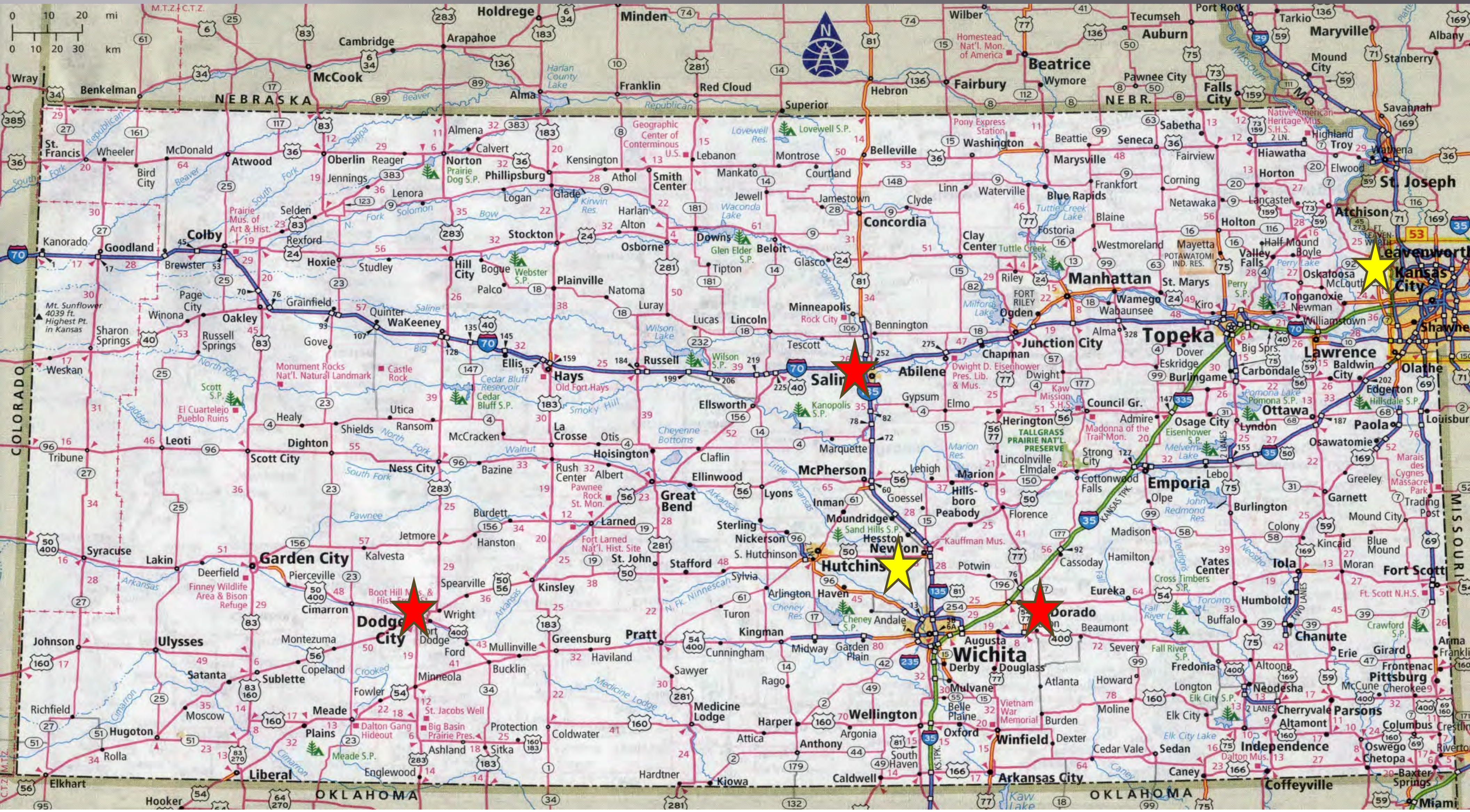
PAVEMENT PRESERVATION SCRUB SEALS/SCRUB CAPE SEALS

Ergon Asphalt & Emulsions
B.J. Cottman, P.E. 918-404-1989

References:

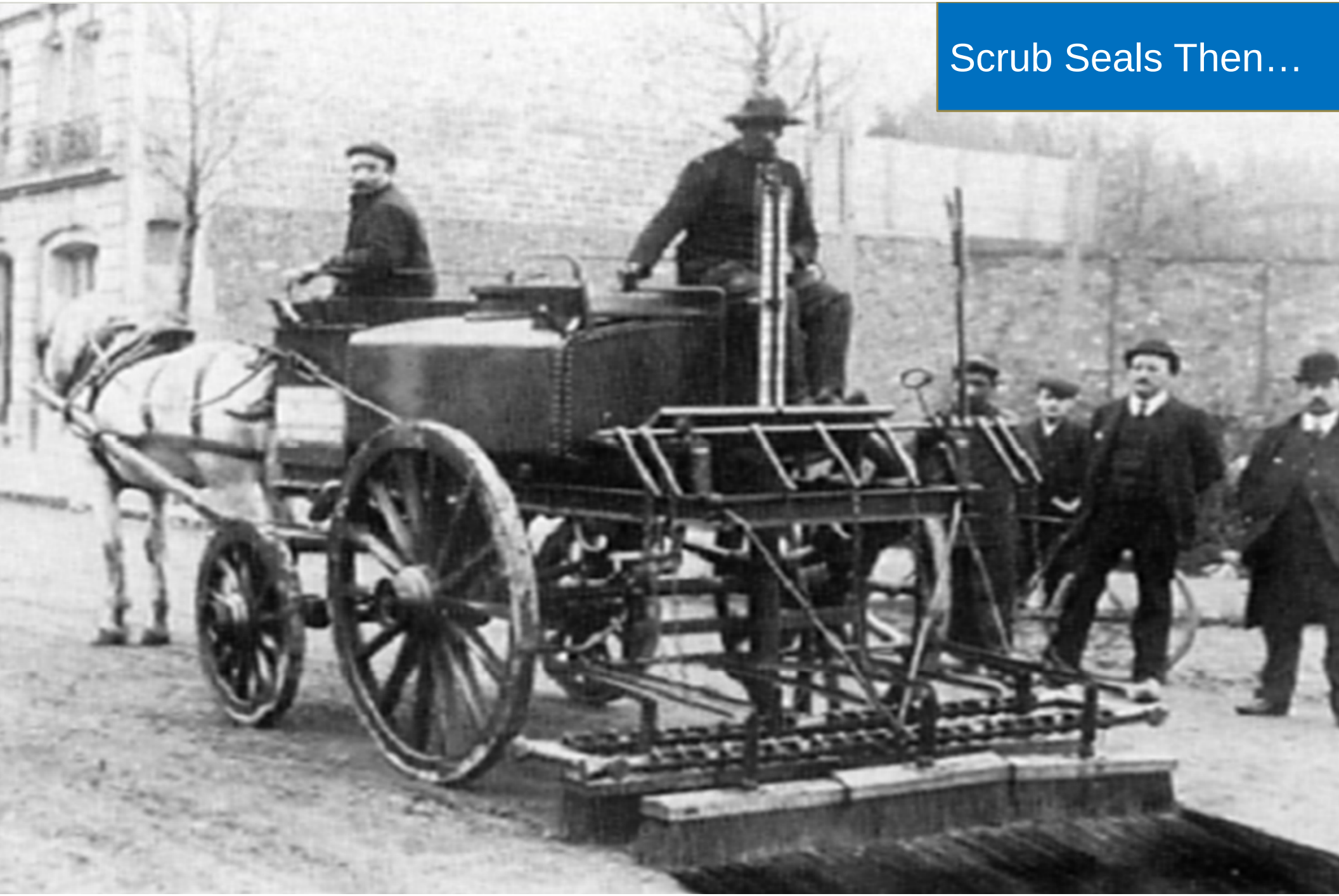
- roadresource.org
- National Center for Asphalt Technology Pavement Preservation Study TPF-5(375)
- Kansas Department of Transportation
- Oklahoma Department of Transportation

Ergon A & E Kansas Facilities



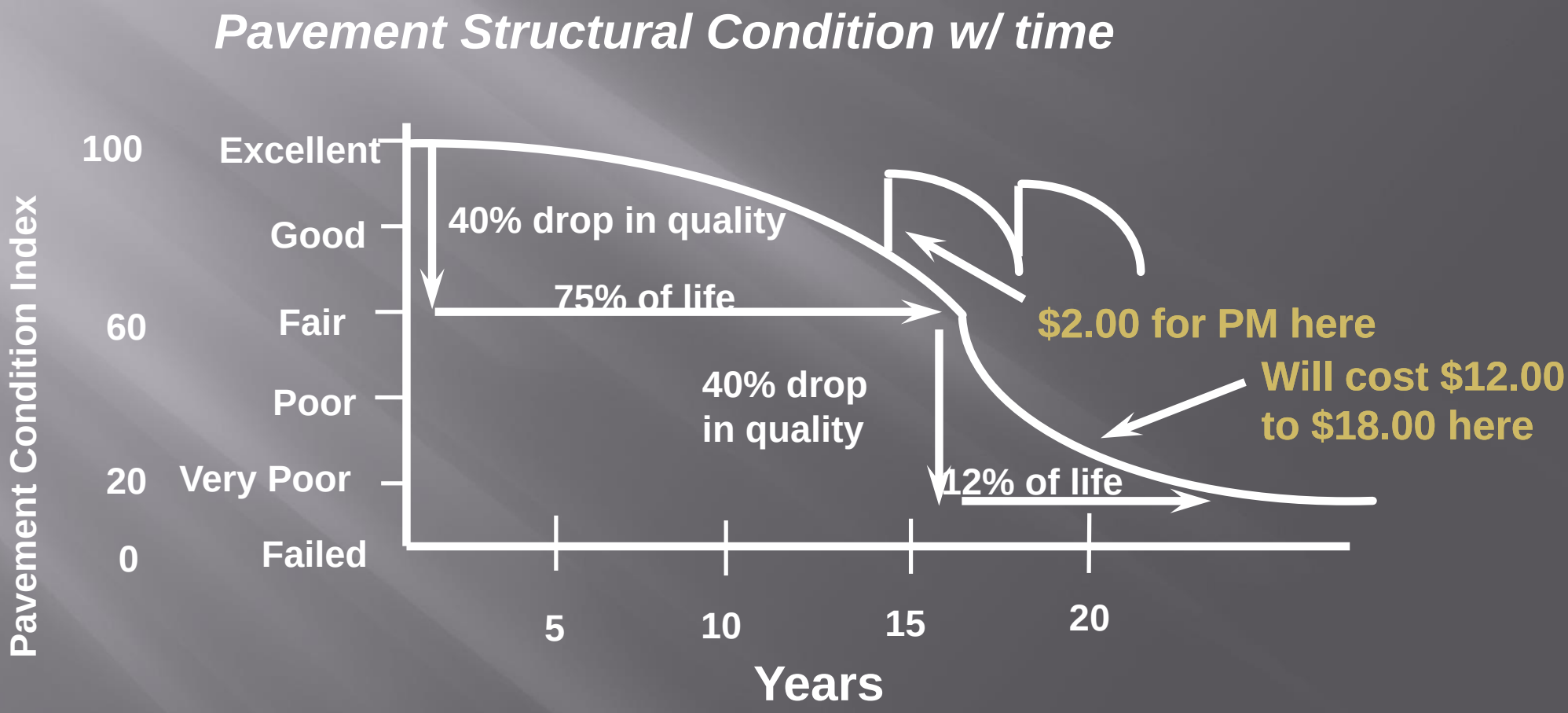
Why Scrub Seals?

Scrub Seals Then…



Scrub Seals Now…

Importance of Timing of Preservation



Typical - Pavement Management Section

Costs per ODOT Average Price History for 2023 & Pavement Preservation & Recycling Alliance 2021

Treatment/Alternative	2023 Approximate Cost		Estimated Service Life (Years)	Annualized Cost
	$ Lane Mile	$/SY		
Fog Seal	$ 4,787.00	$0.68	1 to 3	$0.34
Chip Seal	$ 14,502.00	$2.06	6	$0.34
Scrub Seal	$ 16,544.00	$2.35	6 to 7	$0.39
Micro	$ 19,501.00	$2.77	6	$0.46
Double Chip Seal	$ 26,400.00	$3.75	7	$0.54
1" 9.5mm PG64-22 Overlay	$ 47,097.60	$6.69	10	$0.67
Bonded Wearing Course	$ 48,224.00	$6.85	10	$0.69
HIR w/Chip Seal	$ 62,585.00	$8.89	10	$0.89
Scrub Seal w/1 1/2" HMA PG64-22	$ 91,450.00	$12.58	10	$1.26
4" CIR w/Chip Seal	$ 84,057.00	$11.94	10	$1.19
HIR w/UTBWC	$ 95,180.00	$13.52	10	$1.44
2" S4 PG 64-22 PM Mill & Fill	$ 119,609.00	$16.99	10	$1.69
2" Mill & Fill w/2" SMA PG70-28	$ 145,939.00	$20.73	13	$1.60
4" CIR w/3" HMA Overlay	$ 172,198.00	$24.46	15	$1.63
FDR w/4" HMA	$ 200,921.60	$28.54	25	$1.14

Scrub Seal

DESCRIPTION

- Same as chip seal except for:
  - A broom sled is connected to the distributor with a series of brooms which “scrub” the emulsion into cracks in the existing surface; hence a mass crack fill
  - Two different emulsions are utilized by KDOT, a polymer-modified or polymer modified rejuvenating emulsion
- PCI Index = 55-70

ISSUES ADDRESSED

- Fatigue Cracking
- Longitudinal Cracking
- Transverse Cracking
- Loss of Friction/Surface Restoration
- Raveling
- Severe Oxidation

Scrub Seal Attributes

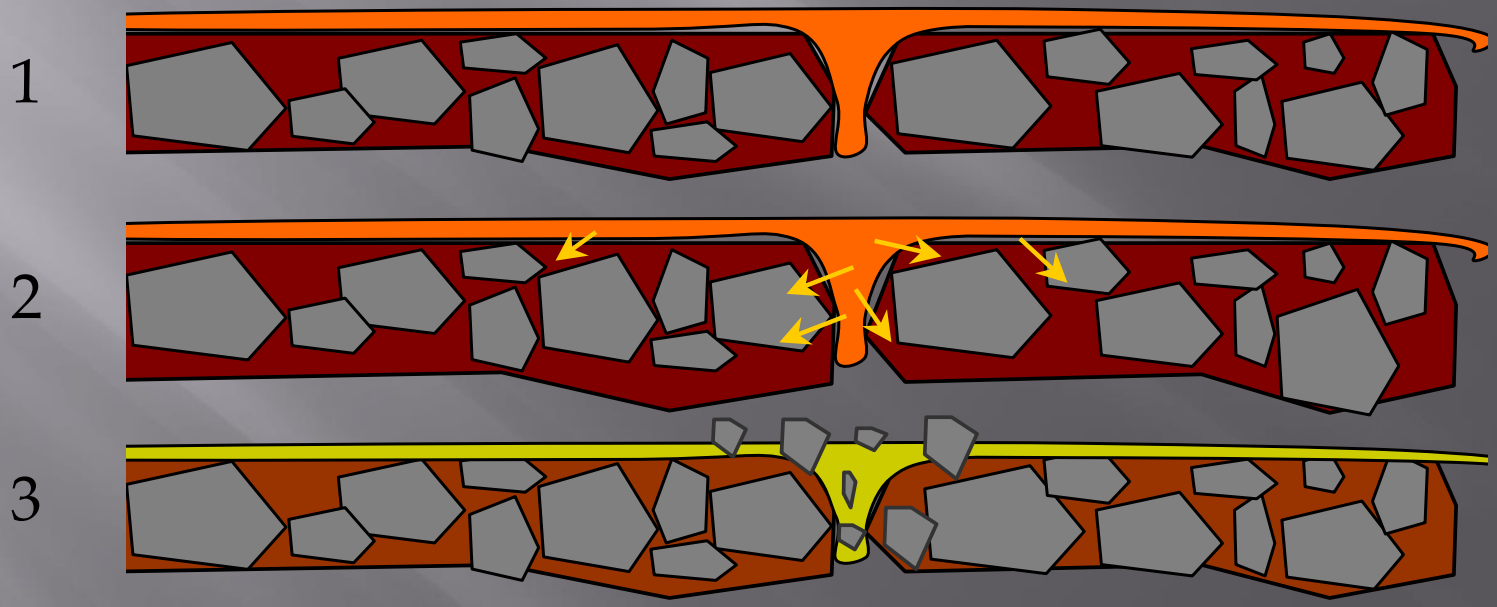
- Reduce life cycle cost by 48%
- Reduce energy use by over 60%
- Reduces greenhouse gases by over 51%
- Reduces raw materials by 49%
- Return to slow moving traffic typically within 1 hour
- Extends the life of pavement up to 6 to 7 years

Scrub Seal Road Candidates

- Pavements must have adequate structural capacity. If structural distress is evident, these areas must be fixed .
- No active rutting or shoving.
- Cracks greater than ¼" should be sealed prior to treatment.
- Scrub seals act as a mass crack filler. They are used when a chip seal is not feasible due to the quantity of cracks.

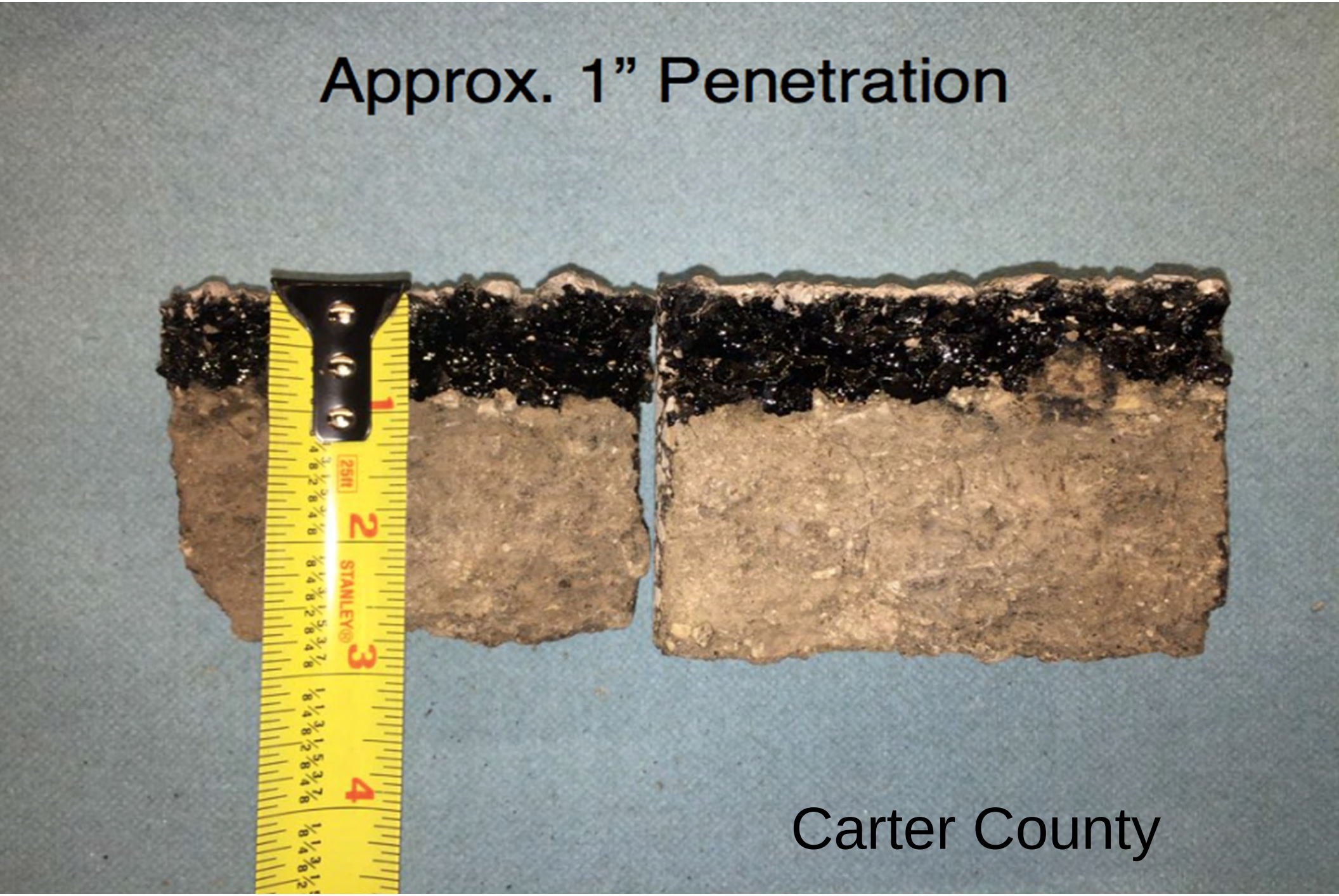
How Scrub Seals Work

1. **The emulsions fills cracks and voids**
2. **CMS-1PC rejuvenates existing asphalt**
3. **Forms a reflective crack resistant membrane between existing pavements and future overlays or seals. This membrane is called a SAMI (stress absorbing membrane interlayer).**



Cores - Typical 1” Penetration

Cores - Typical 1” Penetration


Approx. 1” Penetration
STANLEY®
Carter County


Without Broom
With Broom
Pittsburgh County

NCAT Scrub Seal Lee County Road 159

Treatment

- Scrub seal ✓
- Rejuvenating fog seal
- FiberMat chip seal

Condition

- Fair ✓
- Good ✓
- Poor ✓

Time

- 0.0 ✓
- 0.5 ✓
- 1.0 ✓

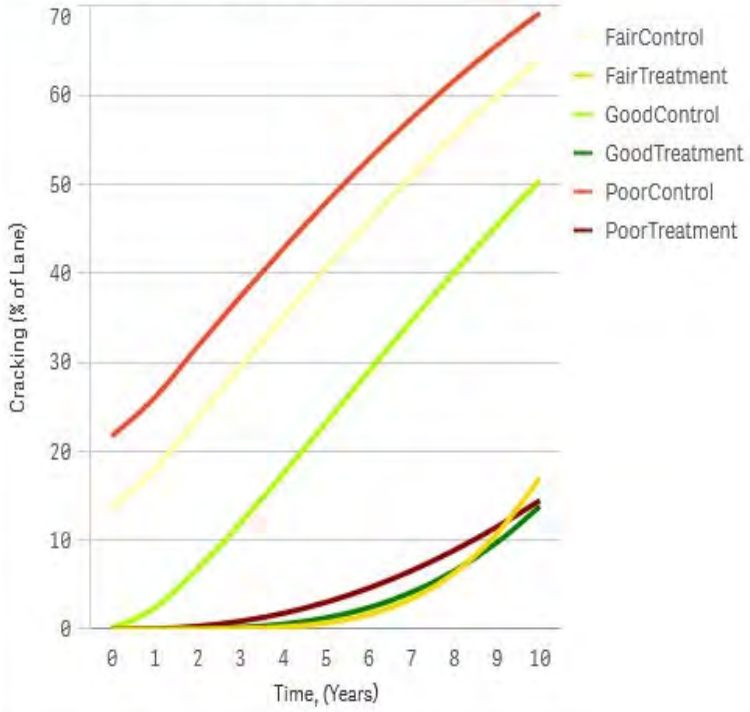
Treatments Location (Google Maps)

Scrub seal | IRI (in/mile) for Treatment | Rutting (mm) for Treatment

Time to Poor (Control)	Crack Reduction (Average)	Time to Poor (Treatment)
1.9	33.8	10+

Treatment to Control Com...

Treatment to Control Comparison

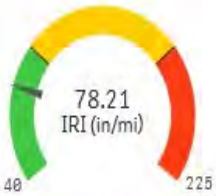


Overall Section Condition FAIR

Cracking % of Area

Rutting (mm)

IRI (in/mile)



NCAT Scrub Cape Seal Lee County Road 159

Treatment

- Scrub Cape seal ✓
- Rejuvenating fog seal
- FiberMat chip seal

Condition

- Fair ✓
- Good ✓
- Poor ✓

Time

- 0.0 ✓
- 0.5 ✓
- 1.0 ✓

MAIN PA...

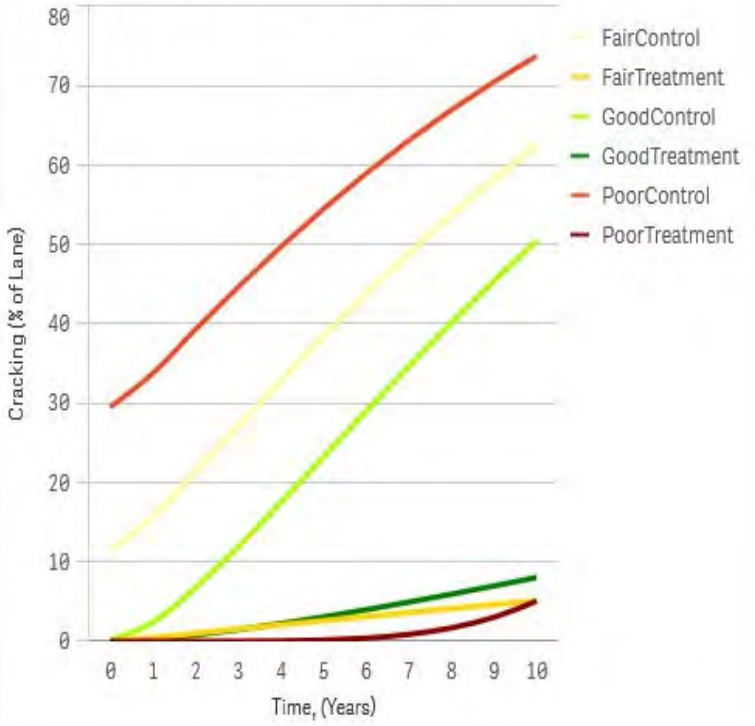
Treatments Location (Google Maps)

Scrub Cape seal | IRI (in/mile) for Treatment | Rutting (mm) for Treatment

Time to Poor (Control)	Crack Reduction (Average)	Time to Poor (Treatment)
2.0	36.9	10+

Treatment to Control Com...

Treatment to Control Comparison

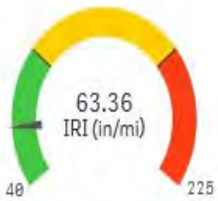


Overall Section Condition FAIR

Cracking % of Area

Rutting (mm)

IRI (in/mile)



Crack Mapping SH 32 ODOT District 7

State Highway 32 SE of Ryan Scrub Seal Results @ 24 Months					
State Highway 32 2020 AADT = 310 to 190					
Field Survey	**Date**	**Crack Width**	**Crack Depth**	**Total Cracks (feet)**	**% Cracks**
Original	6/10/2021	5/16″	5/16″	840	100%
6 Month	12/22/2021	0″	0″	23	3%
12 Month	7/8/2022	3/16″	3/16″	124	14.8%
18 Month	1/5/2023	1/8″	1/8″	127	15.1%
24 Month	7/14/2023	1/8″	1/8″	151	18.0%

Crack Mapping SH 32 ODOT District 7

BEFORE SCRUB SEAL

SCRUB SEAL @ 24 MONTHS

Crack Mapping SH 54 ODOT District 5

State Highway 54 @ Weatherford Scrub Seal Results @ 24 Months				
State Highway 54 2020 AADT = 4300				
Field Survey	**Date**	**Crack Width**	**Crack Depth**	**% Cracks**
Original	7/1/2021	9/16″	½″	100%
6 Month	2/1/2022	0″	0″	0%
12 Month	7/20/2022	0″	0″	0%
18 Month	1/13/2023	0″	0″	0%
24 Month	7/13/2023	0″	0″	0%

Crack Mapping SH 54 ODOT District 5

BEFORE SCRUB SEAL

SCRUB SEAL @ 18 MONTHS

Crack Mapping SH 54 ODOT District 5

Crack Mapping US 77 KDOT District 5

State Highway 77 South of Augusta Scrub Seal Results @ 24 Months

State Highway 77 2020 AADT = 3070 to 4690

Field Survey	Date	Crack Width	Crack Depth	Total Cracks (feet)	% Cracks
Original	8/25/2021	3/16″	3/32″	552	100%
6 Month	3/15/2022	0″	0″	38	6.9%
12 Month	9/9/2022	0″	0″	3	0.5%
18 Month	3/10/2023	0″	0″	0	0.0%
24 Month	9/14/2023	0″	0″	0	0.0%

Crack Mapping US 77 KDOT District 5

BEFORE SCRUB SEAL

SCRUB SEAL @ 24 MONTHS

Core of Crack Mapping US 77 KDOT District 5 @ 26 Months

¾" TOTAL PENETRATION

¾" TOTAL PENETRATION

Scrub Seal Site Selection

- Does not address structural distress
- Does not correct rutting/shoving
- Does not correct drainage deficiencies
- Does address skid resistance/correct loss of friction
- Scrub Seal acts as a mass crack filler

Scrub Seal Candidate- Block Cracking

Scrub Seal Site Selection-Mass Cracking

Scrub Seal Process

Scrub Seal Process Goldsby

Scrub Seal Process KDOT District 5

Scrub Seal Process Custer County

Scrub Seal Combinations

- Stand Alone Scrub Seal
- Scrub Seal + Fog Seal
- Scrub Seal + Micro/Slurry (Scrub Cape Seal)
- Scrub Seal + Hot Mix Overlay also known as a SAMI
  - (Stress Absorbing Membrane Interlayer)
- Scrub Seal + Chip Seal

Scrub Seal Stand Alone

ODOT DISTRICT 7 HIGHWAY 32
BEFORE

ODOT DISTRICT 7 HIGHWAY 32
AFTER

Scrub Seal & Fog Seal Application

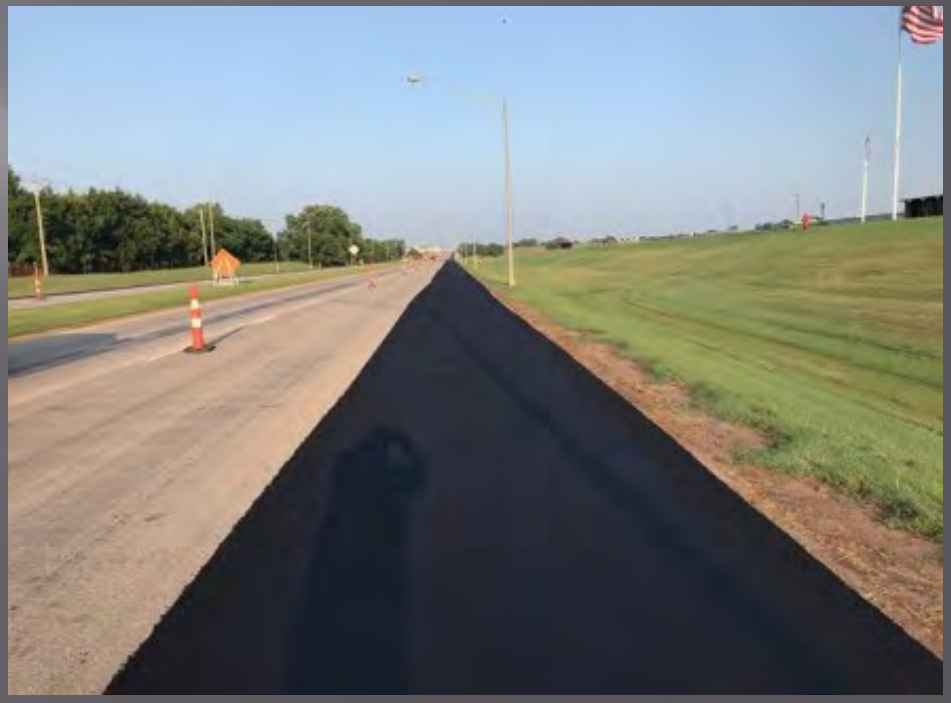
WASHITA COUNTY SCRUB SEAL

WITH FOG SEAL

Scrub Cape Seal (Scrub + MicroSurfacing) ODOT District 4

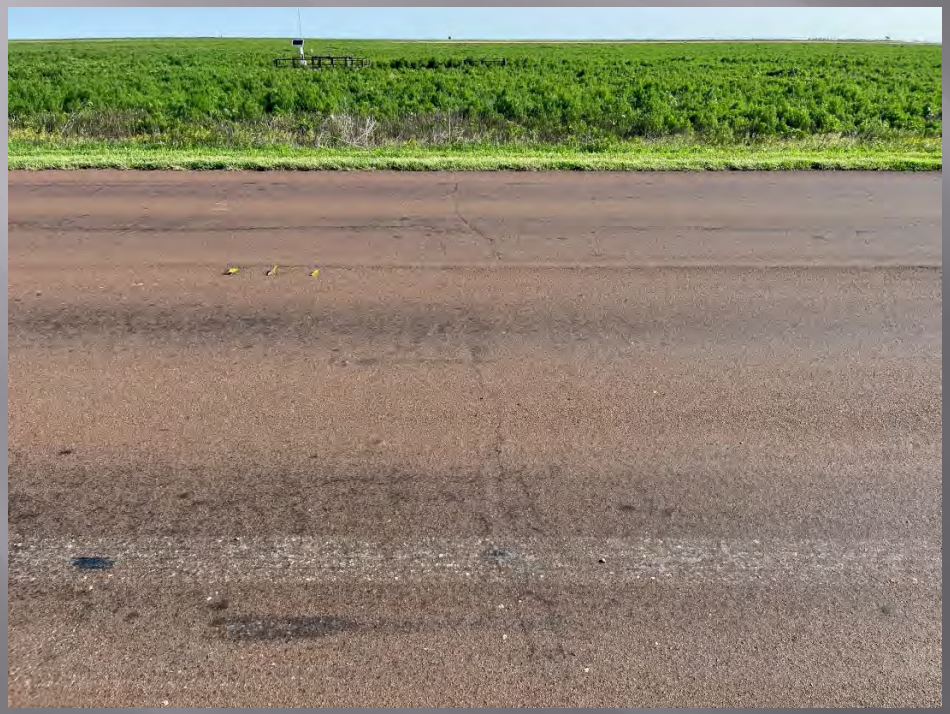
NOBLE COUNTY SCRUB 2018

NOBLE COUNTY MICRO 2018

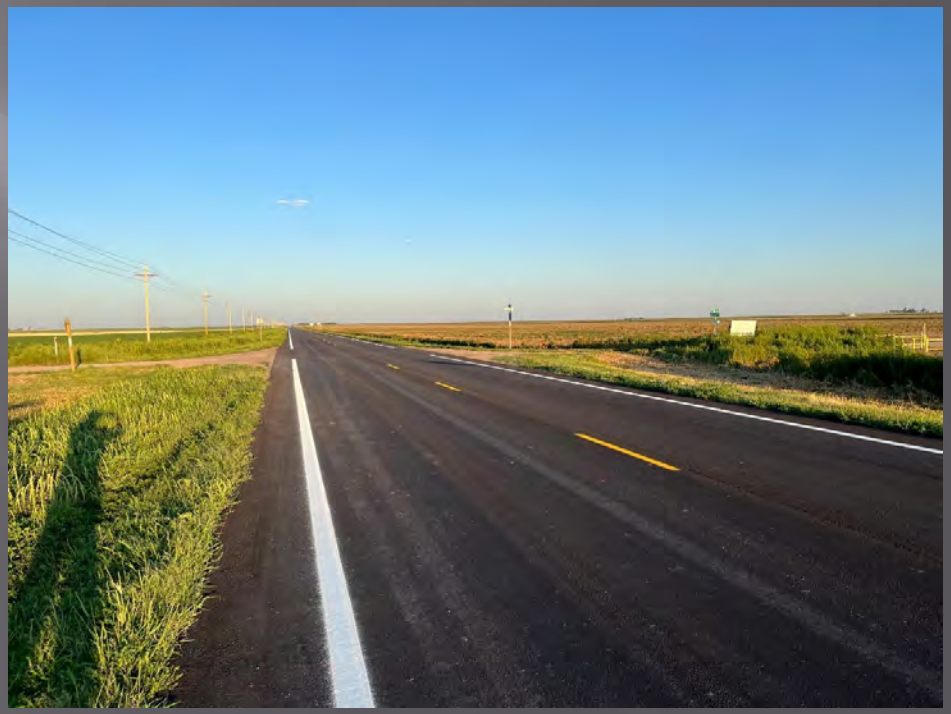


Scrub Cape Seal (Scrub + Microsurfacing) KDOT District 6

GRANT/STANTON COUNTY 2023



GRANT/STANTON COUNTY 2023



Scrub Seal + HMA (SAMI)

MISSISSIPPI HIGHWAY 72 IN NORTH MISSISSIPPI IN 2018

LANES WERE SCRUBBED IN LIEU OF MILLING BECAUSE OF DEPTHS

Scrub Seal + Chip Seal KDOT District 5

SCRUB SEAL W/CM-L-0

CHIP SEAL W/CM-L-1

Scrub Seal + Chip Seal KDOT District 4

SCRUB SEAL W/CM-L-0

CHIP SEAL W/CM-L-1

Design Materials Chip/Scrub Seal Components

- Aggregates –
  - CM-L-0 Lightweight Aggregate No. 4 minus
  - High Quality Chip or Sand 3/8" maximum sieve size
  - No. 200 up to 2% maximum passing
  - 15 to 24 lb/yd^2 average; CM-L-0 averages 6.5 lb/yd^2
- Polymer Modified Emulsion
  - Polymers add flexibility, toughness, and durability
  - Rejuvenator conditions the aged asphalt while restoring the maltene/asphaltene balance (CMS-1PC)
  - Emulsion average 0.22 to 0.40 ga/yd^2

Materials: Aggregate

CM-L-0

3/8" CHIPS

Asphalt Emulsion

CRS-1HP

- Rapid Set
- Polymer Modified

CMS-1PC

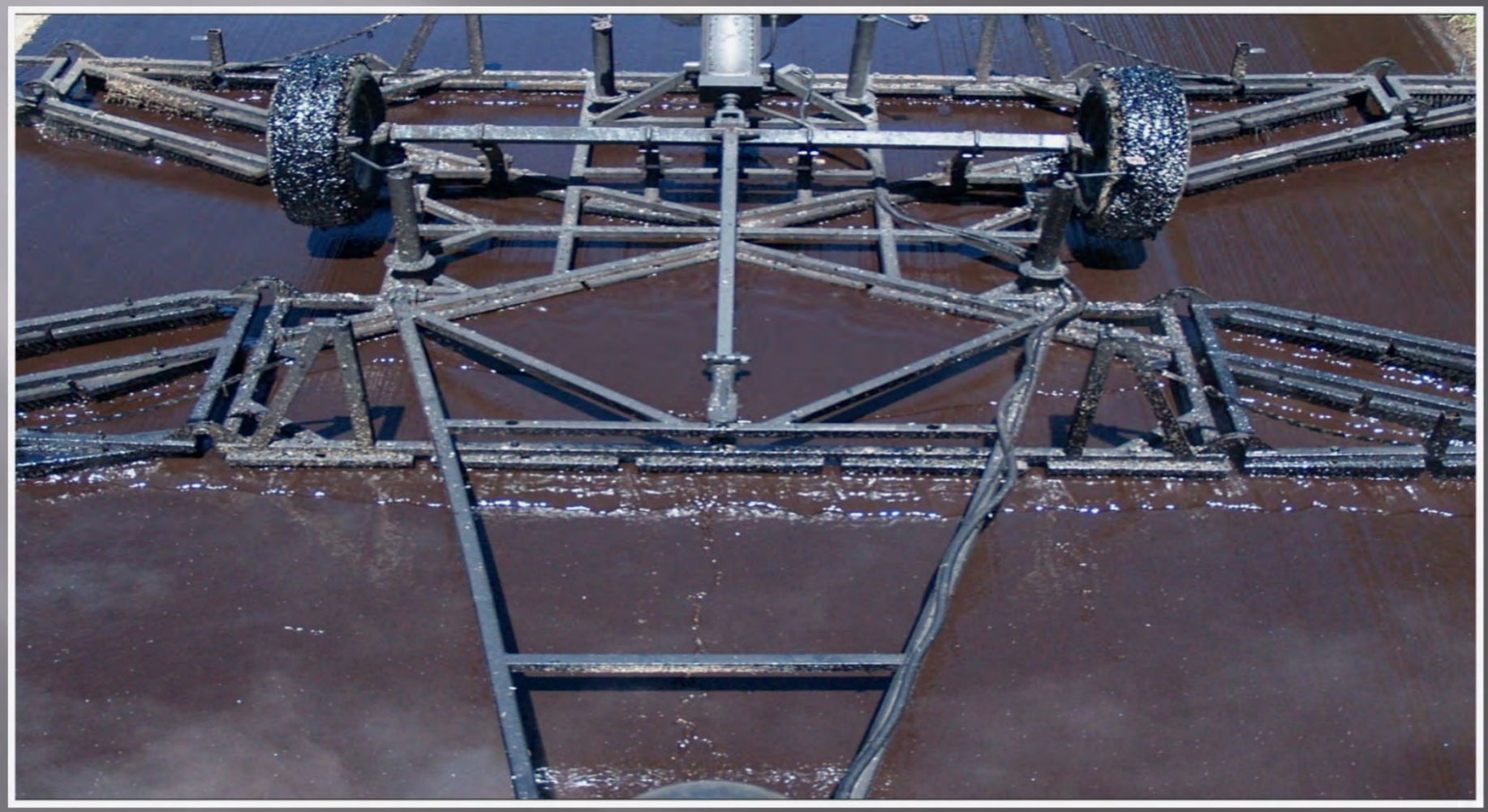
- Medium Set
- Polymer Modified
- Rejuvenating Agent
- 140° to 180° temp range
  - Check with manufacturer

Shot Rate:

- 3/8" Chips ≈ 0.38 ±
- Sand or Man. Sand ≈ 0.28 ±
- CM-L-0 ≈ 0.22 ±

Equipment-Scrub Broom

Scrub broom carries a 4 to 6” wave of emulsion at brooms to fill cracks



Scrub Broom Adjustment Jacks

Scrub Broom Adjustment Control

- Manual Control Adjustments for Greensbroom

Questions?