



JOINT INSPECTOR TRAINING

**Emulsion Chip Seal Inspection:
Inspection, Materials, Section 37 Update**

Asphaltic Emulsion Chip Seal Inspection

Section 37-2.02 Asphaltic Emulsion Chip Seal- Outline

- Section 37-2.02A includes specifications for applying an asphaltic emulsion chip seals.
 - Section 37-2.03A – Polymer Modified Asphaltic Emulsions
- Good Equipment
- Good Construction Practices
- Good Design / Materials / Application
- Inspection / Submittals
- Quality Assurance
- Acceptance

Asphaltic Emulsion Chip Seal Inspection

Section 37-2.02 Asphaltic Emulsion Chip Seal

Section 37-2.02A includes specifications for applying an asphaltic emulsion chip seal.

- Applying an asphaltic emulsion chip seal includes applying asphaltic emulsion followed by screenings followed by a flush coat.
- Section 37-203 deals with an asphaltic emulsion chip seal with a polymer modified asphaltic emulsion.
- A double asphaltic emulsion chip seal consists of the application of asphaltic emulsion followed by screenings applied twice in sequence.



Equipment Used – Section 37-2.01C(2)

- Emulsion distributor truck
- Chip Spreader
- Chip truck
- Rollers
- Brooms

Equipment Condition and Calibration



General Note:

- ✓ All Equipment shall be free of any Hydraulic Leaks!

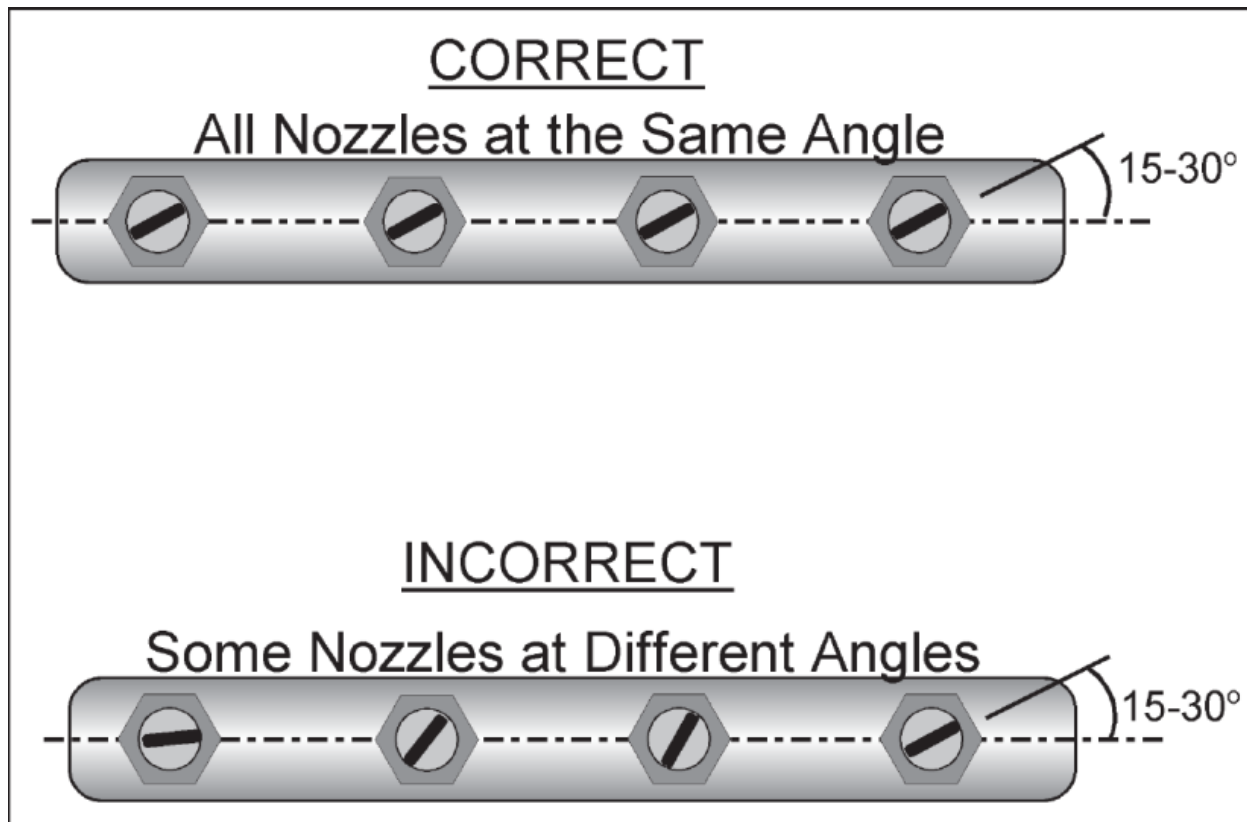
Emulsion Distributor Truck – Section 37-2.01C(4)(b)

Equipment for heating and applying the emulsified asphalt shall meet the following requirements:

- Capable of heating asphalt evenly. (Propane/Diesel)
- Power unit for the pump, and full circulation spray bar adjustable to 4.3 m (14 ft) wide.
- Computerized controls, volumetric measuring device, bar pressure gauge, ft/speed control, to uniformly apply asphalt within 0.10 L/m² (0.02 gal/yd²) of the required rate.
- Thermometer for measuring temperatures in the tank.

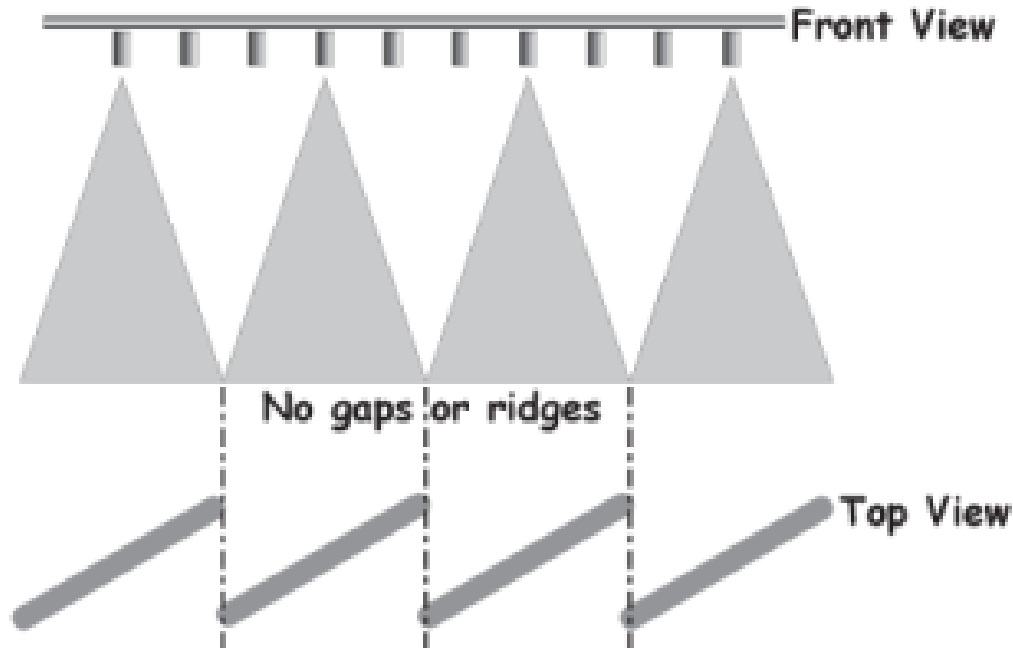
Spray Nozzle Requirements

- ✓ Nozzles shall be free from damage, unclogged, and freely spraying.
- ✓ Nozzles shall be uniformly angled between 15 and 30 degrees from spray bar such that the spray fans do not interfere with one another.
- ✓ Use of correct size for emulsion being used.

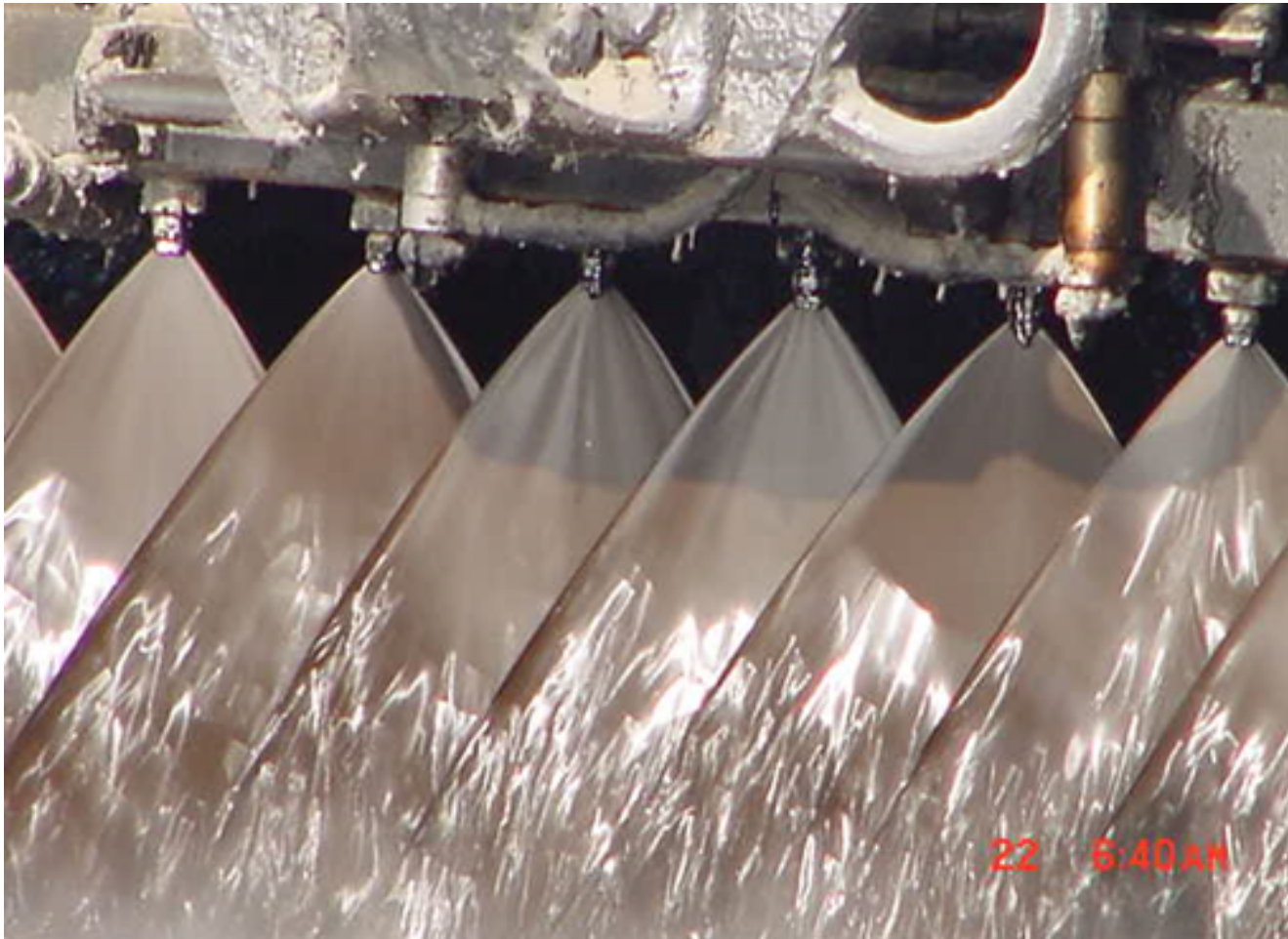


Adjusting Spray bar height

- ✓ Two nozzles should be shut off for every one that is open.
- ✓ The distributor operator then sprays for a very quick moment. If the fans do not hit the pavement surface at the same point, the spray bar is either too high or too low and should be adjusted accordingly.
- ✓ Typical Height is between 12 and 14 inches



Good Spray Pattern



CHIP SPREADER CALIBRATION

Section 37-2.01C(4)(c)

- A 12 to 16 foot length x 36 inches of a grooved rubber mat (depending on the width of the spreader) typically used as stair runners cut into 1 foot wide strips. The result will be mats that are one-third of a square yard. The number depends on width of spreader box.
- ✓ A scale of some type to weigh the chips. A spring loaded dairy scale has been used successfully.
- ✓ One-gallon size plastic food bags to be used for holding the contents of each rubber mat during weighing. The number equals that of the number of rubber mat.
- ✓ Duct tape to prevent the rubber mats from slipping on the pavement surface.







Weighing Aggregate

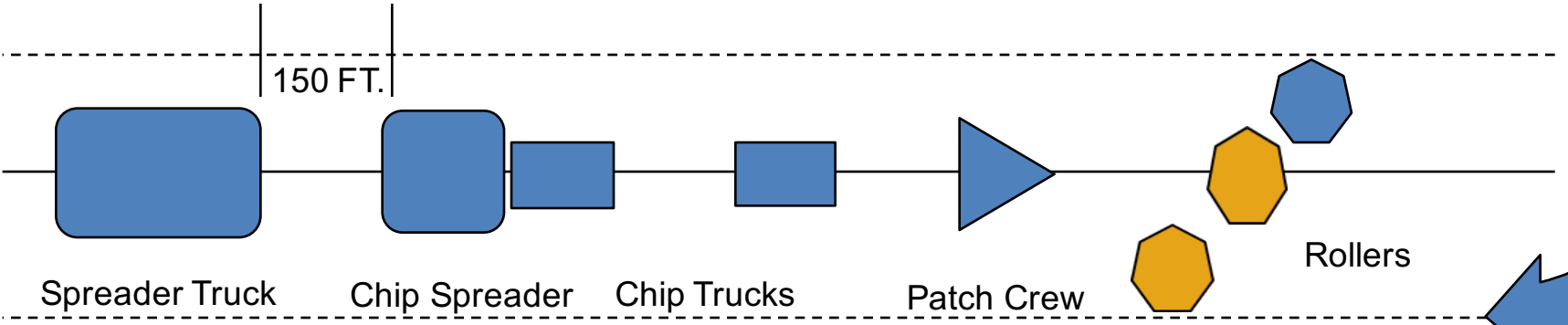
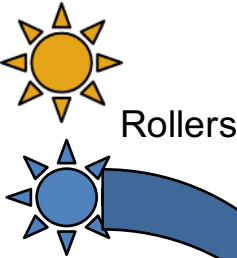


Traffic Control - Section 37-201C(4)(i) Pilot Car

Key Points:

- ❖ Prior to beginning the Chip Seal surface treatment operations, the Contractor and Department shall hold a Partnering meeting. The meeting is intended to ensure cooperation and understanding between the Department staff associated with the project and Contractor personnel directly involved with the project. Attendance is mandatory and shall be scheduled, initiated and moderated by the Resident Engineer responsible for project oversight.
- ❖ Chip only as far forward as can be swept with chip set, applied, and cured before opening to traffic each day.
- ❖ Schedule workload such that spreading operations are completed by 1:00 p.m., or as directed by Engineer, if a threat of thunderstorms is present.
- ❖ Open all lanes to public traffic during non-working hours
- ❖ Submit Traffic Control Plans, to Engineer, no later than 10 days after Notice to Proceed.
- ❖ Regardless of traffic control operations, do not stop public traffic for more than a 20 minute duration and do not delay it for more than 30 minutes total, regardless of the number of work zones. Any proposed traffic control plan must meet the duration of delay restrictions (20 minutes stopped, 30 minutes total delay).

Equipment Placement



Rate Calibration for Emulsion and Aggregate


Apply materials at the established width and rate for 1,000 ft.

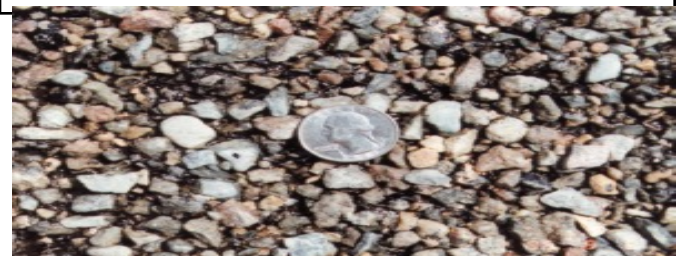
Read Tank gage on distributor truck and record.

Monitor mat to 1,000 ft. watching for ridging, plugged tips, and chip density.

Read gauge at end of 1,000 ft. and calculate the rate of application based on gals used, length and width of application.



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37-2.02C Construction

Asphaltic emulsion must be applied within the application rate ranges shown in the following table:

Asphaltic Emulsion Application Rates

Chip seal gradation	Application rate range (gal/sq yd)
3/8"	0.30–0.45
5/16"	0.25–0.35
1/4"	0.20–0.30

POLYMER MODIFIED ASPHALTIC EMULSION

- Apply polymer asphaltic emulsion when the ambient air temperature is from **65 to 100** degrees F and the pavement surface temperature is at least **80** degrees F.
- At the time of application, the temperature of the asphaltic emulsion must be from 130 to 180 degrees F.

Do not apply polymer asphaltic emulsion when weather forecasts predict the ambient air temperature will fall below 39 degrees F within 24 hours after application.

Construction

For double asphaltic emulsion seal coat, polymer asphaltic emulsion must be applied within the application rates shown in the following table:

Asphaltic Emulsion Application Rates

Double chip seals	Application rate range (gal/sq yd)
1st application	0.30–0.45
2nd application	0.20–0.30

You may stockpile screenings for polymer emulsion seal coat if you prevent contamination. Screenings must have damp surfaces at spreading. If water visibly separates from the screenings, do not spread them. You may re-dampen them in the delivery vehicle.

Spread screenings before the asphaltic emulsion sets or breaks. Screenings must have a spread rate within the ranges shown in the following table:

Aggregate Spread Rates

Chip seal gradation	Spread Rate Range (lb/sq yd)
3/8"	20-30
5/16"	16–25
1/4"	12-20

Construction

The Engineer determines the exact application rate. Spread screenings within 10 percent of the rate determined by the Engineer.

Do not spread screenings more than 2,500 feet ahead of the completed initial rolling.

For a double seal coat, screenings must have a spread rate within the ranges shown in the following table:

Seal coat type	Range (lb/sq yd)
Double	
1st application	23–30
2nd application	12–20

Remove excess screenings on the 1st application before the 2nd application of asphaltic emulsion.

Rolling – Section 37-2.01C(2)



Roll from centerline out overlapping rollers.

Speed should be < 5mph.

3 passes min. to set the chips

Sweeping - 37-2.01C(4)(d)(ii)

When to sweep? Sweep times depend on several factors:

- ✓ Emulsifiers used in the emulsion: Chemistry
 - ✓ Humidity
 - ✓ UV / Shade
 - ✓ Dampness of aggregate
-
- A good way to test is to use a small Wisk Broom to test the pressure and resistance of the chip to dislodge. If the chips can not be dislodge it is time to sweep.

Sweep Time

- ✓ Check to make sure the first pass is light to insure retained chips are not being dislodge
- ✓ Progressively increase the pressure.
- ✓ Don't over sweep. This can destroy a good chip seal



Materials

- **Chips** for the project should be checked for compliance to specification's. State and Supplier will supply test results. Suppliers should submit certificate of compliance, test results and weight slips with each load. Document, date and file!
- **Binder** for the chip seal shall meet the state specifications. State and Supplier will supply test results. Suppliers should submit certificate of compliance, test results and weight slips with each load. Document, date and file!
- **Storage of Chips** should be per specification 106.08 Storage of Materials or supplemental specials

*For each load of chips delivered to the roadway for application should be checked for moisture content. Chips should be **damp**. Water running out of the chip box means the chips are too wet and should be rejected.*

Materials - Emulsions

Polymer Modified Asphaltic Emulsions

Polymer asphaltic emulsion must include elastomeric polymer.

- Polymer asphaltic emulsion must comply with section 94, Table 3, under the test on residue from evaporation test for Grades PMRS2, PMRS2h, PMCRS2, and PMCRS2h and the following:
 1. Penetration at 39.2 degrees F, 200g for 60 seconds, determined under AASHTO T 49 must be at least 6.
 2. Elastic recovery of at least 60 percent when tested under AASHTO T 301.
 3. Polymer content in percent by weight does not apply.
 4. Ring and ball softening point temperature determined under AASHTO T 53 for Test on Residue from Evaporation Test must comply with the following minimum temperature requirement:
 - 4.1. 126 degrees F for a geographical ambient temperature from 32 to 104 degrees F
 - 4.2. 129 degrees F for a geographical ambient temperature from 18 to 104 degrees F
 - 4.3. 135 degrees F for a geographical ambient temperature from 18 to greater than 104 degrees F

Materials - Screenings

The Department accepts screenings based on the quality characteristic requirements specified in section **37-2.01B**.

If test results for the screenings gradation do not comply with the requirements in the table titled "Seal Coat Screenings," you may remove the seal coat represented by these tests or request that it remain in place with a payment deduction.

37-2.01B - Screenings must be broken stone, crushed gravel, or both. At least 90 percent of screenings by weight must be crushed particles as determined under California Test 205.

Screenings for seal coats must comply with the requirements shown in the following table:

Seal Coat Screenings

Quality characteristic	Test method	Requirement
Los Angeles Rattler (max, %)		
Loss at 100 revolutions	California Test 211	10
Loss at 500 revolutions		40
Film stripping (max, %)	California Test 302	25

Materials - Aggregate

Screenings for polymer asphaltic emulsion seal coat must have the gradation as determined under California Test 202 in the following table:

Asphaltic Emulsion Chip Seal Aggregate Gradation

Quality characteristic	Test method	Requirement		
		3/8"	5/16"	1/4"
Gradation, % passing by weight Sieve Size	California Test 202	3/8"	5/16"	1/4"
3/4"		--	--	--
1/2"		100	--	--
3/8"		85–100	100	100
No. 4		0–15	0–50	60–85
No. 8		0–5	0–15	0–25
No. 16		--	0–5	0–5
No. 30		--	0–3	0–3
No. 200		0–2	0–2	0–2

Section 37.201A(4)(c)

- Cleanliness value of test CT 227 must be greater than **80**

Submittals

At least 10 days before starting asphaltic emulsion seal coat application, submit the name of an authorized laboratory that will be performing asphaltic emulsion QC testing.

- Submit a 1/2 gal sample of asphaltic emulsion in a plastic container to the Engineer and to the authorized laboratory.
 - Each sample must be submitted in an insulated shipping container within 24 hours of sampling.
- Within 7 days after taking samples, submit the authorized laboratory's test results for asphaltic emulsion.

At least 10 days before starting polymer modified asphaltic emulsion seal coat application, submit a signed copy of the test result report of the Vialit test method for aggregate retention in chip seals (french chip) to the Engineer and to:

Department of Transportation
Division of Maintenance, Roadway Maintenance Office
1120 N Street, MS 31
Sacramento, CA 95814

Quality Assurance

Samples for the screenings gradation and cleanness value must be taken from the spreader conveyor belt.

Within 3 business days of sampling, the authorized laboratory must test the asphaltic emulsion for:

1. Viscosity under AASHTO T 59
2. Sieve test under AASHTO T 59
3. Demulsibility under AASHTO T 59
4. Torsional recovery under California Test 332 for polymer asphaltic emulsion
5. Elastic recovery under AASHTO T 301 for polymer asphaltic emulsion

Circulate asphaltic emulsion in the distributor truck before sampling. Take samples from the distributor truck at midload or from a sampling tap or thief. Before taking samples, draw and dispose of 1 gal. In Engineer's presence, take two 1/2 gal samples/

37-2.01A(4)(c) Department Acceptance

Department Acceptance shall not apply to identified areas where the existing surfacing prior to application of chip seal, contains defective areas as determined by the Engineer and Contractor.

At least 7 days prior to beginning placement of the chip seal , the Contractor shall submit to the Engineer a written list of existing defective areas, identifying the lane direction, lane number, starting and ending highway post locations and defect type.

The Engineer and contractor must agree on which of the identified areas are defective.

-For asphaltic emulsion or asphalt binder, acceptance is based on the Department's sampling and testing for compliance with the requirements for the quality characteristics specified.

-For aggregate, acceptance is based on the Department's sampling and testing for compliance with the requirements shown in the table titled "Chip Seal Aggregate Acceptance Criteria.

37-2.01A(4)(c) Department Acceptance

Defective areas are defined as:

1. Areas with wheel path rutting in excess of 3/8" when measured by placing a straightedge 12 feet long on the finished surface and perpendicular with the center line varies more than 3/8 inch from the lower edge of the straightedge.
2. Areas exhibiting flushing
 1. For chip seal, acceptance is based on visual inspection for the following:
 - 1.1. Uniform surface texture
 - 1.2. Raveling, which consists of the separation of the aggregate from the asphaltic emulsion or asphalt binder.
 - 1.3. Flushing, which consists of the occurrence of a film of asphaltic material on the surface of the chip seal.
 - 1.4 Streaking, which consists of alternating longitudinal bands of asphaltic emulsion or asphalt binder without uniform screening retention, approximately parallel with the lane line.

Areas of raveling, flushing or streaking that are greater than 0.5 sq ft shall be considered defective and must be repaired.

Raveling and streaking must be repaired by placing an additional layer of seal coat over the defective area.

Quality Assurance

If the test results for polymer asphaltic emulsion do not comply with the specifications, the Engineer assesses a pay factor value for the following quality characteristics and increments:

Polymer Asphaltic Emulsion Pay Factor Table

Quality characteristic	Test method	Increment	Pay factor
Test on polymer asphaltic emulsion:			
Viscosity at 50 °C (Saybolt Furol seconds)	AASHTO T 59	Each 10 seconds above max or below min	1
Settlement in 5 days	AASHTO T 59	Each 1.5% above max	1
sieve test	AASHTO T 59	Each 0.2% above max	1
demulsibility	AASHTO T 59	Each 2% below min	1
Test on residue from evaporation:			
Penetration at 25 °C	AASHTO T 49	Each 2 dm above max or below min	1
Field softening point °C	ASTM D36/D36M	2 °C below min	1
Torsional recovery ^a	California Test 332	For each 1 increment below the min value of 18	1
		For each 2 increments below the min value of 18	3
		For each 3 increments below the min value of 18	10
Elastic recovery	AASHTO T 301	For each 1 increment below the min value of 60	1
		For each 2 increments below the min value of 60	3
		For each 3 increments below the min value of 60	10

^aThe highest pay factor applies.

Quality Assurance

The Engineer assesses a pay factor of 1 for sampling not performed in compliance with the specifications, including shipping and sampling containers.

For noncompliant polymer asphaltic emulsion, you may request seal coat to remain in place. If the request is authorized, the Department makes a payment deduction corresponding to the total pay factor value shown in the following table:

Polymer Asphaltic Emulsion Pay Factor Deductions

Total pay factor value	Deduction
0	none
1–2	\$5.00/ton
3–5	\$10.00/ton
6–9	\$15.00/ton
10–14	\$25.00/ton
15–20	\$50.00/ton

You must remove polymer asphaltic emulsion seal coat with a total pay factor value greater than 20.

Acceptance

The Department accepts screenings for asphaltic emulsion chip seals based on compliance with the cleanness value requirements specified in **section 37-2.01A(4)(c)**.

If cleanness value is above 75 and below 80, you may request that it remain in place with a payment deduction. If your request is authorized, the Department deducts the corresponding amount for the cleanness value shown in the following table:

Asphaltic Emulsion Seal Coat Cleanness Value Deductions

Cleanness value	Deduction
Less than 80	\$2.00/ton
77–78	\$4.00/ton
75–76	\$6.00/ton

If the screenings cleanness value is less than 75, remove the asphaltic emulsion seal coat.

Summary Points: Some covered with new thoughts

- ✓ **Roller tires – flats , un even pressure**
- ✓ **Sweeper heads – too short bristles stiffen**
- ✓ **Hydraulic leaks on any equipment – eats the mat**
- ✓ **Over sweeping – can cause early chip failure**
- ✓ **Overlaps, joints – bleeding areas**
- ✓ **Straddling chip trucks for initial roll, this also prevents chip trucks from rolling aggregate in one wheel path, then driving emulsion to surface**
- ✓ **Excess rock placed leads to under rolling, aggregate rolling in mat, excess sweeping**
- ✓ **60 to 80 % embedment of aggregate into emulsion, depending on rock size and binder product**
- ✓ **Proper distance with Chipper and Distributor, depending on chemistry, this can lead to failures**
- ✓ **Touch up team, these would be laborers usually in flatbed with extra aggregate, rakes and shovels, to touch up bald spots , knock down piles, as this team should work in front on rollers to keep them from getting emulsion on tires and from trying to roll excess aggregate**
- ✓ **Emulsion on roller tires, needs to be cleaned, as this could cause damage to mat, and will get worse before it gets better (this could indicate a problem with combo of spread rates)**
- ✓ **Braking of equipment on mat, damage may not show up for a couple of days, this needs to be monitored and discussed with contractor**
- ✓ **Contaminated stock piles, over size material, gouging the pad, tracking emulsion spills, good housekeeping**
- ✓ **Moisture in aggregate, too much bad, too little chokes the crew**



THANK YOU

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