

Challenges of Tack Coat

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What is tack coat and why use it?

Tack coat ensures a **bond** between the new surface being placed and the underlying course.



Unlike this...



What is tack coat?

- Tack coat is typically an emulsified asphalt, but could be a PG binder as well.
- Emulsified asphalts can be anionic, cationic, or non-ionic and are classified by their set speed – RS (rapid set), MS (medium set), or SS (slow set).
- At WSDOT, CSS-1, CSS-1h or a STE-1 is used for tack coat. Have used a PG grade binder in certain situations.



Challenges of tack coat?

- When do I need to use tack?
- How much tack is needed?
- Do I dilute it or not?
- How do I calculate the application rate?
- How long do I have to wait before paving?
- How do I keep tack off the tires and equipment?
- What type of material do I use?
- What about the underlying pavement – does it have to be dry? Clean?
- Can I pave right after tack is placed or do I need to wait? How long?
- Does the tack need to cover the entire lane I'm paving?



NCHRP 9-40

Optimization of Tack Coat for HMA Placement – Report 712

- Goals:
 - Develop a procedure to evaluate the tack coat quality in the field
 - Testing for the bonding characteristics
- Objectives:
 - Determine optimum application methods and rates
 - Equipment type and calibration procedures
 - Asphalt binder materials

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Test Matrix

Variable	Content
Tack Coat Material	CRS-1, SS-1h, SS-1, PG64-22, Trackless
Residual Application Rate (gal/sy)	0.00, 0.031, 0.062, 0.155
Pavement Surface	New, Old, Milled HMA and PCCP
Surface Coverage	50%, 100%
Surface Condition	Clean, Dirty
Wet/Dry Condition	Wet, Dry
Specimen Preparation Method	LL, PF
Testing Temperature	25C
Testing Confinement Pressure	0, 20 psi



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Effect of Clean/Dirty Pavement

- The shear strength for the **clean and dry** pavement was significantly **greater** than the **dirty and dry** pavement.



Recommended Application Rates

Surface Type	Residual Application Rate (gal/sy)
New Asphalt	0.035
Old Asphalt	0.055
Milled Asphalt	0.055
Portland Cement Concrete	0.046



What type of material do I use for tack?

- At WSDOT, CSS-1, CSS-1h or a STE-1 is used for tack coat.
- Have used a PG grade of binder in certain situations.



What product is best for MY project?

- There may be certain conditions that require an agency to spec a certain type of tack coat.
- In general, let the Contractor decide which product to use.
- An agency should be more concerned about correct application.





When do I need to use tack?

- Everytime!
- Between each layer of pavement.
- At vertical faces.
- Cheap insurance to ensure bond between layers.





How much tack is needed?

- Typically use an application rate, but the residual rate is the critical factor.

Surface Type	Residual Application Rate (gal/sy)
New Asphalt	0.035
Old Asphalt	0.055
Milled Asphalt	0.055
Portland Cement Concrete	0.046

How much tack is needed?



Not enough... ↗

↘ Too much...



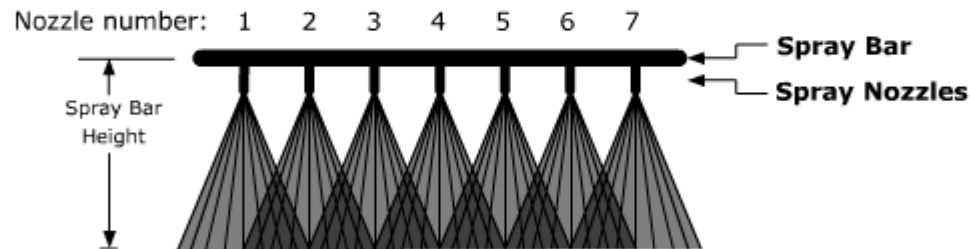
How much tack is needed?



How much tack is needed?

Select Spray Bar - Nozzle View

- Good Coverage - double lap
- Good Coverage - triple lap
- Poor Coverage - spray bar too low
- Poor Coverage - spray bar too high
- Poor Coverage - poor nozzle spray pattern
- Poor Coverage - clogged nozzles



Good coverage - double lap

Except for the outside nozzles, each point on the pavement surface is covered by exactly two spray nozzles - a double lap. Usually at least a double lap is needed to meet specified application rates.

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How do I calculate the application rate?

- Emulsions are about 2/3 asphalt and 1/3 water.
 - *CSS-1 minimum asphalt content is 57%.*
- Generally, this is a decent ratio to calculate the application rate from the residual you want on the pavement.
- Based on this ratio of a *non-diluted emulsion*, the required application rate will be 1.5 times greater than the residual.

Application rate = 1.5 x Desired Residual Rate

How do I calculate the application rate?

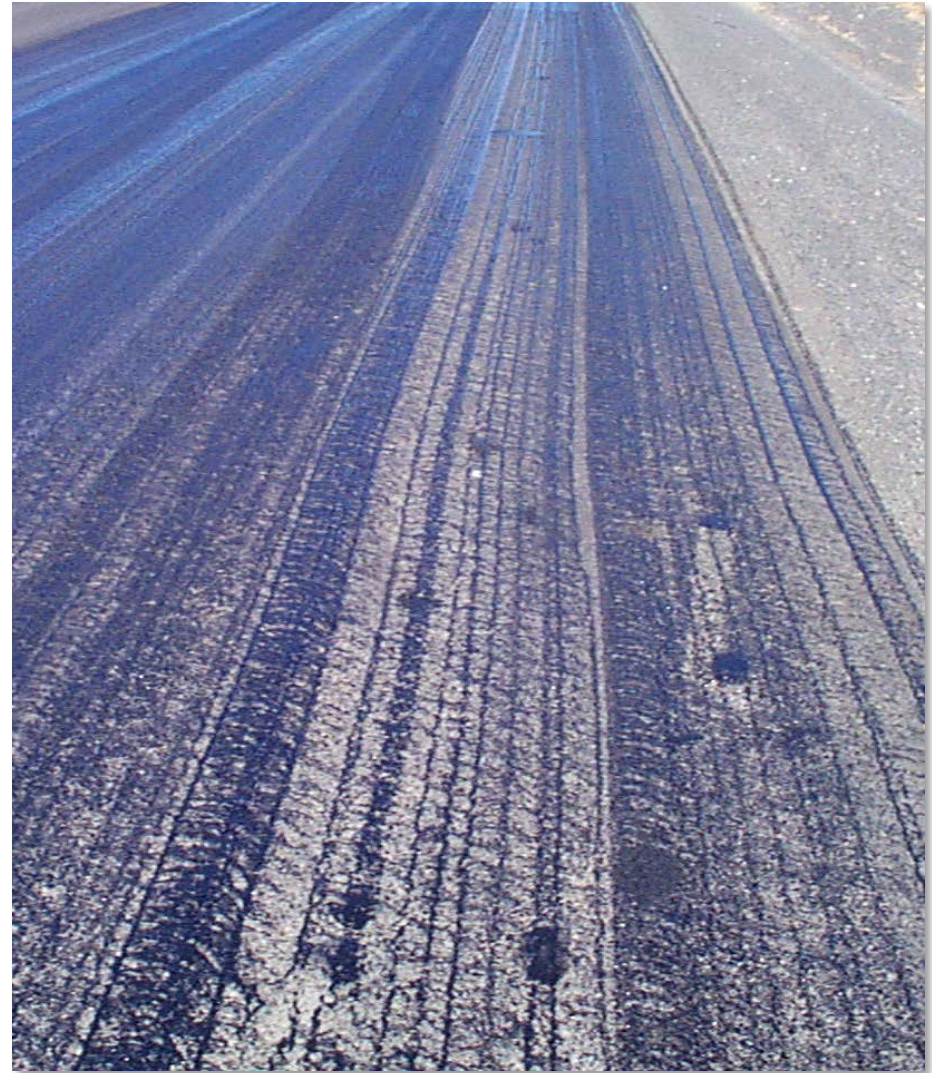
Application rate = 1.5 x Desired Residual Rate

- If placing on a existing or milled asphalt pavement, the recommended residual rate is 0.055 gal/sy.

$1.50 \times 0.055 \text{ gal/sy} = 0.083 \text{ gal/sy application rate}$

Should the emulsion be diluted?

- That depends...
- Diluted emulsions can provide better coverage
- Undiluted emulsions will break and set/cure faster
- Remember: never dilute a STE-1, Trackless tack, or PG binder



How is an emulsion diluted?

- To dilute an emulsion, water is ALWAYS added to emulsion, not the other way around.
- Best if it is warm water.
- Always make sure you know how much water is being added so that you can correctly calculate the application rate.
- Never dilute a STE-1, Trackless tack, or PG asphalt.

Application rate for a diluted emulsion?

- Common dilution rate is 1:1 emulsion:water.
 - This means 50% emulsion (which already has about 1/3 water) and 50% water.
- Based on this ratio of a diluted emulsion, the required application rate will be 3 times greater than the residual.

Application rate = 3.0 x Desired Residual Rate



Application rate for a diluted emulsion?

Application rate = 3.0 x Desired Residual Rate

- If placing on a existing asphalt pavement, the recommended residual rate is still 0.055 gal/sy.

**3.0 x 0.055gal/sy = 0.165 gal/sy application rate
for a 1:1 diluted emulsion**

How clean does my pavement have to be?

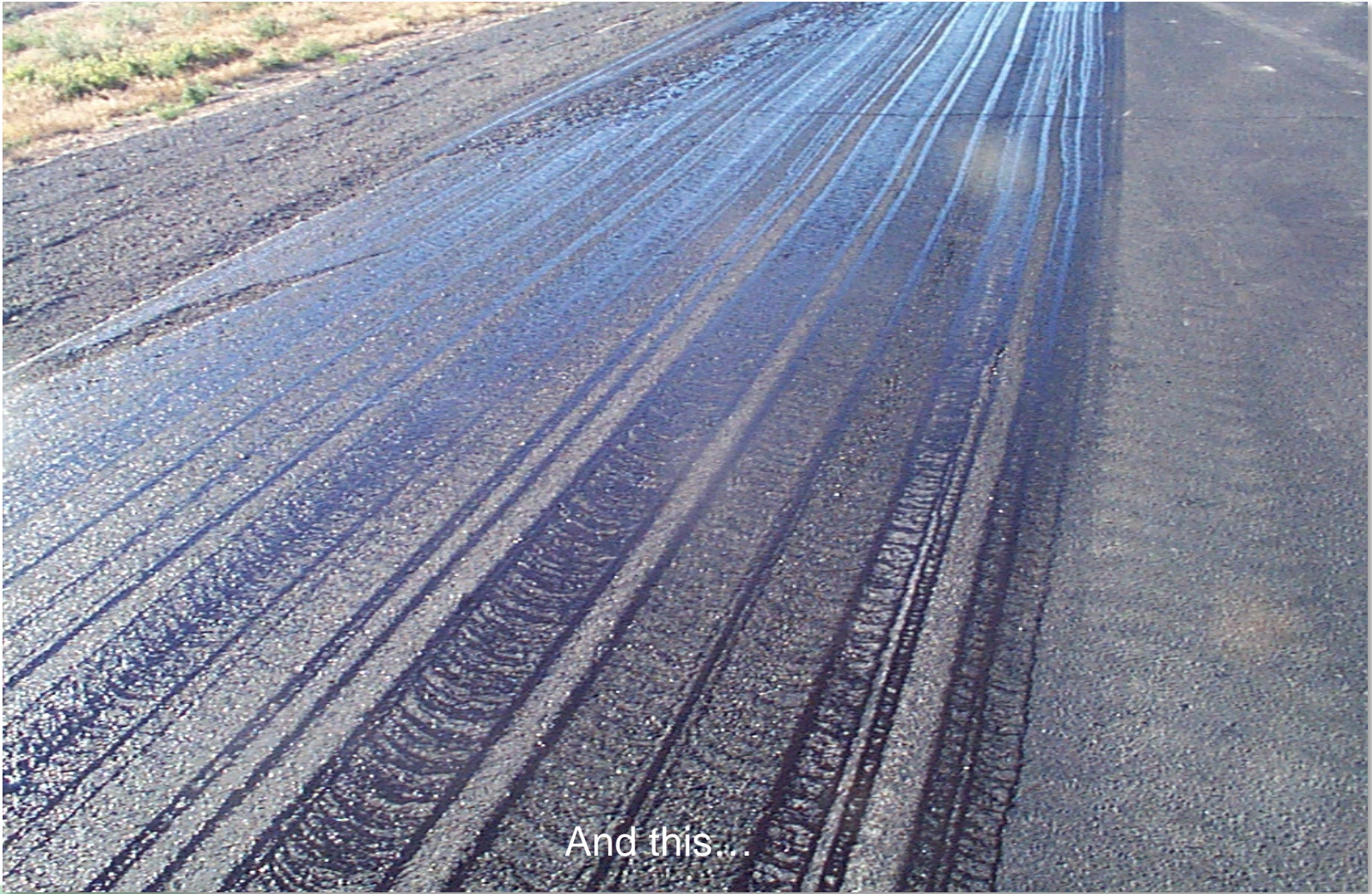


How uniform should the application be?



Needs to be better than this...

How uniform should the application be?



And this...

How uniform should the application be?



How uniform should the application be?





How uniform should the application be?





How uniform should the application be?



Define broken tack, please

- When tack comes out of the distributor truck, it is unbroken (**BROWN**) and is still in the emulsified form.
- Broken tack turns **BLACK** which means that the asphalt and water have separated.
- Once all the water has evaporated, we refer to this as set or cured.





Cured...or not?



Not yet...



Do I have to wait until it's cured?



Do I have to wait until it's cured?





How long do I have to wait?

Well, that depends...on:

- Air temperature
- Relative humidity
- Wind speed
- Pavement temperature
- Temperature of tack
- Application rate and dilution amount
- Type of emulsifying agent



Any way to speed it up?

Maybe...



What happens if I don't use tack?

There are 3 primary tack coat failures:

- Inadequate bond
- Delamination
- Slippage cracks

According to a study, if there is not full bond between layers, the strain in the upper layer is about 12.5 times higher...



Use tack – don't let this happen to your pavement!



Conclusions

- ALWAYS use tack coat
- Use recommended residual application rates
- Know dilution rate
- Ensure a clean and dry pavement
- Achieve full coverage
- Let tack break AND cure

Questions?

NCHRP Report 712, *Optimization of Tack Coat for HMA Placement*

http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_712.pdf



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