

**DEPARTMENT OF TRANSPORTATION**

DIVISION OF ENGINEERING SERVICES

OFFICE ENGINEER

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*Flex your power!  
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March 21, 2013

02-Teh-36-55.2/67.5

02-4E9704

Project ID 0212000114

ACSTP-P036(094)E

Addendum No. 3

Dear Contractor:

This addendum is being issued to the contract for CONSTRUCTION ON STATE HIGHWAY IN TEHAMA COUNTY AT AND NEAR PAYNES CREEK FROM 0.1 MILE WEST OF MANTON ROAD TO 0.2 MILE EAST OF LATKA ROAD.

Submit bids for this work with the understanding and full consideration of this addendum. The revisions declared in this addendum are an essential part of the contract.

Bids for this work will be opened on April 16, 2013. The original bid opening date was previously postponed indefinitely under Addendum No. 2 dated February 11, 2013.

This addendum is being issued to set a new bid opening date as shown herein and revise the Project Plans, the Notice to Bidders and Special Provisions, the Bid book, and the Federal Minimum Wages with Modification Number 4 dated March 8, 2013.

Project Plan Sheets 2 and 5 are revised. Copies of the revised sheets are attached for substitution for the like-numbered sheets.

In the Special Provisions, Section 1-1.01 is replaced as attached.

In the Special Provisions, Section 37, "BITUMINOUS SEALS" is replaced as attached.

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02-Teh-36-55.2/67.5  
02-4E9704  
Project ID 0212000114  
ACSTP-P036(094)E

In the Bid book, in the "Bid Item List," Item 13 is revised, Items 17, 18, and 19 are added and Items 9, 10, and 11 are deleted as attached.

To Bid book holders:

Replace page 3 of the "Bid Item List" in the Bid book with the attached revised page 3 of the Bid Item List. The revised Bid Item List is to be used in the bid.

Inquiries or questions in regard to this addendum must be communicated as a bidder inquiry and must be made as noted in the Notice to Bidders section of the Notice to Bidders and Special Provisions.

Indicate receipt of this addendum by filling in the number of this addendum in the space provided on the signature page of the Bid book.

Submit bids in the Bid book you now possess. Holders who have already mailed their book will be contacted to arrange for the return of their book.

Inform subcontractors and suppliers as necessary.

This addendum, attachments and the modified wage rates are available for the Contractors' download on the Web site:

**[http://www.dot.ca.gov/hq/esc/oe/project\\_ads\\_addenda/02/02-4E9704](http://www.dot.ca.gov/hq/esc/oe/project_ads_addenda/02/02-4E9704)**

If you are not a Bid book holder, but request a book to bid on this project, you must comply with the requirements of this letter before submitting your bid.

Sincerely,

  
JOHN BULINSKI  
District Director

Attachments

**Add to section 1-1.01:**

**Bid Items and Applicable Sections**

Item code	Item description	Applicable section
025541	ASPHALT-RUBBER BINDER (TYPE II), WMA ADDITIVE	37
025542	CRUMB RUBBER R18 MODIFIED BINDER	37
025543	CRUMB RUBBER R18 MODIFIED BINDER, WMA ADDITIVE	37
025191	THERMOPLASTIC TRAFFIC STRIPE (SPRAYABLE 2-COAT)	84

## 37 BITUMINOUS SEALS

### Replace the 2nd paragraph of section 37-2.01A with:

Seal coat includes applying heated asphalt rubber binder or crumb rubber R18 modified binder, followed by heated screenings precoated with asphalt binder, then a flush coat.

Seal coat binder used for seal coat must be asphalt rubber binder (Type II), except for test sections.

This project includes test sections as shown for the evaluation of seal coats constructed with different seal coat binders including evaluation of test sections with and without warm mix asphalt (WMA) additive technologies. The following seal coat binder types will be evaluated on this project:

1. Asphalt rubber binder (Type II) with WMA additive technology
2. Crumb rubber R18 modified binder
3. Crumb rubber R18 modified binder with WMA additive technology

The Department will not consider a VECP that eliminates the use of the above seal coat binder types or WMA additive technology for the test sections.

Select a WMA additive to be used in the specified test sections from Department-approved WMA additive technologies. Some Department-approved WMA technologies for HMA are not appropriate for use in the above seal coat binders for seal coats. For Department-approved WMA technologies, go to:

[http://www.dot.ca.gov/hq/esc/approved\\_products\\_list/](http://www.dot.ca.gov/hq/esc/approved_products_list/)

For Laboratory Procedures, go to:

<http://www.dot.ca.gov/hq/esc/Translab/ofpm/fpmlab.htm>

For Vialit Test Method, go to:

<http://www.dot.ca.gov/hq/esc/ctms/index.html>

### Replace "Reserved" in section 37-2.01B with:

**crumb rubber modifier:** Ground or granulated high natural crumb rubber and/or scrap tire crumb rubber.

**descending viscosity reading:** Subsequent viscosity reading that must be at least 5 percent lower than any previous viscosity reading.

**high natural crumb rubber:** Material containing 40 to 48 percent natural rubber.

**scrap tire crumb rubber:** Any combination of:

1. Automobile tires
2. Truck tires
3. Tire buffings

### Replace section 37-2.01C(5) with:

#### 37-2.01C(5) Seal Coat

##### 37-2.01C(5)(a) General

For seal coat using asphalt rubber binder (Type I) and (Type II) submit a certificate of compliance and a copy of the specified test results for each delivery of asphalt rubber binder ingredients and asphalt rubber binder to the job site.

Submit MSDS for each seal coat binder ingredient and the seal coat binder.

At least 15 days before use, submit:

1. Four 1-quart cans of mixed seal coat binder
2. Samples of each seal coat binder ingredient
3. Seal coat binder formulation and data as follows:
  - 3.1. For asphalt binder, submit source and grade of asphalt binder
  - 3.2. For asphalt modifier, submit:
    - 3.2.1. Source and type of asphalt modifier
    - 3.2.2. Percentage of asphalt modifier by weight of asphalt binder
    - 3.2.3. Percentage of combined asphalt binder and asphalt modifier by weight of asphalt rubber binder
    - 3.2.4. Test results for the specified quality characteristics
  - 3.3. For crumb rubber modifier, submit:
    - 3.3.1. Each source and type of scrap tire crumb rubber and high natural rubber
    - 3.3.2. Test results for the specified quality characteristics
  - 3.4. For WMA additive technology, submit:
    - 3.4.1. Name of technology
    - 3.4.2. Percent admixture by weight of seal coat binder as recommended by the manufacturer
  - 3.5. For seal coat binder, submit:
    - 3.5.1. Test results for the specified quality characteristics
    - 3.5.2. Test results for AASHTO T 228. Report test results in pounds per gallon
    - 3.5.3. For asphalt rubber binder (Type I) and (Type II):
      - 3.5.3.1. Minimum reaction time and temperature
      - 3.5.3.2. Percentage of scrap tire crumb rubber and high natural rubber by total weight of asphalt rubber binder
    - 3.5.4. For crumb rubber R18 modified binder, percentage of scrap tire crumb rubber by total weight of crumb rubber R18 modified binder
  - 3.6. Test result for Vialit Test Method for aggregate in Chip Seals, French Chip.
  - 3.7. For precoated screenings, submit:
    - 3.7.1. Name of proposed aggregate source
    - 3.7.2. California mine number
    - 3.7.3. SMARA identification number
    - 3.7.4. Aggregate test results performed within past 60 days for:
      - 3.7.4.1. California Test 202
      - 3.7.4.2. California Test 211
      - 3.7.4.3. California Test 302
      - 3.7.4.4. California Test 227
      - 3.7.4.5. California Test 229
    - 3.7.5. Name of HMA plant producing precoated screenings
    - 3.7.6. Asphalt binder grade for coating
    - 3.7.7. Precoated screenings asphalt binder coating percentage by weight of dry screenings
  - 3.8. For seal coat, submit the proposed:
    - 3.8.1. Seal coat binder temperature range
    - 3.8.2. Seal coat binder application rate
    - 3.8.3. Precoated screenings spread rate

At least 5 days before use, submit permit issued by local air quality agency for seal coat binder:

1. Field blending equipment
2. Application equipment

For each delivery of seal coat binder ingredients, submit:

1. A certified volume or weight slip
2. Certificate of compliance with manufactures test results for the specified quality characteristics

Submit for each delivery of seal coat binder:

1. A certified volume or weight slip
2. Percentage of crumb rubber modifier by weight of seal coat binder
3. Certificate of compliance for the specified quality characteristics

**37-2.01C(5)(b) Prepaving Conference**

Submit a list of names participating in the prepaving conference. Identify each participant's name, employer, title, and role in the production and placement of seal coat.

**37-2.01C(5)(c) Tests and Samples**

At least 10 days before starting seal coat activities, submit the name of an independent testing laboratory that participates in the AASHTO Materials Reference Laboratory (AMRL) program and the Department's Independent Assurance Program.

The independent testing laboratory must submit seal coat tests results to the Engineer.

Submit a certificate of compliance and accuracy verification of test results for viscometers.

Upon request, submit notification 15 minutes before each viscosity test or submit a schedule of testing times.

**37-2.01C(5)(d) Daily Production Log**

Submit log of production data daily and upon request.

Submit log of seal coat binder production viscosity test results each day of seal coat work.

**Replace "Reserved" in section 37-2.01D(1) with:**

Equipment used in producing asphalt rubber binder (Type I) and (Type II) must be permitted for use by local air quality agency. If an air quality permit is not required by local air quality agency for producing asphalt rubber binder (Type I) and (Type II) submit a project specific verification from the local air quality agency that an air quality permit is not required.

Equipment used in spreading seal coat binder must be permitted for use by local air quality agency. If an air quality permit is not required by local air quality agency for spray applying seal coat binder, submit project specific verification from the local air quality agency that an air quality permit is not required.

**Replace section 37-2.01D(4) with:**

**37-2.01D(4) Seal Coat**

**37-2.01D(4)(a) General**

Not Used

**37-2.01D(4)(b) Technical Representatives**

**37-2.01D(4)(b)(i) General**

Technical representatives for the following must participate in the prepaving conference and be present during placement of the portion of the seal coat related to the product they represent:

1. Asphalt rubber binder (Type I) and (Type II) producer
2. Crumb rubber R18 modified binder producer
3. WMA additive technology supplier

### **37-2.01D(4)(b)(ii) Asphalt Rubber Binder (Type I) and (Type II) Producer**

A technical representative from the asphalt rubber producer must be present during the production and placement of seal coat using asphalt rubber binder. The technical representative may advise you and the Engineer during the seal coat application as it relates to the asphalt rubber binder placement temperature, asphalt rubber binder application rate and other placement issues.

### **37-2.01D(4)(b)(iii) Crumb Rubber R18 Modified Binder Producer**

A technical representative from the crumb rubber R18 modified binder producer must be present during the placement of seal coat using crumb rubber R18 modified binder. The technical representative may advise you and the Engineer during the seal coat application as it relates to the crumb rubber R18 modified binder placement temperature, crumb rubber R18 modified binder application rate, and other placement issues.

### **37-2.01D(4)(b)(iv) WMA Additive Technology Supplier**

A technical representative from the WMA technology supplier must be present during the production and placement of seal coat using asphalt rubber binder or crumb rubber R18 modified binder with WMA additives. The technical representative may advise you, the Engineer, and the asphalt rubber binder producer or crumb rubber R18 modified binder producer. The technical representative may advise the seal coat binder mix operation as it relates to the WMA technology. The WMA technology representative may advise you of placement temperature and other potential placement issues.

The technical representative for WMA technology may advise the seal coat binder producer regarding seal coat binder plant and seal coat binder plant process-controller modifications necessary for integrating WMA additive technology equipment with seal coat binder plant. Seal coat binder plant modifications and WMA technology equipment, scales, and meters must comply with Department's Materials Plant Quality Program (MPQP).

### **37-2.01D(4)(c) Prepaving Conference**

Schedule a prepaving conference with the Engineer at a mutually agreed time and place. Make arrangements for the conference facility. Be prepared to discuss:

1. Seal coat production and placement
2. Method for incorporating WMA technology and any impacts on seal coat binder production and seal coat placement including requirements for compaction, sweeping, and workmanship
3. Proposed application rates for seal coat binder and precoated screenings and who in the field has authority to adjust application rates and how adjustments are documented
4. When initial sweeping will be done, including any issues when WMA additives are used, and schedule for maintenance sweepings
5. Opening to traffic requirements including any concerns when WMA additives are used
6. Quality control testing
7. Contingency plan for material deliveries, equipment breakdowns, and traffic handling

The following personnel must attend the prepaving conference:

1. Project manager
2. Superintendent
3. Technical representative for WMA additive technology
4. Technical representative for asphalt rubber binder producer
5. Technical representative for crumb rubber R18 modified binder producer

### **37-2.01D(4)(d) Quality Control Testing**

### **37-2.01D(4)(d)(i) General**

The independent testing laboratory must conduct quality control testing on asphalt rubber binder ingredients at the following frequencies:

1. For crumb rubber modifier except for grading, one per 250 tons. Samples of scrap tire crumb rubber and high natural crumb rubber must be sampled and tested separately. Test each delivery of crumb rubber modifier for grading.
2. For asphalt modifier, one per 25 tons of asphalt modifier.

Scrap tire crumb rubber and high natural crumb rubber must be delivered to the asphalt rubber binder production site in separate bags.

### **37-2.01D(4)(d)(ii) Asphalt Rubber Binder (Type I) and (Type II)**

For asphalt rubber binder (Type I) and (Type II) with WMA additives, sample and test asphalt rubber binder:

1. Immediately before the addition of the WMA additive after the asphalt rubber binder has two consecutive descending viscosities and the viscosity meets the specification requirements.
2. 30 minutes after the addition of the WMA additive.
3. 15 minutes before use.

The quality control test results for asphalt rubber binder with WMA additive are report only.

The independent testing laboratory must take viscosity readings of asphalt rubber binder under ASTM D7741 during asphalt rubber binder production. Begin taking viscosity readings of samples taken from the reaction vessel at least 45 minutes after adding crumb rubber modifier and continue taking viscosity readings every 15 minutes until two consecutive descending viscosity readings have been obtained and the final viscosity meets the specification requirement. After meeting the specification requirement, continue to take viscosity readings hourly and within 15 minutes before use. Log the test results, including time of testing and temperature of the asphalt rubber binder.

For asphalt rubber binder, the independent testing laboratory must perform quality control sampling and testing at the specified frequency and location for the following quality characteristics:

**Asphalt Rubber Binder (Type I) and (Type II) for Hot Applied Seal Coat Applications**

Quality characteristic	Test method	Minimum sampling and testing frequency	Requirement	Sampling location	Maximum reporting time allowance
<b>Original binder</b>					
Flash point, min, °C	AASHTO T 48	1 per 100 tons	230	Spray bar sampling port <sup>h</sup>	3 business days
Solubility, min, %	AASHTO T 44 or ASTM D 5546		Report only		
Viscosity at 135°C, max, Pa·s	AASHTO T 316		Report only		
Dynamic shear <sup>a</sup> , test temperature at 10 rad/s, °C min. G*/sin(delta), kPa	AASHTO T 315		Report only <sup>b</sup> 1.00		
RTFO test <sup>c</sup> , mass loss, max, %	AASHTO T 240 or ASTM D 2872		Report only		
Cone penetration at 25 °C, 1/10 mm min max	ASTM D 217		25 60		
Resilience at 25 °C, percent rebound min max	ASTM D 5329		18 50		
Softening point, °C min max	ASTM D 36		55 88		
Viscosity at 375°F, Pa · s (x10-3)	ASTM D 7741		1500 - 2500		
<b>RTFO test aged binder</b>					
Dynamic shear, test temperature at 10 rad/s, °C min, G*/sin(delta), kPa	AASHTO T 315	1 per 100 tons	Report only <sup>b</sup> 2.20	Spray bar sampling port <sup>h</sup>	3 business days
Dynamic shear, test temperature at 10 rad/s, °C, Phase Angle,%	AASHTO T 315		Report only <sup>d</sup> Report only		
Elastic recovery, test temperature, °C min recovery, %	AASHTO T 301		25 Report only		
PAV <sup>e</sup> aging, temperature, °C	AASHTO R 28		110		

RTFO test and PAV aged binder					
Dynamic shear, test temperature at 10 rad/s, °C max $G^*\sin(\delta)$ , kPa	AASHTO T 315	1 per 100 tons	Report only <sup>f</sup> 5000	Spray bar sampling port <sup>h</sup>	3 business days
Creep stiffness, test temperature, °C max S-value, MPa min M-value	AASHTO T 313		Report only <sup>g</sup> 300 0.300		

<sup>a</sup> Test original binder and RTFO aged binder on the DSR using 25mm plates and a 3 mm gap. Test the PAV aged binder using 8 mm plates and a 3 mm gap. All samples are trimmed at 3.15 mm. Ensure that the DSR software allows for the 3 mm gap in its calculations.

<sup>b</sup> AASHTO R29 can be used as a guideline for Grade Determination. Report  $G^*/\sin(\delta)$  for the initial fail temperature and the passing temperature one grade below the initial fail temperature.

<sup>c</sup> RTFO means the asphaltic residue obtained using the rolling thin film oven test. The residue from mass change determination may be used for other tests.

<sup>d</sup> Report the phase angle measured at both the pass and fail temperature of the RTFO aged binder.

<sup>e</sup> PAV<sup>m</sup> means pressure aging vessel.

<sup>f</sup> AASHTO R29 can be used as a guideline for Grade Determination. Report  $G^*\sin(\delta)$  for the initial fail temperature and the passing temperature one grade below the initial fail temperature.

<sup>g</sup> AASHTO R29 can be used as a guideline for Grade Determination. Report stiffness S and m-value for the initial fail temperature and the passing temperature one grade below the initial fail temperature.

<sup>h</sup> For asphalt rubber binder (Type I) and (Type II) with WMA additives, you may sample asphalt rubber binder before the addition of the WMA additive from the reaction vessel

### 37-2.01D(4)(d)(iii) Crumb Rubber R18 Modified Binder

Crumb rubber R18 modified binder must comply with the Department's *Certification Program for Suppliers of Asphalt*. For program requirements, procedures, and a list of authorized material sources, go to the METS Web site.

For crumb rubber R18 modified binder with WMA additives, sample and test crumb rubber R18 modified binder:

1. Immediately before the addition of the WMA additive.
2. 30 minutes after the addition of the WMA additive.
3. 15 minutes before use.

The quality control test results for crumb rubber R18 modified binder with WMA additive are report only.

Before the application of crumb rubber R18 modified binder, sample crumb rubber R18 modified binder from spray bar sampling port and test for viscosity under ASTM D7741. Take at least 1 viscosity reading for each distributor truck load at the project site and within 15 minutes before use. Log the test results, including time of testing and temperature of the crumb rubber R18 modified binder.

For crumb rubber R18 modified binder, the independent testing laboratory must perform quality control sampling and testing at the specified frequency and location for the following quality characteristics:

**Crumb Rubber R18 Modified Binder for Hot Applied Seal Coat Applications**

Quality characteristic	Test method	Minimum sampling and testing frequency	Requirement	Sampling location	Maximum reporting time allowance
			Binder grade PG 76-22 R		
<b>Original binder</b>					
Flash point, min, °C	AASHTO T 48	1 per 100 tons	230	Spray bar sampling port <sup>e</sup>	3 business days
Solubility, min, %	AASHTO T 44 or ASTM D 5546		97.5		
Viscosity at 135°C, max, Pa·s	AASHTO T 316		3.0		
Dynamic shear, Test temperature at 10 rad/s, °C min, G*/sin(delta), kPa	AASHTO T 315		76 1.00		
RTFO test <sup>a</sup> , mass loss, max, %	AASHTO T 240 or ASTM D 2872		1.00		
Cone penetration at 25 °C, 1/10 mm	ASTM D 217		Report only		
Resilience at 25 °C, percent rebound	ASTM D 5329		Report only		
Softening point, °C	ASTM D 36		Report only		
Viscosity at 375°F, Pa · s (x10-3)	ASTM D 7741		Report only		
<b>RTFO test aged binder</b>					
Dynamic shear, test temperature at 10 rad/s, °C min G*/sin(delta), kPa	AASHTO T 315	1 per 100 tons	76 2.20	Spray bar sampling port <sup>e</sup>	3 business days
Dynamic shear, test temperature at 10 rad/s, °C max (delta), %	AASHTO T 315		Note b 80		
Elastic recovery <sup>c</sup> , test temperature, °C min recovery, %	AASHTO T 301		25 65		
PAV <sup>d</sup> Aging, temperature, °C	AASHTO R 28		110		

RTFO test and PAV aged binder					
Dynamic shear, test temperature at 10 rad/s, °C max G*/sin(delta), kPa	AASHTO T 315		31 5000		
Creep stiffness, test temperature, °C max S-value, MPa min M-value, MPa	AASHTO T 313	1 per 100 tons	-12 300 0.300	Spray bar sampling port <sup>e</sup>	3 business days

<sup>a</sup>"RTFO" means the asphaltic residue obtained using the Rolling Thin Film Oven Test. The residue from mass change determination may be used for other tests.

<sup>b</sup>Test temperature is the temperature at which G\*/sin(delta) is 2.2 kPa. A graph of log G\*/sin(delta) plotted against temperature may be used to determine the test temperature when G\*/sin(delta) is 2.2 kPa. A graph of (delta) versus temperature may be used to determine delta at the temperature when G\*/sin(delta) is 2.2 kPa. The Engineer also accepts direct measurement of (delta) at the temperature when G\*/sin(delta) is 2.2 kPa.

<sup>c</sup>Tests without a force ductility clamp may be performed.

<sup>d</sup>"PAV" means Pressure Aging Vessel

<sup>e</sup>For crumb rubber R18 modified binder with WMA additives, sample crumb rubber R18 modified binder before the addition of the WMA additive at sampling location you choose and the engineer authorizes.

### 37-2.01D(4)(d)(iv) Precoated Screenings

For precoated screenings, the independent testing laboratory must perform sampling and testing at the specified frequency and location for the following quality characteristics. All tests, except the film stripping, must be performed on uncoated screenings.

#### Minimum Quality Control

Quality characteristic	Test method	Minimum sampling and testing frequency	Requirement	Location of sampling	Maximum reporting time allowance
Los Angeles Rattler Loss, %, max Loss at 100 revolutions Loss at 500 revolutions	California Test 211	1st day of production	10 40	See California Test 125	48 hours
Gradation, percentage passing	California Test 202	2 per day	Seal coat screenings gradation table under Materials	See California Test 125	24 hours
Film stripping, %, max	California Test 302	1st day of production	25	See California Test 125	48 hours
Cleanness value, min	California Test 227	2 per day	80	See California Test 125	24 hours
Durability, min	California Test 229	1st day of production	52	See California Test 125	48 hours

### 37-2.01D(4)(d)(v) Seal Coat

For seal coat, the independent testing laboratory must perform sampling and testing at the specified frequency and location for the following quality characteristics:

#### Minimum Quality Control

Quality characteristic	Test method	Minimum sampling and testing frequency	Requirement	Location of sampling	Maximum reporting time allowance
Seal coat binder spread rate, gal/sq yd	Modified California Test 339	2 per day	Target value $\pm 0.05$ gal/sq yd	Pavement surface	24 hours

For determining seal coat binder spread rate California Test 339 is modified as follows:

#### A. Scope

Modified California Test 339 describes the procedure for determining the transverse spread rate of a bituminous distributor in gallons per square yard.

#### B. Apparatus

1. Balance sensitive to 0.1 gram with a minimum capacity of  $\pm 2,000$  grams.
2. Suitable weighing box with windshield or enclosed area for balance to ensure no impacts from wind conditions.
3. Balance table and/or work bench.

#### C. Materials

1. 8" x 12" Galvanized Sheet Metal Plates -28 gauge. Verify size of the metal plates used in calculations in Section F.
2. Polyester Filter Roll material.
3. Cementing material.
4. 10" x 13" min. - Manila Envelopes.
5. 30 pound Roofing Felt Paper.

Note:

The roofing felt paper is available at most home supply stores or roofing suppliers.

#### D. Preparation of the Test Plates

1. Cut the polyester material from the roll to an 8" x 12" size and cement to the 8" x 12" plate.
2. Number the bottom of each metal plate. One plate for each one (1) foot of roadway surface to be sprayed.
3. Number each manila envelope.
4. Weigh each test plate + polyester filter placed in each manila envelope.
5. Cut the roofing felt paper to a width of 18".

E. Sampling

1. Prior to the distributor approaching, place the roofing felt paper transversely across the pavement surface at the test location and secure with duct tape.
2. Place the metal plates with the 12" width, transversely across the pavement surface, centered on the roofing felt paper.
3. If desired, mark the test location outside the spray area for future reference.
4. After the distributor vehicle has passed, slide the roofing felt paper off the roadway with the test plates remaining in place, and let cool for a minimum of five minutes.
5. Remove each separate metal plate with the polyester material and binder and place in the properly numbered manila envelope. Care should be taken to ensure that each plate has no material loss.
6. Proceed to weighing area and weigh each of the test plates and the manila envelopes and record as the Gross Weight.
7. Determine the Net Weight of the binder and record the weight.

F. Calculations

To determine the spread rate the following is required:

1. The Specific Gravity of the binder.
2. The field application temperature.

Calculate the spread rate as follows for each plate:

Where:

Application Temperature Factor – Use Column A from Temperature Conversion Table in Section 93 of the Standard Specifications when the density at 60°F is greater than 60.3 lbs/cf (0.9963).

cf - cubic feet

gal - gallon

lbs - pounds

Sp. Gr. – Binder Specific Gravity

sq. in. – square inches

1.  $Sp.Gr. \times 62.4 \text{ lbs/cf} \times \frac{1}{7.48 \text{ lbs/gal}} \times \text{Application Temperature Factor} = \text{_____ lbs/gal at } 60^\circ\text{F}.$

2.  $\text{_____ lbs/gal} \times 0.074 \text{ SQYD}^{**} \times 454 \text{ grams/lbs} = \text{_____ grams} \times \text{SQYD/gal}$

\*\*Test Plate 8" x 12" = 96 sq. in.

$\frac{96 \text{ sq.in.}}{1,296 \text{ sq.in./SQYD}} = 0.0741 \text{ SQYD. Verify plate dimensions and adjust accordingly.}$

3.  $\frac{\text{Net Weight of Binder grams}}{\#2 \text{ Above grams} \times \text{SQYD/gal}} = \text{_____ gal/SQYD (spread rate).}$

4. Record the spread rate for each plate across the lane.

For seal coat, the independent testing laboratory must perform sampling and testing at the specified frequency and location for the following quality characteristics:

### Minimum Quality Control

Quality characteristic	Test method	Minimum sampling and testing frequency	Requirement	Location of sampling	Maximum reporting time allowance
Chip retention, %	Field modified Vialit test method for aggregate in chip seals, French chip (modified)	1 per day	Report only	Pavement surface after chip application and rolling	48 hours

For field testing seal coat chip retention the Field Modified Vialit Test Method for Aggregate in Chip seals, French Chip is revised as follows:

1. Use a 20 cm x 20 cm galvanized plate 2.0 mm thick and determine the tare weight of the galvanized plate.
2. Place the plate on the existing pavement surface before placing chip seal. After finish rolling the seal coat and initial surface sweeping, remove the specimen. Place the specimen in a plastic bag.
3. Cure the specimen, except cure at 100 degree F for the first 2 hours.
4. Condition the specimen.
5. Weigh the test specimen and any loose chips in the sample bag.
6. Perform the Vialit test and reweight the test specimen.
7. Calculate the binder weight as follows:

$$\text{Binder weight} = \text{BAR (gallons/sq yd)} \times 0.0478 \text{ (sq yd)} \times \text{SG}_{\text{ARB}} \text{ (lbs/gal)}$$

Where:

BAR = seal coat binder application rate in gal/sq yd

Plate dimension = 20 cm X 20 cm = 0.0478 sq yd

SG<sub>ARB</sub> = specific gravity of seal coat binder determined under ASSHTO T 228

8. Calculate the chip retention by weight as follows:

$$\text{Percent retention} = \frac{[\text{SW}_{\text{initial}} - (\text{BW} + \text{TW})]}{[\text{SW}_{\text{final}} - (\text{BW} + \text{TW})]}$$

Where:

SW<sub>initial</sub> = initial specimen weight

SW<sub>final</sub> = final specimen weight

BW = seal coat binder weight

TW = tare weight

### Add section 37-2.01D(5):

#### 37-2.01D(5) Acceptance Criteria

Seal coat acceptance is based on:

1. Visual inspection for the following:
  - 1.1. Uniform surface texture throughout the work limits.
  - 1.2. Raveling consists of the separation of the aggregate from the binder.
  - 1.3. Flushing consists of the occurrence of a film of bituminous material on the surface of the seal coat.
  - 1.4. Streaking consists of alternating longitudinal bands of binder without uniform aggregate retention, approximately parallel with the lane line.

2. For asphalt rubber binder (Type I) and (Type II), acceptance is based on the Department's sampling and testing for compliance with the requirements for the quality characteristics shown in section 37-2.02G with the following table titles:
  - 2.1. Asphalt Rubber Binder (Type I) and (Type II) for Hot Applied Seal Coat Applications, except asphalt rubber binder with WMA additives acceptance is based on asphalt rubber binder sampled before the addition of WMA additive
  - 2.2. Asphalt Modifier for Asphalt Rubber Binder
  - 2.3. Crumb Rubber Modifier
  - 2.4. Scrap Tire Crumb Rubber Gradation
  - 2.5. High Natural Crumb Rubber Gradation
3. For crumb rubber R18 modified binder, acceptance is based on the Department's sampling and testing for compliance with the requirements for the quality characteristics shown in table titled "Crumb Rubber R18 Modified Binder for Hot Applied Seal Coat Applications" in section 37-2.02G, except crumb rubber R18 modified binder with WMA additives acceptance is based on crumb rubber R18 modified binder sampled before the addition of WMA additive.
4. Compliance with the table titled "Seal Coat Acceptance Criteria Testing Precoated Screenings."

<b>Seal Coat Acceptance Criteria Testing Precoated Screenings</b>		
Quality Characteristic	Test Method	Requirements
Los Angeles Rattler Loss, %, max Loss at 100 revolutions Loss at 500 revolutions	California Test 211	10 40
Gradation	California Test 202	Seal coat screenings gradation table under Materials
Film stripping, %, max	California Test 302	25
Cleanness value, min	California Test 227	80
Durability, min	California Test 229	52

**Replace section 37-2.02G with:**

**37-2.02G Seal Coat Binder**

**37-2.02G(1) General**

Seal coat binder includes asphalt rubber binder (Type I), asphalt rubber (Type II), and crumb rubber R18 modified binder.

**37-2.02G(2) Asphalt Rubber Binder (Type I) and (Type II)**

**37-2.02G(2)(a) General**

The blending equipment must allow the determination of weight percentages of each asphalt rubber binder ingredient.

**37-2.02G(2)(b) Asphalt Rubber Binder (Type I)**

Asphalt rubber binder (Type I) must be a combination of:

1. Asphalt binder
2. Crumb rubber modifier

Crumb rubber modifier must be scrap tire crumb rubber.

Asphalt rubber binder (Type I) must be  $80 \pm 2$  percent by weight asphalt binder and  $20 \pm 2$  percent by weight crumb rubber modifier. The minimum percentage of crumb rubber modifier must be 18.0 percent and lower values must not be rounded up.

**37-2.02G(2)(c) Asphalt Rubber Binder (Type II)**

Asphalt rubber binder (Type II) must be a combination of:

1. Asphalt binder
2. Asphalt modifier
3. Crumb rubber modifier

Asphalt rubber binder (Type II) must be  $79 \pm 1$  percent by weight asphalt binder and  $21 \pm 1$  percent by weight crumb rubber modifier. The minimum percentage of crumb rubber modifier must be 20.0 percent and lower values must not be rounded up.

Crumb rubber modifier must be  $76 \pm 2$  percent by weight scrap tire crumb rubber and  $24 \pm 2$  percent by weight high natural crumb rubber.

**37-2.02G(2)(d) Asphalt Rubber Binder (Type I) and (Type II) Production**

For asphalt rubber binder (Type II) asphalt modifier and asphalt binder must be blended at the production site. Asphalt modifier must be from 2.5 to 6.0 percent by weight of the asphalt binder in the asphalt rubber binder. The asphalt rubber binder producer determines the exact percentage.

When blended, the asphalt binder must be from 375 to 440 degrees F when asphalt modifier is added and the mixture must circulate for at least 20 minutes.

The asphalt binder or blend of asphalt binder and asphalt modifier must be combined with crumb rubber modifier at the asphalt rubber binder production site. The asphalt binder or asphalt binder and asphalt modifier blend must be from 375 to 440 degrees F when crumb rubber modifier is added. Asphalt binder, asphalt modifier, and crumb rubber modifier may be proportioned and combined simultaneously. Combined ingredients must be allowed to react at least 45 minutes at temperatures from 375 to 425 degrees F except the temperature must be at least 10 degrees F below the flash point of the asphalt rubber binder.

After reacting, the asphalt rubber binder must have the values for the quality characteristics shown in the following table:

**Asphalt Rubber Binder (Type I) and (Type II) for Hot Applied Seal Coat Applications**

Quality characteristic	Test method	Requirement
		Asphalt rubber binder
Original binder		
Flash point, min, °C	AASHTO T 48	230
Solubility, min, %	AASHTO T 44 or ASTM D 5546	Report only
Viscosity at 135 °C, max, Pa·s	AASHTO T 316	Report only
Dynamic shear <sup>a</sup> , test temperature at 10 rad/s, °C min. G*/sin(delta), kPa	AASHTO T 315	Report only <sup>b</sup> 1.00
RTFO test <sup>c</sup> , mass loss, max, %	AASHTO T 240 or ASTM D 2872	Report only
Cone penetration at 25 °C, 1/10 mm min max	ASTM D 217	25 60
Resilience at 25 °C, percent rebound min max	ASTM D 5329	18 50
Softening point, °C min max	ASTM D 36	55 88
Viscosity at 375 °F, centipoises	ASTM D 7741	1500 - 2500
RTFO test aged binder		
Dynamic shear, test temperature at 10 rad/s, °C min, G*/sin(delta), kPa	AASHTO T 315	Report only <sup>b</sup> 2.20
Dynamic shear, test temperature at 10 rad/s, °C, Phase Angle,%	AASHTO T 315	Report only <sup>d</sup> Report only
Elastic recovery, test temperature, °C min recovery, %	AASHTO T 301	25 Report only
PAV <sup>e</sup> aging, temperature, °C	AASHTO R 28	110
RTFO test and PAV aged binder		
Dynamic shear, test temperature at 10 rad/s, °C max G*sin(delta), kPa	AASHTO T 315	Report only <sup>f</sup> 5000
Creep stiffness, test temperature, °C max S-value, MPa min M-value	AASHTO T 313	Report only <sup>g</sup> 300 0.300

<sup>a</sup>Test original binder and RTFO aged binder on the DSR using 25 mm plates and a 3 mm gap. Test the PAV aged binder using 8 mm plates and a 3mm gap. All samples are trimmed at 3.15 mm. Ensure that the DSR software allows for the 3 mm gap in its calculations.

<sup>b</sup>AASHTO R29 can be used as a guideline for Grade Determination. Report  $G^*/\sin(\delta)$  for the initial fail temperature and the passing temperature one grade below the initial fail temperature.

<sup>c</sup>RTFO means the asphaltic residue obtained using the rolling thin film oven test. The residue from mass change determination may be used for other tests.

<sup>d</sup>Report the phase angle measured at both the pass and fail temperature of the RTFO aged binder.

<sup>e</sup>PAV" means pressure aging vessel.

<sup>f</sup>AASHTO R29 can be used as a guideline for Grade Determination. Report  $G^*\sin(\delta)$  for the initial fail temperature and the passing temperature one grade below the initial fail temperature.

<sup>g</sup>AASHTO R29 can be used as a guideline for Grade Determination. Report stiffness S and m-value for the initial fail temperature and the passing temperature one grade below the initial fail temperature.

Maintain asphalt rubber binder at a temperature from 375 to 415 degrees F.

Stop heating unused asphalt rubber binder 4 hours after two descending viscosity readings have been obtained. Reheating asphalt rubber binder that cools below 375 degrees F is considered a reheat cycle. Do not exceed 2 reheat cycles. If reheating, asphalt rubber binder must be from 375 to 415 degrees F before use.

During reheating, you may add scrap tire crumb rubber. Scrap tire crumb rubber must not exceed 10 percent by weight of the asphalt rubber binder. Allow added scrap tire crumb rubber to react for at least 45 minutes. Reheated asphalt rubber binder must comply with the specifications for asphalt rubber binder.

### **37-2.02G(3) Crumb Rubber R18 Modified Binder**

Crumb rubber R18 modified binder must be a combination of:

1. Asphalt binder
2. Crumb rubber modifier

Crumb rubber modifier must be scrap tire crumb rubber.

Crumb rubber R18 modified binder must be  $80 \pm 2$  percent by weight asphalt binder and  $20 \pm 2$  percent by weight crumb rubber modifier. Crumb rubber R18 modified binder must have the values for the quality characteristics shown in the following table:

### Crumb Rubber R18 Modified Binder for Hot Applied Seal Coat Applications

Quality characteristic	Test method	Requirements
		Binder grade PG 76-22 R <sup>a,b</sup>
Original binder		
Flash point, min, °C	AASHTO T 48	230
Solubility, min, %	AASHTO T 44 or ASTM D 5546	97.5
Viscosity at 135 °C, max, Pa·s	AASHTO T 316	3.0
Dynamic shear, test temperature at 10 rad/s, °C min. G*/sin(delta), kPa	AASHTO T 315	76 1.00
RTFO test <sup>c</sup> , mass loss, max, %	AASHTO T 240 or ASTM D 2872	1.00
Cone penetration at 25 °C, 1/10 mm	ASTM D 217	Report Only
Resilience at 25 °C, percent rebound	ASTM D 5329	Report Only
Softening point, °C	ASTM D 36	Report Only
RTFO test aged binder		
Dynamic shear, test temperature at 10 rad/s, °C min, G*/sin(delta), kPa	AASHTO T 315	76 2.20
Dynamic shear, test temperature at 10 rad/s, °C max (delta), %	AASHTO T 315	Note d 80
Elastic recovery <sup>e</sup> , test temperature, °C min recovery, %	AASHTO T 301	25 65
PAV <sup>f</sup> aging, temperature, °C	AASHTO R 28	110
RTFO test and PAV aged binder		
Dynamic shear, test temperature at 10 rad/s, °C max G*sin(delta), kPa	AASHTO T 315	31 5000
Creep stiffness, test temperature, °C max S-value, MPa min M-value	AASHTO T 313	-12 300 0.300

<sup>a</sup>Do not modify binder using polyphosphoric acid modification. Report type and dosage if any acid modification other than polyphosphoric acid modification is used.

<sup>b</sup>Supplier is required to certify crumb rubber R18 modified binder contains 20 ± 2 percent by weight crumb rubber modifier.

<sup>c</sup>"RTFO" means the asphaltic residue obtained using the rolling thin film oven test. The residue from mass change determination may be used for other tests.

<sup>d</sup>Test temperature is the temperature at which G\*/sin(delta) is 2.2 kPa. A graph of log G\*/sin(delta) plotted against temperature may be used to determine the test temperature when G\*/sin(delta) is 2.2 kPa. A graph of (delta) versus temperature may be used to determine delta at the temperature when G\*/sin(delta) is 2.2 kPa. The Engineer also accepts direct measurement of (delta) at the temperature when G\*/sin(delta) is 2.2 kPa.

<sup>e</sup>Tests without a force ductility clamp may be performed.

<sup>f</sup>"PAV" means pressure aging vessel.

**37-2.02G(4) Asphalt Binder**

Asphalt binder for asphalt rubber binder (Type I) and (Type II) must be Grade PG 64-16. Do not modify asphalt binder with polymer.

Crumb rubber R18 modified binder must be Grade PG 76-22 R.

**37-2.02G(5) Asphalt Modifier**

Asphalt modifier must be a resinous, high flash point, and aromatic hydrocarbon. Asphalt modifier must have the values for the quality characteristics shown in the following table:

<b>Asphalt Modifier for Asphalt Rubber Binder</b>		
Quality characteristic	Test method	Requirements
Viscosity, m <sup>2</sup> /s (x 10 <sup>-6</sup> ) at 100 °C	ASTM D 445	X ± 3 <sup>a</sup>
Flash point, CL.O.C., °C	ASTM D 92	207 min
Molecular analysis		
Asphaltenes, percent by mass	ASTM D 2007	0.1 max
Aromatics, percent by mass	ASTM D 2007	55 min

<sup>a</sup> "X" denotes the proposed asphalt modifier viscosity from 19 to 36. A change in "X" requires a new asphalt rubber binder submittal.

Asphalt modifier must be sampled and tested for compliance with the specifications by the manufacturer.

**37-2.02G(6) Crumb Rubber Modifier**

Crumb rubber modifier must be ground or granulated at ambient temperature.

Scrap tire crumb rubber and high natural crumb rubber must be delivered to the seal coat binder production site in separate bags.

Steel and fiber must be separated. If steel and fiber are cryogenically separated, the separation must occur before grinding and granulating. Cryogenically-produced crumb rubber modifier particles must be large enough to be ground or granulated.

Crumb rubber modifier must be free of contaminants except wire and fabric. Determine the percent weight of wire and fabric under Laboratory Procedure LP-10. Contaminants percentage by weight of crumb rubber modifier must not exceed:

1. 0.01 percent wire
2. 0.05 percent fabric

The length of an individual crumb rubber modifier particle must not exceed 3/16 inch.

Crumb rubber modifier must be dry, free-flowing particles that do not stick together. A maximum of 3 percent calcium carbonate or talc by weight of crumb rubber modifier may be added. Crumb rubber modifier must not cause foaming when combined with the asphalt binder and asphalt modifier.

Specific gravity of crumb rubber modifier must be from 1.1 to 1.2 determined under California Test 208.

Crumb rubber modifier must comply with the requirements for quality characteristics shown in the following table:

**Crumb Rubber Modifier**

Quality characteristic	Test method	Requirements			
		Scrap tire crumb rubber		High natural crumb rubber	
		Min	Max	Min	Max
Acetone extract, %	ASTM D 297	6.0	16.0	4.0	16.0
Rubber hydrocarbon, %		42.0	65.0	50.0	--
Natural rubber content, %		22.0	39.0	40.0	48.0
Carbon black content, %		28.0	38.0	--	--
Ash content, %		--	8.0	--	--

Scrap tire crumb rubber must have the gradation requirements shown in the following table:

**Scrap Tire Crumb Rubber Gradation**  
Percentage passing

Sieve size	Gradation requirement	Operating range	Contract compliance
No. 8	100	100	100
No. 10	98–100	95–100	90–100
No. 16	45–75	35–85	32–88
No. 30	2–20	2–25	1–30
No. 50	0–6	0–10	0–15
No. 100	0–2	0–5	0–10
No. 200	0	0–2	0–5

NOTE: Determine gradation under Laboratory Procedure LP-10.

High natural crumb rubber must comply with the gradation requirements shown in the following table:

**High Natural Crumb Rubber Gradation**  
Percentage passing

Sieve size	Gradation requirement	Operating range	Contract compliance
No. 10	100	100	100
No. 16	95–100	92–100	85–100
No. 30	35–85	25–95	20–98
No. 50	10–30	6–35	2–40
No. 100	0–4	0–7	0–10
No. 200	0–1	0–3	0–5

NOTE: Determine gradation under Laboratory Procedure LP-10.

The scrap tire crumb rubber and high natural crumb rubber gradations requirements do not apply to crumb rubber R18 modified binder.

Each seal coat binder ingredient must be sampled and tested for compliance with the specifications by the manufacturer.

**37-2.02G(7) Warm Mix Asphalt Additive Technology**

WMA additive technology must be on the Department-approved WMA technologies list. Approved WMA additive technologies are for Hot Mix Asphalt and you must choose WMA additive technology appropriate for use in seal coat binder.

Percent WMA additive by weight of seal coat binder must be as recommended by the manufacturer.

**37-2.02G(8) Seal Coat**

The independent testing laboratory must conduct testing using the proposed seal coat binders, including seal coat binders with and without WMA, and aggregate for compliance with the design requirements shown in the following table:

Quality characteristic	Test method	Requirement
Chip retention, %	Vialit test method for aggregate in chip seals, French chip (Modified) <sup>a</sup>	95

<sup>a</sup> Cure the specimen, except cure at 100 degree F for the first 2 hours.

For the Vialit test, the seal coat binders must be placed within the proposed seal coat binder placement temperature range.

**Replace section 37-2.02H(4) with:**

**37-2.02H(4) Seal Coat**

Before precoating with asphalt binder and when tested under California Test 202, screenings for seal coat must have the gradation shown in the following table:

**Seal Coat Screenings Gradation**

Sieve sizes	Percentage passing		
	Coarse 1/2" max	Medium 1/2" max	Fine 3/8" max
3/4"	100	100	100
1/2"	75-90	85-90	95-100
3/8"	0-20	0-30	70-85
No. 4	0-2	0-5	0-15
No. 8	--	--	0-5
No. 200	0-1	0-1	0-1

Screenings must have the values for the quality characteristics shown in the following table:

**Seal Coat Screenings**

Quality Characteristic	Test method	Requirement
Los Angeles Rattler Loss, %, max	California Test 211	
Loss at 100 revolutions		10
Loss at 500 revolutions		40
Film stripping, %, max	California Test 302	25
Cleanness value, min	California Test 227	80
Durability, min	California Test 229	52

Screenings for seal coat must comply with the 3/8-inch grading.

**Add to section 37-2.03A:**

Remove pavement markers before applying seal coat.

**Add to item 1 in the list in the 1st paragraph of section 37-2.03B(1):**

- 1.5. Tarpaulins to cover precoated screenings when haul distance exceeds 30 minutes or ambient temperature is less than 65 degrees F.

**Replace section 37-2.03B(2) with:**

**37-2.03B(2) Seal Coat Binder**

**37-2.03B(2)(a) General**

Asphalt rubber binder (Type I) and (Type II) production plants must comply with the Materials Plant Quality Program (MPQP) starting July 1, 2013.

Crumb rubber R18 modified binder manufacturing facility for PG 76-22R must comply with the MPQP.

**37-2.03B(2)(b) Asphalt Rubber Binder (Type I) and (Type II) without Warm Mix Asphalt Additive Technology**

Equipment for asphalt rubber binder (Type I) and (Type II) without WMA additive technology must include and comply with the following:

1. Tank to heat and maintain the temperature of blended asphalt binder and asphalt modifier before adding crumb rubber modifier. The tank must have a thermostatic heat control device and a temperature reading device accurate to within 5 degrees F. The heat control device must be the recording type.
2. Mechanical mixer for complete, homogeneous blending of asphalt binder, asphalt modifier, and crumb rubber modifier. Asphalt binder and asphalt modifier must be introduced into the mixer through meters. The blending system must vary the rate of delivery for asphalt binder and asphalt modifier proportionate to crumb rubber modifier delivery. The mixer must not allow the temperature of asphalt binder and asphalt modifier to vary more than 25 degrees F. Each ingredient feed must be equipped with a rate-of-feed indicator for determining the amount delivered during production. The meters used to proportion each liquid ingredient must be equipped with rate-of-flow indicators with resettable totalizers so that the total amount can be determined. Feed liquid and dry ingredients directly into the mixer at a uniform and controlled rate. Reduce the quantity of ingredients in the mixer if dead areas occur. The reaction vessel must have a safe sampling device that delivers completed asphalt rubber binder in the quantity needed for testing.
3. Storage tank for asphalt rubber binder. The storage tank must have a heating system to maintain the temperature and an internal mixing device to prevent separation.
4. Under supports for scale bearing points for scale structures where the total load, the live load plus dead load is less than 17 tons. The under supports must be constructed as follows:
  - 4.1. Use 4 legs. Total load on any leg may not exceed 14.5 psi.
  - 4.2. Use structural grade steel with a minimum cross sectional dimension of 20 inches and a minimum thickness of 1.5 inches.
  - 4.3. Construct under supports in a way that they do not move or deflect during production operations.
  - 4.4. Install mechanical indicating elements level, plumb, and rigidly mounted on the under supports.
  - 4.5. Prevent saturation of the ground under the scale with adequate drainage and provide support of 14.5 psi at each support.
  - 4.6. Scale structure may be installed using concrete under supports and comply with Section 9.

**37-2.03B(2)(c) Asphalt Rubber Binder (Type I) and (Type II) with Warm Mix Asphalt Additive Technology**

Equipment for asphalt rubber binder (Type I) and (Type II) with WMA additive technology must be produced at a stand-alone plant unit.

Perform all asphalt rubber binder (Type I) and (Type II) proportioning at the asphalt rubber binder production site.

Asphalt rubber binder proportioning must either be accomplished by proportioning all ingredients simultaneously or must be proportioned using the 3-stage process as follows:

1. Stage 1 must proportion asphalt modifier with paving grade asphalt.
2. Stage 2 must proportion scrap tire crumb rubber and high natural rubber.
3. Stage 3 must proportion the preblended liquids, combine with the proportioned ground rubbers, and mix further for the specified time and temperatures.

When the asphalt and asphalt modifier are preblended, provide an asphalt heating tank equipped to maintain the blended ingredients at the necessary temperature before blending with the dry ingredients.

The method and equipment for combining the liquid and dry ingredients must be such that the Engineer can readily determine compliance with proportioning requirements for each material and the completed asphalt rubber binder. All required equipment must be authorized before use.

The plant process controller must assure that combined liquids and combined dry ingredients have been proportioned to within their own ratio limits before proportioning the final liquid and dry mixtures for asphalt rubber binder.

The plant process controller must assign a lot number to each volume of asphalt rubber binder moved from the initial mixing chamber to reaction storage. The product volume represented by each lot must be the amount set aside for the reaction period. Leftovers and portions of lots may be combined and assigned a new nonrepeating lot number. Reassigned lots must include all electronic data captured for the previous original lots used to generate the new lot.

Feed the liquid and dry ingredients directly into the mixer at a uniform rate. Asphalt rubber binder must be mechanically mixed to provide for the complete blending of liquid and dry ingredients in a controlled fashion.

Produce asphalt rubber binder by either a batch or continuous method. Regardless of production method, proportion all ingredients by weight. Proportion liquid ingredients with a meter that complies with Chapter 2, Section IC, "Liquid Ingredient Measurement," of the MPQP.

### **37-2.03B(2)(c)(i) Asphalt Rubber Binder (Type I) and (Type II) Additives**

Asphalt rubber binder (Type I) and (Type II) additives include those used for anti-strip and warm mix properties and may be either in a liquid or dry state. Dry additive ingredients must be measured by weight. Liquid additives must be measured with a mass-flow meter. Additives must be added at least 30 minutes before end use to facilitate mixing.

The asphalt rubber binder (Type I) and (Type II) plant must have a sampling device in the feed line connecting the additive storage to the additive metering system. The additive sampling equipment must meet the requirements of California Test 125 and section 92-1.01D(3).

### **37-2.03B(2)(c)(i)(a) Batch Method Proportioning**

Use a plant process controller complying with Chapter 2, Section IIF, "Batch Mixing HMA Plants," of the MPQP. The plant process controller must proportion all ingredients used in the production of the asphalt rubber binder (Type I) and (Type II).

The hopper scale system must include interlocks which prevent filling the hopper while drawing ingredients from the same hopper.

The zero tolerance for dry ingredient scales must be 0.5 percent of the total draft being weighed.

The indicated weight of material drawn from storage must not vary from the preselected target weight setting by more than 1.0 percent of the total draft target.

**37-2.03B(2)(c)(i)(b) Continuous Method Proportioning**

Proportion dry ingredients with a conveyor scale or a loss-weight meter. Continuous proportioning must be fully automatic. This automatic system must proportion total asphalt binder to total crumb rubber modifier to within 0.5 percent of the target rate.

**37-2.03B(2)(c)(ii) Asphalt Rubber Binder (Type I) and (Type II) Transportation**

During transportation between the asphalt rubber binder production location and the end-use facility or project site, the mixture must comply with all requirements for agitation, temperature control, and data log.

**37-2.03B(2)(c)(iii) Asphalt Rubber Binder (Type I) and (Type II) Storage**

During the proportioning and blending of the liquid ingredients, maintain the temperature of asphalt and the asphalt modifier to within 25 degrees F of the specified temperature. Asphalt rubber binder mixing and temperature control must be continuous from initial ingredient blending until the product end use.

When asphalt rubber binder is produced at a site remote from the end-use plant site, the receiving tank at the end-use site must comply with all agitation, heating, temperature, and data-reporting requirements.

Provide a safe sampling device capable of delivering a representative sample of the completed asphalt rubber binder. The device must meet the requirements of California Test 125 and section 92-1.01D(3).

**37-2.03B(2)(c)(iv) Ingredient and Asphalt Rubber Binder (Type I) and (Type II) Temperatures**

During production, use automatic and continuous temperature sensing and recording equipment to control and document asphalt rubber binder and liquid asphalt rubber binder ingredient temperatures accurately. Continuous recording occurs when production temperature data are collected electronically at intervals of 1 minute or less. Temperature-sensing devices must be accurate to within 5 degrees F.

Place temperature-sensing points at each liquid feed line where the blend is reacted and at each storage tank for completed asphalt rubber binder.

Install and maintain temperature indicators at the point where the asphalt rubber binder proportioning operation is controlled.

**37-2.03B(2)(c)(v) Asphalt Rubber Binder (Type I) and (Type II) Production Data Log**

Subsequent to the lot number designation, correlate all captured data to the lot number. The plant process controller used for asphalt rubber binder production must produce a log of production data consisting of a series of snapshots captured at a maximum of 1-minute intervals throughout the period of daily production. Each snapshot of production data must be a register of production activity at the time and not a summation of the data over the preceding interval to the previous snapshot. The amount of material represented by each snapshot is the amount produced during the 0.5-minute interval before and the 0.5-minute interval after the capture time.

Asphalt rubber binder (Type I) and (Type II) temperature need not be captured during periods where the product temperature is below 370 degrees F.

When asphalt rubber binder (Type I) and (Type II) proportioning is used, the following data must be captured:

1. Date of production.
2. Production location.
3. Time of day the data is captured.
4. Assigned, non-repeating lot number.
5. Certification of compliance numbers for dry and liquid ingredients currently used in the production process. Input liquid ingredients certificate numbers to the nearest 25-ton increment.
6. Viscosity test results including sampling time.
7. Asphalt rubber binder temperature at each required sensing point.
8. Ratio A—The high natural rubber to scrap tire crumb rubber ratio calculated from metered ingredient output.
9. Ratio B—The asphalt modifier to asphalt binder ratio calculated from metered ingredient output.
10. Ratio C—The total dry ingredient to total liquid ingredient ratio calculated from metered ingredient output.
11. Total reacting time and the reaction ending time.
12. Asphalt rubber binder additive type and asphalt rubber binder to additive target ratio.
13. Asphalt rubber binder to additive ratio calculated from individual metered output.

When a batch type proportioning system is used, record the batch weight for each :

1. Dry ingredient as determined by its scale system
2. Liquid ingredient as determined by its meter

When a continuous type proportioning system is used, capture the rate of flow for each dry and liquid ingredient determined by its metering system.

### **37-2.03B(2)(c)(vi) Asphalt Rubber Binder (Type I) and (Type II) Production Data Reports**

Make as-collected raw data available to the Engineer during production.

Submit the production report generated from data collected at remote end-use sites to the Engineer within 7 days of production date. A remote end-use site is one at a distance greater than 5 miles from the asphalt rubber binder production location.

Submit the report generated from production data for non-remote production sites to the Engineer daily.

### **37-2.03B(2)(c)(vii) Electronic Media**

Present the electronic media in a comma-separated values (CSV) format. Recorded data for the ingredients represented by production snapshots must have allowances for sufficient fields to satisfy the amount of data required and include data titles at least once per report. The Engineer must authorize report formats.

Collect and hold data for the duration of the contract. All collected data must be submitted as electronic media. No handwritten reports or data will be accepted.

### **37-2.03B(2)(d) Crumb Rubber R18 Modified Binder**

When WMA additives are added to the crumb rubber R18 modified binder in the field the additives may be either in a liquid or dry state. Dry additive ingredients must be measured by weight. Liquid additives must be measured with a mass-flow meter. Additives must be added at least 30 minutes before end use to facilitate mixing or as recommended by the WMA additive manufacturer. If WMA additives are added at refinery, the proportioning must comply with the MPQP requirement.

The feed line connecting the WMA additive storage to the additive metering system must have a sampling device. The additive sampling equipment must meet the requirements of California Test 125 and section 92-1.01D(3).

Crumb rubber R18 modified binder must be mechanically mixed to provide for the complete blending of liquid or dry ingredients in a controlled fashion.

The tank used for mixing crumb rubber R18 modified binder and WMA additive must have a sampling device. The sampling equipment must meet the requirements of California Test 125 and section 92-1.01D(3).

### **37-2.03B(2)(e) Distributor Trucks for Placing Seal Coat Binder**

Distributor truck for spreading seal coat binder must have the following features:

1. Be self-propelled
2. Heating unit
3. Internal mixing unit, except for crumb rubber R18 modified binder
4. Pumps that spray seal coat binder within 0.03 gal/sq yd of the specified rate
5. Fully circulating spray bar that applies seal coat binder uniformly
6. Tachometer
7. Pressure gages
8. Volume measuring devices
9. Thermometer
10. Observation platform on the rear of the truck for an observer on the platform to see the nozzles and unplug them if needed, except for crumb rubber R18 modified binder

**Replace section 37-2.03E with:**

### **37-2.03E Precoating Screenings**

For seal coat, screenings must be preheated from 260 to 325 degrees F. Coat with any of the asphalts binders specified in the table titled "Performance Graded Asphalt Binder" in section 92. Coat at a central mixing plant. The asphalt binder must be from 0.5 to 1.0 percent by weight of dry screenings.

Plant must be authorized under the Department's MPQP.

Do not stockpile preheated or precoated screenings.

Do not recombine fine materials collected in dust control systems except cyclone collectors or knock-out boxes with any other aggregate utilized in the production of screenings.

**Replace the heading of section 37-2.03F with:**

### **37-2.03F Applying Seal Coat Binder**

**Replace the paragraphs of section 37-2.03F(1) with:**

For areas not accessible to a truck's distributor bar, apply the seal coat binder with a squeegee, rake, or other authorized means.

Prevent spray on existing pavement not intended for seal coat or on previously applied seal coat. Use a material such as building paper and remove the material after use. At longitudinal joints, you may overlap the seal coat binder applications before application of screenings if the overlap is dispersed with squeegees or rakes.

Align longitudinal joints between seal coat applications with designated traffic lanes. Overlap longitudinal joints by not more than 4 inches. If the Engineer authorizes your request, the overlap may be up to 8 inches.

Do not apply the seal coat binder unless there are sufficient precoated screenings at the job site to cover the seal coat binder.

Discontinue the application of seal coat binder early enough to comply with lane closure specifications and darkness. Apply to 1 lane at a time and cover the lane entirely in 1 operation.

**Replace section 37-2.03F(6) with:**

**37-2.03F(6) Seal Coat Binder**

For asphalt rubber binder (Type II) without WMA additive technology, the temperature of asphalt rubber binder must be from 385 to 415 degrees F at the time of application. For asphalt rubber binder (Type I) without WMA additive technology, the temperature of asphalt rubber binder must be from 350 to 375 degrees F at the time of application. For asphalt rubber binder (Type I) and (Type II) with WMA additive technology, the temperature of asphalt rubber binder must be from 330 to 375 degrees F at the time of application.

For crumb rubber R18 modified binder with and without WMA additive technology, at the time of application, the temperature of crumb rubber R18 modified binder must be from 330 to 375 degrees F.

For asphalt rubber binder (Type I) and (Type II) determine the seal coat binder application rate from 0.55 to 0.65 gal/sq yd. For crumb rubber R18 modified binder, determine the seal coat binder application rate from 0.30 to 0.45 gal/sq yd.

Apply seal coat binder when the atmospheric temperature is from 60 to 105 degrees F and the pavement surface temperature is at least 55 degrees F.

Do not apply seal coat binder unless there are sufficient precoated screenings available to cover the seal coat binder within 2 minutes. Seal coat binder applied at intersections, turn lanes, gore points, and irregular areas must be covered with precoated screenings within 15 minutes.

Do not apply seal coat binder when weather or road conditions are unsuitable, including high wind or when the pavement is damp. In windy conditions you may adjust the distributor bar height and distribution speed, and use shielding equipment, if authorized.

**Replace the 1st paragraph of section 37-2.03G(1) with:**

Prevent vehicles from driving on seal coat binder before spreading precoated screenings.

**Replace section 37-2.03G(4) with:**

**37-2.03G(4) Seal Coat**

During transit, cover precoated screenings for seal coat with tarpaulins if the ambient air temperature is below 65 degrees F or the haul time exceeds 30 minutes.

At the time of application, precoated screenings for seal coat must be from 225 to 325 degrees F.

For seal coat using asphalt rubber binder (Type I) and (Type II), spread precoated screenings at a rate from 28 to 40 lb/sq yd. For seal coat using crumb rubber R18 modified binder, spread precoated screenings at a rate from 20 to 34 lb/sq yd. Spread to within 10 percent of the determined rate.

**Replace section 37-2.03H(2) with:**

**37-2.03H(2) Seal Coat**

Perform initial rolling within 90 seconds of spreading precoated screenings. Do not spread precoated screenings more than 200 feet ahead of the initial rolling.

For final rolling, you may request use of a steel-wheeled roller weighing from 8 to 10 tons, static mode only.

Perform a final sweeping before Contract acceptance. The final sweeping must not dislodge screenings.

Remove collected seal coat screenings from paved shoulders, drain inlets, other drainage areas, curbs, dikes and sidewalks. You may stockpile collected material at the jobsite. Remove and dispose of collected material.

**Add to section 37-2.04:**

Screenings for seal coat are measured by coated weight after they are preheated and precoated with asphalt binder.

Screenings for seal coat is paid for as screenings (hot-applied).

Seal coat binder is measured under the specifications for asphalts.

Deductions for crumb rubber gradations are taken based on:

1. Each gradation test for scrap tire crumb rubber represents 10,000 lbs or the amount used in that day's production, whichever is less.
2. Each gradation test for high natural crumb rubber represents 3,400 lbs or the amount used in that day's production, whichever is less.

For each gradation test, the following pay deductions will be taken for noncompliant material:

<b>Gradation Test</b>		
Material	Test result <sup>a</sup>	Deduction
Scrap tire crumb rubber	Operating range < TR < Contract compliance	\$250
Scrap tire crumb rubber	TR > Contract compliance	\$1,100
High natural crumb rubber	Operating range < TR < Contract compliance	\$250
High natural crumb rubber	TR > Contract compliance	\$600

<sup>a</sup>Test Result = TR

**BID ITEM LIST  
02-4E9704**

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity	Unit Price	Item Total
1	070030	LEAD COMPLIANCE PLAN	LS	LUMP SUM	LUMP SUM	
2	120090	CONSTRUCTION AREA SIGNS	LS	LUMP SUM	LUMP SUM	
3	120100	TRAFFIC CONTROL SYSTEM	LS	LUMP SUM	LUMP SUM	
4	130100	JOB SITE MANAGEMENT	LS	LUMP SUM	LUMP SUM	
5	130200	PREPARE WATER POLLUTION CONTROL PROGRAM	LS	LUMP SUM	LUMP SUM	
6	150715	REMOVE THERMOPLASTIC PAVEMENT MARKING	SQFT	360		
7	370001	SAND COVER (SEAL)	TON	490		
8	370120	ASPHALT-RUBBER BINDER	TON	410		
9	BLANK					
10	BLANK					
11	BLANK					
12	374004	ASPHALTIC EMULSION (FLUSH COAT)	TON	61		
13	375030	SCREENINGS (HOT-APPLIED)	TON	3,780		
14	840515	THERMOPLASTIC PAVEMENT MARKING	SQFT	810		
15	840560	THERMOPLASTIC TRAFFIC STRIPE (SPRAYABLE)	LF	130,000		
16	025191	THERMOPLASTIC TRAFFIC STRIPE (SPRAYABLE 2-COAT)	LF	63,100		
17	025541	ASPHALT-RUBBER BINDER (TYPE II), WMA ADDITIVE	TON	50		
18	025542	CRUMB RUBBER R18 MODIFIED BINDER	TON	50		
19	025543	CRUMB RUBBER R18 MODIFIED BINDER, WMA ADDITIVE	TON	49		

**TOTAL BID:**

**\$**

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