

# A Guide to Pavement Maintenance Options and LCCA Considerations

Buzz Powell  
2/12/25



# Unified Voice

**Mission Statement:**  
Champion,  
Support, and  
Promote Quality  
Asphalt  
Pavements



**Core Pillars:**

- Innovation
- Collaboration
- Education



# APA Team



**Buzz Powell**



**Brittyn Heisler**



**Reed Ryan**

# #BuzzOnAsphalt Keys to Pavement Performance

An aerial photograph showing a road that curves through a dense forest. In the foreground, there is a building with a dark roof and a parking lot. The road is paved and has a few vehicles. The background shows a vast expanse of green trees under a clear sky.

- Mix/materials – meeting specific needs of each layer
- Thickness design – preventing non-surface cracking
- Preservation – safe, durable, renewable surface
- Materials, design, construction effort, inspection.

# Technical Resources

- [www.DriveAsphalt.org](http://www.DriveAsphalt.org) – Asphalt Pavement Alliance
- [www.NCAT.us](http://www.NCAT.us) – National Center for Asphalt Technology
- [www.RoadResource.org](http://www.RoadResource.org) – Pavement Preservation & Recycling Alliance
- [websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx](http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx)
- [www.whitehouse.gov/omb](http://www.whitehouse.gov/omb) - historical real discount rates for NPV
- [www.fhwa.dot.gov/pavement/lcca](http://www.fhwa.dot.gov/pavement/lcca) - LCCA technical bulletin
- [www.ChatGPT.com](http://www.ChatGPT.com) – general information about roads and highways
- [www.HeyNAPA.com](http://www.HeyNAPA.com) – specific information about asphalt pavement.



Welcome to Hey NAPA

# What asphalt pavement questions can I answer for you?

I've been trained on hundreds of NAPA publications and have broad general knowledge of asphalt pavement topics. Ask me anything that you'd like and I'll do my best to provide a concise answer and point you to additional resources.

Please provide an overview of asphalt pavement maintenance options and include LCCA considerations.



# HeyNAPA on Maintenance and LCCA

- Asphalt pavement maintenance is essential to prolong the lifespan of a roadway, ensure safety, and maintain smoothness:
  - Preventive maintenance (preservation)
  - Corrective maintenance (patching, overlays)
  - Rehabilitation (mill and inlay/overlay, in-place recycling)
  - Reconstruction (remove/replace, reclamation/overlay).

# HeyNAPA on Maintenance and LCCA

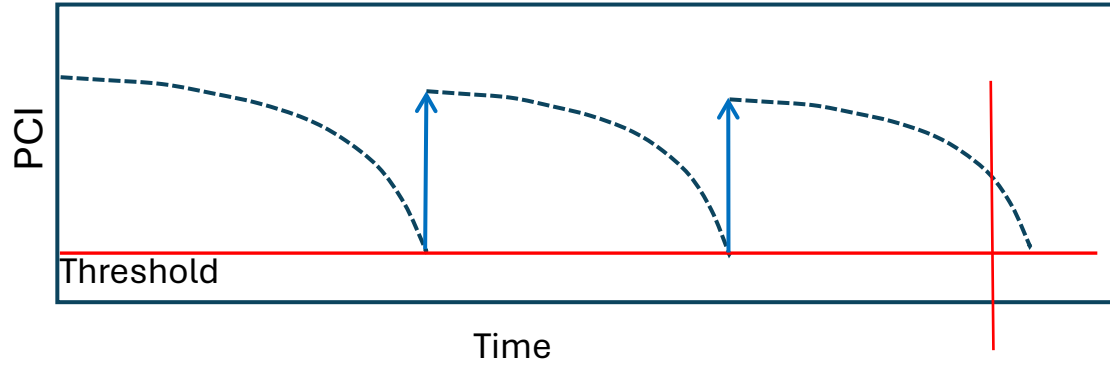
- LCCA is a key tool for evaluating the total cost of pavement maintenance strategies over their entire life span, helping to make informed decisions that balance cost and performance:
  - Initial (all-inclusive cost based on bid prices)
  - Maintenance (historical cost/timing of prevention/correction)
  - Rehabilitation costs (historical costs of major repairs)
  - Salvage value (estimated at end of analysis period)
  - Discount rate (OMB historical averaging for fluctuations)
  - User costs (work zone, time delays, vehicle operation).

# Life Cycle Cost Analysis (LCCA)

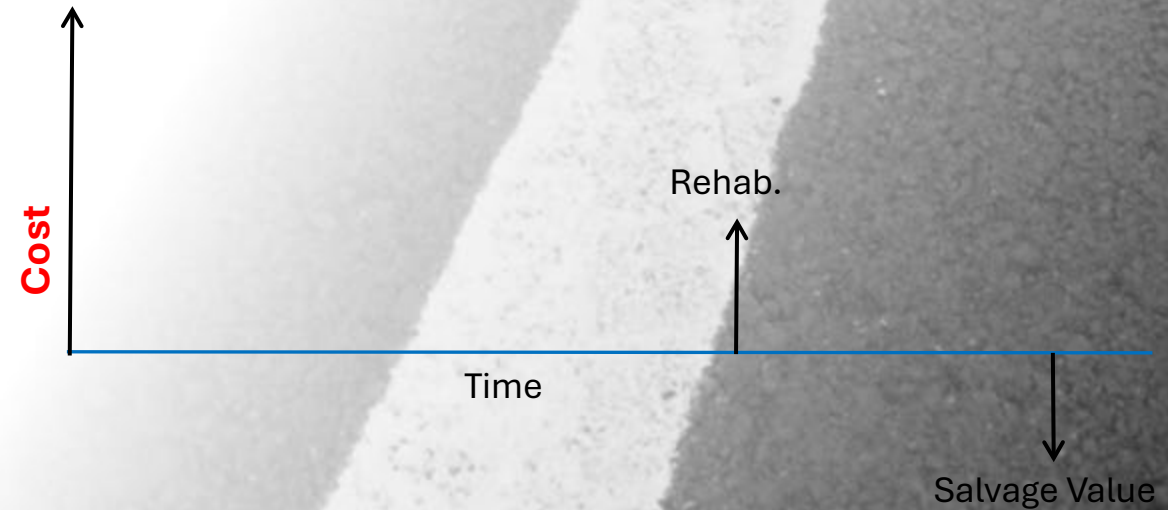
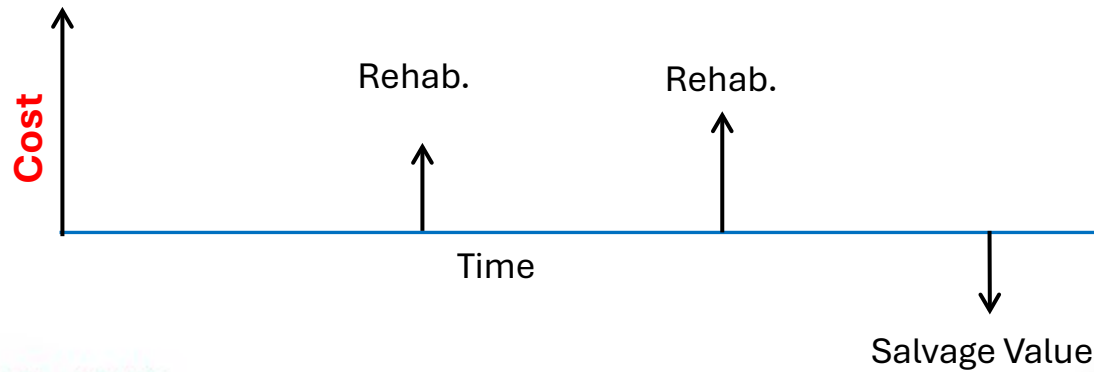
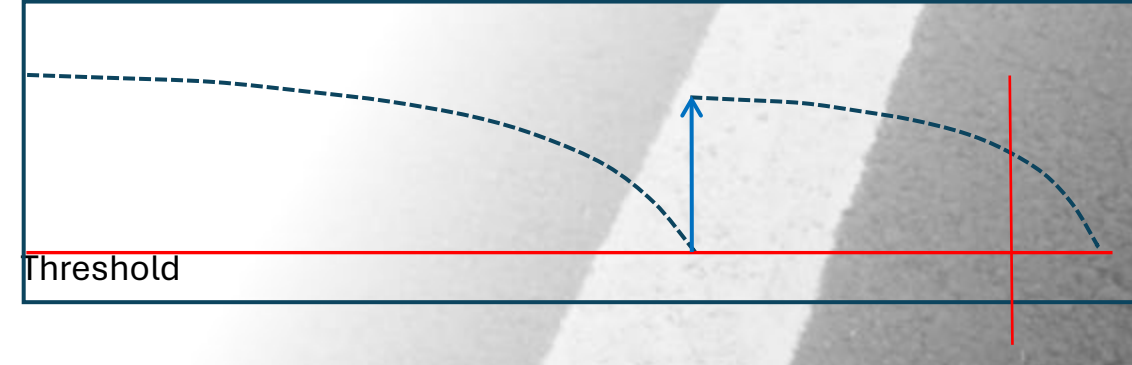
- Compare the long-term costs of different alternatives
- Perform an LCCA for each alternative under consideration
- Calculate the Net Present Value (NPV) of alternate choices
- Construction + preservation + maintenance + rehabilitation ± salvage
- Is one alternative clearly superior (> 10% cost difference)?
- Proceed to final choice with the lower LCCA alternative if > 10%
- Consider evaluation of secondary factor(s) if < 10% difference.

# LCCA Process

Option A

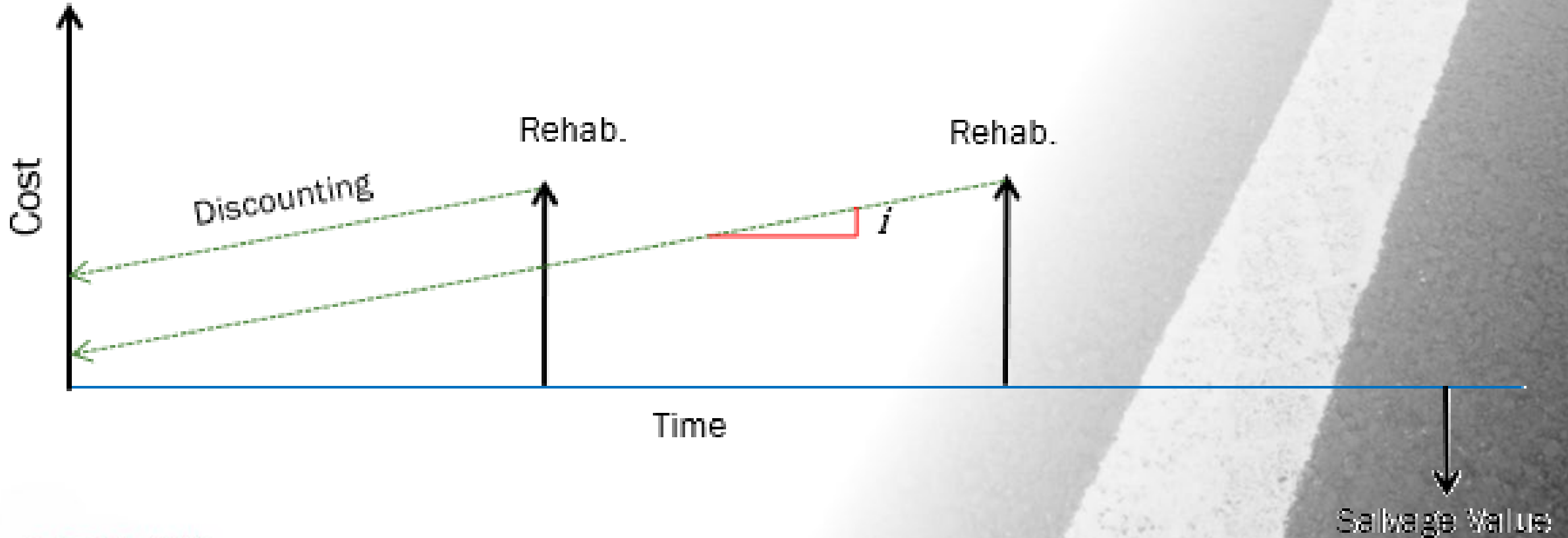


Option B



# LCCA Discounting (Net Present Value)

Excel Function = NPV(real discount rate, year 1 expense, year 2 expense, ... year n expense)



# Pavements

- Design & Analysis**
- Materials Quality Assurance
- Sustainability
- Pavement Management & Performance
- Pavement & Materials
- [Life Cycle Cost Analysis](#)
- Mechanistic Empirical Design Guide
- Surface Characteristics, Smoothness
- Pavement Preservation
- Pavement Policy

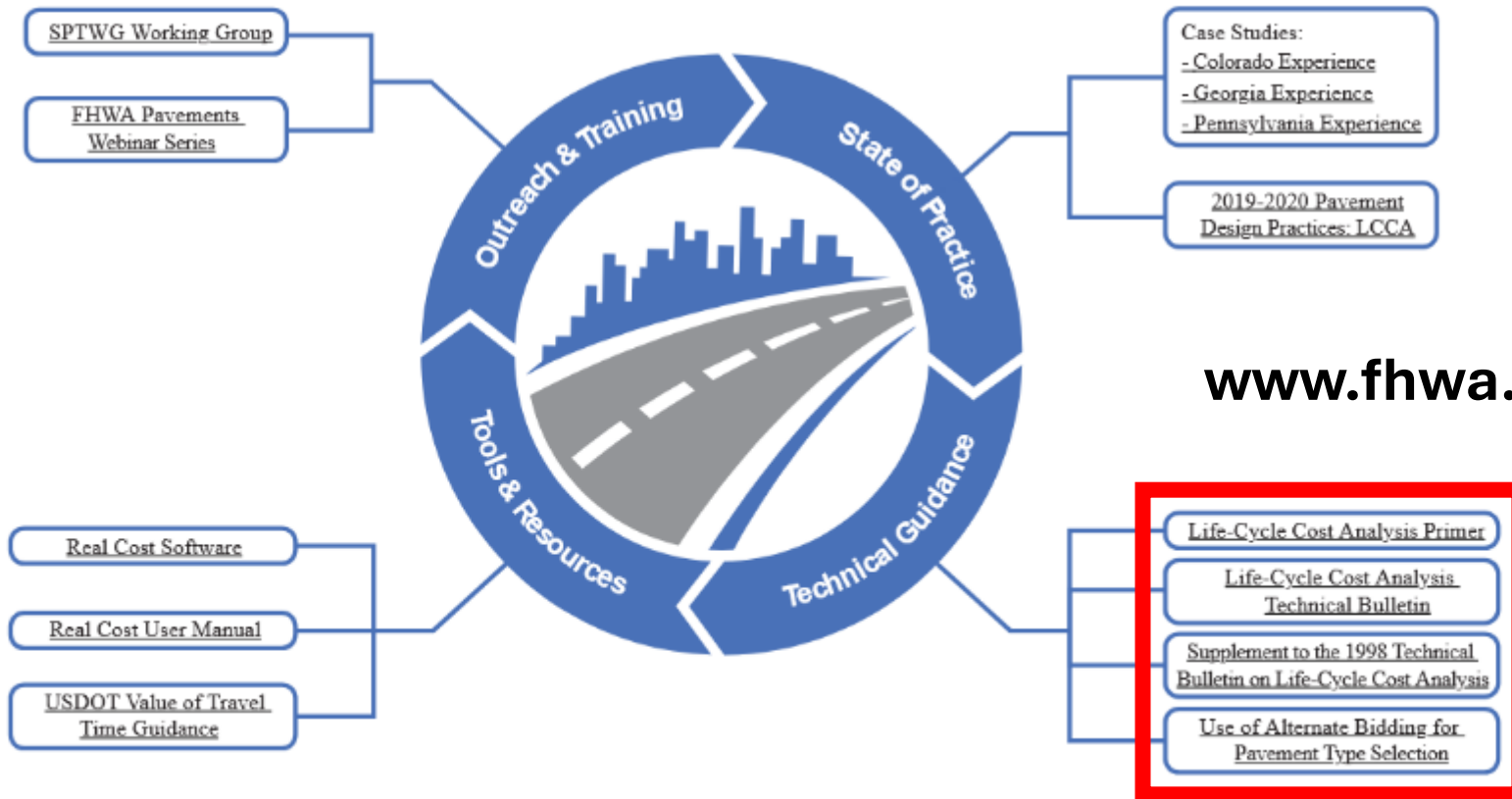
[Home](#) / [Programs](#) / [Pavements](#) / [Design & Analysis](#) / [Life Cycle Cost Analysis](#)

## Life-Cycle Cost Analysis

FHWA promotes Life-Cycle Cost Analysis (LCCA) as an engineering economic analysis tool that allows transportation officials to quantify the differential costs of alternative investment options for a given project. LCCA can be used to study either new construction projects or to examine preservation strategies for existing transportation assets. [\[More About LCCA\]](#)

**Contact**

- **Migdalia Carrion**  
[Office of Preconstruction, Construction and Pavements](#)  
787-771-2515  
[E-mail Migdalia](#)



[www.fhwa.dot.gov/pavement/lcca](http://www.fhwa.dot.gov/pavement/lcca)

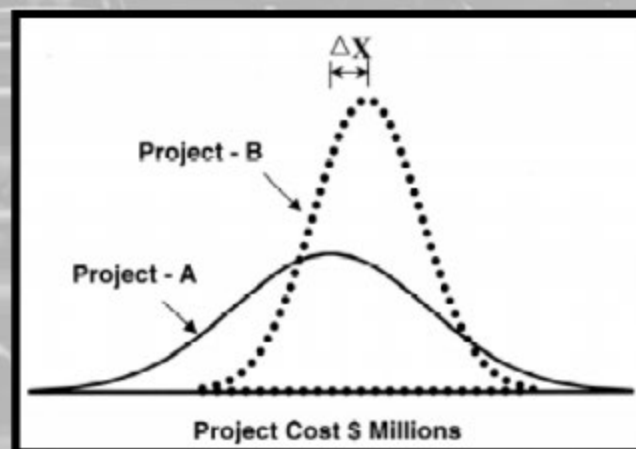


U.S. Department  
of Transportation  
**Federal Highway  
Administration**

Publication No. FHWA-SA-98-079

# Life-Cycle Cost Analysis in Pavement Design

- In Search of Better Investment Decisions -



Pavement Division Interim Technical Bulletin  
September 1998

# Values to Use

Discount rates can significantly influence the analysis result. LCCA should use a reasonable discount rate that reflects historical trends over long periods of time. Data on the historical trends over very long periods indicate that the real time value of money is approximately 4 percent.

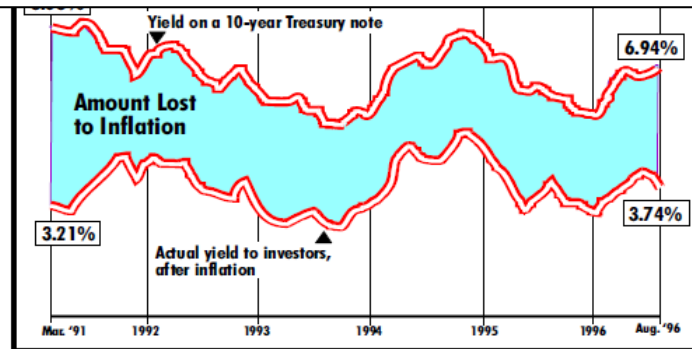


Figure 1.1. Historical trends on 10-year Treasury notes.

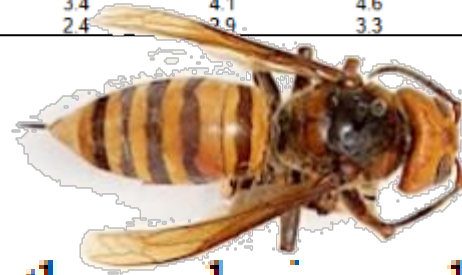
The Department of the Treasury made its first offering of Inflation Protected Securities to the general public in spring 1997. These securities offer a real rate of return and a provision that adjusts the principal to protect against inflation. The offering was very well received by the public (there was more demand for the securities than the Treasury Department wanted to sell) at a yield of just over 3.5 percent.

In 1995 and 1996, the FHWA Office of Engineering, Pavement Division, conducted a national pavement design review and found that the discount rates currently employed by SHAs to conduct LCCA in pavement design showed a distribution of values clustering in the 3- to 5-percent range.

[www.whitehouse.gov/omb/](http://www.whitehouse.gov/omb/)

Calendar Year	Real Treasury Interest Rates					
	3-Year	5-Year	7-Year	10-Year	20-Year	30-Year
1979	2.8	3.4	4.1	4.6	N/A	5.4
1980	2.1	2.4	2.9	3.3	N/A	3.7

## Values to Use



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2008	2.1	2.5	2.4	2.6	2.6	2.6
2009	0.9	1.6	1.9	2.4	2.9	2.7
2010	0.9	1.6	1.9	2.2	2.7	2.7
2011	0.0	0.4	0.8	1.3	2.1	2.3
2012	0.0	0.4	0.7	1.1	1.7	2.0
2013	-1.4	-0.8	-0.4	0.1	0.8	1.1
2014	-0.7	0.0	0.5	1.0	1.6	1.9
2015	0.1	0.4	0.7	0.9	1.2	1.4
2016	0.3	0.6	0.8	1.0	1.2	1.5
2017	-0.5	-0.3	0.0	0.1	0.5	0.7
2018	0.6	0.6	0.7	0.7	0.9	1.0
2019	1.3	1.3	1.3	1.4	1.5	1.5
2020	-0.4	-0.3	-0.2	0.0	0.3	0.4
2021	-1.8	-1.6	-1.4	-1.1	-0.5	-0.3
2022	-1.2	-0.6	-0.3	0.0	0.4	0.5
2023	1.2	1.3	1.4	1.5	2.0	2.0
2024	2.2	2.2	2.2	2.3	2.5	2.5

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# HeyNAPA on Choosing Preservation

- Crack sealing/filling – overband in combo vs route+fill standalone
- Fog seals – conventional to stop aging vs rejuvenating to restore
  - [www.ncat.us/research/newsletters/newsspring19.pdf](http://www.ncat.us/research/newsletters/newsspring19.pdf)
- Chip seals – single vs double vs triple vs scrub seal
- Slurry seals – well graded road mix with emulsion and filler
- Micro surfacing – dense road mix with polymer emulsion and filler+
- Thin asphalt overlay – from 1/2 to 3/4 inch thick “ThinLay” paving
- Ultra thin bonded wearing surface – gap graded spray paving.

## Test Track

### Pavement Preservation

[Construction Data](#)

[Observed Performance](#)

[Sponsors \(2012-2020\)](#)

[Pavement Preservation Group Study Resources](#)

[Pavement Preservation Webinars](#)

## Pavement Preservation Webinars

The NCAT-MnRoad PG Study Findings Webinar series is designed to discuss the construction, performance, and conclusions from our test sections, with a focus on implementation of findings. Below are the recordings of past webinars.



Crack Seal Webinar NCAT & MnROAD presents Watch later Share  
PG Study Findings Webinar Series  
TOPIC: CRACK SEAL  
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Chip Seal Webinar NCAT & MnROAD presents Watch later Share



Micro Surfing Webinar NCAT & MnROAD presents Watch later Share

# Preservation Webinar Library

## Some Best Practices (RoadResource, NAPA)

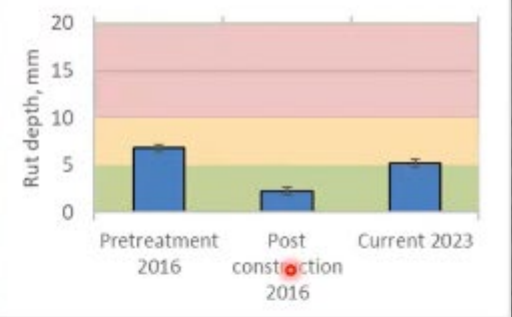
- Road with raveling, minor rutting/cracking, friction needs
- Materials, design, installation effort, inspection
- Ultra Thin Lift HMA  $\frac{3}{4}$ " to 1", DGA thin overlays  $\leq 1\frac{1}{2}$ ", thinlays  $\frac{1}{2}$ " to  $\frac{3}{4}$ "
- Materials, design to meet road needs (e.g., macrotexture, friction)
- Importance of healthy mix design (BMD for rutting, cracking)
- Need for uniform cross slope (milling), clean surface, good tack
- Thin lifts cool quickly (WMA), impermeable at lower densities.



# Healthy ThinLays on 70<sup>th</sup> Street at MnROAD

Control (Thinlay)  
 Pretreatment: Poor  
 @ Year 4: 24%

70<sup>TH</sup> ST NE



Parameter	Value	Rating	Overall Condition
Cracking, %	24	POOR	FAIR
Rutting, mm	5	FAIR	
IRI, in/mi	122	FAIR	



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Micro Surfing Webinar NCAT & MnROAD presents Watch later Share

# www.NCAT.us

Treatment

- Virgin thinlay with PG67-22
- Virgin thinlay with PG67-22 on 100% foamed recycle base
- Virgin thinlay with PG76-22
- Ultra thin bonded surface course
- 50% RAP thinlay

Condition

Time

Fair	0.0
Good	0.5
Poor	1.0
	1.5
	2.0

Treatments Location (Google Maps)

Overall Section Condition

FAIR

Cracking % of Area



Rutting (mm)

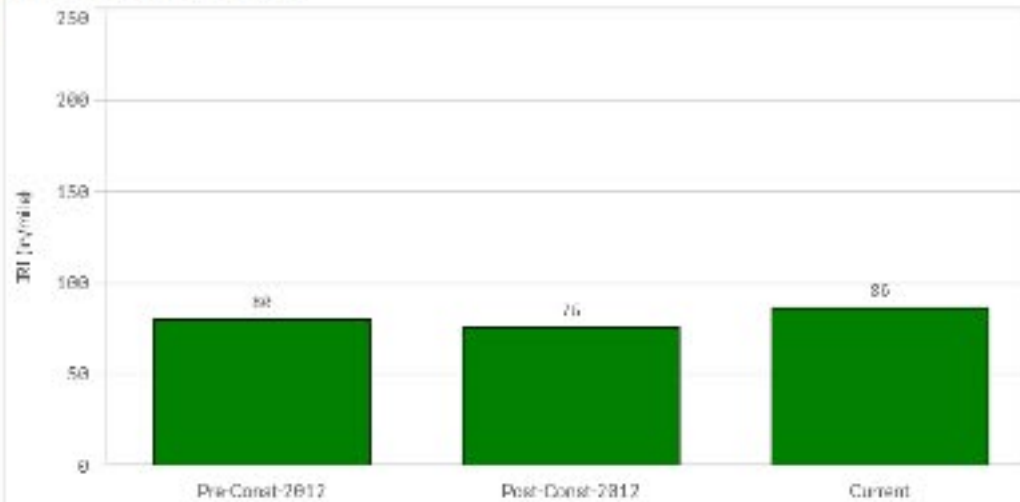


IRI (in/mile)



IRI (in/mile) for Treatment    Rutting (mm) for Treatment

IRI (in/mile) for Treatment



Time to Poor (Control)

1.1

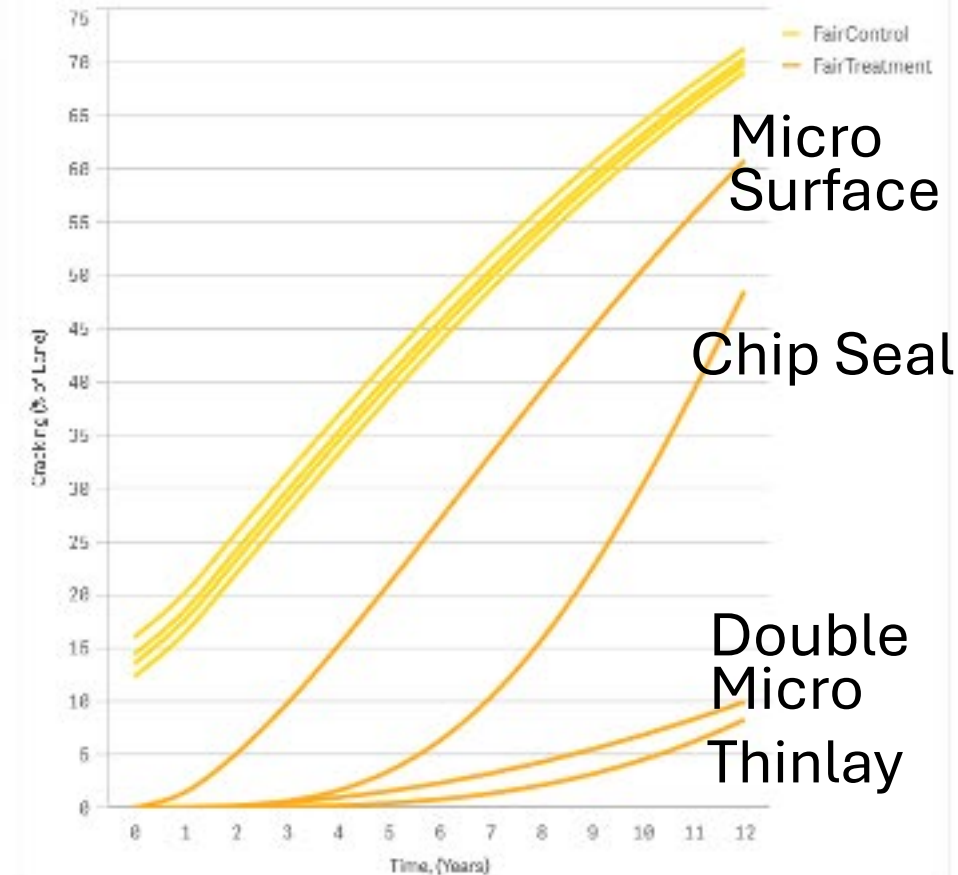
Crack Reduction (Average)

32.7

Time to Poor (Treatment)

6.5

Treatment to Control Comparison



# www.NCAT.us

... [Close] [Check]

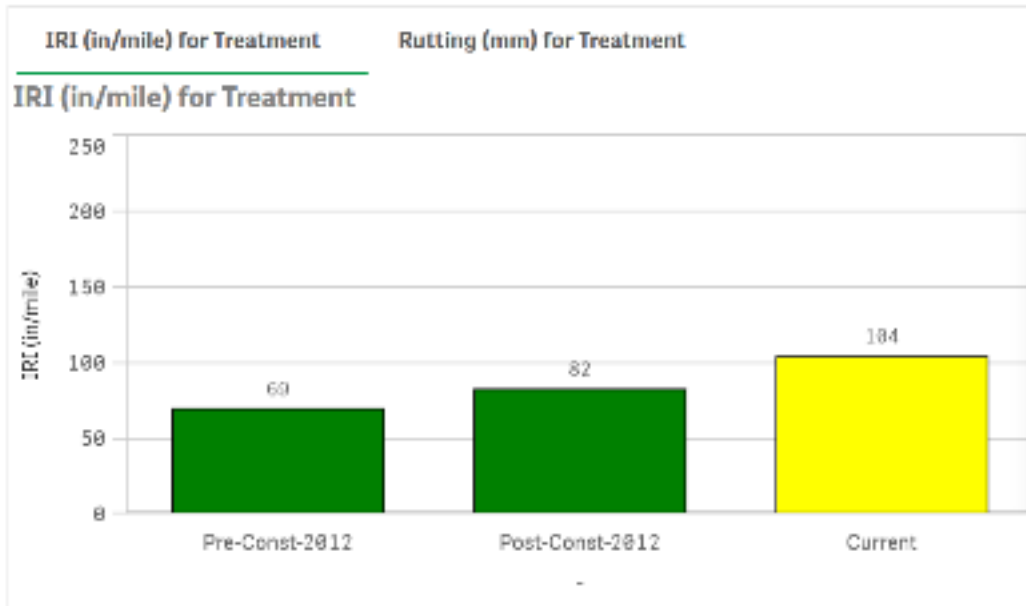
Q Treatment

- Virgin thinlay with PG75-22
- Ultra thin banded surface course
- 50% RAP thinlay** ✓

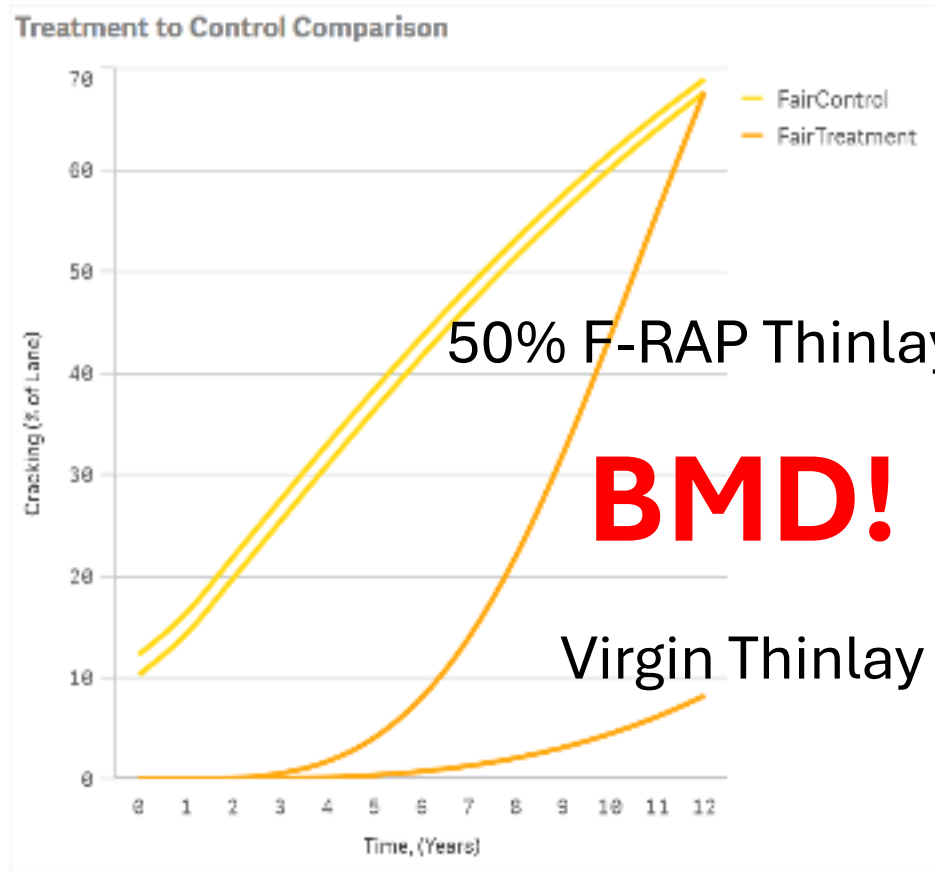
Q Condition    Q Time

<b>Fair</b> ✓	0.0
Good	0.5
Poor	1.0

Treatments Location (Google Maps)



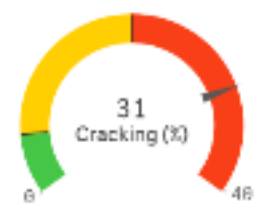
Time to Poor (Control)	Crack Reduction (Average)	Time to Poor (Treatment)
<b>1.6</b>	<b>31.5</b>	<b>7.5</b>



Overall Section Condition

**FAIR**

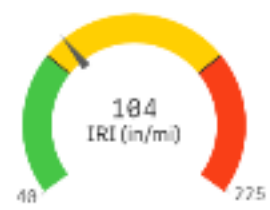
Cracking % of Area



Rutting (mm)



IRI (in/mile)



# www.NCAT.us

Q Treatment

- Scrub Cape seal
- Scrub seal**
- Virgin Thinley on Fibermat Chipseal
- Virgin thinley with PG67-22

Q Condition

- Fair**
- Good
- Poor

Q Time

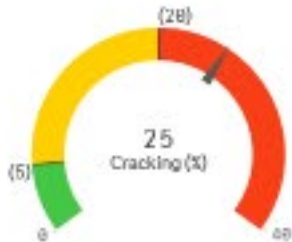
- 6.8
- 8.5
- 1.8
- 1.5
- ...

Treatments Location (Google Maps)

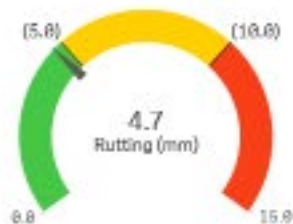
Overall Section Condition

FAIR

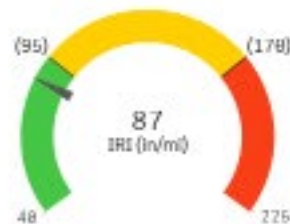
Cracking % of Area



Rutting (mm)

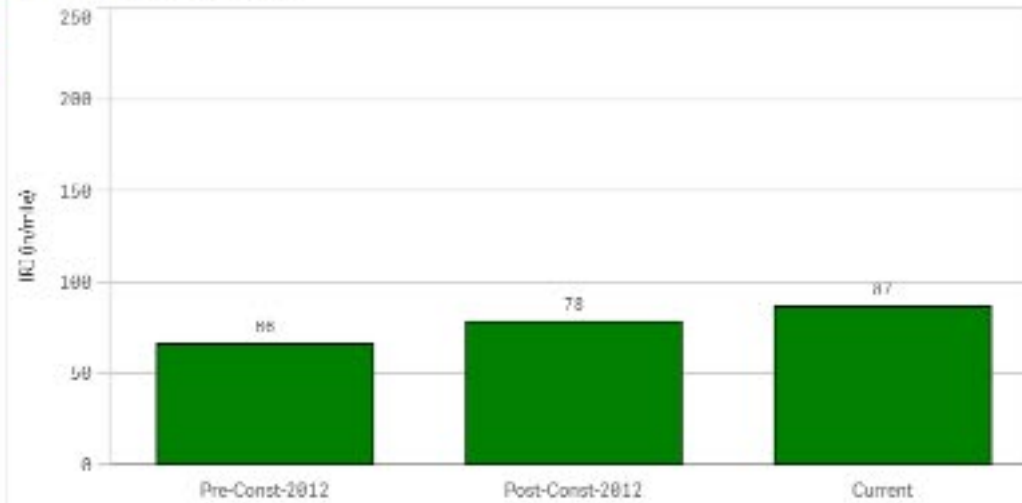


IRI (in/mile)



IRI (in/mile) for Treatment    Rutting (mm) for Treatment

IRI (in/mile) for Treatment



Time to Poor (Control)

1.1

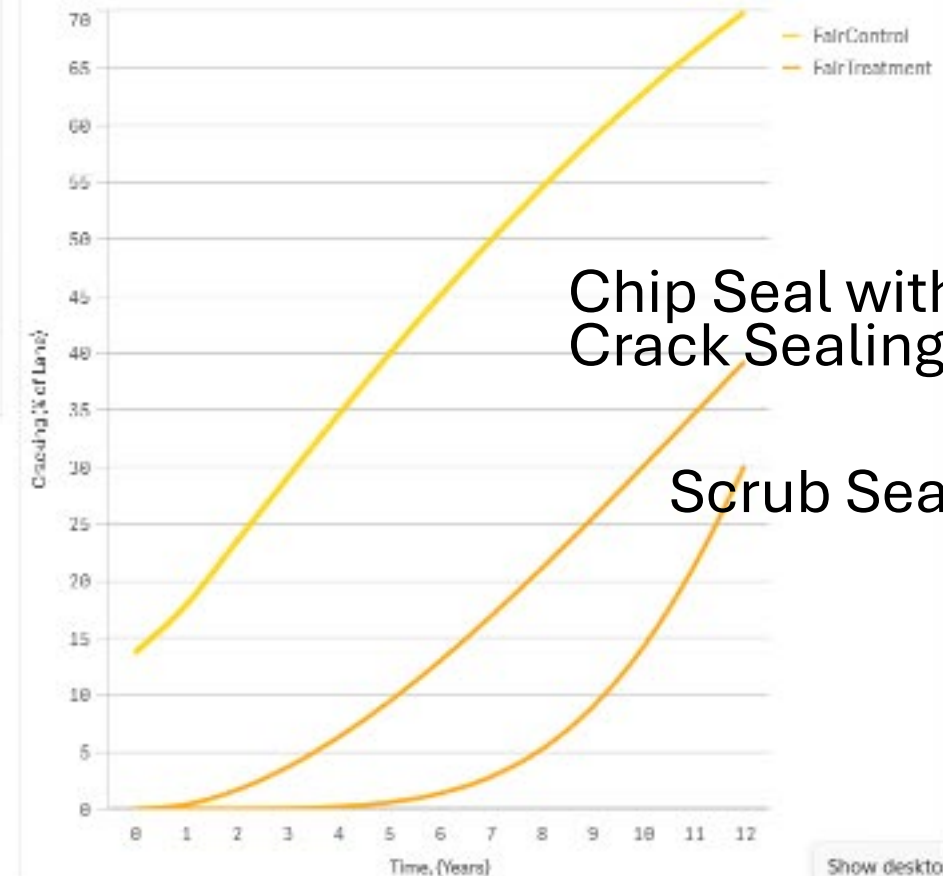
Crack Reduction (Average)

33.2

Time to Poor (Treatment)

9.1

Treatment to Control Comparison



Chip Seal with Crack Sealing

Scrub Seal

Show desktop

# Scrub Seal





Welcome to Hey NAPA

# What asphalt pavement questions can I answer for you?

I've been trained on hundreds of NAPA publications and have broad general knowledge of asphalt pavement topics. Ask me anything that you'd like and I'll do my best to provide a concise answer and point you to additional resources.

What are the pros and cons of various preservation alternatives?



# [www.HeyNAPA.com](http://www.HeyNAPA.com)

- When considering pavement preservation, it's important to weigh the pros and cons of various alternatives to determine the most appropriate treatment for a given situation Here's a detailed overview of some common preservation alternatives and their associated advantages and disadvantages:

# [www.HeyNAPA.com](http://www.HeyNAPA.com)

- Fog seals
- Chip seals
- Slurry seals
- Micro surfacing
- Crack sealing
- Ultra thin bonded wearing courses
- Hot-mix overlays
- Crack prevention interlayers
- In-place recycling (HIR and CIR)
- Base stabilization
- Reconstruction.

# Concrete Pavement

- Joint sealing
- Spall and corner break repairs
- Diamond grinding
- Punch-outs, blow-ups, and asphalt patches
  
- full-depth slab removal and replacement, under-sealing, dowel-bar retrofit, asphalt overlays, or bonded concrete overlays
  
- removal/replacement, rubblization plus asphalt overlay .

# Takeaways

- APA exists as a unified voice & resource for the asphalt community
- ChatGPT is useful, but HeyNAPA is trained on vetted research library
- LCCA to estimate actual cost to maintain safe mobility (discounting)
- Use actual costs/data to build/operate pavement infrastructure
- [www.fhwa.dot.gov/pavement/lcca](http://www.fhwa.dot.gov/pavement/lcca) for guidance, but performance...
- [www.NCAT.us/testtrack/preservation/observed-performance.html](http://www.NCAT.us/testtrack/preservation/observed-performance.html)
- Perpetual pavements only require preservation (no rehab/rebuild)
- **Safe, sustainable asphalt pavement at lowest possible life cycle cost!**

# #BuzzOnAsphalt

**DR. R. BUZZ POWELL, PE**

APA Technical Director

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