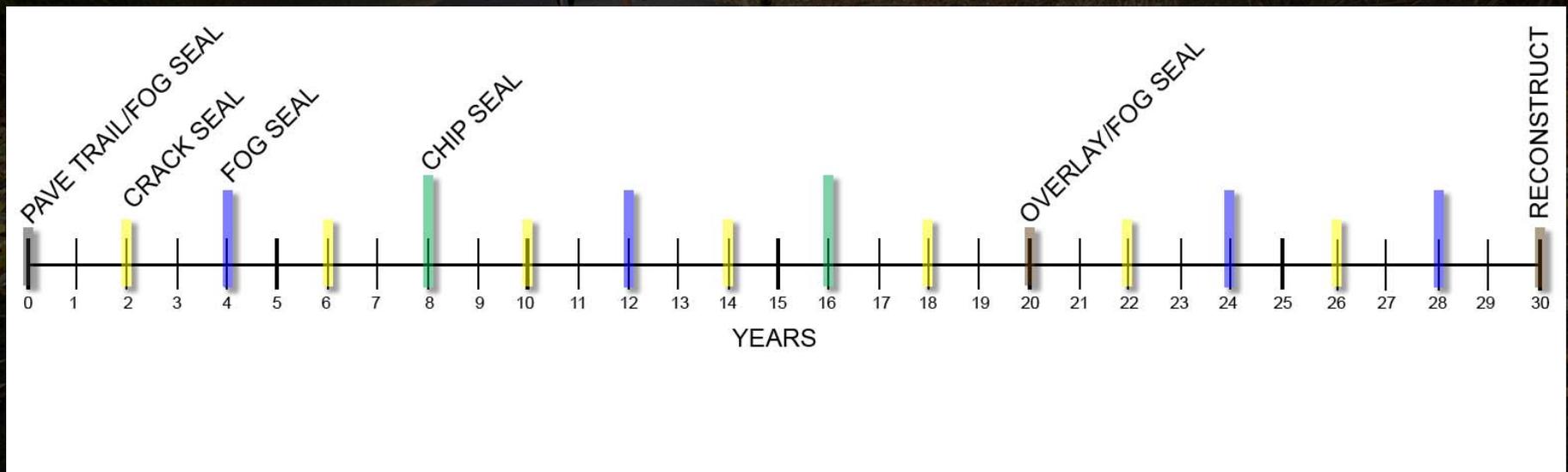
# How to Build a Trail Maintenance Schedule

## Primary Asphalt Treatment Example: Slurry Seal



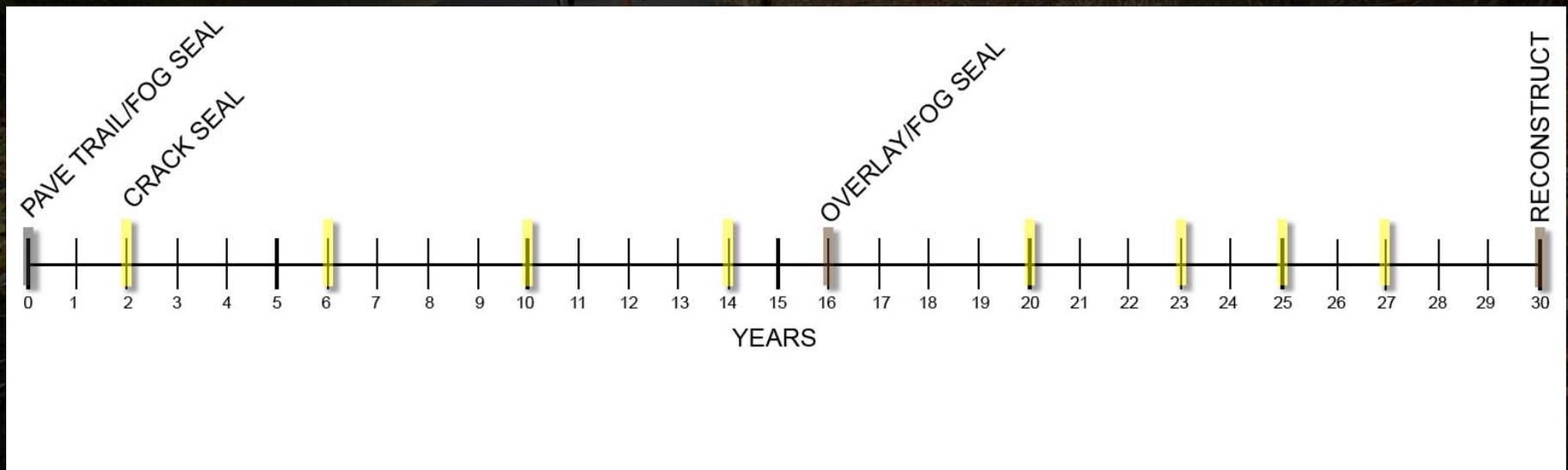
# How to Build a Trail Maintenance Schedule

Primary Asphalt Treatment Example:  
Fog Seal and Sealcoat (chip seal)



# How to Build a Trail Maintenance Schedule

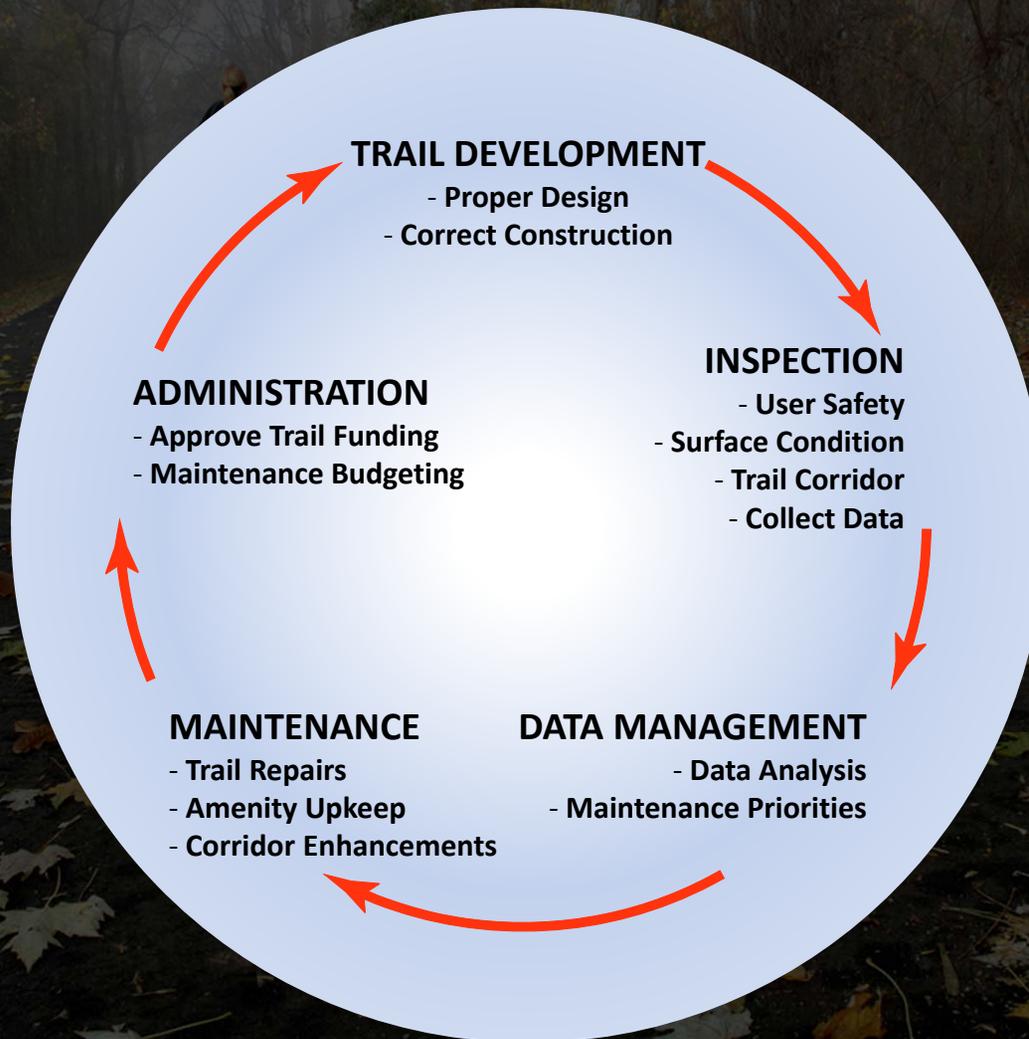
## Primary Asphalt Treatment Example: Crack Seal



# Presentation Outline

- Operational Maintenance Activities
- Trail Pavement Management
- Asset Management
- How to Build a Trail Maintenance Schedule
- Multi-Use Trail Maintenance Recap
- References

# Multi-Use Trail Maintenance Recap



# Presentation Outline

- Operational Maintenance Activities
- Trail Pavement Management
- Asset Management
- How to Build a Trail Maintenance Schedule
- Multi-Use Trail Maintenance Recap
- References

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Minnesota Local Technical Assistance Program

MN LTAP – [www.mnltap.umn.edu](http://www.mnltap.umn.edu)

National Center for Pavement Preservation

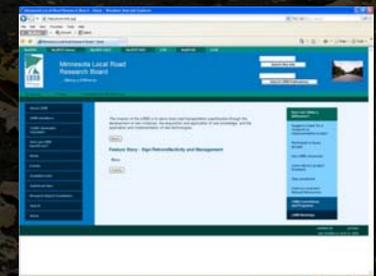
NCPP – [www.pavementpreservation.org](http://www.pavementpreservation.org)

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Produced by Greer and Associates, January 2011.





# Maintenance of Recreational Trails

