ODOT MATERIALS & INSPECTION

Chip Seal Workshop Manual

2024

ODOT Construction Chip Seal Workshop

20234

ODOT Construction Chip Seal Workshop

2024

ODOT Construction Chip Seal Workshop

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Welcome

Welcome to the 2024 ODOT Chip Seal Class

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General Housekeeping – In Person Attendees

- Turn cell phones to silent
- If you have a question, feel free to raise your hand
- Encourage discussion as long as its not a distraction to the speaker or other attendees

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General Housekeeping – Virtual Attendees

- Please mute your microphone when not speaking
- Please use “raise your hand” function if you have a question or comment
- Use the chat feature tool also when appropriate for a question or comment.

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Introductions

- Name
- Organization & Role
- Experience

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Speakers

Tim Earnest (ODOT)
Andy Clayton (Blueline)
Bert Perisho (Albina)
Steve Van De Bogert (Ergon)

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AASHTOWare Project

odoteconstruction@odot.oregon.gov
AWPAdmin@odot.oregon.gov

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What type of data will Inspectors input?

Civil Rights & Labor

- Field Interviews
  - Employee Interviews

Construction & Materials

- Daily Work Report (DWR)
  - Formerly General Daily Progress Reports
  - Weigh memos attachments
- Pay notes generated from DWR
- Sample Tests

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What type of data will Externals input?

Civil Rights & Labor

- Certified Payrolls

Primes have ability to review data submitted by subs and technicians in AWP prior to ODOT's review.

Construction & Materials

- Subcontracts
- Daily Source Reports (DSR)
  - Updating production quantity
  - Identify how much material has been produced
- Submit mix designs
- Managing testing labs testers
- Sample Records - access to create records and enter test data
- View Sources and source material

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AASHTOWare Project

Visit the APOST Website:

https://www.oregon.gov/odot/Construction/Pages/AW-Construction.aspx

Subscribe to The APOST Times:

https://public.govdelivery.com/accounts/ORDOT/subscriber/new?topic_id=ORDOT_863

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Unit 1

1

Outline

- Preventive Maintenance
- Project Selection
- Terminology
- Material Selection

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Preventive Maintenance

The planned strategy of cost-effective treatments to an existing roadway system:

- That preserves the system,
- Retards future deterioration, and
- Maintains or improves the functional condition of the system (without increasing structural capacity).

AASHTO's Standing Committee on Highways

3

Preventive Maintenance

- Planned
- Performed on good pavements
- Contributes to long-term performance
- Examples: Fog Seal, Chip Seal, Thin HMA Overlay

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Routine Maintenance

"…consists of work that is planned and performed on a routine basis to:

- maintain and preserve the condition of the highway system or
- to respond to specific conditions and events that restore the highway system to an adequate level of service."

AASHTO's Standing Committee on Highways

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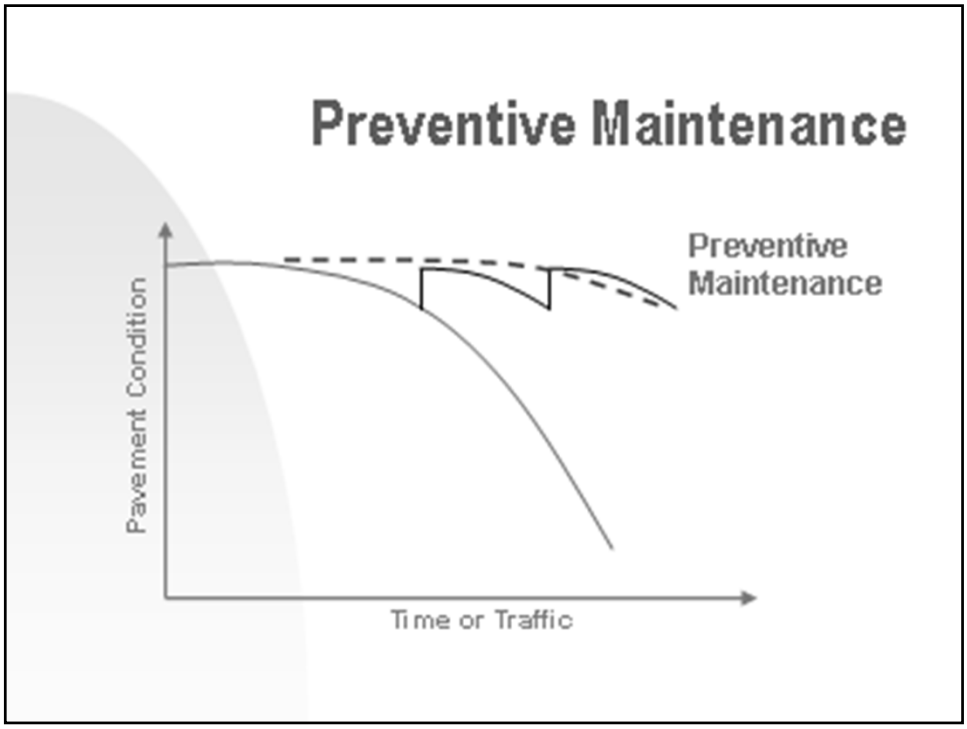

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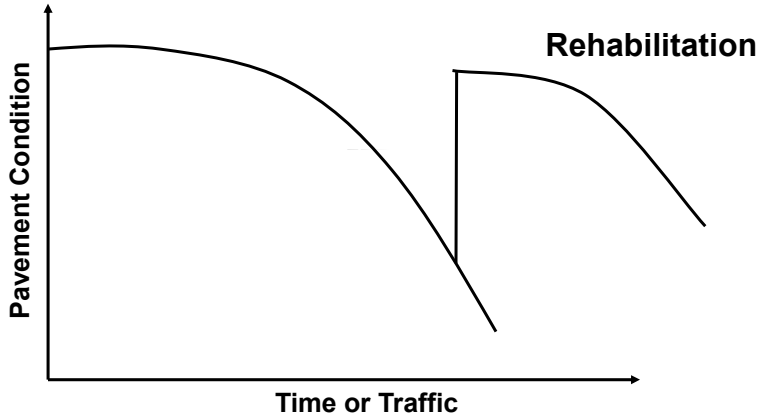
Rehabilitation



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Project Selection

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Philosophy of Pavement Preservation

Applying the right treatment…

. . . to the right pavement

. . . at the right time

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Chip Seal Description

Application of asphalt and aggregate chips rolled onto the pavement

Purpose

- Seal pavement
- Improve skid resistance
- Prevent raveling and further aging of pavement
- Cover locations of flushing w/ aggregate

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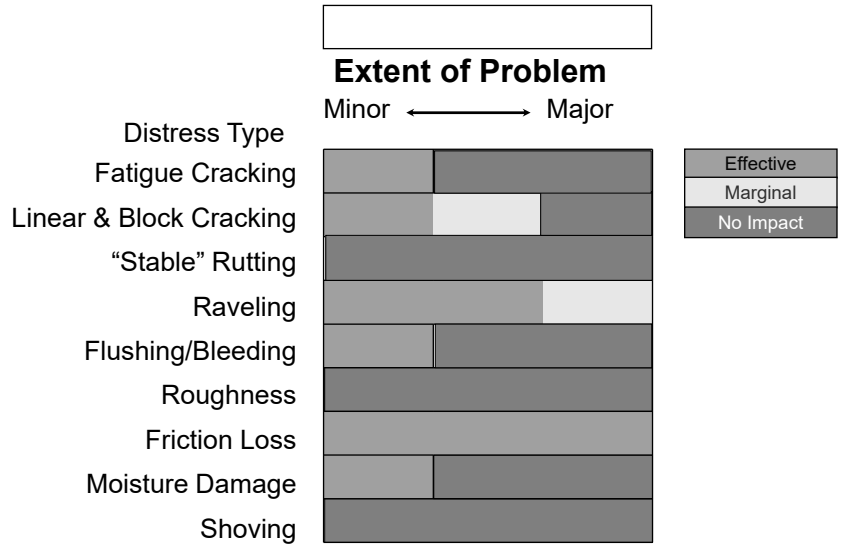
Chip Seal



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Terminology

Handout has selected definitions of common terms used while chip sealing.

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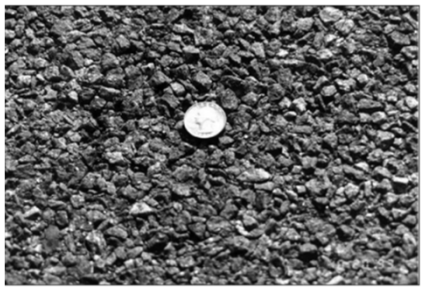
Material Selection

- Aggregates
  - Properties
  - Gradation
  - Pre-coated chips
- Emulsion binder types



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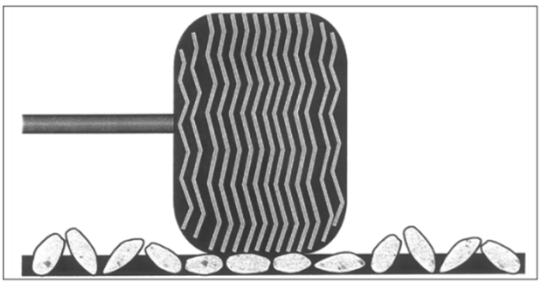
Aggregate Properties

- Impact of flat aggregate
  - the more susceptible bleeding in the wheelpaths
  - excessive chip loss in the non-wheelpath area.



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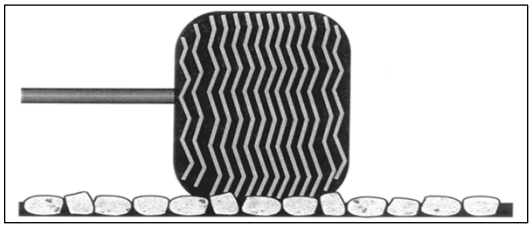
Aggregate Properties

- Impact of cubical aggregate
  - With cubical aggregate, traffic will not have a pronounced effect on chip orientation. No matter how the chips are oriented, the seal coat height will be essentially the same and chip embedment will be uniform.



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Aggregate Properties

- Impact of round aggregate
  - The roundness of the aggregate will determine how resistant the seal coat will be to turning and stopping movements.
  - Round aggregates are much more susceptible to rolling and displacement by traffic than angular aggregates, which tend to lock together better.

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Aggregate Properties

- Impact of aggregate gradation
  - Aggregate gradation also plays an important role in seal coat design, construction and performance.
  - Gradation refers to the distribution of the various sized stones that make-up the aggregate matrix.
  - Aggregates used in seal coat construction are normally classified as either one-size or graded.

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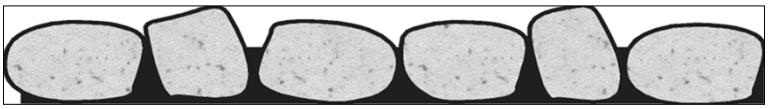
Aggregate Properties

- Impact of aggregate single sized gradation
  - The best seal coat gradations are those that are essentially one-size.
  - An aggregate is considered one-size if nearly all of the material is retained on two consecutive sieves.



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Aggregate Properties

- Advantages of aggregate single sized gradation
  - Better friction.
  - Checking for adequate binder can be determined quickly and there is less chance of bleeding because if one particle is embedded properly, nearly all of the others are also.
  - Better drainage due to clear surface channels between the aggregate particles, which allows for rapid and positive removal of water.

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Aggregate Properties

- Impact of graded aggregate
  - Graded aggregates have lower air voids, or less room to fit the binder in between chips.
  - There is a fine line between applying too much binder (bleeding) and not enough (loss of aggregate).

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Aggregate Properties

- Problems to watch with graded aggregate
  - Larger particles project above the average thickness, they risk being torn out of the surface by vehicle tires and snowplow blades.
  - Smaller particles are so small they are completely submerged into the asphalt binder which may causes bleeding.
  - It is difficult to determine the proper quantity of binder that will be both sufficient to hold onto larger particles and yet not submerge too many of the smaller particles.

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Aggregate Properties

- Impact of Dusty Aggregate
  - Aggregates containing dust should not be used for seal coating.
  - Dust will coat the outside of the aggregate particles and prevent them from bonding with the bituminous binder. Consequently, extensive chip loss will result.

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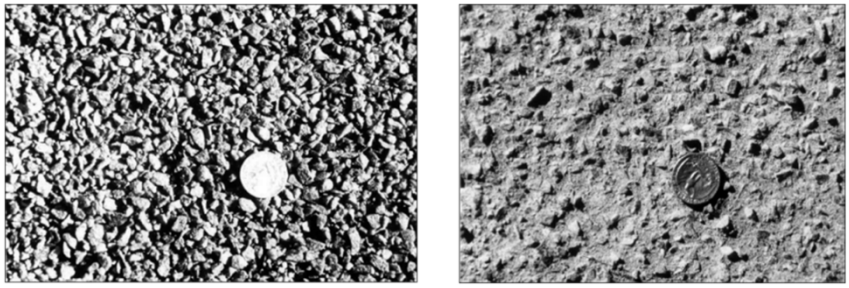
Aggregate Properties

- Impact of Dusty Aggregate
  - To avoid dusty aggregate, the specified aggregate gradation should have 1 percent or less passing the #200 sieve (75µm).



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Aggregate Properties

- Impact of Pre-Coated Aggregate
  - Pre-coating the aggregate through a hot asphalt plant controls the dust.

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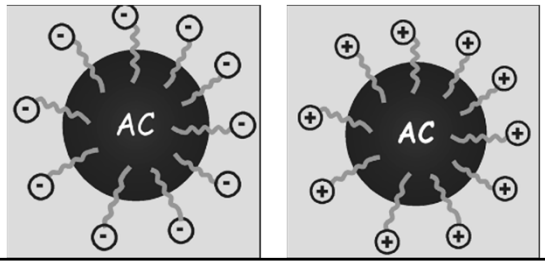
Emulsion Types

- Two Main Categories of Emulsions used by ODOT
  - Non-Polymer-Modified Emulsified Asphalt
    - CRS-2 and HFRS-2
  - Polymer-Modified Emulsified Asphalt
    - CRS-2P and HFRS-P1



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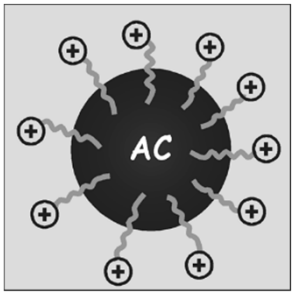
Emulsion Types

- Advantages of Polymer Modified Emulsions
  - Early chip retention
  - Typically have higher softening point, allowing more binder to be applied.
  - Less chance of loose chips after sweeping (better chip retention)



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Hot Asphalt Cement Types

- Two grades
  - AC15-5TR
    - Contains 5% scrap tire rubber
  - AC-15P
- Essentially meet same specs, AC-15P is currently most used

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Unit 2

Asphalt Emulsion Manufacturing

BLUE LINE ROAD PRODUCTS

1

Introduction

- It is said that oil and water don't mix…
- An asphalt emulsion is asphalt binder that is mechanically dispersed in water and chemically stabilized.
- Why emulsify asphalt? The primary reasons we emulsify asphalt are to reduce the temperature required for handling and the ability to coat damp aggregate.

2

Asphalt Emulsion Ingredients

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Asphalt Emulsion Ingredients

- The three basic ingredients are:
  - Asphalt binder
  - Water
  - Emulsifying agent
- Other ingredients:
  - Polymers
  - Solvents
  - pH modifying agents

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Asphalt Binder

- Asphalt binder is a basic ingredient but an important one. The properties must be analyzed and tested prior to use because not all asphalt binder is conducive to emulsification.

- Considerations
  - Source of the binder
  - Binder modification
  - Emulsifier compatibility

5

Water

- The composition and properties of the water is also very important. Additives in potable water may interfere with the emulsification process.

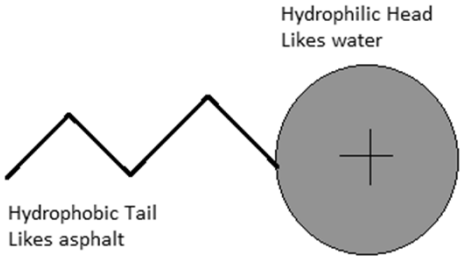
- Considerations
  - pH
  - Free of contaminants
  - Hard or soft

6

Emulsifying Agent

- The emulsifying agent allows the asphalt and water to be emulsified with less energy and produces greater stability as the droplets are formed in the colloid mill.

- Considerations
  - Particle charge
  - Setting requirements
  - Stability



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Other Ingredients

The addition of other ingredients is determined by the needs of the end user.

- Polymers add elasticity and/or strength to the asphalt binder.
- Solvents soften the asphalt binder, improves adhesion to aggregate during mixing and slows the curing time.
- pH modifying agents allow for adjustment of the pH when the emulsifying agent does not meet the requirement.

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Asphalt Emulsion Chemistry

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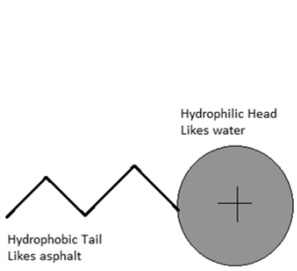
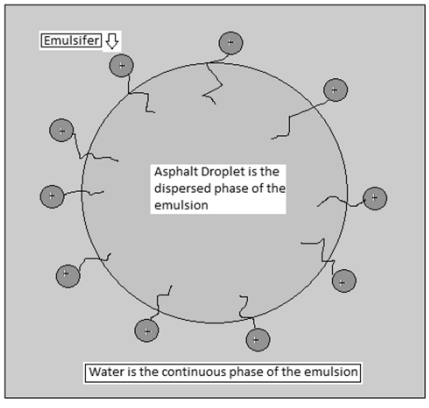
Droplet Characteristics

Cationic or anionic emulsifying agents provide a positive or negative charge to the surface of the asphalt droplet.





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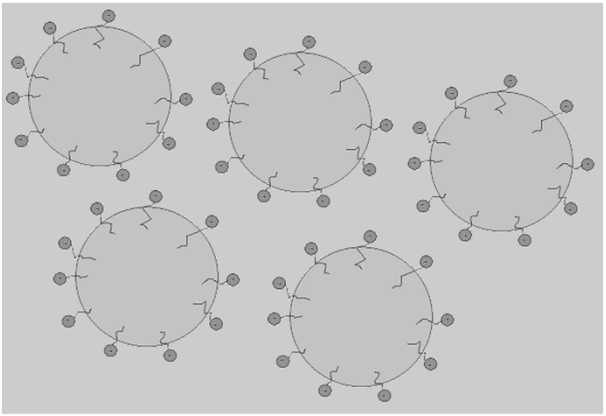
Emulsion Characteristics

Through electrostatic repulsion the asphalt droplets stay dispersed in water.



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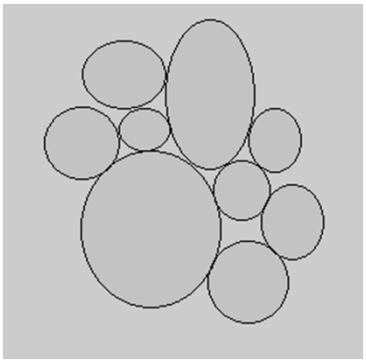
Flocculation (breaking)

Flocculation describes the clustering of individual dispersed droplets that do not lose their identity.



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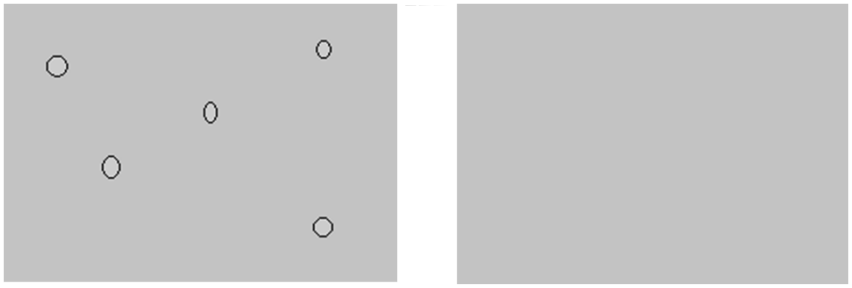
Coalescence (curing)

Coalescence is the process of breaking down the emulsifier coating and allowing the asphalt droplets to combine. Small amounts of water will be trapped within the asphalt droplet until fully cured.



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Asphalt Emulsion Manufacturing Facility

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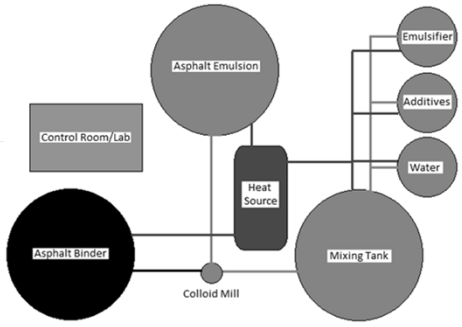
Equipment

The manufacturing of asphalt emulsions requires specialized equipment.

- Colloid mill
- Asphalt binder storage
- Emulsion storage
- Water storage
- Mixing tank
- Heat source
- Additive storage
- Control room / laboratory
- Pumps



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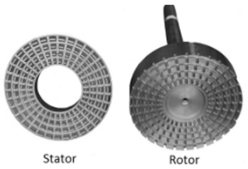
Colloid Mill

The colloid mill provides the mechanical force needed to shear the asphalt binder into microscopic droplets that then disperse into the water phase.



- The main components of the mill are the Rotor and Stator. They mesh closely together and when operating, the rotor rotates while the stator remains stationary.

- The gap between the rotor and stator determines the particle size of the asphalt binder droplets produced.

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Control Room / Laboratory

The control room and laboratory work in conjunction with each other to produce quality asphalt emulsions.

- Control room – Designed so that all equipment can be operated and monitored from a single point.
- Laboratory – Produces mix designs and ensures quality control on all asphalt emulsions being produced.

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Storage and Mixing Tanks

From storing the asphalt binder to the finished asphalt emulsion, the facility is equipped with many different tanks.

- Asphalt binder – heated and insulated
- Asphalt emulsion – heated, insulated and equipped with a mixer
- Water – heated and insulated
- Mixing (soap) – equipped with a mixer
- Additive – specific to product requirements

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Asphalt Emulsion Mix Design

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Introduction

- Prior to manufacturing, a mix design must be established.
- Mix designs determine the characteristics of the finished product.
- Product type and customer expectation drive the mix design.
- Chemistry determines the successfulness of the mix design.

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Product Type

Product type is generally determined by the end use application.

- Tack
- Chip seal
- Fog seal
- Cold mix
- In-place recycling

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Characteristics

Once the product type is determined the characteristics come in to play.

- Demulsibility
- Penetration
- Viscosity
- Elastic recovery
- Particle charge
- Residue
- Distillate
- Stability

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Finalizing the Mix Design

Once the product type and characteristics are determined the chemistry and mechanical force is addressed.

- Compatibility – ingredients
- Compatibility – other emulsions
- Dosage
- Temperatures
- Ductility

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Asphalt Emulsion Manufacturing

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Processing Temperatures

The ingredient temperatures play a vital roll in determining the quality of the finished asphalt emulsion.

- Asphalt Binder – 300° F
- Soap – 100° F
- Emulsion exit temperature must not exceed 212° F

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Processing Temperatures (continued)

$$\frac{[(\text{AB wt\%}) \times (\text{AB Temp}) \times .5] + [(\text{Soap wt\%}) \times (\text{Soap Temp})]}{[(\text{AB wt\%}) \times .5] + [\text{Soap wt\%}]} = \text{Emulsion Temp}$$

$$\frac{[(62) \times (300) \times .5] + [(38) \times (100)]}{[(62) \times .5] + [38]} = 189.85° \text{ F}$$

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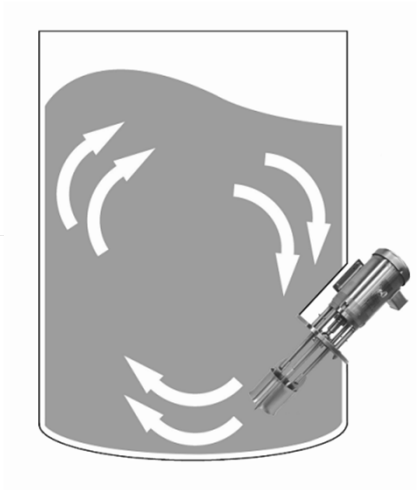
Soap Mixing

Mixing the soap ingredients to achieve the mix design is the next step.

- Water
- Emulsifier
- Additives
- Check pH
- Adjust
- Check temperature



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Production

Production is where it all comes together.

- Mill activation and conditioning
- Introduce the soap
- Introduce the asphalt binder
- Check the production temperature
- Check the residue
- Continue checking everything – STRESS FACTOR 10
- Shut down the asphalt binder
- Shut down the soap
- Shut down the mill

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Asphalt Emulsion Testing

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Introduction

The primary purpose for testing the asphalt emulsion is to ensure the quality and characteristics of the product.

- Sampling
- Viscosity
- Sieve
- Storage stability
- Demulsibility
- Distillation
- Penetration
- Solubility
- Ductility
- Elastic recovery

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Sampling

Sampling is as important as the testing, and precautions must be taken to ensure a true representation of the asphalt emulsion.

- New plastic containers only
- One (1) gallon drawn prior to sampling
- Sampling under pressure can entrap air
- Label the container with the proper information NOT THE LID!
- Fill completely full to avoid skin formation at the air-emulsion interface

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Viscosity

Viscosity determines the utility of an asphalt emulsion and is measured as Saybolt Furol Seconds (SFS). Viscosity of asphalt emulsion is everchanging and protocol must be followed.

- Condition the sample
- Prepare the Saybolt Furol viscometer
- Conduct the test
- Record the data

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Sieve

Sieve identifies excessive amounts of particles that may form due to handling, manufacturing and/or contamination issues.

- Condition the sample
- Prepare the sieve
- Run the test
- Record the data

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Sieve (continued)

$$\text{Oversized Particles \%} = [(B-A)/(C-D)]x100$$

- A = mass of sieve and pan
- B = mass of sieve, pan and residue
- C = mass of full sample container
- D = mass of empty sample container

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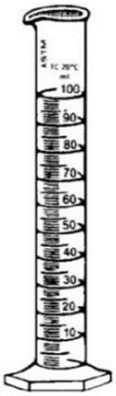
Storage Stability

Determines in a relatively short time frame the ability of the asphalt emulsion to remain uniformly dispersed during storage.

- Condition the sample
- Prepare the equipment
- Run the test
- Record the data



% = B – A

A = percentage of residue from the top sample

B = percentage of residue from the bottom sample

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Demulsibility

Determines the classification of the chemical breaking of the asphalt emulsion.

- Condition the sample
- Prepare the solution
- Run the test
- Record the data

% = (A/B) x 100

A = weight of demulsibility residue from the test of the sample of emulsified asphalt

B = weight of residue in 100g of the asphalt emulsion

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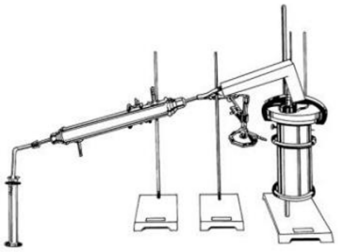
Distillation

Quantifies the percentage of asphalt residue and oil distillate in the asphalt emulsion. This test method also obtains the asphalt residue for additional tests.

- Condition the sample
- Prepare the still apparatus
- Run the test
- Record the data



% = ((B – A)/C) x 100

A = weight of empty still assembly before test

B = weight of still assembly after test + 1.5

C = weight of asphalt emulsion added to still

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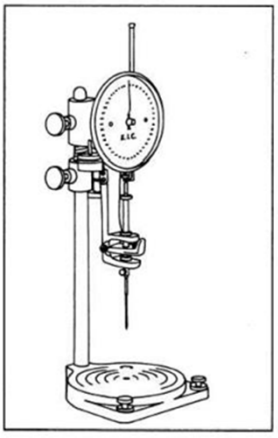
Penetration

Determines the hardness of the asphalt residue expressed in tenths of a millimeter.

- Condition the sample
- Prepare the penetration apparatus
- Run the test
- Record the data



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Solubility

- This test method determines the degree of solubility in trichloroethylene of asphalt residue.
- TRICHLOROETHYLENE is toxic and extremely flammable so this test is conducted at an outside laboratory.

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Ductility

Determines at what length does a specific specimen break under controlled temperature and speed.

- Prepare the specimen
- Prepare the testing apparatus
- Run the test
- Record the data

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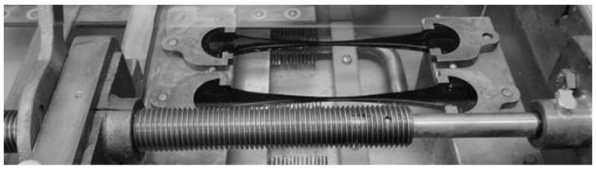
Elastic Recovery

Verifies an elastomeric material has been added to the asphalt and is quantified as a percentage.

- Prepare the specimen
- Prepare the testing apparatus
- Run the test
- Record the data



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Asphalt Emulsion Quality

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Introduction

The characteristics of a quality asphalt emulsion will differ depending on who you are talking to.

- What is quality asphalt emulsion?
- Emulsion nomenclature
- Specifications polymer modified
- Specifications non-polymer modified
- Performance expectations

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What is Quality Asphalt Emulsion?

- Manufacturer
  - meets specification
  - maximizes profits
- Tester
  - meets specification
- End user
  - meets specification
  - lowest cost

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Emulsion Nomenclature

Understanding the nomenclature of Asphalt Emulsion is essential when engineering for a given application.

- C = Cationic
- HF = High Float
- QS = Quick Set
- RS = Rapid Set
- MS = Medium Set
- SS = Slow Set
- 1 = Low Viscosity
- 2 = High Viscosity
- P = Polymer
- H = Hard

HFRS-2
CRS-2
HFRS-P1
CRS-2P
HFMS-2
CMS-2
SS-1
CSS-1
SS-1H
CSS-1H

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Specifications – Polymer Modified

General Requirements: This specification has been designed to yield a set of distinguishing characteristics for a polymer-modified emulsion. It is for use in chip seal projects where early chip retention and resistance to chip loss is an important objective. The binder is not a conventional asphalt cement. The asphalt must be polymerized before shipment. It shall show no separation of asphalt after thorough mixing within 14 days after delivery. It shall meet the following requirements when tested within 14 days of sampling according to AASHTO Method T 59 as modified.

GRADE	HFRS-P1		CRS-2P		HFRS-P2		RS-LTP	
	Min	Max	Min	Max	Min	Max	Min	Max
TESTS ON EMULSION:								
Saybolt Viscosity @ 50°C (122°F), SFS	100		100	400	100		100	
Sieve Test, %		0.10		0.10		0.10		0.10
Storage Stability, % (1 day)		1.0		1.0		1.0		1.0
Demulsibility, %	30		40		40		60	
Distillation: Oil distillate, % (by volume of emulsion)		3.0		3.0		2.0		3.0
Residue, % (by weight)	65[1]		65[2]		65[1]		65[1]	
Breaking Index @ 25°C (77°F)[3]								80
TESTS ON RESIDUE FROM:	**DISTILLATION**						**DISTILLATION**	
Penetration @ 25°C (77°F), 100g, 5s, dmm	90	200	90	200	90	200	150	300
Float Test @ 60°C (140°F) , seconds	1200				1200			
Solubility in Trichloroethylene, %[4]	97.5		97.5		97.5			
Elastic Recovery, %[5] or	30		45		58		45	
Torsional Recovery	18[7]		18[6]		18[7]		18[6]	

[1] AASHTO T 59 with modifications to include a 204 ± 5ºC (400 ± 10ºF) maximum temperature to be held for 15 minutes.
[2] AASHTO T 59 with modifications to include 300 grams emulsion and a 177 ± 5ºC (350 ± 10ºF) maximum temperature to be held for 15 minutes.
[3] ODOT TM 431, Breaking Index - method of testing on file at ODOT Materials Laboratory in Salem, Oregon.
[4] AASHTO T 44, Solubility of Bituminous Materials. May be waived if polymer modification interferes with test accuracy.
[5] ODOT TM 429, Elastic Recovery – method of testing on file at ODOT Materials Laboratory in Salem, Oregon.
[6] ODOT TM 428 Method A, Torsional Recovery - method of testing on file at ODOT Materials Laboratory in Salem, Oregon.
[7] ODOT TM 428 Method B, Torsional Recovery - method of testing on file at ODOT Materials Laboratory in Salem, Oregon.

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Specifications – Non-polymer Modified

General Requirement: The cationic emulsified asphalt furnished under this specification shall be an emulsion of asphalt cement, water and emulsifying agent. The emulsified asphalt shall be homogeneous. It shall show no separation of asphalt after thorough mixing within 30 days after delivery. It shall meet the following requirements when tested within 30 days of sampling according to AASHTO Method T 59.

GRADE	RAPID SETTING				MEDIUM SETTING						SLOW SETTING			
	CRS-1[2]		CRS-2[2]		CMS-2S		CMS-2		CMS-2h		CSS-1		CSS-1h	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
TESTS ON EMULSION:														
Saybolt Viscosity @ 25ºC (77ºF), SFS											20	100	20	100
Saybolt Viscosity @ 50ºC (122ºF), SFS	20	100	150*	400	100*	450	100*	450	100	450				
Storage Stability, % (1 day)		1		1		1		1		1		1		1
Demulsibility %[1]	40		40											
Coating ability & water resistance: Coating, dry aggregate Coating, after spraying Coating, wet aggregate Coating, after spraying					Good Fair Fair Fair		Good Fair Fair Fair		Good Fair Fair Fair					
Particle charge test	Positive		Positive		Positive		Positive		Positive		Positive		Positive	
Sieve test, % [4]		0.10		0.10		0.10		0.10		0.10		0.10		0.10
Cement mixing test, %												2.0		2.0
Distillation to 260ºC (500ºF): Oil distillate, % (by volume of emulsion) Residue, % (by weight)	60	3	65	3	60	12[3]	65	8[3]	65	8[3]	57	3[3]	57	3[3]
TESTS ON RESIDUE FROM DISTILLATION:														
Penetration @ 25ºC (77ºF), 100g, 5s, dmm	100[2]	250[2]	100[2]	250[2]	100	250	100	250	40	90	100	250	40	90
Ductility @ 25ºC (77ºF), cm	40		40		40		40		40		40		40	
Solubility in Trichloroethylene, %	97.5		97.5		97.5		97.5		97.5		97.5		97.5	

* Modification of AASHTO M 208

(1) The demulsibility test shall be performed within 30 days from date of shipment.
(2) When CRS-1h or CRS-2h is specified, the penetration range is changed from 100-250 dmm to 40-90 dmm.
(3) Required under Oregon Administrative Rules, Chapter 340, Division 232-0120 - Department of Environmental Quality.
(4) This test requirement on representative samples is waived, if successful application of the material has been achieved in the field. (per AASHTO M-140)

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Questions

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INSERT TAB

Unit 3

Asphalt Distributor

PROJECT MANAGER AND INSPECTOR ORIENTATION

BLUE LINE ROAD PRODUCTS

1

Introduction

This course is designed to introduce project managers and inspectors to the basic design, operation and capabilities of Asphalt Distributors.

- Asphalt distributor orientation
- Record keeping
- Operation of an asphalt distributor
- Quality Control
- Safety

2

Asphalt Distributor Orientation

3

Asphalt Distributor Orientation

The Asphalt Distributor is designed to apply liquid asphalt products evenly and accurately to road surfaces.

- Manufacturers
- Computerized Rate Control (CRC)
- Control panel
- Spray bar
- Float gauge

4

Manufacturers

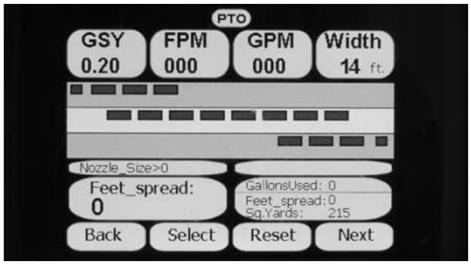
- BearCat
  (utilized for this training)
- Rosco
- Etnyre

5

Computerized Rate Control (CRC)

The CRC is designed to accurately control a specific shot rate at varying speeds and widths.

- Gallons per square yard (GSY)
  - Specified Shot Rate
- Feet per minute (FPM)
  - Monitors travel speed
  - Must be calibrated
  - Feet traveled – totalized



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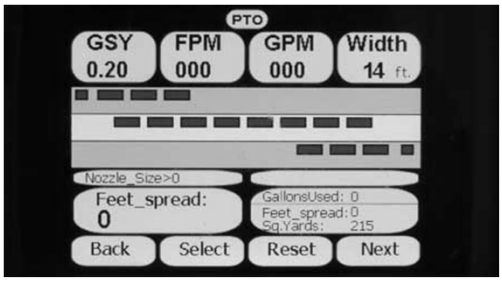
Computerized Rate Control (CRC) (continued)

- Gallons per minute (GPM)
  - Monitors flow
  - Must be calibrated
  - Gallons used – Totalized and must be checked against float gallons
- Width setting
  - Specified width
- Idle setting
  - Specifies GPM at joint lines (not equipped on all distributors)



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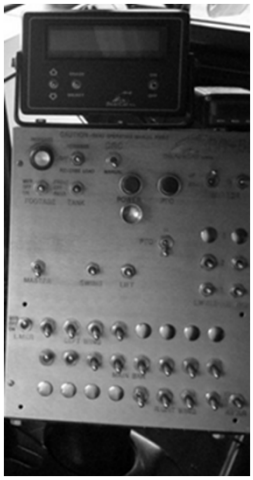
Control Panel

The Control Panel is the primary location for all function controls.

- Manual / CRC
- Width – one-foot increments
- Swing
- Lift
- Raise / lower wings
- Master on / off
- Mirror controls
- Line markers



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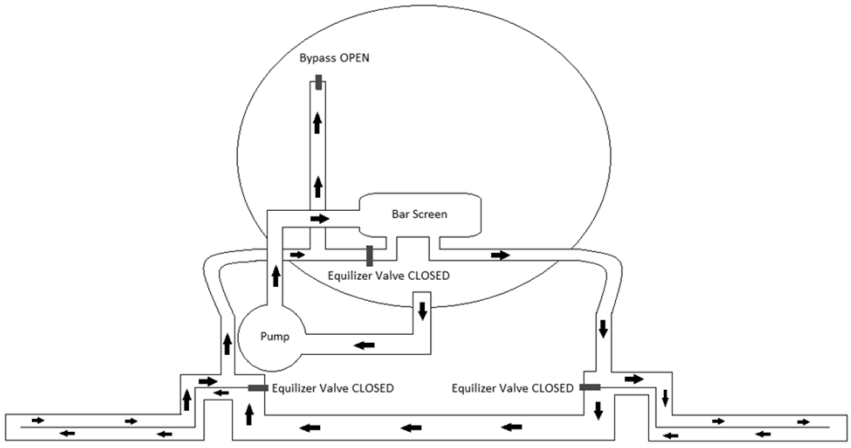
Spray Bar

The Spray Bar is designed to evenly apply liquid asphalt to road surfaces.

- Pump – moves liquid asphalt
- Bar screen – removes large particulate matter
- Bypass – pressure relief
- Nozzles – provides spray pattern
- Circulation – heat distribution
- Equalizers – even product distribution

9

Spray Bar – Circulation Flow



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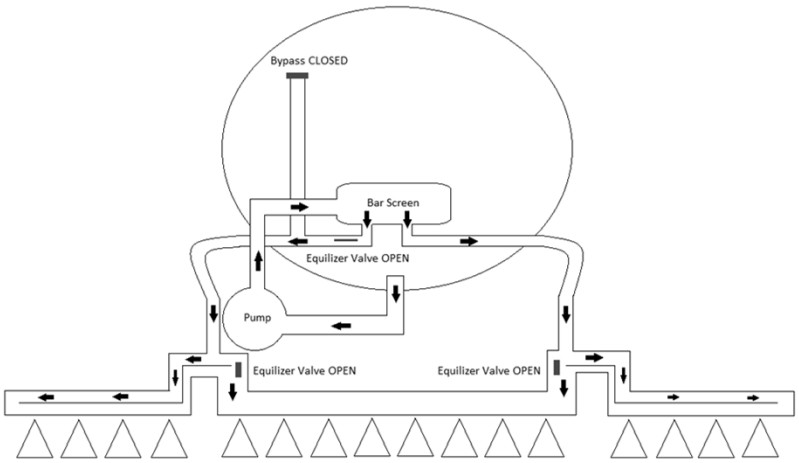
Spray Bar – Application Flow



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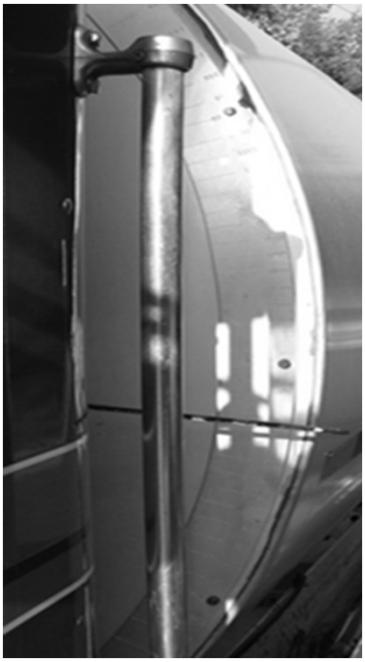
Float Gauge

Indicates product level

- Can be calibrated
- Read on level ground
- 25-gallon increments



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Record Keeping

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Record Keeping

Record keeping ensures that the necessary documentation is recorded to evaluate the accurate shot rate of the liquid asphalt and future performance of the road surface.

- Shot rate GSY
- Road conditions
- Climate conditions
- Daily recap

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Shot Rate Gallons Per Square Yard

Checking the shot rate ensures the CRC accurately applied the specified shot rate.

- Start gallons
- Length in feet
- Width in feet – average if applicable
- Stop gallons

Length x Width / 9 = Square Yards

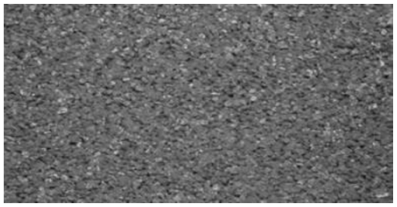
Gallons / Square Yards = Shot Rate GSY

15

Road Conditions

Recording the Road Conditions prior to the application of the liquid asphalt provides information to evaluate the specified shot rate after completion of the work.

- Texture
- Patching
- Crack seal
- Road debris



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Climate Conditions

Recording the Climate Conditions during the application of the liquid asphalt provides information to evaluate the performance of the specified shot rate after completion of the work.

- Road temperature
- Air temperature
- Atmospheric conditions
- Precipitation
- Wind

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Daily Recap

The Daily Recap records the information necessary to document the days work.

- Total gallons
- Total square yards
- Average shot rate
- Compare gallons delivered to gallons applied
- Traffic density
- Traffic type

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Operation of an Asphalt Distributor

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Operation of an Asphalt Distributor

Operation of an Asphalt Distributor is combining all the components, functions and skills necessary to apply liquid asphalt in a professional manner.

- Setup
- Application
- Shut down

20

Setup

Setup is when the Operator prepares the Asphalt Distributor for the daily work.

- Communicate with the contractor
- Activation of system
- Charge spray bar
- Check equalizers and bypass
- Evaluate heat distribution across spray bar
- Apply release agent
- Prepare records
- Prepare CRC

21

Application

Application is from when the Operator arrives to the work zone and continues until Shutdown.

- Spray bar movement
- Align square
- Set bar width
- Applies liquid asphalt

- Pumps over liquid asphalt from transports
- Provides recommendations
- Record keeping

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Shut Down

Shutdown is when the Operator cleans and inspects the Asphalt Distributor for future seamless Start Up.

- Circulate spray bar
- Pump spray bar empty
- Utilize release agent both interior and exterior
- Deactivate system
- Finalize records
- Communicate with Contractor

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Quality Control

24

Quality Control

Quality Control is the process of evaluating the asphalt distributor operation to attain the desired finished product.

- Asphalt distributor operator
- Asphalt distributor
- Nozzle considerations
- Joint line
- Meet line
- Ridging
- Intersection radius
- Crack seal and patches
- Surface condition upon application
- Workmanship repairs

25

Asphalt Distributor Operator

The Asphalt Distributor Operator is the key component for quality liquid asphalt application.

- Safety first
- Professional
- Knowledgeable
- Skilled
- Motivated

26

Asphalt Distributor

The Asphalt Distributor must be capable of providing an accurate and even application of liquid asphalt to the road surface.

- CRC
- Calibrated – GPM and FPM
- Accurate float
- Spray bar leaks
- Equalizers and bypass
- Bar screen

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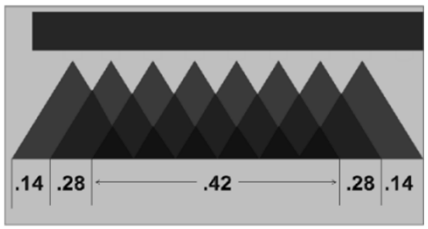
Nozzle Considerations

Nozzle Considerations are vital to provide the spray pattern at the spray bar for even application.

- Consistent size
- Consistent orientation
- Clear of obstructions



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Joint Line

A Joint Line is the lateral point at which liquid asphalt application is stopped and started.

- Straight
- Even application
- Three inches or less overlap
- Minimize distance required
- Paper?
- Staggered – Lane to lane

29

Joint Line – Acceptable

30

Joint Line – Unacceptable

31

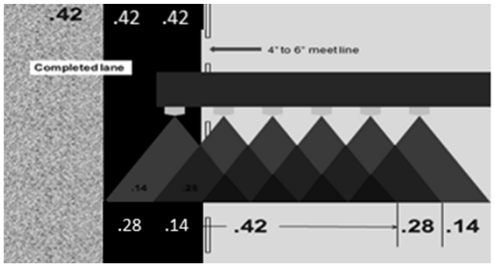
Joint Line – Unacceptable

32

Meet line

A Meet Line is the longitudinal point at which liquid asphalt application combines with adjoining lanes.

- Straight
- Even application
- Oil Type – Emulsion vs. Hot Applied
- Oil – Oil vs. Oil – Rock – Oil



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Meet Line – Hot Applied

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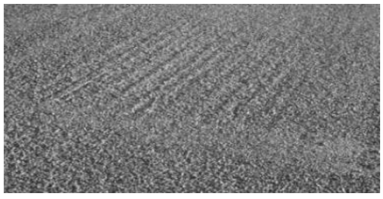
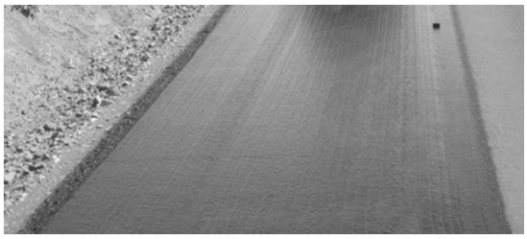
Ridging



Ridging is when the liquid asphalt is NOT evenly applied across the road surface.

- High viscosity
- Bar height
- High pressure
- Cold liquid asphalt
- Existing surface



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Intersection Radius

An Intersection Radius is the road surface outside of the longitudinal lane at intersections that requires the application of liquid asphalt.

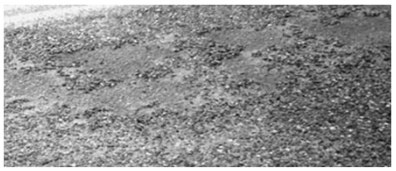
- Very difficult!!!
- Safety – Safety – Safety!!!
- Asphalt distributer has the right of way!!!
- Operator skill determines
  - The portion of the radius to be covered
  - Even application
  - On / off side

37

Crack Seal and Patches

The application of liquid asphalt over Crack Seal and Patches requires adjustment to the application process.

- Temperature effects?
- Bleeding?
- Shot rate increase / decrease?
- Engineered?



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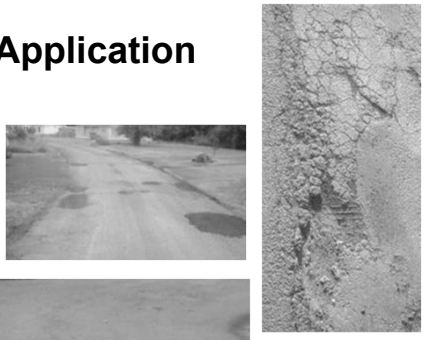
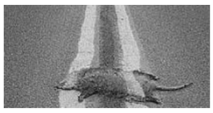
Surface Condition upon Application

The Surface Condition upon application must be clean, dry and free of obstructions.

- Dirt
- Road debris
- Water
- Road kill





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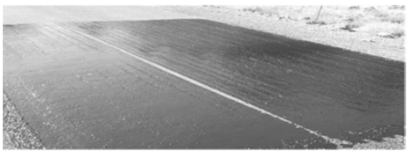
Workmanship Repairs

Workmanship Repairs need to be conducted when Operator, Equipment or Environmental conditions cause failures.

- Human error
- Equipment error
- Visibility
- Wind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Safety

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Safety

Safety IS the most important aspect of conducting liquid asphalt application!!!

- Understanding the asphalt distributor
- Operator protection
- Personnel awareness

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Operator Protection

Liquid Asphalt Distributor Operators work in a limited visibility environment and must comply with all DOT Regulations.

- Traffic
- Pedestrians
- Hours of service

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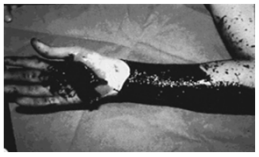
Personnel Awareness

ALL work site personnel need to be aware of the hazards of the Asphalt Distributor.

- Unexpected backing
- Spray bar movement
- Elevated temperatures
- Component malfunction



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Thank you

Questions?

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Unit 4

Chip Seal Basics for Inspectors

1

Chip Spreader

2

Spreader Types

- Manual
  - Tailgate / box spreaders
- Mechanical
- Computerized

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Geffs

7

Bearcat

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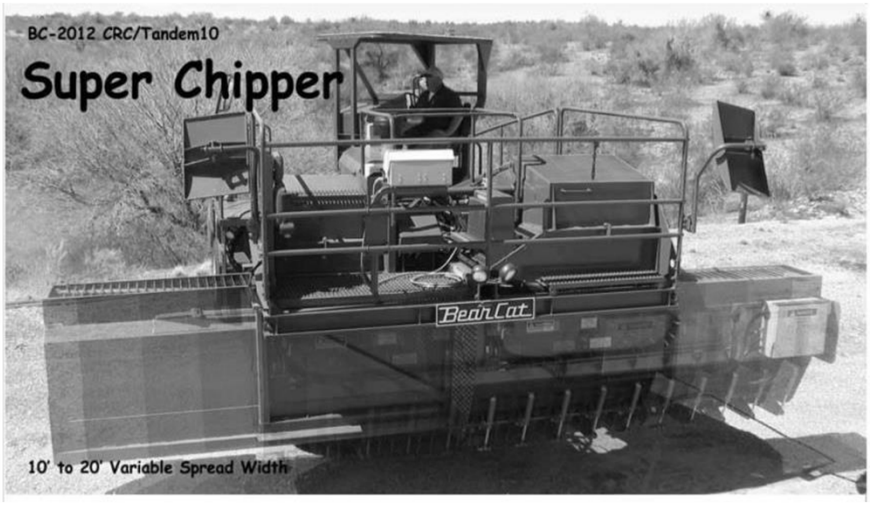
BC-2012 CRC/Tandem10
Super Chipper
Bear Cat
10' to 20' Variable Spread Width

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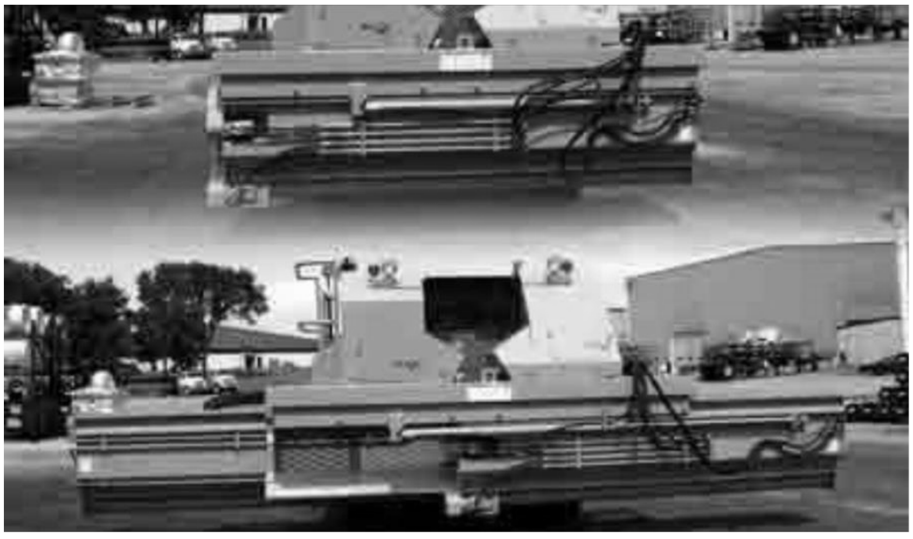
Etnyre



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Key Components of Chip Spreaders

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Hitch

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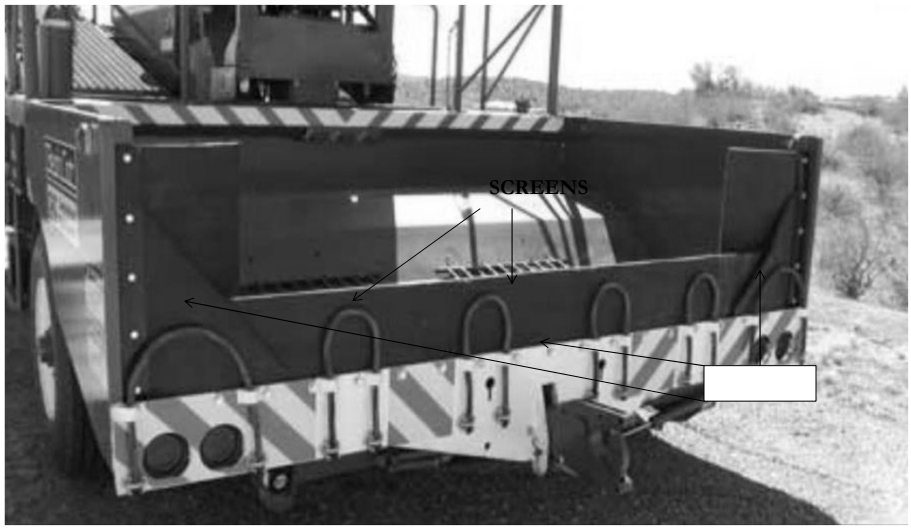
Back Hopper



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Conveyor Belts

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Front Hopper (Head)

- Aggregate segregator
- Augers
- Roller
- Gate adjustment
- Load sensors
- Vibrators
- Final segregation screen

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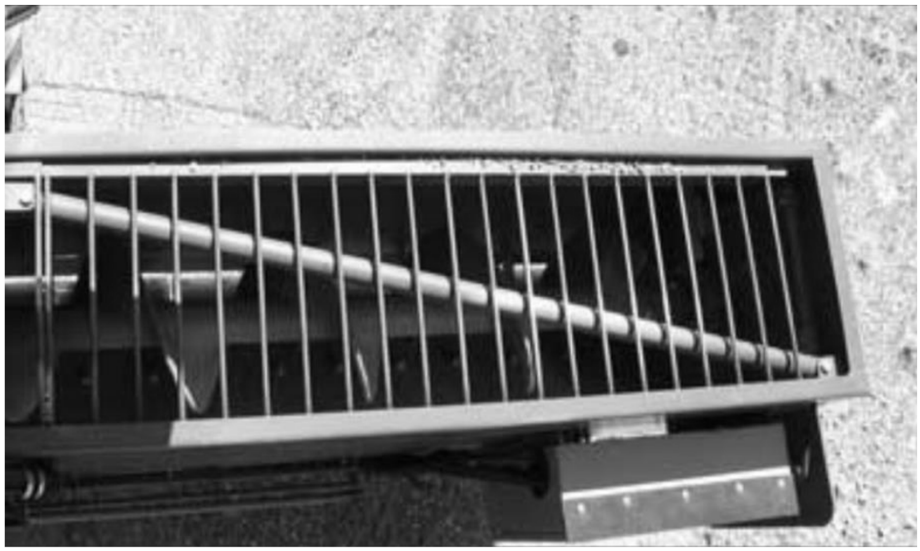

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Operator Controls

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Important Control Features

- Ability to operate from the left or right
- Individual gate control (on/off)
- Variable head width adjustment
- Hitch adjustment and release
- Gate clear function
- Surface temperature gauge that reads ahead of rock placement.

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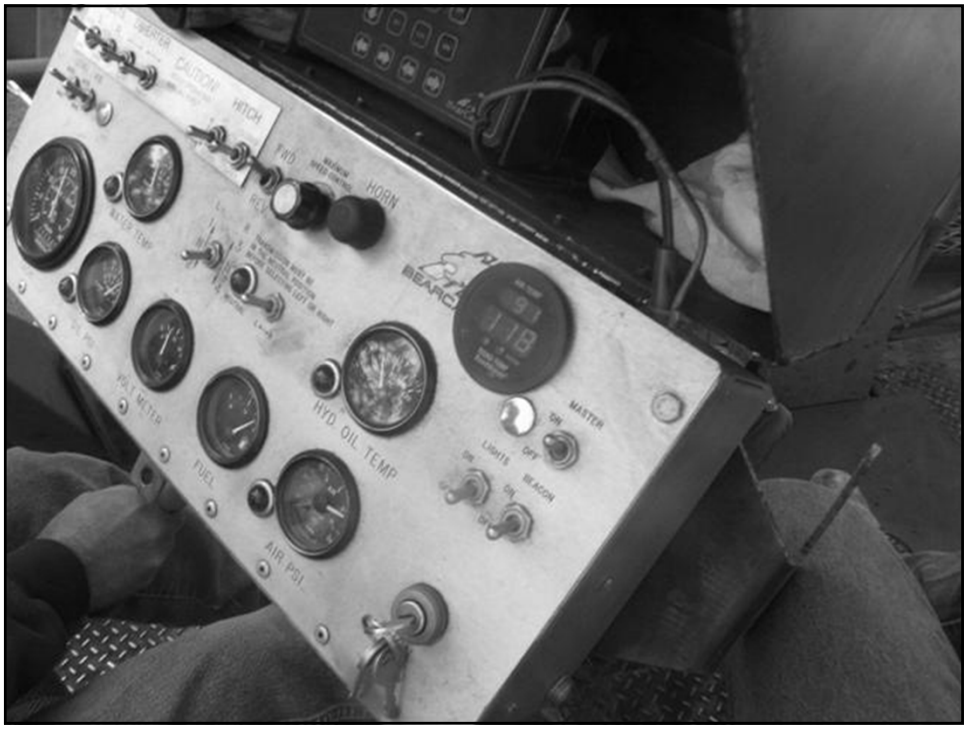

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Calibrate Chip Spreader

- Pounds of aggregate per square yard
- Uniformity across the total width of the head

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When to Calibrate

- Prior to job start-up
- Changes in aggregate size or source
- Environment- or equipment-driven rate variations
- Intermittently throughout the job to verify rate settings.

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What to look for with a Chip Spreader

- Changes in aggregate rate/uniformity
- Blocked gates
- Displacement of larger stones in mat
- Changes in aggregate moisture content
- Problems with aprons or belts
- Spreader running in oil in radius or stopping
- Motor or hydraulic oil and radiator leaks

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Haul Trucks

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Basic Information on Trucks (Based on 10-yard capacity)

- Begin each job with 6 trucks.
  - For every mile greater than 5 that you are away from your rock source, add one truck.
  - Consider one additional truck for mechanical failures or flat tires and getting stuck.
  - Make sure you have plenty of spare tires on the job.
  - Use deflectors on air dryers.

34

Haul Truck Capacities

- Require legal loads
- Load consistently with same amount
- Do not overload to the point that rock is lost in curves and intersections

35

Haul Truck Requirements

- Chipper bar
- Apron
- Adjusted mirrors
- Properly inflated tires
- Air dryer deflection shields
- Back-up alarms
- Communication

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What to look for

- Ability to hook and unhook from spreader
- Adequate depth of dump box into chip spreader hopper
- Tailgate clearances
- In the dumping procedure, raising wheels off the mat
- Entering and leaving new mat (crossing the meet line)

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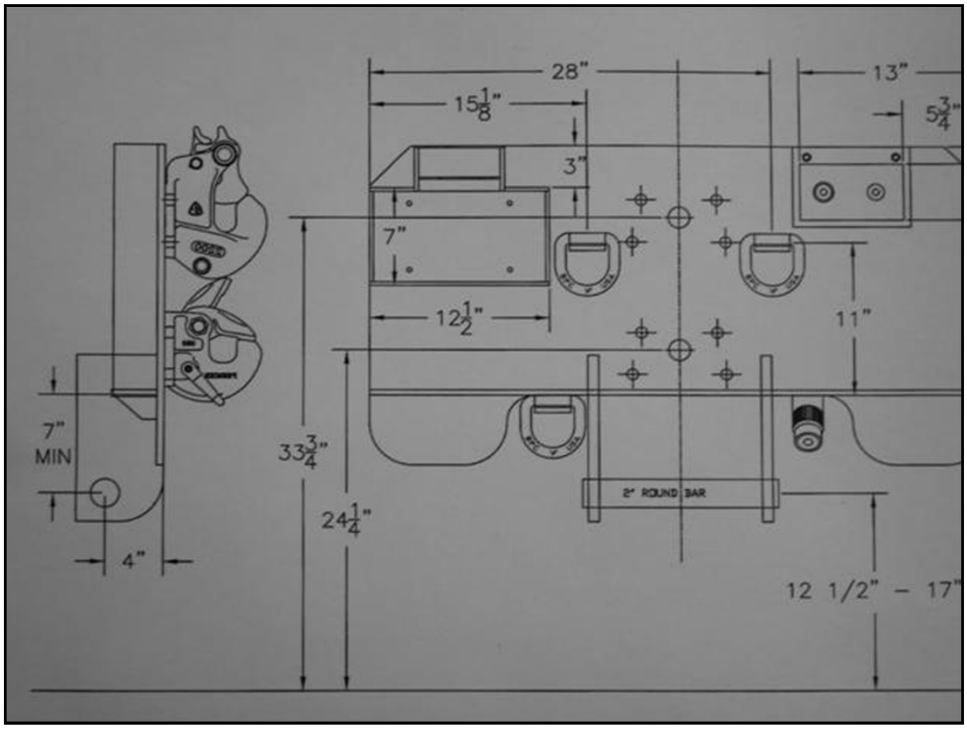

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What to look for (continued)

- Breaking track (staggered truck positioning on mat)
- Piles of aggregate
- Motor, crankcase or hydraulic oil leaks

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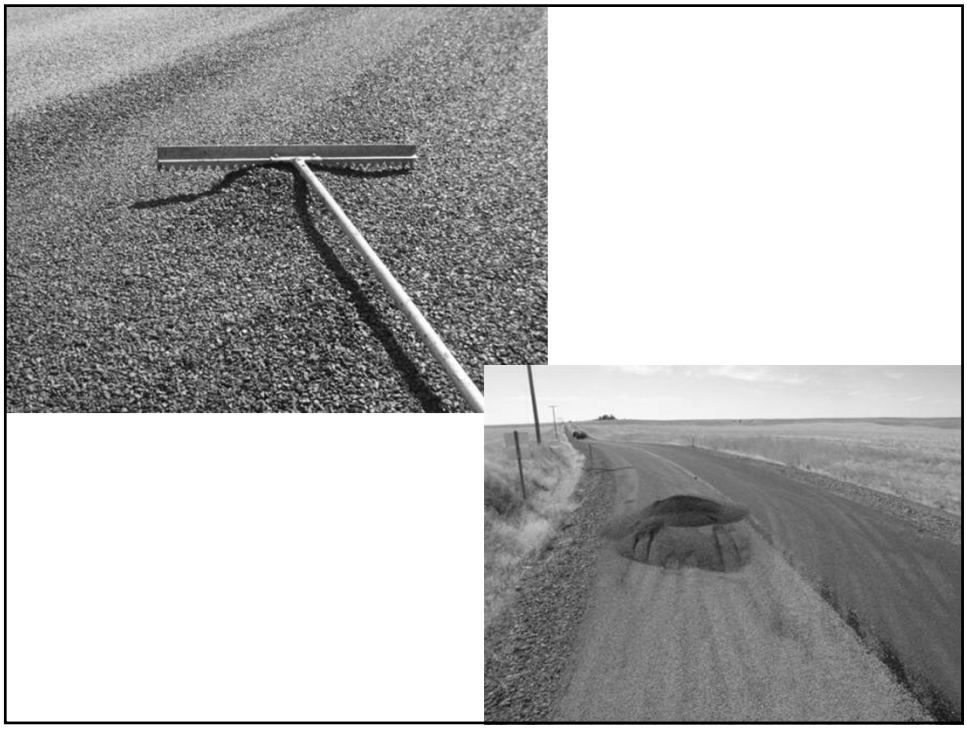

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Rollers

Pneumatic, Steel Wheel, Combination

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Purpose for Rolling

Seat the aggregate in the oil
Orient aggregate (interlock & flatten)

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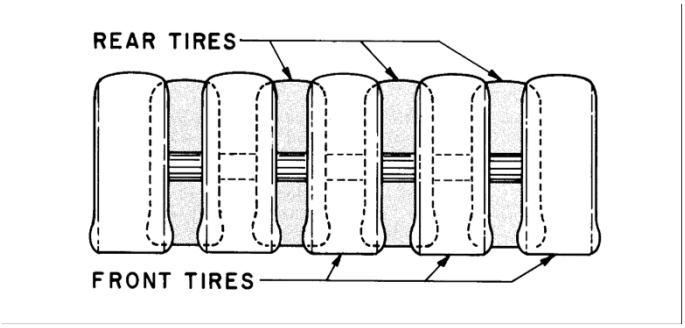
Pneumatic Rollers

Light rollers normally cover an area 60 inches wide on each pass. The rear tires must be offset to provide coverage of the areas between the front wheels



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Number of Pneumatic

- Rule of thumb, width of panel minus the spreader and haul truck tracks, divided by width of your roller coverage. Round up.
- For emulsion work the specs require a minimum of 2 and more as width or speed of operation dictate to accomplish the acceptable results.
- For hot oil work the specs require a minimum of 3 and more as width or speed of operation dictate to accomplish the acceptable results.

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Number of Steel Wheel

- 1 steel wheel roller and more as width or speed of operation dictate to accomplish the acceptable results.
- Combination rollers can only count towards the requirements of steel wheel.

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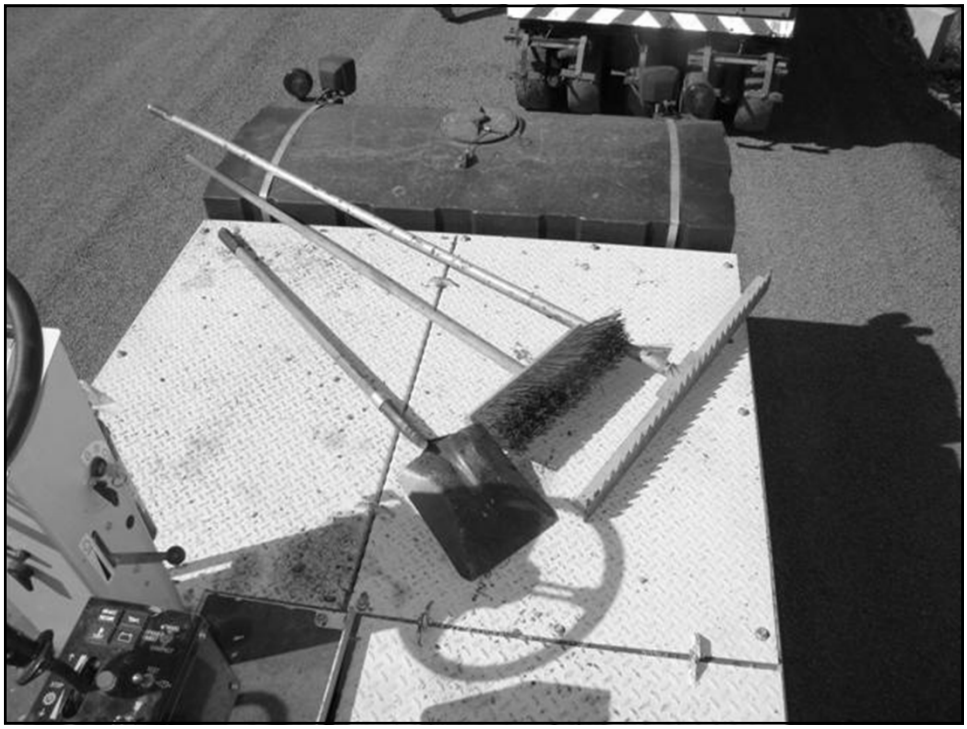

59

What to look for when inspecting

- Roller spacing and coverage being completed in a timely manner.
- Speed of rolling operation.
- Properly inflated tires and clean tires and drums.
- Water use on tires and drums, especially when stationary.
- Rolling operations that falls to far behind the spreader. This is very critical to successful job.

60

What to look for when inspecting (continued)

- When work stoppage occurs for an extended time move chip spreader and trucks off the new panel and complete the rolling process.
- Motor, crankcase or hydraulic oil leaks.

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Brooms

62

Types of Brooms

Hand Broom, Sidecast Power Broom,
Pickup Broom

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Purpose of Brooming Operation

- To prepare roadway surface/clean, prior to chip seal
- To remove loose aggregate materials from newly sealed travel surface
- Help in the removal of dust from roadway surface and approaches
- On hot seals, a broom is used to sweep/prepare the meet-line for the next panel

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When is it OK to broom a newly sealed surface?

- When the operation of brooming itself does not damage or displace aggregate from the oil mat.
  - Emulsion seals are a minimum of 3 to 4 hours preferably next day or that evening after mat has had time to cure and cool.
  - Hot oil seals can be broomed once the oil has cooled sufficiently to hold the rock, water can be used to improve these conditions.

73

What to watch for when inspecting

- Unusual broom wear or shape of broom core
- To much down pressure
- The speed of the brooming operation
- Stationary brooms with brooms rotating
- Use of too much water on emulsion seals if brooming early
- Motor, crankcase or hydraulic oil leaks

74

Planning & Staging

75

Project Plan

- Project scoping
  - Changes in pavement type and pavement width
  - Curb areas
  - Drains
  - Overhead lines
  - Cross streets / junctions / approaches
  - Guardrail / bridges
  - Take lots of photos

76

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Project Plan (continued)

- Stockpile and oil delivery staging areas
  - Locate rock stockpile sites ideally every 5 miles.
  - Identify staging areas to transfer oil to distributor.
  - Areas need to be large enough to handle truck and trailer movements.
  - Identify areas for distributor cleanout / bar testing / repairs.

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Project Plan (continued)

- Traffic Control
  - Estimate daily accomplishment, set work zone flagger locations.
  - Identify need for 1-2 pilot cars.
  - Locations and number of flaggers needed for each work zone section. 1-3 miles long.
  - Identify tab requirements color and type.
  - Note truck turn-around locations when establishing work zone areas.

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Project Plan (continued)

- Special events
- Personnel
  - Know your personnel's skill level and physical condition and place them in appropriate jobs.
  - Make allowances for cross training and rookie |development.

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Tracking / Summary

- Complete daily cost and accomplishment information.
- Make note of oil delivery times and distributor hours.
- Track rate changes and locations.
- Develop unit cost for the project and save for future reference.

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Unit 5


The Chip Seal Process
And why we do it that way
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1


Standard Chip Seal:
1. Spray emulsion binder
2. Drop chips
3. Roll 3 times
4. Let cure overnight
5. Sweep away excess
VOLVO
7825

2

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Key elements of the process

- Design (McCleod)
  - Application Rates
  - Rock Requirements
- Rolling
- Using choke
- Fogging
- The importance of time, temperature and traffic

Don't forget the road needs to be prepped and clean

3

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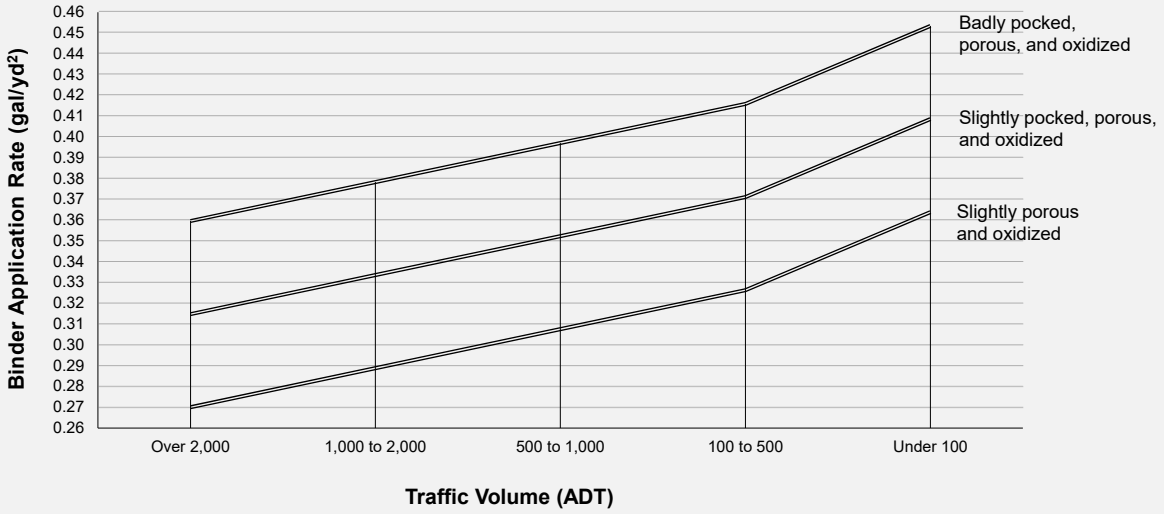
Why do a Chip Seal design before starting?

- Proper chip embedment is critical to seal success
  - Too little and we lose rock
  - Too much and we flush, losing skid resistance
- Chip embedment is affected by binder application rate as well as traffic load and road condition
- A chip seal design gives you the right emulsion and aggregate rates
- This cuts out the guessing

4

Traffic (rolling) has a huge effect on binder volume needed



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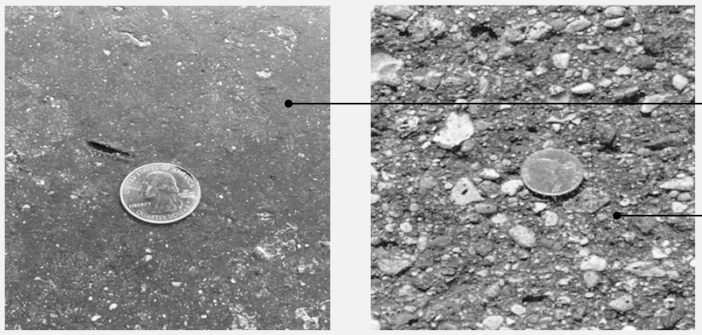
Know your pavement condition

Flushed pavement vs. badly pocked, porous and oxidized (and everything in between)



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ODOT Test Section 2019

This design is for reference only. Field adjustments are necessary. Design done from one sample supplied by the customer and may vary due to stockpile variations, errors in sampling, etc.

H	**Ave Least Dimension**	**Median Rock Size**	0.244			**Flakiness Ratio**		0.9	0.244	
T	**Traffic Factor**		**-100 ADT**	0.85	**100-500**	0.75	**500-1000**	0.7	**1000-2000**	0.65
V	**Voids in Loose Aggregate**		**Single Chip**	0.5						
S	**Surface Condition**		**Smooth, Non-porous**	0	**Slightly Porous and Oxidized**	0.03	**Slightly Pocked, Porous and Oxidized**	0.06	**Badly Pocked, Porous and Oxidized**	0.09
A	**Aggregate Absorption**		None	0.018						
R	**Residual AC Cont**		0.67							

-100 ADT on Badly Pocked and Oxidized									
Binder Appl Rate at 60°C =	0.509	Gal/yd^2	2.244	0.244	0.85	0.5	0.09	0.018	
					0.67				
Hot Binder Rate at 165°F	**0.528**								
-100 ADT on Slightly Pocked, Porous and Oxidized									
Binder Appl Rate at 60°C =	0.464	Gal/yd^2	2.244	0.244	0.85	0.5	0.06	0.018	
					0.67				
Hot Binder Rate at 165°F	**0.481**								
-100 ADT on Slightly Porous and Oxidized									
Binder Appl Rate at 60°C =	0.419	Gal/yd^2	2.244	0.244	0.85	0.5	0.03	0.018	
					0.67				
Hot Binder Rate at 165°F	**0.435**								
-100 ADT on Smooth Non-porous									
Binder Appl Rate at 60°C =	0.374	Gal/yd^2	2.244	0.244	0.85	0.5	0	0.018	
					0.67				
Hot Binder Rate at 165°F	**0.388**								

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Standard Chip Seal aggregate requirements

- Single sized
- Must be clean – for reliability
  - Less than 1% passing #200 sieve; better adhesion
    - ✓ **Dust grabs the binder before the rock can**
- Durable – wear life
  - LAR, lower = harder, polish/wear resistant
    - ✓ **Reduces stud and traffic wear**
- Flakiness Index – reliability
  - Lower = More cubicle, uniform shape easier to design around
    - ✓ **More accurate design = more reliable seal**
- Fractured faces – Stability on the road

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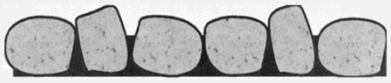
Single size vs. graded aggregate



Single sized aggregate is perfect for the standard chip seal with rapid cure emulsions (CRS-2P)

More uniform height

- Has more room for binder – space not filled by smaller aggregate particles
- The more single sized, the easier it is to develop a good chip seal design

Graded aggregate is not good for CRS-2P or CMS-2P

- Will flush the little rock and may not hold the big rock
- Great for Otto Seal or maintenance seal with HFE-150

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Aggregates *9-03*

9-03.4 Aggregate for Bituminous Surface Treatment

9-03.4(1) General Requirements

Aggregate for bituminous surface treatment shall be manufactured from ledge rock, talus, or gravel, in accordance with Section 3-01, which meets the following test requirements:

Los Angeles Wear, 500 Rev.	35% max.
~~Degradation Factor~~	30 min.

9-03.4(2) Grading and Quality

Aggregate for bituminous surface treatment shall conform to the requirements in the table below for grading and quality. The particular type or grading to be used shall be as shown in the Plans. All percentages are by weight.

The material shall meet the requirements for grading and quality when placed in hauling vehicles for delivery to the roadway, or during manufacture and placement into a temporary stockpile. The exact point of acceptance will be determined by the Engineer.

Crushed Screening Percent Passing					
	¾"-½"	⅜"-No. 4	½"-No. 4	⅜"-No. 4	No. 4-0
1"	99-100				
¾"	95-100	99-100			
½"		95-100	99-100		
⅜"	0-20		90-100	99-100	
⅜"	0-5		60-85	70-90	99-100
No. 4		0-10	0-3	0-5	76-100
No. 10		0-3			30-60
No. 200	0-1.5	0-1.5	0-1.5	0-1.5	0-10.0
% fracture, by weight, min.	90	90	90	90	90

All percentages are by weight.

The fracture requirement shall be at least one fractured face and will apply to the combined aggregate retained on the No. 4 sieve in accordance with FOP for AASHTO T 335.

The finished product shall be clean, uniform in quality, and free from wood, bark, roots, and other deleterious materials.

Crushed screenings shall be substantially free from adherent coatings. The presence of a thin, firmly adhering film of weathered rock shall not be considered as coating unless it exists on more than 50 percent of the surface area of any size between successive laboratory sieves.

The portion of aggregate for bituminous surface treatment retained on a No. 4 sieve shall not contain more than 0.1 percent deleterious materials by weight.

Fine aggregate used for choke stone applications meeting the grading requirements of Section 9-03.1(2)B may be substituted for the No. 4-0 gradation.

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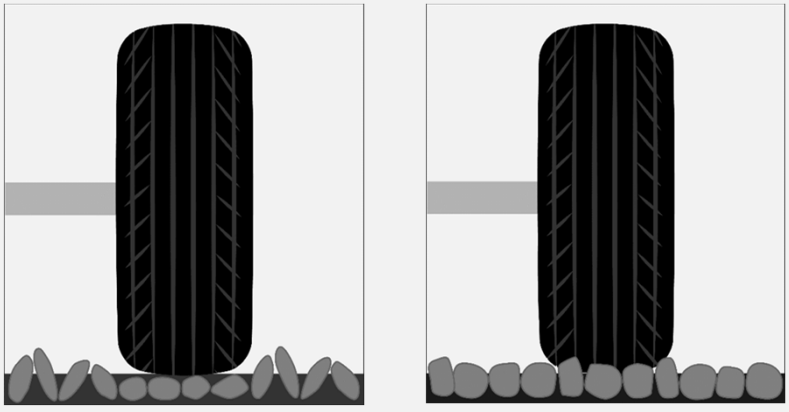
The problem with flat chips



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The rock needs to be damp

- Rapid breaking emulsions start to break as soon as they find aggregate, usually it's the dust
- Water on the rock slows the break on the emulsion giving more time for the emulsion to get to the chip
- Water on the rock helps pull the emulsion through the dust layer

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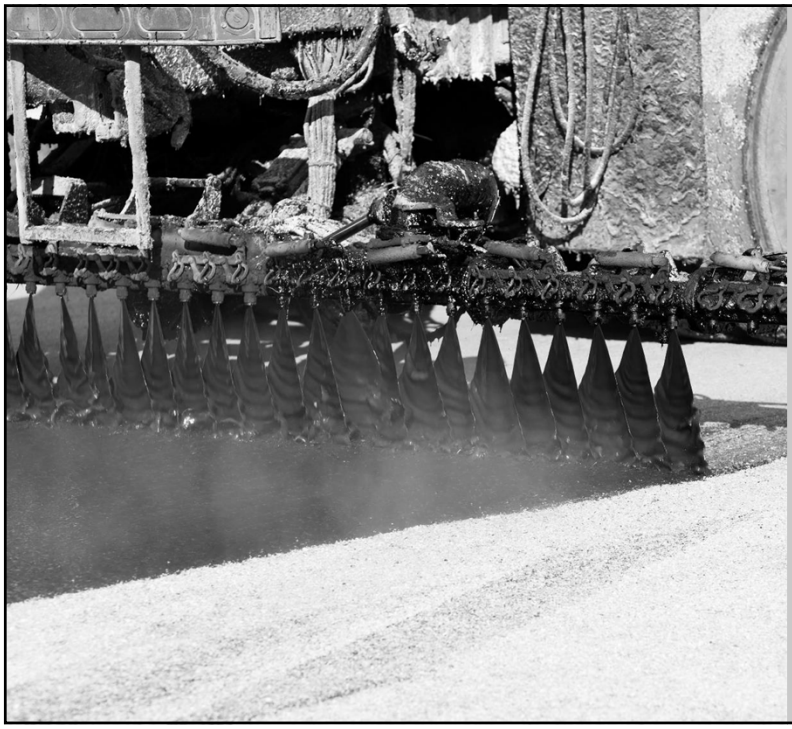

Binders

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CRS-2P, CMS-2P, CRS-2LM, CRS-2R

- Polymer-containing emulsions
- Polymer acts like glue enhancing the grab on the rock
  - **The polymer does not make the emulsion elastic!**
- Develops strength faster than other emulsions, can sweep sooner
- Requires clean chips
- Damp rock is recommended
- Must place chips immediately
- Most expensive conventional chip seal emulsion

New – "CVRS-2P"

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What is really important!

9-02.1(6)A Polymerized Cationic Emulsified Asphalt CRS-2P

CRS-2P shall be a polymerized cationic emulsified asphalt. The polymer shall be milled into the asphalt or emulsion during the manufacturing of the emulsified asphalt. CRS-2P shall meet the following requirements:

	AASHTO Test Method	Specifications	
		Minimum	Maximum
Viscosity @122°F, SFS	T 59	100	400
Storage Stability 1 day %	T 59		1
Demulsibility 35 ml. 0.8% Dioctyl Sodium Sulfosuccinate	T 59	40	
Particle Charge	T 59	positive	
Sieve Test %	T 59		0.30
Distillation			
→ Oil distillate by vol. of emulsion %	T 59[1]	0	3
→ Residue	T 59[1]	65	
Tests on the Residue From Distillation			
→ Penetration @77°F	T 49	100	250
→ Elastic Recovery %	T 301[2]	50	

[1]Distillation modified to use 300 grams of emulsified asphalt heated to 350°F ± 9°F and maintained for 20 minutes.
[2]The residue material for T 301 shall come from the modified distillation per note 1.

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There is more to having a successful chip seal than having a good design

After you've placed the seal, it needs the 3 Ts:

1. **Temperature:** Warm temperatures to soften the residue
2. **Traffic:** Enough traffic traveling over the seal to finish embedment
3. **Time:** To get the seal completely compacted before warm summer temperatures end

The more you can count on one of these, the less you worry about the others

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Temperature

Pavement temperature exceeding 110°F

- 110°F is close to the softening point of the binder
- Need warm temperatures to change the emulsion residue to a smooth film from separate particles as they were when the binder was still suspended in the emulsion
- The softened binder is necessary to allow traffic to work the seal for embedment and to knead the last few % of water trapped in the residue out of the system
- This means even with a good design, if the seal is done after all the warm weather is gone, the rock won't be fully embedded and may retain water going into the plow season
- If the road is shaded, you will not get as high of road temperature
- The earlier the better!! Let the warm weather help traffic finish the seal

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Temperature of the same road in the shade and in the sun

Air temperature at 2 PM is 80°F

→ Shaded area: 87.2°F

→ Sunny area: 115°F

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The shade effect

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Traffic

- When the rock is dropped into the binder, the voids will approach 50%
- Rolling will drop that to around 30%
- The final product to be achieved in the design will not occur until the voids are down around 20%
- **This has to be achieved by a lot of post construction traffic. Wheels on the road!**
- If you don't have enough traffic, the voids won't decrease, and the chips will not reach the design embedment
- Possible seal failure risk until final embedment/voids are reached

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Time

- Low-volume roads need more time to get enough traffic
  - **100 ADT county roads need a lot of warm weather days to complete embedment**
    - They need to be done early so there are wheels on the road on every hot day
    - Need more time before end of season
- High-volume roads achieve the traffic levels fast
  - **Freeways and 2000 ADT roads will get enough wheels within a few days to a week when temperature is achieved to complete embedment**
    - They can be sealed later in the summer
    - Need less time before end of season

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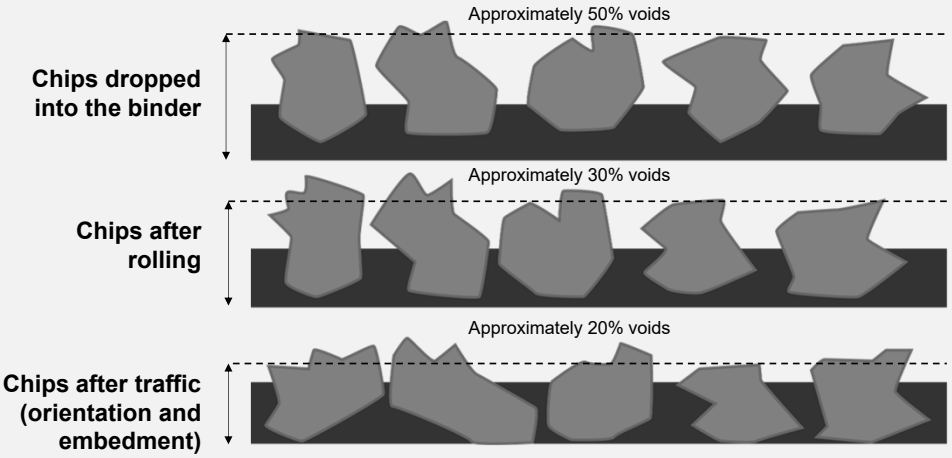
The stages of chip embedment



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Rollers

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Steel Rollers

- Being used successfully by WSDOT, ODOT and many counties
- Add it to the fleet, don't just replace a pneumatic; more rollers are always better
- If it bridges the low points, don't worry they already get compaction
- The high points aren't getting enough traffic for embedment, steel will help
- Steel immediately improves embedment and cuts plow damage

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38,000 lb. Vibratory

Bonner County, Idaho

Any steel wheel roller works: double drum, grade, big, small

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Note the effect on the aggregate texture

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Areas that need more rolling

- While the wheel paths get the compaction needed for a successful seal
- **Parking lanes, fog line, turn lanes, quarter crown, centerline area, etc. do not**
- Traffic will take much longer to give these areas the compaction needed per the design
- Give it extra attention while building; increase the emulsion application rate slightly (give them extra rolling)
- The higher the traffic count the bigger disparity between the travel area and Parking Lanes, fog line, turn lanes, quarter crown, centerline area, etc. May need to increase application in these areas if possible

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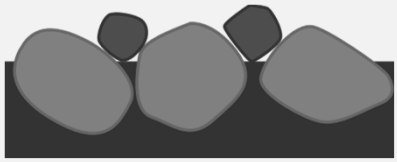
Why we use choke stone

- Choke keeps traffic out of the oil
- Choke helps to keep the chips from rolling around
  - It wedges in between chips, they don't turn over, keeping the seal from tracking
- Choke helps the emulsion break
  - Emulsion wants to break when it makes contact with any rock



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Fog Seal

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Why we Fog Seal a fresh Chip Seal

- Extra security against chip loss – additional emulsion residue
- Helps in post construction traffic embedding action
  - Black color increases pavement temp to soften residue for improved embedment from traffic. Extends window to cooler days.
- Aesthetics – black like new pavement

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Fog Sealing

- .12 to .14 gal/yd^2 on chip seals
- .08 to .10 gal/ yd^2 on pavements
- Loss of skid resistance is a concern over dense pavements
  - Use of sand is a good temporary fix
- Recommended emulsions are CSS-1 or CSS-1H Dilute, “Quickseal”, rapid setting fog oils, etc.

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Fog Seal has benefits beyond Chip Seal use

- TRB Paper 08-0632, fog seals are cost effective
- Seal pavement against water/oxidation
- Reduce hardening – flexibility of pavement
- Reduce/delay deterioration – maintain texture
  - Start within 1 to 2 years of paving
- Fog wears off surface but stays in matrix
  - Review of 4-year-old fog seals show the seal effects still present – retarding water infiltration

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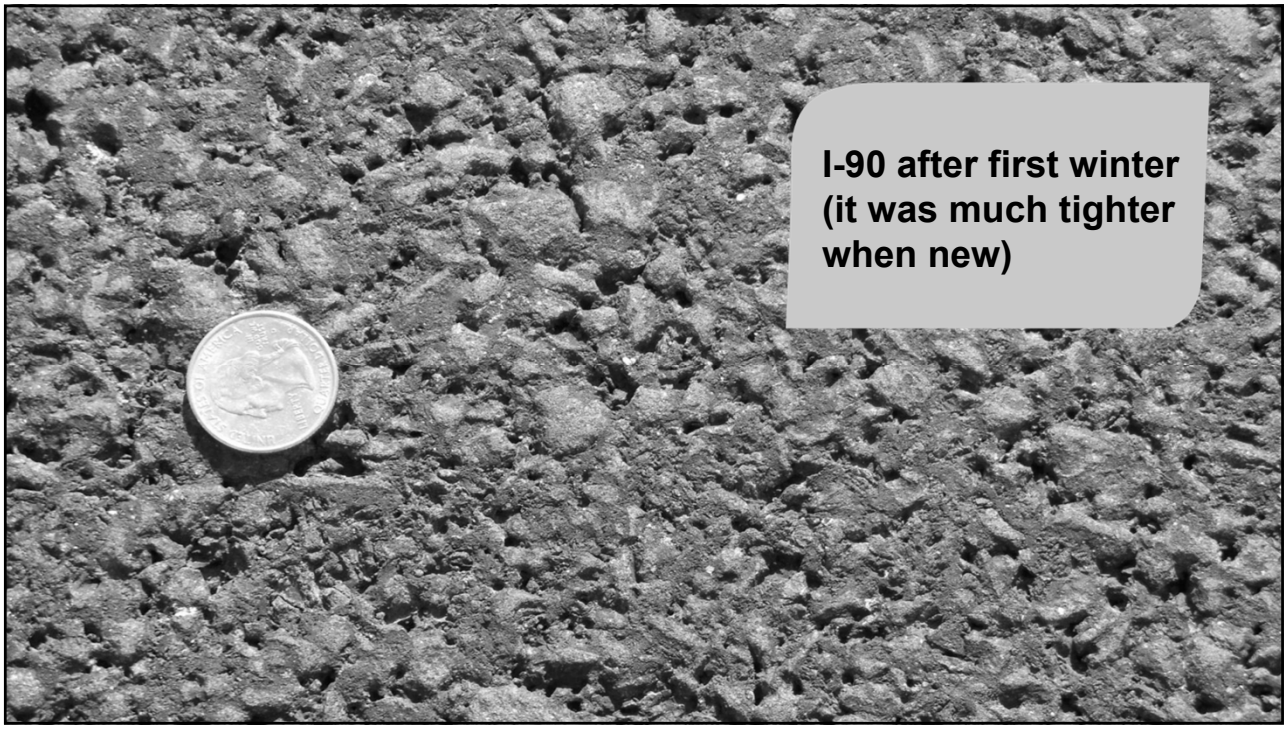
I-90 after first winter
(it was much tighter
when new)

35


Fresh Fog
Filling voids – sealing
against water and air
infiltration

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What can make a Chip Seal fail?

- Heavy rain or overly wet surface
  - Flushes out the emulsion
  - Emulsion drains off the road
- Cool temperatures
  - Emulsion sets and cures slow, can't hold rock under traffic
- Dirty rock
  - Emulsion can't get through the dust and doesn't lock onto the rock
- Over choking/choke too dirty
  - Same effect as cool temps, slow cure water cannot escape

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What can make a Chip Seal fail?

- Sealing late in the season
  - Not enough warm weather and traffic to compact seal before winter
  - Emulsion just crusts over and stiffens – doesn't lose all water until spring (Spring flushing)
- Low shot rate
  - Not enough to hold rock
- High shot rate
  - Flushing
- Not enough rolling
  - Poor early embedment, possible windshield damage

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What can make a Chip Seal fail?

- Not prepping patches
  - Oil soaks in, chips have nothing to hold them
- Not accounting for shade
  - Seal does not get warm enough for traffic to embed, particularly before first winter

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What can make a Chip Seal fail?

1. Heavy rain or overly wet surface
2. Cool temperatures
3. Dirty rock
4. Over choking/choke too dirty
5. Sealing late in the season
6. Low shot rate
7. High shot rate
8. Not enough rolling
9. Not prepping patches
10. Not accounting for shade

2 out of 10 = 50% chance of failure
3 out of 10 = <u>100%</u> chance of failure

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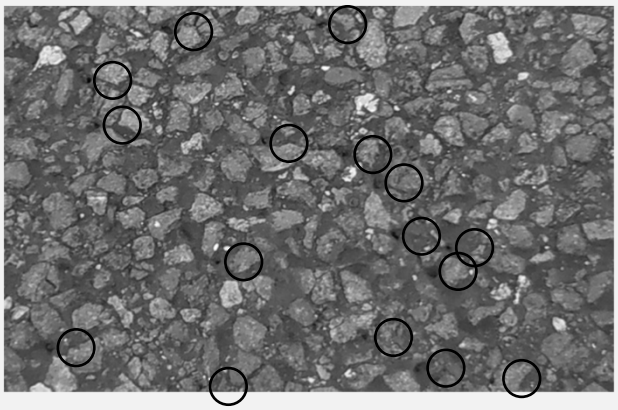
Holes left by late water vapor



Seal was done too late to get rid of trapped water before winter

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Too much dirty rock/choke

- Late season
- Water could not evaporate
- It pooled and drained out

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Road never dries out

- Probably not a good seal candidate for any type of seal, emulsion or hot (notice the moss)
- Cold temperatures
- This road never gets to temperature- Never!

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Sealed in September on a shady road. Emulsion did not cure, it just stiffened. Traffic could not embed further. Peeled off under traffic. Further down the section in full sun looks great.

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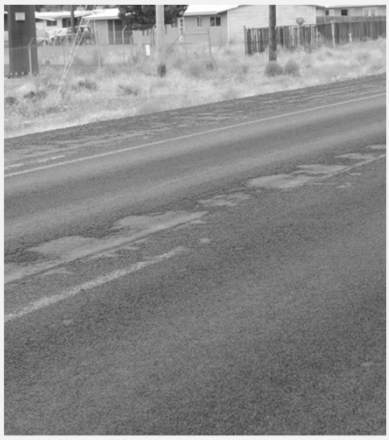
No traffic, no seal



High traffic with double stripe
- No traffic crossed the centerline
- Needed extra rolling attention

This was a hot-applied chip seal
- They are less responsive to traffic for final embedment due to higher residue softening point
- Has had some issues in northern states

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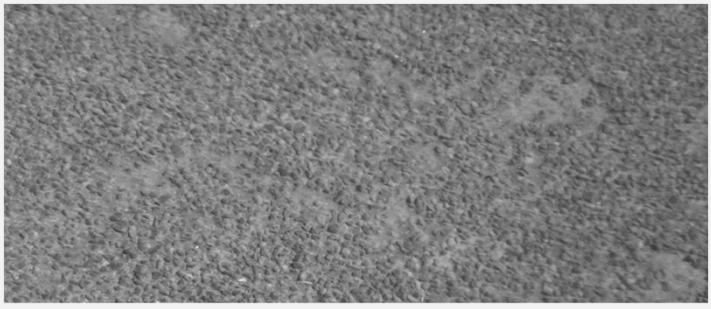
Rock picking out



Could be dirty rock or low shot rate

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Flushing in the wheel paths

Shot rate too high for the level of traffic on this road

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Special techniques for Chip Seals

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FA-2 Chip Seal specs

“.25-inch Chip Seal”

- CRS-2P .25 to .30 gal/yd^2
  - Application at the higher end holds multi layers of rock for finer surface, more surface correction
- FA-2 (.25 inch) rock 15 to 20 lbs/yd^2
  - Will sweep off a good percentage (retains about 11 lbs) but need to place initially to absorb/account for all the CRS-2P
  - Retain the rock swept off to use going forward – the rock is expensive, and this technique requires a lot of extra rock
- Rapid curing fog emulsion .1 to .15 gal/yd^2
  - Extra insurance and gives a final appearance like pavement
- End result is a seal that looks much like a Type II Slurry and is more accepted on residential streets

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High Float Emulsion and Crushed Cover Stone

"Otto Seal" – Report 1989

- Use HF-150 and Crushed Cover Stone vs. ½ to ¼ and CRS-2P
- Crushed Cover Stone has high fracture and is fully graded like hot mix rock (Rock keys in on itself)
- Application rate is .40 to .46 gal/yd^2 vs. .55+ gal/yd^2 for CRS-2P
- Apply approx. 35 lbs of DRY Crushed Cover Stone
  - This dense graded material will bridge in the chipper otherwise
- Very reliable because we get both binder and rock interlock to hold these seals in place

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Points to remember for success

- Do a design – understand the size and cleanliness of your rock, the condition of the road, and traffic count
- Match your seal construction to your conditions
  - Sunny and warm climate – early to late
  - High traffic – early to late
  - Shade or colder climate – early only
    - **If you're going late, paint it black and use the sun's heat**
    - **If you're nervous, paint it black and add some residue**
- Roll, roll, roll
- Add that steel roller
- Remember to compensate for new mats, open pavements, shady areas – they may need more emulsion and/or extra rolling

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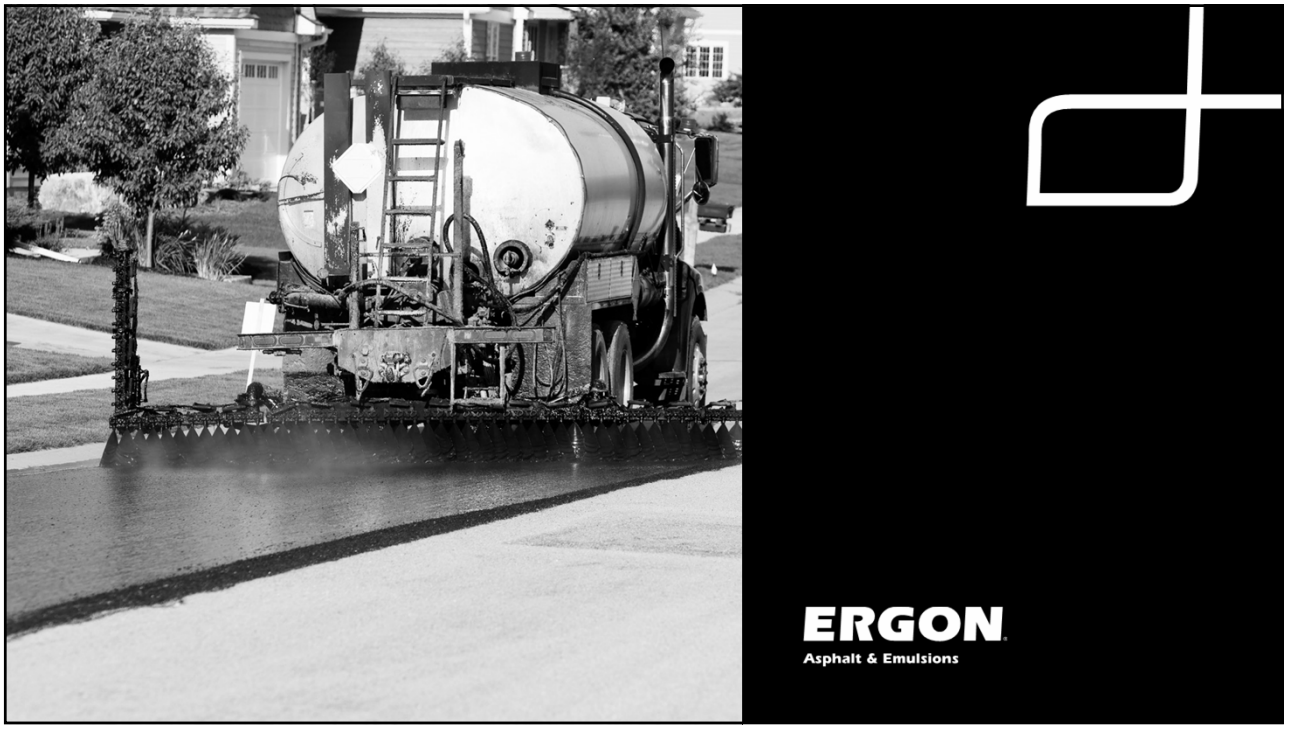

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Unit 6


CHIP SEAL
INSPECTION
Presented by Bert Perisho
Albina Asphalt Field Rep
Adapted from:
FHWA Pavement Preservation Checklist Series
Chip Seal Application

1


Pavement Preservation
Checklist Series
2 Chip
Seal
Application
https://www.fhwa.dot.gov/pavement/preservation/ppcl00.cfm

2

Agenda Topics

- Preapplication Inspection
- Equipment Calibration
- Traffic Control
- Project Inspection
- Trouble Shooting

3

4

Preapplication Inspection

Surface Preparation

- The road surface is clean and dry
- Surface issues have been addressed
  1) significant cracks have been addressed
  2) potholes have been addressed
  3) leveling repairs have been complete
- Road surface has been inspected for drainage problems

5

Preapplication Inspection

Equipment Inspection

- **Distributor**
  - The spray bar is at the proper height
  - All nozzles are uniformly angled at 15° – 30° from spray bar
  - All nozzles are free of clogs
  - The spray pattern has been checked for uniformity and proper overlap (double or triple)
  - The application pressure has been checked.
  - The distributor's application calibration has been checked
  - Equipment is free of leaks (oil, water, air)

6

Preapplication Inspection

Equipment Inspection

- **Chip Spreader**
  - Each gate control and setting has been checked
  - The Scalping screen is in good condition
  - The chip spreader's calibration across the entire chipper head has been checked and is in tolerance
  - The truck hookup hitch has been checked for function and safety
    - Equipment is free of leaks (oil, water, air)

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Preapplication Inspection

Equipment Inspection

- **Haul Trucks**
  - The truck box is clean and free of debris and other materials.
  - The truck hookup hitch is in good working order
  - If needed, a truck box apron or extension for loading the chip spreader is in place.
  - Air dryers are equipped to direct air "pop off" away from surface
  - Safety equipment is working properly (Mirrors, lights, backup alarm)
  - Equipment is free of leaks (oil, water, air)

8

Preapplication Inspection

Equipment Inspection

- **Rollers**
  - Appropriate types of rollers have been selected
  - Appropriate number of rollers has been determined
  - For pneumatic-tired rollers the tire size, rating, and pressures comply with the manufacturer's recommendations
  - The tire pressure is the same on all tires
  - All tires have a smooth surface
  - Equipment is free of leaks (oil, water, air)

9

Preapplication Inspection

Equipment Inspection

- **Brooms**
  - The bristles are the proper length.
  - The broom can be adjusted vertically to avoid excess pressure
  - The broom core is showing even wear, no flat spots or cone shape
  - Equipment is free of leaks (oil, water, air)

- **All Equipment**
  - All equipment is free of leaks (oil, water, air)
  - All equipment is calibrated correctly and clean

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Preapplication Inspection

- **Timing and Weather Requirements**
  - Application is within date range specifications
  - Air and surface temperatures meet agency requirements
  - Application of asphalt does not begin if rain is likely
  - Recognize the possibility of strong winds. Wind will cause problems with asphalt application
  - High temperatures, humidity, and wind will affect how long the asphalt/emulsion takes to break

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Preapplication Inspection

Know Your Road

- **Determining Application Rates**
  - Follow agency guidelines and requirements as appropriate
  - Verify that a chip seal design has been done
  - The road surface has been reviewed
  - More asphalt is applied to "dried out" and porous (open) surfaces
  - More asphalt is applied on roads with low traffic volumes
  - Less asphalt is applied to smooth, nonporous, and asphalt rich (fat) surfaces
  - Less asphalt is applied on roads with high traffic volumes

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Equipment Calibration

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Application Rate Check

Asphalt – Method A

- **Recommended for Calibration**
  - Record weight of a 1 yd² pan
  - Place the pan on the road surface
  - Have distributor apply asphalt over the pan
  - Record the weight of the pan and asphalt
  - Subtract the pan weight from total to obtain the weight of the applied asphalt

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Application Rate Check

Asphalt – Method B

- **Recommended for Random Checks**
  - Park the distributor on level ground, measure asphalt level in tank record in gallons
  - Measure off a known area for a test section
  - Have distributor apply asphalt to the test section
  - Park the distributor on level ground and record gallons remaining
  - Subtract 2nd reading from 1st reading to obtain gallons applied
  - Divide the gallons applied by the area covered with application. The result equals the application rate: gal/yd².
  - If measuring in feet: length X width ÷ 9 = yd²

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Application Rate Check

Aggregate – Method A

- **Recommended for Calibration**
  - Weigh a 1 yd² tarp
  - Place the tarp on the roadway
  - Have the chip spreader apply the chips over the tarp at operational speed
  - Weigh the tarp with the chips
  - Tarp with chips – tarp weight = lbs chip per yd²

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Application Rate Check

Aggregate – Method B

- **Option For Random Checks**
  - Weigh an empty haul truck
  - Load truck with chip rock and reweigh the truck
  - Calculate weight of chip rock (loaded – empty = lbs chip)
  - Apply all chip rock from the weighed truck
  - Measure the length and with of area covered to find yd^2
    If measured in feet Length X Width ÷ 9 = yd^2
  - Lbs chip ÷ yd^2 = Application Rate

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Traffic Control

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Traffic Control

- Traffic Control Plan (TCP) has been developed
- The signs and devices used match the TCP
- The TCP complies with local agency regulations or the Federal MUTCD
- Traffic is not delayed for extended periods of time
- Pilot car leads traffic at reduced speeds over the fresh seal
- Signs are removed/covered/turned when they no longer apply
- Any unsafe conditions are reported to a supervisor

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Project Inspection

- **Asphalt Application**
  - The bar should fire off evenly and shut off evenly. If there are issues, building paper may be used to get straight edges.
  - Starts should not have significant overlap or dry skip
  - Verify asphalt emulsion is within required application range
  - The application looks uniform to the eye
  - Watch for plugged or partially plugged nozzles
  - Watch for visual appearance of streaking, drilling, ridging
  - Do random application rate checks
  - Adjust speed of distributor to stay in “contact” with chip spreader allowing distributor to shoot out without stopping. This prevents additional joints and associated issues.
  - Stop the distributor if any problems are observed

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Project Inspection

- **Aggregate Application**
  - Best if enough haul trucks to keep steady supply of aggregate to spreader
  - Starts have limited overlap of rock
  - Chip spreader remains “in contact” with distributor with emulsions, within temperature for hot oil seals
  - Chip spreader travels at a speed that prevents the rock from rolling or bouncing on the surface
  - The aggregate is damp

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Project Inspection

- **Aggregate Application (continued)**
  - There is enough aggregate to prevent tires from tracking, no asphalt on top of aggregate
  - The application appears uniform to a visual inspection
  - For hot oil seal the aggregate has a salt and pepper appearance
  - The aggregate embedment in the asphalt is checked and the asphalt or aggregate rates are adjusted accordingly
  - Watch for streaks, plugged gates, and oversized aggregate in the application

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Project Inspection

- **Truck Operation**
  - Trucks split tracks (stagger) across the new mat. This assist in the rolling/embedment of the aggregate
  - Trucks travel at reduced speeds on the new mat
  - Stops and turns are made gradually
  - Trucks avoid driving through exposed oil if possible

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Project Inspection

- **Rolling**
  - Rollers need to keep up with the chip spreader, not falling behind, leaving room for trucks between rollers and spreader
  - Recommend the steel drum rolls the meet line when there is exposed oil
  - Rollers MUST avoid driving on exposed oil
  - All starts, stops, and turns are made gradually
  - The entire surface should be rolled 2 times
  - You cannot over roll a chip seal. Rollers can keep rolling and improve the embedment of the aggregate

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Project Inspection

- **Longitudinal Joints - Meetline**
  - The meetline is only as wide as the spray from the end nozzle (≈ 8 inches)
  - On subsequent panel, the distributor lines up to completely cover the exposed meetline with fresh oil
  - Meetlines are not made in the wheel paths
  - Meetlines are made at the center of the road, center of a lane (¼ crown), or edge of a lane
  - Meetlines are not left uncovered overnight

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Project Inspection

- **Meetline Methods**
  - **Exposed Method**
  - Leave 6–8-inch strip of exposed asphalt when applying aggregate
  - On the next distributor pass re-apply asphalt to the exposed strip
  - Cover all asphalt with aggregate
  - **Tight Meetline Method**
  - Knife end nozzle ≈ 90°
  - Apply aggregate the full width of the asphalt applied
  - Broom or blow any aggregate material from the untreated lane
  - Repeat on next panel. No overlap on meetline.

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Project Inspection

- **Transverse Joints – Starts and Stops**
  - Distributor bar should “fire off” all nozzles simultaneously.
  - Distributor bar should turn off all nozzles simultaneously
  - If not, building paper can be used to give a good clean line
  - Distributor operator needs to be able to “hit” their mark. No dry skip, no significant overlap. More than ≈ 2 inches will need to use building paper on all starts.
  - Building paper must be disposed of properly

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Project Inspection

- **Brooming**
  - On Hot Oil seals the brooming happens as soon as possible. Often as part of the same work zone
  - On Emulsion seals brooming generally occurs several hours later or the next day. This will vary depending on type of emulsion used and environmental conditions affecting curing.
  - Brooming should not dislodge aggregate
  - Consider spraying the road surface with water before brooming to reduce dust problems.

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Project Inspection

- **Project Wrap Up**
  - **Opening The Seal To Traffic**
  - Work Zone related signs remain in place until permanent stripping is completed (No Center Stripe, Construction Speed, Loose Gravel)
  - After final brooming and permanent pavement markings completed, remove all work zone signs
  - **Cleanup Responsibilities**
  - Verify all loose gravel has been removed from the travel lanes
  - Verify any asphalt spills or clean out areas are cleaned up appropriately
  - If building paper was used, make sure it is all collected and disposed of

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Trouble Shooting

- **Problem: Solution**
  - **Chip embedment over 80%:** Consider lowering the asphalt application rate
  - **Chip embedment less than 50%:** Consider increasing the asphalt application rate
  - **Lots of chips with small amount of asphalt on the:** Consider reducing chip rock rate
  - **Asphalt splattering:** Check spray pressure. Probably excessive
  - **Exposed asphalt remains after chip application:** Chip spreader gate plugged or not working

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Trouble Shooting

- **Problem: Solution (continued)**
  - **Excessive chip rock:** Chip spreader gate may be malfunctioning, or head may be overloaded
  - **Asphalt bleeding or flushing:** To much asphalt applied
  - **Streaking or ridging in asphalt:**
    - Cold asphalt
    - Nozzles not properly aligned
    - Spray bar to low/high
    - Spray bar pressure too high
    - Plugged or partially plugged nozzles
    - Asphalt viscosity too high
  - **Loss of chips at meetline after brooming:** Check meetline process

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Trouble Shooting

- **Problem: Solution (continued)**
  - **Uneven chip application:** Chip spreader may need recalibrated
  - **Asphalt on top of chip rock:** Chip spreader may be traveling to fast. Other equipment in the work zone may be operating incorrectly tracking asphalt onto the chip rock or rolling the chip rock
  - **Chip rock being dislodged:**
    - Asphalt application rate too low
    - Chip rock excessively dirty or dusty
    - Traffic or equipment speeds are too high
    - Asphalt applied to far ahead of chip spreader.
    - Rollers not getting rock embedded in a timely manner before asphalt sets
    - Brooming has begun before the asphalt is adequately set

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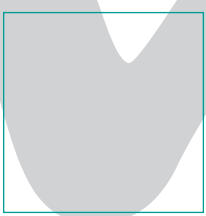
Pavement Preservation
Checklist Series

2 Chip Seal Application



FP2

U.S. Department of Transportation
Federal Highway Administration

Chip Seal Application Checklist

This checklist is one of a series created to guide State and local highway maintenance and inspection staff in the use of innovative pavement preventive maintenance processes. The series is provided through the joint efforts of the Pavement Preservation Program of the Federal Highway Administration (FHWA), and the Foundation for Pavement Preservation (FP^2).

FHWA uses its partnerships with FP^2, the American Association of State Highway and Transportation Officials, and State and local transportation agencies to promote pavement preservation.

To obtain other checklists or to find out more about pavement preservation, contact your local FHWA division office or FP^2 (at www.fp2.org), and check into these FHWA Web pages:

www.fhwa.dot.gov/preservation

www.fhwa.dot.gov/infrastructure/asstmgmt/resource.htm

Chip Seal Application Checklist

Preliminary Responsibilities

Project Review

- ❑ Is the project a good candidate for a chip seal?
- ❑ How much rutting is present?
- ❑ How much and what type of cracking exists?
- ❑ Is crack sealing needed?
- ❑ How much bleeding or flushing exists?
- ❑ Review project for bid/plan quantities.

Document Review

- ❑ Bid specifications
- ❑ Special provisions
- ❑ Construction manual
- ❑ Traffic control plan
- ❑ Agency requirements
- ❑ Manufacturer s instructions
- ❑ Material safety data sheets

Materials Checks

- ❑ The type of asphalt emulsions to be used is compatible with the aggregate.
- ❑ The asphalt is from an approved source (if required).
- ❑ The asphalt is sampled and submitted for testing (if required).
- ❑ All aggregate chips are close to the same size.
- ❑ The aggregate is clean and free of excess fines.
- ❑ The asphalt application temperature range is specified.

Preapplication Inspection Responsibilities

Surface Preparation

- ❑ The surface is clean and dry.
- ❑ All pavement distresses have been repaired.
- ❑ The existing surface has been inspected for drainage problems.

Equipment Inspections

Distributor

- ❑ The spray bar is at the proper height.
- ❑ All nozzles are uniformly angled 15° to 30° from the spray bar.
- ❑ All nozzles are free of clogs.
- ❑ The spray pattern has been checked for uniformity and proper overlap (double or triple).
- ❑ The application pressure has been checked.
- ❑ The distributor s application calibration has been checked.

Chip Spreader

- ❑ Each gate control and setting has been checked.
- ❑ The scalping screen is in good condition.
- ❑ The chip spreader s calibration across the entire chipper head has been checked.
- ❑ The truck hookup hitches have been checked.

Haul Trucks

- ❑ The truck box is clean and free of debris and other materials.
- ❑ The truck hookup hitch is in working order.
- ❑ If required, a truck box apron or extension for loading the chip spreader is in place.

Rollers

- ❑ The type of roller to be used has been selected (pneumatic-tired roller recommended).
- ❑ The roller tire size, rating, and pressure comply with the manufacturer s recommendations.
- ❑ The tire pressure is the same on all tires.
- ❑ All tires have a smooth surface.

Broom

- ❑ The bristles are the proper length.
- ❑ The broom can be adjusted vertically to avoid excess pressure.

All Equipment

- ❑ All equipment is free of leaks.
- ❑ All equipment is calibrated and clean.

Weather Requirements

- ❑ The agency has a range of dates when chip sealing can be done.
- ❑ Air and surface temperatures have been checked at the coolest location on the project.
- ❑ Air and surface temperatures meet agency requirements.
- ❑ Application of asphalt does not begin if rain is likely.
- ❑ High winds can create problems with asphalt application.
- ❑ High temperatures, humidity, and wind will affect how long the asphalt/emulsion takes to break.

Determining Application Rates

- ❑ Agency guidelines and requirements are followed.
- ❑ A chip seal design has been done.
- ❑ More asphalt is applied to dried-out and porous surfaces.
- ❑ More asphalt is applied on roads with low traffic volumes.
- ❑ Less asphalt is applied to smooth, nonporous, and asphalt-rich surfaces.
- ❑ Less asphalt is applied on roads with high traffic volumes.
- ❑ There is a salt and pepper appearance after the aggregate has been applied.

Checking Application Rates

Asphalt - Method A
(RECOMMENDED FOR CALIBRATION)

- ❑ Record the weight of a .84 m^2 (1 yd^2) pan or nonwoven geotextile material.
- ❑ Place the pan or geotextile on the road surface.
- ❑ Have the distributor apply asphalt over the pan or geotextile.
- ❑ Record the weight of the pan and asphalt or the geotextile and asphalt.
- ❑ Subtract the two weights to obtain the weight of the applied asphalt.

Asphalt – Method B
(RECOMMENDED FOR RANDOM CHECKS)

- ❑ Park the distributor on level ground, measure the asphalt, and recover the number of L (gal) area of asphalt (note: not a conversion).
- ❑ Measure off a known area for a test section.
- ❑ Have the distributor apply asphalt to the test section.
- ❑ Park the distributor on level ground and remeasure and record the L (gal) of asphalt.
- ❑ Subtract the two numbers to obtain the L (gal) of asphalt applied.
- ❑ Divide the L (gal) applied by the area covered by asphalt. The result equals the application rate: L/m^2 (gal/yd^2). (If using feet, length x width/9 = yd^2.)

Aggregate – Method A
(RECOMMENDED FOR CALIBRATION)

- ❑ Weigh a .84 m^2 (1 yd^2) tarp or geotextile material.
- ❑ Place the tarp or geotextile on the roadway.
- ❑ Have the chip spreader apply the aggregate over the tarp or geotextile.
- ❑ Weigh the tarp or the geotextile material with the aggregate.
- ❑ Subtract the two weights to obtain the weight of the aggregate.
- ❑ Divide the weight of the aggregate by .84 m^2 (1 yd^2) to determine the application rate.

Aggregate – Method B
(RECOMMENDED FOR RANDOM CHECKS)

- ❑ Weigh a haul truck empty.
- ❑ Load the haul truck with aggregate and reweigh the truck.
- ❑ Subtract the two weights to obtain the weight of the aggregate.
- ❑ Empty all the aggregate into the chip spreader.
- ❑ Have the chip spreader apply all the aggregate from the weighed truck.
- ❑ Measure the length and width of the aggregate spread and calculate the area (if using feet, length x width/9 = yd^2).
- ❑ Divide the weight of the chips by the area of spread to determine the actual application rate (kg/m^2 or lb/yd^2).

Traffic Control

- ❑ The signs and devices used match the traffic control plan.
- ❑ The setup complies with local agency regulations or the *Federal Manual on Uniform Traffic Control Devices* (MUTCD).
- ❑ Flaggers do not hold the traffic for extended periods of time.
- ❑ The pilot car leads traffic slowly 40 kph (24 mph) or less over fresh seals.
- ❑ Signs are removed or covered when they no longer apply.
- ❑ *Any unsafe conditions are reported to a supervisor.*

Project Inspection Responsibilities

Asphalt Application

- ❑ Building paper is used to start and stop asphalt application for straight edges.
- ❑ The asphalt temperature is within the required application range.
- ❑ The application looks uniform.
- ❑ A check is made for plugged nozzles.
- ❑ A check is made for drilling or streaking.
- ❑ Random checks of application rates are performed.
- ❑ The distributor speed is adjusted to match the chip spreader speed to prevent stop-start operations.
- ❑ The distributor is stopped if any problems are observed.

Aggregate Application

- ❑ Enough trucks are on hand to keep a steady supply of aggregate for the spreader.
- ❑ The application starts and stops with neat, straight edges.
- ❑ The application starts and stops on building paper.
- ❑ The chip spreader follows closely 30 m (33 yd) or less behind the distributor when an emulsion is used.
- ❑ The spreader travels slowly enough to prevent chips from rolling when they hit the surface.
- ❑ The aggregate is in a surface-damp condition.
- ❑ No asphalt is on top of the chips.
- ❑ The application is stopped as soon as any problems are detected.
- ❑ The application appears uniform.
- ❑ The aggregate has a salt and pepper appearance.
- ❑ The percentage of aggregate embedment in the asphalt is checked and the asphalt or aggregate application rate adjusted if required.
- ❑ A check is made for streaks and plug-ups.

Truck Operation

- ❑ Trucks are staggered across the fresh seal coat to avoid driving over the same area.
- ❑ Trucks travel slowly on the fresh seal coat.
- ❑ Stops and turns are made gradually.
- ❑ Truck operators avoid driving over exposed asphalt.
- ❑ Trucks stagger their wheel paths when backing into the chip spreader to help eliminate aggregate rollover and to aid in rolling.

Rolling

- ❑ The rollers follow closely behind the chip spreader.
- ❑ The rollers first pass is on the meetline.
- ❑ The rollers travel slowly speeds are kept at 8 kph (5 mph) maximum.
- ❑ Rollers must avoid driving on exposed asphalt.
- ❑ All stops, starts, and turns are made gradually.
- ❑ The entire surface is rolled twice.

Longitudinal Joints

- ❑ The meetline is only as wide as the spray from the end nozzle about 20 cm (8 in).
- ❑ The distributor lines up so that the end nozzle sprays the meetline.
- ❑ The meetlines are not made in the wheel paths.
- ❑ The meetlines are made at the center of the road, center of a lane, or edge of a lane.
- ❑ The meetlines are not left uncovered overnight.

Method A

- ❑ Leave a 15 20 cm (6 8 in) strip of asphalt exposed when applying the aggregate.
- ❑ Apply asphalt to the strip on the next distributor s pass.
- ❑ Apply aggregate to the asphalt.

Method B

- ❑ Turn the end nozzle 90°.
- ❑ Apply asphalt and aggregate the full width of the binder.
- ❑ Repeat the process on subsequent passes.

Transverse Joints

- ❑ All asphalt applications begin and end on building paper.
- ❑ All aggregate applications begin and end on building paper.
- ❑ The building paper is disposed of properly.

Brooming

- ❑ Brooming begins as soon as possible.
- ❑ Brooming does not dislodge the aggregate.
- ❑ Brooming does not begin until a sufficient bond is formed between the aggregate and the asphalt. Check the asphalt manufacturer s recommendation or refer to agency requirements.
- ❑ Consider using a flush truck to place water on the surface before brooming to reduce dust problems.

Opening the Chip Seal to Traffic

- ❑ The traffic travels slowly 40 kph (25 mph) or less over the fresh seal coat until it is broomed and opened for normal traffic.
- ❑ Reduced speed limit signs are used when pilot cars are not used.
- ❑ After brooming, pavement markings are placed before opening pavement to normal traffic.
- ❑ All construction-related signs are removed when opening pavement to normal traffic.

Cleanup Responsibilities

- ❑ All loose aggregate from brooming is removed from the travelway.
- ❑ Excessive asphalt application and spills are removed.

Common Problems and Solutions

(Problem: Solution)

- ❑ **Aggregate embedment over 80 percent:** Consider lowering the asphalt application rate.
- ❑ **Aggregate embedment less than 50 percent:** Consider raising the asphalt application rate.
- ❑ **Lots of chips with small amounts of asphalt on them:** Consider lowering the aggregate application rate.
- ❑ **Excessive asphalt splattering:** The spray pressure is too high.
- ❑ **Streaking or drill marks in asphalt:**
  1. Asphalt is too cold.
  2. Viscosity of the asphalt is too high.
  3. All the nozzles are not at the same angle.
  4. Spray bar is too high.
  5. Spray bar is too low.
  6. Spray bar pressure is too high.
  7. Nozzle is plugged.
- ❑ **Exposed aggregate remains after aggregate application:** Chip spreader gate may be clogged or malfunctioning.
- ❑ **Excessive aggregate:** Spreader gate may be malfunctioning or chipper head may be overloaded.

- ❑ **Uneven aggregate application:** Recalibrate the chip spreader; gates may not all be set the same.
- ❑ **Asphalt on top of the aggregate:**
  1. Chip spreader may be operating too fast.
  2. Truck, roller, or pilot car may be operating incorrectly.
- ❑ **Chips being dislodged:**
  1. Asphalt application rate is too low.
  2. Aggregate is dirty or dusty.
  3. Traffic or equipment speeds are too high.
  4. Brooming has been started before the asphalt is properly set.
- ❑ **Asphalt bleeding or flushing:** Asphalt application rate is too high.
- ❑ **Loss of aggregate at meetlines after brooming:** Check meetline procedures.

Sources

Information in this checklist is based on or refers to the following sources:

Manual on Uniform Traffic Control Devices, Millennium Edition. 2000. Washington, DC: Federal Highway Administration.

An Overview of Surface Rehabilitation Techniques for Asphalt Pavements. Pub. No. FHWA-PD-92-008. 1992. Washington, DC: Federal Highway Administration.

Thin-Surfaced Pavements, Synthesis of User Practices, NCHRP Synthesis 260. 1998. Washington, DC: Transportation Research Board, National Cooperative Highway Research Program.

For more information about pavement preservation, visit these Web sites:

www.fhwa.dot.gov/preservation

www.fhwa.dot.gov/infrastructure/asstmgmt/resource.htm

www.fp2.org

For more information on the Pavement Preservation Checklist Series, contact:

Construction and System Preservation Team
Office of Asset Management
Federal Highway Administration, HIAM-20
U.S. Department of Transportation
400 Seventh Street, SW, Room 3211
Washington, DC 20590
E-mail: preservation@fhwa.dot.gov
Telephone: 202-366-1557

National Center for Pavement Preservation
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Telephone: 517-432-8220
www.pavementpreservation.org

Foundation for Pavement Preservation
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www.fp2.org

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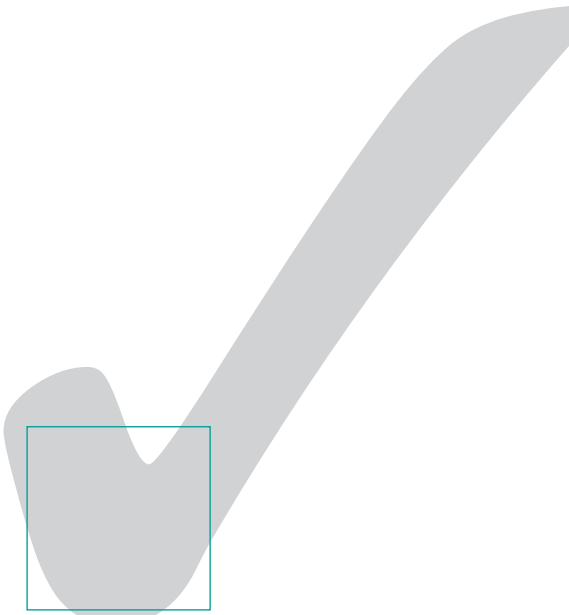

FP^2

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INSERT TAB

Unit 7

ODOT Specifications

1

Specification Training Purpose

- Highlight critical components of Specifications
- Differentiate between the two types of chip seals
- Very critical item
- Experience-based – not in Specifications

2

ODOT Specifications

- **Section 00710**
  Single Application Emulsified Asphalt Surface Treatment
- **Section 00711**
  Pre-Coated Aggregate Asphalt Surface Treatment

3

#####.00 Scope

- **Section 710** – This work consists of applying emulsified asphalt and graded aggregates as shown or directed.
- **Section 711** – This work consists of applying a surface treatment using a modified hot asphalt binder and pre-coated graded aggregate as shown.

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#####.10 Aggregates

- **Section 710** – Various rock sizes generally determined by the District Manager and Pavements Section. Plans will designate design. Generally, “Graded Medium (3/8 – No. 4)”
- **Section 711** – Pre-coated aggregates have single option 3/8 – No. 4

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#####.10 Aggregates

- **710 & 711** – Standard QC & QA Testing for Aggregates, but also require Unit Weight Testing according to AASHTO T19.

BULK DENSITY ("UNIT WEIGHT") AND VOIDS IN AGGREGATE AASHTO T 19

	SOUCE NAME		Best Rock	Best Rock	Best Rock
	SOURCE NUMBER		12-123-3	12-123-3	12-123-3
	MATERIAL SIZE		85% 3/4 Rnd - 15% 1/2 Cr	3/4" - #4 round	1/2" - #4 Crushed
A	MEASURE + AGGREGATE	lb	70.76	70.90	70.12
B	EMPTY MEASURE	lb	19.12	19.12	19.12
C	MASS OF AGGREGATE A-B	lb	51.64	51.78	51.00
D	VOLUME OF MEASURE	ft^3	0.5002	0.5002	0.5002
	UNIT WEIGHT C / D	lb/ft^3	103.2	103.5	102

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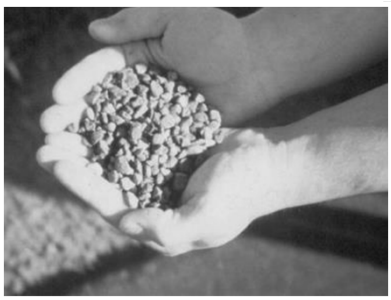
#####.11 Asphalt

- **710, Emulsified Asphalt** – Non-Polymer (CRS-2 or HFRS-2) or Polymer (CRS-2P or HFRS-P1)
- **711, Asphalt Binder** – AC15-5TR or AC-15P
- Asphalt Samples required at the plant per AASHTO T40.

7

Coated Aggregate Requirements

- **00711.12** – Asphalt and Additives for Pre-Coated Aggregate aggregate to be coated with PG64-22
- **00711.17** – Pre-Coated Aggregate Mixture



8

Section 00711.17
Pre-Coated Aggregate Mixture

- Use an asphalt hot plant to coat the aggregate
- Achieve at least a 90% coating by applying between 0.7 and 1.0 percent liquid asphalt. Asphalt content determined by ODOT TM321.
- Plant dryer temperature between 190° and 230°
- After pre-coating, stockpile, cool, and cure the aggregate mixture for at least seven calendar days.

9

Section 00711.17
Pre-Coated Aggregate Mixture (continued)

- **Turn the pre-coated aggregate mixture with a loader or other means to accelerate cooling.**
- If clumping occurs rescreening of the mixture will be required.

10

#####.21 Asphalt Distributors

- **710 & 711** – Identical except for computer rate control device and calibration requirement on hot oil applications.
- Variation shall be within 0.02 gallons per square yard
- Bar height to be set for triple lap coverage
- Volume measuring devices and thermometer

11

#####.22 Chip Spreaders

- **710 & 711** – Basically identical except for computerized and surface temperature requirement for pre-coated applications.
- Self-propelled capable of uniform spread rate
- **Pre-coated rock requires surface temperature visible to the chip spreader operator**

12

Chip Spreader Calibration

- Each individual gate(s) should be calibrated
- Calibrate across the width of the spreader and in line
- Calibration must occur at typical speed
- Calibration should occur each morning, and sometimes mid shift

13

#####.23 Compactors
#####.24 Power Brooms

- 710, Steel-Wheeled Roller
- 711, Minimum 5 Rubber Tired Rollers Required
    - Minimum 4 Power Brooms
- Pick-up Brooms needed on Bridges or in town

14

00711.25 Asphalt Storage Tank

- **00711.25 Asphalt Storage Tank** – Provide a heated asphalt storage tank in close proximity to Project.

This specification is not an absolute and should be reviewed for each project.

15

00711.31 Technical Representative

00711.31 Technical Representative – Provide a qualified technical representative from the asphalt binder supplier, on site, during all surface treatment operations. The technical representative duties are to assist the Engineer in establishing the asphalt binder and pre-coated aggregate mixture application rates and to provide input on the temperatures for the application of the asphalt binder coat.

16

#####.40 Season, Weather and Temperature Limitations

- Section 710
  - July 1 to August 31
  - Surface temp above 70 degrees
  - Complete application daily 3 hours before sunset
  - Remove weather damaged sections within 24 hours
- Section 711
  - Ambient temperature 70 degrees
  - Surface temperature 75 degrees (Sun and Shade)
  - Do not apply if rain is predicted **(50% chance or more)**
  - After rain do not resume the surface treatment for at least two days
  - **Complete by August 31st whenever possible**

17

#####.41 Rate of Progress

- Section 710
  - Complete no more than can be swept the following morning
  - Specific Traffic Control Plan required for operations exceeding 3 centerline miles
- Section 711
  - Complete no more than can be swept in the same day

Daily Operations are usually limited by traffic control ability, allowable length of delay, maximum lane closure allowed, etc. Nighttime flagging can be utilized to sweep to maximize production.

18

#####.42 Preparation of Underlying Surfaces

- Section 710 & 711
  - Summary – Surface must be dry. Clean the surface prior to applying surface treatment.
  - **Usually not necessary except for shoulders, or around gravel accesses.**

19

#####.44 Application Rates

Application rates are determined by the Engineer

- Section 710
  - Graded Medium
    - Emulsified asphalt 0.40 – 0.64 gallons per square yard
    - Aggregate 0.005 – 0.015 cubic yards per square yard
- Section 711
  - Asphalt binder 0.35 to 0.45 gallons per square yard
  - Pre-coated aggregate 10 to 20 pounds per square yard (approximate 0.003 to 0.007 – Depends on unit weight)

20

#####.44 Applying Asphalt

- Section 710
  - Apply emulsified asphalt at a temperature between 140° and 185° F
  - Surface treatment to be applied to both sides of roadway each shift
  - Do not apply emulsified asphalt a greater distance than can be immediately covered by aggregates before the emulsion breaks.
- Section 711
  - Apply Asphalt Binder at a temperature between 330° and 370° F and at a rate of 0.35 to 0.45 gallons per square yard
  - Apply asphalt binder at a distance that allows the pre-coated aggregate mixture to be applied at the binder surface temperature between 130° and 180° F.

21

711.44 Applying Asphalt

22

#####.46 Hauling and Spreading Aggregates

- Section 710
  - Aggregates shall be surface damp. **Excess water will not be allowed.**
  - Provide coverage without gaps or overlapping adjacent coverages.
- Section 711
  - **Cover the asphalt binder surface with pre-coated aggregate mixture when the asphalt binder surface temperature is between 130° and 180°.**
  - Apply asphalt binder at a distance that allows the pre-coated aggregate mixture to be applied at the binder surface temperature between 130° and 180° F.

23

#####.46 Hauling and Spreading Aggregates

Route hauling equipment as uniformly as possible over the full width of the new surface.

24

#####.47 Shaping and Compacting

- Section 710
  - Compact the surface with a minimum of two coverages with a pneumatic tired roller and one coverage with a steel wheeled roller.
  - Do not operate in excess of 5 mph.
- Section 711
  - Compact the surface with a minimum of three roller passes.
  - Make the initial compaction pass behind the spreader as soon as the pre-coated aggregate mixture is spread.
  - Hauling equipment may be used to assist in compaction behind the spreader.
  - Roll in a staggered pattern.

25

#####.47 Shaping and Compacting

26

#####.60 Power Brooming

- Section 710
  - Following the application of the surface treatment carefully broom the entire surface to remove loose aggregate. **(Generally performed the following morning).**
  - Additional brooming within 2 days may be directed by the Engineer to ensure roadway is free of loose aggregate.
- Section 711
  - After rolling the pre-coated aggregate mixture, remove loose aggregate by brooming the entire surface.
  - Broom one pass in the opposite direction of traffic.
  - Additional brooming may be required for up to two days after placement.
  - Seven calendar days after completion of a section of surface treatment, remove all loose aggregate from the shoulder.

27

#####.80 Measurement

- Section 710
  - Emulsified asphalt will be measured on the weight basis.
  - Aggregate will be measured on the weight basis or on the volume basis in the hauling vehicle.
- Section 711
  - Asphalt in pre-coated aggregate will be measured on the weight basis.
  - Asphalt binder will be measured on the weight basis.
  - Pre-coated aggregate will be measured on the weight basis.

28

Summary

- Specifications are more process based then “end product”
- No testing of final in place products
- 100% inspection is very critical

29

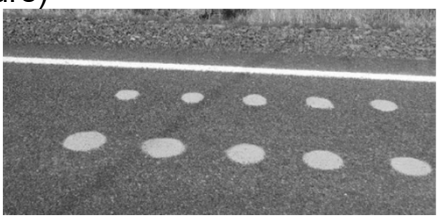
Chip Seal Warranty/Performance Specification

30

What it is

Contractor is responsible for:

- Setting application rates
- Placing and finishing chip seal
- Repairing failures
- Meeting or exceeding performance
  - Measurement (macro texture)



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What it is (continued)

Inspector role becomes that of an observer

- No longer directing rates or methods
- Materials, equipment, and Construction Quality Control inspections
- Initial: 2 weeks post-construction
- Final: 1-year post-construction

Incentive/disincentive based upon performance measurement

32

Why is it important?

- Transfer Agency risk when failure occurs to Contractor
- Improve cost effectiveness of chip seals by increasing performance
- A rational method for evaluating:
  - Emulsion and aggregate application rates
  - Expected service life
- Encourage innovation in materials and construction

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Chip Seal Warranty/Performance Specification

- Where we are
  - 2020 Pilot project
  - Looking for more opportunities for use
- Where we want to be
  - Contractor certification
    - NCPP
    - AASHTO TSP-2
  - Alternative bid process?
    - (design vs. low cost)

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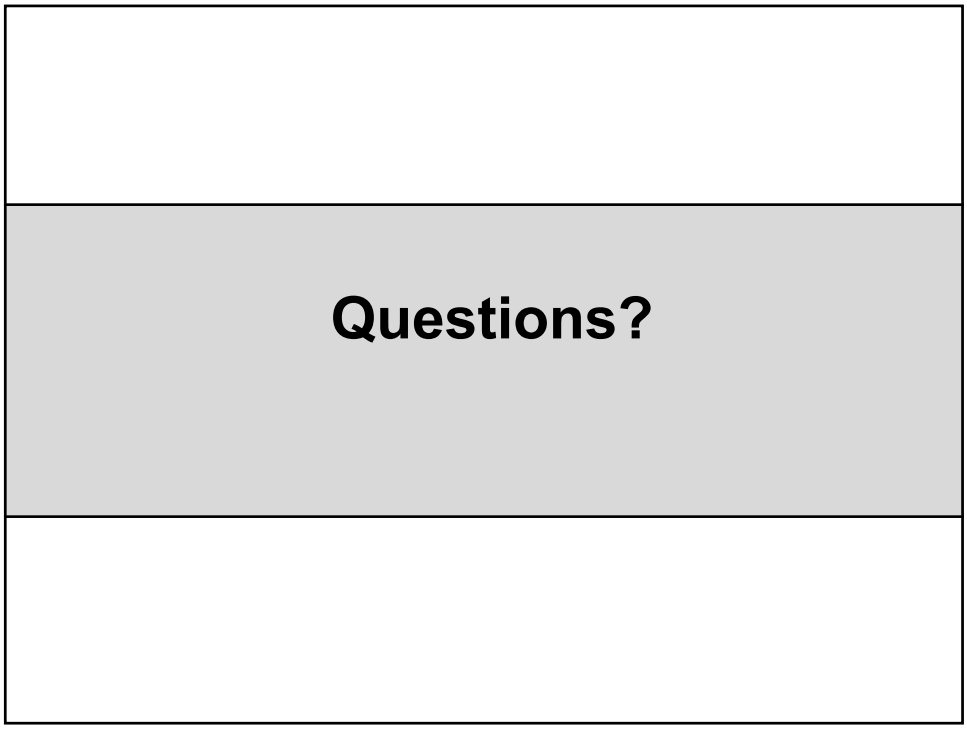

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Unit 8

Contract Administration Issues

1

Chip Seal Contract Administration Training Purpose

- Discuss common issues that arise on the project
- What areas and items are critical to the success of a project?
- Share experiences that will minimize future issues

2

Contract Admin Focus Areas

- On-site inspection
- Measurement and payment
- Safety

3

On-Site Inspection

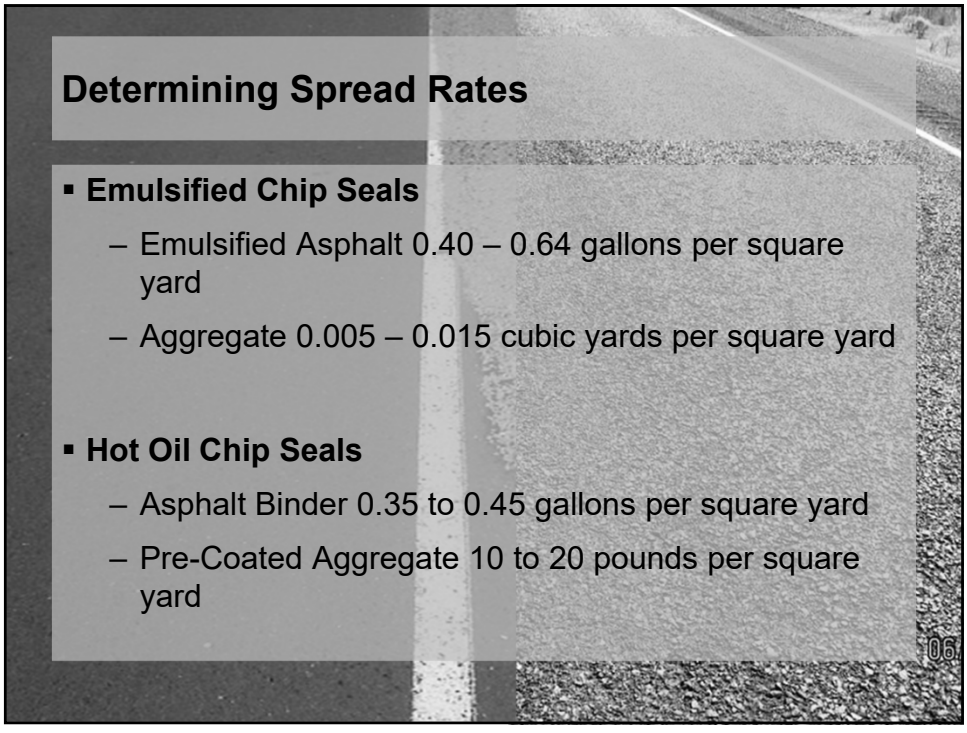
- Inspection priorities
- Determining spread rates
- Verifying calibrations
- Quantity checks

4

Inspection Priorities

- ODOT pre-planning (handout)
- Pre-chip meeting (handout)
- Material delivery inspector
- Asphalt and aggregate placement inspector
- Traffic control, rolling, and sweeping inspector

5



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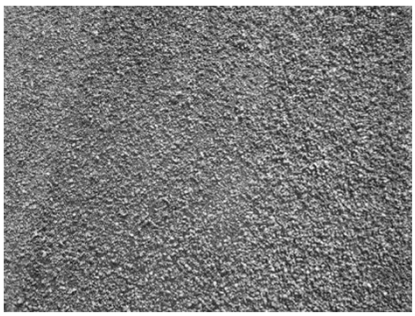
Determining Spread Rates

- Who can help determine the initial spread rates?
  - ODOT Inspector
  - Manufacturer's Rep
  - ODOT Technical Expert
  - Past Comparable Projects
- Don't be afraid to try different combinations.
- The solution is not always to add more rock!!!!



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Verifying Calibrations

- Aggregate Spread Rates
  - Calibration determined by weighing rock placed across 1 square yard
  - Calibration needs to be verified across the spreader
  - Calibration must be made at typical speed
  - Calibration should also be made in line to ensure consistency

- Digital spread rates on spreader mean nothing if they aren't verified DAILY!!!!

8

Verifying Calibrations

- Asphalt Spread Rates
  - Calibration methods vary by distributor operator
  - Calibration based on long runs using area covered vs. material used.
  - Inspector must verify with operator method used to calibrate
  - Inspector should obtain daily records from distributor to verify calibration
- Digital spread rates on distributor mean nothing if they aren't verified DAILY!!!!

9

Quantity Checks

- Asphalt Spread Rates
  - Pavement widths or daily measurements determine area (SQYD)
  - Distributor operators provide daily amount of oil used (gallons)
  - 245 gallons of asphalt weighs 1 ton (verify on delivery tickets)
  - If we know we placed an emulsified chip seal 12 feet wide for 3.2 miles how much oil should we have used if we were shooting a 0.55 shot rate?

10

Quantity Checks

- Asphalt Spread Rates
  - 12 feet x 3.2 miles x 5,280 feet/miles = 202,752 square feet
  - 202752 square feet / 9 square feet per yard = 22,528 square yards
  - 0.55 gallons per square yard x 22,529 square yards = 12,391 gallons
  - 12,391 gallons / 245 gallons per ton = 50.6 tons

11

Quantity Checks

- Aggregate Spread Rates
  - Pavement widths or daily measurements determine area (SQYD)
  - Tally sheet & truck measure determine volume or weight
  - If we know we placed a hot oil chip seal 12 feet wide for 3.2 miles how much aggregate should we have used if we were placing 14 pounds per square shot rate?

12

Quantity Checks

- Aggregate Spread Rates
  - 12 feet x 3.2 miles x 5,280 feet/miles = 202,752 square feet
  - 202,752 square feet / 9 square feet per yard = 22,528 square yards
  - 14 pounds per square yard x 22,529 square yards = 315,406 pounds
  - 315,406 pounds / 2000 pounds per ton = 158 tons

13

Quantity Checks

- Why would our daily quantities not match our spread rates?
  - Calibrations are off
  - Variable widths of placement
  - Overlaps
  - Inconsistent truck loading

14

Measurement and Payment

- Advanced pavement widths
- Truck measure
- Asphalt deliveries
- Remaining quantities

15

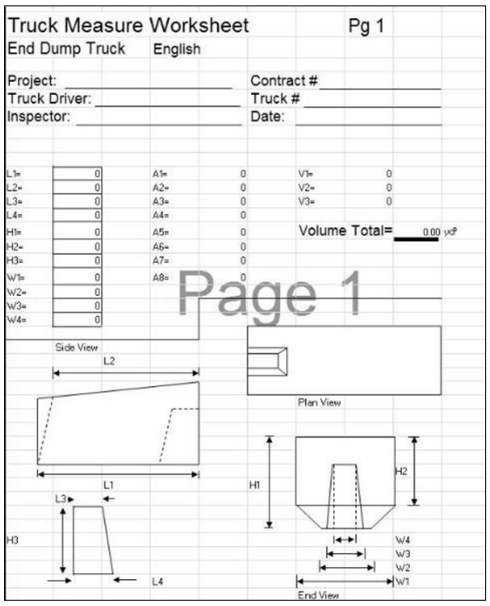
Advanced Pavement Widths

- Project Development may have created pavement width spreadsheet
- If not, Inspector should create pavement width spreadsheet to verify plan quantities, and to assist in verifying spread rates.

M.P.	LENGTH (FT)	WIDTH (FT)	AVG. WIDTH (FT)	AGGREGATES S.Y. (L*W/9)	AGGREGATES Tons (AGG. RATE *S.Y.)	Hot OIL ASPHALTS GAL (APPL. RATE*S.Y.)	Hot OIL ASPHALTS TONS (GAL / 255)
	528.0		45.5	2666.40	18.66	986.57	3.95
9.200		42.9					
	528.0		43.9	2572.53	18.01	951.84	3.81
9.300		44.8					
	528.0		44.0	2581.33	18.07	955.09	3.82
9.400		43.2					
	528.0		43.3	2540.27	17.78	939.90	3.76
9.500		43.4					
	528.0		43.2	2534.40	17.74	937.73	3.75
9.600		43.0					
	528.0		43.2	2531.47	17.72	936.64	3.75
9.700		43.3					
	528.0		42.7	2502.13	17.51	925.79	3.70
9.800		42.0					
	528.0		41.9	2455.20	17.19	908.42	3.63
9.900		41.7					
	528.0		42.0	2461.07	17.23	910.59	3.64
10.000		42.2					
	528.0		41.5	2431.73	17.02	899.74	3.60
10.100		40.7					
	528.0		40.4	2367.20	16.57	875.86	3.50

16

Truck Measurement



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Truck Measurement

- Trucks should be measured in advance of chip seal operation.
- Final truck depth will be determined after filled. This may need to be averaged over a couple of loads or verified periodically.
- Trucks need to be inspected to ensure they are loaded consistently.
- Tally sheet must be completed to verify quantities.

18

Asphalt Deliveries

- Obtain delivery tickets for each delivery (remind contractor to provide notification)
- Verify tanks were completely emptied upon delivery (tank stickings)
- Obtain weigh back tickets at end of project or completion of each unit. ODOT does not pay for oil not placed on the project!!!

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Remaining Quantities

- If bid item amount of aggregate was delivered to the job site, but contractor did not incorporate material into the project ODOT is still responsible for payment.
- ODOT would be responsible for material and haul costs to stockpile site.
- Quantity of material must be determined by survey or re-weighing of rock.
- If survey is used to determine pre-coated aggregate quantity, the unit weight from required test can be used to determine tonnage.
- Floor loss may need to be taken into consideration dependent on stockpile area surfacing.

20

Safety

- Employee
- Traffic control
- Property damage

21

Employee Safety

- Distributor truck awareness (HOT OIL)
- Moving operation involving numerous backing vehicles
- Heat exhaustion
- Fly rock (safety glasses)

22

23

Traffic Control

- Identify delay threshold (20 minutes typical)
- Determine maximum lane closure length
- Ensure adequate signs are provided if flaggers need shifted quickly
- Ensure contractor has adequate traffic control personnel to jump work zones if required

24

25

Property Damage

- Identify process for public to make damage claims
  - Property Damage Claim Form for Vehicles
  - On-site inspectors should possess forms for the public to complete
  - Identify contact person for public to contact regarding damages

STOP AND START OVER

26

Summary

- Pre-planning can minimize risks.
- Inspectors can be the key to a successful project.
- No QC/QA testing means that inspection is the FINAL ACCEPTANCE.
- If poor pavement is placed, test results will verify low quality and asphalt can be removed. If chip seals are placed with little oversight, ODOT has little to support removal or corrective measures.

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North Central Oregon Chip Seals
Cheat Sheet

Monday Maupin Chip Seal – Raul, Albert, Dave
Condon Sign Installation – No onsite inspection

ODOT's Bridge Crew will be overlaying the Maupin Bridge on Monday & Tuesday. They will have their own traffic control. At the start of the shift some coordination between flaggers will need to be performed. Our pilot car will route traffic all the way across the bridge until we get out of town far enough to have two work zones.

Donny will be on-site around 10 a.m. to assist with truck measurement and project oversight. He will take the neat line measurements of the truck and plug them into the spreadsheet to calculate the volumes that will be used on the tally sheets. He will provide these to Albert to place on the tally sheets. Donny will assist in pulling trucks aside to perform loaded measurement.

Tuesday Maupin Fog Seal – Raul, Albert, Dave
Condon Sign Installation – No onsite inspection until fog seal over
Antone Rumble Strip Installation – Brandon

Wednesday Condon Chip Seal – Raul, Albert, Dave
Antone Rumble Strip Installation & Temp Signs – No onsite inspection

Thursday Condon Chip Seal – Raul, Albert
Antone Temp Signs – No onsite inspection

Friday Fog Seal Condon – Raul, Albert
Antone Temp Signs – No onsite inspection

Chip Seal Process
Albert will be at the stockpile site writing down loaded truck information, and verifying that each load is filled consistently. He will write down the initial starting MP and direction in his tally sheet. Throughout the day, Raul will need to call Albert and give him updated MP's for a specific truck. Based on the spread rate, we can back calculate approximate MP's for the other trucks in between. It is not absolutely critical to know where each truck placed on site. As long as we have the direction down and general vicinity we are ok. When Donny arrives on site we will perform our random loaded truck measurement.

Dave Anderson will be on-site acting as our technical expert. We will be starting with an initial spread rate of 0.50 gallons per square yard, and 0.010 cubic yards per square yard of aggregate. Dave, along with the contractor and Raul, will determine when modifications to the spread rate are necessary.

Traffic Control
Post Mounted RWA Signs and Do Not Pass signs will be installed on the project prior to the chip seal. Do Not Pass signs in conflict with the existing striping have been covered. Once we have chipped passed these signs, the covers will need to be removed until striping is complete. The Do Not Pass signs are placed at approximately 1 mile intervals. Roll-up "Loose Gravel, Speed 35 MPH" signs must be placed at 1 mile intervals offset from the DNP signs each day prior to removal of the pilot car(Std. Dwg. TM850). Loose Gravel signs will be shifted to the next section of work once the roadway is swept in the morning.

Single temporary markers (Double Tabbed Markers) will be placed at 40 foot spacing (20 foot spacing on curves that have reduced speed signs) prior to placing the chip seal (Section 225.43(e)). One tab will be removed following the chip seal, the second tab removed following the fog coat.

In areas where a fog line exists, place cones at 200 foot spacing when the existing fog line is covered (Section 225.43(h). In areas where significant drop offs exist (specifically in areas around Maupin and Condon) some cone placement can be skipped if there is no shoulder.

Cell Phone Numbers
Raul 541-
Albert 541-
Dave 541-
Donny 541-
Bob 541-

SECTION 710 CHIP SEAL
PRECHIP DISCUSSION POINTS

PERSONNEL

- ODOT INSPECTORS
  Raul Saavedra, Lead Inspector Cell 541-
  Dave Anderson, Inspector (Chip Seal Expert)
  Albert Garcia, Quantity Verification
- ODOT QCCS
  Karen Barnett, Cell 541-

SECTION 00710.10 AGGREGATE

- ODOT STOCKPILE SITES (710.10 (h)
  - Take material in an orderly manner from stockpiles, shape unused portions of the pile to neat lines when finished

SECTION 00710.40 CONSTRUCTION

- Surface temperature must be 70 degrees

SECTION 00710.42 PREPARATION OF SURFACES

- Surface must be clean and try. Sweeping of roadway/shoulders might be required if agg shoulder is on roadway.
- Widened slow moving vehicle areas will be chipped as well
- Striping references to be completed prior to starting chip seal

SECTION 00710.44 APPLICATION RATES

- Initial suggested starting rate will be 0.50 gallons per square yard & 50 pounds per square yard

SECTION 00710.45 APPLYING EMULSIFIED ASPHALT

- Apply Asphalt at temperature between 140 and 185
- Apply the surface treatment to both sides of the travel way so that the end of the work is squared up three hours before sunset
- Oil Samples need to be provided to the inspector daily, or stored in an agreed upon location

SECTION 00710.46 HAULING AND SPREADING AGGREGATES

- Calibrate the chip spreader prior to beginning placement of aggregate
- Provide coverage with out overlapping adjacent coverages

SECTION 00710.47 SHAPING AND COMPACTING

- Minimum two coverages with a pneumatic tired roller and one coverage with a steel wheeled roller
- Do not exceed roller speeds of 5 mph
- If aggregates begin to pick up under traffic or from the rolling operation, immediately cover and roll the area with additional quantities of aggregate

SECTION 00710.60 POWER BROOMING

- Minimum of 2 Power Brooms
- Loose Gravel signs will remain until all loose gravel is removed

SECTION 00710.80 MEASUREMENT

- Trucks will be measured during a convenient time before or after shift
- During the first shift the inspector will stop a loaded vehicle at the stockpile site. The inspector will need to stop each truck containing different boxes. This will be done twice during the first day, or any day there is a new truck. The inspector will instruct the truck driver to strike off their load. The inspector will then measure down from the top of the bed to determine a dimension. The two dimensions for the truck will be averaged, and the quantity calculated will be used throughout the project for that specific truck. This will be done at random times and in a manner to not delay the operation. The inspector at the stockpile site will then verify that all trucks are being consistently loaded.

FOG SEAL

- Air temperature must be 60 degrees
- Fog Seal will not be allowed until all loose gravel is removed, additional sweeping may be necessary
- Initial Application Rate 0.12 gallons per square yard
- Oil Samples need to be provided to the inspector daily

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Common Terms

Common Chip Seal Terms:

Bleeding / Flushing: Area with too much asphalt cement. Excess asphalt cement occurring on the pavement surface.

Break / Breaking: When the asphalt emulsion turns from brown to black as water evaporates. During curing of an asphalt emulsion by which the globules of asphalt become separated from the water.

Breaking Track / Staggering Trucks: When rock/chip trucks are following the chip spreader by traveling in the different path.

Clear /Pop Gates: Process of increasing rock flow on the chip spreader to clear a blockage.

Chips: The rock/aggregate to be placed in asphalt cement/emulsion.

Chip Spreader: The machine that applies a uniform chip cover at a specified rate. Spreaders range from a simple vane type attached to a truck gate to a highly efficient self-propelled type.

Chipper Bar: The bar on the back of rock trucks that the chip spreader hooks to for pulling the truck down the road.

Corn Rowing/Ridging/Streaking: Non-uniform application of asphalt cement/emulsion showing as lean and heavy bands of asphalt cement behind the distributor truck.

Float: Excess rock that the asphalt cement doesn't bond to.

Flooding (as per fog seal): Complete coverage of chip with pooling in the low areas during fog seals.

Knifing Nozzles: Turning a spray nozzle on the distributor truck to obtain additional asphalt cement/emulsion coverage. Typically parallel to the direction of travel.

Meet Line: This strip of asphalt cement/emulsion on centerline not covered with chips during the first pass with the chip spreader.

Rolling Rock: Chip rock placed in asphalt cement/emulsion that has rotated from first placement caused by chip spreader traveling to fast or traffic turning rock over – possible not enough asphalt cement to hold the chip rock.

Picking: Traffic pulling aggregate from new chip seal.

Shot Rate: Rate (gal/sqyd) of asphalt cement/emulsion placed on road. Sometimes also used as the rate chips (lbs/sqyd) are placed in asphalt cement/emulsion. (For aggregate **application rate** may be used as well)

Spider Webs: Thin strings of asphalt cement that float around on hot chip seals – this is normal

Stars / Flashes: Flashes of light seen during chip seals – an indication of possible proper rock rate

Tracking: Is when asphalt cement adheres on the tires and is spread down the road surface.