



## TACKCOAT

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MIDLAND ASPHALT MATERIALS INC.

# TOPICS

Introduction

Emulsion Basics

Chemistry

Manufacturing

Specifications and Emulsion Properties

Application

Troubleshooting

Questions

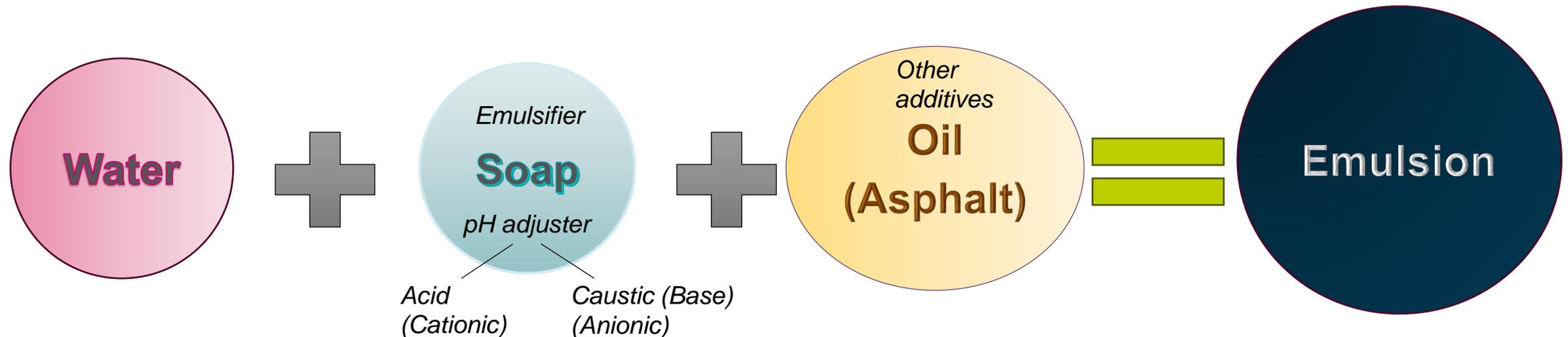




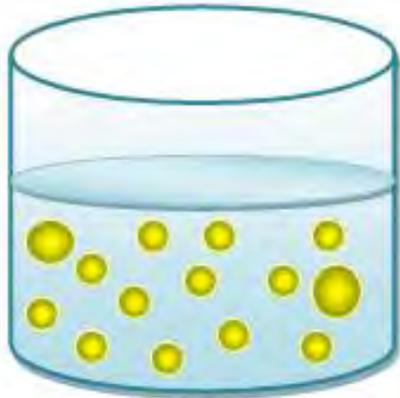
# EMULSION BASICS

# WHAT IS AN EMULSION?

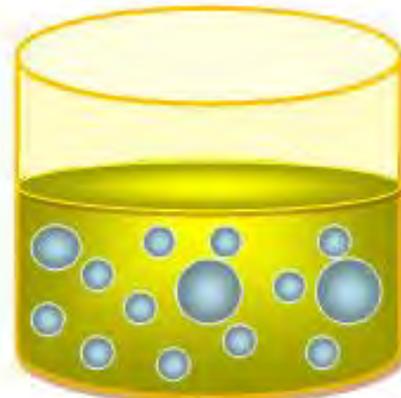
- An emulsion is two liquids that would not normally mix, come together BUT do not dissolve.
- One liquid acts as the “background” and the other liquid acts as little drops inside the background.



# TYPES OF EMULSIONS



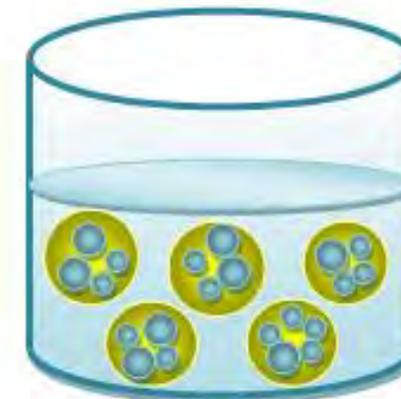
Oil-in-Water



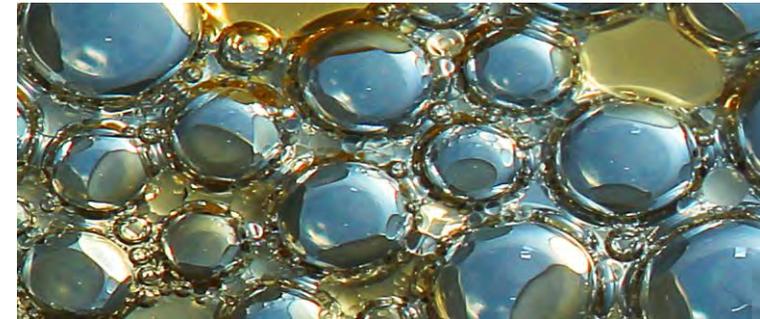
Water-in-Oil



Oil-in-Water-in-Oil

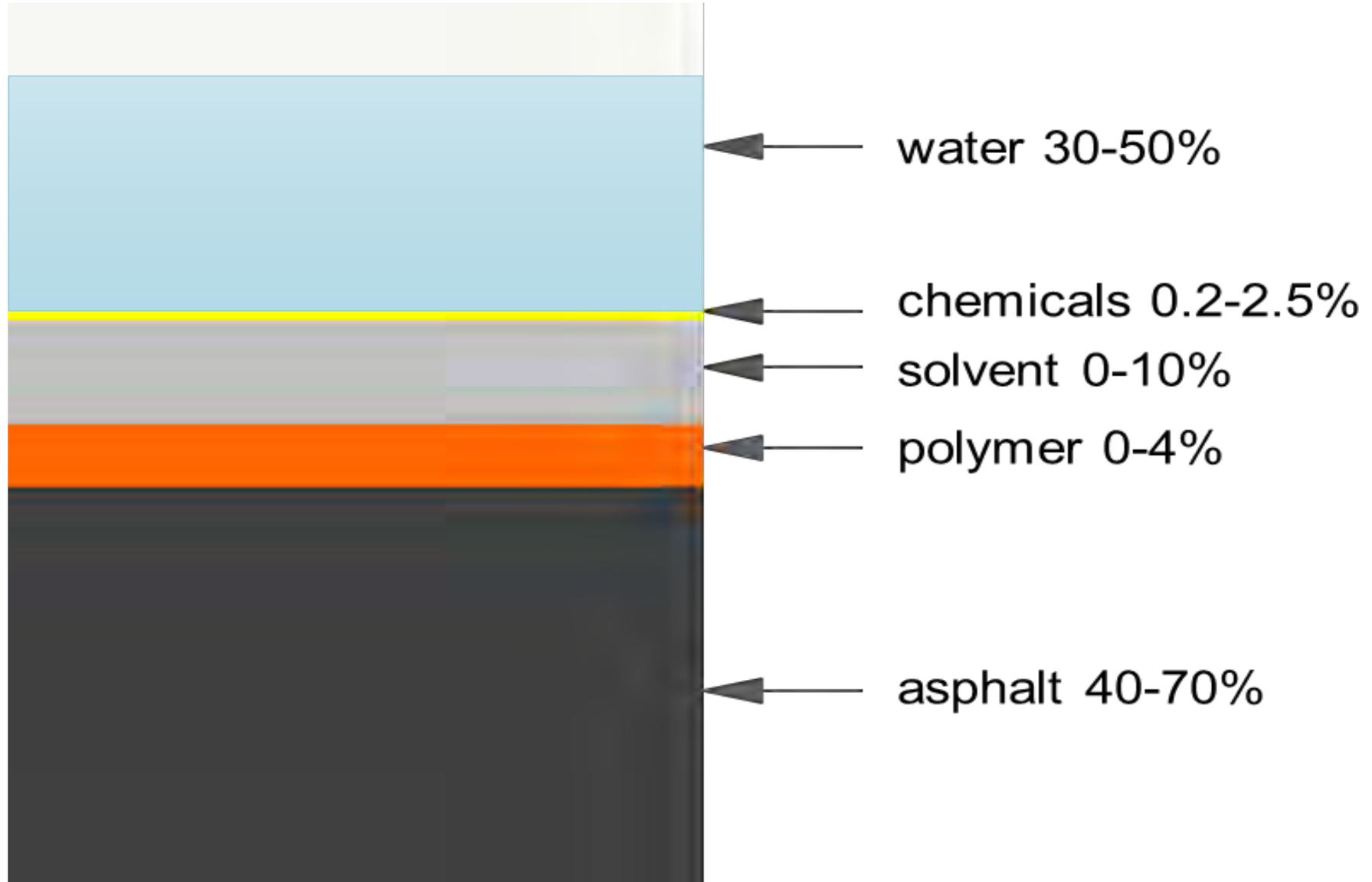


Water-in-Oil-in-Water



Asphalt Emulsion

# COMPONENTS OF ASPHALT EMULSION



# BREAKING AND CURING

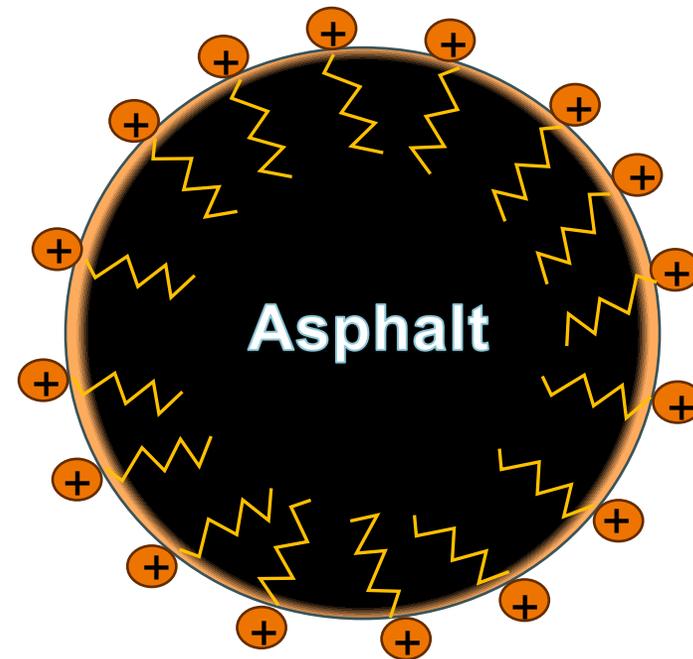
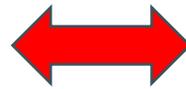
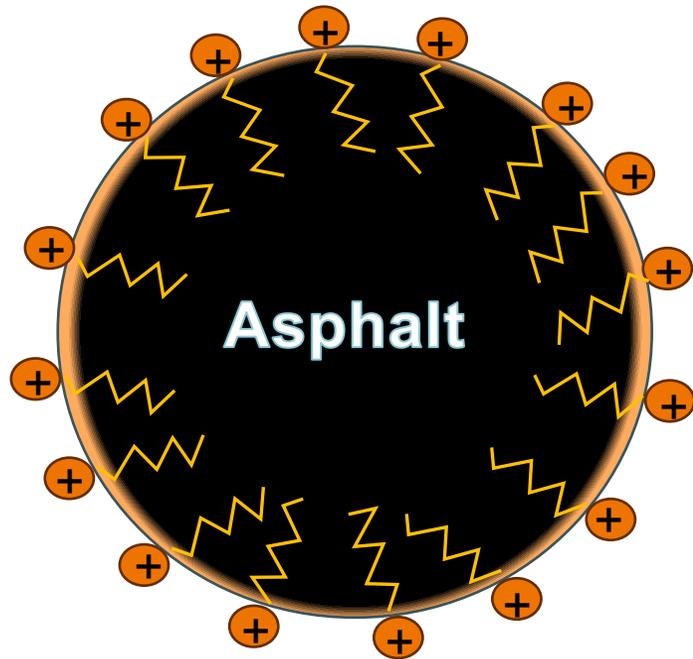
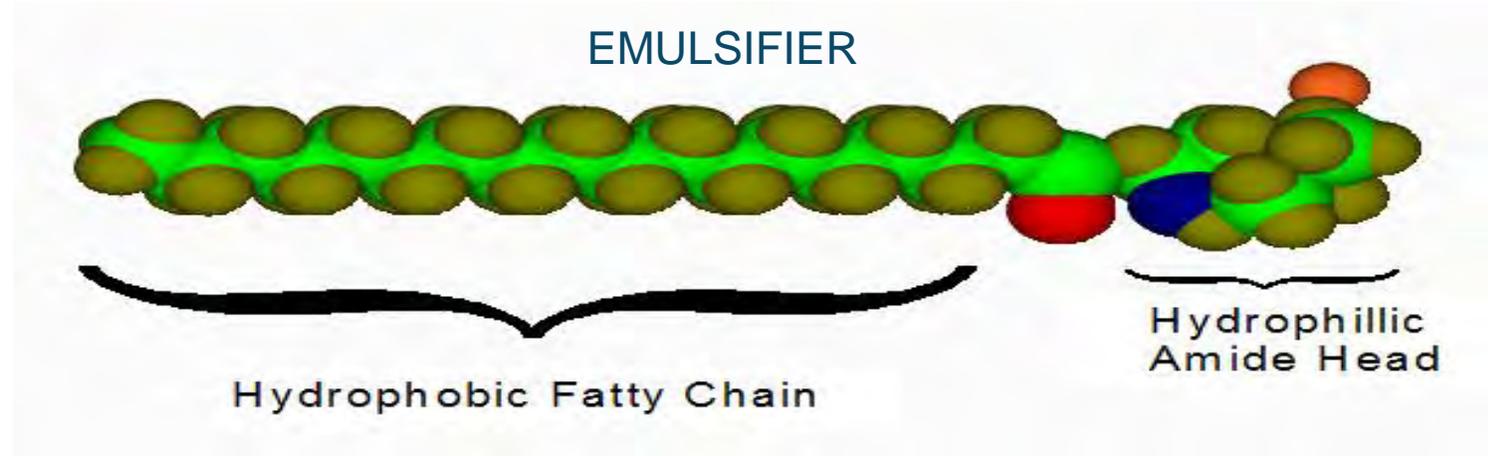
- **BREAKING** – WHEN WATER SEPARATES FROM THE ASPHALT AND EVAPORATES.
  - EMULSIONS ARE FORMULATED TO BREAK DEPENDING ON THEIR USE.
  - USUALLY APPEARS AS A BLACK SURFACE BUT STILL BROWN UNDERNEATH.
- **CURING** – WHEN WATER COMPLETELY EVAPORATES, AND THE ASPHALT IS LEFT.
  - APPEARS BLACK
  - CAN BE DRY AND STICKY





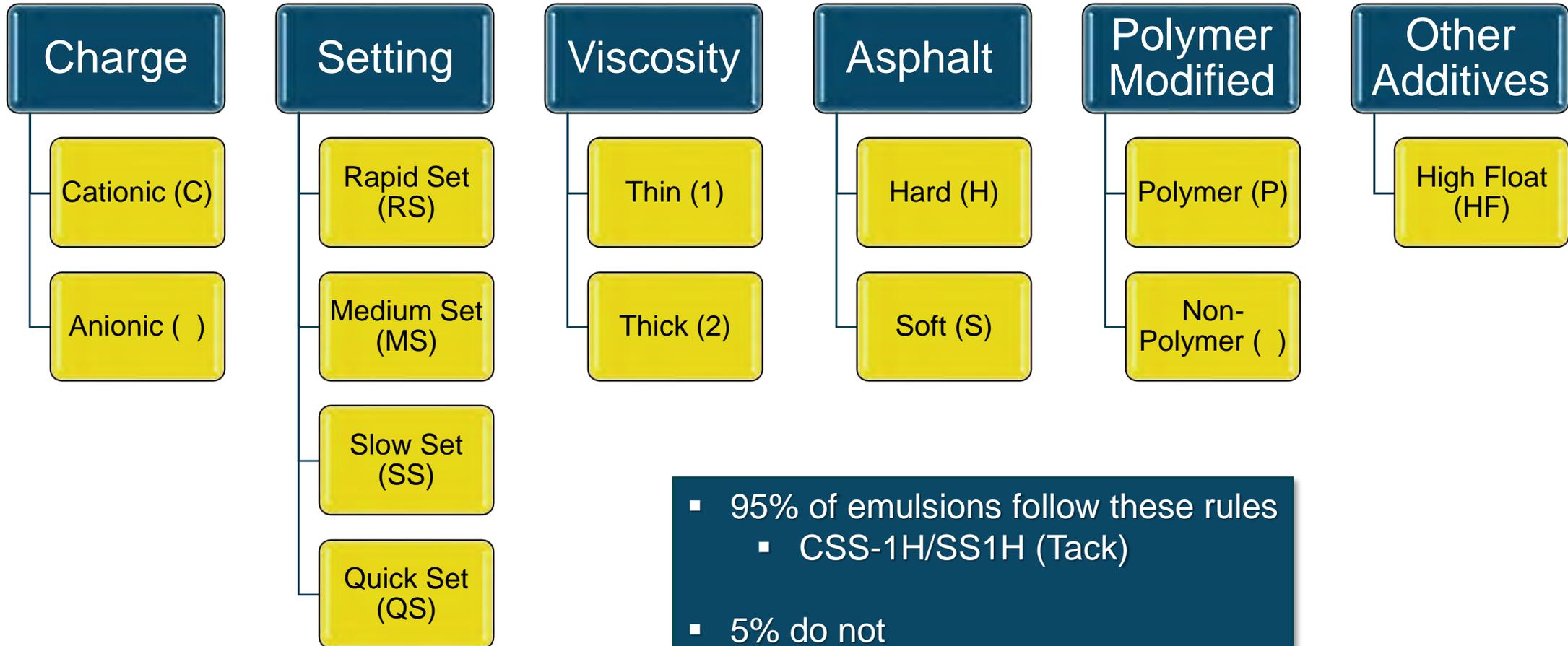
# CHEMISTRY

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Cationic = +  
Anionic = -

# CLASSIFYING EMULSIONS

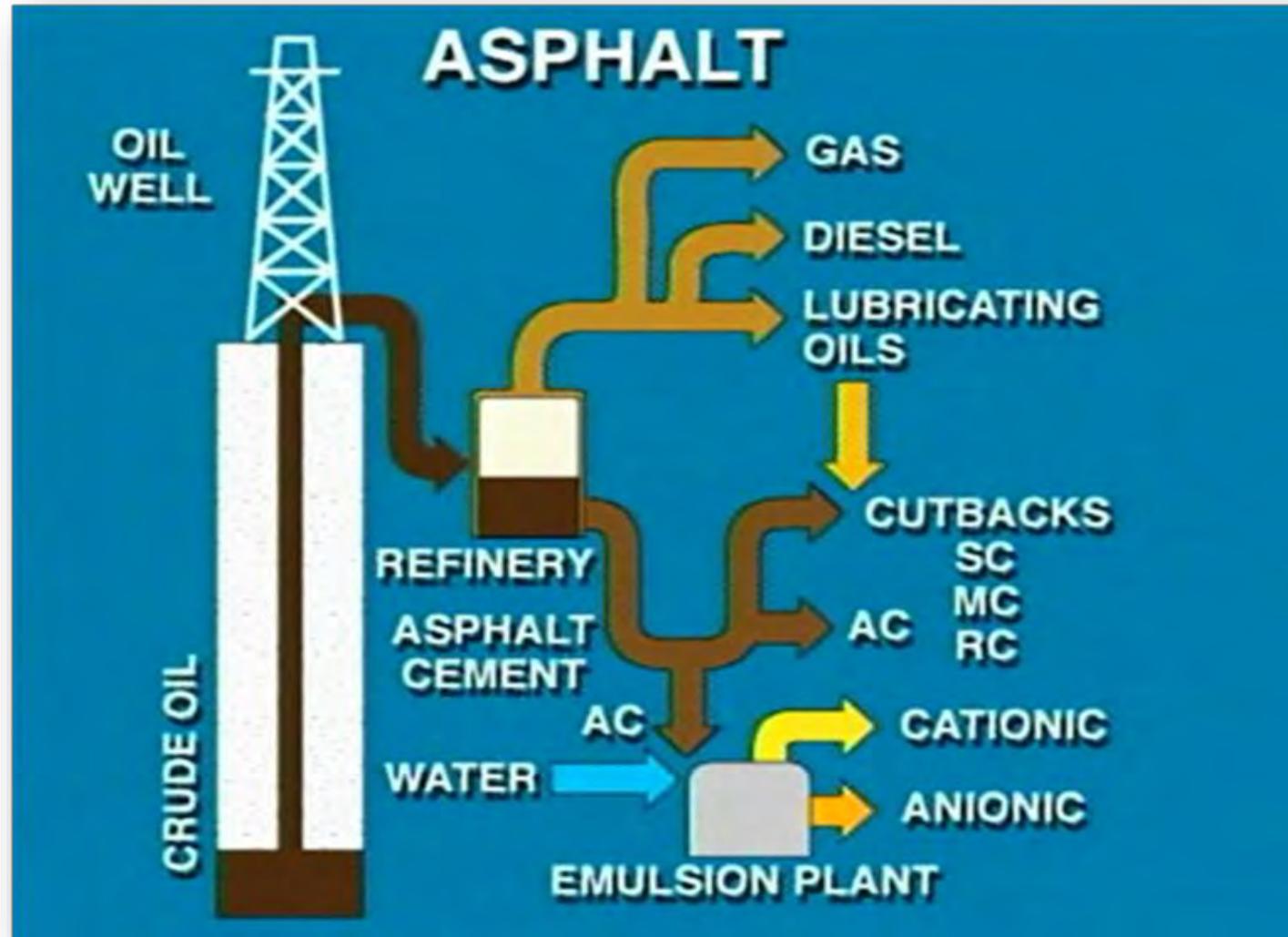


- 95% of emulsions follow these rules
  - CSS-1H/SS1H (Tack)
- 5% do not
  - CNTT/NTT (Trackless Tack)



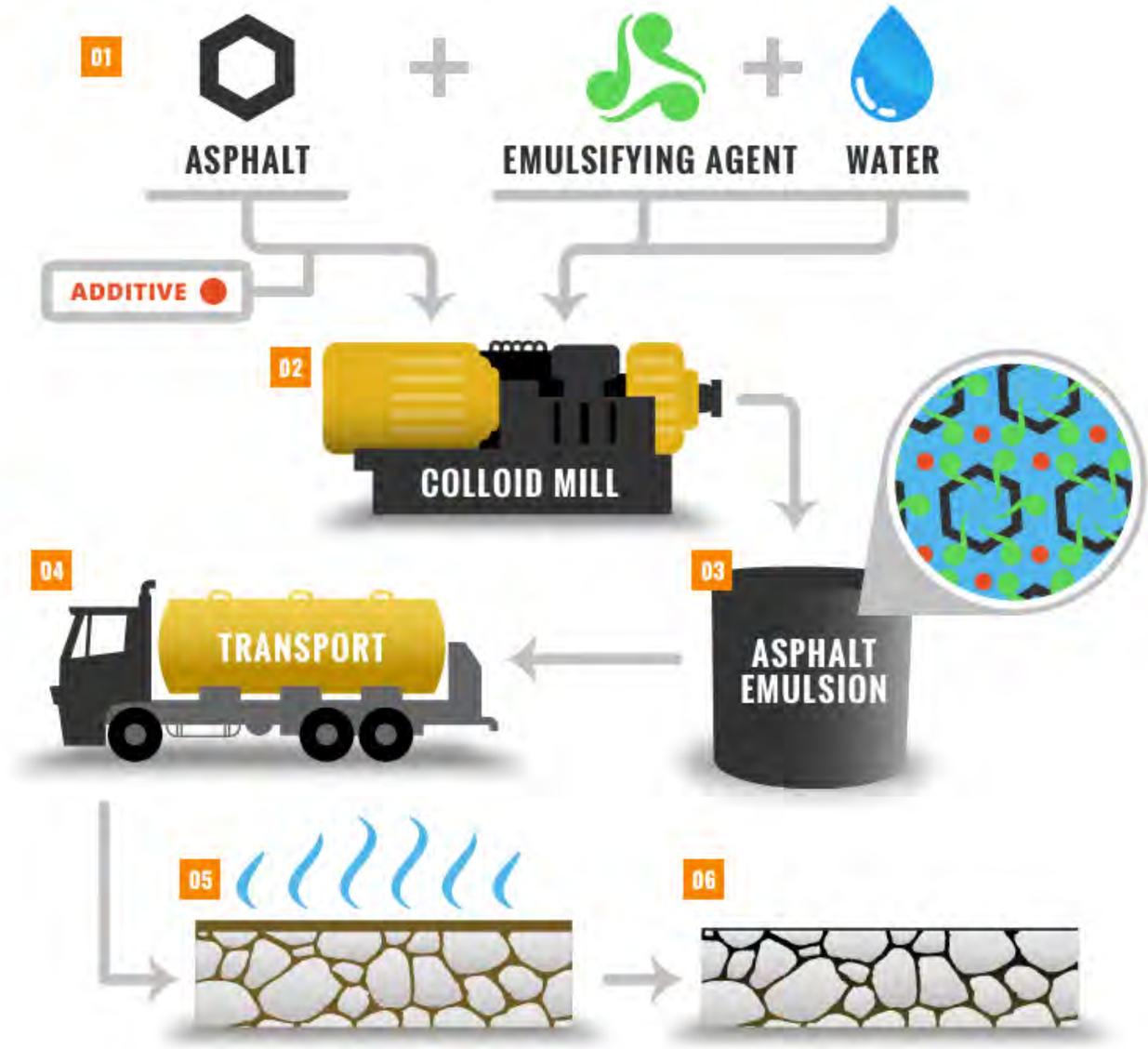
# MANUFACTURING

# HOW ASPHALT IS MADE

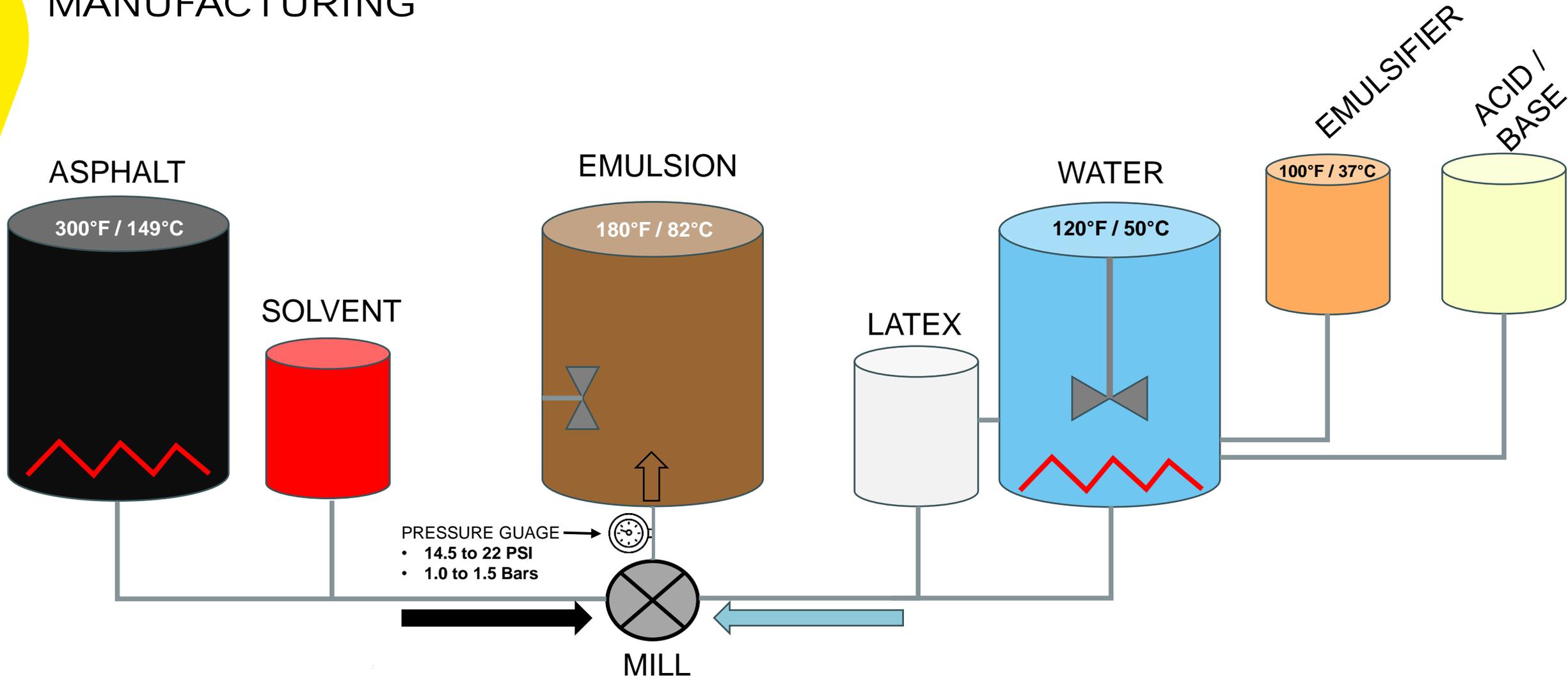


# LIFE OF AN EMULSION

- 01 FORMULATE
- 02 MILL
- 03 EMULSIFY
- 04 TRANSPORT/APPLY
- 05 BREAK
- 06 CURE



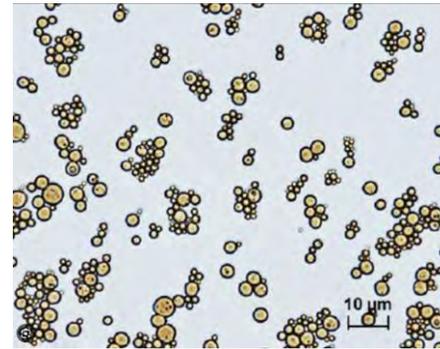
# MANUFACTURING



# THE MILL



1 mm = 1000  $\mu$   
Hair  $\approx$  50 - 70  $\mu$   
Asphalt droplet  $\approx$  5 - 7  $\mu$





# SPECIFICATIONS & EMULSION PROPERTIES



# TYPES OF TACK COAT

PennDOT Types:

- CSS-1H/SS-1h
- CNTT/NTT

Test	CSS-1h/SS-1h	CNTT/NTT
Asphalt Residue	57+	50+
Sieve %	0.1	0.1
Viscosity	20 - 100	0 - 100
Penetration	40 - 90	10 - 60

- CSS-1h/SS-h

- Pro: More asphalt to bond to surface.
- Con: More prone to tracking:
  - Higher asphalt content
  - Softer (higher penetration and lower softening point)

- CNTT/NTT

- Pro: Less tracking:
  - Lower asphalt content
  - Harder (lower penetration and higher softening point)
- Con: More prone to settlement during storage.

# EMULSION PROPERTIES

Emulsion Properties		ASPHALT BINDER	VISCOSITY	SIEVE	BREAK TIME	PENETRATION
ASPHALT	HIGH	Increases	Increases	x	Decreases	Base Asphalt Dependent
	LOW	Decreases	Decreases		Increases	
ACID/BASE	HIGH	x	x	More Stable (Decrease)	Increases	x
	LOW			Less Stable (Increase)	Decreases	
EMULSIFIER	HIGH	x	Type of Emulsifier Used	More Stable (Decrease)	Increases	x
	LOW			Less Stable (Increase)	Decrease	
FUEL	HIGH	Decreases	Decreases	x	Increases	Increases
	LOW	Increases	Increases		Decreases	Decreases
DILUTION	HIGH	Decreases	Decreases	Increase Chance of	Depends on Emulsion	x
	LOW	Increases	Increases			
OTHER ADDITIVES		Antistrip	Some Increase/ Some Decrease	Some Enhance Stability	Some Decrease	Increase or Decrease
MANUFACTURING (MECHANICAL PROCESS)		x	Soap Temp, Asphalt Temp, Pressure	Soap Temp, Asphalt Temp, Pressure	Soap Temp, Asphalt Temp, Pressure	x





# APPLICATION

# TACK COAT DISTRIBUTOR

## Prior to Shooting

- Truck Calibrated?
- Burners Functioning?
- Driver Trained?
- Temperature Probe Accurate?
- Tank Gauge Accurate?
- Spray Bar Inspection?
- Spray Nozzle Inspection?
- Check Numbers:
  - Application Rate
  - FPM (feet/minute)
  - GPM (gallon/minute)



# DOS AND DON'TS

## DO

- Check Weather
- Ensure Surface is Clean and Dry
- Emulsion is Above 140°F and Maintained
- Emulsion is Circulated at 50 GPM maximum
- Warm Spray Bar
- Use Strainer Cone/Basket
- Maintain Constant Speed
- Spray Test Patch and Visually Check Coverage

## DO NOT

- Spray in Rain or if Rain is Imminent
- Pump Emulsion less than 130°F
- Heat if Emulsion is Below Temperature Probe
- Dilute
- Drive Over Before Cured
- Store For Long Periods Of Time

**REMEMBER:** Changes in temperature, humidity and wind will affect how the emulsion performs.



# APPLICATION RATE

Application rate can be calculated by knowing:

- Feet Per Minute (FPM) the truck is moving
- Gallons Per Minute (GPM) the pump is pumping.
- Area (Square Yards) that is to be covered.



# NOZZLES

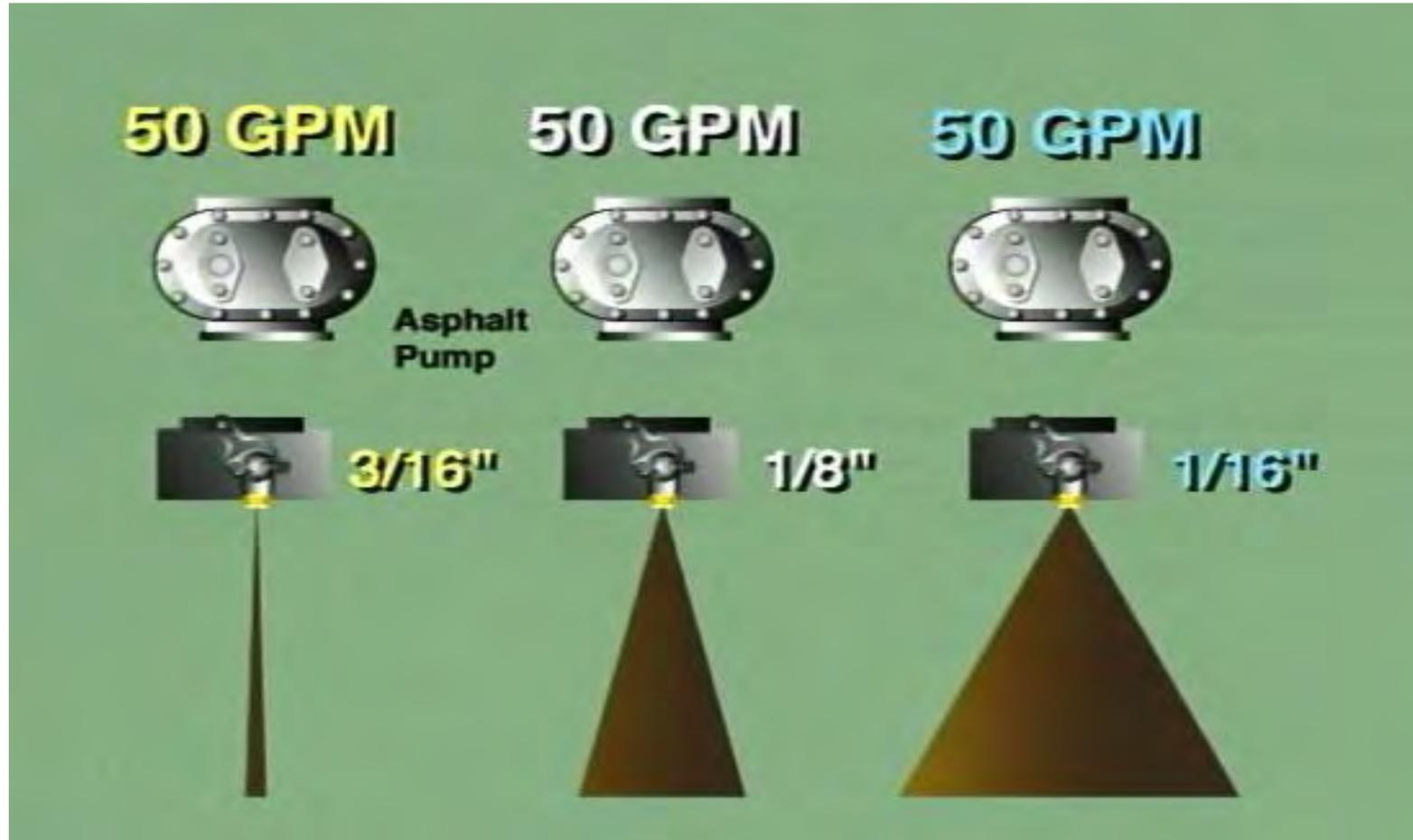


Ref.	Part No.	Description	Application (per square yard)	Application (Metric) Liters per square meter	Flow Gallons per minute per foot
1	3353788	V Slot Tack Nozzle	0.05 - 0.20	0.19 - 0.75	3.0 to 4.5
2	3351008	S36-4 V Slot	0.10 - 0.35	0.38 - 1.30	4.0 to 7.5
3	3351009	S36-5 V Slot	0.18 - 0.45		7.0 to 10.0
4	3352368	Multi-Material V Slot	0.15 - 0.40	0.57 - 1.50	6.0 to 9.0
5	3351015	3/32-inch Coin Slot	0.15 - 0.40	0.57 - 1.50	6.0 to 9.0
6	3352204*	Multi-Material V Slot	0.35 - 0.95	1.30 - 3.60	12.0 to 21.0
7	3352205*	Multi-Material V Slot	0.20 - 0.55	0.75 - 2.08	7.5 to 12.0
8	3352210	End Nozzle	0.20 - 0.55	0.75 - 2.08	7.5 to 12.0
9	3351014	3/16-inch Coin Slot	0.35 - 0.95	1.30 - 3.60	12.0 to 21.0
10	3351010	1/4-inch" Coin Slot	0.40 - 1.10	1.50 - 4.16	15.0 to 24.0

\* Recommended nozzles for chip seal when using emulsified asphalt

**Nozzle sizing and application rates can help us avoid situations of applying emulsion too heavy/light.**

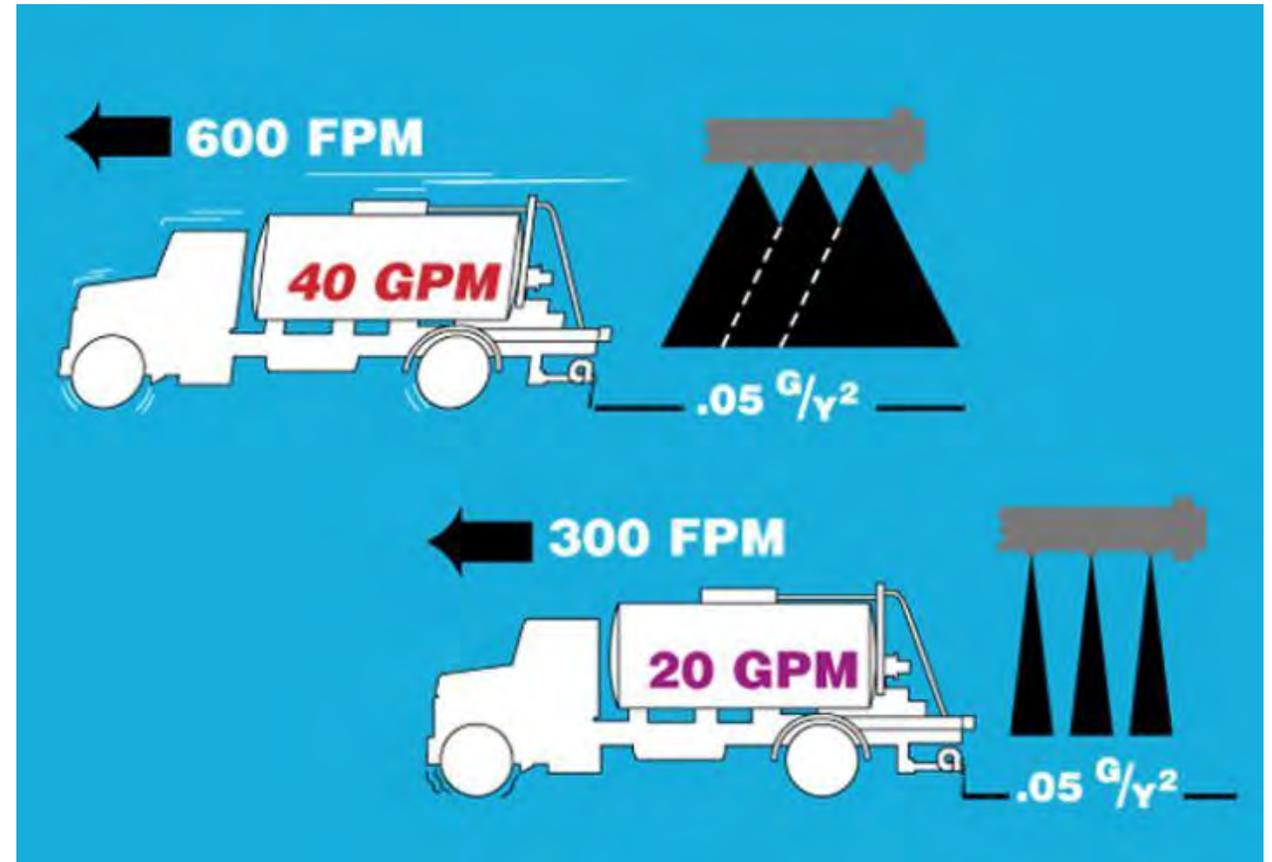
# NOZZLE COMPARISON



Different spray patterns will be observed with different nozzle sizes, even if the speed and pumping rates remain the same.

# TACK COAT COVERAGE

- Decreasing speed and pumping rate will decrease bar pressure and will effect coverage.
- Nozzle size would need to be changed to a smaller size for a slower speed.



# TACK COAT COVERAGE



**GOLD STANDARD**

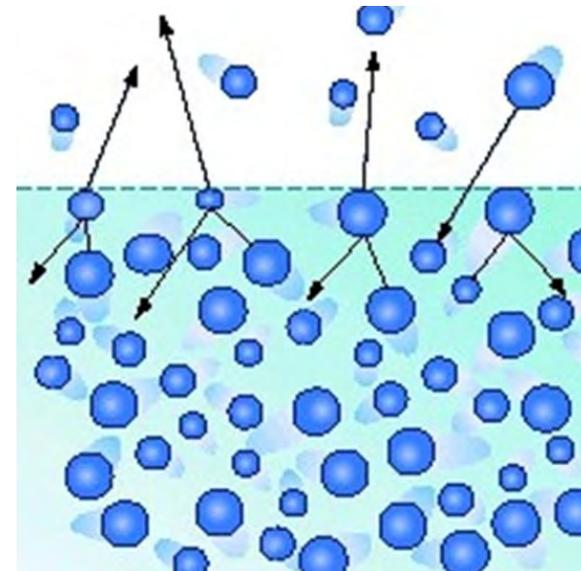


# TROUBLESHOOTING



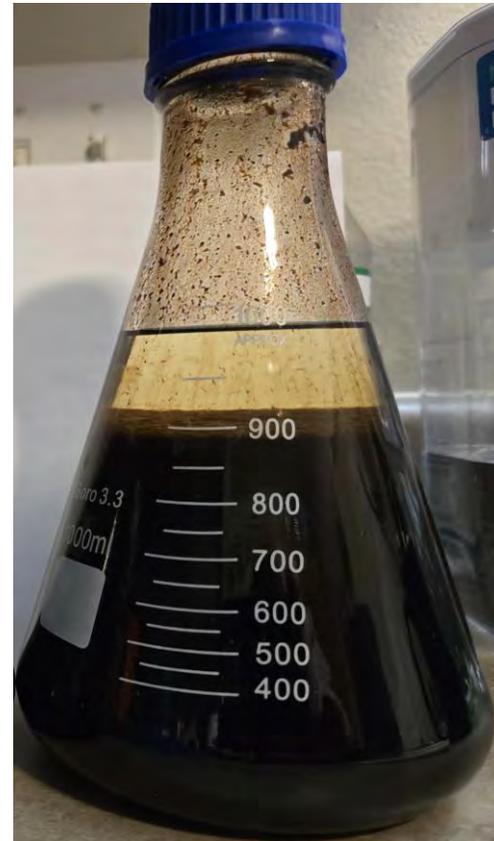
# POTENTIAL EMULSION ISSUES

- Contamination
  - Fuel
    - Used when cleaning bars and can inadvertently get pumped back into distributor tank.
    - Softens asphalt
    - Can interfere with bonding
  - More than 1 emulsion
    - Can change hardness
    - Changes how emulsion bonds
  - Wrong charge emulsions combined
    - Cationic + Anionic = Gummy Mess
- Overheating
  - Drives off Water
    - Causes breaking = Sieve
    - Sieve will plug up nozzles



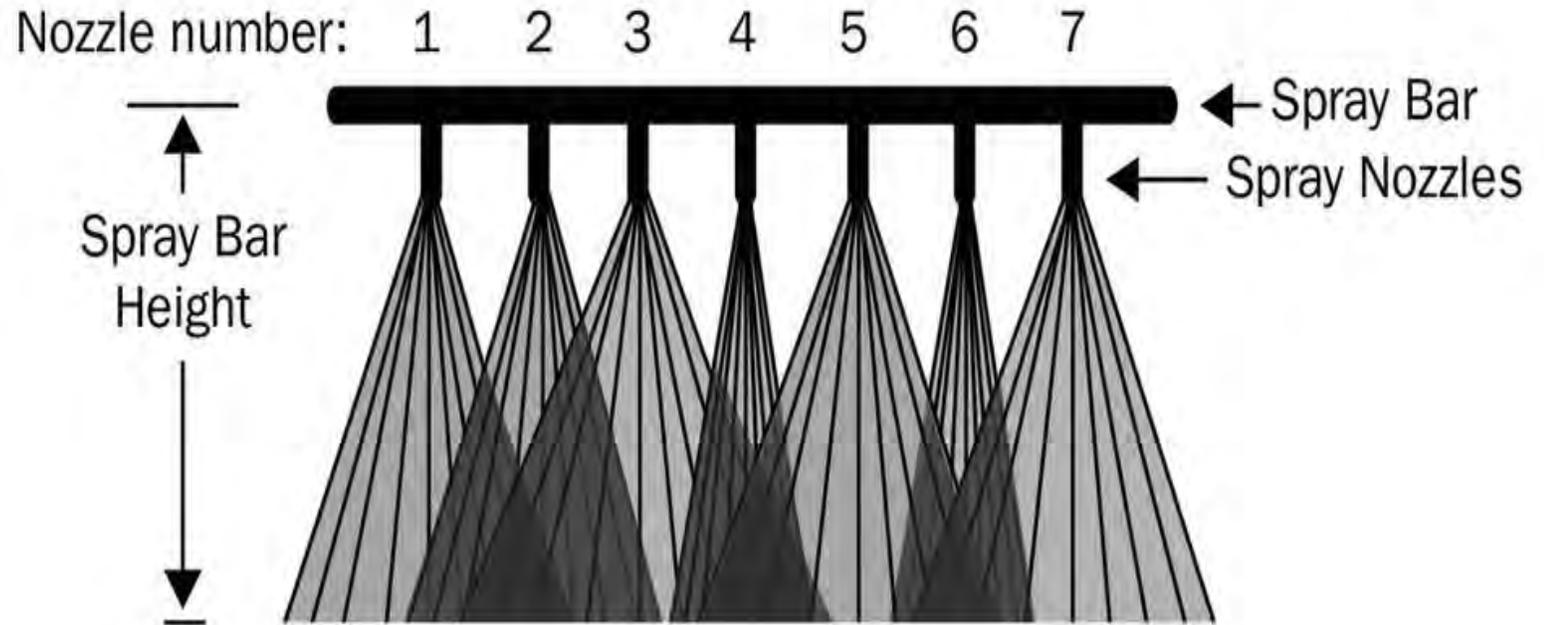
# POTENTIAL EMULSION ISSUES

- Over pumping
  - Can cause emulsion to break
  - Can cause a decrease in viscosity
- Under mixing
  - Can cause separation (Italian dressing)
  - Separation leads to application issues



# NOZZLES

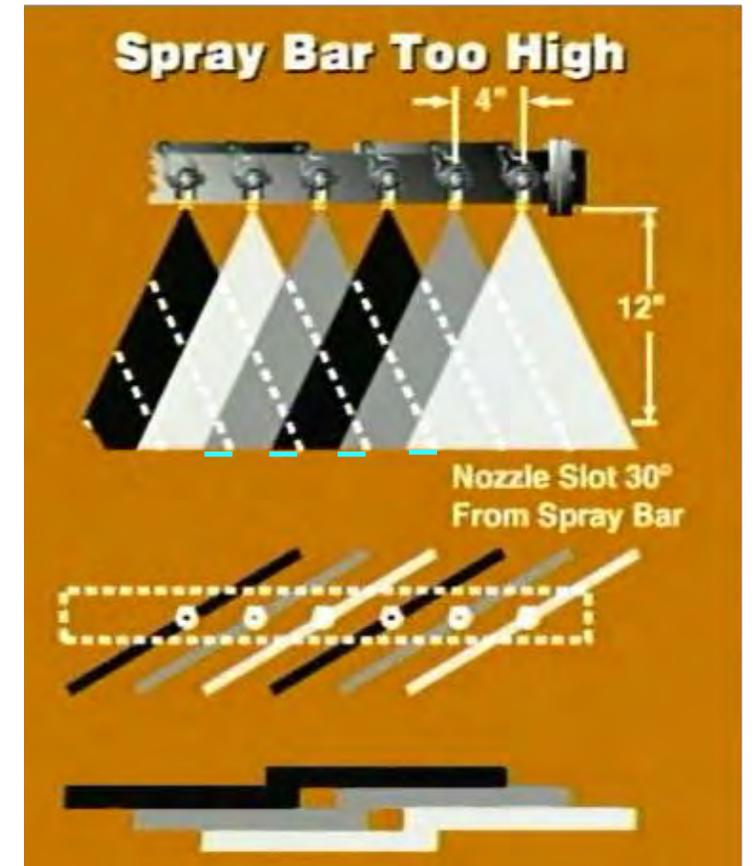
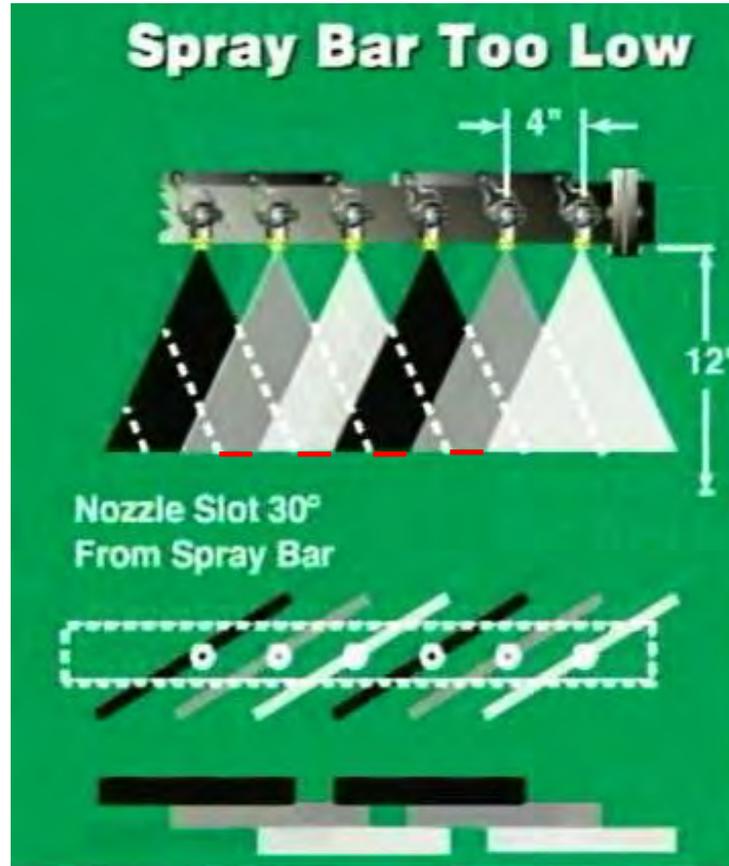
- Clogged nozzles leads to a non-uniform spray pattern and uneven coating.
- Even one clogged nozzle can affect the rest.
- Coverage is KEY
  - Overlap onto joints is a best practice.



# BAR HEIGHT

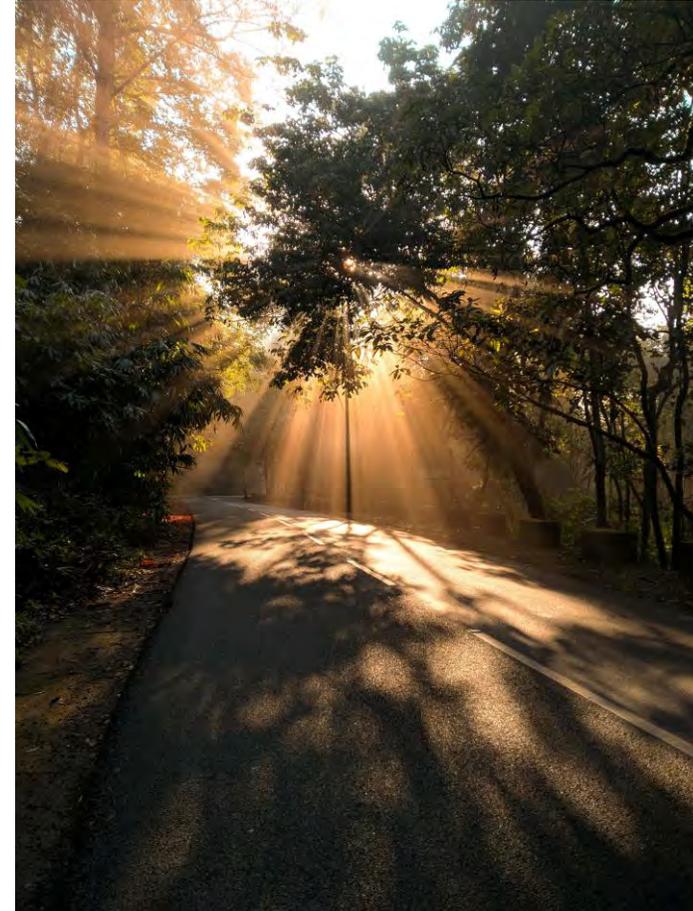
## TARGET: TRIPLE OVERLAP

- Bar Too Low
  - Causes areas of only **double** overlap.
- Bar Too High
  - Causes areas of **quadruple** overlap and uneven pattern.
- Areas will be left with either too much or too little emulsion.
  - Affects break time and bonding.



# FIELD

- Weather – Can cause increase in break time
  - High Humidity
  - Low Temperature (Early AM/Late PM)
  - Lack of Wind
  - Clouds/shading
  - Rain or Dew
- Landscape – Can cause issues with break time
  - Tree Coverage
  - Leaves dropping
  - Agriculture – debris
  - Wind blown debris after tacking



# FIELD

- Surface
  - Dirty/dusty surface area
    - Dust/dirt particles will adhere to the tack preventing the tack to bond with surface of road.
  - Oil and other contaminants, layers can create a barrier for the tack to not adhere to the surface.
  - Concrete milled surface
    - Can be dustier and harder to clean



# APPLICATION ISSUES & PERFORMANCE FAILURES

ISSUE	CAUSES	REASONS	SOLUTIONS
<p><b>Light, streaked, non-uniform application</b></p>	<ul style="list-style-type: none"> <li>• Application rate too low</li> <li>• Emulsion was diluted with water</li> </ul>	<ul style="list-style-type: none"> <li>• Not calibrated</li> <li>• Confusion of emulsion application rate VS residual asphalt rate.</li> <li>• Not correct application rate for surface texture</li> <li>• To reduce tracking</li> <li>• To reduce cure time</li> </ul>	<ul style="list-style-type: none"> <li>• Calibrate truck</li> <li>• Training</li> <li>• Different operation (spray paver, MTV)</li> <li>• Different emulsion (non-tracking)</li> <li>• Inspection/oversight</li> </ul>
	<ul style="list-style-type: none"> <li>• Truck speed, pump speed not sufficient</li> <li>• Nozzles – incorrect size, clogged</li> <li>• Strainers clogged</li> </ul>	<ul style="list-style-type: none"> <li>• Insufficient training</li> <li>• Truck set up for different emulsion</li> <li>• Start up (older trucks)</li> <li>• Road conditions- hills, intersections, approaches</li> </ul>	<ul style="list-style-type: none"> <li>• Job site calibration</li> <li>• Flush truck, clean nozzles &amp; strainer</li> <li>• Inspections</li> <li>• Project planning to reduce slowdowns and ensure sufficient coverage beyond joints (Transverse/Longitudinal)</li> </ul>

# APPLICATION ISSUES & PERFORMANCE FAILURES

ISSUE	CAUSES	REASONS	SOLUTIONS
<b>Hand Application (wand/other)</b>	<ul style="list-style-type: none"> <li>• Transitions</li> <li>• Obstructions</li> </ul>	<ul style="list-style-type: none"> <li>• Ease of application</li> <li>• Time saving</li> </ul>	<ul style="list-style-type: none"> <li>• Preparation of area.</li> <li>• cover surfaces not to be sprayed.</li> <li>• Start and end paper transitions.</li> </ul>
<b>Tracking</b>	<ul style="list-style-type: none"> <li>• Traffic on Emulsion before cured</li> <li>• Emulsion is Tacky/Sticky</li> </ul>	<ul style="list-style-type: none"> <li>• Timing</li> <li>• Emulsion is breaking too slow (emulsion type, application rate, weather/landscape)</li> <li>• Emulsion is too soft</li> <li>• Ambient/surface temperatures too hot</li> </ul>	<ul style="list-style-type: none"> <li>• Different operation (spray paver, MTV)</li> <li>• Different tack (trackless)</li> <li>• Allow more time for cure</li> <li>• Cooling/release agent for tires driving over tack.</li> </ul>
	<ul style="list-style-type: none"> <li>• Insufficient bonding to surface</li> </ul>	<ul style="list-style-type: none"> <li>• Surface prior to tacking was dirty/contaminated</li> <li>• Surface prior to tacking too wet, or cold</li> </ul>	<ul style="list-style-type: none"> <li>• Better cleaning prior to tacking</li> <li>• Planning to avoid adverse conditions.</li> </ul>



# APPLICATION ISSUES & PERFORMANCE FAILURES

ISSUE	CAUSES	REASONS	SOLUTIONS
<b>Concrete milled surface bonding issues</b>	<ul style="list-style-type: none"> <li>Milling concrete creates too much dust</li> </ul>		<ul style="list-style-type: none"> <li>Brooming with water (wet surface) can help.</li> <li>Special emulsions can be used to adhere to concrete surfaces better.</li> </ul>
<b>Slippage-Cracks, movement of top layer</b>  <b>Delamination</b>  <b>Pavement Structure Failures (Fatigue cracking, deflection)</b>	<ul style="list-style-type: none"> <li>Inadequate bonding</li> <li>Issues with surface bonding to. (leveling/scratch course)</li> <li>Improper bonding</li> <li>Issues with the structure bonded too (weak, spalling, green scratch course)</li> </ul>	<ul style="list-style-type: none"> <li>Insufficient tack application</li> <li>Surface not prepared adequately prior to tack placement.</li> <li>Not realizing tack is needed. (on stabilized bases)</li> <li>Insufficient tack application / tracking off</li> </ul>	<ul style="list-style-type: none"> <li>Ensure proper tack application and curing</li> <li>Inspection</li> <li>Ensure solid base layer bonding to</li> <li>Sufficiently clean surface</li> </ul>



QUESTIONS?

THANK YOU!

