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NEBRASKA
Good Life. Great Journey.
DEPARTMENT OF TRANSPORTATION

# 2024 Nebraska Asphalt Paving Workshop

## Best Practices of Inspection and Construction for Asphalt Paving, Compaction, and Plant Operations

# Learning Objectives

- Purpose of Tack Coats
- Types of Emulsions
- Distributor Basics
- Proper Application of Tack Coats

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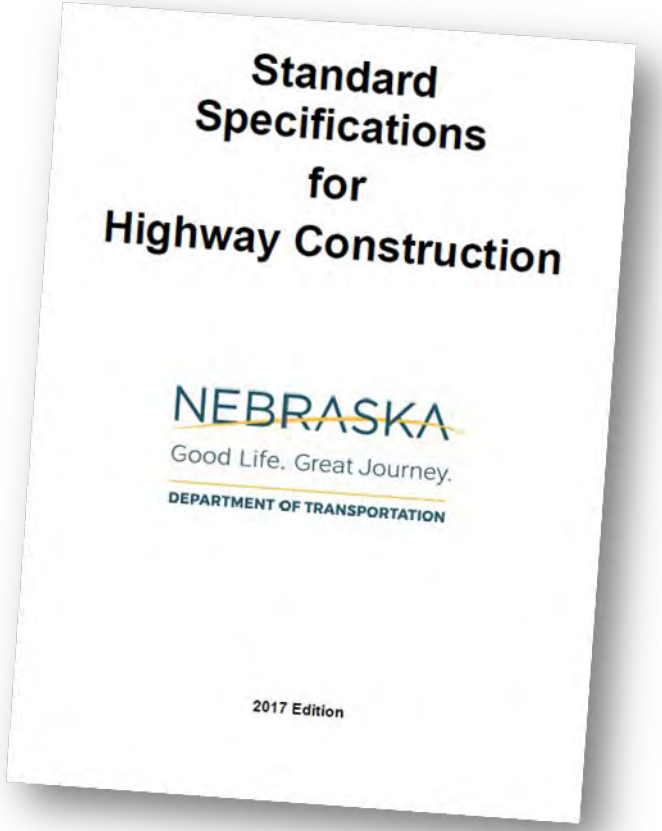
# Cleaning the Surface

- Section 501.01- 4
  - *Before placing the bituminous surfacing, the Contractor shall clean the surface to be treated with mechanical brooms or hand tools as necessary to remove all vegetation, loose surface materials, dirt, mud, old crack sealant, unstable bituminous or other deleterious materials. Any surfacing materials not securely bonded to the surface shall be removed. Material cleaned from the surface shall be swept to the sides or windrowed as required and removed from the project by the Contractor at no additional cost.*

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# Section 501.01- 4 - Cleaning the Surface

- Before placing the asphalt (or other treatment)
- Clean the surface with mechanical brooms or hand tools
- Remove all vegetation, loose surface materials, dirt, mud, old crack sealant, unstable, or other deleterious materials.
- Any surfacing materials not securely bonded to the surface shall be removed.
- Material cleaned from the surface shall be swept to the sides or windrowed as required and removed from the project by the Contractor at no additional cost.

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# Mechanical Brooms


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# Is this ok?

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# Is this ok?

# Purpose of Tack Coats

- Bonds pavement layers together – allows them to behave as a single layer
- Decreases distress between the existing pavement surface and the new asphalt overlay
  - Prevents slippage between pavement layers.
  - Vital for structural performance of pavement.
  - Apply along all transverse and longitudinal vertical surfaces.
- Improved pavement performance

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From a nationwide survey, 17% of agencies indicated they do nothing to correct poor tack shots, and 56% did not vary the application rate due to many factors.

# Effect of Poor Bonding on Service Life

- May & King (2004):
  - 10% bond loss = 50% less fatigue life
- Roffe & Chaignon (2002)
  - No bond = 60% loss of life
- Brown & Brunton (1984)
  - No Bond = 75% loss of life
  - 30% bond loss = 70% loss of life

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# Tack Coat Fundamentals

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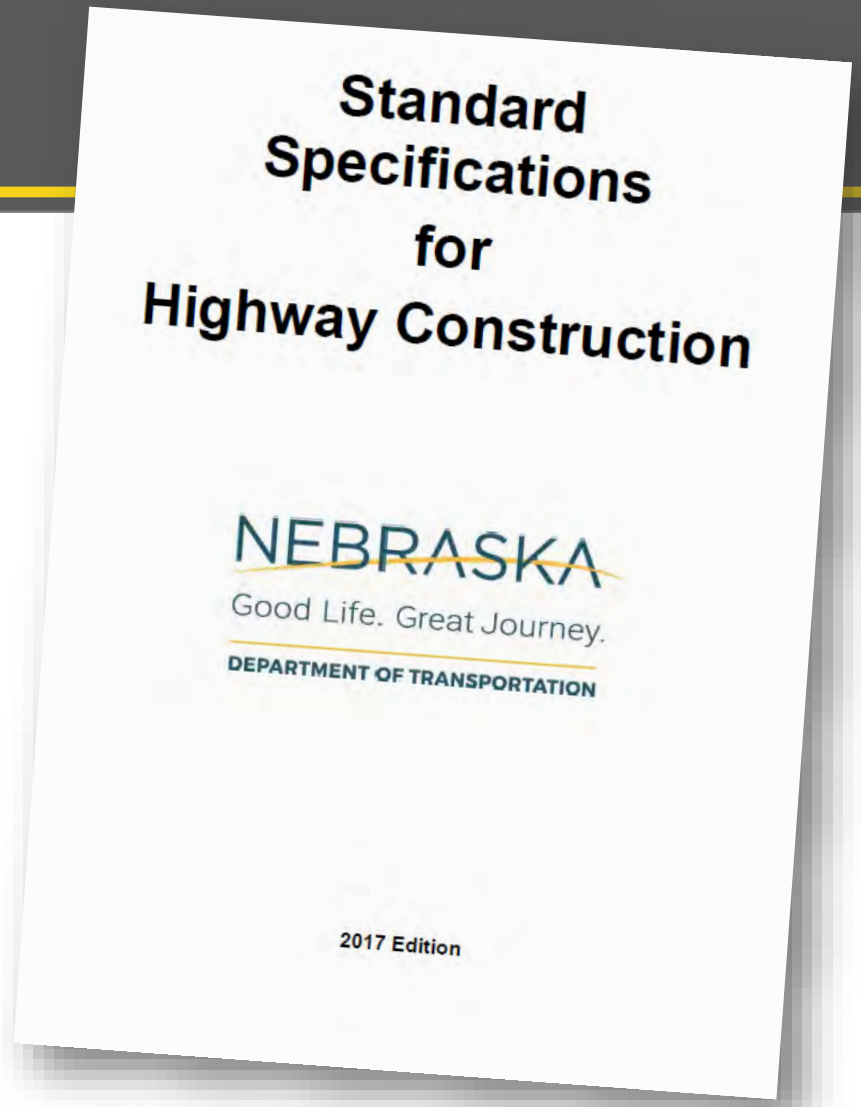
- Correct tack material
- Distributor calibrated and properly setup
- Correct application rate
- Application quality
- Break and Cured
- Limit Construction Traffic

# Tack Coat Materials

The type and grade of emulsified asphalt shall be specified in the contract and shall conform to the requirements in Sections 1031 or 1032.

Fast-Set type emulsified asphalt shall meet the requirements of Table 504.01.



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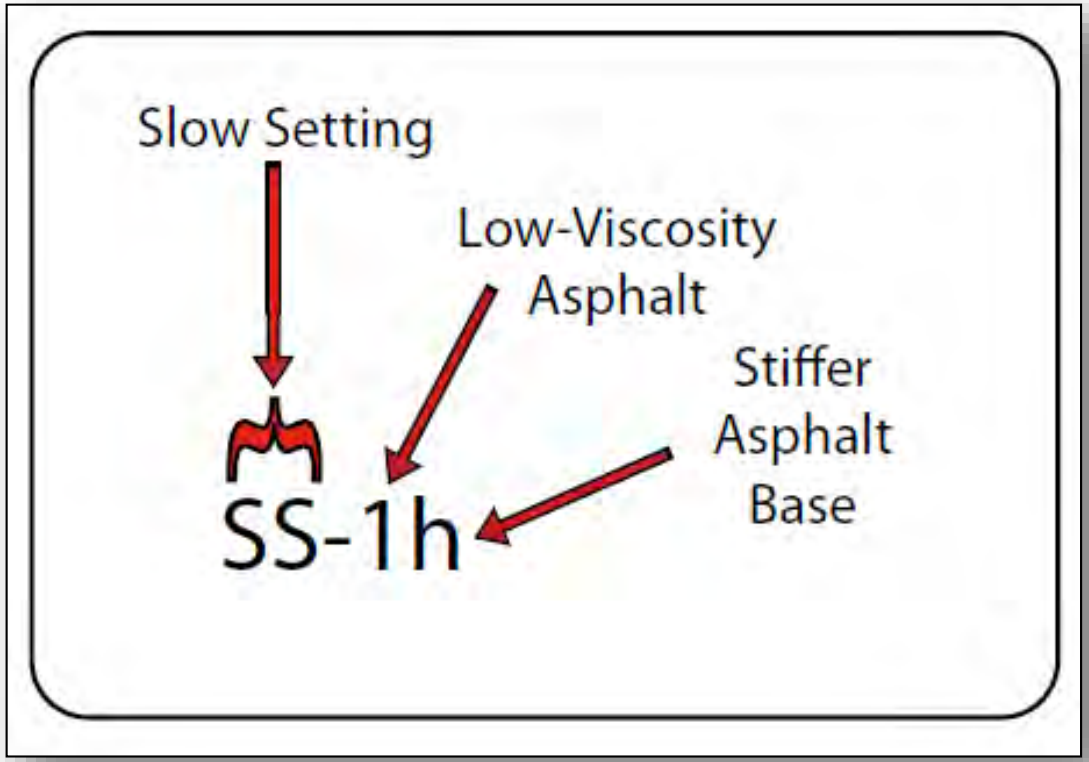
# Types of Emulsions

- Four categories relating to set times:
  - QS – Quick Set
  - RS – Rapid Set
  - MS – Medium Set
  - SS – Slow Set

  - FS - ???

Emulsion type is not always a significant factor in curing time for tack coats.

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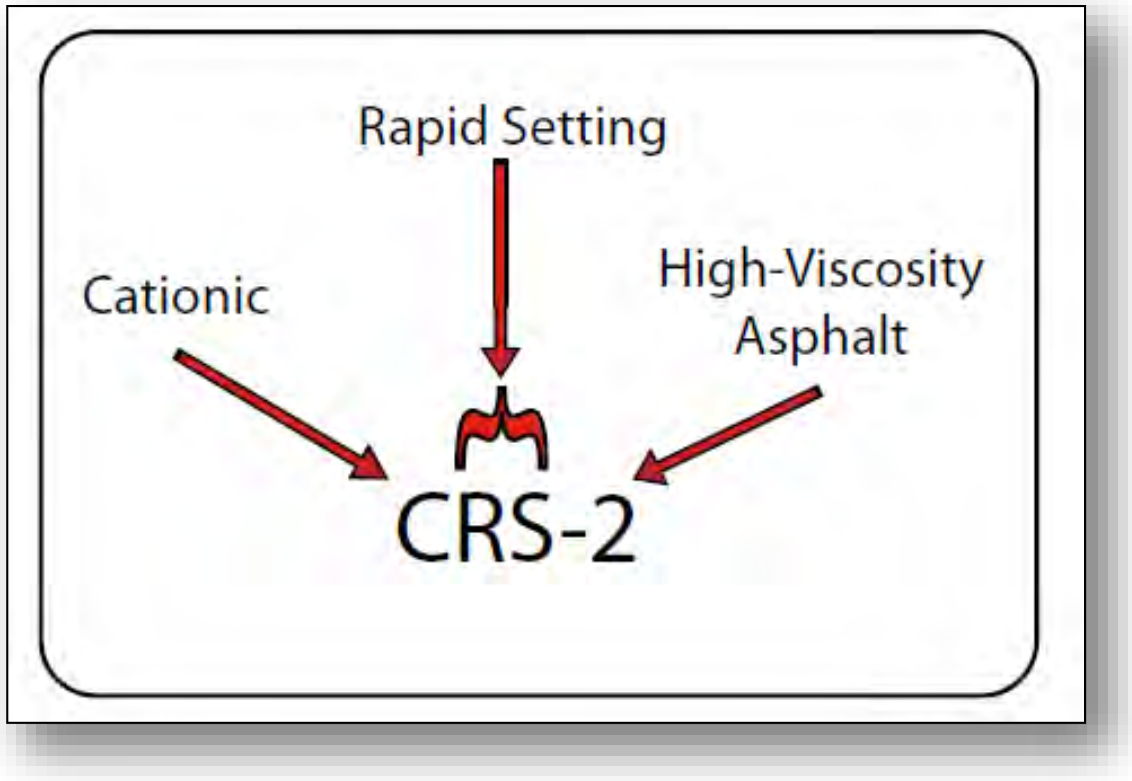
# Types of Emulsions

- Three Categories related to particle charge:
  - Anionic (-)
  - Cationic (+)
  - Nonionic (neutral)

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# Emulsions and Aggregates

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Cationic (+)

Anionic (-)

Slightly (+)

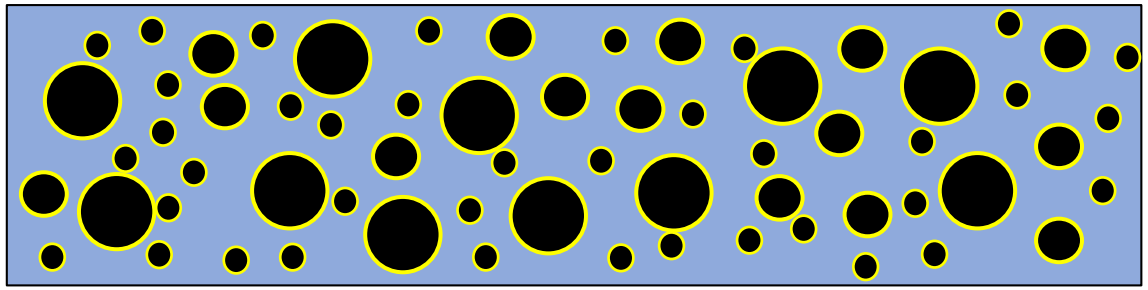
- Limestone
- Dolomite

Slightly (-)

- Granite
- Basalt

# Emulsions - Breaking and Curing Process

- Breaking and Curing
  - After emulsion is applied, it begins to “break”
    - Asphalt particles separate from the water
    - Color turns from brown to black
  - Breaking: Separation and subsequent evaporation of water from the residual asphalt film
  - Curing: The water fully evaporates and the mechanical properties of the residual asphalt are restored.



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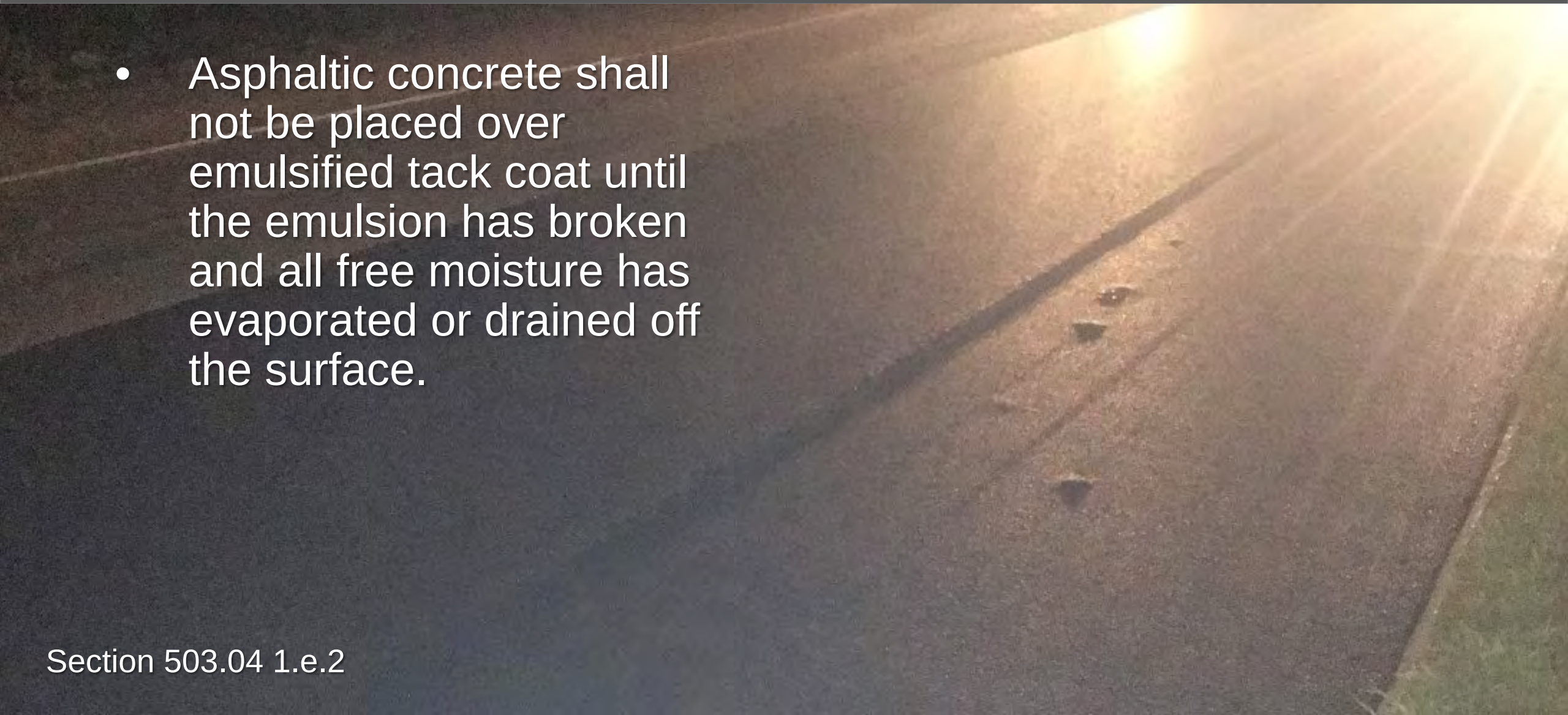
# Is Tack Coat Cured?



- Asphaltic concrete shall not be placed over emulsified tack coat until the emulsion has broken and all free moisture has evaporated or drained off the surface.

Section 503.04 1.e.2

# Tack picked up by trucks

# Get out your phones…

## How to join

### Web

1. Go to **PollEv.com**
2. Enter **TRAVISW910**
3. Respond to activity

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## How can you visually tell that a tack coat has cured and is ready for construction traffic and paving?

It's been 20 minutes. 0%

It turns completely black and no water it present. 0%

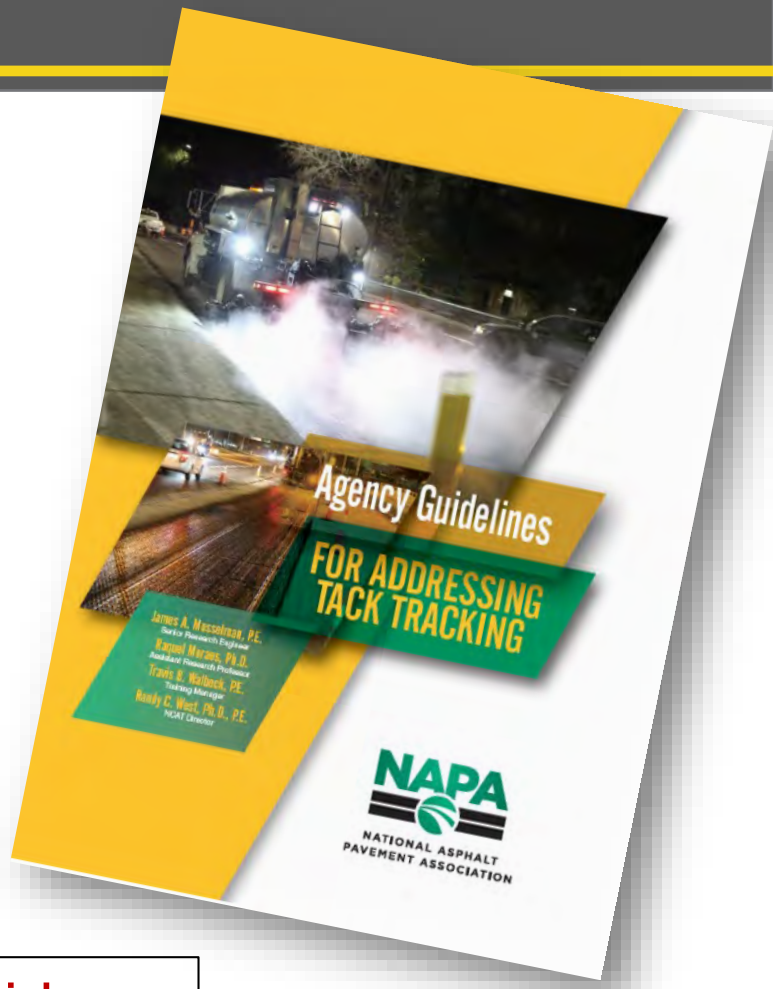
The trucks have arrived with the mix. 0%

The tack is the color of chocolate milk. 0%

The foreman is ready to pave. 0%

# Reduced-Tracking Emulsified Tack Coats

- Designed to minimize the tracking problems associated with traditional tack coat materials
- Typical characteristics:
  - Stiffer base binders
  - Chemical modifications
  - Less-tacky finish
  - Good bond strengths
  - Break and cure faster




Emulsions with softer residues are more likely to track – even if properly cured

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# Distributor Calibration – ASTM D2995

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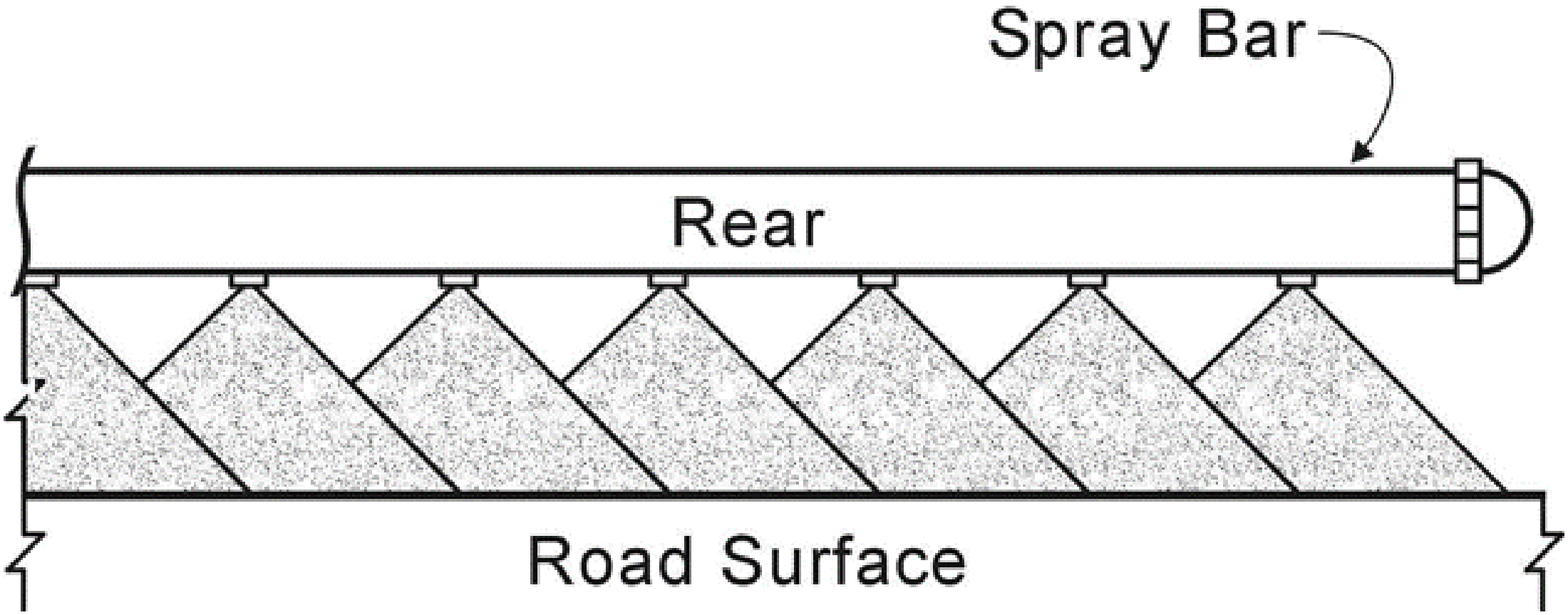
# Method to Check each Nozzle

# Distributor Truck Setup

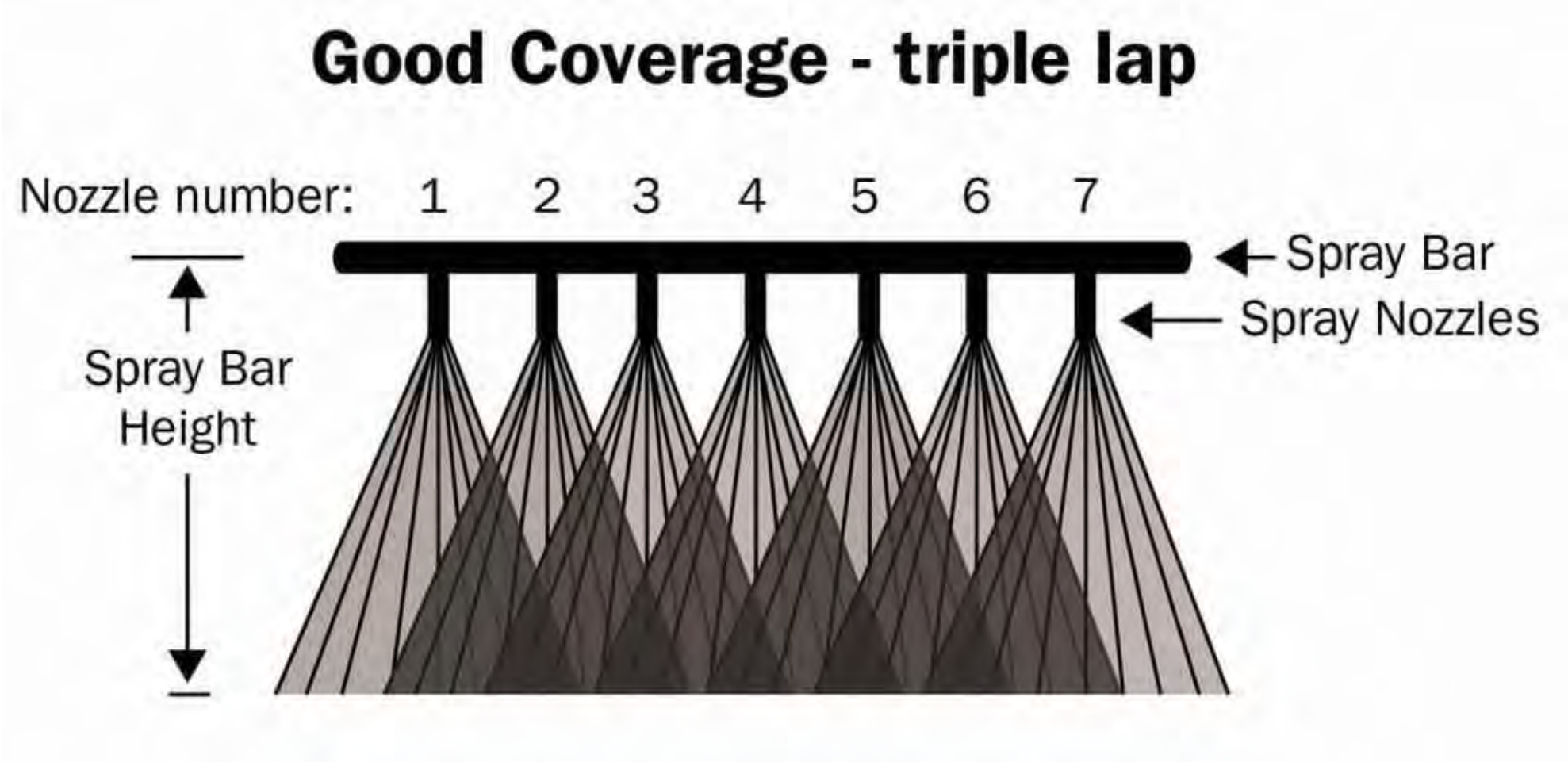
- Liquid temperature
  - Monitor and Match to material

- Calibrate distributor truck
  - Spray bar height
  - Spray bar pressure
  - Nozzle angle
  - Nozzle selection
  - Thermometers
  - Volumeter

# Double Lap



# Use Double or Triple Overlap



# Note Angle of Nozzles

# Application Rates

- The rate of application shall be adequate to bond the new bituminous layer to the existing surface.

- This shall be from
  - 0.10 to 0.20 Gal/SY (0.45 to 0.90 L/m2) when applied to existing or milled surfaces and from
  - 0.05 to 0.10 Gal/SY (0.23 to 0.45 L/m2) when applied to the freshly laid asphaltic concrete.

Section 504.03 3.c

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# Proper Application of Tack Coat

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# Applying Tack Coat on Longitudinal Joint

DOUBLE

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# Is this acceptable?

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# Temperature Corrected Volume

**Table 13. Temperature - volume corrections for asphalt emulsions [6].**

| °C | °F | M | °C | °F | M | °C | °F | M |
|---|---|---|---|---|---|---|---|---|
| 10.0 | 50 | 1.0025 | 35.0 | 95 | 0.9912 | 60.0 | 140 | 0.9800 |
| 10.6 | 51 | 1.0022 | 35.6 | 96 | 0.9910 | 60.6 | 141 | 0.9797 |
| 11.1 | 52 | 1.0020 | 36.1 | 97 | 0.9907 | 61.1 | 142 | 0.9795 |
| 11.7 | 53 | 1.0017 | 36.7 | 98 | 0.9905 | 61.7 | 143 | 0.9792 |
| 12.2 | 54 | 1.0015 | 37.2 | 99 | 0.9902 | 62.2 | 144 | 0.9790 |
| 12.8 | 55 | 1.0012 | 37.8 | 100 | 0.9900 | 62.8 | 145 | 0.9787 |
| 13.3 | 56 | 1.0010 | 38.3 | 101 | 0.9897 | 63.3 | 146 | 0.9785 |
| 13.9 | 57 | 1.0007 | 38.9 | 102 | 0.9895 | 63.9 | 147 | 0.9782 |
| 14.4 | 58 | 1.0005 | 39.4 | 103 | 0.9892 | 64.4 | 148 | 0.9780 |
| 15.0 | 59 | 1.0002 | 40.0 | 104 | 0.9890 | 65.0 | 149 | 0.9777 |
| 15.6 | 60 | 1.0000 | 40.6 | 105 | 0.9887 | 65.6 | 150 | 0.9775 |
| 16.1 | 61 | 0.9997 | 41.1 | 106 | 0.9885 | 66.1 | 151 | 0.9772 |
| 16.7 | 62 | 0.9995 | 41.7 | 107 | 0.9882 | 66.7 | 152 | 0.9770 |
| 17.2 | 63 | 0.9992 | 42.2 | 108 | 0.9880 | 67.2 | 153 | 0.9767 |
| 17.8 | 64 | 0.9990 | 42.8 | 109 | 0.9877 | 67.8 | 154 | 0.9765 |
| 18.3 | 65 | 0.9987 | 43.3 | 110 | 0.9875 | 68.3 | 155 | 0.9762 |
| 18.9 | 66 | 0.9985 | 43.9 | 111 | 0.9872 | 68.9 | 156 | 0.9760 |
| 19.4 | 67 | 0.9982 | 44.4 | 112 | 0.9870 | 69.4 | 157 | 0.9757 |
| 20.0 | 68 | 0.9980 | 45.0 | 113 | 0.9867 | 70.0 | 158 | 0.9755 |
| 20.6 | 69 | 0.9977 | 45.6 | 114 | 0.9865 | 70.6 | 159 | 0.9752 |
| 21.1 | 70 | 0.9975 | 46.1 | 115 | 0.9862 | 71.1 | 160 | 0.9750 |

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# Tack Surface Preparation

- Clean the surface of all materials that prevent the tack from bonding to the existing surface
- Tack all layers
- Cover all tacked surface areas the same day

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# What happened here…?

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# What is the primary function of tack coat?

Add one more person to the crew

Add binder to the mix

Glue the layers together

We really don't need it

Show the location path that the trucks take back to the plant

# Cleaning the Existing Surface

# What could be better here…?

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# Apply Tack Coat

Does this look okay?

Typical Application

# Tack Coat Examples

Proper Coverage?

Anything wrong here?


Why use a tack coat?
When should a tack coat be used?

# Purpose of Tack Coat

- To improve bond
- To improve pavement performance

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# Effect of Poor Bonding on Service Life

| | |
|---|---|
| May & King (2004): | • 10% bond loss = 50% less fatigue life |
| Roffe & Chaignon (2002) | • No bond = 60% loss of life |
| Brown & Brunton (1984) | • No Bond = 75% loss of life<br>• 30% bond loss = 70% loss of life |

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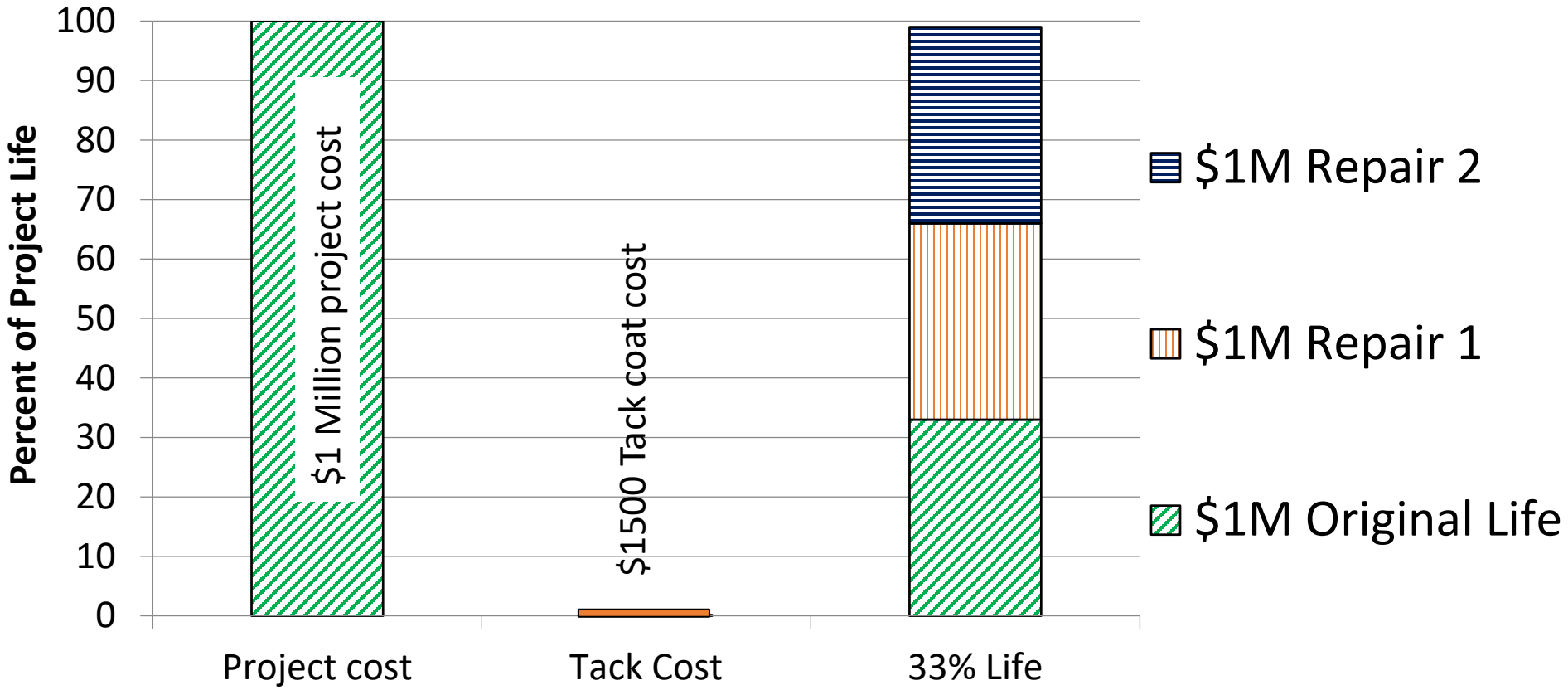
# What is the Risk?




$1500 now vs. $2 million later!

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# Best Practices for Tack Coat Application

- Clean and dry surfaces to be tacked
- Tack all surfaces (horizontal and vertical)
- Match application rate to conditions
- Obtain uniform application
- Verify application rate


SLOW

# Recommended Tack Application Range

| Surface Type | Residual Rate (gal/sy) | Appx. Bar Rate Undiluted* (gal/sy) | Appx. Bar Rate Diluted 1:1* (gal/sy) |
|---|---|---|---|
| New Asphalt | 0.02 – 0.04 | 0.03 – 0.06 | 0.06 – 0.13 |
| Existing Asphalt | 0.04 – 0.07 | 0.06 – 0.10 | 0.12 – 0.21 |
| Milled Surface | 0.04 – 0.08 | 0.06 – 0.12 | 0.12 – 0.24 |
| Portland Cement Concrete | 0.03 – 0.05 | 0.04 – 0.08 | 0.09 – 0.15 |

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

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# Effect of Dilution Ratio

| Dilution Ratio (Emulsion:Water) | Divide Total Volume Applied By: |
|---|---|
| **1:1** | 2 |
| **1:2** | 3 |
| **1:3** | 4 |

Account for original emulsion's water content to determine residual asphalt applied.

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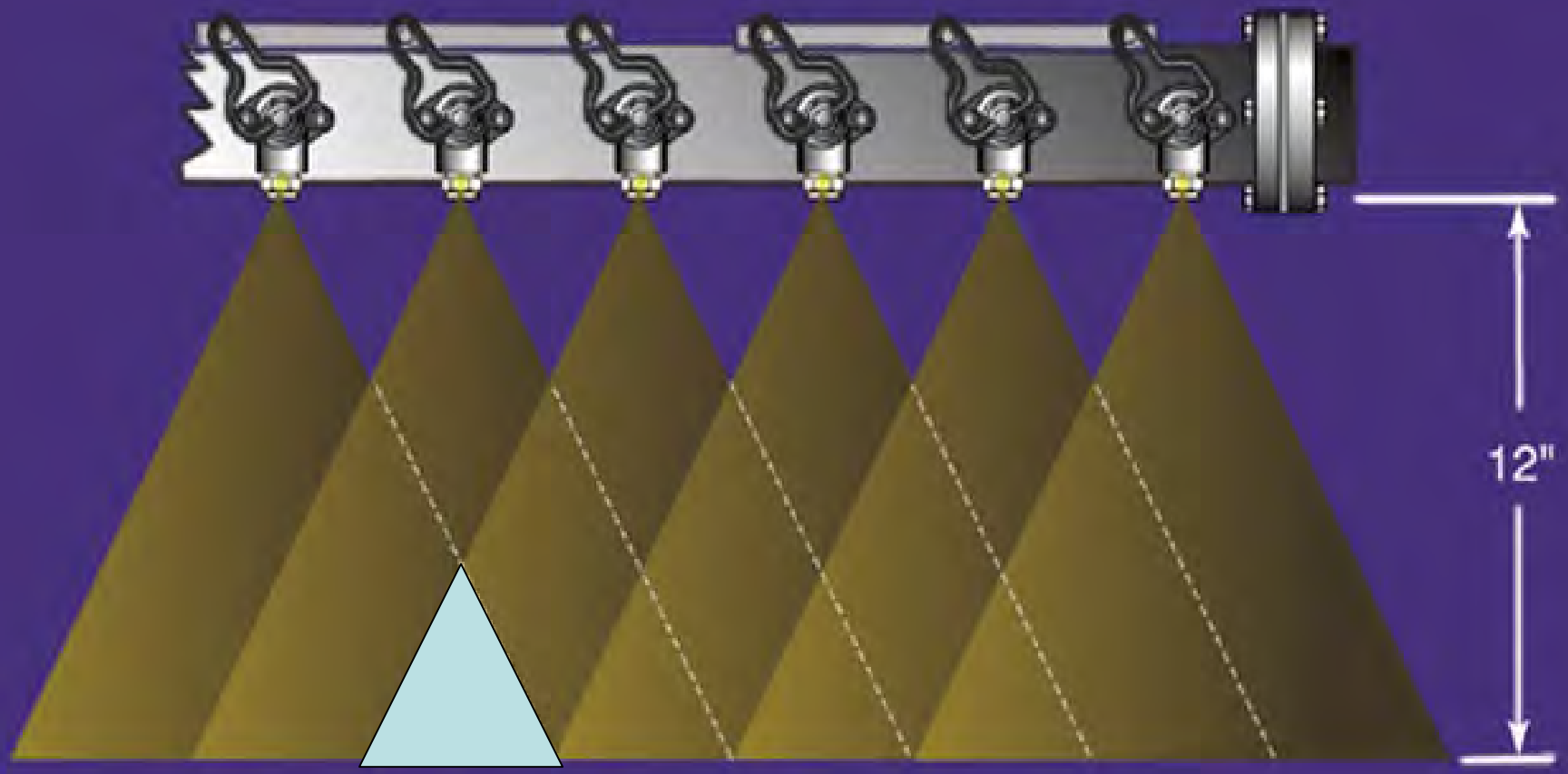
# Triple Lap Coverage



# Calculate Tack Spread Rate

1. Gallons applied = distributor quantity × distributor calibration factor
2. Undiluted gallons = gallons applied/dilution factor
3. Residual gallons = undiluted gallons × % residual
4. Gallons @ 60°F = residual gallons × temperature multiplier factor (M)
5. Distance = Absolute value of beginning station minus ending station
6. Width = Measured width of application
7. Square Yards = (length × width in feet)/(9sf/sy)
8. Rate = gallons at 60°F/square yards

# Learning Objectives

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# Questions