

# Trackless Tack

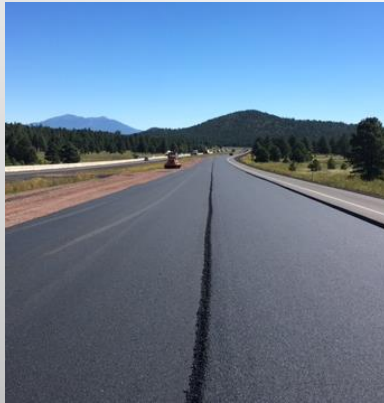
ASU Pavements/Materials Conference 11-16-2022

Prepared by: Nye McCarty, P.E.

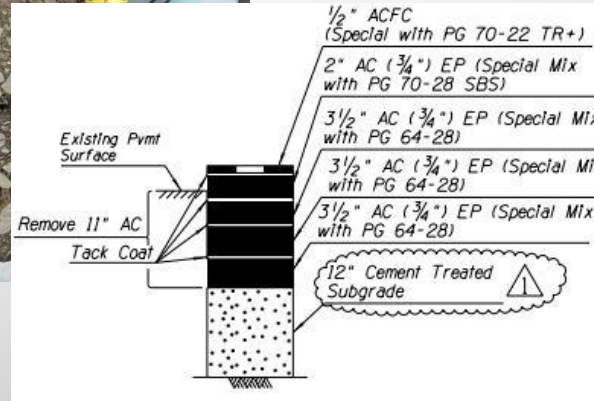
Flagstaff Regional Materials Engineer  
Arizona Dept. of Transportation



# Today we will discuss:



Myths about tack



Importance of Tack



Dos and Don'ts



# ...and we will discuss:



404-1.1 USE ON ALL PROJECTS INVOLVING PRIME COAT, TACK COAT, FOG COAT, OR CHIP SEAL COAT

\*\* USE IN CONJUNCTION WITH SPECIAL PROVISION 108BITUMADJ \*\*

\*\* USE IN CONJUNCTION WITH STORED SPECIFICATION 1005PG \*\*

\*\* USE IN CONJUNCTION WITH STORED SPECIFICATION 1001MATL IF ANY AGGREGATE IS BEING USED \*\*

\*\* FILL IN INFORMATION FROM THE MATERIALS REPORT IN THE FOLLOWING SUBSECTIONS (SHOWN IN RED TEXT) \*\*

\*\* 404-2.03BITUMINOUS TREATMENT MATERIAL TYPES AND APPLICATION RATES \*\*

\*\* CHANGE TO BLACK TEXT IF IT APPLIES. DELETE RED TEXT THAT DOES NOT APPLY \*\*

(040BITUM, 08/18/22)

**SECTION 404 BITUMINOUS TREATMENTS:**

**404-1 Description:** of the Standard Specifications is revised to read:

The work under this section shall consist of furnishing all materials and constructing or applying bituminous treatments at the locations designated on the plans and in accordance with the requirements of the specifications and in conformity to the lines shown on the project plans or established by the Engineer.

The bituminous treatments include one or a combination of prime coat, tack coat, and fog coat. The bituminous treatments also include emulsified asphalt chip seal and hot applied chip seal both either with or without fog coat.

When a "hot applied" chip seal is called for on the plans and specifications, it refers to a chip seal using a performance grade asphalt cement or a crumb rubber asphalt as the bituminous material.

**404-2.02 Aggregate Materials:**

(A) **General:** the second and third paragraphs of the Standard Specifications are revised to read:

With the exception of pre-coated cover material, aggregate material shall be sampled for gradation acceptance from the final stockpile prior to being incorporated into the work. The aggregate for the pre-coated material shall be sampled prior to pre-coating.

(B) **Blotter Material:** of the Standard Specifications is revised to read:

404BITUM - 1/17

**Special Specification 3019**  
**Trackless Underseal Coatings**

**DESCRIPTION**

1. Description of 1 or Two 2' Test Sections

2. Center Line of Road

3. 3' Inner Space Between Patches

4. Patch Size

5. Patch Spacing

6. Patch Shape

7. Patch Color

8. Patch Material

9. Patch Application

10. Patch Maintenance

11. Patch Removal

12. Patch Replacement

13. Patch Repair

14. Patch Sealing

15. Patch Painting

16. Patch Marking

17. Patch Signage

18. Patch Safety

19. Patch Security

20. Patch Compliance

21. Patch Documentation

22. Patch Reporting

23. Patch Review

24. Patch Approval

25. Patch Implementation

26. Patch Evaluation

27. Patch Improvement

28. Patch Innovation

29. Patch Sustainability

30. Patch Resilience

31. Patch Adaptability

32. Patch Flexibility

33. Patch Scalability

34. Patch Portability

35. Patch Interoperability

36. Patch Compatibility

37. Patch Reliability

38. Patch Durability

39. Patch Performance

40. Patch Efficiency

41. Patch Effectiveness

42. Patch Impact

43. Patch Contribution

44. Patch Value

45. Patch Benefit

46. Patch Outcome

47. Patch Result

48. Patch Achievement

49. Patch Success

50. Patch Excellence

51. Patch Leadership

52. Patch Innovation

53. Patch Creativity

54. Patch Vision

55. Patch Mission

56. Patch Values

57. Patch Principles

58. Patch Standards

59. Patch Guidelines

60. Patch Procedures

61. Patch Policies

62. Patch Practices

63. Patch Processes

64. Patch Programs

65. Patch Projects

66. Patch Initiatives

67. Patch Campaigns

68. Patch Events

69. Patch Activities

70. Patch Exercises

71. Patch Operations

72. Patch Management

73. Patch Administration

74. Patch Supervision

75. Patch Control

76. Patch Coordination

77. Patch Collaboration

78. Patch Cooperation

79. Patch Communication

80. Patch Information

81. Patch Knowledge

82. Patch Skills

83. Patch Abilities

84. Patch Competencies

85. Patch Qualifications

86. Patch Certifications

87. Patch Licenses

88. Patch Registrations

89. Patch Memberships

90. Patch Affiliations

91. Patch Partnerships

92. Patch Alliances

93. Patch Coalitions

94. Patch Networks

95. Patch Communities

96. Patch Organizations

97. Patch Institutions

98. Patch Organizations

99. Patch Organizations

100. Patch Organizations

**Tack Coat Best Practices**

This Technical Brief provides an overview of tack coats and their vital role bonding multiple asphalt layers into one monolithic system. Poor tack coat techniques result in an asphalt pavement system that is prone to delamination and cracking. This technical brief provides an overview of tack coats and their vital role bonding multiple asphalt layers into one monolithic system. Poor tack coat techniques result in an asphalt pavement system that is prone to delamination and cracking. This technical brief provides an overview of tack coats and their vital role bonding multiple asphalt layers into one monolithic system. Poor tack coat techniques result in an asphalt pavement system that is prone to delamination and cracking.

**TechBrief**

The Asphalt Pavement Technology Program is an ongoing effort to improve the long-term performance and cost-effectiveness of asphalt pavements. Managed by the Federal Highway Administration through partnerships with state highway agencies, industry and academia, the program's primary goal is to reduce the cost of highway construction and improve the quality of the road. The program has established a variety of programs and projects to address these goals, including:

- Research and development projects
- Technical assistance and training
- Outreach and public awareness
- Policy and regulatory development
- Performance-based contracting
- Quality assurance and control

**EVALUATION OF BOND STRENGTH BETWEEN PAVEMENT LAYERS**

By  
Randy C. West  
Jason Zhang  
Jacob Moore

December 2005

NCAT Report 05-08

National Center for Asphalt Technology  
ALABAMA UNIVERSITY  
NCAT  
877 Technology Parkway Auburn, AL 36889

ADOT's Test Section

ADOT Trackless Tack Specification

Resources



# Fact or Fiction?



- It is ok to pave on tack coat that has not yet broken.
- Application rate is not important as long as there is complete and even coverage.
- Don't need to sweep before applying tack
- Not needed if paving on new pavement surface.
- Ok to put construction traffic on tacked surface.
- Streaks and puddles are ok.
- Old pavement needs more than new pavement.
- All that matters is pavement thickness.

# Paving on Unbroken Tack

- No!
- No!
- No!
- Yes???



Dense Graded AC  
(No!)



Bonded Wearing Course  
(Yes)

# Tack Application Rate

**Table 1. Recommended Tack Coat Application Rates**

Surface Type	Residual Rate (gsy)	Approximate Bar Rate Undiluted* (gsy)	Approximate Bar Rate Diluted 1:1* (gsy)
New Asphalt	0.02 – 0.05	0.03 – 0.07	0.06 – 0.14
Existing Asphalt	0.04 – 0.07	0.06 – 0.11	0.12 – 0.22
Milled Surface	0.04 – 0.08	0.06 – 0.12	0.12 – 0.24
Portland Cement Concrete	0.03 – 0.05	0.05 – 0.08	0.10 – 0.16

\*Assume emulsion is 33% water and 67% asphalt.

Source: FHWA Tech Brief: <https://www.fhwa.dot.gov/pavement/asphalt/pubs/hif16017.pdf>

# Paving on New Pavement ( perhaps even hot lapping)



Tack Coat Necessary?

Yes!!!

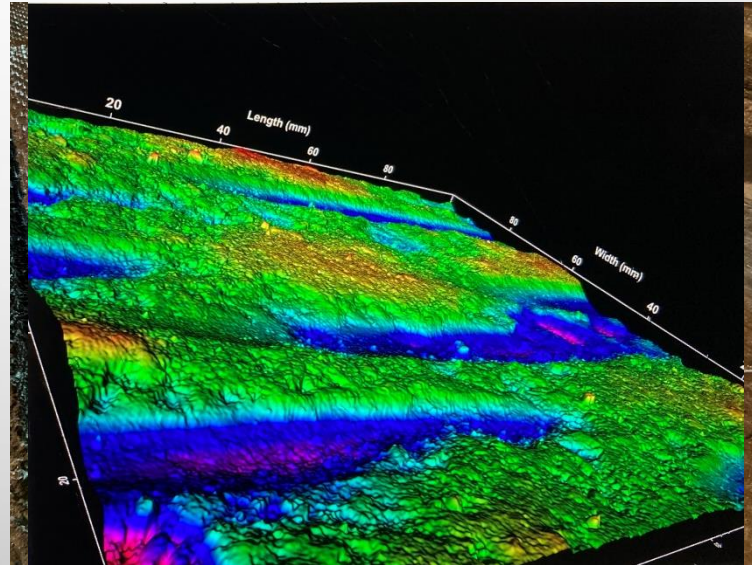
# Pavement Surface Characteristics

- Oxidized/Cracked Surface
- Raveled Surface
- Milled Surface
- Relatively New Surface
- Newly Paved Surface
- Flushed Surface
- Portland Cement Concrete Surface



# Pavement Surface Characteristics

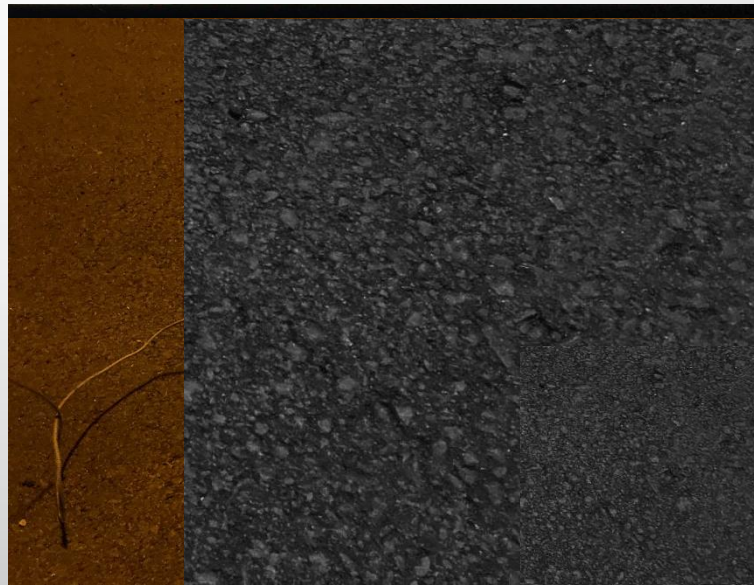
Surface Texture Scanner  
(milled AC surface)



# Pavement Surface Characteristics

Surface Texture Scanner  
(new AC surface)

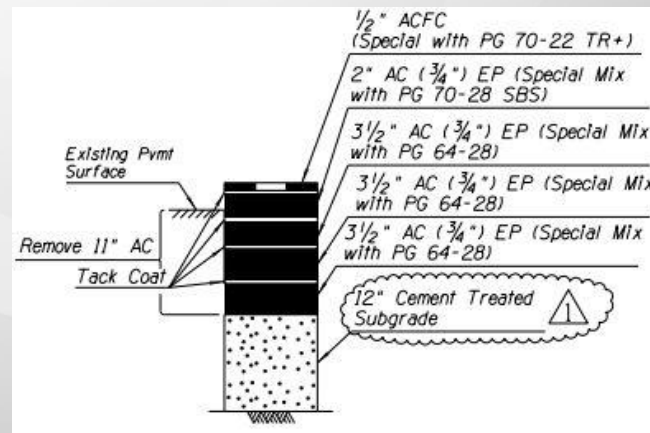
New Pavements Need  
Tack Coat Too!!



# ~~Pave~~ Pavement Structure

- Pavement Design Methodologies
  - AASHTO Guide for Design of Pavement Structures (1993)
  - MEPDG/PaveME

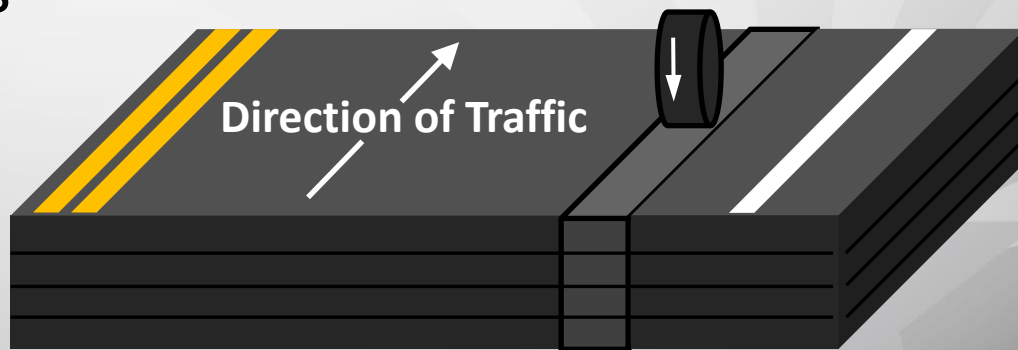
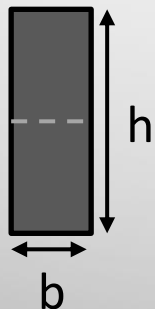
All consider the AC to behave as a “single monolithic pavement layer,” not individual layers.



# Pavement Structure

- Structural Analysis (kind of)
  - Section Modulus

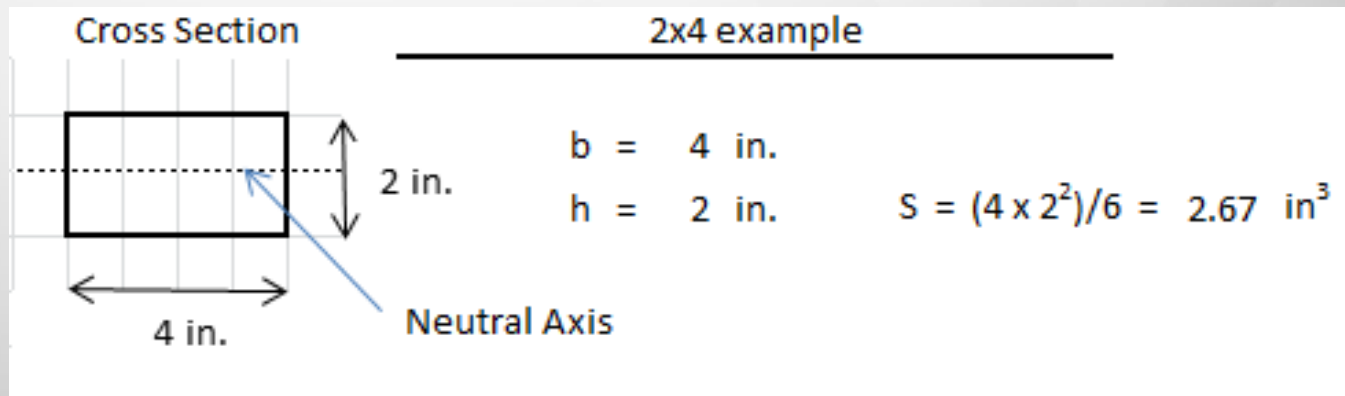
$$S = \frac{bh^2}{6}$$



# Pavement Structure

- Resistance to Bending

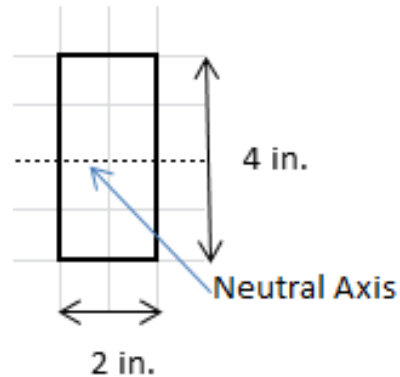
$$S = \frac{bh^2}{6}$$



# Pavement Structure

- Resistance to Bending

$$S = \frac{bh^2}{6}$$



$$b = 2 \text{ in.}$$

$$h = 4 \text{ in.}$$

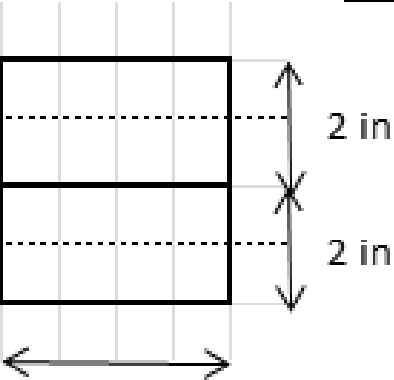
$$S = (2 \times 4^2) / 6 = 5.33 \text{ in}^3$$

Increase of 100%

# Pavement Structure

- Resistance to Bending

Cross Section



two 2x4s example

$b = 4 \text{ in.}$

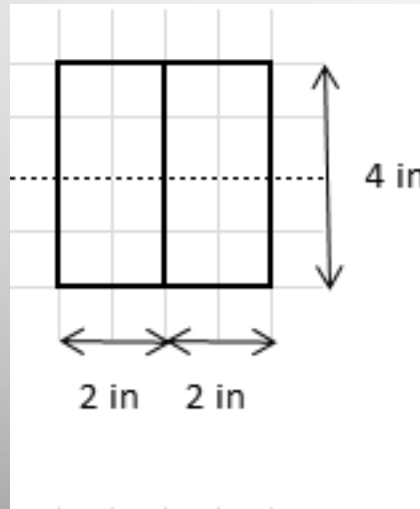
$h = 2 \text{ in.}$

$S = 2 \times (4 \times 2^2) / 6 = 5.33 \text{ in}^3$

2x4s are not fastened together  
both bend independently (2 neutral axes)

# Pavement Structure

- Resistance to Bending



The diagram shows two 2x4 lumber pieces placed side-by-side. Each piece is 2 inches wide and 4 inches high. The total width is 4 inches and the total height is 4 inches. A dashed horizontal line represents the neutral axis, which is the centerline of the combined 4x4 shape. The 2x4s are not fastened together.

$b = 2 \text{ in.}$   
 $h = 4 \text{ in.}$

$$S = 2 \times (2 \times 4^2) / 6 = 10.67 \text{ in}^3$$

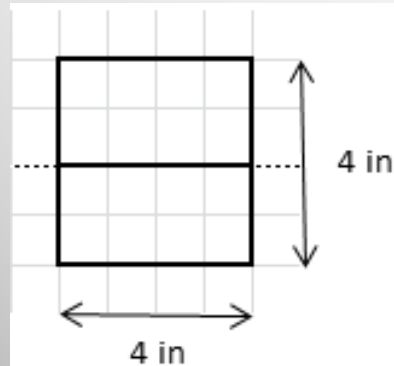
2x4s are not fastened together  
both bend independently (1 neutral axis)

Increase of 100%



# Pavement Structure

- Resistance to Bending



$b = 4 \text{ in.}$

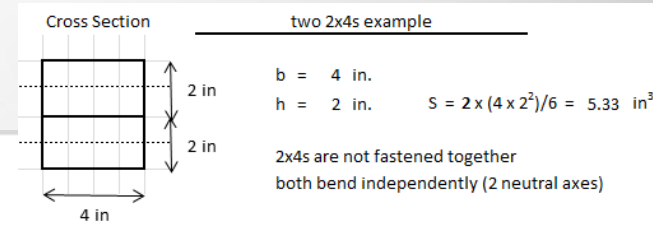
$h = 4 \text{ in.}$

$S = (4 \times 4^2)/6 = 10.67 \text{ in}^3$

2x4s are fastened together

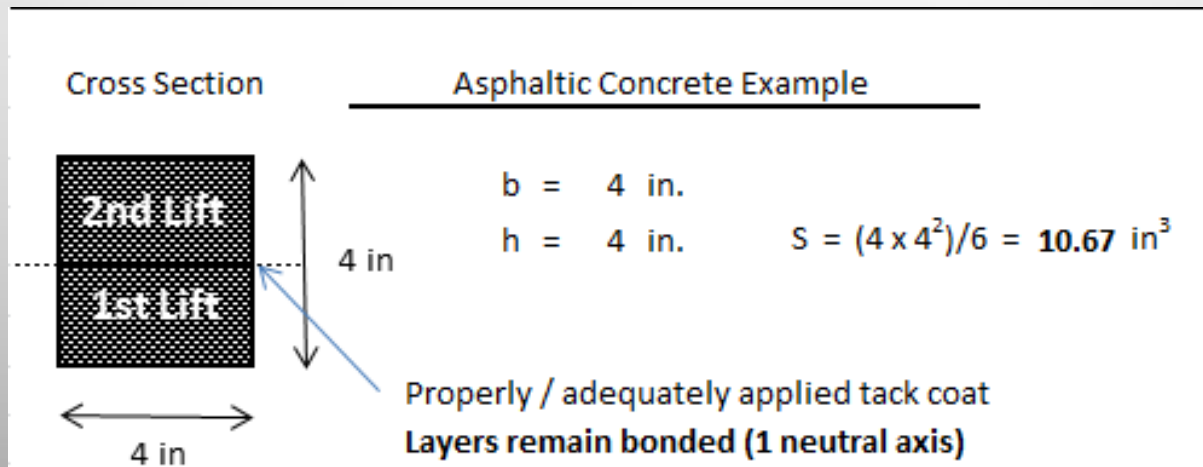
bend as a single object (1 neutral axis)

Increase of 100%



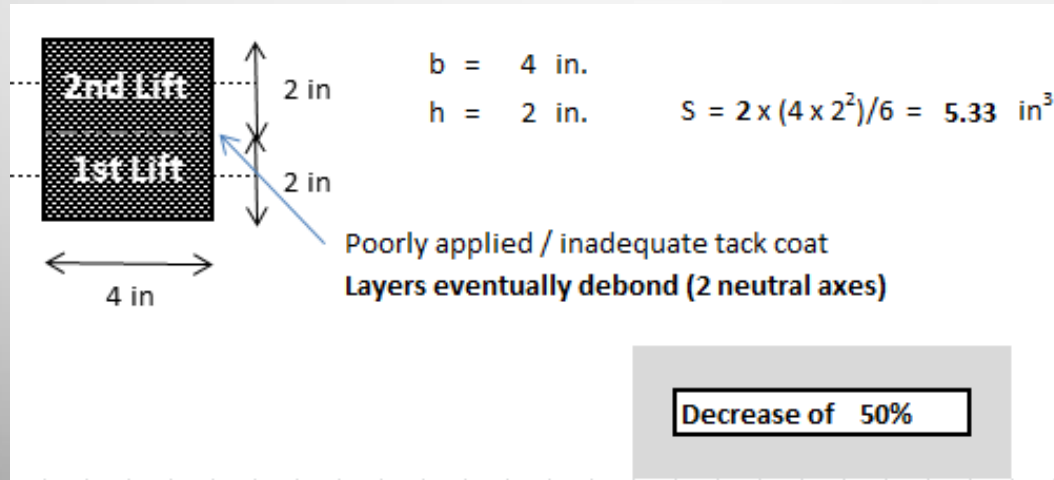
# Pavement Structure

- Resistance to Bending



# Pavement Structure

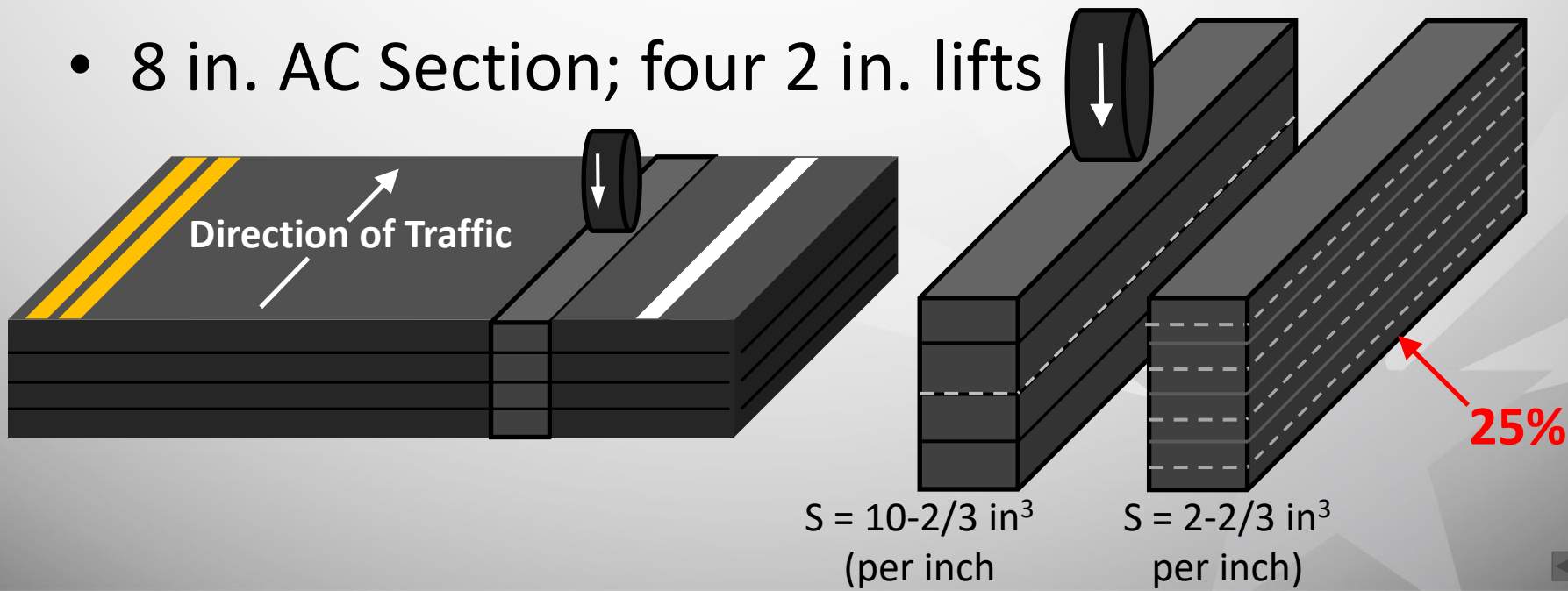
- Resistance to Bending



- Assumptions of the design have been violated
- Fatigue life of the pavement has been significantly reduced

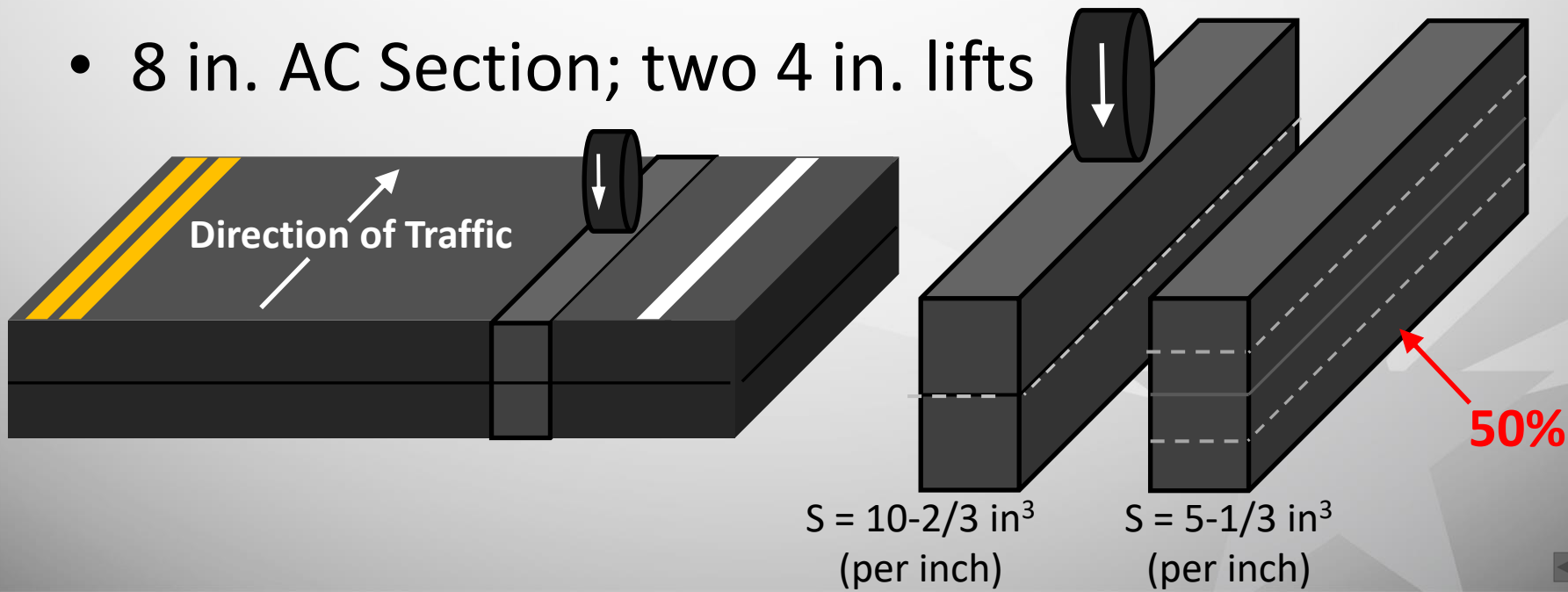
# Fatigue Resistance

- 8 in. AC Section; four 2 in. lifts

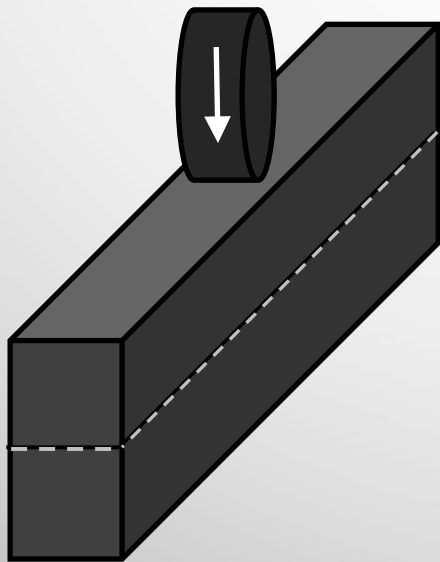


# Fatigue Resistance

- 8 in. AC Section; two 4 in. lifts



# Tack Coat



Theoretical



Real World

# Tack Coat



- Minimum Bond Strength

40 psi (LTRC)

[NCHRP Report 878](#)

100 psi (NCAT)

[NCAT Report 05-08](#)

**0 psi** in wheel tracking paths

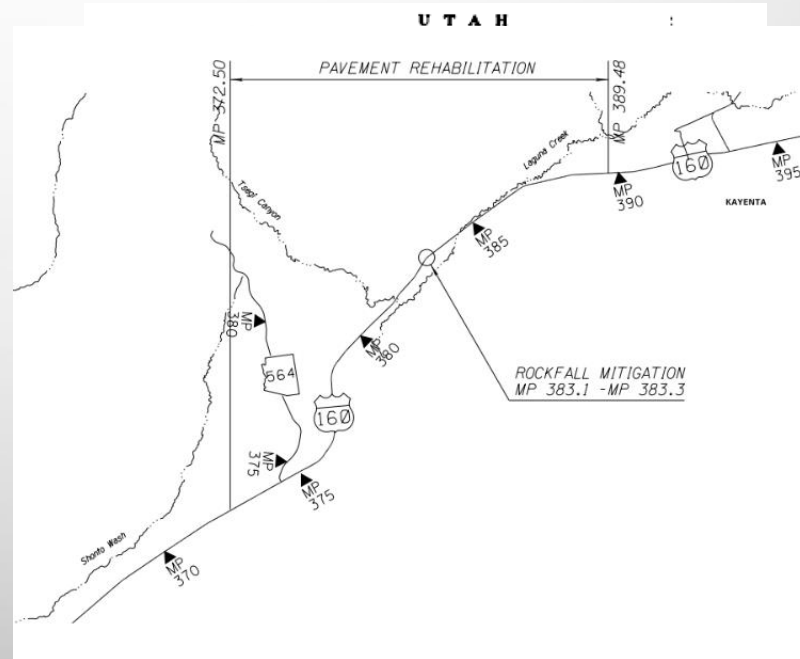
# Trackless Tack

- ADOT Test Sections:
  - Wickenburg, AZ (US89/SR74)
    - Unsuccessful; significant tracking
  - US 160 Longhouse Valley to Kayenta, AZ
    - Very successful; zero tracking
    - Minimal Break time
    - Achieved very good bond strength



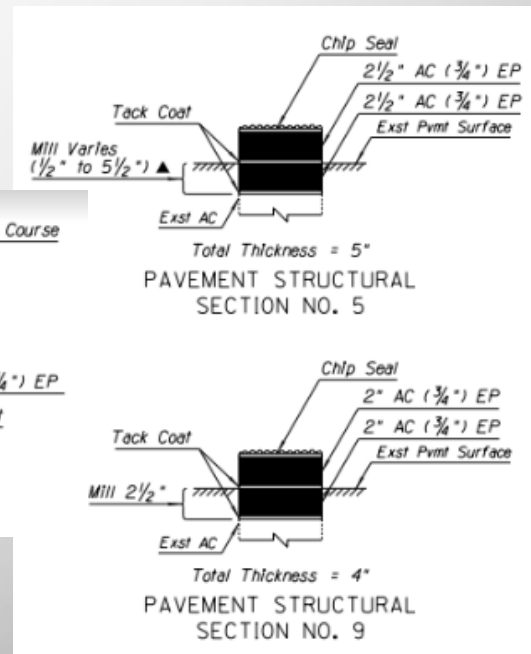
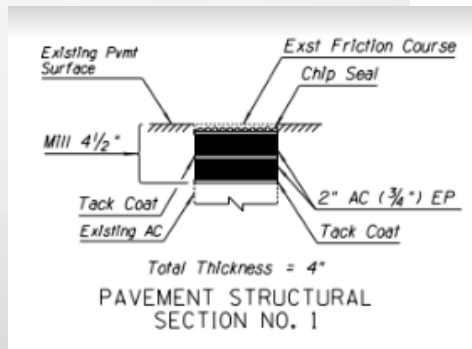
# US 160: Long House Valley to Kayenta

- 17 Miles of single-lane rural highway.
- Approximately 60,000 tons of Asphaltic Concrete
- MP 380-381



# US 160: Long House Valley to Kayenta

- Pavement Preservation
  - Mill and fill
  - Chip Seal
  - 163 Tons of Bituminous Tack Coat



# US 160: Longhouse Valley to Kayenta

- Conventional Tack



# US 160: Longhouse Valley to Kayenta



mulsions)

Videos



# Testing (Bond Strength)



AASHTO TP 114 or Tex-249-F

# Testing (Bond Strength)

- AASHTO TP 114 or Tex-249-F
  - Oven dried to constant weight at 100 degrees F (+/- 5 degrees F), not to exceed 24 hrs, or use Core Dry apparatus.
  - Condition at 77 degrees F (+/- 2 degrees F) for a minimum of 2 hrs prior to testing.
  - Constant Displacement of 0.1 inches per minute
  - No Normal Force applied.

# Bond Strength Results

Core	(Station)	Direction	Offset (ft)	(gal/sq.yd)	Strength (psi)	Strength (psi)
1A	336+00	EB	7 R of CL	0.08	95.3	133.63
1B					169.5	
1C					136.0	
2A	350+00	EB	5.5 R of CL	0.10	183.9	182.20
2B					Error	
2C					180.5	
3A	370+00	EB	6 R of CL	0.12	239.6	210.78
3B					205.9	
3C					186.9	
4A	324+00	WB	7 L of CL	0.10	236.1	203.56
4B					196.6	
4C					178.0	
5A	320+00	WB	7 L of CL	0.12	268.4	261.50
5B					254.6	

# Trackless Tack

- Emulsified Asphalt
  - Harder Base Binder
  - Achieves “non-tacky” state in short period of time
  - Project-specific chemistry
  - Formulated to project conditions
- Variety of products from several suppliers.

Why go Trackless?





# Trackless Tack

- Owner / Agency
  - Ensures Adequate Bond between Pavement Layers
  - Improves Pavement Performance
  - Achieve/exceed Pavement Design Life
  - Reduces unsightly tracking.



# Trackless Tack

- Contractor
  - Reduces wait time for conventional tack to break
  - Increase daily paving production by 20-25%
  - Extends Paving Season
  - Happy inspectors, project supervisors, and engineers



# ADOT Specification (404Bitum)

- 404-2.01 Emulsified Trackless Tack added to table of bituminous materials
- 404-2.03 Bituminous Material Types and Application Rates (404-4.02)
- 404-3.01(E) Seasonal and Weather Limitations
  - Formulated by supplier for project conditions
  - Shall not be applied to surfaces greater than 140 deg. F
  - Use within manufacture recommended conditions unless approved by Engineer
  - Range of conditions need to be provided in product literature
- 404-3.02(A) Equipment (Distributor Truck)
  - Thoroughly cleaned by circulating warm water (consult with supplier)
  - Heating flues covered while slowly heating (circulating) trackless tack

# ADOT Specification (404Bitum)

- 404-3.03 Bituminous Material Storage (Trackless Tack)
  - Minimize exposure to air
  - Storage container must be completely emptied/flushed prior to loading
  - Avoid using storage containers used for solvent based materials
  - Store within manufacturer recommended temperature range (50 to 170 deg. F)
  - No contact with anything at/above 212 deg. F
  - Use prior to dropping below 50 deg. F
  - Do not return unused material to storage container.
- 404-3.04 Preparation of the Surface
  - Must remove all debris, dust, coatings (pressure spray if necessary)

# ADOT Specification (404Bitum)

- 404-3.05            Application of Bituminous Material
  - Apply at 140 to 170 deg. F
- 404-4.02            Tack Coat
  - Contractor shall choose the product
  - Trackless tack must be formulated for the project
  - Dilution may only be performed by the manufacturer
  - COA for each batch / COC for each delivery
  - Subject to approval by the Engineer

# ADOT Specification (404Bitum)

- 404-4.02 Tack Coat (continued)

Test Property	Test Method	Requirement
Viscosity: Saybolt Furol, seconds, @ 77° F	AASHTO T 59	10-150
Settlement: 24hrs, % maximum	AASHTO T 59	1.0
Sieve: Retained on No. 20, % maximum	AASHTO T 59	0.3

# ADOT Specification (404Bitum)

- 404-4.02 Tack Coat (continued)

Oil Distillate to 176.7° C (350° F), Volume of Emulsion, % maximum	AASHTO T59	1.0
Solubility in Trichloroethylene, % minimum	ASTM D 2042	97.5
Softening Point, @ 65° C, minimum	AASHTO T 53	65
Dynamic Shear of Original Binder: G*/Sin δ @ 76° C (10 rad/sec), kPa minimum	AASHTO T 315	1.00

# ADOT Specification (404Bitum)

- 404-4.02 Tack Coat (continued)

Particle Charge	AASHTO T59	Report Only
Residue from Distillation to 176.7° C (350° F), %	AASHTO T59	Report Only
Shear Bond Strength, psi	Tex-249-F	Report Only



# ADOT Specification (404Bitum)

- 404-4.02 Tack Coat (continued)

Type of Bituminous Material	Approximate Tack Coat Application Rates: Gallons / Square Yard		Payment Factor
	Prior to Placing ACFC or AR-ACFC	All Other Tack Coats	
Emulsified Asphalt (Special Type) – See Note (1) Below.	Not Allowed	0.12	0.7
Emulsified Asphalt (Trackless Tack) - See Note (2) Below			1.0
Emulsified Asphalt (Other than Special Type)	0.08	0.08	1.0

# ADOT Specification (404Bitum)

- 404-4.02 Tack Coat (Note 2 from Application Rate table)
  - Apply in accordance with manufacturer recommendations based on **residual asphalt content**
  - Existing Asphaltic Concrete Surfaces: 0.05 gal/sy
  - New Asphaltic Concrete Surfaces: 0.03 gal/sy
  - Milled Surfaces: 0.06 gal/sy
  - Portland Cement Concrete Surfaces: 0.04 gal/sy
  - Application rates are always subject to adjustment as appropriate
- Refer to supplier's estimated time to achieve a "non-tacky" condition.
- Test it out before opening to all construction traffic

# Resources

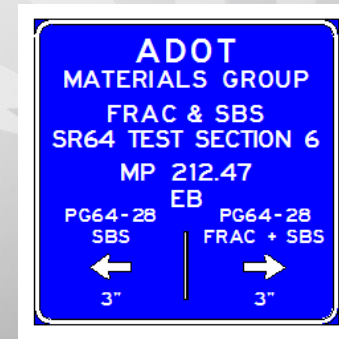
- NCAT Power Point Slides: [Bond Strength of Tack Coat Materials](#)
- NCAT Report 05-08: [Evaluation of Bond Strength Between Pavement Layers](#)
- FHWA TechBrief: [Tack Coat Best Practices](#)
- FHWA Checklist: [Asphalt Emulsion-Based Tack Coat](#)
- NCHRP Synthesis 516: [Tack Coat Specifications, Materials, and Construction Practices](#)
- NCHRP Report 878: [Validation of the Louisiana Interlayer Shear Strength Test for Tack Coat](#)
- Asphalt Institute: [Construction Quality Asphalt Pavements \(workshop\)](#)

# Additional Innovations

- Increased Density – I40, I17, I10, I19
- Polymer Modified Asphalt – I40, SR64 (HiMA; EDC-6 TOPS)
- Trackless Tack – US160



- Longitudinal Joint Compaction – I40, I10
- Fiber Reinforced Asphaltic Concrete – SR89A, SR64



Thank you!

**QUESTIONS?**

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