

APPENDIX B – SPECIFICATIONS USED FOR FIELD PROJECTS

FHWA Technology Study: *Using Polymer Modified Asphalt Emulsions in Surface Treatments*

Task 3: Laboratory evaluation of Strawman testing protocol.

Project Specifications

409 – Chip Seal Specification (standard)

410 – Micro Surfacing Specification (Utah projects only)

702 – Asphalt Emulsion & Aggregate Specification – Utah Projects

702 – Asphalt Emulsion & Aggregate Specification – Crater Lake (CRLA)

702 – Asphalt Emulsion & Aggregate Specification – Death Valley (DEVA)

702 – Asphalt Emulsion & Aggregate Specification – Dinosaur (DINO) Standard Specification (some project-by-project modification)

B.1 Section 409. — ASPHALT SURFACE TREATMENT

Standard Specification (some project-by-project modification)

Description

409.01 This work consists of constructing a single or multiple asphalt surface treatment with aggregate or precoated aggregate. This work also includes constructing an asphalt fog seal without aggregate.

Surface treatment aggregate designation is designated as shown in Tables 409-1, 409-2, and 409-3.

Provide emulsified asphalt grade CRS-2P or equivalent meeting the requirements of Table 702-4.

Material

409.02 Conform to the following Subsections:

Aggregate 703.10

Asphalt binder 702.01

Blotter 703.13

Emulsified asphalt 702.03

Construction Requirements

409.03 Qualifications. Submit the following information for approval at least 28 days before placement.

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Companies and individuals involved with the placement of asphalt surface treatments must conform to the:

- (a) Demonstrate satisfactory completion of at least 10 comparable projects.
- (b) Provide Superintendent or Foremen experience in surface treatment construction on at least 10 comparable projects.

409.04 Composition. Submit the following information and samples for approval at least 21 days before placement:

- (a) **Aggregate samples.** 80 pounds from each stockpile produced and the gradation range represented by each.
- (b) **Aggregate gradation target values.** The proposed percentage of each stockpile to be used and the proposed target value for each sieve size. Standard Specification (some project-by-project modification)
- (c) **Asphalt samples.** 2 1-quart samples of asphalt binder or emulsified asphalt from the same source and of the type to be used for the surface treatment.
- (d) **Asphalt temperature.** Apply asphalt at temperatures according to Table 702-1.
- (e) **Spread rates.** The proposed spread rate for the aggregate and asphalt material.

409.05 Equipment. Furnish equipment as follows:

(a) Asphalt distributor.

- (1) Capable of heating asphalt evenly.
- (2) Adjustable full circulation spray bar to 15-foot width.
- (3) Positive controls including tachometer, pressure gauge, volume measuring device, or calibrated tank to uniformly deposit asphalt over the full width within 0.02 gallons per square yard of the required rate.
- (4) Thermometer for measuring the asphalt temperature in the tank.

(b) Vacuum Sweeper. Furnish a minimum of two vacuum sweepers both with the following capabilities:

- (1) Self-propelled.
- (2) Capable of controlling the vertical broom pressure.
- (3) Capable of removing excess aggregate particles.

(c) Pneumatic-tire rollers. Furnish a minimum of two pneumatic-tire rollers both with the following capabilities:

- (1) Self-propelled.
- (2) Minimum compacting width - 5 feet.
- (3) Gross weight adjustable within the range of 200 to 360 pounds per inch of compaction width.

(d) Aggregate spreader.

- (1) Self-propelled.
- (2) Minimum of 4 pneumatic tires on 2 axles. Standard Specification (some project-by-project modification)
- (3) Positive controls to uniformly deposit the aggregate over the full width of asphalt within 10 percent by mass of the required rates.

(e) Other equipment. Other equipment of proven performance may be used in addition to or in lieu of the specified equipment when approved by the CO. Provide two-way communication between the asphalt distributor and the aggregate spreader if the roadway alignment does not permit visual contact.

409.06 Surface Preparation. On existing asphalt surfaces, ensure that the surface is dry. Immediately before placing the layer of chips, remove loose dirt and other objectionable material from the surface by approved methods. Fog seal patches using a slow setting emulsion diluted with an equal part water. Apply the diluted emulsion at a rate of 0.15 gallons per square yard.

409.07 Weather Limitations. Apply surface treatment or fog seal according to the following:

(a) Apply single or multiple asphalt surface treatments when:

- (1) Between June 15th and September 4th unless other dates are approved by the CO.
- (2) Ambient air temperature is above 68 °F and rising and surface temperatures are between 80 °F and 140 °F
- (3) Weather is not foggy or rainy, and when rain or temperatures below 40°F are not anticipated for at least 24 hours after application.
- (4) Winds are less than or equal to 10 miles per hour.
- (5) Complete surface treatment application at least 2 hours before sunset.

(b) Apply fog seal when:

- (1) Ambient air and surface temperatures are above 50 °F and rising.
- (2) Weather is not foggy or rainy, and when rain or temperatures below 40 °F are not anticipated for at least 24 hours after application.

(3) Complete fog seal applications at least 2 hours before sunset.

409.08 Production Start-Up Procedures for Surface Treatments. At least 10 days before the start of constructing all surface treatments containing aggregate, arrange for a pre-surface treatment conference. Coordinate attendance with the CO and any applicable subcontractors. Be prepared to discuss or submit the following:

- (a) Proposed schedule of operations. Standard Specification (some project-by-project modification)
- (b) List of all personnel involved in the production and construction of the work including equipment calibration, sampling, and testing.
- (c) List of equipment, quantity, and description to be used in the production and construction of the work.
- (d) Proposed traffic control plan.
- (e) Discuss Section 153, minimum frequency schedule for process control sampling and testing (to be performed by the Contractor).
- (f) Discuss Subsections 409.08; 409.09, and 409.10.
- (g) Discuss spill prevention and safety contingency plan.

Provide 7 days advance notice before constructing all asphalt surface treatments containing aggregate. Also use these start-up procedures when resuming production after termination due to nonconforming work.

On the first day of placement of each surface treatment layer, or whenever there is a change in the surface texture or aggregate gradation, construct a minimum of three 50-foot control strips that are one-lane wide. Each control strip will have different application rates of emulsion and/or surface aggregate. The CO will indicate which strip of the will serve as the approved project control strip. Coordinate location of the control strips with the CO.

Construct the control strip using material, lay-down, and compaction procedures intended for the remainder of the surface treatment. Cease production after construction of the control strip until the material and the control strip are evaluated and accepted.

Acceptable control strips may remain in place and will be accepted as a part of the completed surface treatment.

Repeat the control strip process until an acceptable control strip is produced.

409.09 Asphalt Application. Calibrate the asphalt distributor spray bar height, nozzle angle, pump pressure and check the longitudinal and transverse spread rates daily, before start up, and as directed by the CO according to ASTM D2995. If different asphalt distributors are used, calibrate each before use on the project. Ensure that the length of the spread is no more than can be covered with aggregate

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immediately after application. Document all calibration and application rates and provide to the CO at the end of each days production.

Protect the surfaces of nearby objects, such as stone curbing, to prevent spattering or marring. Spread building paper on the surface for a sufficient distance from the Standard Specification (some project-by-project modification) beginning and end of each application so the flow through the distributor nozzles may be started and stopped on the paper.

Apply the asphalt uniformly with an asphalt distributor at the optimum application rate determined from the test strip. Move distributor forward at the proper application speed at the time the spray bar is opened. Stop application if any nozzles are plugged or if triple nozzle spray coverage is not occurring. Use care not to apply excess asphalt at the junction of spreads.

Correct skipped areas or deficiencies. Remove and dispose of paper or other material used.

409.10 Aggregate Application. When using asphalt binder, the aggregate surface should be dry. When using emulsified asphalt, the aggregate surface should be moist. Verify aggregate stockpiles moisture daily during production with visual inspection.

Apply the aggregate uniformly with an aggregate spreader immediately after the asphalt is applied at the optimum application rate determined from the test strip. Check and record spread rate daily, before start up, and as directed by the CO. Operate aggregate spreader so the asphalt is covered with the aggregate before wheels pass over it. During part-width construction, leave uncovered a strip of sprayed asphalt approximately 6 inches wide to permit an overlap of asphalt material.

Immediately correct excesses and deficiencies by brooming or by the addition or removal of aggregate until a uniform texture is achieved. Use hand methods in areas not accessible to power equipment.

When precoated aggregates are used, they may be mixed on the job or at a central mixing plant. Uniformly coat the aggregate with 1.0 to 2.0 percent residual asphalt, by weight of aggregate. Maintain the flow qualities of the precoated aggregate, so it is satisfactorily spread with an aggregate spreader.

Operate rollers at a maximum speed of 5 miles per hour. Do not permit the aggregate to be displaced by pickup or sticking of material to the tire surface. Roll the surface to uniformly and thoroughly bond the aggregate over the full width. Complete rolling within 1 hour after asphalt is applied to the surface.

409.11 Fog Seal. A fog seal consists of applying slow-setting emulsified asphalt diluted with water onto an existing asphalt surface. Unless otherwise noted on the plans, dilute the specified emulsion one part water to one part emulsified asphalt. Apply the diluted emulsified asphalt according to Subsection 409.09 at a rate of 0.10 to 0.15 gallons per square yard depending on the condition of the existing surface. Allow the fog seal to penetrate undisturbed for at least 2 hours or until the emulsified asphalt breaks and is substantially absorbed into the existing surface. Then lightly cover remaining spots of excess asphalt with blotter according to Section 411 before opening the surface to traffic. Standard Specification (some project-by-project modification)

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409.12 Single-Course Surface Treatment. A single-course surface treatment consists of applying asphalt material onto an existing surface immediately followed by a single, uniform application of aggregate. Apply the asphalt and aggregate according to Subsections 409.09 and 409.10 at the approximate rates shown in Table 409-1. Application rates shown in Table 409-1 should be used for estimating purposes only. The contractor shall determine aggregate and asphalt application rates that may fall outside the ranges shown in Table 409-1. Before curing, the emulsion should rise just below the top of the aggregate. After curing, embedment depth of the aggregate in the residual asphalt should be approximately 60% of the nominal maximum size. Determine the exact rates based on approved control strips.

Use a pilot car according to Section 635 to limit traffic speeds. During the initial 45 minutes after completion of rolling, limit the traffic speeds to 10 miles per hour. Limit traffic speeds to 20 miles per hour for 24 hours.

Lightly broom the aggregate surface on the morning after construction. Maintain the surface for 4 days by distributing blotter according to Section 411 to absorb any free asphalt and by repairing areas deficient in aggregate. Remove excess material from the surface using a rotary broom. Do not displace embedded material. Do not broom the surface where the air temperature is above 90 °F.

Table 409-1

Approximate Quantities of Material for Single Course Surface Treatments

Single-Course Surface Treatment Designation	Nominal Maximum Size of Aggregate	Aggregate Gradation⁽¹⁾	Estimated Quantity of Aggregate⁽²⁾ pounds/yd²	Estimated Quantity of Emulsified Asphalt gallons/yd²	Estimated Quantity of Asphalt Binder gallons/yd²
1A	¾ inch	B	44 – 53	0.48 – 0.65	0.31 – 0.43
1B	½ inch	C	29 – 33	0.39 – 0.53	0.27 – 0.36
1C	⅜ inch	D	24 – 28	0.27 – 0.43	0.17 – 0.29
1D	No. 4	E	18 – 24	0.22 – 0.29	0.14 – 0.19
1E	Sand	F	13 – 18	0.17 – 0.24	0.12 – 0.17

(1) See Table 703-7 for aggregate gradations.

(2) Aggregate masses are for aggregates having a bulk specific gravity of 2.65, as determined by AASHTO T 84 and AASHTO T 85. Make proportionate corrections when the aggregate furnished has a bulk specific gravity above 2.75 or below 2.55.

Standard Specification (some project-by-project modification)

409.13 Acceptance. Asphalt binder, and emulsified asphalt, will be evaluated under Subsections 106.03, 106.04 and 702.09. Furnish a production certification for the grade of emulsified asphalt specified in Subsection 409.01.

Aggregate gradation for asphalt surface treatment will be evaluated under Subsection 106.05.

See Table 409-4 for sampling and testing requirements.

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The upper and lower specification limits are equal to the calculated mean of all test results plus or minus the allowable deviations shown in Table 703-7, except as follows:

- (a) If the calculated mean value for any tested sieve exceeds the maximum gradation value shown in Table 703-7, the upper specification is equal to the maximum gradation value plus the allowable deviation, and the lower specification is equal to the maximum gradation value minus the allowable deviation.
- (b) If the calculated mean value for any tested sieve is less than the minimum gradation value shown in Table 703-7, the upper specification is equal to the minimum gradation value plus the allowable deviation and the lower specification is equal to the minimum gradation value minus the allowable deviation.

Construction of asphalt surface treatment course will be evaluated under Subsections 106.02 and 106.04.

Prime coat and blotter will be evaluated under Section 411.

Measurement

409.14 Measure the Section 409 items listed in the bid schedule according to Subsection 109.02 for each day's production and the following as applicable.

Measure and provide temperature volume corrections for emulsified asphalt and asphalt binder to 60 °F.

Measure surface treatment aggregate in the hauling vehicle prior to stockpiling or prior to placement if not stockpiled.

Measure fog seal including water added for dilution.

Indicate a breakdown of total emulsion and water added on the load invoices supplied to the CO for payment.

Measure blotter under Section 411. Standard Specification (some project-by-project modification)

Payment

409.15 The accepted quantities will be paid at the contract price per unit of measurement for the Section 409 pay items listed in the bid schedule except the aggregate surface treatment contract price unit bid price will be adjusted according to Subsection 106.05. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

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**Table 409-4
Sampling, Testing and Acceptance Requirements**

Material or Property	Type of Acceptance (subsection)	Characteristic	Category	Test Methods Specifications	Sampling Frequency	Point of Sampling	Split Sample	Reporting Time
Aggregate Surface treatment aggregate ⁽¹⁾ (703.10)	Measured and tested for conformance (106.04 & 105)	LA abrasion	---	AASHTO T 96	1 per type & source of material	Source of Material	Yes, when requested	Before using in work
		Sodium sulfate soundness loss (coarse & fine)	---	---	AASHTO T 104	“	“	“
		Fractured faces	---	---	ASTM D5821	“	“	“
		Flat & elongated particles	---	---	ASTM D4791	“	“	“
		Adherent coating	---	---	ASTM D5711	“	“	“
		Clay lumps & friable particles	---	---	AASHTO T 112	“	“	“
Aggregate surface treatment aggregate ⁽¹⁾	Statistical (106.05)	Gradation. See Table 703-7 for applicable sieves	I	AASHTO T 27 & T 11	1 per 750 tons	Production belt or spreader discharge	Yes	24 hours
	Measured and tested for conformance (106.04 & 106.05)	Fractured faces		ASTM D5821	1 per 750 tons	Production belt or spreader discharge	Yes	24 hours
		Liquid limit ⁽²⁾		AASHTO T 89	“	“	“	“
Asphalt binder ⁽³⁾ (702.01) or emulsified asphalt ⁽³⁾ (702.03)	Measured and tested for conformance (106.04)	Quality		Subsection 409.13	1 per tanker truck including trailer	Point of shipment delivery	2 1-quart samples	---

(1) Applies to each aggregate grade furnished.

(2) For blotter material only.

(3) Applied to each asphalt material furnished.

B.2 Section 410. — MICRO-SURFACING

Description

410.01 This work consists of applying a polymer modified micro surfacing mix on an existing pavement surface.

Micro Surfacing Type III as shown in Table 703-8 is to be used on this project. The residual asphalt content specified is 7.5 ± 2 percent by dry total weight of aggregate.

410.02 Conform to the following Subsections:

Aggregate 703.11

Emulsified asphalt, polymer modified 702.03(d)

Mineral Filler 725.05

Water 725.01(c)

Construction Requirements

410.03 Composition of Mix (Job-Mix Formula). Furnish a micro surfacing mixture of aggregate, water, polymer modified emulsified asphalt and additives according to ASTM 6372-05. Conform to the Type III aggregate gradation in Table 703-8 and the residual asphalt content in Subsection 410.01.

Submit a written job-mix formula for approval at least 14 days before production that meets the mix design requirements in ISSA A143 for micro surfacing. Submit the following:

(a) Aggregate gradation values. The representative value for each sieve size for the aggregate blend.

(b) Emulsified asphalt content. The residual asphalt content, as a percent by mass of dry aggregate.

(c) Polymer modifier. Type and amount of polymer modifier solids based on the residual asphalt content.

(c) Aggregate samples. 100-pound sample of each aggregate.

(d) Emulsified asphalt sample. Source of and 5-gallon sample of the emulsified asphalt to be used in the mix.

(e) Mineral filler samples. 50-pound sample of each proposed mineral filler.

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(f) Qualifications. Demonstrate satisfactory completion of at least 5 comparable projects. Provide Superintendent or Foreman experience in micro surfacing on at least 5 comparable projects.

The job-mix formula will be evaluated for approval.

410.04 Equipment. Furnish with the following capabilities.

(a) Mixing equipment.

- (1) Self-propelled;
- (2) Continuous-flow mixing,
- (3) Calibrated controls;
- (4) Easily readable metering devices that accurately measure all raw material before entering the pugmill;
- (5) Automated system for sequencing in all raw material to ensure constant slurry mix;
- (6) Mixing chamber to thoroughly blend all ingredients together;
- (7) Fines feeders with an accurate metering devices for introducing additives into the mixer;
- (8) A pressurized water system with a fog-type spray bar capable of fogging the surface immediately ahead of the spreading equipment at a rate of 0.03 to 0.06 gallons per square yard;
- (9) Proportioning system that is accurate for measuring all material independent of engine speed;
- (10) Minimum speed of 60 feet per minute and maximum speed of 180 feet per minute;
- (11) Minimum storage capacity of 7 tons; and
- (12) Capable according to ISSA Performance Guidelines A143.

(b) Mechanical-type single squeegee spreader box.

- (1) Attaches to the slurry seal mixer; CO IMR-PRES-1(08) Utah Parks

- (2) Flexible squeegee in contact with the surface to prevent loss of slurry;
- (3) Adjustable to ensure a uniform spread over varying grades and crowns;
- (4) Adjustable in width with a flexible strike-off; and
- (5) Augers for uniform flow to edges.

(c) **Auxiliary equipment.** Furnish hand squeegees, shovels, and other equipment necessary to perform the work. Provide cleaning equipment including, but not limited to, power brooms, air compressors, water flushing equipment, and hand brooms for surface preparation.

410.05 Surface Preparation. Clean the existing surface of all loose material, dirt, or other deleterious substances by approved methods. Protect all service entrances such as manholes, valve boxes and drop inlets from the micro surfacing by a method suitable to the CO. Protect all concrete work, rock walls and other objects from the micro surfacing with a method suitable to the CO.

410.06 Weather Limitations. Apply the mixture when the air temperature in the shade and the surface temperature are at least 45°F and rising and when the weather is not foggy, rainy, or overcast. Do not apply when there is a danger that the finished product will freeze within 24 hours.

410.07 Production Start-Up Procedures for Surface Treatments. At least 10 days before the start of constructing the micro surfacing, arrange for a pre-micro surfacing conference. Coordinate attendance with the CO and any applicable subcontractors. Be prepared to discuss or submit the following:

- (a) Proposed schedule of operations.
- (b) List of all personnel and equipment involved in the production and construction of the work including equipment calibration, sampling, and testing.
- (c) Proposed traffic control plan.
- (e) Discuss Section 153, minimum frequency schedule for process control sampling and testing (to be performed by the Contractor).
- (f) Discuss Subsections 410.05, 410.06, 410.07 and 410.08.
- (g) Discuss spill prevention and safety contingency plan.

Provide 7 days advance notice before constructing all micro surfacing. Also use these start-up procedures when resuming production after termination due to nonconforming work.

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On the first day of placement, construct a 300-foot test strip, one lane wide. The CO will approve the test strip before production begins. Coordinate location of the control strips with the CO.

Construct the control strip using material and lay-down procedures intended for the remainder of the micro surfacing. Cease production after construction of the control strip until the material and the control strip are evaluated and accepted.

Acceptable control strips may remain in place and will be accepted as a part of the completed surface treatment.

Repeat the control strip process until an acceptable control strip is produced.

410.08 Application. Mix the materials using a slurry seal mixer and according to ISSA Performance Guideline A 143. Fog the surface with water immediately preceding the spreader.

Blend the additives with the aggregate using the fines feeders. Pre-wet the aggregate in the pugmill immediately before mixing with the polymer-modified emulsified asphalt.

Mix the surfacing materials a maximum of 4 minutes. Ensure the mix is of the desired consistency as it leaves the mixer and conforms to the approved job-mix formula. Adjustment of the mineral filler and the emulsified asphalt content during construction may be approved to adjust for variations in field conditions.

Carry sufficient mix in the spreader to completely cover the surface. Spread the mix with a mechanical-type squeegee spreader box. In areas not accessible to the spreader box, use hand squeegees to work the mix.

Allow treated areas to completely cure before opening to traffic. Cure is complete when clear water can be pressed out of the mix with a piece of paper without discoloring the paper.

Prior to starting application of micro surfacing, calibrate each mixing unit to be used on the project in accordance with ASTM D6372 and in the presence of the CO or designated representative. Clean spreader box prior to start of each work shift.

Transverse joints: Use a butt joint. Use building paper placed over previously placed slurry seal or other suitable method to avoid double placement of slurry seal. Ridges or bumps in the finished surface are not permitted.

Longitudinal joints: Place longitudinal joints on lane lines. Half passes and odd-width passes can be used only in turnouts and parking areas. When half passes are used, they shall not be the last pass of any paved area. Overlap longitudinal joints no more than 3 inches. Keep elevation difference at joints less than ¼ inch.

Roll parking areas and turnouts with a self-propelled, 10-ton pneumatic roller with a tire pressure of 50 psi and equipped with a water spray system. Subject surfaced areas to a minimum of 2 full-coverage passes with the roller. Do not commence rolling until micro surfacing has cured to the point where it will not pick up on the tires of the roller.

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No streaks or transverse ripples as defined by ISSA Performance Guidelines A 143 are allowed in the finished surface. Ensure straight lines along curb and shoulders. No runoff on these areas is permitted. Mask off surface areas at the project start, end, and as directed by the CO to provide straight and neat starting and ending joints.

Clean up all material spills; remove from the park, and dispose of in accordance with all local, state, and federal regulations. On a daily bases remove all debris associated with the performance of the work from the park, and dispose of in accordance with all local, state, and federal regulations.

410.09 Acceptance. See Table 410-1 for sampling and testing requirements.

Polymer modified emulsified asphalt will be evaluated under Subsections 106.03 and 702.09.

Aggregate for surfacing mixture will be evaluated under Subsections 106.02 and 106.04.

Construction of surfacing will be evaluated under Subsections 106.02 and 106.04.

Construction of asphalt surface treatment course will be evaluated under Subsections 106.02 and 106.04.

Measurement

410.10 Measure the Section 410 items listed in the bid schedule according to Subsection 109.02 for each day’s production.

Payment

409.11 The accepted quantities will be paid at the contract price per unit of measurement for the Section 410 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

**Table 410-1
Sampling and Testing Requirements**

Material or Property	Type of Acceptance (subsection)	Characteristic	Category	Test Methods Specifications	Sampling Frequency	Point of Sampling	Split Sample	Reporting Time
Aggregates for surfacing mixture (703.11)	Measured and tested for conformance (106.04)	Gradation	---	AASHTO T 27 & T 11	1 per 500 tons	Stockpile	Yes, when requested	Before using in work
		LA abrasion	---	AASHTO T 96	1 per aggregate	Aggregate source	“	“
		Soundness	---	AASHTO T 104	“	“	“	“
		Sand equivalent	---	AASHTO T 176, alternate method no.2, reference method	“	Stockpile	“	“

B.3 Section 702. — ASPHALT MATERIAL — Utah Parks

Section 702. — ASPHALT MATERIAL

702.03 Emulsified Asphalt. Add the following:

702.03(d) Polymer modified emulsions. Delete the title and text of this subsection and substitute the following:

(d) Polymer modified emulsions. Mill or blend the polymer material into the asphalt or emulsifier solution prior to or during the emulsification process. AASHTO T 59 will be followed for all test methods, except as noted.

For chip seal application, use a polymer cationic rapid set emulsified asphalt (CRS-2P) conforming to Table 702-4. Latex modified cationic rapid setting emulsified asphalt (LMCRS-2) conforming to Table 702-6 may be used in lieu of CRS-2P for this project.

**Table 702-4
Chip Seal Emulsion Specification**

Emulsion Grade	CRS-2P⁽¹⁾	
	Minimum	Maximum
Tests on emulsion:		
Viscosity, Saybolt Furol at 140 °F, SFS	100	400
Settlement, 5 days, %	---	5.0
Storage stability test, 24-hour, % ⁽²⁾	---	1.0
Sieve test, %	---	0.10
Particle charge test	Positive	
Demulsibility, %	40	---
Residue by distillation, % ⁽³⁾	68	---
Tests on residue from distillation test:		
Penetration, 77 °F, 100 g, 5 sec	80	150
Ductility, 77 °F, 5 cm/min, cm	125	---

(1) CRS-2P will be an emulsion blend of polymerized asphalt, water, and emulsifiers. The asphalt cement will be polymerized prior to emulsification and will contain a minimum of 2½ percent polymer by weight of asphalt cement.

(2) This test requirement on representative samples is waved if successful application of the material has been achieved

(3) The standard distillation procedure will be modified as follows: The temperature on the lower thermometer will be brought slowly to 400 ± 8 °F and maintained at this point for 20 minutes. Complete the total distillation in 60 ± 15 minutes from the first application of heat.

For micro surfacing application use a quick-set polymer modified asphalt emulsion conforming to AASHTO M 208 CSS-1h; delete the cement mixing test requirements. The polymer modifier to be added at a minimum of 2.5 percent solids based on the residual asphalt content. The asphalt/polymer emulsion must parallel the standard from an established infrared spectrum characterizing the asphalt/polymer emulsion. The modified emulsion residue must meet Table 702-5.

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**Table 702-5
Modified Emulsion Residue**

Emulsion Grade	CSS-1h quick set	
Tests on emulsion:	Description	Specification
AASHTO T 49	Penetration @ 77 °F	40-90
AASHTO T 53	Softening Point	135 °F minimum
AASHTO T 59-modified (a)	Residue by Distillation	62% minimum
AASHTO 316	Rotational Viscosity 275 °F	650 CPS minimum
(a) Modified distillation procedure: Heat emulsion residue to 270 ± 10 degrees F and maintain that temperature for 20 minutes. Perform the distillation within 60 ± 15 minutes.		

**Table 702-6
Latex Modified Cationic Rapid Setting Emulsified Asphalt (LMCRS-2)**

Tests	AASHTO Test Method	Min.	Max.
Emulsion			
Viscosity, SF, 122 °F (50 °C), sec (Project Site Acceptance/Rejection Limits)	T 59	140	400
Settlement (a) 5 days, percent	T 59		5
Storage Stability Test (b) 1 d, 24 h, percent	T 59		1
Demulsibility (c) 35 ml, 0.8% sodium dioctyl Sulfosuccinate, percent	T 59		40
Particle Charge Test	T 59		Positive
Sieve Test, percent	T 59		0.3
Distillation			
Oil distillate, by volume of emulsion, percent			0
Residue (d), percent			65
Residue from Distillation Test			
Penetration, 77 °F (25 °C), 100 g, 5 s, dmm	T 49	40	200
Torsional Recovery (e)			18
(a) The test requirement for settlement may be waived when the emulsified asphalt is used in less than a five-day time; or the purchaser may require that the settlement test be run from the time the sample is received until it is used, if the elapsed time is less than 5 days.			
(b) May use the 24-hour (1-day) storage stability test instead of the five-day settlement test.			
(c) Make the demulsibility test within 30 days from date of shipment.			
(d) Determine distillation by AASHTO T 59, with modifications to include a 350 ± 5 °F (177 ± 3 °C) maximum temperature to be held for 15 minutes.			
(e) CA 332 (California Test Method)			
Co-mill latex and asphalt during emulsification			

Section 703. — AGGREGATE

703.05 Subbase, Base, and Surface Course Aggregate.

(a) General. Delete lines (3), (4), (5), and (6) and substitute the following:

- (3) Fractured faces, one or more, ASTM D5821 50% min.
- (4) Free from organic matter and lumps or balls of clay

(b) Subgrade or Base aggregate.

Table 703-2 Target Value Ranges for Subbase and Base Gradation. Delete reference to the “436-74(6)” percent by mass passing the 4.75 millimeter sieve for grading E (base) and substitute “36-74 (6).”

(c) Surface Course Aggregate. Delete the text including Table 703-3 and substitute the following:

Furnish hard, durable particles or fragments of crushed stone, crushed slag, or crushed gravel conforming to the following:

- (1) Los Angeles abrasion, AASHTO T 96 50% max.
- (2) Fractured faces, one or more, ASTM D5821 50% min.
- (3) Free from organic matter and lumps or balls of clay
- (4) Liquid Limit, AASHTO T 89 35 max.
- (5) Dust ratio: $\frac{\% \text{ passing } \#200}{\% \text{ passing } \#40}$ 2/3 max.
- (6) Gradation and plasticity index, AASHTO T 90 Table 703-3

Do not use material that breaks up when alternately frozen and thawed or wetted and dried.

Obtain the aggregate gradation by crushing, screening, and blending processes as necessary. Fine aggregate, material passing the No. 4 sieve, will consist of natural or crushed sand and fine mineral particles.

Do not furnish material that contains asbestos fibers.

APPENDIX B – SPECIFICATIONS USED FOR FIELD PROJECTS

**Table 703-3
Target Value Ranges for Surface Course Gradation and Plasticity Index**

Sieve Size	Percent by Mass Passing Designated Sieve (AASHTO T 27 & T 11)
¾ inch	100 ⁽¹⁾
No. 4	41 – 71 (7)
No. 40	*(5)
No. 200	9 – 16 (4)
Plasticity Index (PI)	8 (4)

(1) Statistical procedures do not apply.

(*) Submit target values for applicable sieves

() Allowable deviations (+/-) from the target values

703.06 Crushed Aggregate. Add the following to the end of the paragraph:

When aggregate is used as a surface course, furnish an aggregate with a Plasticity Index conforming to Table 703-3a.

**Table 703-3a
Surface Course Gradation and Plasticity Index**

Sieve Size	Percent by Mass Passing Designated Sieve (AASHTO T 27 & T 11)
¾ inch	100
No. 4	41 – 71
No. 40	*
No. 200	5 – 20
Plasticity Index (PI)	4 – 12
Plasticity Index (PI)	4 – 12

(*) Submit target values for applicable sieves

703.10 Asphalt Surface Treatment Aggregate.

Delete lines (d), (e), (f), (g), and (h) and substitute the following:

- | | |
|--|-----------|
| (d) Fractured faces, one or more, ASTM D5821 | 90% min. |
| (e) Flat and elongated particles, 1:3 ratio. +¾ inch sieve, calculated by mass, weighted average, ASTM D4791 | 10% max. |
| (f) Clay lumps and friable particles, AASHTO T 112 | 1.0% max. |
| (g) Adherent coating, ASTM D5711 | 0.5% max. |

Table 703-7. Delete Table 703-7 and substitute the following:

APPENDIX B – SPECIFICATIONS USED FOR FIELD PROJECTS

**Table 703-7
Target Value Ranges for
Single and Multiple Course Surface Treatment Aggregate Gradation**

Sieve Size	Percent by Mass Passing Designated Sieve (AASHTO T 27 & T 11)					
	Grading Designation					
	A	B	C	D	E	F
1½ inch	100 ⁽¹⁾					
1 inch	90 – 100 (3)	100 ⁽¹⁾				
¾ inch	0 – 35 (5)	90 – 100 (3)	100 ⁽¹⁾			
½ inch	0 – 8 (3)	0 – 35 (5)	90 – 100 (3)	100 ⁽¹⁾		
⅜ inch	---	0 – 12 (3)	0 – 35 (5)	70 – 90 (3)	100 ⁽¹⁾	100 ⁽¹⁾
No. 4	---	---	0 – 12 (3)	0 – 10 (5)	85 – 100 (3)	85 – 100 ⁽¹⁾
No. 8	---	---	---	0-5 (3)	0 – 23 (4)	---
No. 200	0 – ½ (½)	0 – ½ (½)	0 – ½ (½)	0 – ½ (½)	0 – ½ (½)	0 – 10 ⁽¹⁾

(1) Statistical procedures do not apply.

() The value in parentheses is the allowable deviation (±) from the target value.

703.11 Micro-Surfacing Aggregate.

Table 703-8. Delete Table 703-8 and substitute the following:

**Table 703-8
Micro-Surfacing Aggregate
Gradation and Tolerance**

<u>Sieve Size</u>	<u>Type II Percent Passing</u>	<u>Type III Percent Passing</u>	<u>Stockpile Tolerance</u>
<u>3/8 inch</u>	<u>100</u>	<u>100</u>	
<u>No. 4</u>	<u>90 – 100</u>	<u>70 – 90</u>	<u>± 5%</u>
<u>No. 8</u>	<u>65 – 90</u>	<u>45 – 70</u>	<u>± 5%</u>
<u>No. 16</u>	<u>45 – 70</u>	<u>28 – 50</u>	<u>± 5%</u>
<u>No. 30</u>	<u>30 – 50</u>	<u>19 – 34</u>	<u>± 5%</u>
<u>No. 50</u>	<u>18 – 30</u>	<u>12 – 25</u>	<u>± 4%</u>
<u>No. 100</u>	<u>10 – 21</u>	<u>7 – 18</u>	<u>± 3%</u>
<u>No. 200</u>	<u>5 – 15</u>	<u>5 – 15</u>	<u>± 2%</u>

B.4 Section 702. — ASPHALT MATERIAL — Crater Lake National Park

Section 702. — ASPHALT MATERIAL

702.03 Emulsified Asphalt. Add the following:

APPENDIX B – SPECIFICATIONS USED FOR FIELD PROJECTS

702.03(d) Polymer modified emulsions. Delete the title and text of this subsection and substitute the following:

(d) Polymer modified emulsions. Mill or blend the polymer material into the asphalt or emulsifier solution prior to or during the emulsification process. AASHTO T 59 will be followed for all test methods, except as noted.

For chip seal application use a polymer cationic rapid set emulsified asphalt conforming to Table 702-4.

**Table 702-4
Chip Seal Emulsion Specification**

Emulsion Grade	CRS-2P / HFRS-P2 ⁽¹⁾	
	Minimum	Maximum
Tests on emulsion:		
Viscosity, Saybolt Furol at 140 °F, SFS	100	400
Settlement, 5 days, %	---	5.0
Storage stability test, 24-hour, % ⁽²⁾	---	1.0
Sieve test, %	---	0.10
Particle charge test	Positive	
Demulsibility, %	40	---
Residue by distillation, % ⁽³⁾	65	---
Tests on residue from distillation test:		
Penetration, 77 °F, 100 g, 5 sec	90	200
Ductility, 77 °F, 5 cm/min, cm	125	---

⁽¹⁾ CRS-2P or HFRS-P2 will be an emulsion blend of polymerized asphalt, water, and emulsifiers. The asphalt cement will be polymerized prior to emulsification and will contain a minimum of 2½ percent polymer by weight of asphalt cement.

⁽²⁾ This test requirement on representative samples is waved if successful application of the material has been achieved

⁽³⁾ The standard distillation procedure will be modified as follows: The temperature on the lower thermometer will be brought slowly to 400 ± 8 °F and maintained at this point for 20 minutes. Complete the total distillation in 60 ± 15 minutes from the first application of heat.

For micro surfacing application use a quick-set polymer modified asphalt emulsion conforming to AASHTO M 208 CSS-1h; delete the cement mixing test requirements. The polymer modifier to be added at a minimum of 2.5 percent solids based on the residual asphalt content. The asphalt/polymer emulsion must parallel the standard from an established infrared spectrum characterizing the asphalt/polymer emulsion. The modified emulsion residue must meet Table 702-5.

APPENDIX B – SPECIFICATIONS USED FOR FIELD PROJECTS

**Table 702-5
Modified Emulsion Residue**

Emulsion Grade	CSS-1h quick set	
Tests on emulsion:	Description	Specification
AASHTO T 49	Penetration @ 77 °F	40-90
AASHTO T 53	Softening Point	135 °F minimum
AASHTO T 59-modified (a)	Residue by Distillation	62% minimum
AASHTO T 316	Rotational Viscosity 275 °F	650 CPS minimum
(a) Modified distillation procedure: Heat emulsion residue to 270 ± 10 degrees F and maintain that temperature for 20 minutes. Perform the distillation within 60 ± 15 minutes.		

Section 703. — AGGREGATE

703.10 Asphalt Surface Treatment Aggregate.

Delete lines (d), (e), (f), (g), and (h) and substitute the following:

- | | |
|---|-----------|
| (d) Fractured faces, one or more, ASTM D5821 | 90% min. |
| (e) Flat and elongated particles, 1:3 ratio. + ³ / ₈ inch sieve, calculated by mass, weighted average, ASTM D4791 | 10% max. |
| (f) Clay lumps and friable particles, AASHTO T 112 | 1.0% max. |
| (g) Adherent coating, ASTM D5711 | 0.5% max. |

Table 703-7. Delete Table 703-7 and substitute the following:

**Table 703-7
Target Value Ranges for Single and Multiple Course Surface Treatment Aggregate Gradation**

Sieve Size	Percent by Mass Passing Designated Sieve (AASHTO T 27 & T 11)					
	Grading Designation					
	A	B	C	D	E	F
1½ inch	100 ⁽¹⁾					
1 inch	90 – 100 (3)	100 ⁽¹⁾				
¾ inch	0 – 35 (5)	90 – 100 (3)	100 ⁽¹⁾			
½ inch	0 – 8 (3)	0 – 35 (5)	90 – 100 (3)	100 ⁽¹⁾		
⅜ inch	---	0 – 12 (3)	0 – 35 (5)	85 – 100 (3)	100 ⁽¹⁾	100 ⁽¹⁾
¼ inch	---	---	---	0 – 15 (3)	---	---
No. 4	---	---	0 – 12 (3)		85 – 100 (3)	85 – 100 ⁽¹⁾
No. 30	---	---	---	0 – 2	0 – 23 (4)	---
No. 200	0 – ½ (½)	0 – ½ (½)	0 – ½ (½)	0 – ½ (½)	0 – ½ (½)	0 – 10 ⁽¹⁾

(1) Statistical procedures do not apply.

() The value in parentheses is the allowable deviation (±) from the target value.

B.5. Section 702. — ASPHALT MATERIAL — Death Valley National Park

Section 702. — ASPHALT MATERIAL

702.03 Emulsified Asphalt. Add the following:

702.03(d) Polymer modified emulsions. Delete the title and text of this subsection and substitute the following:

(d) Polymer modified emulsions. Mill or blend the polymer material into the asphalt or emulsifier solution prior to or during the emulsification process. AASHTO T 59 will be followed for all test methods, except as noted.

For chip seal application use a polymer cationic rapid set emulsified asphalt conforming to Table 702-4.

**Table 702-4
Chip Seal Emulsion Specification**

Emulsion Grade	CRS-2P⁽¹⁾	
	Minimum	Maximum
Tests on emulsion:		
Viscosity, Saybolt Furol at 140 °F, SFS	75	300
Settlement, 5 days, %	---	5.0
Storage stability test, 24-hour, % ⁽²⁾	---	1.0
Sieve test, %	---	0.10
Particle charge test	Positive	
Demulsibility, %	60	95
Residue by distillation, % ⁽³⁾	65	---
Tests on residue from distillation test:		
Penetration, 77 °F, 100 g, 5 sec	40	90
Ductility, 77 °F, 5 cm/min, cm	125	---

(1) CRS-2P will be an emulsion blend of polymerized asphalt, water, and emulsifiers. The asphalt cement will be polymerized prior to emulsification and will contain a minimum of 2½ percent polymer by weight of asphalt cement.

(2) This test requirement on representative samples is waved if successful application of the material has been achieved

(3) The standard distillation procedure will be modified as follows: The temperature on the lower thermometer will be brought slowly to 400 ±8°F and maintained at this point for 20 minutes. Complete the total distillation in 60 ± 15 minutes from the first application of heat.

703.10 Asphalt Surface Treatment Aggregate.

Delete lines (d), (e), (f), (g), and (h) and substitute the following:

APPENDIX B – SPECIFICATIONS USED FOR FIELD PROJECTS

- (d) Fractured faces, one or more, ASTM D5821 90% min.
- (e) Flat and elongated particles, 1:3 ratio. +³/₈ inch sieve, calculated by mass, weighted average, ASTM D4791 10% max.
- (f) Clay lumps and friable particles, AASHTO T 112 1.0% max.
- (g) Adherent coating, ASTM D5711 0.5% max.

Table 703-7. Delete Table 703-7 and substitute the following:

**Table 703-7
Target Value Ranges for Single and Multiple Course Surface Treatment Aggregate Gradation**

Sieve Size	Percent by Mass Passing Designated Sieve (AASHTO T 27 & T 11)					
	Grading Designation					
	A	B	C	D	E	F
1½ inch	100 ⁽¹⁾					
1 inch	90 – 100 (3)	100 ⁽¹⁾				
¾ inch	0 – 35 (5)	90 – 100 (3)	100 ⁽¹⁾			
½ inch	0 – 8 (3)	0 – 35 (5)	90 – 100 (3)	100 ⁽¹⁾		
⅜ inch	---	0 – 12 (3)	0 – 35 (5)	70 – 90 (3)	100 ⁽¹⁾	100 ⁽¹⁾
No. 4	---	---	0 – 12 (3)	0 – 10 (5)	85 – 100 (3)	85 – 100 ⁽¹⁾
No. 8	---	---	---	0 – 5 (3)	0 – 23 (4)	---
No. 200	0 – ½ (½)	0 – ½ (½)	0 – ½ (½)	0 – ½ (½)	0 – ½ (½)	0 – 10 ⁽¹⁾

(1) Statistical procedures do not apply.

() The value in parentheses is the allowable deviation (±) from the target value.

B.6 Section 702. - ASPHALT MATERIAL – Dinosaur National Monument

702.03 Emulsified Asphalt. Add the following:

702.03(d) Polymer modified emulsions. Delete the title and text of this subsection and substitute the following:

(d) Polymer modified emulsions. Mill or blend the polymer material into the asphalt or emulsifier solution prior to or during the emulsification process. AASHTO T 59 will be followed for all test methods, except as noted.

For chip seal application, use a polymer cationic rapid set emulsified asphalt (CRS-2P) conforming to Table 702-4. Latex modified cationic rapid setting emulsified asphalt (LMCRS-2) conforming to Table 702-6 may be used in lieu of CRS-2P for this project.

APPENDIX B – SPECIFICATIONS USED FOR FIELD PROJECTS

**Table 702-4
Chip Seal Emulsion Specification**

Emulsion Grade	CRS-2P⁽¹⁾	
Tests on emulsion:	Minimum	Maximum
Viscosity, Saybolt Furol at 77 °F, SFS	50	350
Settlement, 5 days, %	---	5.0
Storage stability test, 24-hour, % ⁽²⁾	---	1.0
Sieve test, %	---	0.10
Particle charge test	Positive	
Demulsibility, %	40	---
Residue by distillation, % ⁽³⁾	65	---
Tests on residue from distillation test:		
Penetration, 39.2 °F, 100 g, 5 sec	40	---
Ductility, 77 °F, 5 cm/min, cm	125	---

(1) CRS-2P will be an emulsion blend of polymerized asphalt, water, and emulsifiers. The asphalt cement will be polymerized prior to emulsification and will contain a minimum of 2½ percent polymer by weight of asphalt cement.

(2) This test requirement on representative samples is waved if successful application of the material has been achieved

(3) The standard distillation procedure will be modified as follows: The temperature on the lower thermometer will be brought slowly to 400 ± 8 °F and maintained at this point for 20 minutes. Complete the total distillation in 60 ± 15 minutes from the first application of heat.

Section 703. — AGGREGATE

703.06 Crushed Aggregate. Add the following to the end of the paragraph:

When aggregate is used as a surface course, furnish an aggregate with a Plasticity Index conforming to Table 703-3a.

**Table 703-3a
Surface Course Gradation and Plasticity Index**

Sieve Size	Percent by Mass Passing Designated Sieve (AASHTO T 27 & T 11)
¾ inch	100
No. 4	41 – 71
No. 40	*
No. 200	5 – 20
Plasticity Index (PI)	4 – 12

(*) Submit target values for applicable sieves

703.10 Asphalt Surface Treatment Aggregate.

Delete lines (d), (e), (f), (g), and (h) and substitute the following:

(d) Fractured faces, one or more, ASTM D5821 90% min.

(e) Flat and elongated particles, 1:3 ratio. +¾ inch sieve, 10% max.
calculated by mass, weighted average, ASTM D4791

APPENDIX B – SPECIFICATIONS USED FOR FIELD PROJECTS

- (f) Clay lumps and friable particles, AASHTO T 112 1.0% max.
- (g) Adherent coating, ASTM D5711 0.5% max.

Table 703-7. Delete Table 703-7 and substitute the following:

Table 703-7

Target Value Ranges for Single and Multiple Course Surface Treatment Aggregate Gradation

Sieve Size	Percent by Mass Passing Designated Sieve (AASHTO T 27 & T 11)					
	Grading Designation					
	A	B	C	D	E	F
1½ inch	100 ⁽¹⁾					
1 inch	90 – 100 (3)	100 ⁽¹⁾				
¾ inch	0 – 35 (5)	90 – 100 (3)	100 ⁽¹⁾			
½ inch	0 – 8 (3)	0 – 35 (5)	90 – 100 (3)	100 ⁽¹⁾		
⅜ inch	---	0 – 12 (3)	0 – 35 (5)	70 – 90 (3)	100 ⁽¹⁾	100 ⁽¹⁾
No. 4	---	---	0 – 12 (3)	0 – 10 (5)	85 – 100 (3)	85 – 100 ⁽¹⁾
No. 8	---	---	---	0 – 5 (3)	0 – 23 (4)	---
No. 200	0 – ½ (½)	0 – ½ (½)	0 – ½ (½)	0 – ½ (½)	0 – ½ (½)	0 – 10 ⁽¹⁾

(1) Statistical procedures do not apply.

() The value in parentheses is the allowable deviation (±) from the target value.