# The Selection and Timing of Pavement Preservation Strategies

## Louisiana Asphalt Technology Conference

*Larry Galehouse, P.E., P.S.*

*National Center for Pavement Preservation*

# Americans demand easy mobility on safe, smooth, and well-maintained roads.

ncpp
National Center for Pavement Preservation

MICHIGAN STATE
UNIVERSITY

# Driving on Poor Roads Cost

- $49 billion per year in extra vehicle repairs and operation costs
- $255 per motorist

Source: The Road Information Program

# EVOLVING DEMANDS

- Highway Usage Increased 29% in the 1990's
- Truck Traffic Increased 40% in the 1990's
- Truck Traffic Will Increase 3% per year in next 20 years

ncpp
National Center for Pavement Preservation

MICHIGAN STATE UNIVERSITY

# CONSEQUENCES

- Operating Revenues Can't Keep Pace with Needs
- Highway Agencies Face Increasing Demands with Decreasing Resources

*The Solution:*

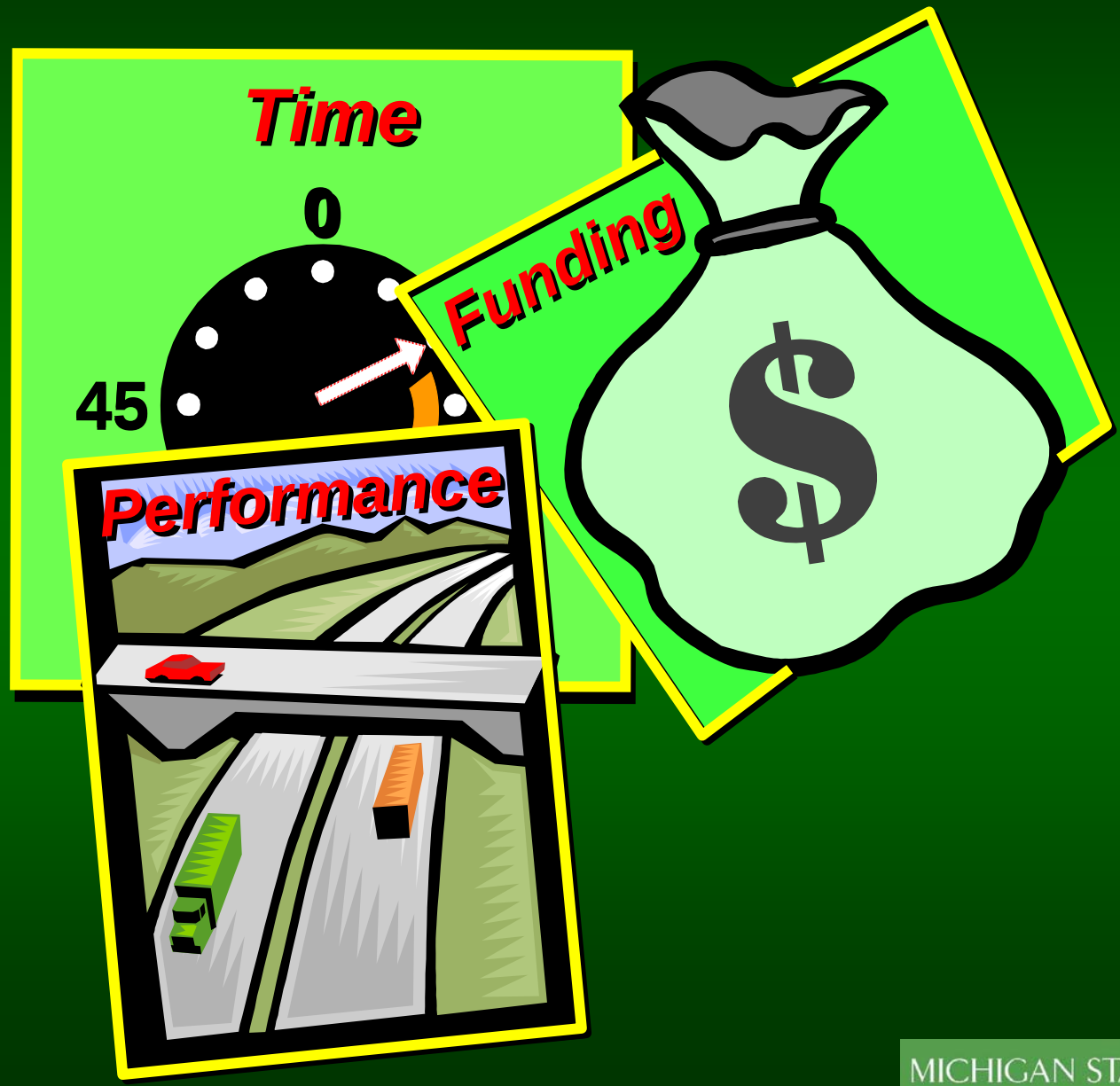
# Pavement Preservation

**Improves the Performance of the Network while Spending Less Program Dollars**

ncpp
National Center for Pavement Preservation

MICHIGAN STATE UNIVERSITY

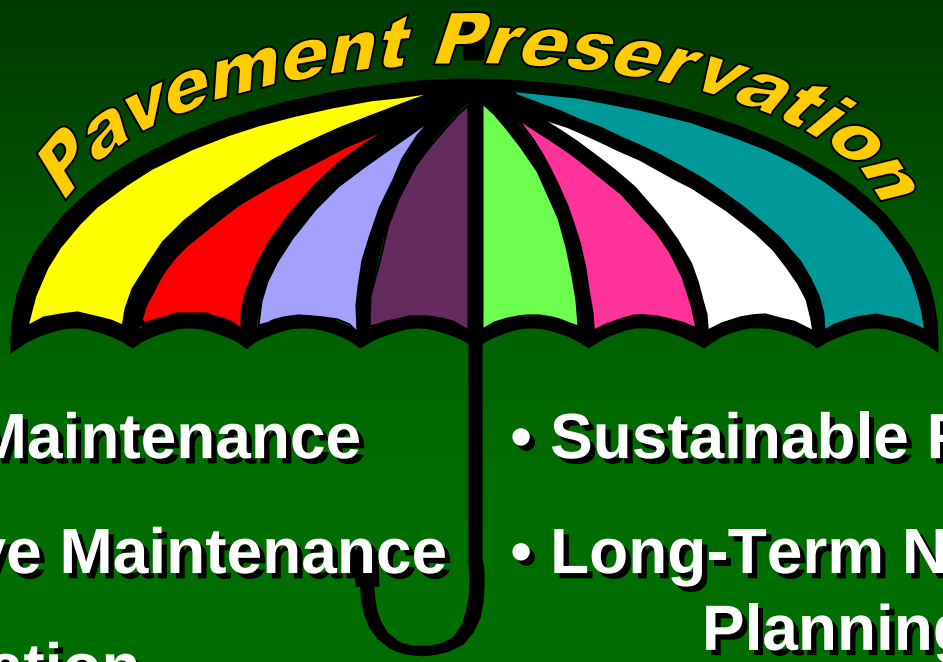
# What is Pavement Preservation ?



# Pavement Preservation is *NOT* about Maintenance as Usual

# Pavement Preservation "Definition"

Pavement preservation is a program employing a network level, long-term strategy that enhances pavement performance by using an integrated, cost-effective set of practices that extend pavement life, improve safety and meet motorist expectations.




- Routine Maintenance
- Preventive Maintenance
- Rehabilitation
- Sustainable Financing
- Long-Term Network Planning
- Cost-Effective Decision Making
- Pavement Management System
- Optimization

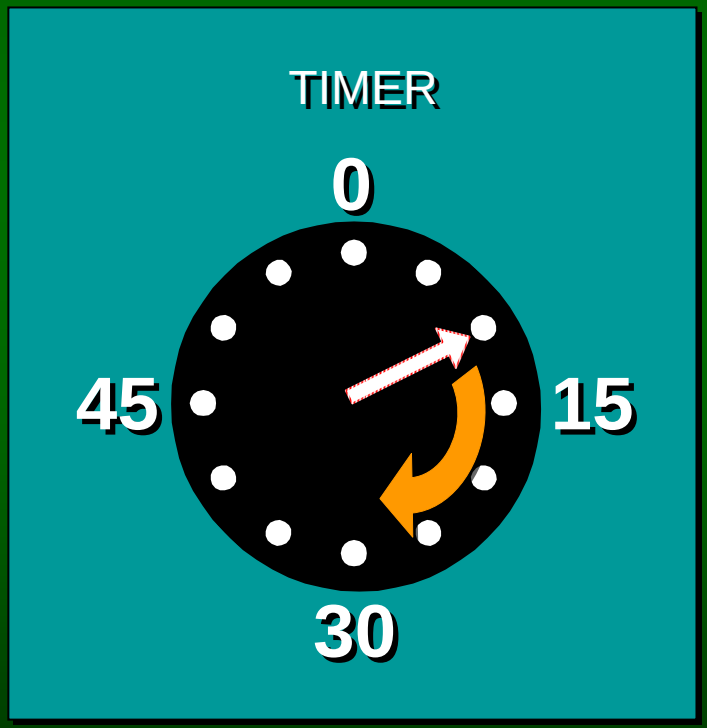
ncpp
National Center for Pavement Preservation

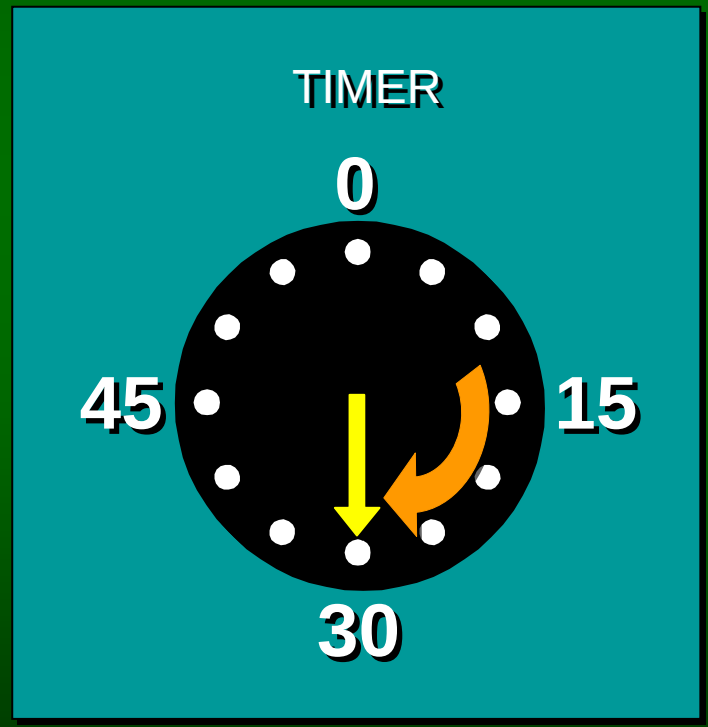
MICHIGAN STATE UNIVERSITY

# Rehabilitation

## Minor Rehab

### Extends Life



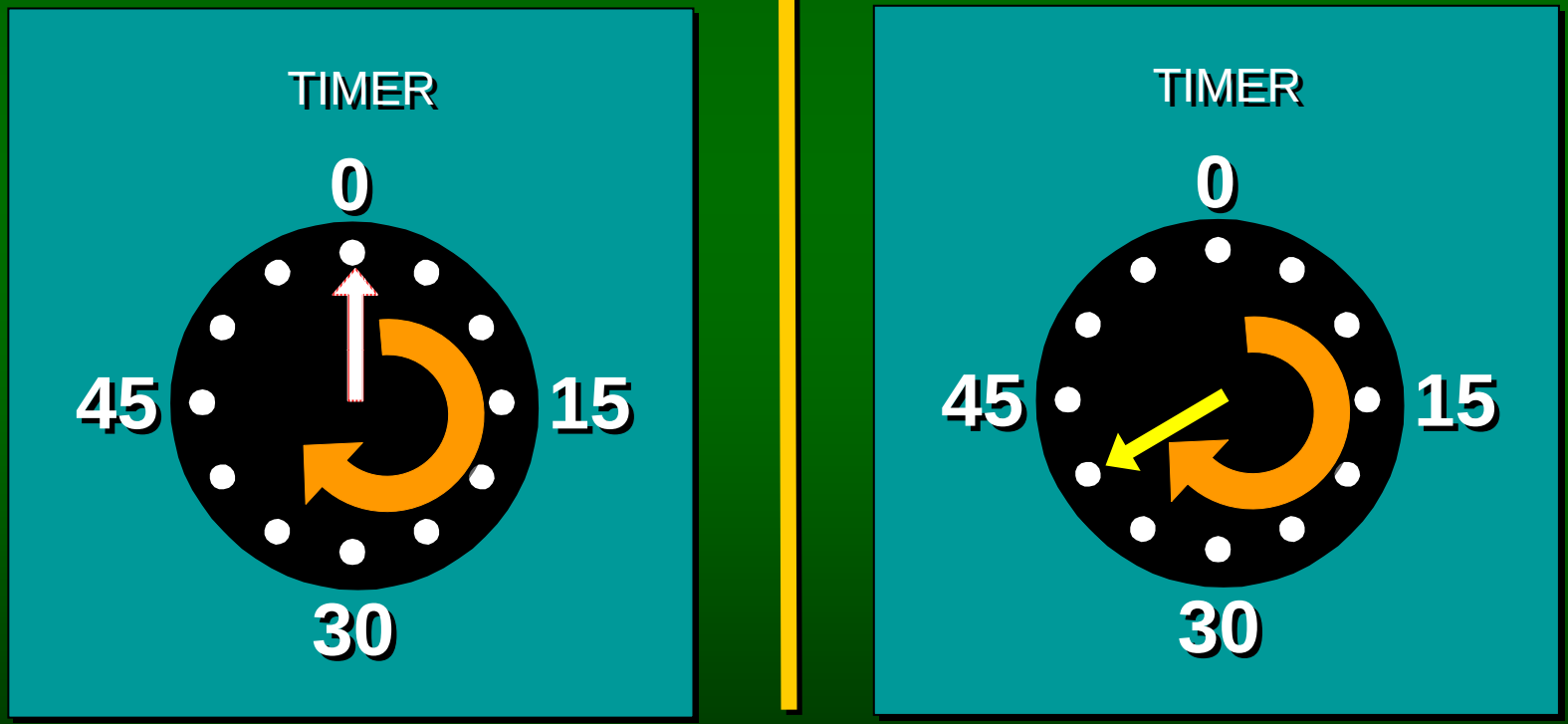




*Adding More Time*

# Rehabilitation

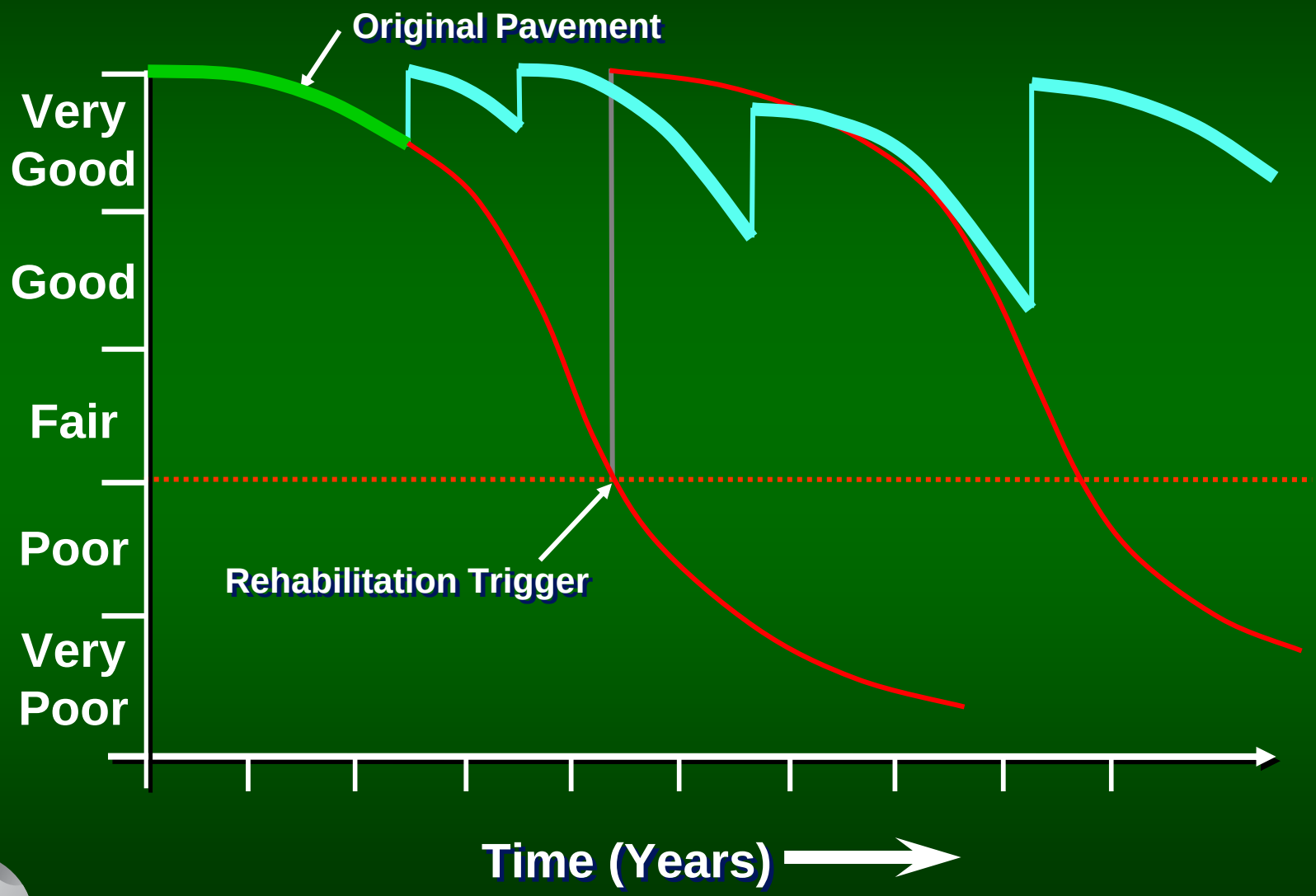
## Major Rehab

### Originates Life

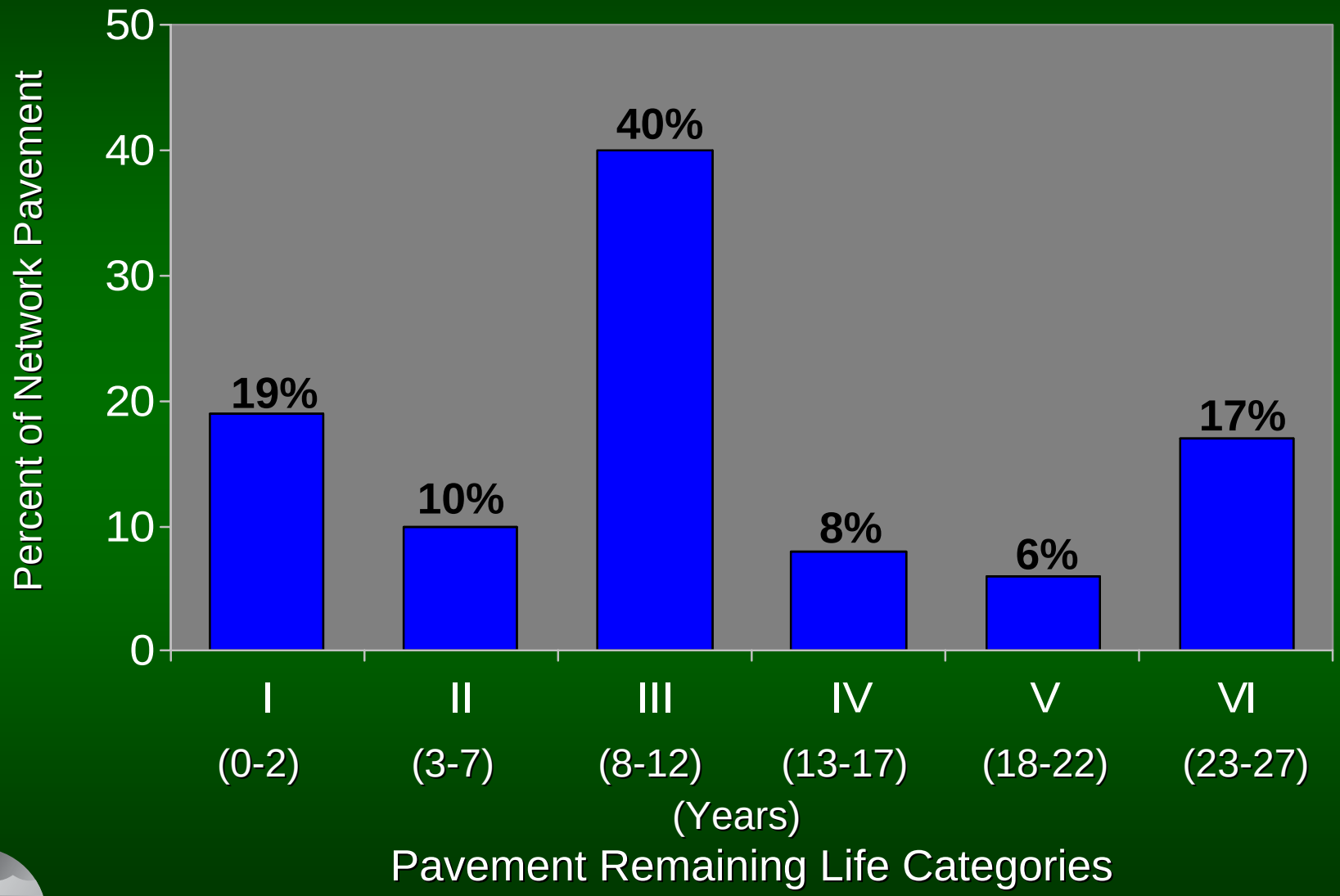



*Initiating Time*

# The Pavement Preservation Concept



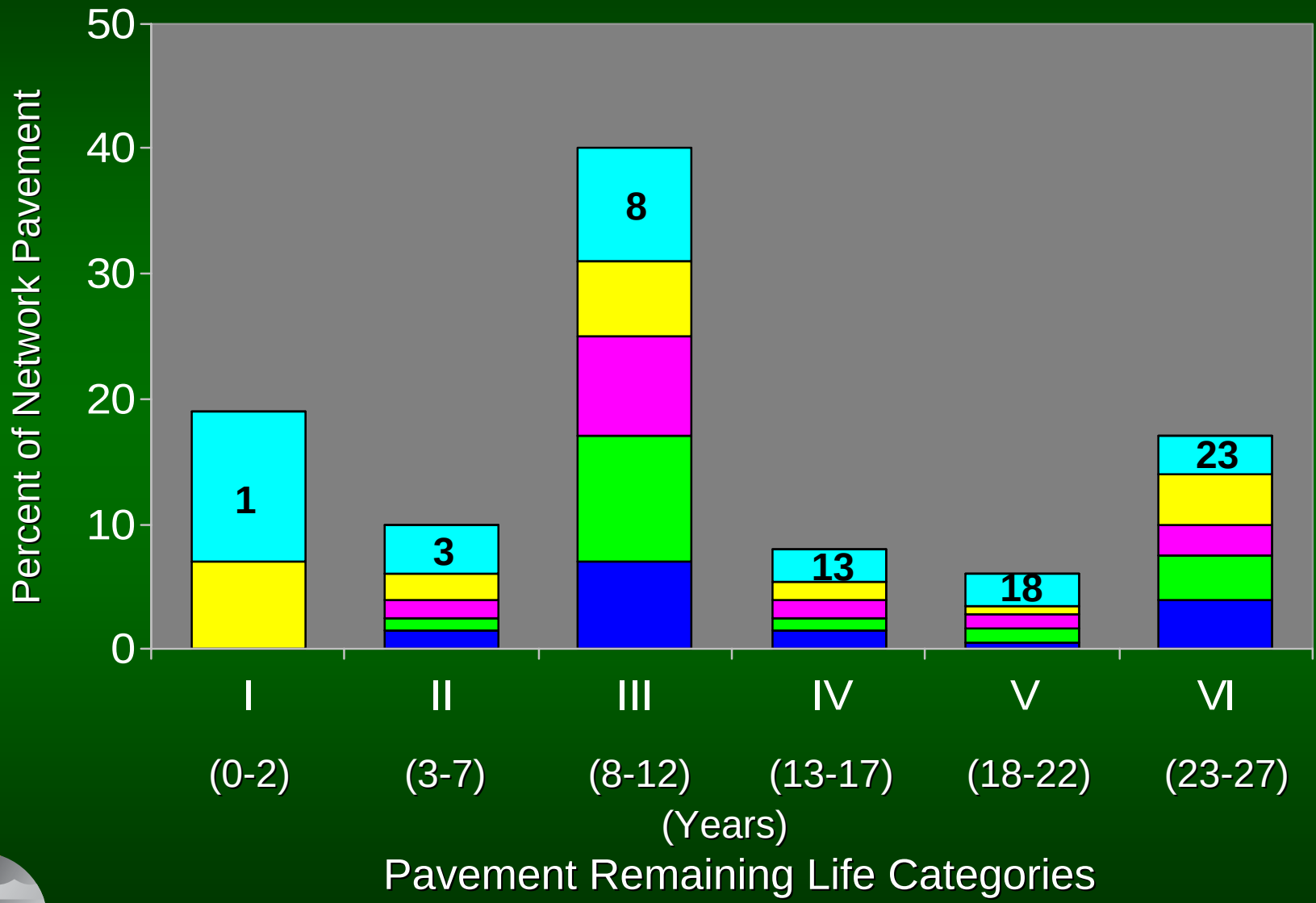
# Current Condition




ncpp
National Center for Pavement Preservation

MICHIGAN STATE UNIVERSITY

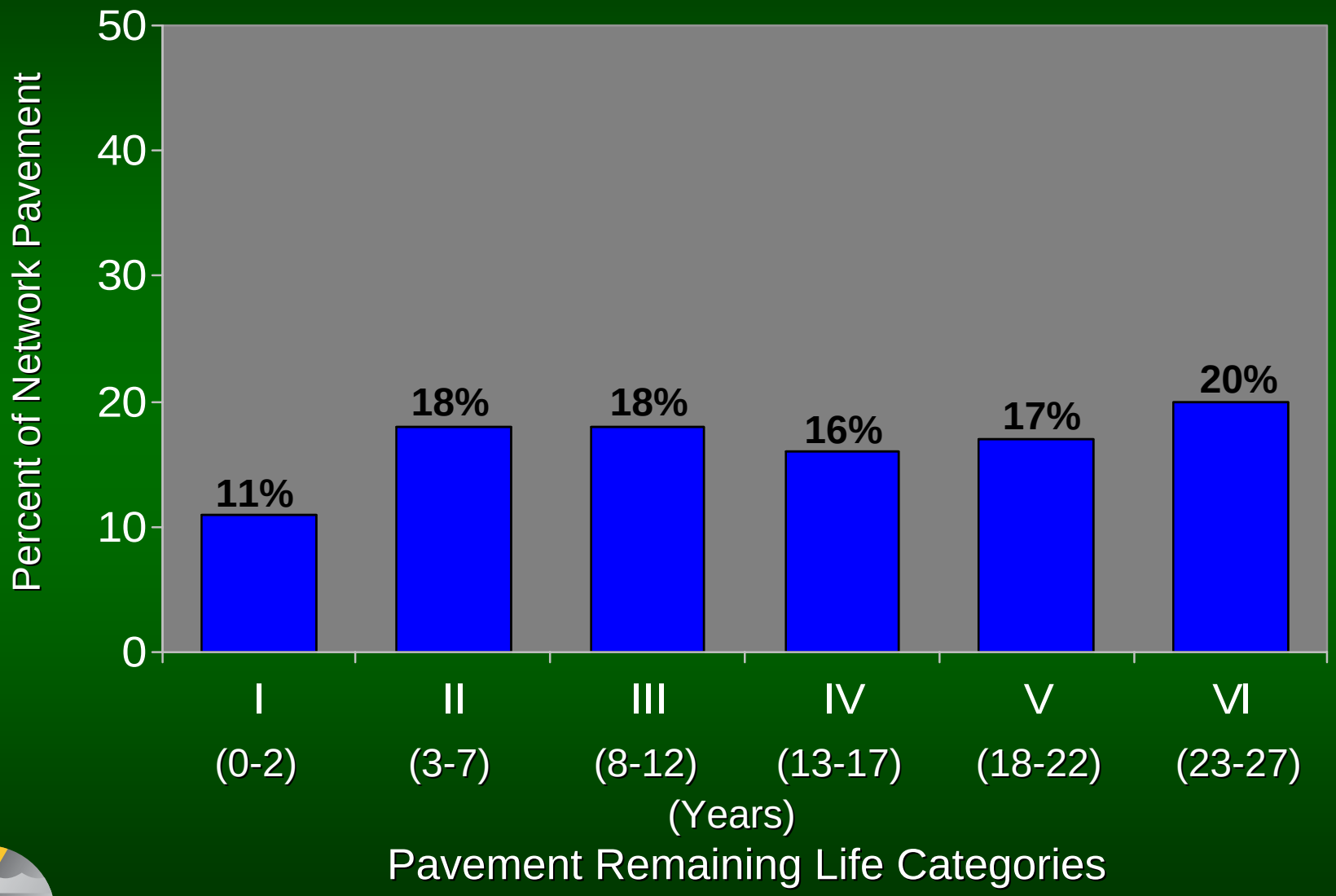
# Yearly Distribution



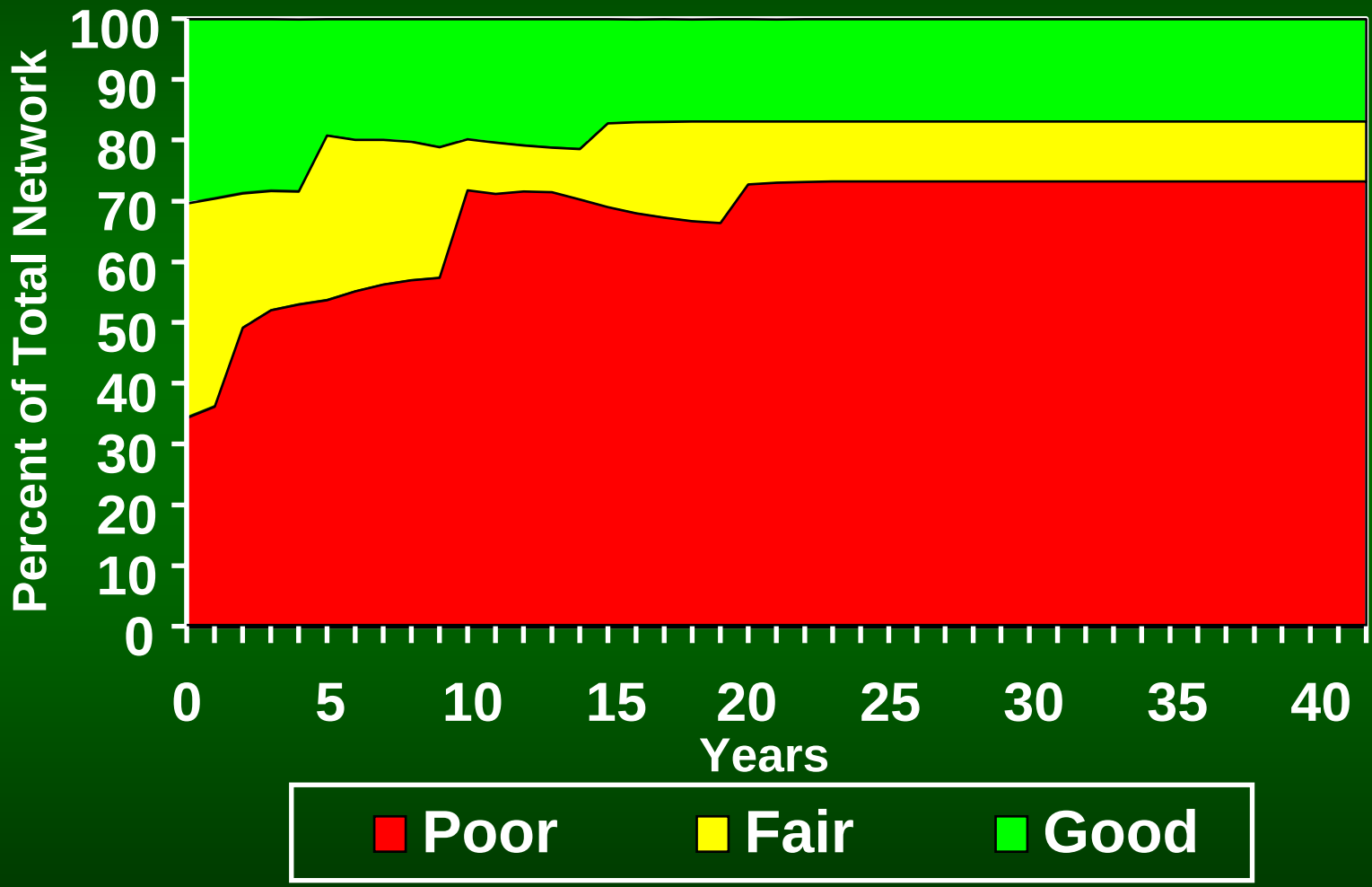

ncpp
National Center for Pavement Preservation

MICHIGAN STATE UNIVERSITY

# Optimal Condition



# Reconstruction Strategy
## (20, 25, & 30 Year Fixes)




ncpp
National Center for Pavement Preservation

MICHIGAN STATE UNIVERSITY

# Combined Reconstruct and Rehab Strategy

(10 to 30 Year Fixes)


ncpp
National Center for Pavement Preservation

MICHIGAN STATE UNIVERSITY

# Combined Reconstruct, Rehab & Preventive Maintenance Strategy

(5 to 30 Year Fixes)


ncpp
National Center for Pavement Preservation

MICHIGAN STATE UNIVERSITY

# MEASUREMENTS

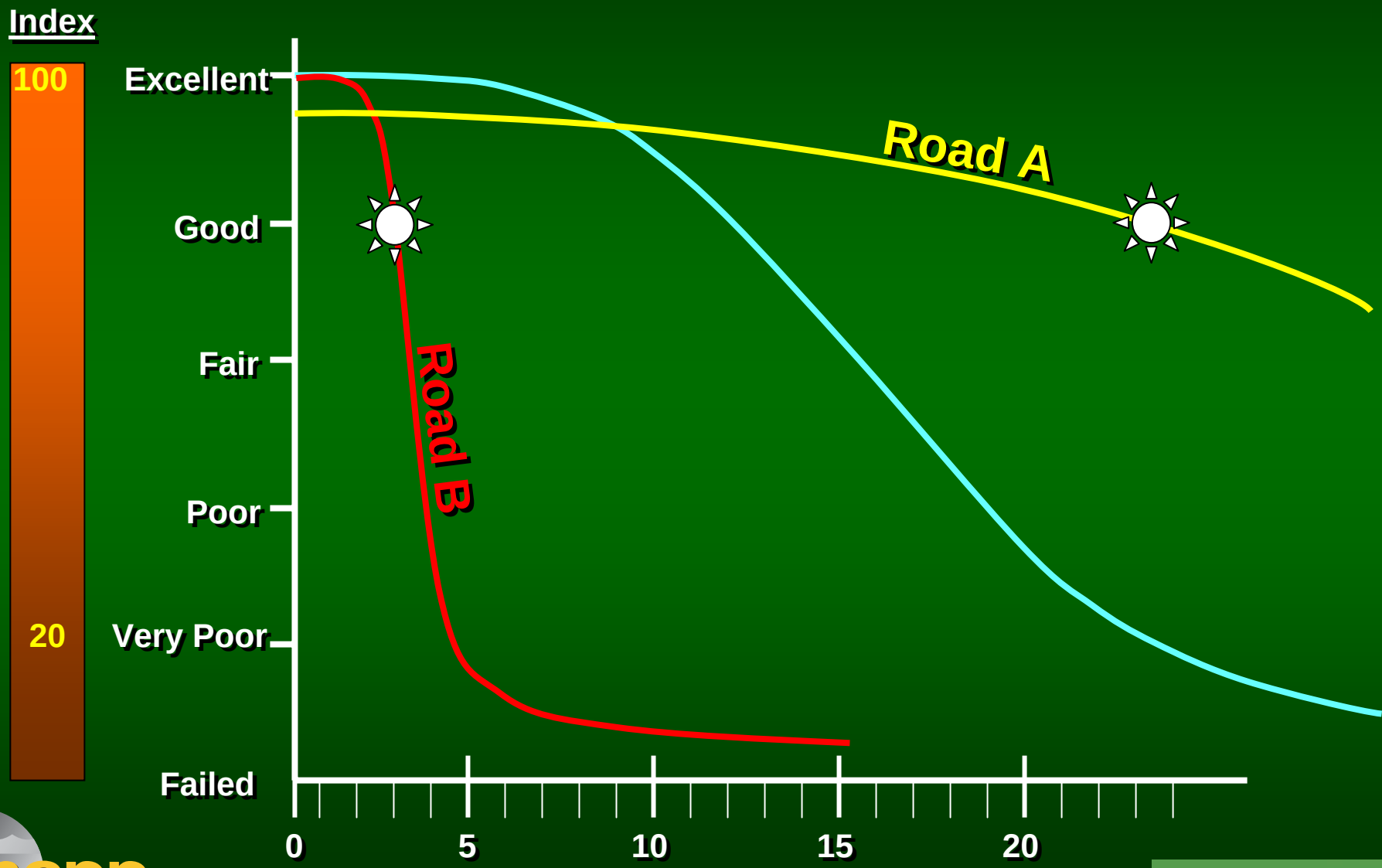
# Of

# PAVEMENT LIFE

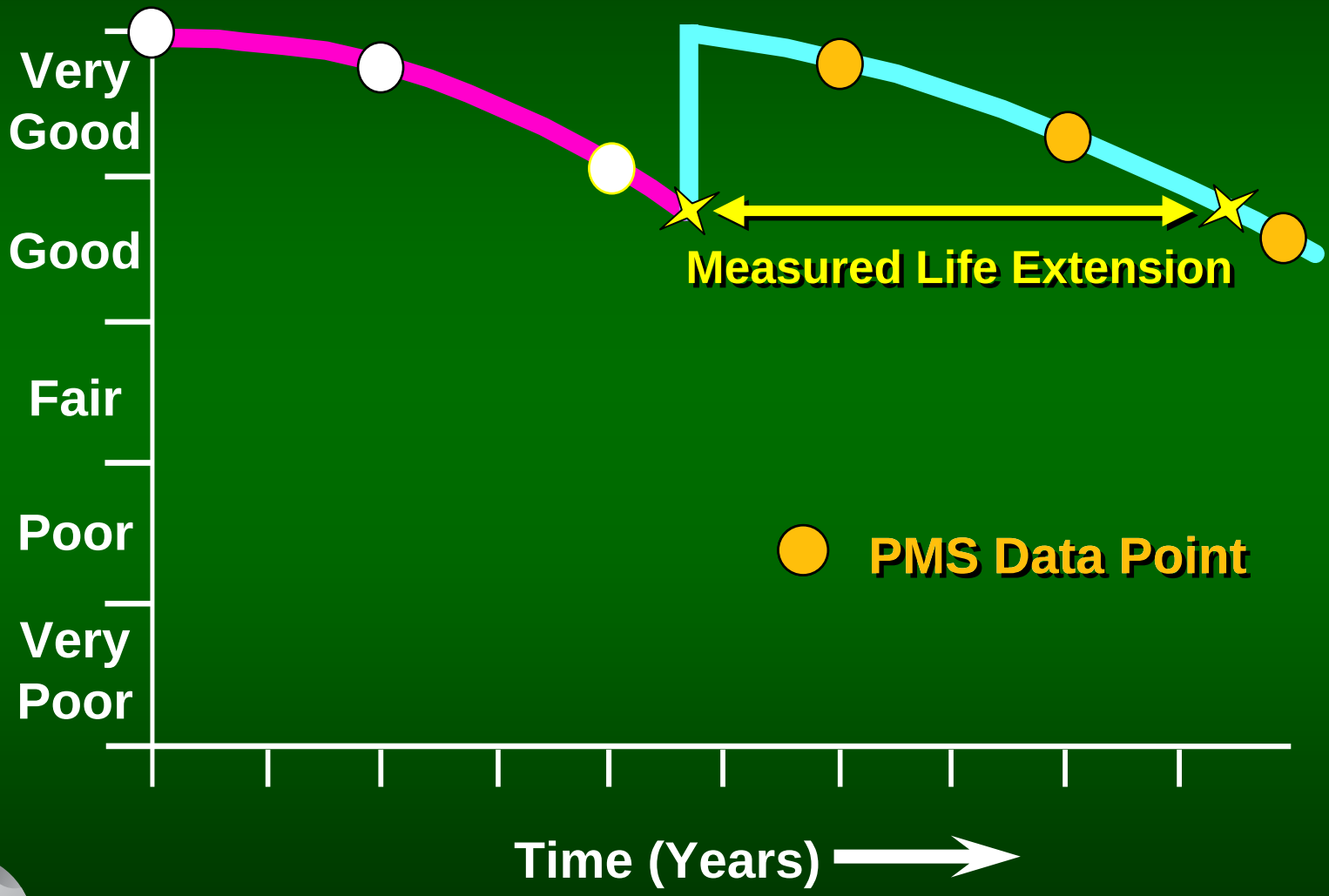
ncpp
National Center for Pavement Preservation

MICHIGAN STATE
UNIVERSITY

# Pavement Deterioration Curves



# Life Extension



# Typical Treatments
## Flexible & Composite Pavements

- Asphalt Crack Sealing
- Asphalt Crack Filling
- Chip Seals
- Slurry Seals
- Micro-Surfacing
- Thin Bonded Wearing Course
- HMA Thin Overlay
- Surface Milling w/ Non-Structural HMA Overlay

# Typical Treatments
## Rigid Pavements

- Diamond Grinding
- Concrete Crack Sealing
- Concrete Joint Resealing
- Partial Depth Concrete Pavement Repair
- Dowel Bar Retrofit
- Full Depth Concrete Pavement Repair


# PREVENTIVE MAINTENANCE PROGRAM

# GUIDELINES

# 1 - ASPHALT CRACK SEALING

## Description:

## Performance:

## Existing

## Existing Pavement Surface Preparation:

## Timing:

**Description:** Crack sealing is the placement of specialized materials into working cracks[1] b… desired reservoir… cleaning the cut s… cutting is perform…

This treatment is… conjunction with a…

…with a good base… (HMA) surface s… (with underlying … may include: fair… secondary cracki… few patches in ex…

| Min RSL (1) | L… |
|---|---|
| 10 | |

**Existing Pavement Su…**

**Timing:** The use of magnesium chloride as a roadway snow and ice melter may leave residue in pavement cracks. Early season crack treatment applications could likely result in poor adhesion and a high loss of the sealant material. To assure a successful crack sealing operation, work should be scheduled in the early fall once daytime temperatures begin to cool. Application should be …

**Performance:** Crack sealing introduces materials that adhere to the crack walls, are flexible and elastomeric in nature. This allows significant strain to be absorbed by the material without fracture. Much of this strain will be recoverable …

[1] Working Crack: A crack in a pavement that undergoes significant deflection and thermal opening and closing movements greater than 2 mm (1/16 inch), typically oriented transversely to the pavement centerline.

…lose with thermal stresses or traffic loading and …ess of the seal will depend greatly upon the width …movement of the pavement structure at the crack.

**Expected Life Extension** (3)

| Commercial Traffic/Pavement Type | (Trucks)/(Years) | | |
|---|---|---|---|
| AADT-T | < 400 | 400 - 6000 | > 6000 |
| Flexible | Up to 4 (4) | Up to 3 | Up to 2 |

*(3) The time range is the expected life-extending benefit given to the pavement, not the anticipated longevity of the treatment. The life-extending value for pavements above 8,000' elevation should be reduced up to 50% from the values shown in the table.*

*(4) After application of the treatment, the pavement service life should be limited to a maximum RSL of 15 years due to anticipated environmental effects.*

ncpp National Center for Pavement Preservation

MICHIGAN STATE UNIVERSITY

# Working Crack

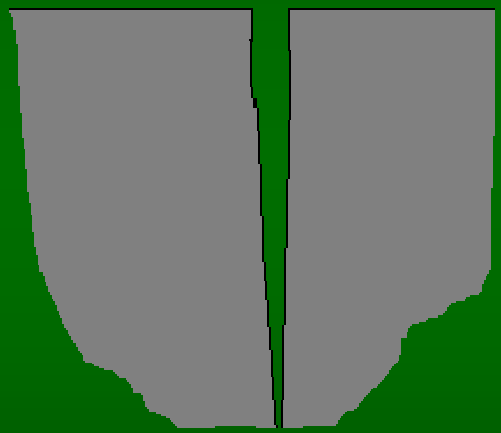
***Criteria:***

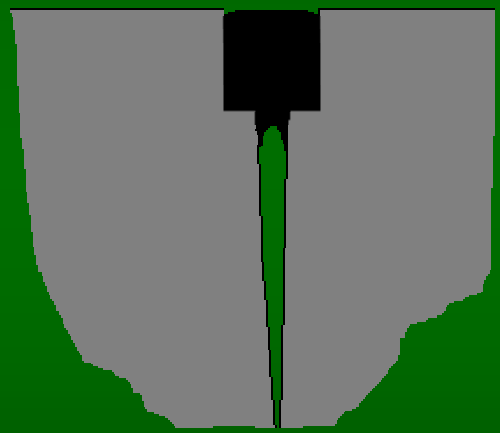
**Crack movement is at least 1/8” (3-mm)**

# Transverse Cracking

# Crack Sealing

## *Working Cracks*





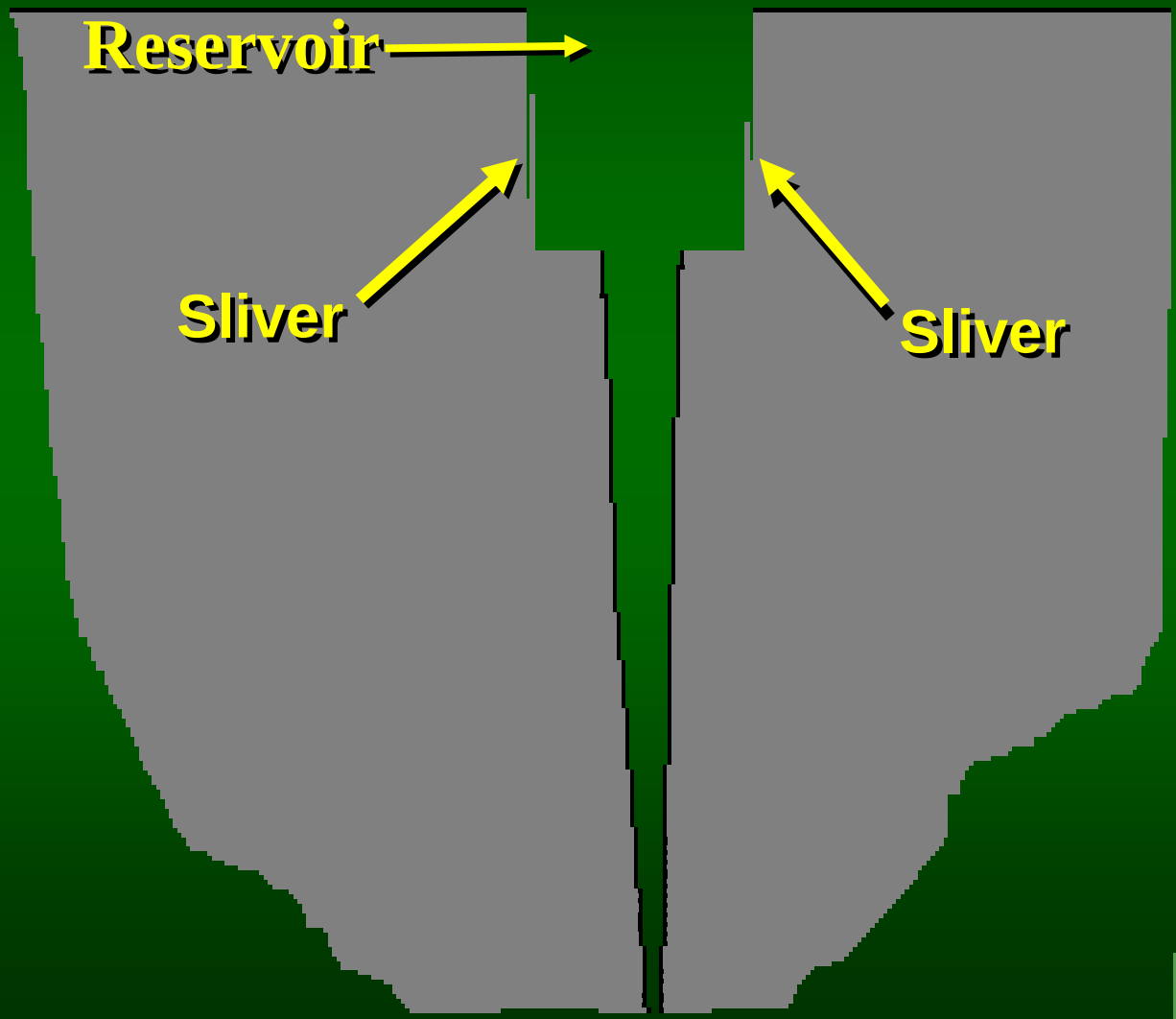
***Typical Crack*** ***Standard Reservoir***

# Crack Router

# Random Crack Saw

# Attention to Detail

## *Corrects Future Problems*



# 2 – ASPHALT CRACK FILLING

## Performance

## Existing Pavement Conditions

2 – ASPHALT CRACK FILLING

**Description:** Crack filling is the placement of materials into non-working cracks by the overband crack fill method. This method consis
the asphalt pavement surface with compressed air and
materials into and above the crack.

This treatment is usually performed on non-working cr
with an Asphalt Crack Sealing treatment for working cr

**Purpose:** The purpose of overband crack filling in the
pavement is to prevent water from entering the pavem

This treatment is commonly used as a surface prepara

fall once daytime temperatures begin to cool. Application should be scheduled only when dry and air temperatures are 35ºF or greater.

**Performance:** When used as a pre-treatment, crack filling will help extend the service life of its subsequent surface treatment. A stand-alone overband crack filling will also extend the life of the pavement structure.

If crack filling is to be used as a stand-alone treatment, it should be used with

e numbers of working cracks.
cracks and should be followed in later years

*Expected Life Extension* (3)

| Commercial Traffic/Pavement Type | (Trucks)/(Years) | | |
|---|---|---|---|
| AADT-T | < 400 | 400 - 6000 | > 6000 |
| Flexible | Up to 4 (4) | Up to 2 | Up to 2 |

*ange is the expected life-extending benefit given to the pavement, not the d longevity of the treatment. The life-extending value for pavements above 8,000' elevation should be reduced up to 50% from the values shown in the table.*

*(4) After application of the treatment, the pavement service life should be limited to a maximum RSL of 15 years due to anticipated environmental effects.*

*Minimu*
*FOR STAN*

| Pavement | Min RSL (1) | Long_Index | Tran_Index | Ride_Index | Rut_Index |
|---|---|---|---|---|---|
| Flexible | 9 | 80 | 80 | 85 | 80 |

*(1) For low commercial traffic roadways (AADT-T < 400), the minimum RSL = 7.*

*(2) These are initial starting points that should be fine-tuned over time based upon experience in using this treatment option.*

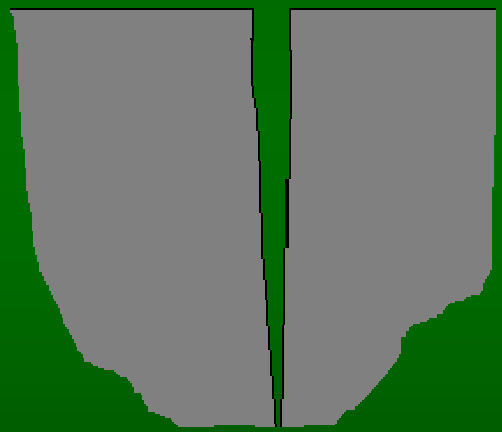
***Note: Contact the Region Pavement Manager for the Index Values of specific highways.***

ncpp
National Center for Pavement Preservation

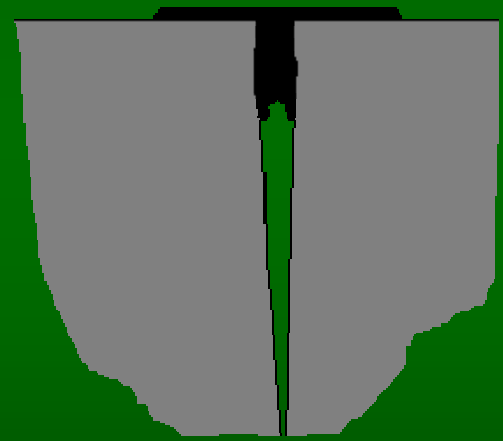
MICHIGAN STATE UNIVERSITY

# Crack Filling

## *Non-Working Cracks*



***Typical Crack***



***Simple Overband***

# Melter / Applicator

ncpp
National Center for Pavement Preservation

MICHIGAN STATE
UNIVERSITY


NEW YEAR'S EVE
2005
FREE
Fireworks Show!
JANUARY 1-2

# Overband Crack Fill Operation

*What's wrong with this operation ?*

Too Much Material

# Safety Issues. . . .

# Economic Issues . . .

Too Much Material

ncpp
National Center for Pavement Preservation

MICHIGAN STATE UNIVERSITY

# 4 – CHIP SEALS

## Performance

## Existing Pavement Conditions

4 - CHIP SEALS

**Description:** A chip seal is a surface treatment in which the pavement is sprayed with asphalt (generally emulsified) and the
and rolled. Chip seals may be applied in s

r moderate to heavy commercial traffic

| Pavement | Min |
|---|---|
| Flexible | |

(1) For low commercia
(2) These are initial sta
using this treatment option.

***Note: Contact the Region Pavement Manager for the Index Values of specific highways.***

**Expected Life Extension** [3]

| avement Type | (Trucks)/(Years) | | |
|---|---|---|---|
| AADT-T | < 400 | 400 - 6000 | > 6000 |
| Flexible | 6 to 9 [4] | 3 to 6 | 2 to 3 |

*(3) The time range is the expected life-extending benefit given to the pavement, not the anticipated longevity of the treatment. The life-extending value for pavements above 8,000' elevation should be reduced up to 50% from the values shown in the table.*
*(4) After application of the treatment, the pavement service life should be limited to a maximum RSL of 15 years due to anticipated environmental effects.*

**Existing Pavement Surface Preparation:** For single and double chip seals, all visible cracks and construction joints should be sealed by the overband crack fill method.

**Timing:**

**Recommended Placement Times**

| Location | Start | Stop |
|---|---|---|
| Above 10,000' | July 4 | August 1 |
| 8,000' to 10,000' | June 15 | August 15 |
| 6,000' to 8,000' | June 1 | September 1 |
| 4,000' to 6,000' | May 15 | September 1 |
| Below 4,000' | May 1 | September 1 |

**Performance:** Chip seals perform best on flexible pavement structures in rural

ncpp National Center for Pavement Preservation

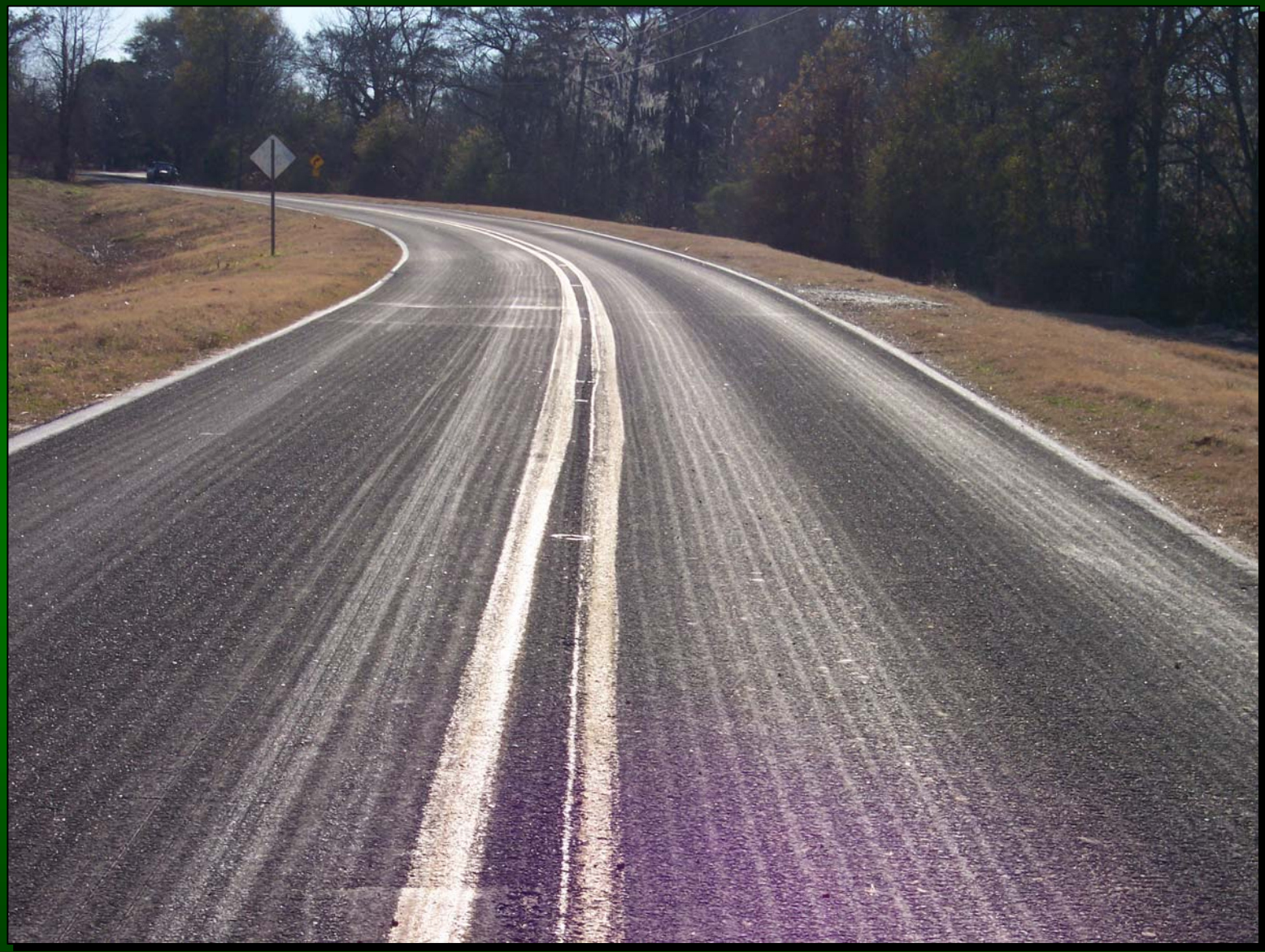
MICHIGAN STATE UNIVERSITY

# Watercutter Retexturizing in New Zealand

# Watercutter Retexturizing

Before

After



ncpp
National Center for Pavement Preservation

MICHIGAN STATE
UNIVERSITY


ncpp
National Center for Pavement Preservation

MICHIGAN STATE
UNIVERSITY

ncpp
National Center for Pavement Preservation

MICHIGAN STATE
UNIVERSITY


JUL 31 2002

# 5 - MICRO-SURFACING

## Performance

## Existing Pavement Conditions

5 - MICRO-SURFACING

**Description:** Micro-surfacing is a mixture of polymer modified asphalt emulsion, fine aggregate, mineral filler, water, and c
mixed, and spread on a paved surface.

cro-surfacing formulation makes it a poor crack
very aggregate-specific because of the
n characteristics of the mixture. Late season

| Pavement | Min RS |
|---|---|
| Flexible | 8 (mult<br>12 (sing |

(1) For low commercial tra
(2) These are initial startin
using this treatment op

***Note: Contact the Regional Pavement Manager for the Index Values of Specific Highways.***

protection of utility structures.

**Timing:**

**Recommended Placement Times**

| Location | Start | Stop |
|---|---|---|
| Above 10,000' | July 4 | August 1 |
| 8,000' to 10,000' | June 15 | August 15 |
| 6,000' to 8,000' | June 1 | September 1 |
| 4,000' to 6,000' | May 15 | September 1 |
| Below 4,000' | May 1 | September 1 |

**Performance:** Micro-surfacing corrects several surface deficiencies related to wet weather traffic accidents. A Micro-surface application performs under all traffic volumes to correct the pavement surface conditions described above.

**Expected Life Extension [3]**

| Commercial Traffic/Pavement Type | (Trucks)/(Years) | | |
|---|---|---|---|
| AADT-T | < 400 | 400 - 6000 | > 6000 |
| Flexible: Single Course | 6 to 9 [4] | 3 to 5 | 2 to 3 |
| Flexible: Multiple Course | 8 to 9 [4] | 4 to 6 | 2 to 4 |

*(3) The time range is the expected life-extending benefit given to the pavement, not the anticipated longevity of the treatment. The life-extending value for pavements above 8,000' elevation should be reduced up to 50% from the values shown in the table.*

*(4) After application of the treatment, the pavement service life should be limited to a maximum RSL of 15 years due to anticipated environmental effects.*

ncpp
National Center for Pavement Preservation

MICHIGAN STATE UNIVERSITY

ncpp
National Center for Pavement Preservation

MICHIGAN STATE
UNIVERSITY

ncpp
National Center for Pavement Preservation

MICHIGAN STATE
UNIVERSITY


SLOW

ncpp
National Center for Pavement Preservation

MICHIGAN STATE
UNIVERSITY

# 6 – Thin Bonded Wearing Course

**6 – Thin Bonded Wearing Course**

**Description:** Thin Bonded Wearing Course is a layer of heavily polymerized emulsion followed by a thin (less than 1 inch) polymer modified hot mix overlay

## Existing Pavement Condition

*Minimum PMS Values*

| Pavement | Min RSL (1) | Long_Index | Tran_Index | Ride_Index (2) | Rut_Index |
|---|---|---|---|---|---|
| Flexible | 8 | 70 | 70 | 80 | 65 |

*(1) For low co*
*(2) These are*
*using this*
***Note: Contac***

*in*

## Existing Pavement Surface Preparation

**Existing Pavement Surface Preparation:** The following items should be performed before paving operations.

1. Cover all utility structures such as manhole covers, etc.
2. Remove thermoplastic traffic markings.
3. Clean and fill pavement cracks greater than 0.25 inch wide.
4. Fill surface irregularities greater than 1 inch deep.
5. Mill or fill ruts greater than 0.5 inch.

| Comme | | | |
|---|---|---|---|
| AADT-T | | | |
| Flexible or Composite | Up to 5 | Up to 7 | Up to 5 |

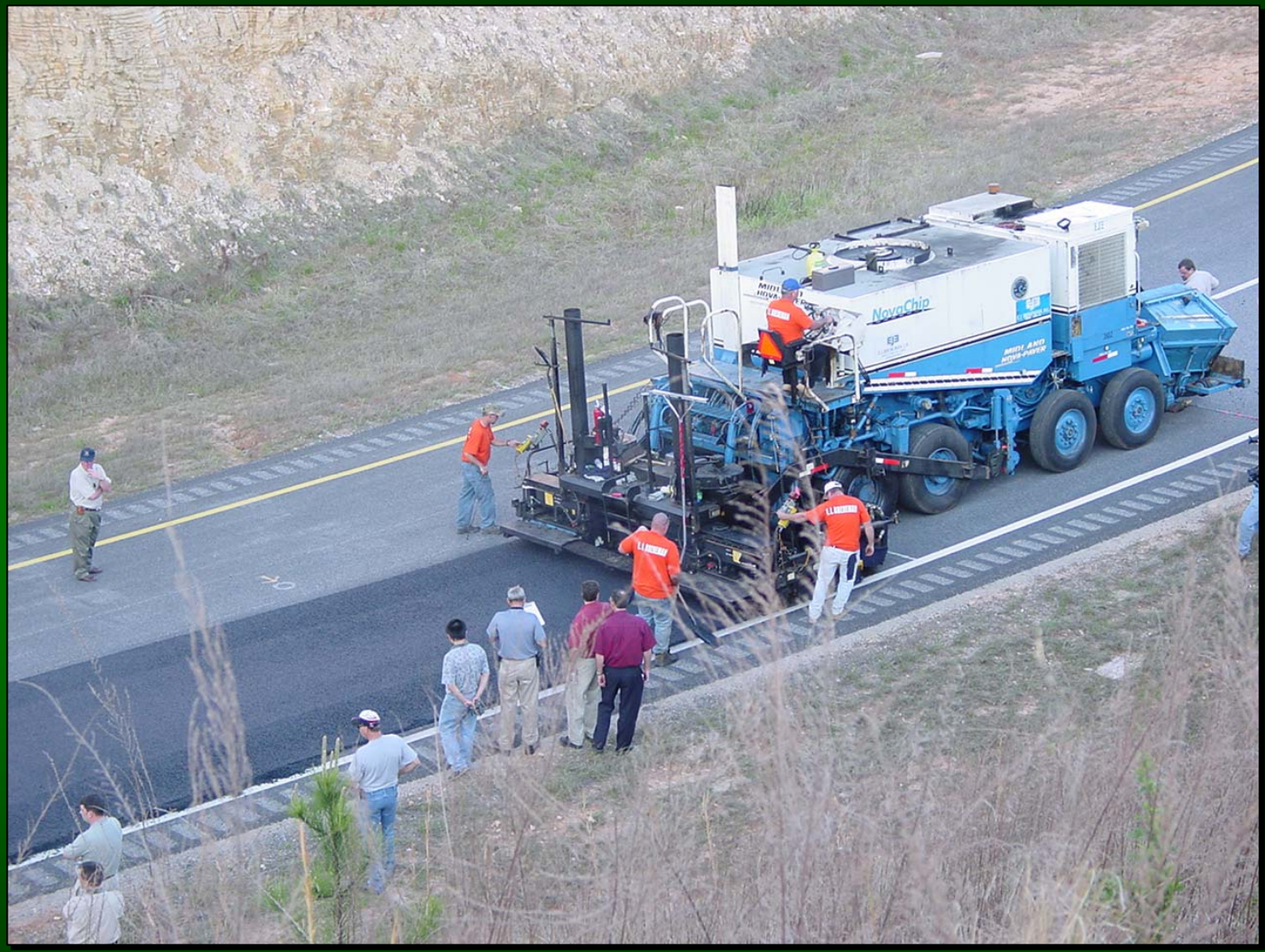
*(3) The time range is the expected life-extending benefit given to the pavement, not the anticipated longevity of the treatment. The life-extending value for pavements above 8,000' elevation should be reduced up to 50% from the values shown in the table.*
*(4) After application of the treatment, the pavement service life should be limited to a maximum RSL of 15 years due to anticipated environmental effects.*

ncpp National Center for Pavement Preservation

MICHIGAN STATE UNIVERSITY


ncpp
National Center for Pavement Preservation

MICHIGAN STATE
UNIVERSITY




ncpp
National Center for Pavement Preservation

MICHIGAN STATE
UNIVERSITY

ncpp
National Center for Pavement Preservation

MICHIGAN STATE
UNIVERSITY

# 7 – HMA THIN OVERLAY (Less than 1½")

7- HMA THIN OVERLAY (Less than 1½")

**Description:** A dense-graded hot-mix asphalt (HMA) applied at a maximum rate of 170 lb / square yard over an existing bituminous surface.

**Purpose:** A non-structural HMA overlay will provide protection to the pavement structure, slow the rate of pavement deterioration, correct many pavement

## Existing Pavement Conditions

*Minimum PMS Values*

| Pavement | Min RSL (1) | Long_Index | Tran_Index | Ride_Index (2) | Rut_Index |
|---|---|---|---|---|---|
| Flexible | 6 | 70 | 70 | 60 | 65 |

*(1) For low commercial traffic roadways (AADT-T < 400), the minimum RSL = 4.*
*(2) These are initial starting points that should be fine-tuned over time based upon experience in using this treatment option.*
***Note: Contact the Region Pavement Manager for the Index Values of specific highways.***

severely tented joints, and correcting deficient super-elevations.

## Performance

nt performs best on flexible pavement structures, but
site pavements depending on the extent of any

**Expected Life Extension (3)**

| Commercial Traffic/Pavement Type | (Trucks)/(Years) | | |
|---|---|---|---|
| AADT-T | < 400 | 400 - 6000 | > 6000 |
| Flexible | 10 – 11 (4) | 5 – 9 (4) | 3 - 5 |

*(3) The time range is the expected life-extending benefit given to the pavement, not the anticipated longevity of the treatment. The life-extending value for pavements above 8,000' elevation should be reduced up to 50% from the values shown in the table.*
*(4) After application of the treatment, the pavement service life should be limited to a maximum RSL of 15 years due to anticipated environmental effects.*

National Center for Pavement Preservation

MICHIGAN STATE UNIVERSITY


ncpp
National Center for Pavement Preservation

MICHIGAN STATE
UNIVERSITY

# 8 – SURFACE MILLING WITH NON-STRUCTURAL HMA OVERLAY

## Less than 1½”

**8 - SURFACE MILLING WITH NON-STRUCTURAL HMA OVERLAY**
**(Less than 1½")**

**Description:** The removal of an existing asphalt s
method and the placement of a dense-graded hot-mix
170 lb / square yard application rate.

**Purpose:** This treatment will correct several exis
improve the shape of the existing cross section, a

eventive maintenance treatment

## Performance

Expected Life Extension [3]

| Commercial Traffic/Pavement Type | (Trucks)/(Years) | | |
|---|---|---|---|
| | < 400 | 400 - 6000 | > 6000 |
| Flexible | 10 -11[4] | 5 - 5 | 3 - 5 |

*(3) The time range is the expected life-extending benefit given to the pavement, not the anticipated longevity of the treatment. The life-extending value for pavements above 8,000' elevation should be reduced up to 50% from the values shown in the table.*

*(4) After application of the treatment, the pavement service life should be limited to a maximum RSL of 15 years due to anticipated environmental effects.*

## Existing Pavement Conditions

| Pavement | Min RSL [1] |
|---|---|
| Flexible | 6 |

*(1) For low commercial traffic roadways (AADT-T < 400), the minimum RSL = 4.*

*(2) These are initial starting points that should be fine-tuned over time based upon experience in using this treatment option.*

***Note: Contact the Region Pavement Manager for the Index Values of specific highways.***

cold milling can be used to remove a portion of the existing asphalt surface to retain the existing curb face. Cold milling can also be used in those areas where the existing pavement grade cannot be raised.

***Minimum PMS Values***

| Pavement | Min RSL [1] | Long_Index | Tran_Index | Ride_Index [2] | Rut_Index |
|---|---|---|---|---|---|
| Flexible | 6 | 70 | 70 | 50 | 50 |

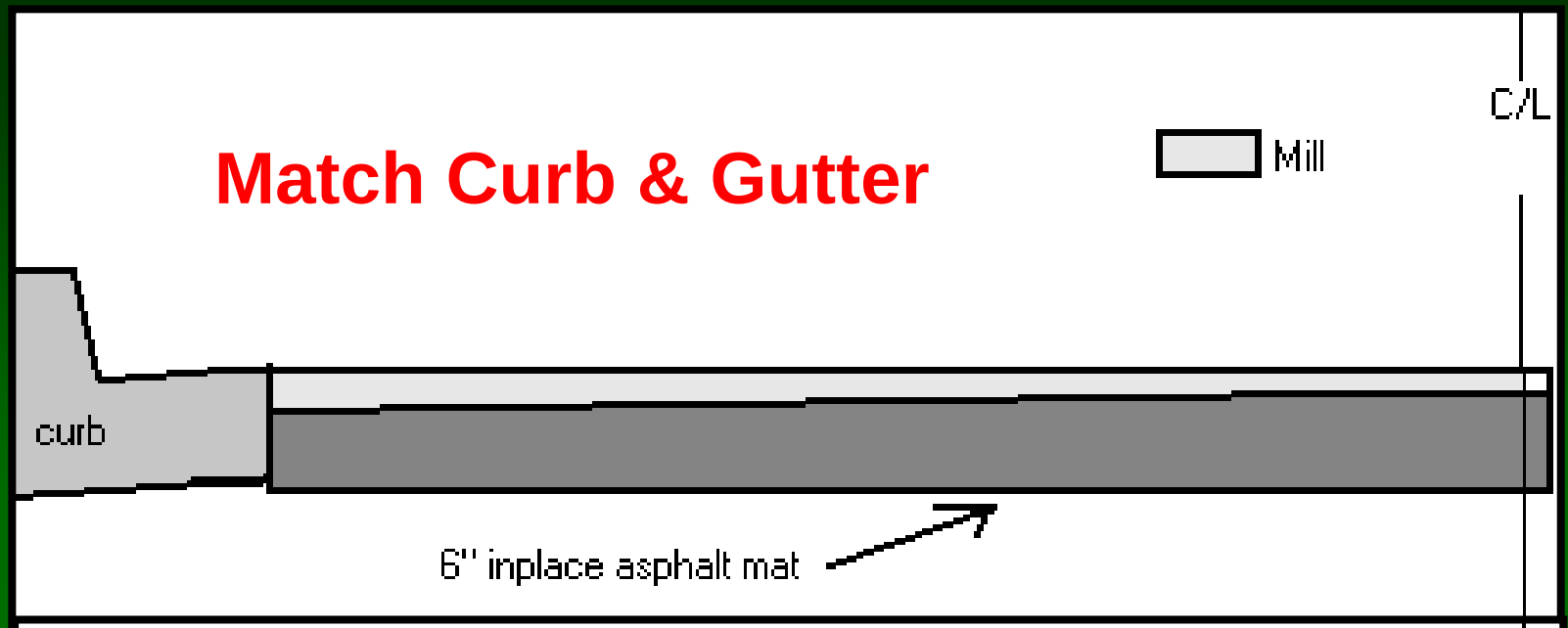
*(1) For low commercial traffic roadways (AADT-T < 400), the minimum RSL = 4.*
*(2) These are initial starting points that should be fine-tuned over time based upon experience in using this treatment option.*
***Note: Contact the Region Pavement Manager for the Index Values of specific highways.***

**Existing Pavement Surface Preparation:** None.

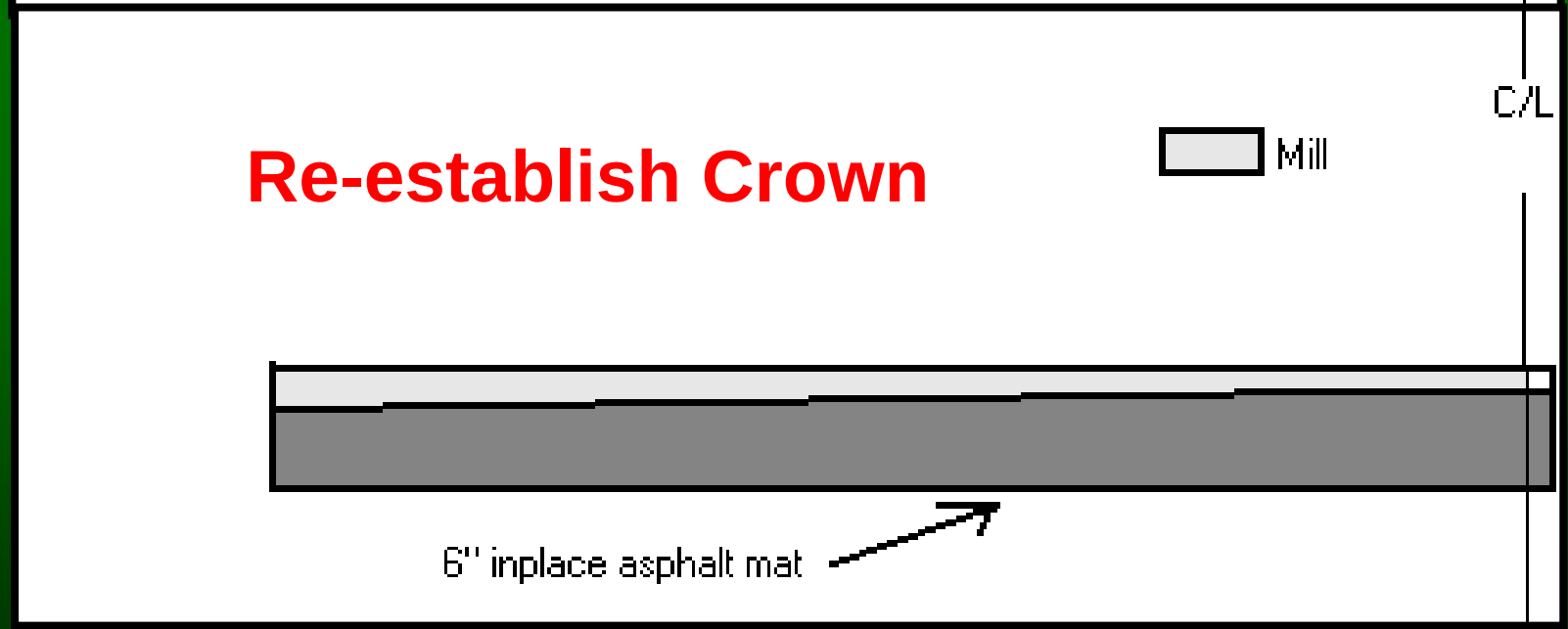
ncpp National Center for Pavement Preservation

MICHIGAN STATE UNIVERSITY

## Match Curb & Gutter




## Re-establish Crown



National Center for Pavement Preservation

MICHIGAN STATE UNIVERSITY

ncpp
National Center for Pavement Preservation

MICHIGAN STATE
UNIVERSITY

# Tech Sharing & Tech Support

# is needed

# *for*

# Pavement Preservation

# Pavement Preservation Partnerships

# OVERVIEW

ncpp
National Center for Pavement Preservation

MICHIGAN STATE
UNIVERSITY

**Partnerships** involve pavement preservation professionals from state & local public agencies, contractors, suppliers, academia, and federal government officials.

# The Partnerships Mission

**Provide ongoing regional forums for Pavement Preservation principles, by sharing and exchanging improvements in research, design, specifications, materials and construction practices, and by promoting the benefits of Pavement Preservation through education and application.**

ncpp
National Center for Pavement Preservation

MICHIGAN STATE UNIVERSITY

# The Partnerships Objectives

- Promote uniformity of regional guidelines for pavement preservation treatments.
- Promote the use of improved materials, equipment, and processes among the member agencies.

# The Partnerships Objectives

- Implement a comprehensive information sharing process.
- Establish a coordinated regional research effort.

# The Partnerships Objectives

- **Advocate policies that integrate system preservation activities.**
- **Publicize pavement preservation findings at the national level.**

ncpp
National Center for Pavement Preservation

MICHIGAN STATE
UNIVERSITY

# The Partnerships Objectives

- **Advocate common terminology and their definitions.**

# The Partnerships Issue Teams

- Materials
- Research
- Training
- Specification
- Policy

ncpp
National Center for Pavement Preservation

MICHIGAN STATE
UNIVERSITY


***A formal agreement between –***
***Foundation for Pavement Preservation & Michigan State University***




# NATIONAL CENTER FOR PAVEMENT PRESERVATION

Home | About | NCPP Organization | Services | Reference Library | Links

**Pavement preservation is a cost-effective set of practices that extend pavement life and improve safety and motorist satisfaction while saving public tax dollars.**

**The National Center for Pavement Preservation (NCPP) seeks to advance and promote sound preservation practices through education, research management, outreach, and technical hands-on assistance.**

www.pavementpreservation.org

ncpp
National Center for Pavement Preservation

*... preserving our nation's pavement investment*

## Quick Links

- FHWA Policy Memo 10/04
- Midwestern Pavement Preservation Partnership
- Current Publications
- Calendar of Events
- Pictures
- Expert Task Group
- TRB Preservation Activities

ncp
National Center for Pavemen

AN STAT
RSIT


# Services

- Outreach
- Training
- Research


# Outreach

- **Assist Public Agencies to Develop Preservation Programs**
- **Administer & Manage Regional Pavement Preservation Partnerships**
- **Provide a Technical Resource Library**

ncpp
National Center for Pavement Preservation

MICHIGAN STATE UNIVERSITY


# Training

## Current Course Offerings

- **Pavement Preservation – Applied Asset Management**
  *(2-Day Training)*
- **Chip Seals – The Best Practice**
  *(1-Day Training)*
- **Ultra-Thin HMA Overlay – Design & Construction**
  *(1-Day Training)*

***Continuing Education Credits (CEU's) granted from Michigan State University***

ncpp
National Center for Pavement Preservation

MICHIGAN STATE UNIVERSITY


# Training

## Future Course Offerings

- **Crack Sealing & Filling**
  *(1-Day Training)*
- **Micro-Surfacing**
  *(1-Day Training)*
- **Inspection of Preventive Maintenance Treatments**
  *(1-Day Training)*

***Continuing Education Credits (CEU's) granted from Michigan State University***

ncpp
National Center for Pavement Preservation

MICHIGAN STATE UNIVERSITY


# Research

- **Facilitate Applied Research**
- **Oversee Pooled-Fund Studies**

ncpp
National Center for Pavement Preservation

MICHIGAN STATE
UNIVERSITY

# State of the Practice Reference


ncpp
National Center for Pavement Preservation

MICHIGAN STATE UNIVERSITY


ncpp
National Center for Pavement Preservation

MICHIGAN STATE
UNIVERSITY