Alabama Asphalt Pavement Association

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ADVANTAGE OF THIN LIFT HMA OVERLAYS

DECEMBER 4, 2024

68TH ANNUAL KANSAS ASPHALT PAVING CONFERENCE

Agency Funding

- ALDOT Funds Are Limited Even With Gas Tax Increase.
- ALDOT New Construction Projects Are Still Uncommon.
- If You Can Not Afford To Maintain Existing System, Why Add New To System?
- ALDOT Priority Is Maintaining Current System.
- Need To Determine Best Pavement Preservation Treatments To Maintain System.

What Does Public Want In Roads?

What Does Public Want In Roads?

- Smoothness
- Safety

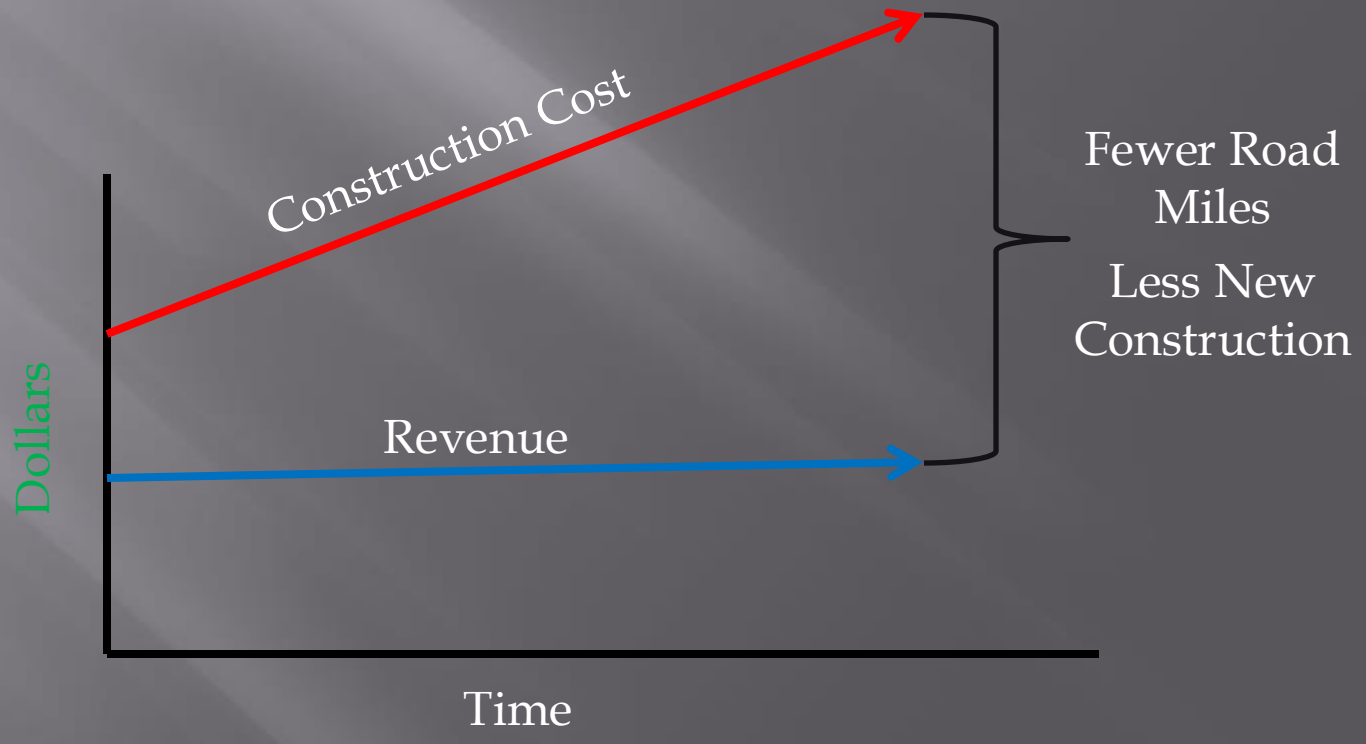
Objectives -

- **Why** Thin Lift Asphalt?
- **Where** Thin Lift Asphalt?
- **Specifications** For Thin Lift Asphalt.
- History Of Thin Lift Asphalt.
- Economics Of Thin Lift Asphalt.

Why Thin Lift Asphalt?

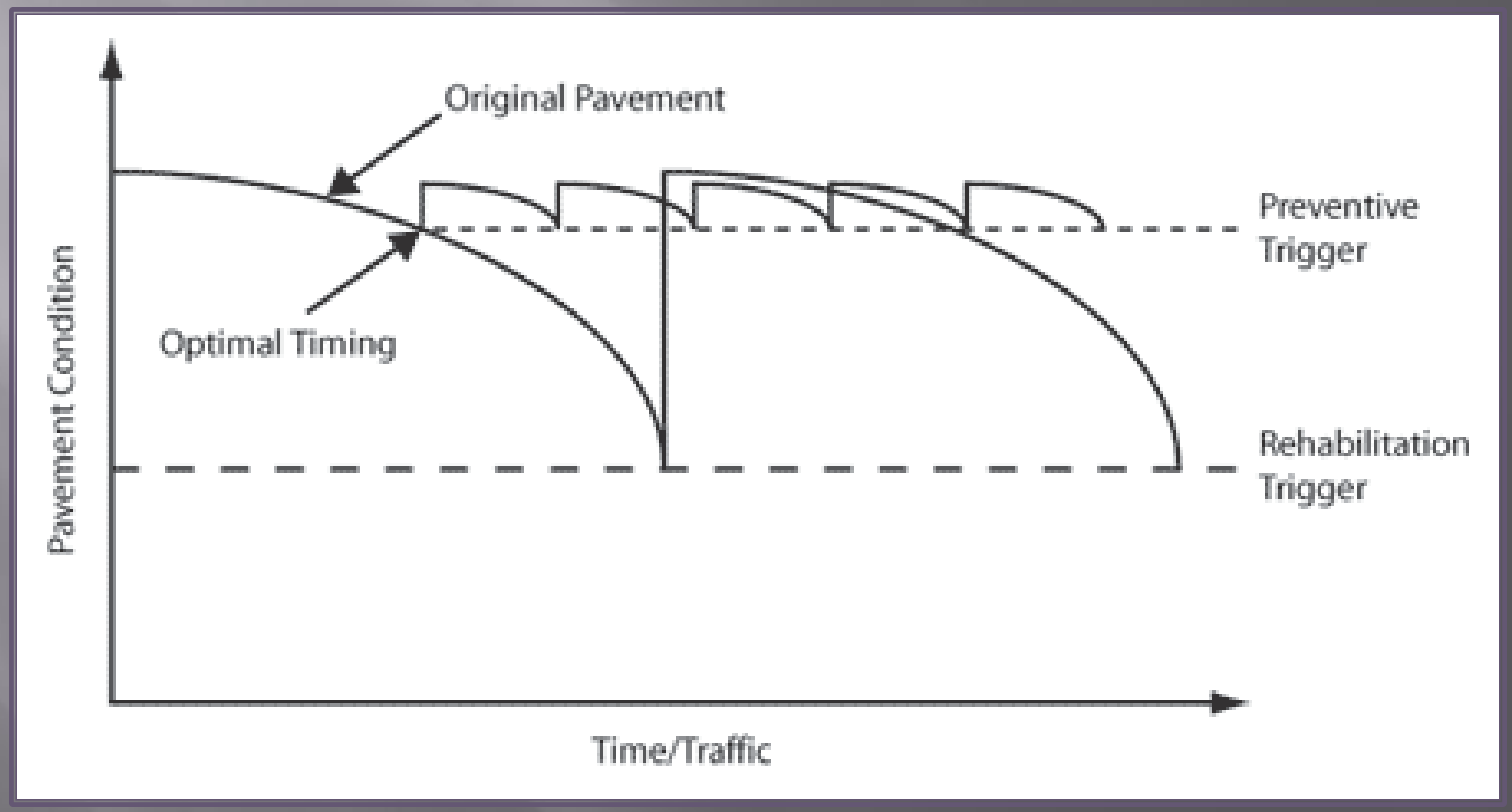
Why Thin Lift Asphalt?

- Funding Crisis
  - Escalating Construction Cost
  - Limited Revenue



Why Thin Lift Asphalt?

- Concept Of Pavement Preservation



Why Thin Lift Asphalt?

Benefits To The Traveling Public

- Improved Ride
- Improved Smoothness
- Public Perception – Freshly Paved Road – New Road
- Public Perception – No Broken Windshields
- Local / In State Contractors – Contributing To Tax Base And Employment At Local / State Level
- Increased Competition
- Future Value Of RAP
- Adding Structural Capacity To Pavement
- Building Perpetual Pavement 1" At The Time

Pavement Preservation Comparisons

	Thin Lift	Micro-Surface	Scrub Seal	Chip Seal
Corrects Surface Distress	√	√	√	√
Increase Skid Resistance	√	√	√	√
Minimizes Curb Loss	√	√	√	√
Can Be Applied In One Pass	√	√	√	√
Eliminates Loose Aggregate	√	√		
Corrects Minor Rutting	√			
Minimizes Delamination	√			
Improves Ride Quality	√			
Increases Structural Strength	√			
Improves Pavement Drainage And Pavement Cross Slope	√			

Where Thin Lift Asphalt?

Where Thin Lift Asphalt?

- Roads That Are Structurally Sound

Good Candidates?

Good Candidate?

Good Candidate?

Good Candidate?

Good Candidate?

Specifications For 3/8” Thin Lift Asphalt

Alabama DOT Specifications

3/8 Inch Maximum Aggregate Size Mix

- SuperPave Mix
- ALDOT Uses Maximum Aggregate Size Mixes

3/8 Inch Maximum Aggregate Size Mix

Sieve Size	3/8 Inch Mix, Section 424
½”	100
3/8”	95 - 100
#4	75 -100
#16	30 - 60
#200	6 - 12

3/8 Inch Maximum Aggregate Size Mix – Design Considerations

Fine Aggregate Angularity (FAA) Requirements (Section 424 Mixes)

- FAA Greater Than Or Equal To 43 For Less Than 1 Million 20 Year Design ESALs (ESAL Range A/B Mixes).
- FAA Greater Than Or Equal To 45 For Between 1 Million And 30 Million 20 Year Design ESALs (ESAL Range C/D And ESAL Range E Mixes).

Carbonate Stone (Limestone) Requirements (Section 424 Mixes)

- Varies From A Maximum of 30% To A Maximum of 50% Depending Upon BPN 9 Value of Aggregate Source.

Liquid Asphalt Binder Requirements (Section 424 Mixes)

- PG 67-22 Required For Less Than 10 Million 20 Year Design ESALs (ESAL Range A/B And ESAL Range C/D Mixes).
- PG 76-22 Required For Between 10 Million And 30 Million 20 Year Design ESALs (ESAL Range E Mixes).

Design Gyration And Minimum Design AC Requirements (Section 424 Mixes)

- Design Gyration Of 60 Gyrations.
- Minimum Design AC Content Of 5.90%.

Air Voids, VMA, Dust Proportion And TSR Requirements (Section 424 Mixes)

- Design Air Voids Of 4.0%.
- Minimum Design VMA Of 16.5% And Maximum Design VMA Of 18.0% With A 0.5% Production VMA Tolerance.
- Dust Proportion Range of 0.90 To 2.00 Based On Effective Asphalt Content.
- TSR Of Minimum Of 0.80.

RAP And RAS Requirements And Warm Mix (Section 424 Mixes)

- Maximum 20% RAP Use.
- No RAS Use.
- Warm Mix Asphalt Allowed As Contractor Option On All Section 424 Mixes.

Spread Rate And Density Requirements (Section 424 Mixes)

- Spread Rate Can Be Specified From A Minimum of 80 Pounds Per Square Yard (0.72 Inches)To A Maximum Of 110 Pounds Per Square Yard (0.99 Inches).
- Density Requirement Is To Satisfaction Of Engineer. Typically, A Roller Pattern Using Non-Destructive Density Gauges.

3/8 Inch Maximum Aggregate Size Mix (Section 424 Mix)

Sample Mix Design (Contractor)

- 30% ¼" Limestone Chips.
- 26% # 89 Granite.
- 15% Manufactured Granite Sand.
- 8% Sand.
- 20% RAP.
- 1% Baghouse Fines.
- Design Asphalt Content : 5.90%.

3/8” Asphalt Mix (Section 424 Mix)

Sieve Size	3/8 Inch Mix % Passing	Contractor JMF % Passing
½”	100	100
3/8”	95 - 100	97
#4	75 -100	78
#16	30 - 60	33
#200	6 - 12	6.7

History Of Thin Lift Asphalt

ALDOT's First 3/8" Asphalt Mix Project

- Approximately 2002.
- SR 135 – Baldwin County.
- Contractor – H.O. Weaver & Sons, Inc.
- Excellent Performance For 10 Plus Years.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SAFETY
SAFETY


INGERSOLL-RAND


SA

3/8” Mix Projects

Project Details – Thin Lift 3/8" Asphalt

- Project Letting Date – April 7, 2017.
- Project Length – 14.599 Miles In Butler County.
- Bituminous E Treatment To Address Cracking In Existing Roadway.
- Thin Lift HMA – 90 Pounds Per Square Yard of 3/8" Maximum Aggregate Size Mix.
- ALDOT Guidelines Allow Placement Rate From Minimum Of 80 Pounds Per Square Yard To Maximum Of 110 Pounds Per Square Yard.
- Project Construction – Summer 2017.

3/8 Inch Maximum Aggregate Size Mix Design

- 24% Coarse Sand
- 21% Granite Screenings
- 20% RAP
- 13% Crushed Gravel
- 11% Shot Gravel
- 10% #8910 Limestone
- 1% Baghouse Fines
- Design Asphalt Content : 5.90% (PG 67-22)
- 60 Design Gyrations

Thin Lift Asphalt Edge Line

Thin Lift Asphalt Longitudinal Joint

Thin Lift Asphalt Texture

Ride Quality / Smoothness

- ALDOT Uses Inertial Profiler To Measure Smoothness.
- ALDOT Measures Smoothness By Mean Roughness Index (MRI).
- Lower MRI = Smoother Ride

Ride Quality / Smoothness – Thin Lift Asphalt

- Average Pre – Construction MRI (2017) = 88.9 Inches Per Mile.
- Average Post – Construction MRI (2017) = 36.8 Inches Per Mile.
- Significant Average MRI Improvement Of 52.1 Inches Per Mile.
- Average Post – Construction MRI (2022) = 50 Inches Per Mile.
- Smooth Quiet Ride.

Project Cost – Thin Lift Asphalt

- Bituminous Treatment E – 225,000 Square Yards At $1.25 Per Square Yard.
- Thin Lift Asphalt – 10,200 Tons At $80.20 Per Ton. Approximately $3.61 Per Square Yard.
- Total Cost - $1,099,290.
- Average Cost Per Mile = $75,299 Per Mile.
- Average Cost Per Lane Mile = $37,649 Per Lane Mile.

Thin Lift Asphalt (One Year Old)

Thin Lift Asphalt (7 Years Old)

3/8” Mix Projects

Project Details – 3/8” Asphalt Mix

- Project Letting Date – January 31, 2020.
- Project Length And Description – 3.587 Miles On US 231 From Ross Clark Circle In Dothan To The Dale County Line.
- Prime Contractor – Midsouth Paving, Inc.
- 0.75” Micro Milling And Overlay Of Existing Roadway.
- 3/8” Mix HMA – 90 Pounds Per Square Yard (0.81 Inches) of Section 424 ESAL Range E Mix.
- ALDOT Guidelines Allow Placement Rate From Minimum Of 80 Pounds Per Square Yard (0.72 Inches) To Maximum Of 110 Pounds Per Square Yard (1.00 Inches).
- Project Construction – Summer 2020.

3/8” Asphalt Mix

Project Mix Design

- 20% #8910 Limestone.
- 20% #8910 Granite Screenings.
- 20% Sand.
- 20% RAP.
- 12% Shot Gravel.
- 8% #89 Limestone.
- Design Asphalt Content : 5.90%.

3/8” Asphalt Mix

Sieve Size	3/8 Inch Mix % Passing	Project JMF % Passing
½”	100	100
3/8”	95 - 100	99
#4	75 -100	86
#16	30 - 60	49
#200	6 - 12	7.1

Ride Quality / Smoothness

- ALDOT Uses Inertial Profiler To Measure Smoothness.
- ALDOT Measures Smoothness By Mean Roughness Index (MRI).
- Lower MRI = Smoother Ride

Ride Quality / Smoothness – 3/8" Asphalt

- Average Pre – Construction MRI (2019) = 83.4 Inches Per Mile.
- Construction Build Up – 0.75" Micro Milling And 90 Pounds Per Square Yard HMA(Approximately 0.81")
- Average Post – Construction MRI (2021) = 55.3 Inches Per Mile.
- Significant Average MRI Improvement Of 28 Inches Per Mile.
- Average Post – Construction MRI (2023) = 58 Inches Per Mile
- Smooth Quiet Ride.

Project Cost – 3/8”Asphalt Mix

- 3/8” Asphalt – 7,035 Tons At $102.85 Per Ton. Approximately $4.63 Per Square Yard.
- Total Cost - $723,549.75.
- Average Cost Per Mile = $201,714.45 Per Mile.
- Average Cost Per Lane Mile = $33,619.075 Per Lane Mile.

3/8” Mix Projects

City Of Opelika Road

Performance To Date

- No Structural Failures Reported.
- No Major Performance Issues Reported.
- No Friction Number Issues Reported.

Economics Of Thin Lift Asphalt

ECONOMICS OF PREVENTIVE MAINTENANCE TREATMENTS

Pavement Preservation Comparisons

	Thin Lift	Micro-Surface	Scrub Seal	Chip Seal
Corrects Surface Distress	√	√	√	√
Increase Skid Resistance	√	√	√	√
Minimizes Curb Loss	√	√	√	√
Can Be Applied In One Pass	√	√	√	√
Eliminates Loose Aggregate	√	√		
Corrects Minor Rutting	√			
Minimizes Delamination	√			
Improves Ride Quality	√			
Increases Structural Strength	√			
Improves Pavement Drainage And Pavement Cross Slope	√			

Other Considerations

- Economic Benefit Of In State Contractors Versus Out Of State Contractors.
- Local / In State Contractors – Contribute To Tax Base And Employment At Local / State Level.
- Increased Competition.
- Future Value Of RAP.

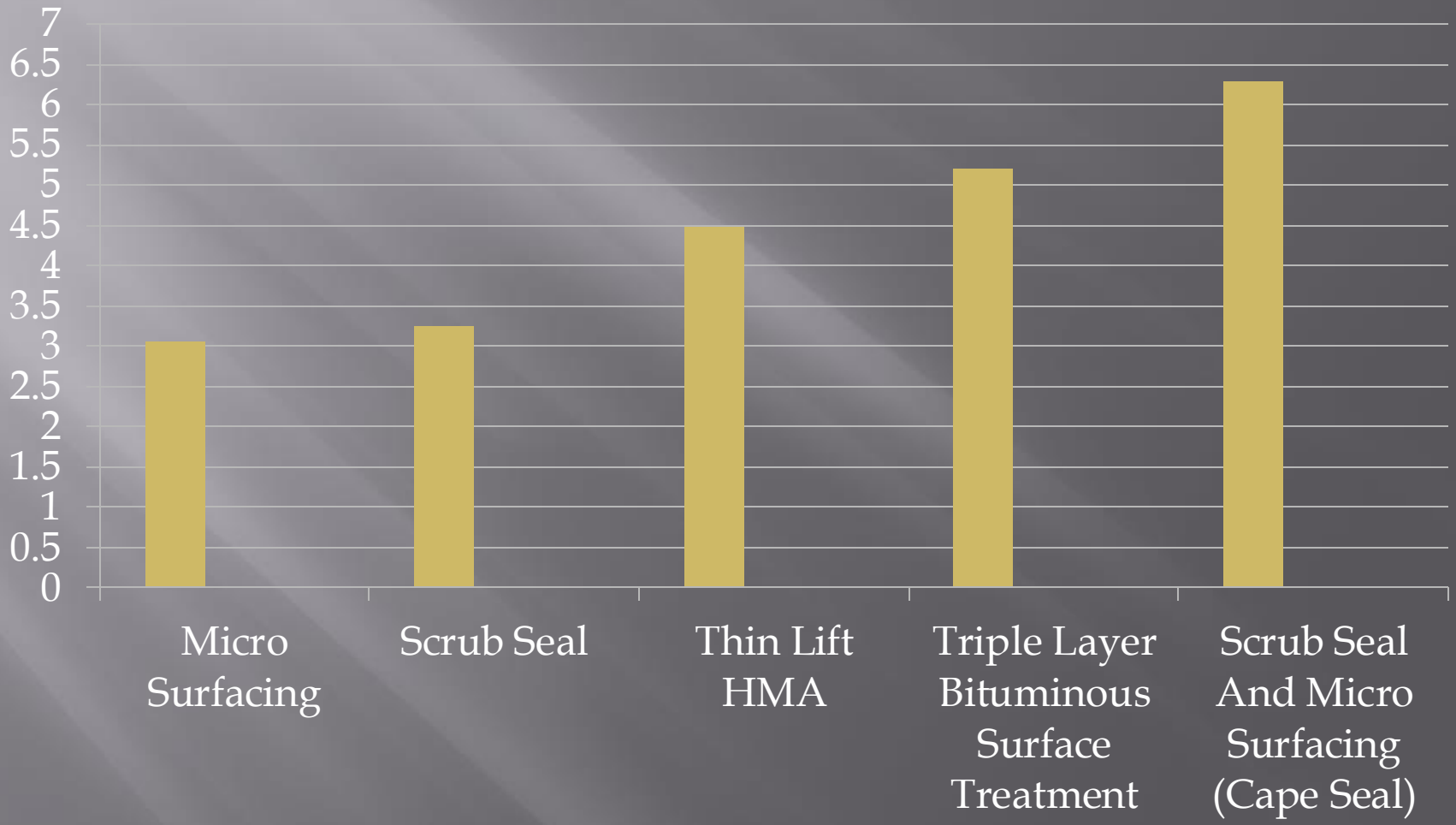
Cost Data Background

- Cost Data Obtained From ALDOT Bid History And Averaged For Discussion.
- Thin Lift Asphalt – 2023 Statewide Average For 3/8” Mix.
- Micro Surfacing – 2023 Average From 18 Projects.
- Triple Layer Bituminous Surface Treatment – 2022 Average From 2 Projects.
- Scrub Seal – 2023 Average From 28 Projects.

Cost Comparison (Initial Cost)

- Micro Surfacing = $3.05 Per Square Yard
- Scrub Seal = $3.25 Per Square Yard
- Thin Lift HMA = $4.48 Per Square Yard
- Triple Layer Bituminous Treatment = $5.20 Per Square Yard
- Scrub Seal And Micro Surfacing (Cape Seal) = $6.30 Per Square Yard

Cost Comparison (Initial Cost)



Performance Life Definition

- Length Of Time Pavement Treatment Lasts Before Exhibiting Distresses Generally Equivalent To Condition of Original Pavement.
- Treated Distress / Untreated Distress = 50% - 100%.
- Pavement Treatment May Remain In Service Well Past End Of Performance Life.

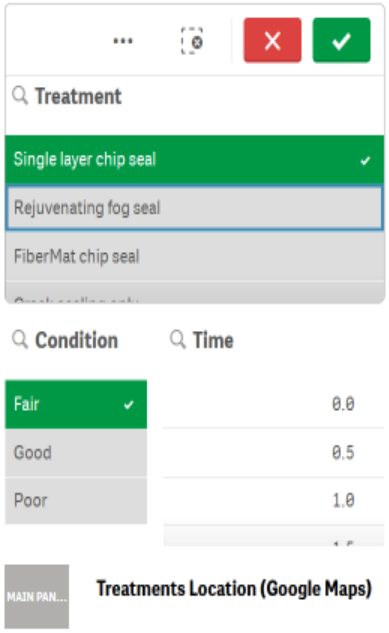
Performance Life Background

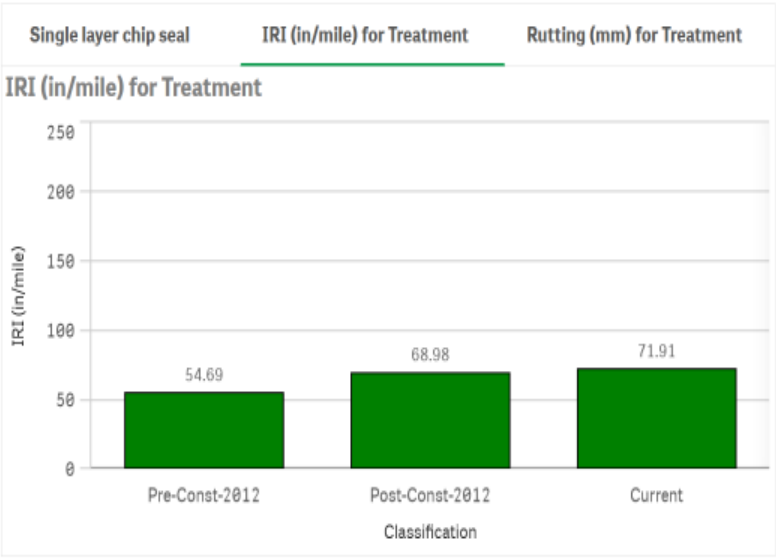
- Estimates Of Performance Life Taken From Average Of Numerous Sources Including Data From ALDOT, CDOT, MDOT, MNDOT, ODOT, FHWA, NCPP and NCAT.
- Performance Life Dependent Upon Many Things Including Pre-Existing Condition Of Road, Traffic Levels, Etc.
- Current Studies By NCAT To Further Detail This Issue.

NCAT Preservation Research – NCAT Test Track, US 280, Lee County Road 159

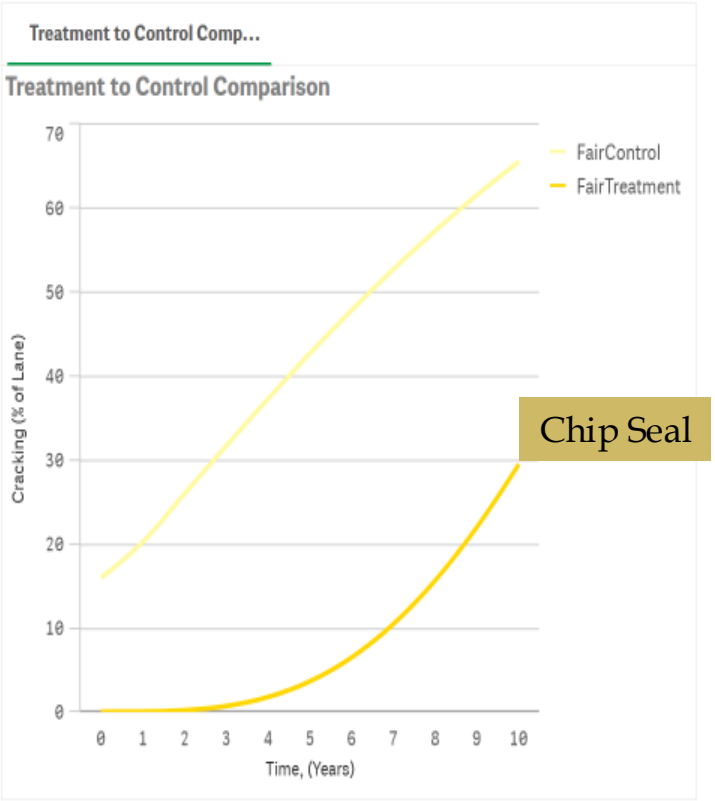
NCAT Preservation/Maintenance

www.NCAT.us





Time to Poor (Control)	Crack Reduction (Average)	Time to Poor (Treatment)
0.9	34.4	8.5



Chip Seal

NCAT Preservation/Maintenance

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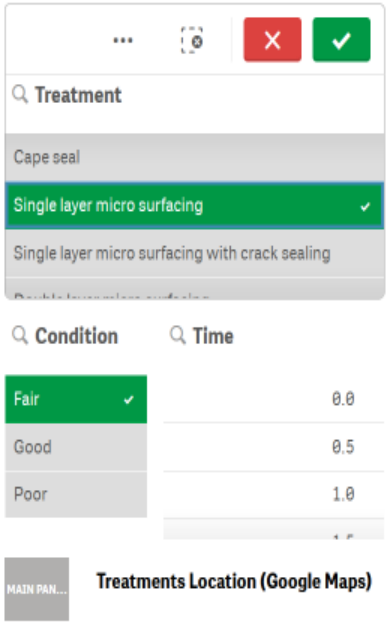
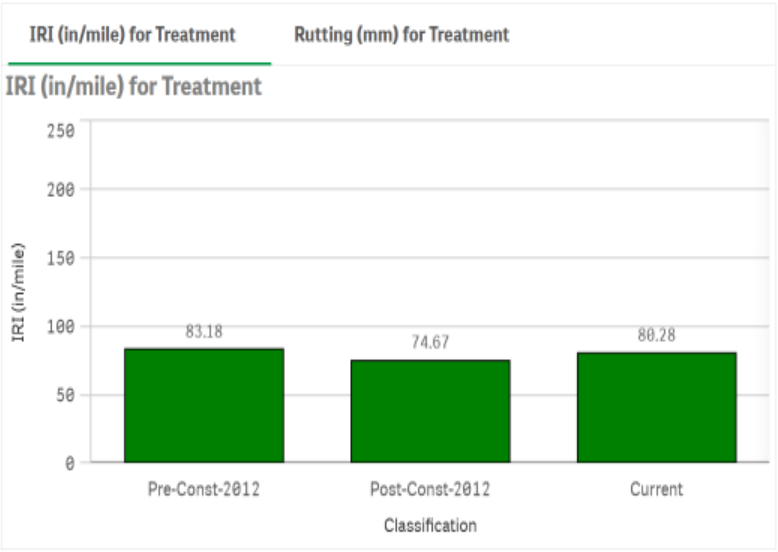
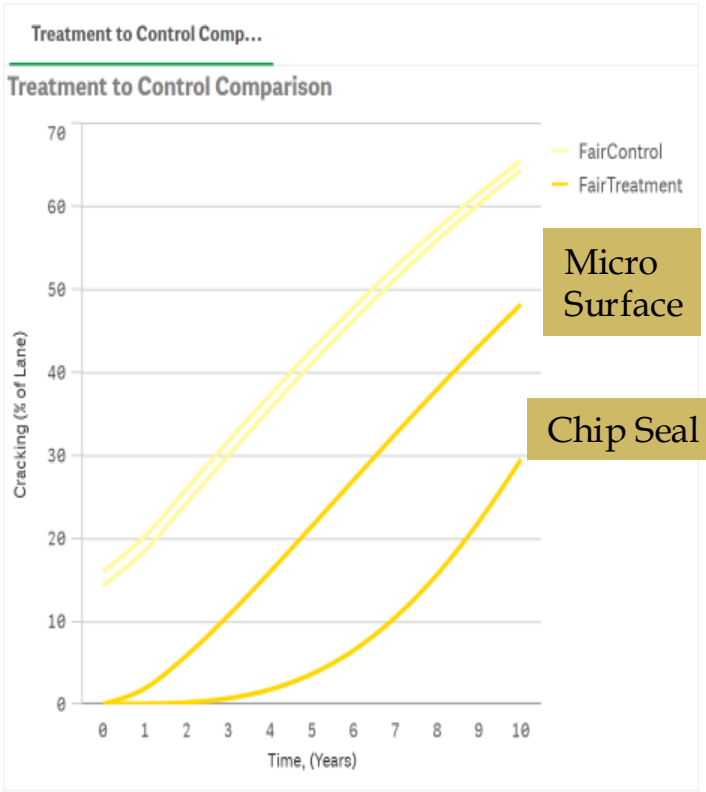




Time to Poor (Control)	Crack Reduction (Average)	Time to Poor (Treatment)
1.0	26.3	6.5



Micro Surface

Chip Seal

NCAT Preservation/Maintenance

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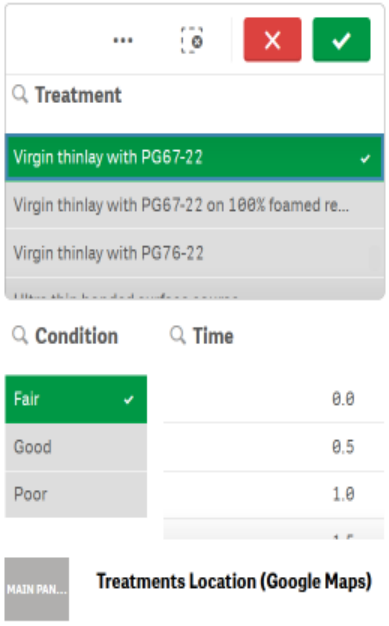
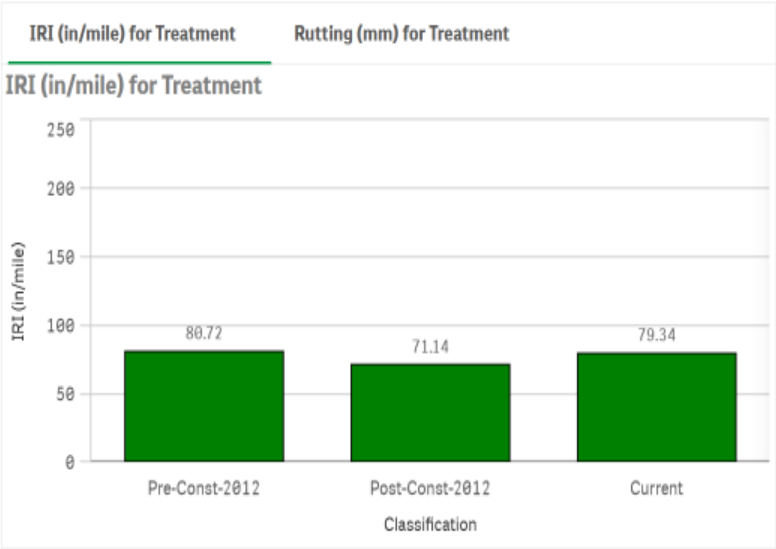
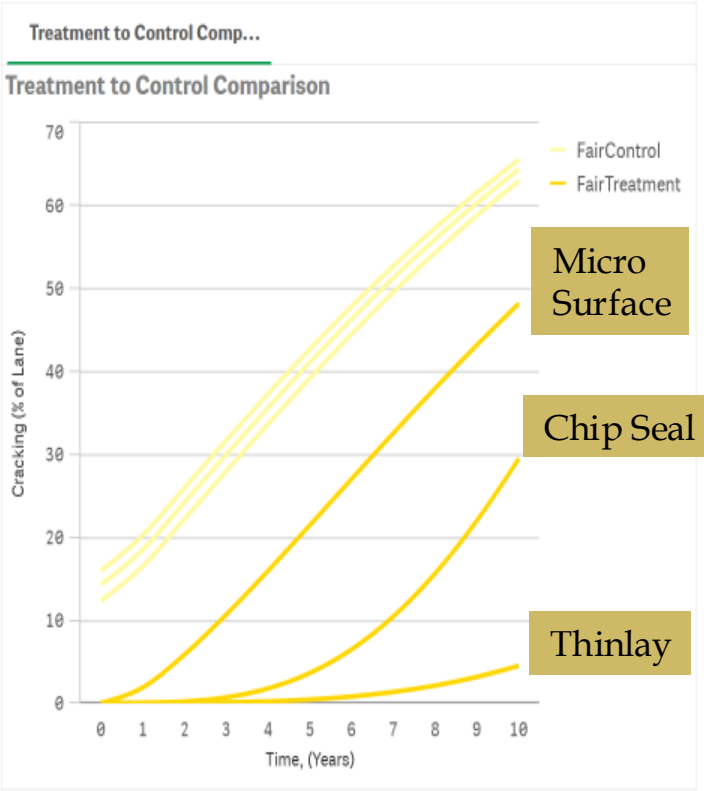




Time to Poor (Control)	Crack Reduction (Average)	Time to Poor (Treatment)
1.1	30.3	6.5



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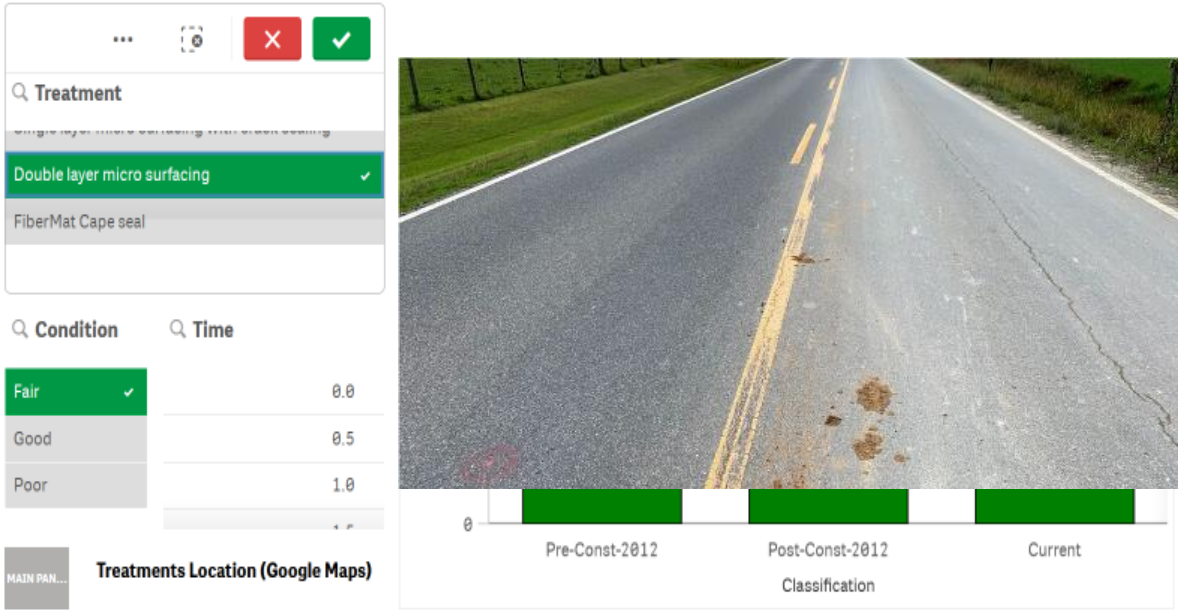
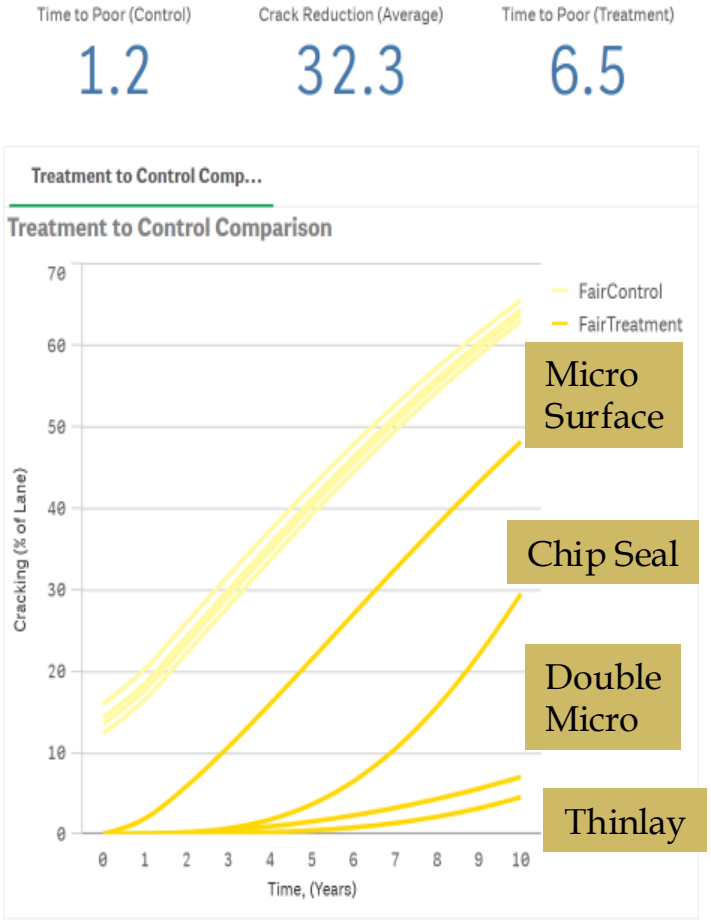
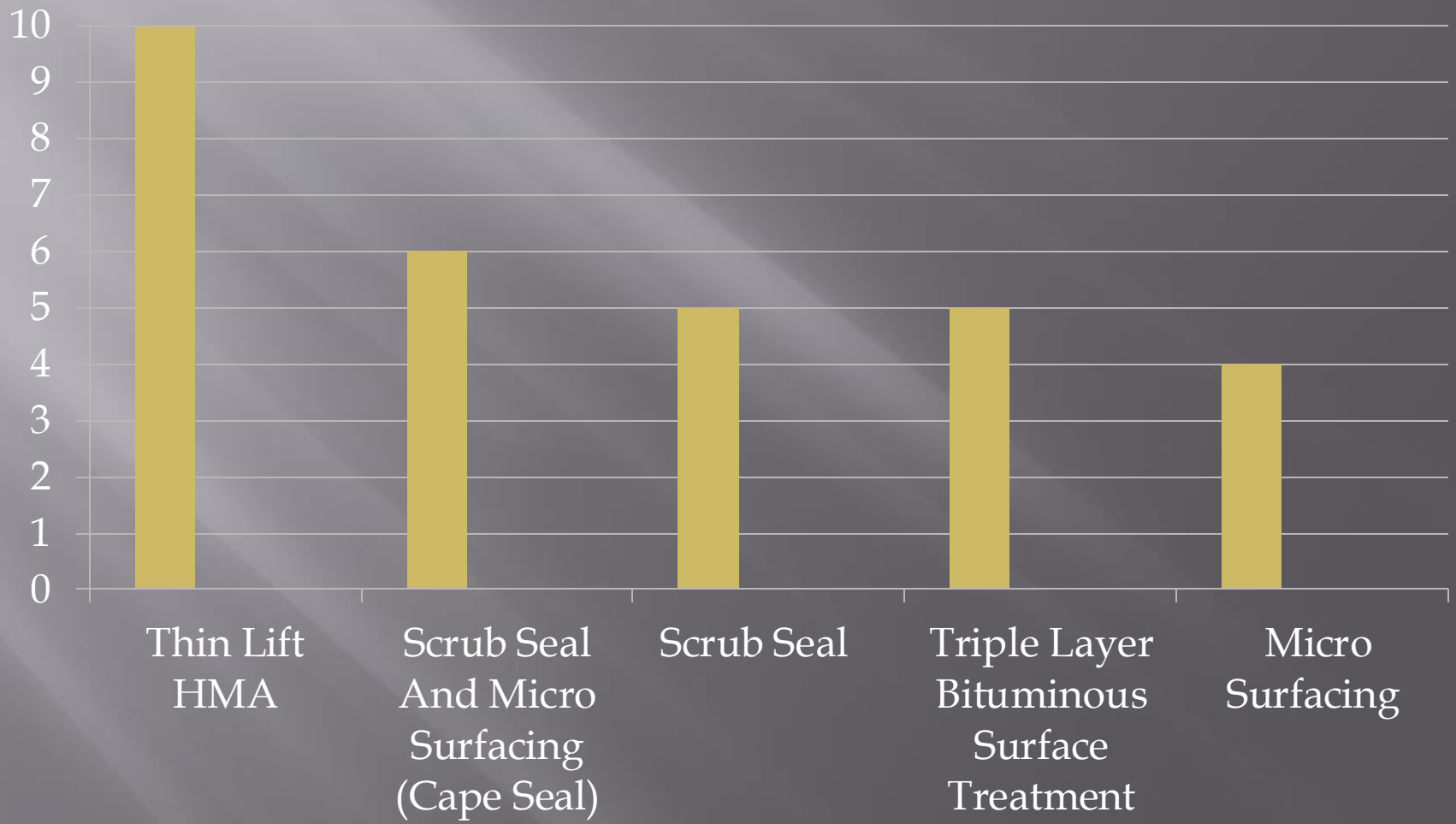




Performance Life Estimates

- Thin Lift HMA = 10 Years
- Scrub Seal And Micro Surfacing (Cape Seal) = 6 Years
- Scrub Seal = 5 Years
- Triple Layer Bituminous Surface Treatment = 5 Years
- Micro Surfacing = 4 Years

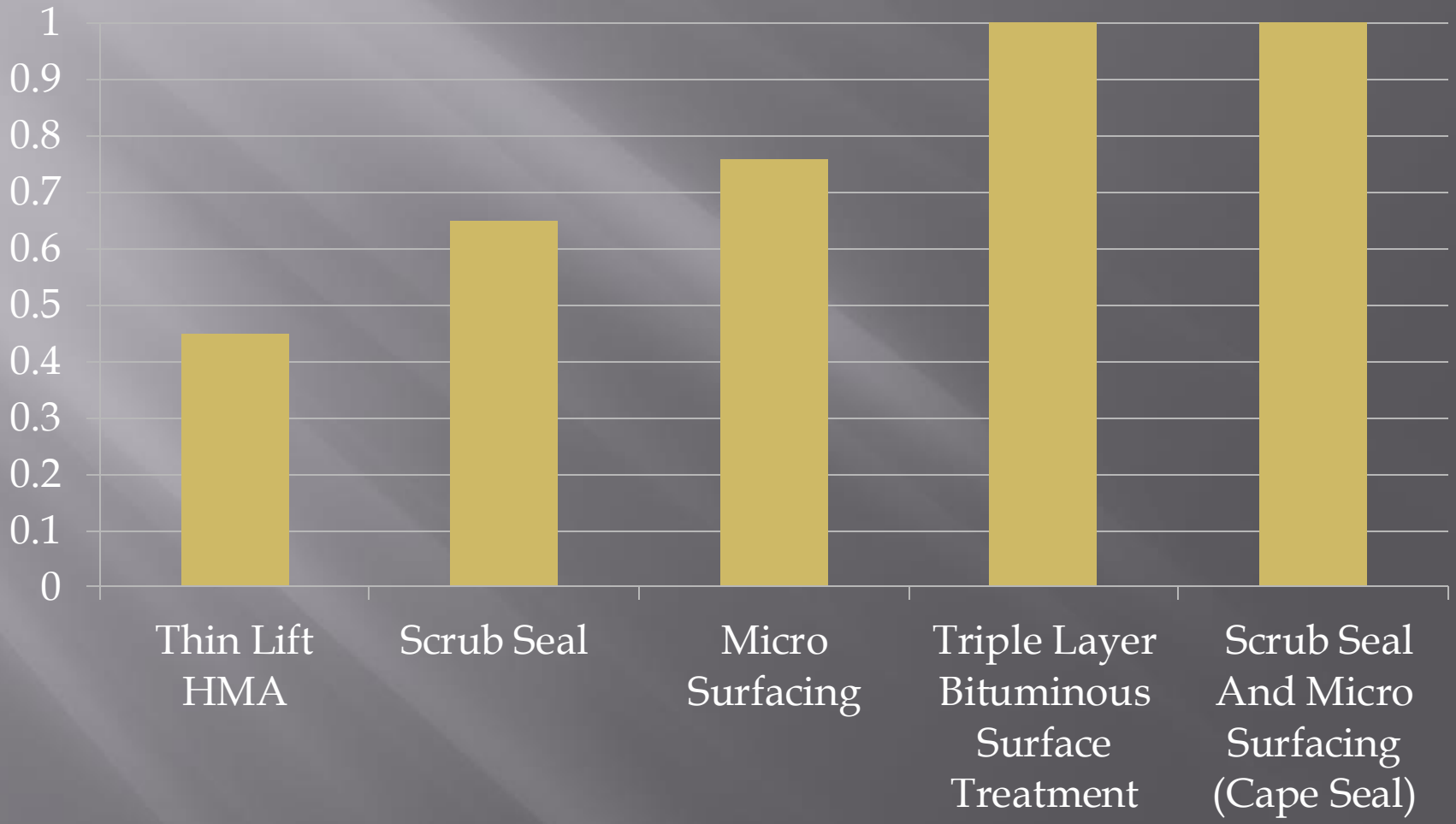
Performance Life Estimates



Life Cycle Cost Comparison (Annualized Cost) (No Discount Rate)

- Thin Lift HMA = $0.45 Per Square Yard
- Scrub Seal = $0.65 Per Square Yard
- Micro Surfacing = $0.76 Per Square Yard
- Triple Layer Bituminous Surface Treatment = $1.04 Per Square Yard
- Scrub Seal And Micro Surfacing (Cape Seal) =$1.05 Per Square Yard

Life Cycle Cost Comparison (Annualized Cost)



Thank You

- ALDOT (Scott George, John Jennings And Frank Bell).

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