THINLAY ASPHALT FOR PAVEMENT PRESERVATION

WAPA & WSDOT 2015 JOINT TRAINING

LINDSI HAMMOND, P.E.
PAVEMENT SERVICES, INC.

WASHINGTON ASPHALT PAVEMENT ASSOCIATION

Washington State Department of Transportation

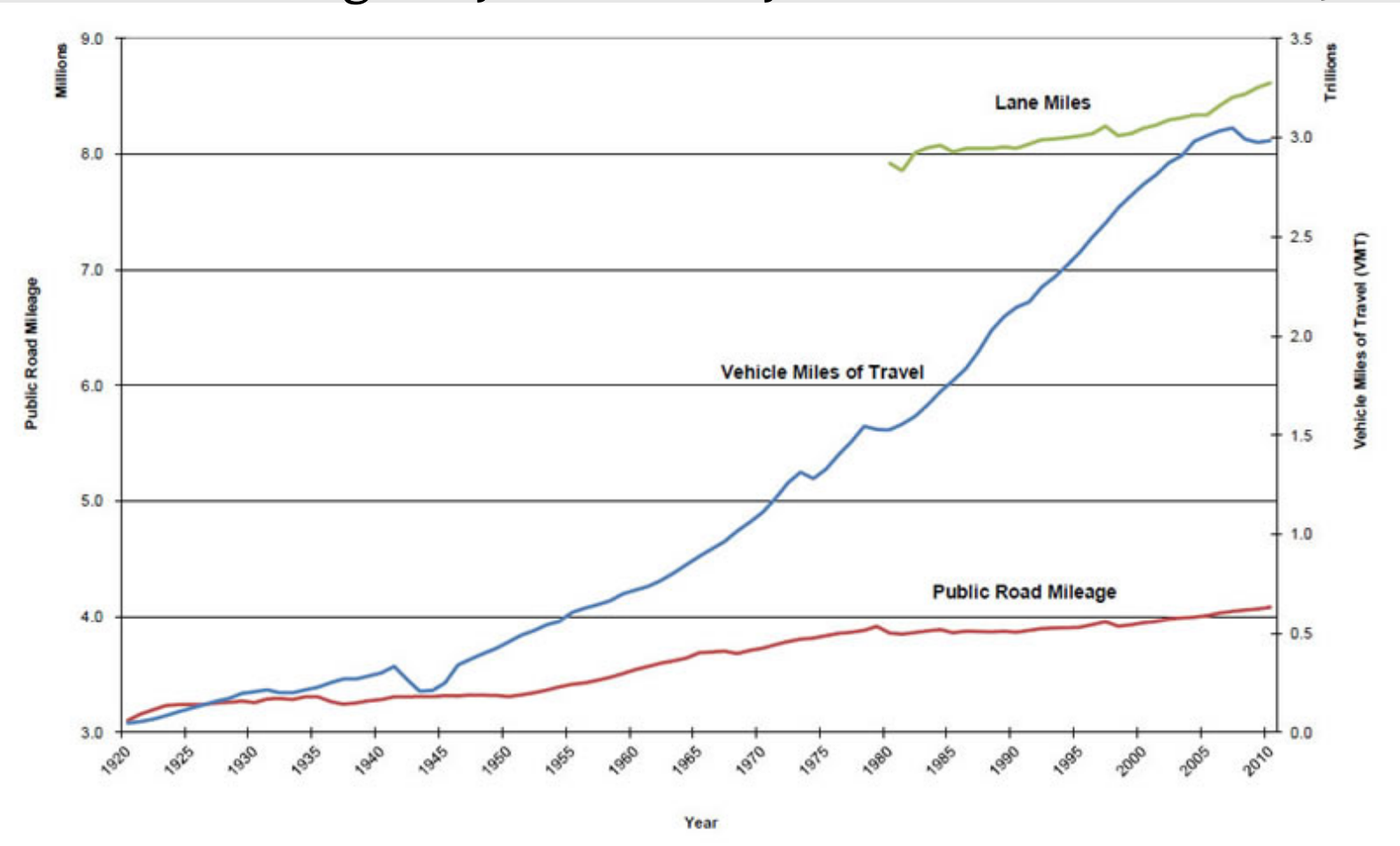
Overview

- The Need for Pavement Preservation
- Purpose & Benefits of Pavement Preservation
- Thinlay Asphalt Treatments
  - NCHRP Synthesis 464
  - Mix Design Considerations
  - Thinlay Benefits
    - Serviceability
    - Structural
  - Thinlay Case Study

Polk County, OR

The Need

The value of our highway and road system estimated at $1.75 trillion



Growth of vehicle miles traveled (VMT), registered vehicles and statute miles of roadway in the U.S. since 1960 (FHWA 2010).

Preservation Treatments
need to correct surface distresses

- Raveling
- Seal the existing pavement to prevent intrusion of water and air
- Cracking
- Rutting

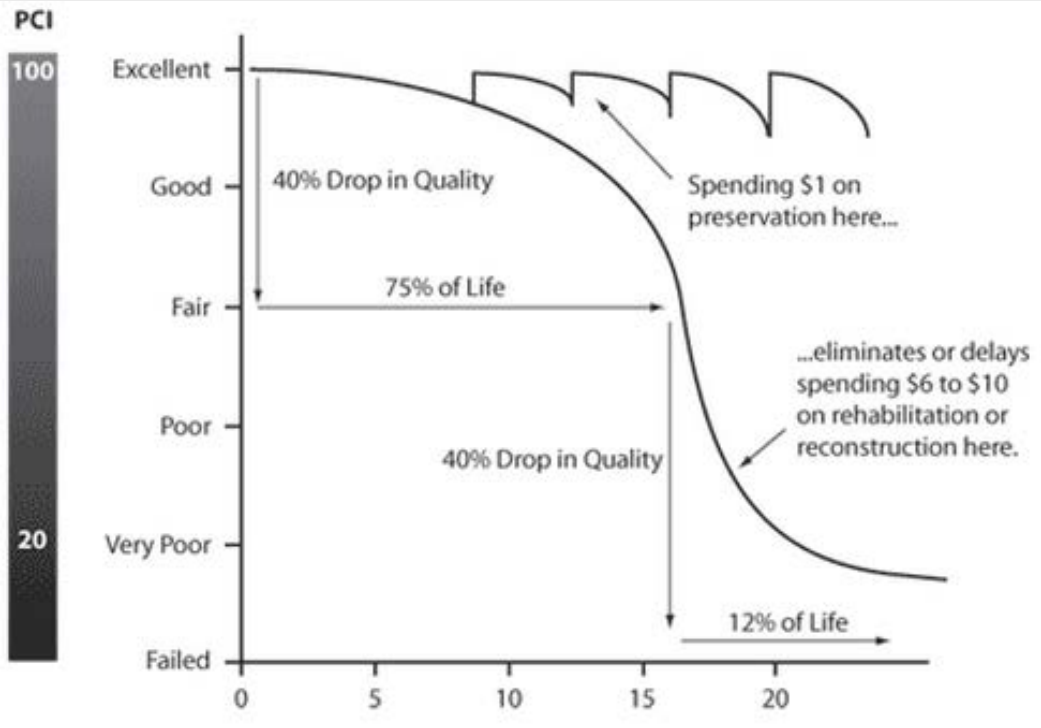
Preservation Treatments
can also improve serviceability

- Smoothness
- Surface Friction
- Drainage Issues


City of Corvallis, OR

Preservation Treatments
fundamental to the life cycle

- Preservation treatments maintain the surface at a higher condition
- Preservation treatments allow Pavement Managers to optimize the performance of the entire network



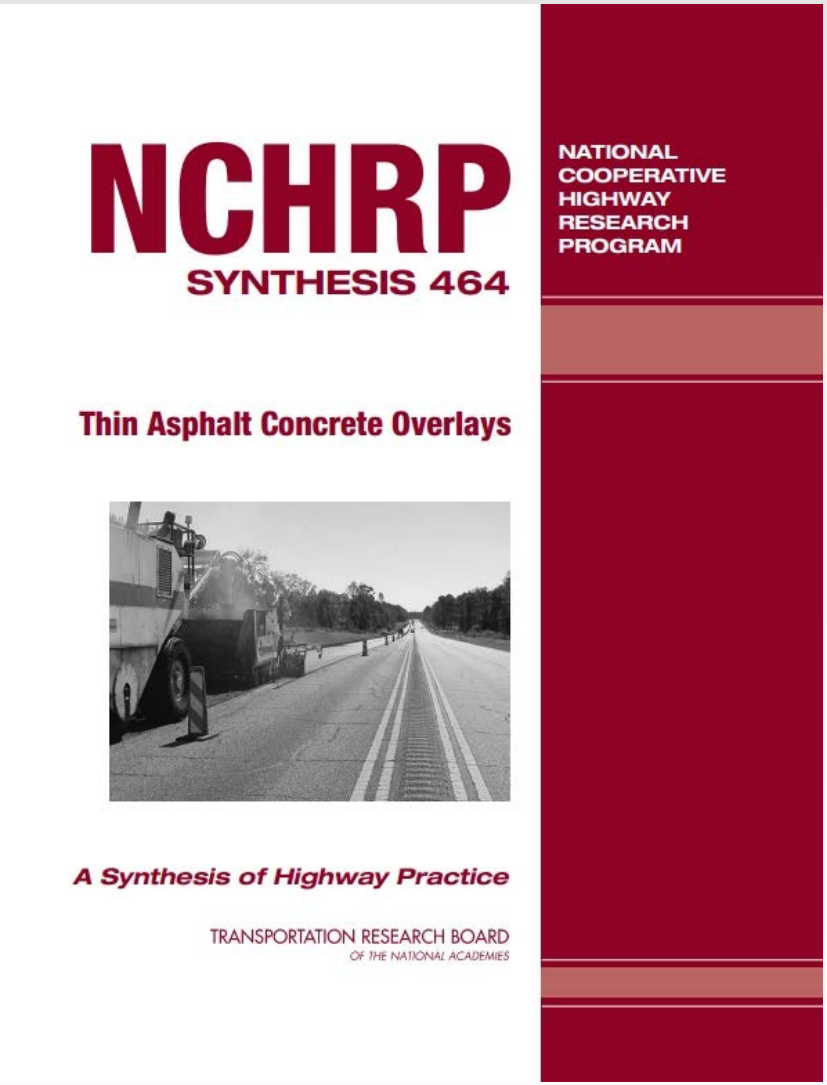
Source: FHWA

Thinlay Asphalt Treatment

Thinlay Asphalt Treatments

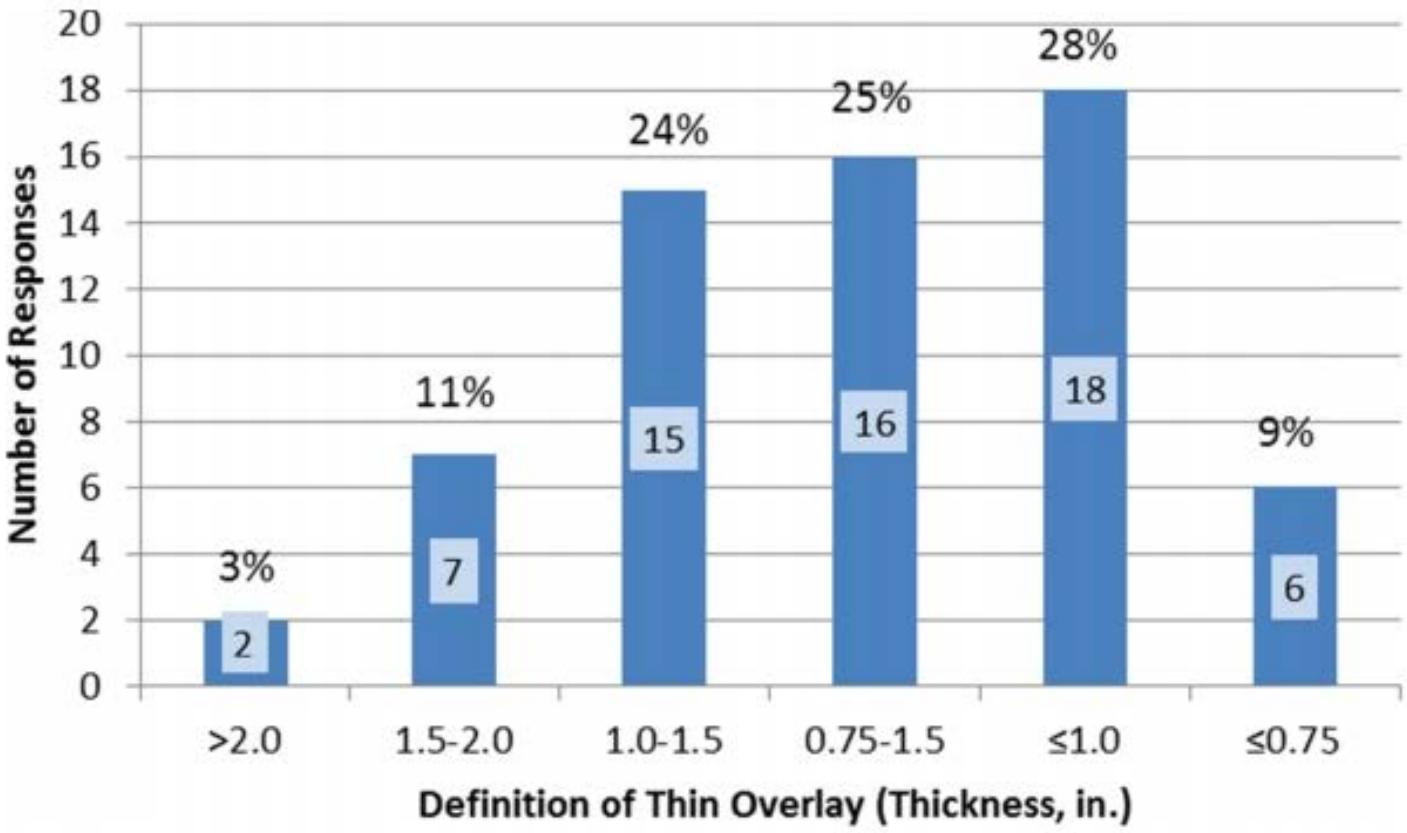
- Are designed to address important pavement preservation needs
  - ✓ Correct surface distress
  - ✓ Seal existing surface
  - ✓ **Improve serviceability**
  - ✓ **Extend structural life**

NCHRP Synthesis 464
Thin Asphalt Concrete Overlays



NCHRP Synthesis 464
Thin Asphalt Concrete Overlays

Agency Definition of Thin Overlay



NCHRP Synthesis 464
Thin Asphalt Concrete Overlays

PROJECT SELECTION

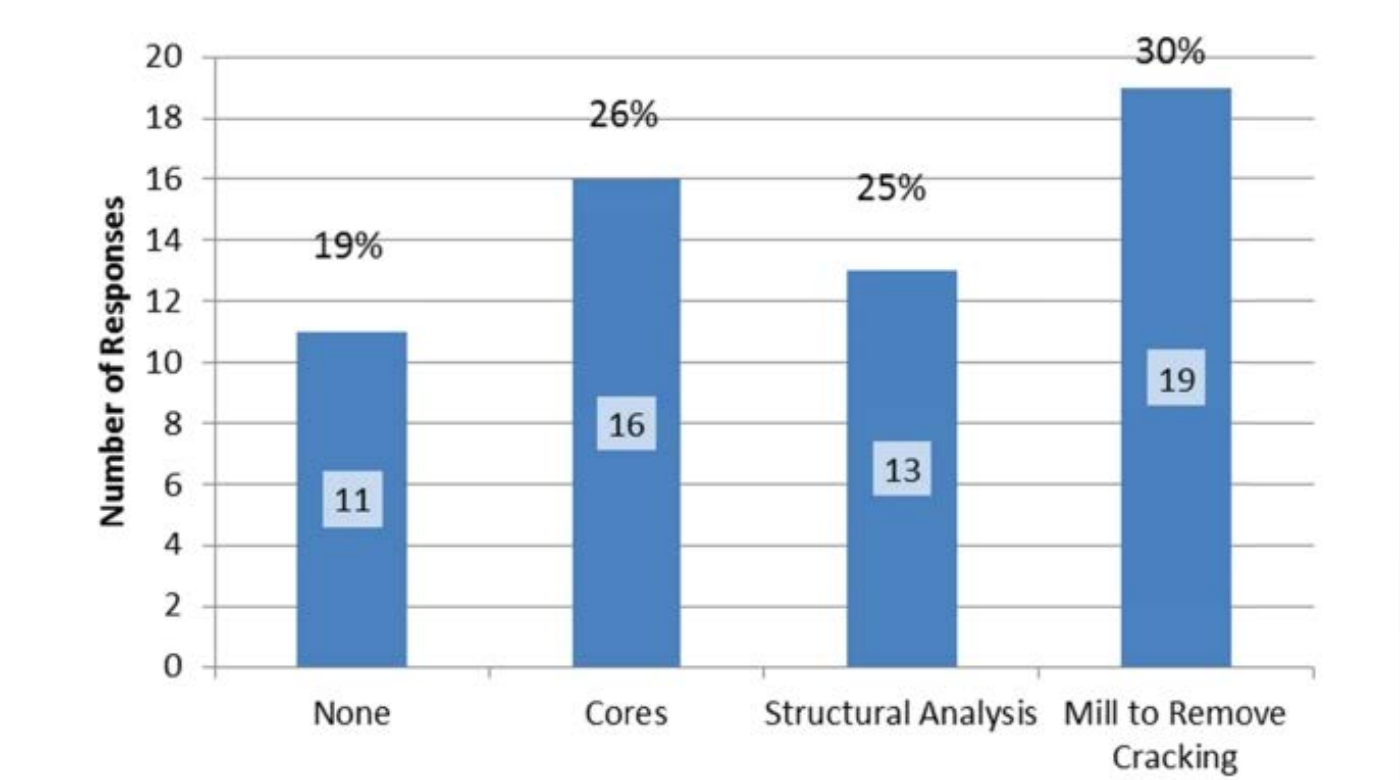
Pavements in Fair to Good Condition

- Low to Medium **Raveling**
- Low to Medium **Longitudinal Cracking** (Not in Wheel Path)
  - Short-Term Fix for **Longitudinal Cracking** in the Wheel Path
- Low Severity **Transverse Cracking** (Milling is Recommended)
- Low Severity **Rutting** < ½”
- Low **Skid Resistance**

NCHRP Synthesis 464
Thin Asphalt Concrete Overlays

PROJECT SELECTION

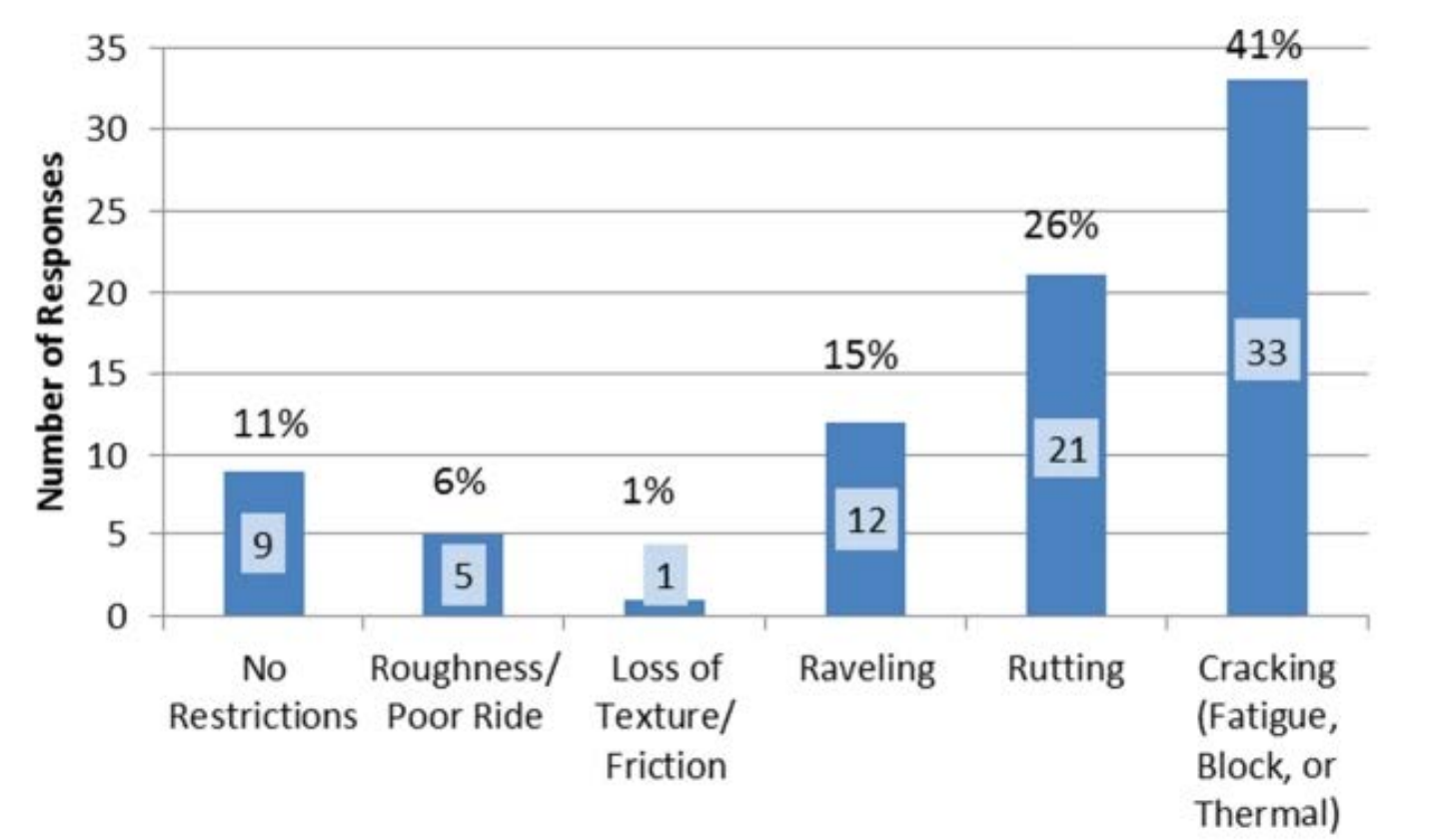
In addition to using Visual Condition Survey data, agencies use other investigative strategies to determine when to apply a Thinlay



NCHRP Synthesis 464
Thin Asphalt Concrete Overlays

PROJECT SELECTION

Agency response to when they would NOT recommend a thinlay



NCHRP Synthesis 464
Thin Asphalt Concrete Overlays

Cost Comparison for Preventive Maintenance Treatments (Montana DOT)

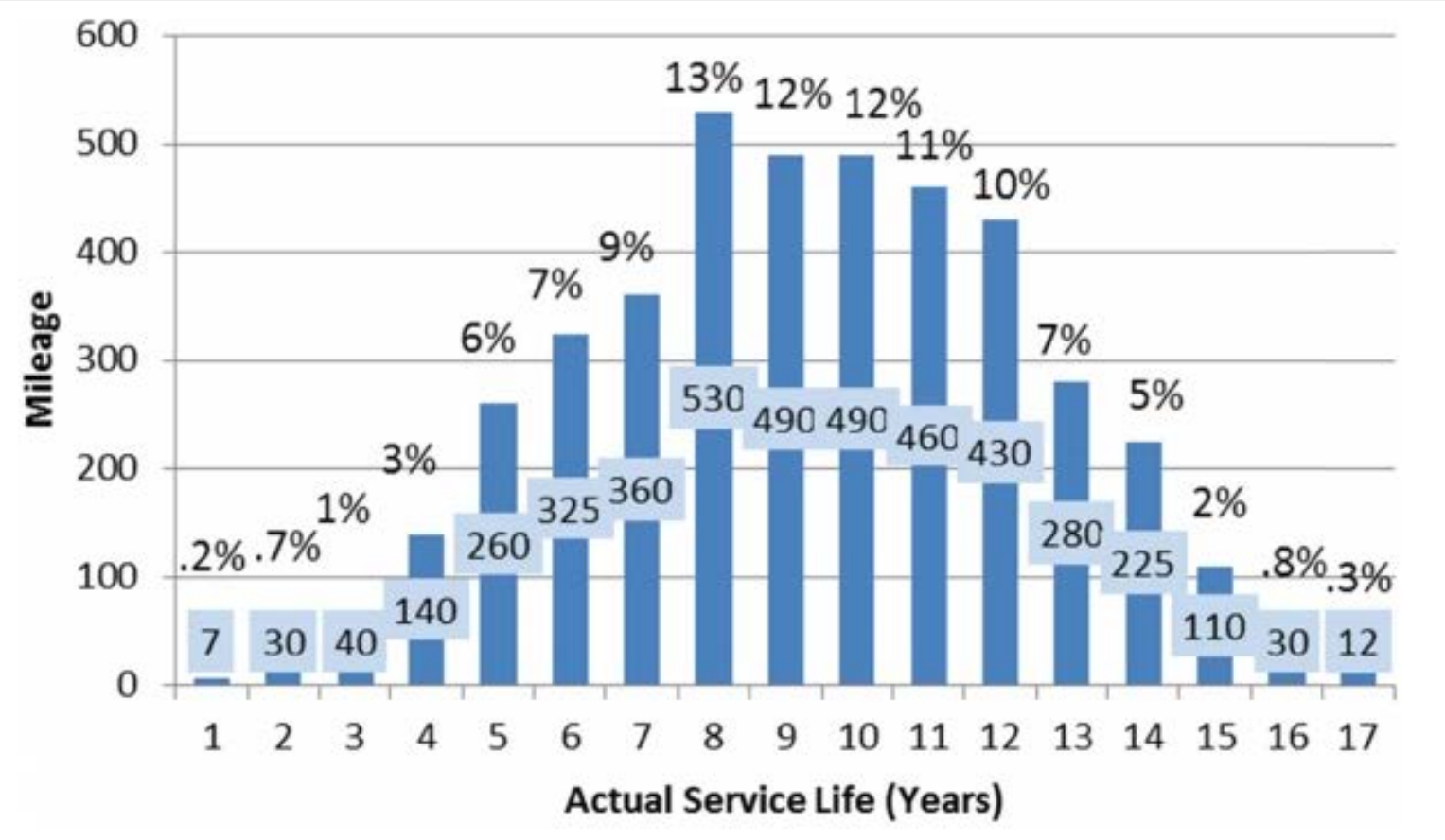
TABLE 1
SUMMARY OF EXPECTED LIVES AND COSTS FOR PREVENTIVE MAINTENANCE TREATMENTS

Preventive Maintenance Treatment	Average Service Life (Years)	Cost per Lane-Mile (12 ft wide)
Thin overlay	8.4	$14,600
Double chip seal	7.3	$12,600
Microsurfacing	7.4	$12,600
Slurry seal	4.8	$6,600

Source: Cuelho et al. (2006).

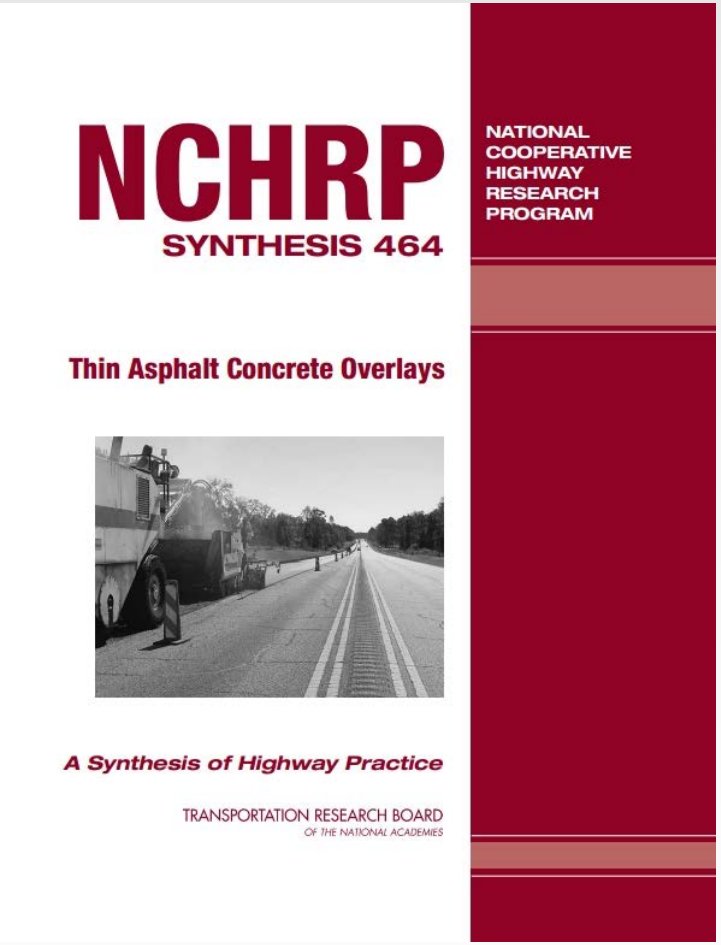
NCHRP Synthesis 464
Thin Asphalt Concrete Overlays

Service Life of thinlay projects in Ohio



NCHRP Synthesis 464
Thin Asphalt Concrete Overlays

- Published 2014
- Nationwide survey, 47 of 52 DOT
- Thinlay are being used more frequently as a preservation tool
  - Thinlay initial costs are lower than traditional overlays
  - Allow pavement managers to overlay more lane miles with same $
  - Thinlays improve ride quality
- Success of thinlays depend on proper project selection
  - Not used when moderate to severe cracking is present
- Service life is generally 7 to 11 years



Thinlay Asphalt Treatments

- Asphalt mixes engineered specifically for pavement preservation
- Designed with aggregate gradations allowing placement as thin as 5/8”
- Binders and gradations selected to optimize flexibility, durability and rut resistance

Thinlay Asphalt Family of Treatments

- **Fine-graded dense-graded mixes for most applications**
- Fine-graded permeable friction courses for improved wet weather skid and to address bleeding chip or other seals
- Fine-graded stone-matrix asphalt for high speed and very high traffic applications

- Can include recycled materials RAP, RAS, GTR to enhance performance, reduce costs, reduce demand for new raw materials (improve sustainability)
- Can be produced with warm mix technology to further enhance sustainable qualities

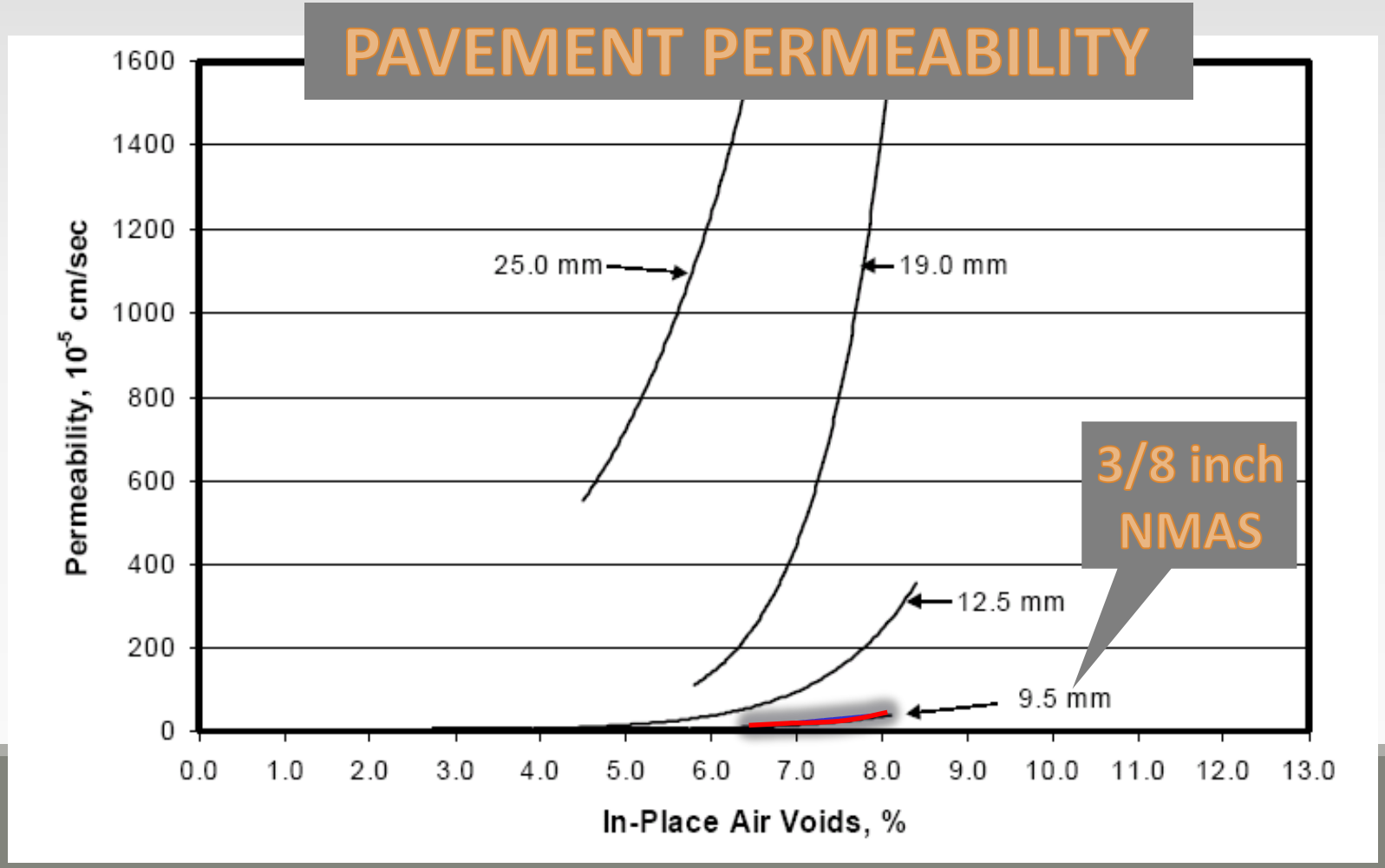
Thinlay Mix Design

- Mix design criteria to optimize preservation needs
  - ✓ Nominal Max Aggregate Size (NMAS)
    - ✓ < 1/3 lift thickness (for 1" lift use 3/8" NMAS mix)
  - ✓ binder selected to optimize crack resistance (softest binder that passes rut test)
    - ✓ polymers for highest demand areas
  - ✓ RAP and RAS combined with softer base binders to provide optimum value

Thinlay Mix Design

- Mix design criteria to optimize preservation needs
  - ✓ Gyration levels to match traffic and local practice generally 50-75
  - ✓ V_a, (4% +/- 1%)
  - ✓ VMA (>= 15%)
  - ✓ VFA (65-80%)
  - ✓ Dust/Asphalt Ratio (0.6-1.6)
  - ✓ Minimum binder content normally 6.0% or more.

Thinlay Asphalt Mix Durability



Reduced permeability improves pavement longevity by protecting the pavement from the damaging effects of air and moisture intrusion.

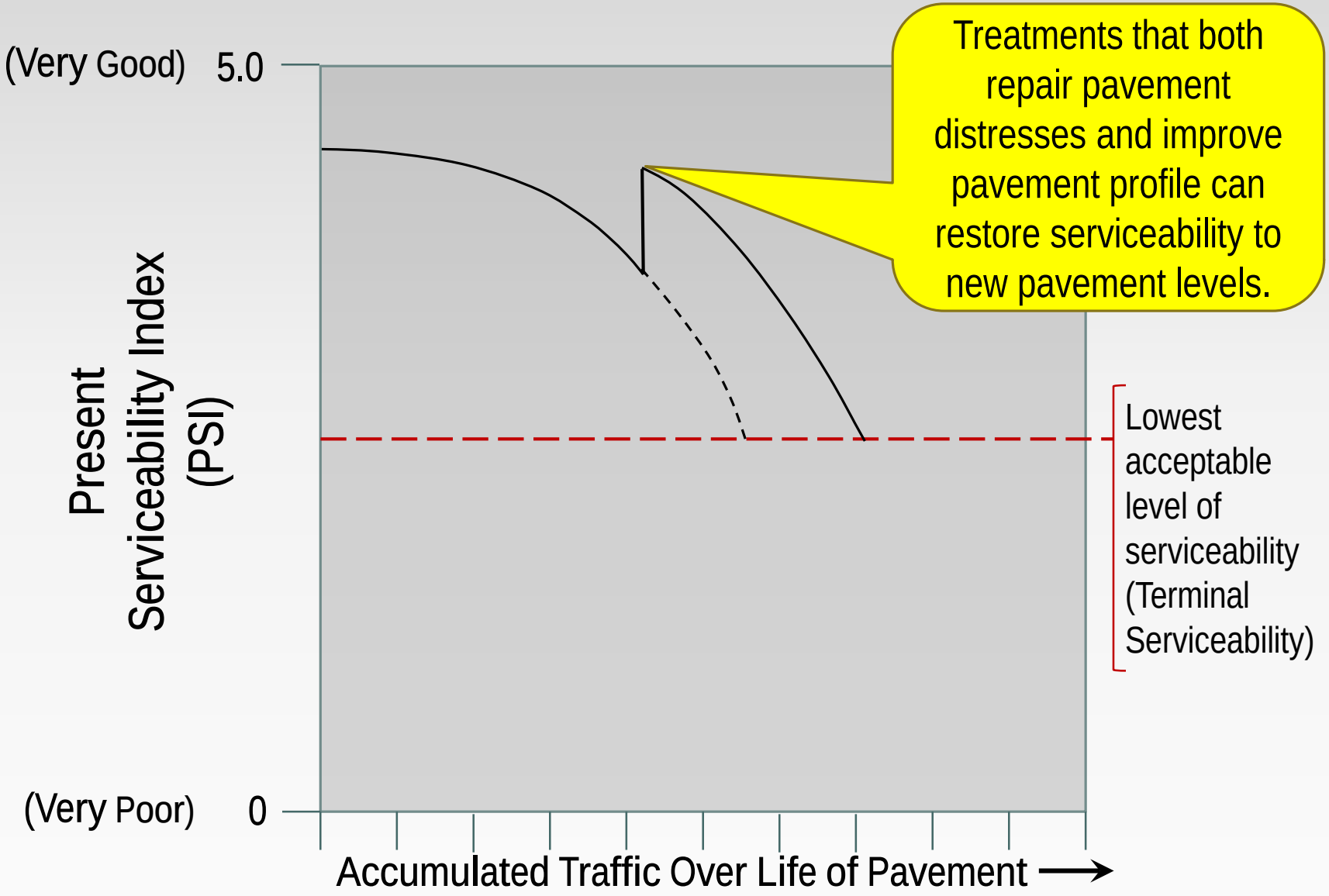
Source: NCAT Research Synopsis 03-02

Benefits of Thinlay Asphalt

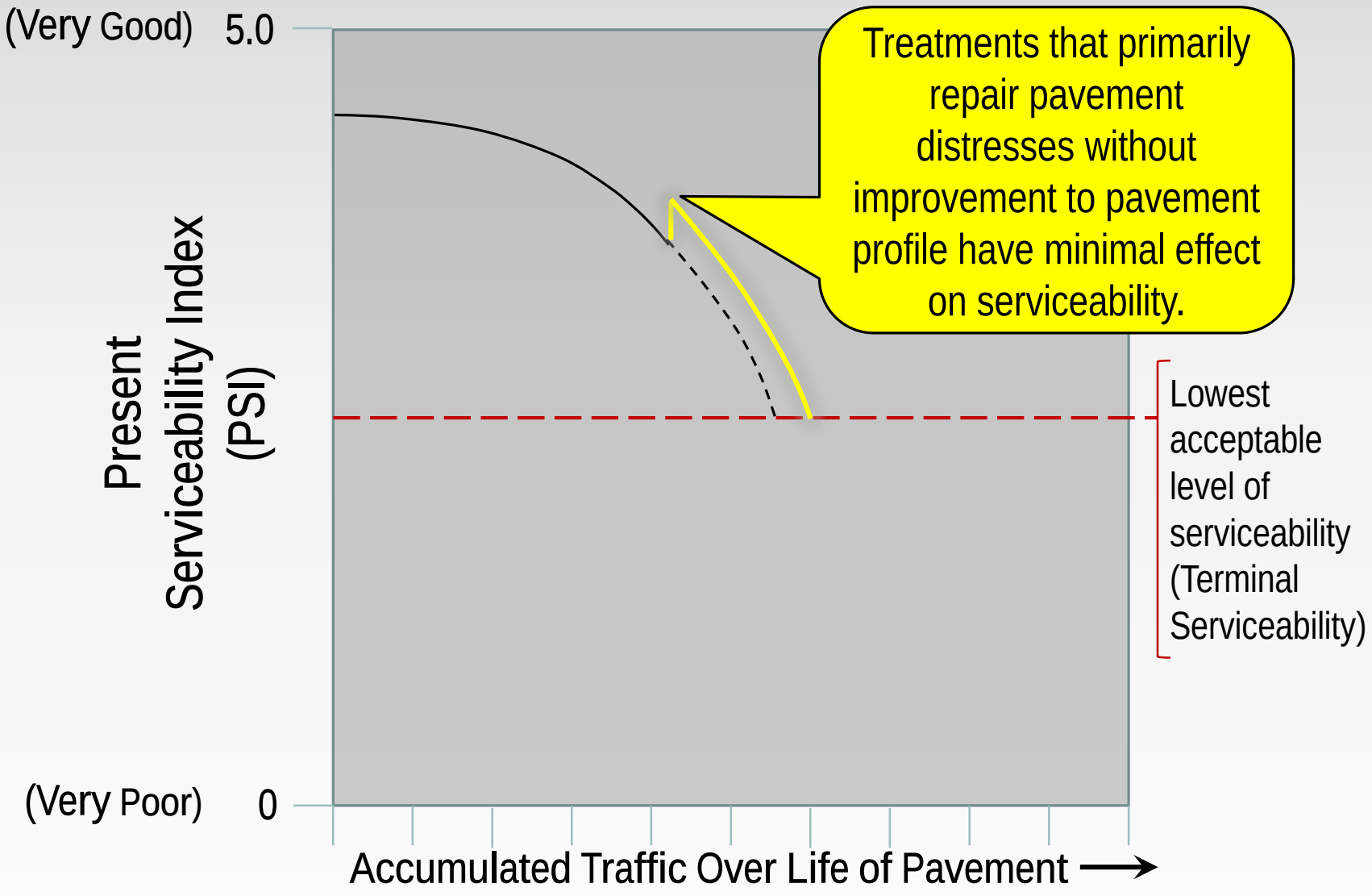
Serviceability
Structural

Serviceability is…

- A pavement performance measure developed as part of the AASHO Road Test, and
- A measure of the ability of the pavement to serve the type of traffic using the facility, and
- A measurement of highway users' perceptions regarding the **acceptability of a pavement**, and
- Largely impacted by highway users' perceptions of ride quality.



Preventive maintenance treatments differ widely in their ability to improve serviceability.



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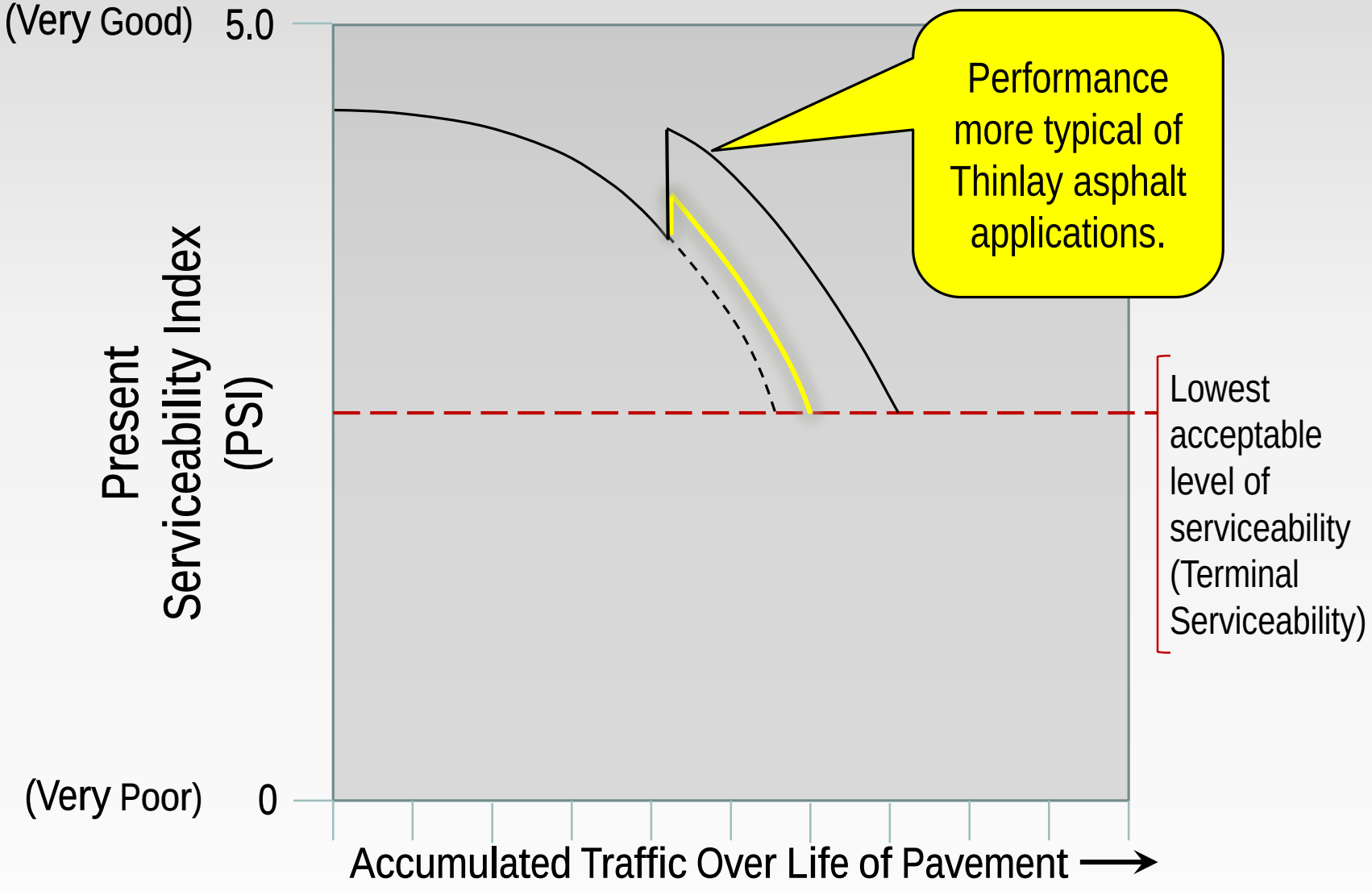


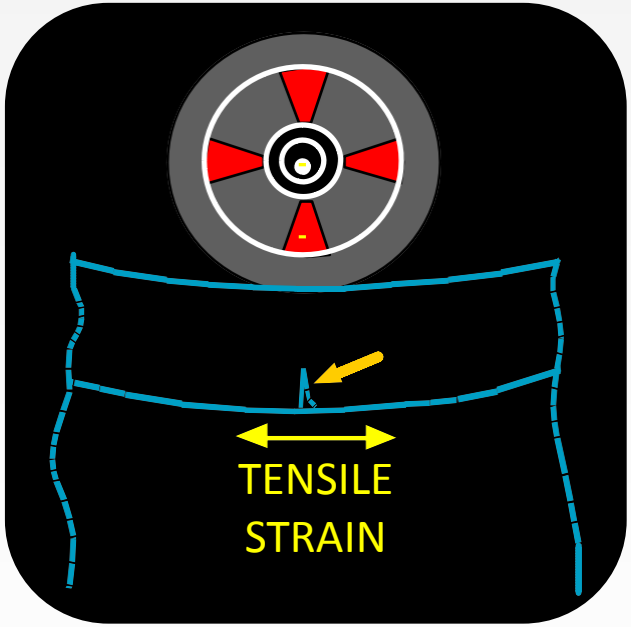
Preventive maintenance treatments differ widely in their ability to improve serviceability.

Structural Benefits

- Preventive maintenance treatments are typically non-structural
  - Slurry seals, chips seals, microsurfacing add no structure
- Preventive maintenance treatments should be applied to structurally sound pavements
- A 1-inch thick thinlay asphalt treatment <u>does</u> provide structural benefits

Structural Benefits

- Most in-service pavements were designed for 20 years with AASHTO design
- They have finite bottom-up fatigue life, meaning if thickness is not increased the pavement will eventually fail from bottom up cracking



Structural Benefits

- A seal type treatment applied on those pavements will have no impact on the tensile strain and therefore no impact on the structural life
- Preventive seals on these pavements will only mask the impending structural distresses and eventually lead to full depth failures

A Case Study Rehabilitation Using Thin Overlays

WASHINGTON COUNTY, OREGON

2001

Why Slurry Seals?
(or microsurfacing)

- → Weathered Surface
- → Very Minor Cracking
- → Restoration of Skid Resistance
- → Pavement Life Extension

Jamieson Road Microsurfacing

Evergreen Microsurfacing

Mix Design

3/8" NMAS

- 12.5 mm -- 100%
- 9.5 mm -- 99%
- 6.3 mm -- 88%
- 4.75 mm -- 75%
- 2.36 mm -- 51%
- 600 um -- 25%
- 75 um -- 6.7%
- PG 64-22 -- 6.0%

APA Rut Test Results – 4.6 mm

Fischer Road

→ ADT = 3,200 vehicles per day

Leahy Road

→ ADT = 4,800 vehicles per day

Murray Blvd.

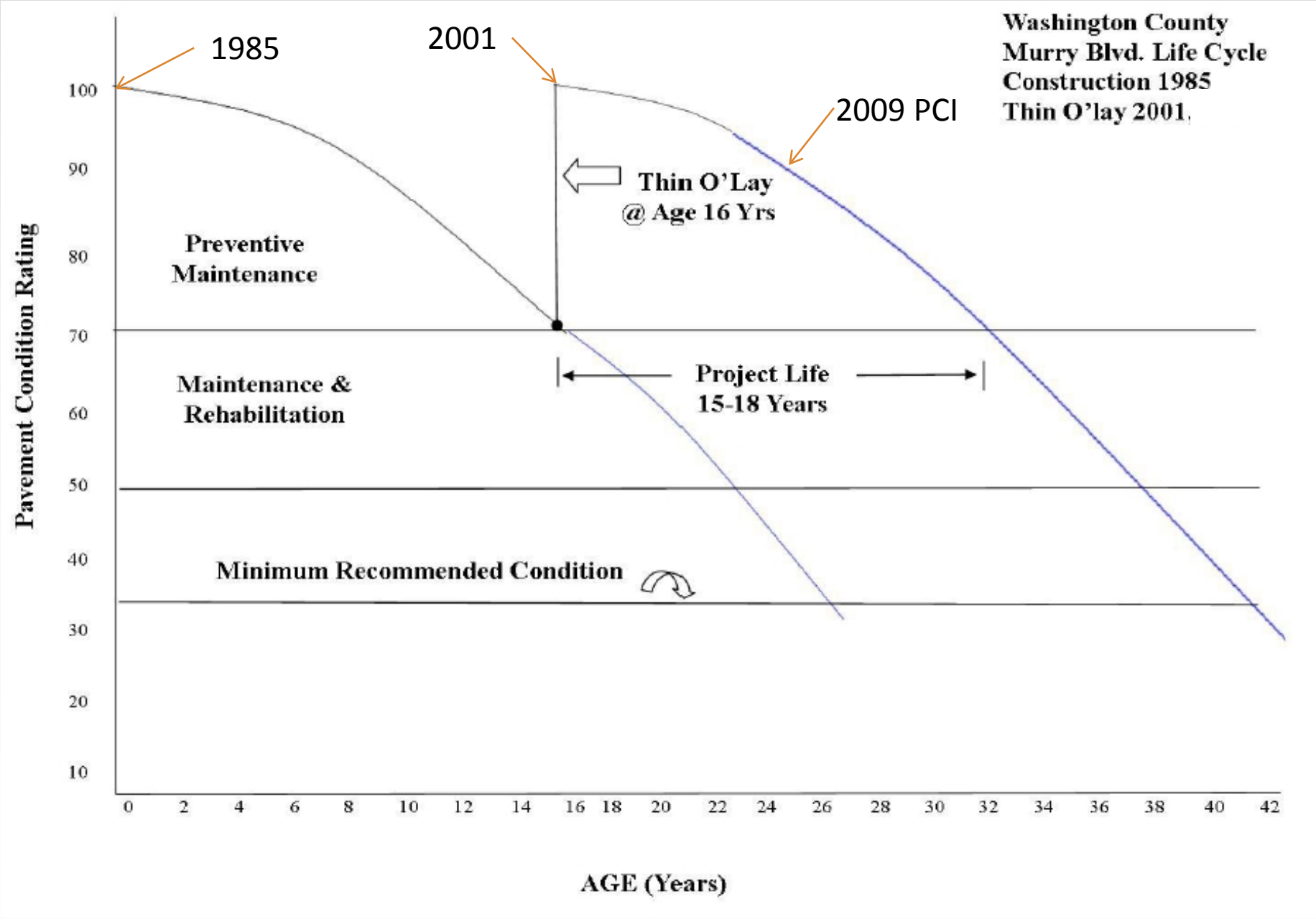
→ ADT = 30,000 vehicles per day

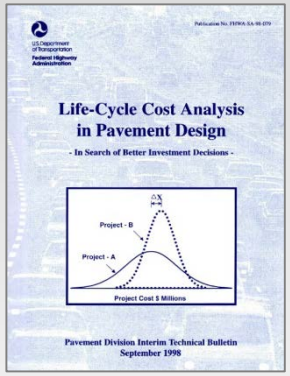
3/8 inch NMAS Mix


Fischer Road Paved 2001
2009 PCI 95

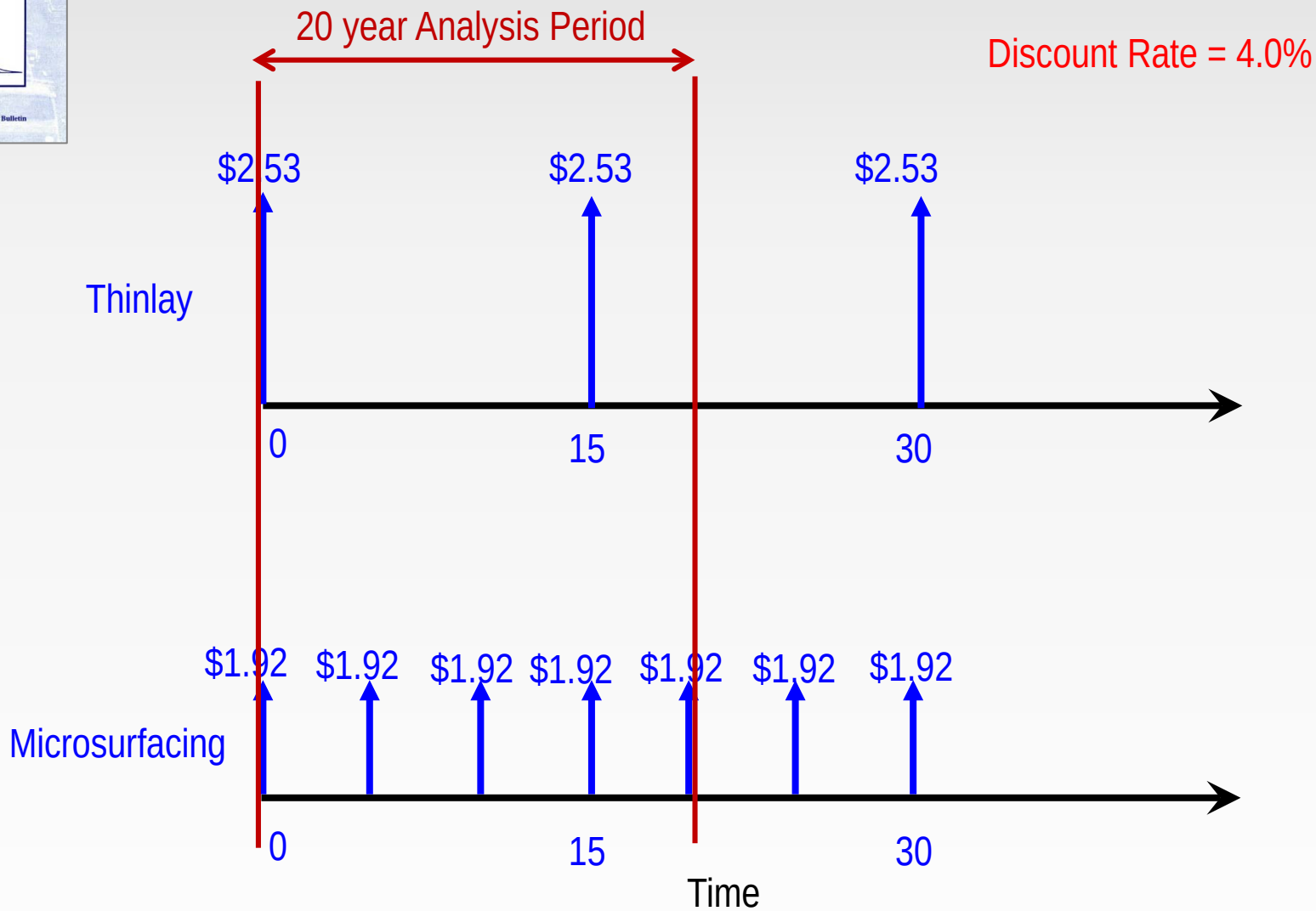

Walker Road Paved 2002
2009 PCI 95


Murray Blvd. ADT 30,000, 1” Thinlay
placed in 2001, 2009 PCI =88


Washington County
Murry Blvd. Life Cycle
Construction 1985
Thin O'lay 2001.
1985
2001
2009 PCI
Thin O'Lay
@ Age 16 Yrs
Preventive
Maintenance
Maintenance &
Rehabilitation
Project Life
15-18 Years
Minimum Recommended Condition
Pavement Condition Rating
100
90
80
70
60
50
40
30
20
10
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
AGE (Years)



Life Cycle Cost Analysis



Life Cycle Cost Analysis

- 20 Year Analysis, Discount Rate i=4%
- Thinlay Service Life = 15 years
- Microsurfacing Service Life = 5 years
- **Thinlay = $3.93/yd²**
- **Microsurfacing = $6.74/yd²**

Life Cycle Cost Analysis shows Thinlay net present value is $2.81/yd² <u>less</u> than microsurfacing over 20 years

Thinlay Asphalt

- ✓ Correct surface distress
- ✓ Seal existing surface
- ✓ **Improve serviceability**
- ✓ **Extend structural life**

City of Newberg, OR 2013

Thank You!!

Lindsi Hammond, P.E.
www.psipdx.com