Thin Asphalt Concrete Overlays

June 20, 2016

Today's Presenters

- **Moderator**
  Julie Kliewer, Arizona DOT
- **Thin Asphalt Concrete Overlays**
  Don Watson, National Center for Asphalt Technology
- **Selecting the Right Mix for the Right Conditions**
  Michael Heitzman, National Center for Asphalt Technology

NCHRP is...

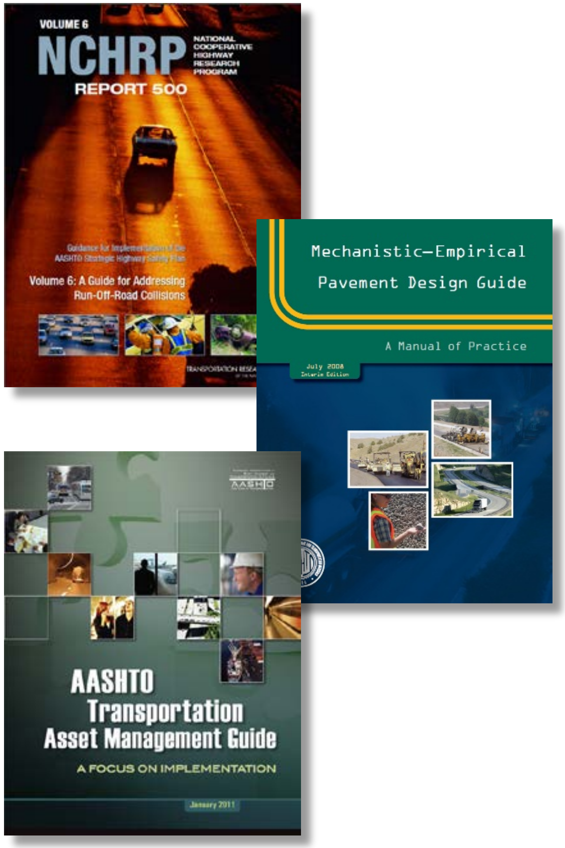
A state-driven national program

- The state DOTs, through AASHTO’s Standing Committee on Research...
  - Are core sponsors of NCHRP
  - Suggest research topics and select final projects
  - Help select investigators and guide their work through oversight panels

NCHRP delivers...

Practical, ready-to-use results

- Applied research aimed at state DOT practitioners
- Often become AASHTO standards, specifications, guides, manuals
- Can be directly applied across the spectrum of highway concerns: planning, design, construction, operation, maintenance, safety

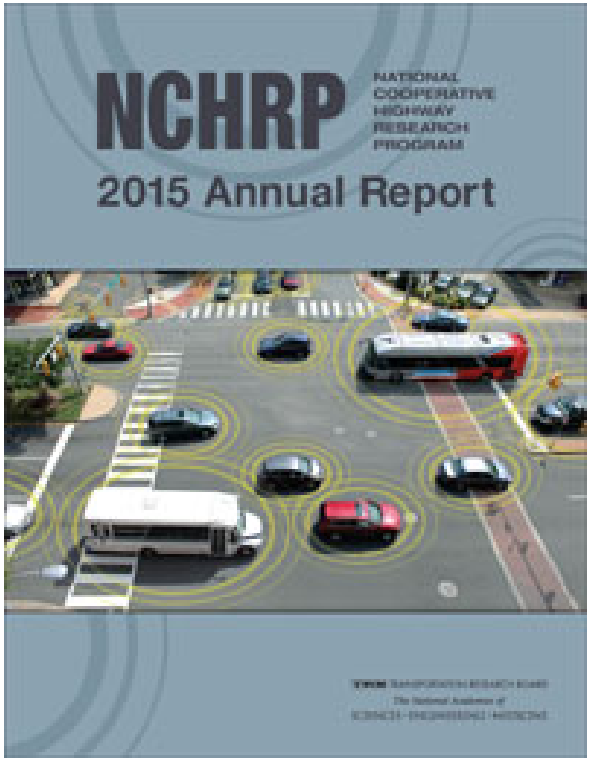


A range of approaches and products

- Traditional NCHRP reports
- Syntheses of highway practice
- IDEA Program
- Domestic Scan Program
- Quick-Response Research for AASHTO
- Other products to foster implementation:
  - *Research Results Digests*
  - *Legal Research Digests*
  - *Web-Only Documents and CD-ROMs*

NCHRP Webinar Series

- Part of TRB’s larger webinar program
- Opportunity to interact with investigators and apply research findings.



Today’s First Presenter

- **Thin Asphalt Concrete Overlays**
  Don Watson, National Center for Asphalt Technology

Thin Asphalt Concrete Overlays
NCHRP Synthesis 464

TRB Webinar

June 20, 2016

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Outline

- Purpose/Scope
- Use
- Design and Construction
- Performance, Maintenance, Rehab
- Case Studies
- Conclusions

Purpose/Scope

- Document current experience/research
  - Literature review
  - Agency/industry survey
    - 43 States
    - 8 Private Industry companies

Advantages of Thin Overlays

- Provides long service life (when placed over structurally sound pavements)
- Provides good riding surface
- Reduces noise (fine-graded mixes)
- Maintains grade and slope geometry
- Is easily maintained
- Is recyclable

Previous Research

- NAPA – (Newcomb, 2009) IS 135
- Zubek – Cold Regions, 2012
- Montana – (Cuelho, 2006)
- NCHRP Synthesis 222 – (Zimmerman, 1995) Project/Treatment selection

NAPA Information Series 135

- Character of pavement construction has changed
- Thin Overlays meet a funding need
- New technologies and improved materials extend service life

Zubek- Cold Regions

- Thin overlays common for roads with heavy studded-tire use
- Average service life in such environment – 6 yrs

Montana Survey

Preventive Maintenance Treatment	Average Service Life (Years)	Cost per Lane Mile (12 feet 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

NCHRP Synthesis 222

- Most important basis for treatment selection- find treatment that most effectively addresses deficiencies
- Automated models used for “what if” scenarios

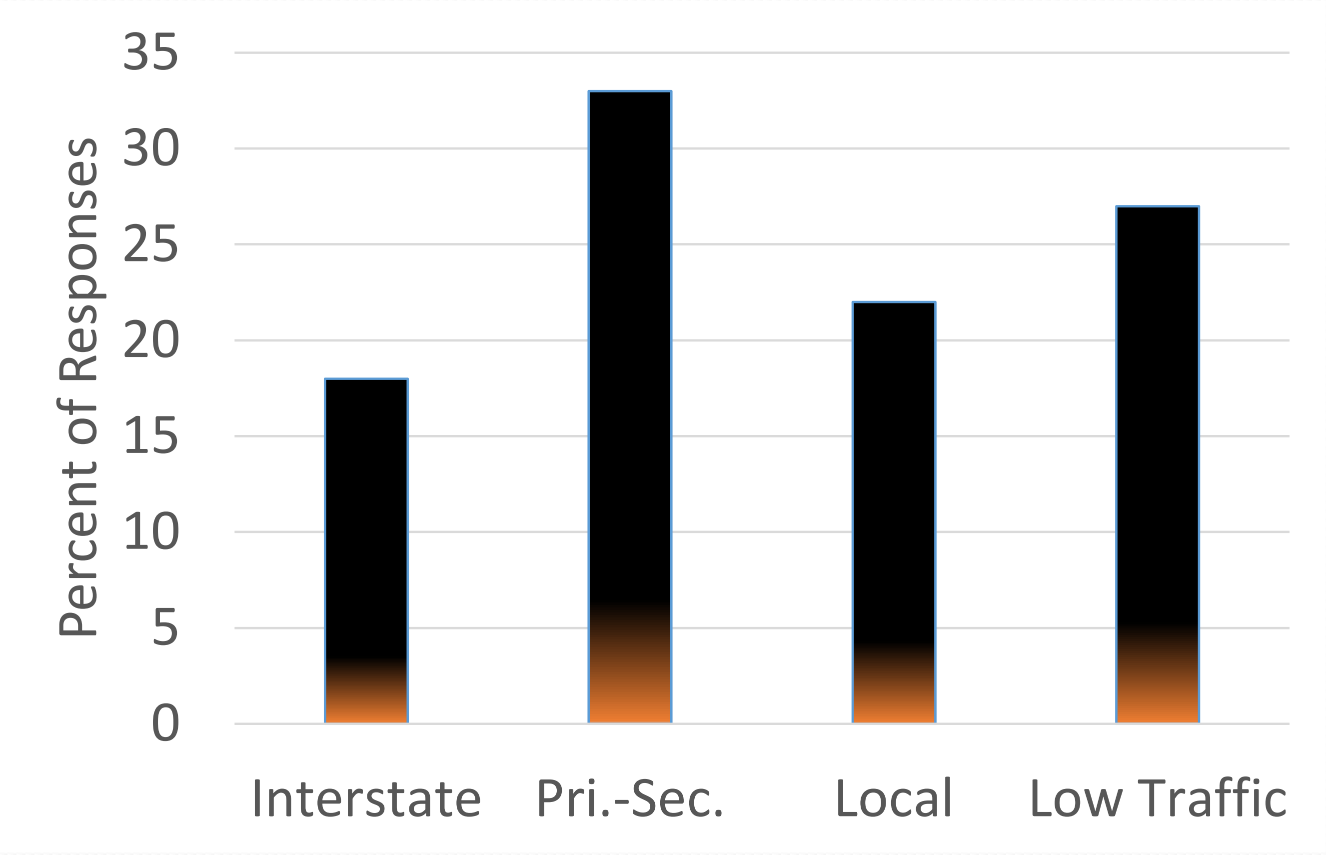
Types of Thin Overlays

- 9.5 and 12.5mm Superpave
- 9.5 and 12.5mm SMA
- UTBWC
  - Arkansas
  - Illinois, Kansas, Louisiana, Minnesota, Vermont
- 4.75mm Superpave and SMA
- OGFC/PFC

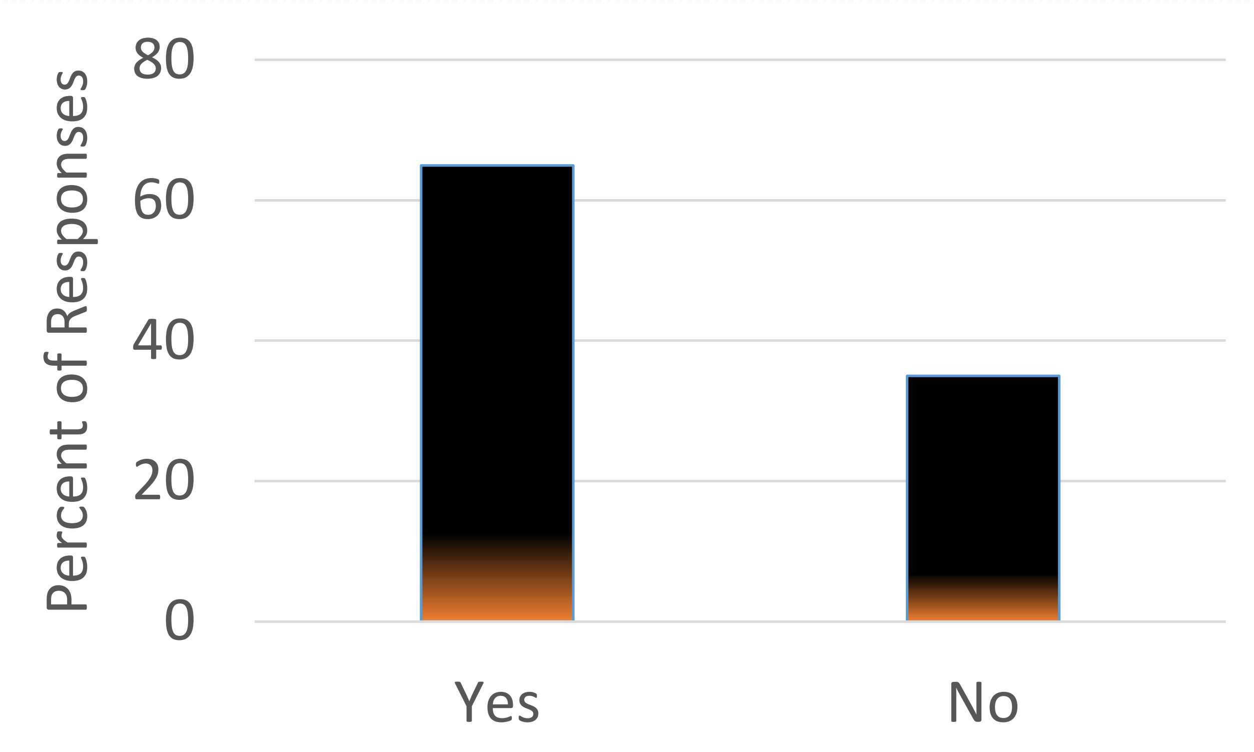
NCAT Pavement Preservation Study

Section	18	19	20	21	22	23	24	25
Surface	4.75/PG 67-22	4.75/PG 67-22	4.75/PG 76-22	4.75/PG 76-22	UTBWC	4.75 50% RAP	4.75 5% Shingles	4.75 PG 88-22
Subsurface	Fibermat	Existing	Full-Depth Reclamation	Existing	Existing	Existing	Existing	Existing

Where are Thin Overlays Used?



Are Thin Overlays Typically Used?



PennDOT Use of Thin Overlays

Where Not To Use Thin Overlays

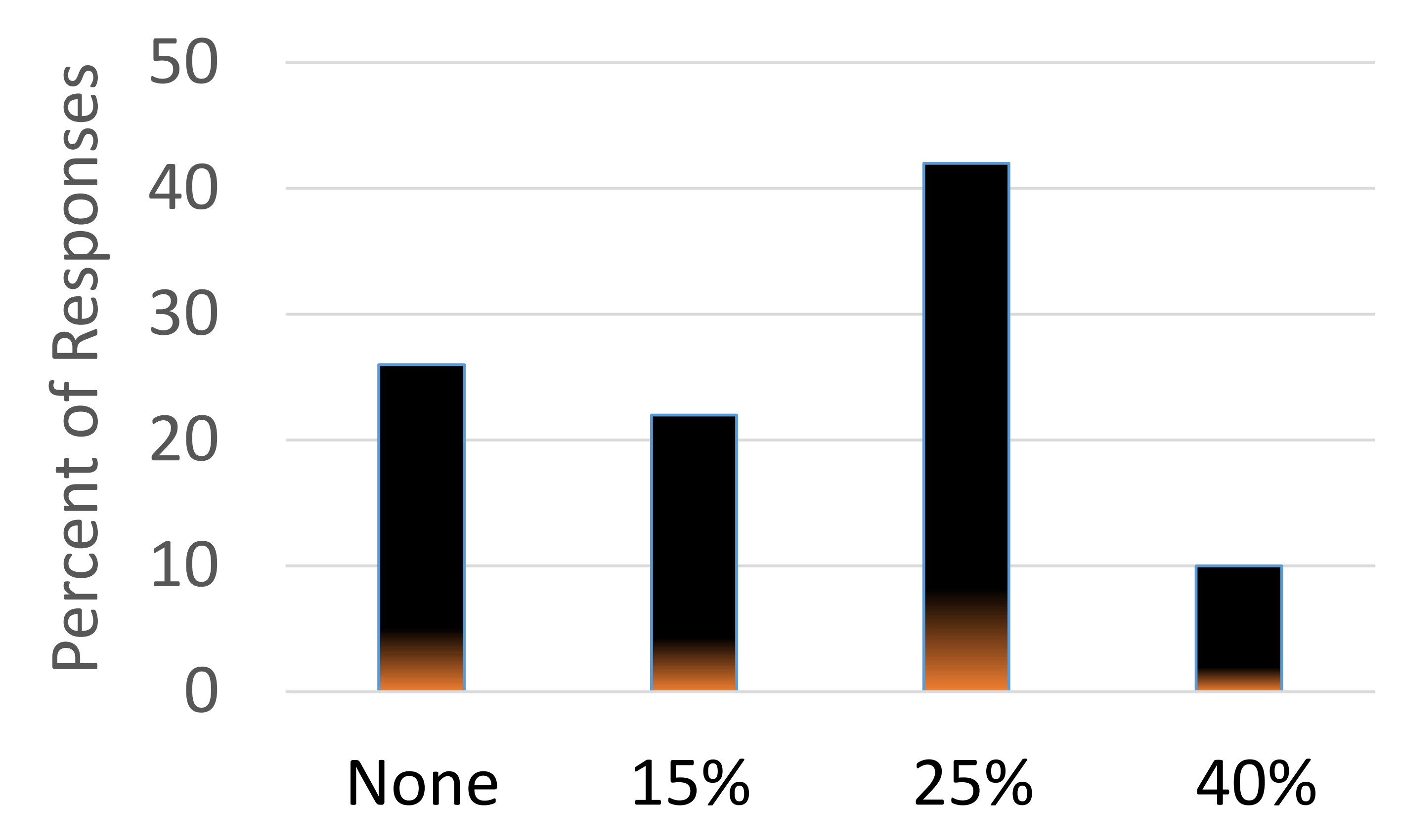
Use of Thin Overlays

Pavements that are failing, or have already failed, cannot be successfully treated with a thin overlay alone.

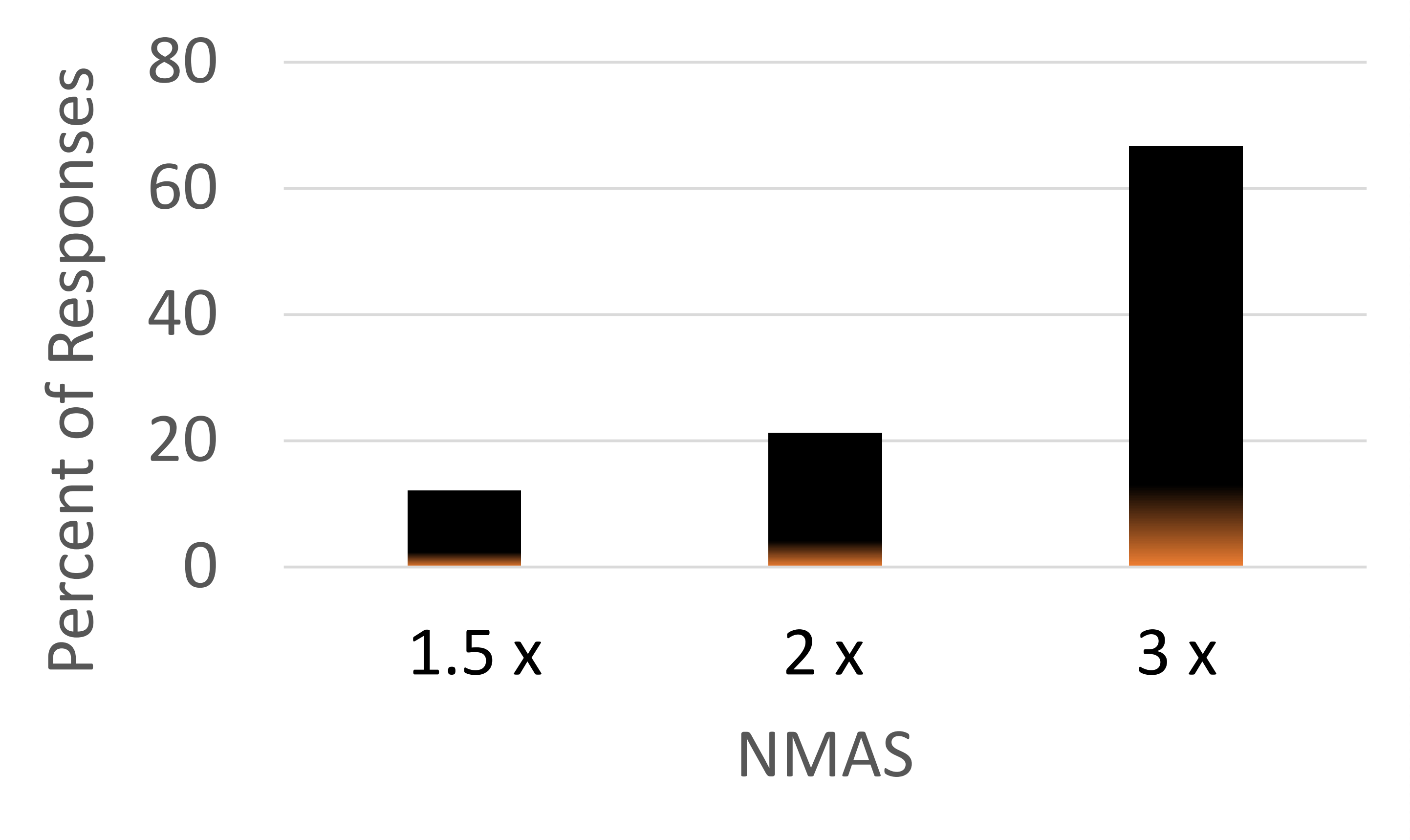
Design and Construction

- Aggregate – Superpave quality standards
- Binder – Often modified
- Compaction level – 50 gyrations, locking point, other
- Testing constraints

Maximum RAP Allowed



Typical Thickness



RAP May Need to be Fractionated

Beneficial to Keep Aggregate Dry

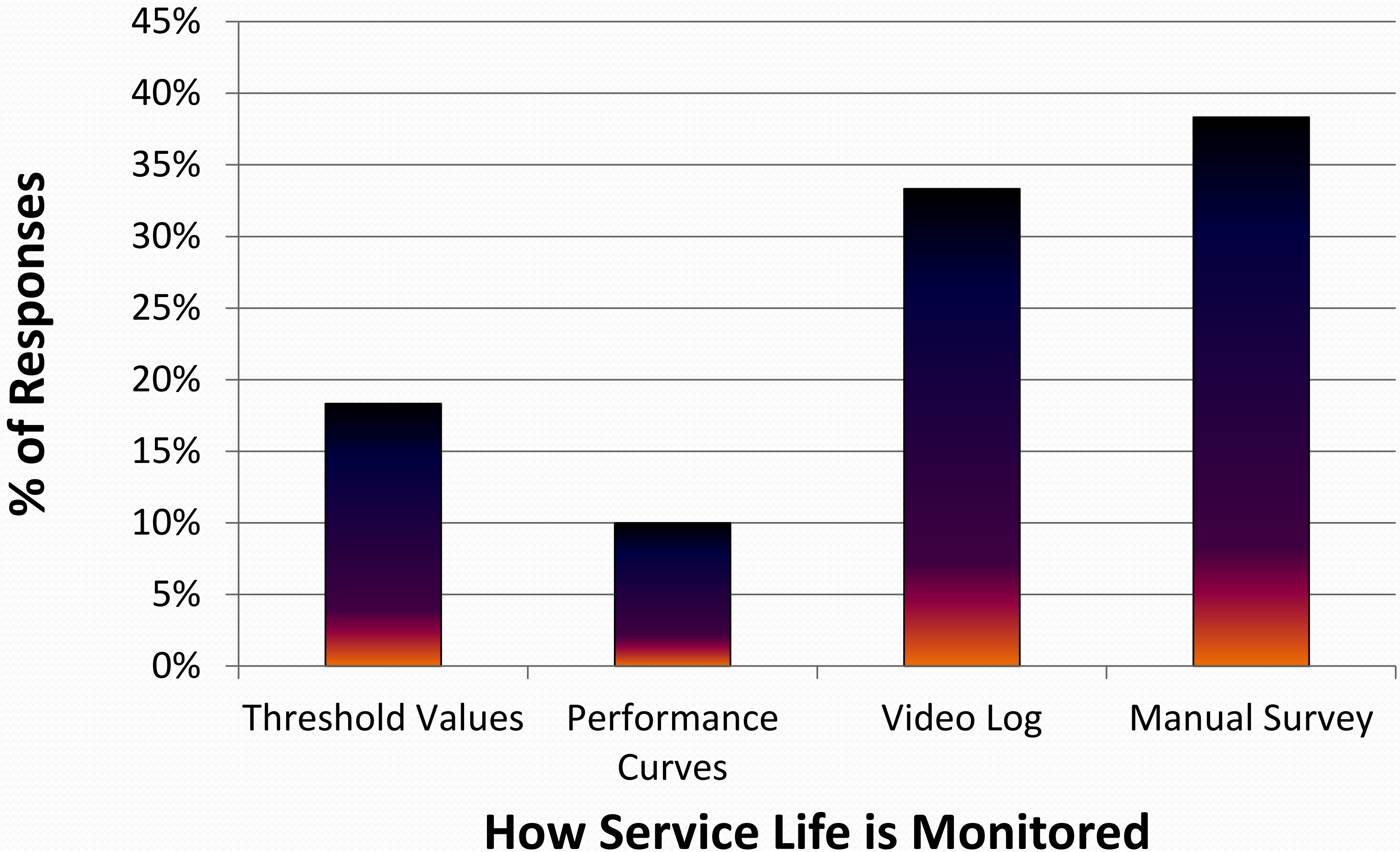
1% increase in moisture = 10-12% increase in drying cost while reducing production about 11%.

Surface Preparation is Critical

Thin Overlays Can Improve Smoothness

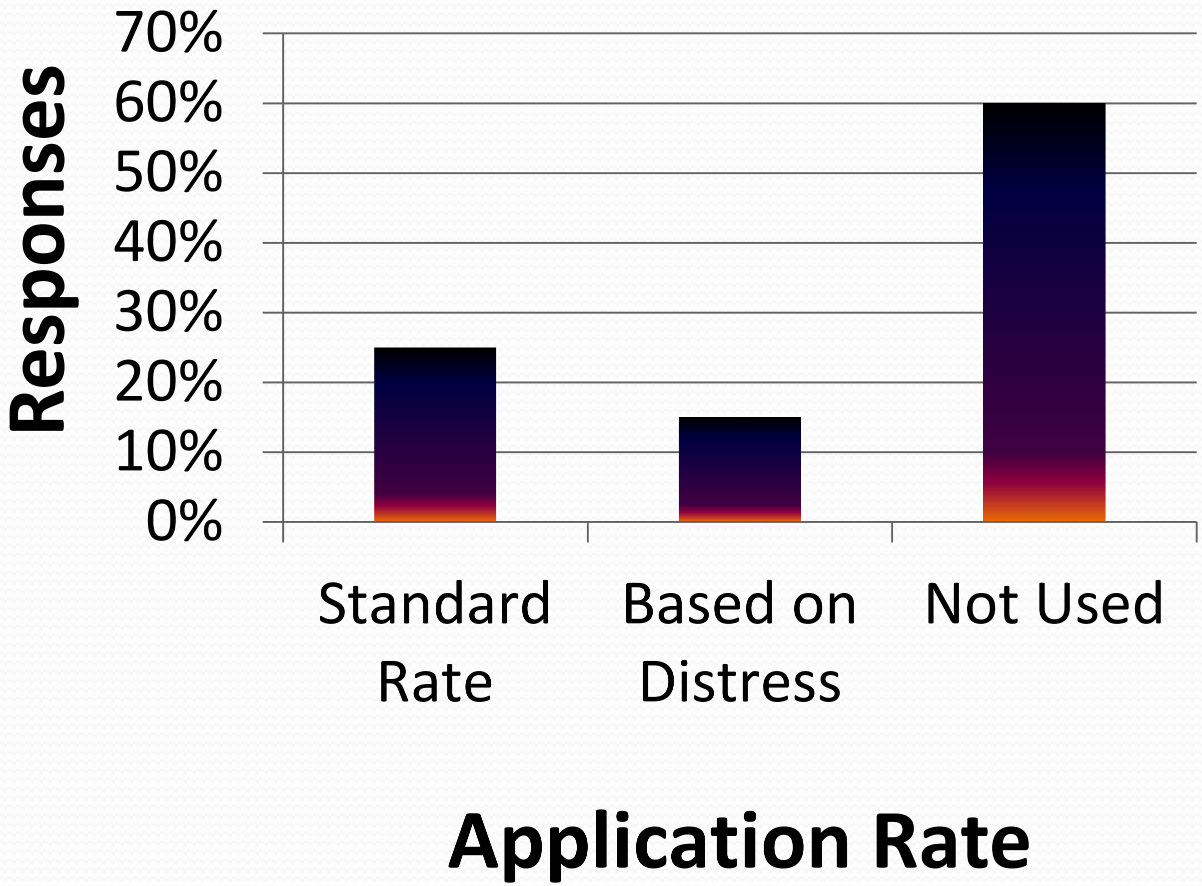
As a general rule, only 40-60% improvement in ride quality can be expected with a single layer of asphalt mix.

Performance, Maintenance, Rehab



Maintenance

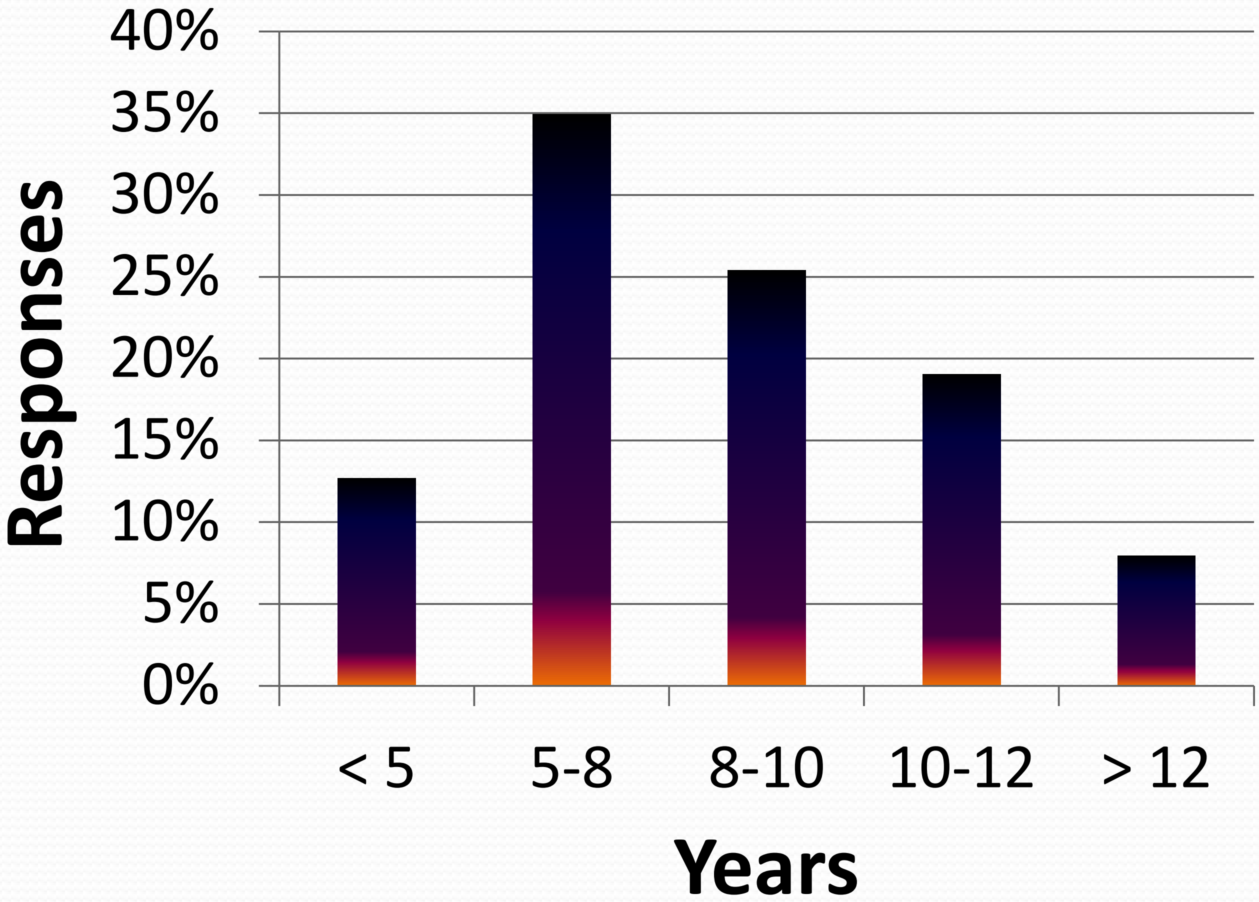
(Fog Seal/Rejuvenator Application)



Service Life

- LTPP Data (Liu, 2013)
  - 341 Thin Overlay Sections
  - 40 States, 8 Canadian Provinces
- Median life expectancy – 7 to 9.5 years

Service Life



Explanations for Range in Service Life

Environmental Differences

Explanations for Range in Service Life

Construction Quality Standards - Interstate versus Secondary

Explanations for Range in Service Life

Variation in material quality

Explanations for Range in Service Life

Temporary Fix

Cost/Benefit of Preservation Treatments

- Wang, 2012 – 29 state agencies
  - Thin Overlays cost more initially
  - Extended pavement life the longest
- Oregon (Parker, 1993) – 87 sites within state
  - Thin overlays most cost-effective
  - Particularly more effective for heavy traffic

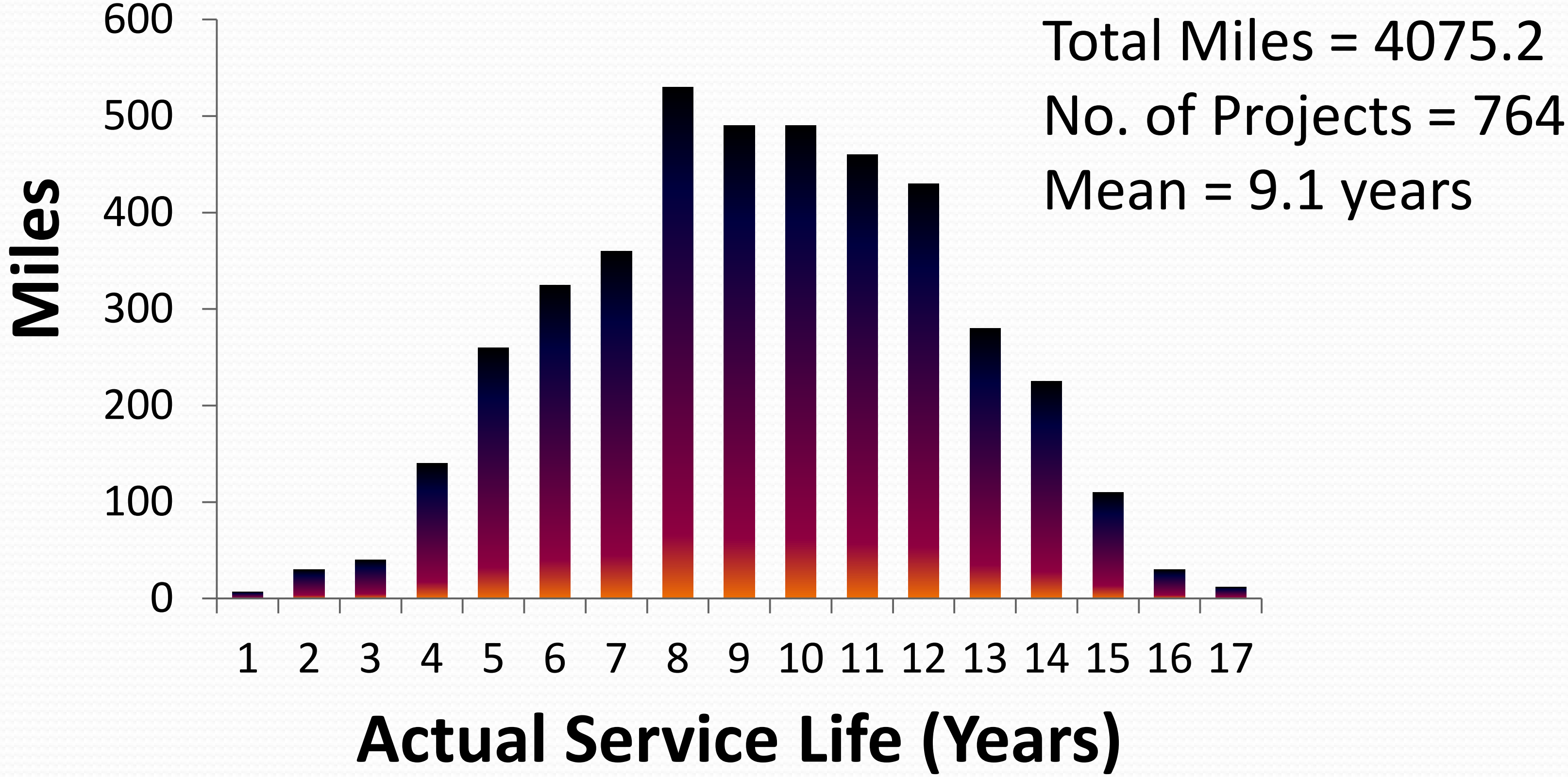
Case Studies - Tennessee

Bid Prices for Preservation Treatments

Year	**Microsurfacing ($/sy)**	**4.75 mm NMAS ($/sy)**
2013	2.02	2.24
2011	2.41	1.88
2009	2.15	2.09

Case Studies - Ohio

Mileage vs Service Life of Thin Overlays



Case Studies - Louisiana

- Compared UTBWC to Conventional Overlay
  - UTBWC – 0.75 inch Thick
  - Conventional – 3.5 inch thick
- UTBWC would save $3.34/sy
- Consider UTBWC for new or surface rehab, concrete overlays, alternate to mill/fill

Case Studies - Georgia

Tips for Successful Practice

- Select the right candidate
  - Condition of existing structure is critical
  - Target resurfacing before structural failure
- Adequate tack coat is critical
- Avoid coarse mixes with low AC
- Avoid <1 in for turn lanes and intersections
- Avoid placement rate that is too thin

Conclusions

- Thin overlays routinely used as preservation tool
- Thin overlays are economical/competitive
- Success depends on existing distresses
- Service life generally in 7 – 11 year range

NCHRP Synthesis 464
Thin Asphalt Concrete Overlays
"Selecting the Right Mix for the Right Conditions"

Webinar

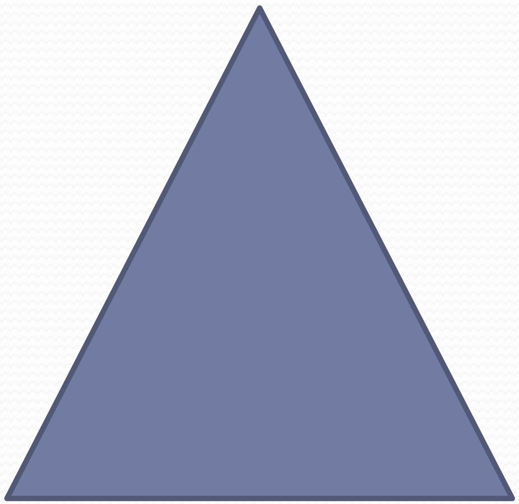
June 20, 2016

Outline

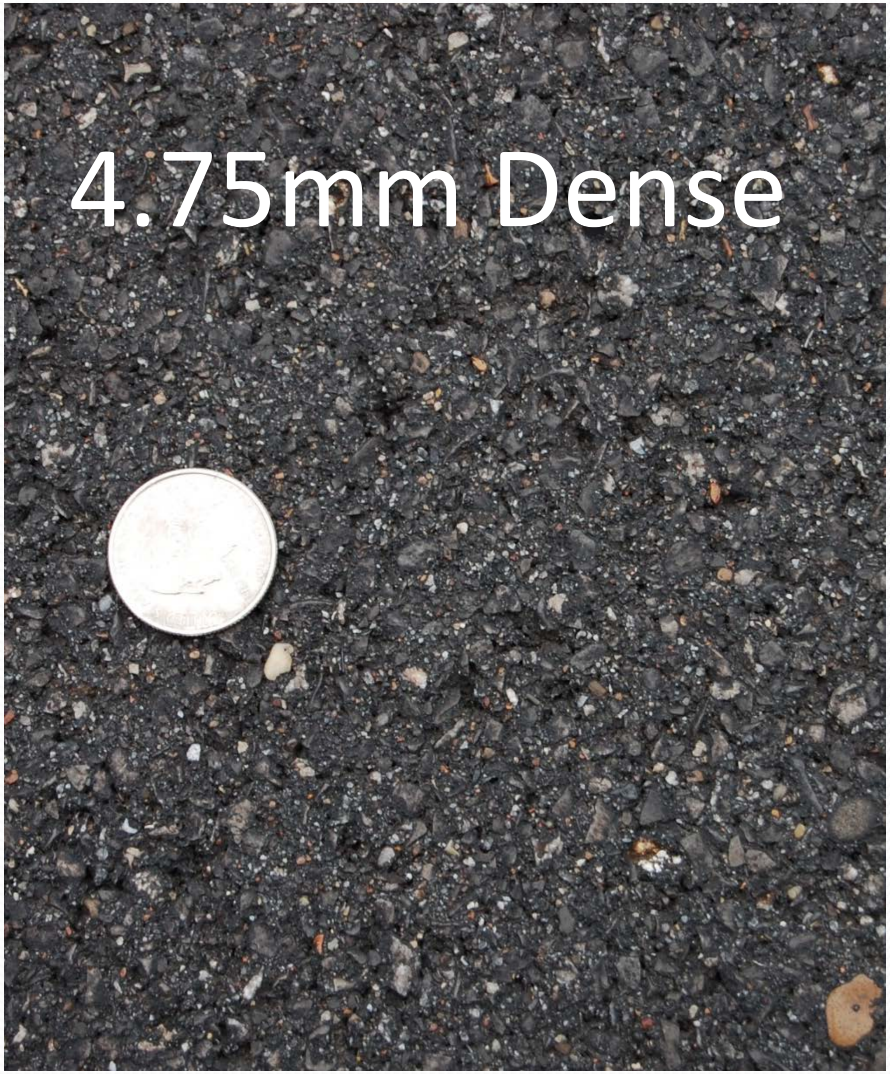
- Defining thin asphalt concrete
- Factors influencing mix selection
- Pavement condition categories
- Selection process

Defining thin asphalt concrete

- OGFC/PFC
- UTBWC
- SMA (12.5, 9.5)
- Dense Graded (12.5, 9.5 and 4.75)

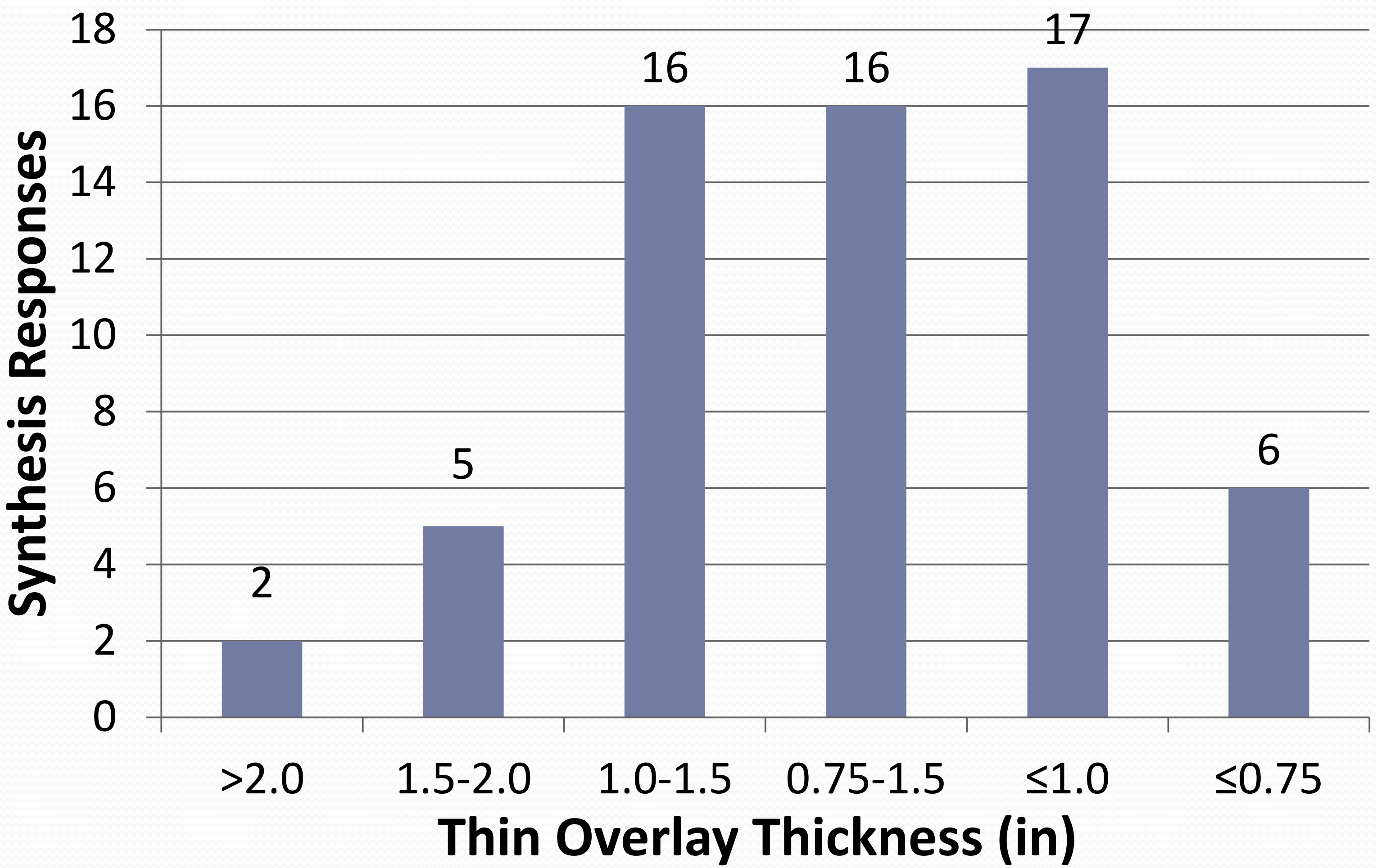


- Unique Agency Mixes


4.75mm Dense


12.5mm OGFC

Thin Overlay Thickness



NAPA Thinlays^{TM} Definition

- NAPA Thinlays^{TM} successfully extend the life of structurally sound pavements. Thinlays^{TM} can be as thin as 5/8 inch and of greater thickness as surface conditions necessitate.

Factors Influencing Mix Selection

- Type of route
- Traffic
- Climate
- Pavement condition
- Desired pavement performance
- Cost-effective
- Availability

Factors Influencing Mix Selection

- Type of route
  - Rural / Urban
  - Residential / Commercial / Industrial
- Traffic
  - Volume
  - Speed

Factors Influencing Mix Selection

- Climate
  - Temperature (no freeze / freeze)
  - Precipitation (dry / wet)

Factors Influencing Mix Selection

- Pavement Condition
  - Type of distress
    - Rutting
    - Fatigue cracking
    - Thermal cracking
  - Extent of distress
    - Unit of measure per lane length
  - Severity of Distress
    - Low / moderate / high

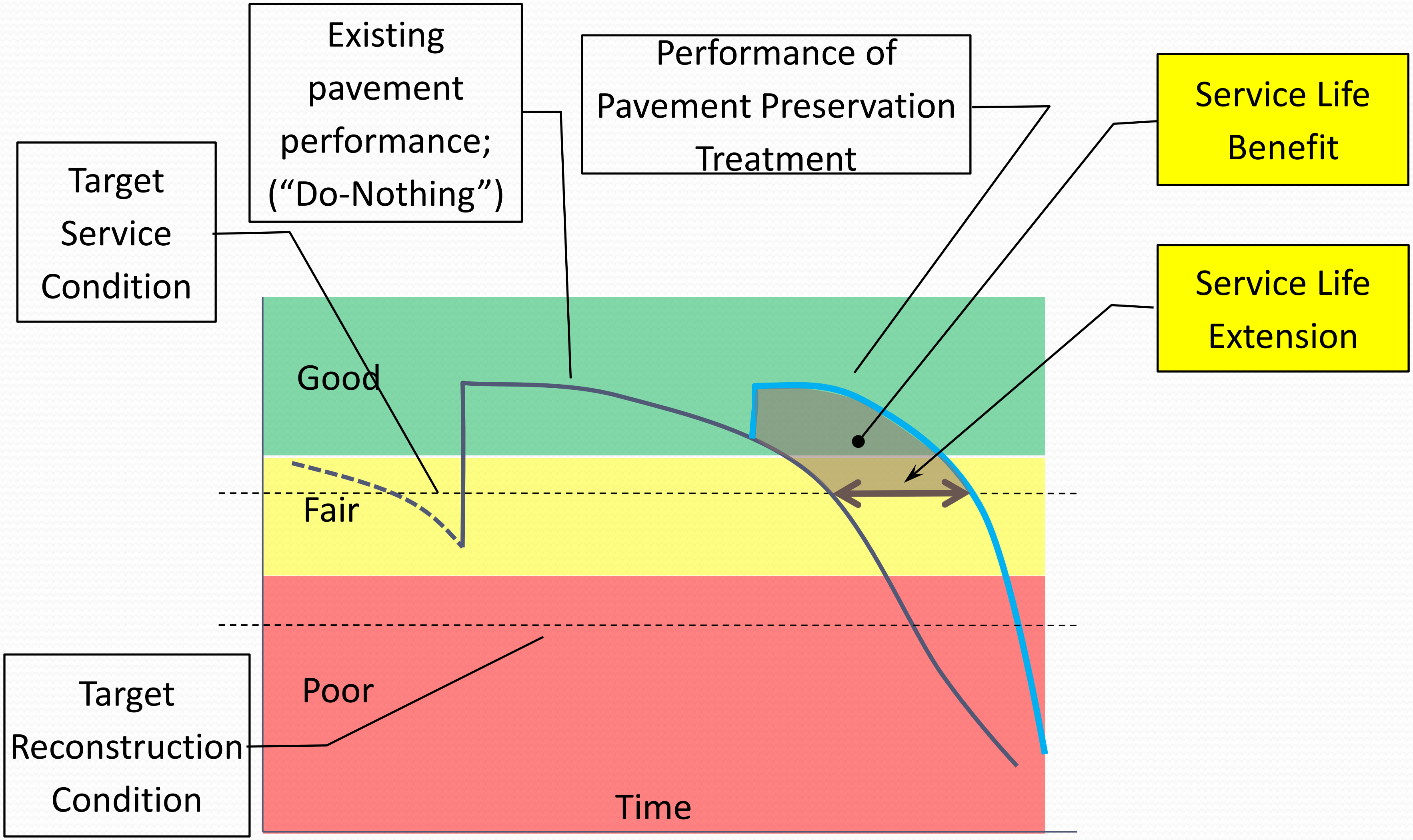
Factors Influencing Mix Selection

- Desired Pavement Performance
  - Short-term “stop-gap” versus long-term “optimum”
  - Ride quality
  - Safety
  - Structure

Factors Influencing Mix Selection

- Cost-Effective
  - Use of pre-overlay actions
    - crack sealing/filling
    - patching
    - milling
  - traffic control costs
  - Compare to other preservation treatment options
    - Cost/year service
    - Performance (ride, safety, noise)/year service

Defining Service Life



Factors Influencing Mix Selection

- Availability
  - Materials
    - Aggregate
    - Binder / emulsion
  - Equipment
    - Conventional asphalt paving
    - Slurry truck, chip spreader
  - Experience (agency, contractor, performance)

Spray Paver for UTBWC

Slurry Paving

Pavement Condition Categories

- Maintenance (isolated distress)
  - Thin asphalt overlay is not cost-effective)
- Preservation (low distress)
  - Thin asphalt overlay is cost effective alternative
- Rehabilitation (moderate distress)
  - Thin asphalt surface may be part of rehabilitation package

Pavement Condition Categories

- Type/extent/severity of distress
  - Rutting (construction, asphalt mixture, pavement structure)
  - Fatigue (Bottom-up)
  - Fatigue (Top-down)
  - Thermal cracking (asphalt binder)
  - Reflective cracking

Pavement Condition Categories

- type/extent/severity of distress
  - Safety (friction, geometry)
  - Ride (construction or lagging indicator)
  - Raveling/moisture (construction, mixture)
  - Block cracking (age/oxidation)

Lee Road 159 – NCAT Study

Performance Measures (Purdue Study)

Performance Indicator	Roughness (IRI)	Condition (PCR)	Rut Depth
Threshold Used	110 in/mi (1.74 m/km)	85	0.25 in (6 mm)
Expected Life (Yrs.)	7 - 10	7 - 11	8 - 11

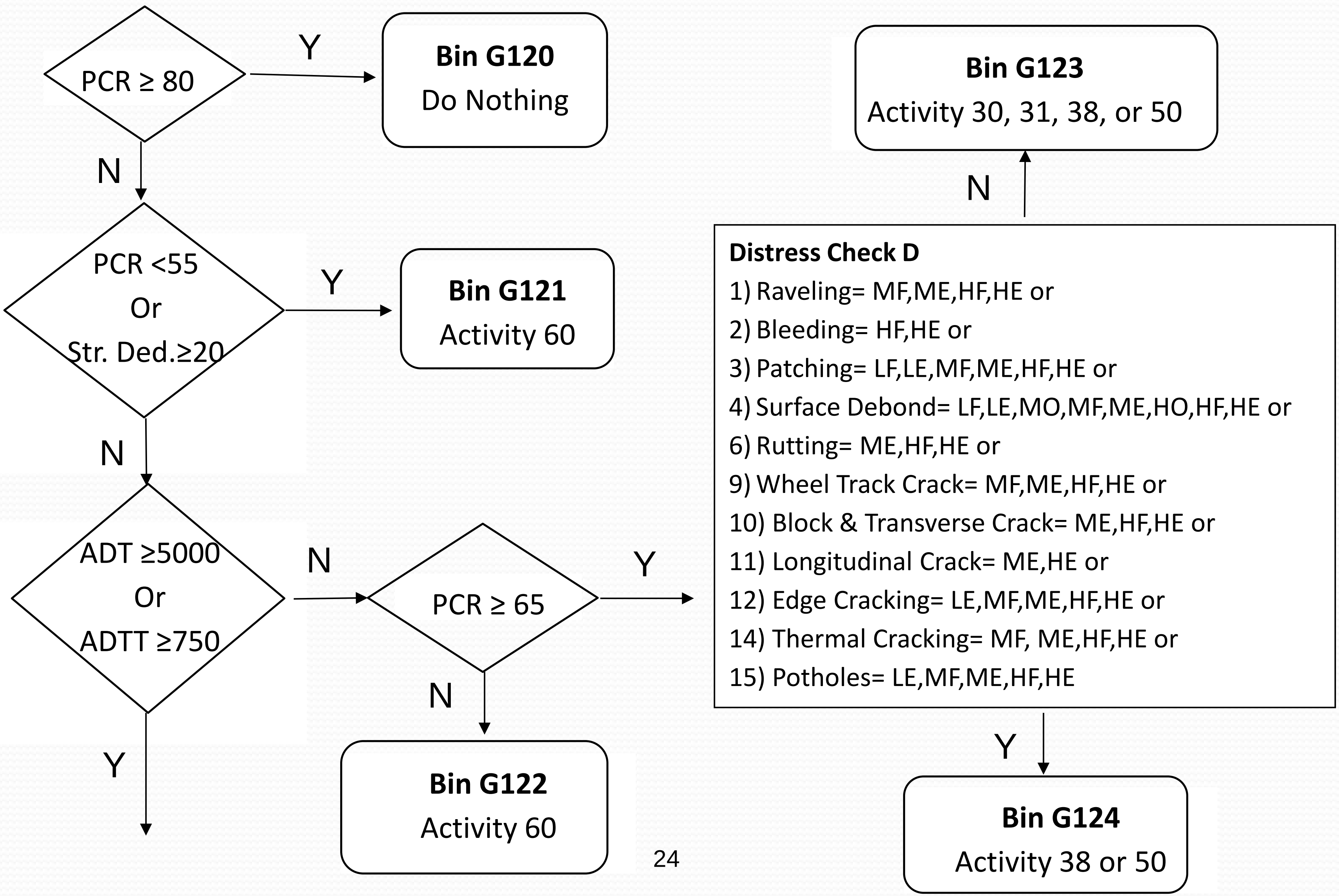
Selection Process

- Type of Route (use)
- Traffic (speed and volume)
- Climate (fixed for some regions, variable for other regions)
- Current Pavement Condition
- Desired Performance (often to correct distress)

Project/Treatment Selection Strategies (NCHRP Synthesis 222)

- Current condition rating
- Prediction models ("What if" scenario)
- Network Optimization models
- Find treatment that addresses deficiencies (may be affected by local policies/mandates)

Ohio Decision Tree



Thin Asphalt Mix Selection

Traffic		High volume, high speed HIGHWAYS				High volume, low speed URBAN ARTERIAL			
Climate	Precipitation Temperature	Dry Frz	Wet Frz	Dry No frz	Wet No frz	Dry Frz	Wet Frz	Dry No frz	Wet No frz
Extend Service Life		S,U	S,U	S,U	S,U	D	D	D	D
Improve Ride		S,U	S,U	S,U	S,U	D	D	D	D
Eliminate Rutting		S	S	S	S	S	S	S	S
Seal Surface Cracks		U	U	U	U	D	D	D	D
Improve Friction		S,U	S,U	O	O	D	D,S	D	D,S
Mixture Types		D=Dense, S=SMA, O=OGFC, U=UTBWC							

Thin Asphalt Mix Selection

Traffic		Low volume, high speed RURAL TWO-LANE				Low volume, low speed RESIDENTIAL			
Climate	Precipitation Temperature	Dry Frz	Wet frz	Dry No frz	Wet No frz	Dry Frz	Wet Frz	Dry No frz	Wet No frz
Extend service life		D	S	D	S	D	D	D	D
Improve Ride		D	S	D	S	D	D	D	D
Eliminate Rutting		S	S	S	S	D	D	D	D
Seal Surface Cracks		D	S	D	S	D	D	D	D
Improve Friction		S	S	S	S	D	D	D	D
Mixture Types		D=Dense, S=SMA, O=OGFC, U=UTBWC							

Right Mix, Right Conditions

- Selection Process must consider:
  - Traffic
  - Climate
  - Pavement condition
  - Intended pavement performance
  - Available thin asphalt concrete mixtures

Build a selection process for agency conditions.