Joe, can you please identify in this document the additions/deletions/changes made in the "cut and paste" text? Also, can you please identify the DATE of the Section 39 spec from which you made the additions/deletions/changes? The text in blue (inserted on 18Sep13) does not appear to be merely the result of a "cut and paste" operation. Instead, it appears that there were some changes/additions. We have attempted to address what appear to be the OBVIOUS changes. We will gladly review the document again … once all the changes to the SSP have been identified.

DRAFT DO NOT USE FOR PROJECTS

Use this NSSP for PILOT PROJECTS ONLY.

Use when requiring contractor to produce HMA using the Superpave mix design method.

Use this NSSP only with approval the Office of Roadway Materials Testing. Contact Joe Peterson.

This NSSP replaces the entire section 39. Project-specific requirements are included in this NSSP. Project-specific paragraphs with instructions for use are the only numbered paragraphs within this NSSP.

Do not use SSP's 39-1.01, 39-1.02C, 39-1.02E, 39-1.03B, 39-1.11 thru 39-1.21 inclusive, 39-1.23, 39-1.30, 39-1.31 and 39-6.

Replace section 39 with:

39 HOT MIX ASPHALT, SUPERPAVE

39-1.01 GENERAL

39-1.01A Summary

Section 39 includes specifications for producing and placing HMA by mixing aggregate and asphalt binder at a mixing plant and spreading and compacting the HMA mixture.

Section 39 includes specifications for producing and placing WMA by mixing aggregate, asphalt binder and a warm mix technology at a mixing plant and spreading and compacting the WMA mixture.

You may produce HMA-SP (Type A), or RHMA-SP-G using an authorized warm mix asphalt (WMA) technology. For Department-authorized WMA technologies, go to the METS Web site

HMA includes one or more of the following types:

1. HMA, superpave (HMA-SP) Type A
2. HMA, superpave (HMA-SP) Type C
3. RHMA, superpave, gap graded (RHMA-SP-G)
4. OGFC including HMA-O, and RHMA-O

The RSSs of section 39 do not apply.

Is WMA allowed for any open graded mix types and is it allowed for Type C?

39-1.01B Definitions

coarse aggregate: Aggregate retained on a 1/4-inch screen ***What happened to the #4 sieve? Conflicts with specific gravity test procedure.*** ***Not related to SSP dated 25Sep13, but what about Section 39?***

fine aggregate: Aggregate passing the 1/4-inch screen.

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leveling course: Thin layer of HMA used to correct minor variations in the longitudinal and transverse profile of the pavement before placement of other pavement layers.

lower course: HMA-SP (Type A) layers below 0.2 feet from finished grade

miscellaneous areas: Areas outside the traveled way such as:

1. Median areas not including inside shoulders
2. Island areas
3. Sidewalks
4. Gutters
5. Gutter flares
6. Ditches
7. Overside drains
8. Aprons at the ends of drainage structures

modified binder: PG graded binder designated as polymer modified (PM) or terminal blend (TR), or any PG grade binder with rubber modifiers.

processed RAP: RAP that has been fractioned.

substitution rate: Amount of RAP aggregate substituted for virgin aggregate in percent. ***(verify that this is by dry weight of aggregate?)***

supplemental fine aggregate: Aggregate passing the no. 30 sieve including hydrated lime, portland cement, and fines from dust collectors. ***Does this mean that another specific gravity determination will be required? What about baghouse dust? We need additional discussion of this topic. Not related to SSP dated 25Sep13, but what about Section 39?***

surface course: Upper 0.2 feet of HMA-SP (Type A) exclusive of HMA-O or RHMA-O.

top layer: Final riding surface exclusive of HMA-O or RHMA-O.

WMA: HMA produced at temperatures no greater than 275 degrees F.

HMA with WMA technology: HMA produced using additives to aid with mixing and compaction of HMA produced at temperatures greater than 275 degrees F.

39-1.012~~C~~ Submittals

39-1.012A~~C(1)~~ General

For miscellaneous areas and dikes, a JMF submittal is not required.

For OGFC, submit a complete JMF submittal, except for asphalt binder content. The Department determines the asphalt binder content under California Test 368 within 20 days of your complete JMF submittal and provides you a *Caltrans Hot Mix Asphalt Verification* form.

For JMF mix design, JMF verification, production start-up, and each 10,000 tons, submit AASHTO T 283 and AASHTO T 324 (Modified) test results to the Engineer and electronically to:

Moisture_Tests@dot.ca.gov

At production start-up and within 1000 tons of the halfway point of production of HMA, submit samples split from your HMA production sample for AASHTO T 283 and AASHTO T 324 (Modified) tests to the Engineer and the Transportation Laboratory, Attention: Moisture Test.

Submit all completed quality control test results within 3 business days of a request. Submit all quality control tests except AASHTO T 283 within 7 days of a request. Submit AASHTO T 283 quality control tests within 14 days of a request. *Does the term "days" always mean "business days?"*

For tests performed under AASHTO T324 (Modified) as specified in section 39-1.01D(1), submit test data and 1 tested sample set within 3 business days of sampling.

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Submit a new JMF if you change any of the following:

1. Target asphalt binder percentage greater than ±0.2 percent ***If one has an approved mix design, can one adjust the OBC within ±0.2 and use the "adjusted" OBC for another project? Not related to SSP dated 25Sep13, but what about Section 39?***

2. Asphalt binder supplier
3. Asphalt rubber binder supplier
4. Component materials used in asphalt rubber binder or percentage of any component materials
5. Combined aggregate gradation
6. Aggregate sources
7. WMA – ***clarification…change in producer, type, dosage?***
8. LAS producer - ***clarification…change in producer, type, dosage?***
9. Any material in the JMF

Submit a new JMF when the average binder content in a new fractionated RAP stockpile is more than ± 2.0 percent from the average binder content of the original fractionated RAP stockpile used in the mix design.

Submit a new JMF when the processed RAP specific gravity is more than 0.060 from the average maximum specific gravity reported on page 4 of your *Contractor Hot Mix Asphalt Design Data* form.

39-1.02B~~1C(2)~~ Job Mix Formula

39-1.02B(1)~~1C(2)(a)~~ General

For each type of HMA shown, submit your proposed JMF on the *Contractor Job Mix Formula Proposal* form along with:

1. Mix design documentation on *Hot Mix Asphalt Design Data* form dated within 12 months of submittal
2. JMF verification on a *Caltrans Hot Mix Asphalt Verification* form, if applicable ***(Clarification on the form #, ie, is the "SP" suffix going to be added to CEM 3513?)***
3. JMF renewal on a *Caltrans Job Mix Formula Renewal* form, if applicable ***(Clarification on the form #, ie, is the "SP" suffix going to be added to CEM 3514?)***

4. MSDS for:
   - 4.1. Asphalt binder
   - 4.2. Base asphalt binder used in asphalt rubber binder
   - 4.3. CRM and asphalt modifier used in asphalt rubber binder
   - 4.4. Blended asphalt rubber binder mixture
   - 4.5. Supplemental fine aggregate except fines from dust collectors
   - 4.6. Antistrip additives
   - 4.7 WMA technology
5. For RHMA-G SP, asphalt rubber binder design and profile

The JMF must be based on a HMA mix design determined as described in the Superpave Mix Design SP-2 Manual by the Asphalt Institute ***– CLARIFICATION, please….perhaps the confusion is a result of "cutting and pasting."***

39-1.02B(2) Job Mix Formula Document Review

Allow the Engineer 5 business days from a complete JMF submittal, for document review of the aggregate qualities, mix design, and JMF. Do not start HMA production before verification and acceptance of JMF.

39-1.02B(3) Job Mix Formula Verification

If you cannot submit a Department-verified JMF on a *Caltrans Hot Mix Asphalt Verification* form dated within 12 months before HMA production, the Engineer verifies the JMF.

For OGFC, the Engineer determines the asphalt binder content under California Test 368 within 20 days of your complete JMF submittal and provides you a *Hot Mix Asphalt Verification* form.

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HMA produced with WMA technology for JMF verification must be produced using the WMA technology shown in the JMF submittal.

Based on your testing and production experience, you may submit an adjusted aggregate gradation TV on a *Contractor Job Mix Formula Proposal* form before verification testing. Aggregate gradation TV must be within the TV limits specified in the aggregate gradation tables.

Asphalt binder set point for HMA verification must be the OBC specified on your *Contractor Hot Mix Asphalt Design Data* form. When RAP is used, asphalt binder set point for HMA must be:

$$\text{Asphalt Binder Set Point} = \frac{\dfrac{BC_{OBC}}{\left(1 - \dfrac{BC_{OBC}}{100}\right)} - R_{RAP}\left[\dfrac{BC_{RAP}}{\left(1 - \dfrac{BC_{RAP}}{100}\right)}\right]}{100 + \dfrac{BC_{OBC}}{\left(1 - \dfrac{BC_{OBC}}{100}\right)}}$$

Where:
BC_{OBC} = optimum asphalt binder content, percent based on total weight of mix
R_{RAP} = RAP ratio by weight of aggregate
BC_{RAP} = asphalt binder content of RAP, percent based on total weight of RAP mix

If % RAP = 0, this equation does not yield the asphalt binder set point equal to the OBC. Not related to SSP dated 25Sep13, but what about Section 39?

For HMA, the Engineer verifies the JMF from samples taken from HMA produced by the plant to be used. Notify the Engineer at least 2 business days before sampling materials.

In the Engineer's presence and from the same production run, take samples of:

1. Aggregate – Coarse, fine, and supplemental fine aggregate from cold feed belts, or hot bins. Samples must include at least 120 pounds for each coarse aggregate, 80 pounds for each fine aggregate, and 10 ***pounds*** for each type of supplemental fines. The Department combines these aggregate samples to comply with the JMF TVs submitted on a *Contractor Job Mix Formula Proposal* form. ***This is a lot of aggregate…do you want COMBINED cold feed sample of coarse and fine? Not related to SSP dated 25Sep13, but what about Section 39?***

2. Asphalt binder- 2 quarts minimum ***[should there a be a "." after minimum?]*** Asphalt rubber binder with the components blended in the proportions to be used. Samples must be in four 1-quart cylindrical shaped cans with open top and friction lids. ***Confusing…2 quarts or 4 quarts? Not related to SSP dated 25Sep13, but what about Section 39?***

3. RAP- From the RAP system. Samples must be at least 50 pounds minimum
4. HMA- 250 pounds minimum ***Would Caltrans consider requiring 500lb divided equally between the Contractor and Caltrans? Not related to SSP dated 25Sep13, but what about Section 39?***

Sample aggregate from cold feed belts or hot bins.

You may sample from a different project including a non-Department project if you make arrangements for the Engineer to be present during sampling.

For aggregate, RAP, and HMA, split the samples into at least 4 parts and label their containers. Submit 3 parts to the Engineer and use 1 part for your testing.

After completion of the JMF document review, the Engineer verifies each proposed JMF within 20 days of receiving all verification samples and the JMF document submittal has been accepted. If you request, the

Field Code Changed

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Engineer verifies RHMA-G quality requirements within 7 days of receiving all verification samples, and the JMF document submittal has been accepted. Verification is testing for compliance with the specifications for:

1. Aggregate quality
2. Aggregate gradation (JMF TV ± tolerance)
3. Asphalt binder content (JMF TV ± tolerance)
4. HMA quality specified in the table Hot Mix Asphalt Mix Design Requirements except:
   4.1. Air voids content (design value ± 1.5 percent)
   4.2. VMA (~~minimum~~ HMA mix design requirement ***per the mix design requirements table*** 12.5-15.5) ***Not related to SSP dated 25Sep13, but what about Section 39?***
   4.3. Dust proportion (0.6-1.3)

To verify the JMF air voids content the Engineer uses an average of three briquettes for air voids content, VMA, and Dust Proportion The Engineer tests plant produced material.

If the Engineer verifies the JMF, the Engineer provides you a *Hot Mix Asphalt Verification* form.

If the Engineer's tests on plant-produced samples do not verify the JMF, the Engineer notifies you and you must submit a new JMF or submit an adjusted JMF based on your testing. JMF adjustments may include a change in:

1. Asphalt binder content target value up to ±0.2 percent from the OBC value submitted on *Hot Mix Asphalt Design Data* form except do not adjust the target value for asphalt rubber binder for RHMA-G-SP below 7.5 percent by total weight of mixture.
2. Aggregate gradation target values within the target value limits specified in the aggregate gradation table.

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You may adjust the JMF only once due to a failed verification test. An adjusted JMF requires a new *Contractor Job Mix Formula Proposal* form and *Hot Mix Asphalt Design Data* form and verification of a plant-produced sample.

The Engineer reverifies the JMF if HMA production has stopped for longer than 30 days and the verified JMF is less than 12 months old. ***Why does the JMF need to be re-verified if it is good for one year from initial verification? Why not a production set-up rather than re-verification? Not related to SSP dated 25Sep13, but what about Section 39?***

For each HMA type and aggregate size specified, the Engineer verifies up to 2 proposed JMF submittals including a JMF adjusted after verification failure. If you submit more than 2 JMF for each type of HMA and aggregate size, the Engineer deducts $3,000 from payments for each verification exceeding this limit. This deduction does not apply to verifications initiated by the Engineer or if a JMF expires while HMA production is stopped longer than 30 days. ***Clarification…per contract or per year? What about multi-year projects? Not related to SSP dated 25Sep13, but what about Section 39?***

If you have a verified *Hot Mix Asphalt Verification* form, the Engineer will verify 1 binder source change for each HMA type and aggregate size specified. The Engineer deducts $2,000 from payments for this verification. This deduction does not apply to verifications initiated by the Engineer or JMF renewal.

39-1.02B(4) Job Mix Formula Renewal

You may request a JMF renewal by submitting:

1. Proposed JMF on a *Contractor Job Mix Formula Proposal* form
2. Previously verified JMF documented on a *Caltrans Hot Mix Asphalt Verification* form dated within 12 months
3. Mix design documentation on a *Contractor Hot Mix Asphalt Design Data* form used for the previously verified JMF

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If the Engineer requests, sample the following materials in the presence of the Engineer and place in labeled containers weighing no more than 50 pounds each:

1. Coarse, fine, and supplemental fine aggregate from cold feed belts, or hot bins. Samples must include at least 120 pounds for each coarse aggregate, 80 pounds for each fine aggregate, and 10 pounds for each type of supplemental fines. The Department combines these aggregate samples to comply with the JMF TVs submitted on a *Contractor Job Mix Formula Proposal* form.
2. RAP from the RAP system. Samples must be at least 50 pounds.
3. Asphalt binder from the binder supplier. Samples must be in two 1-quart cylindrical-shaped cans with open top and friction lids.
4. Asphalt rubber binder with the components blended in the proportions to be used. Samples must be in four 1-quart cylindrical-shaped cans with open top and friction lids.

Notify the Engineer at least 2 business days before sampling materials. For aggregate, RAP and HMA, split samples into at least 4 parts. Submit 3 parts to the Engineer and use 1 part for your testing.

Allow the Engineer 5 business days from a complete JMF re-verification submittal for document review of the aggregate qualities, mix design, and JMF. Do not start HMA production before re-verification and acceptance of JMF.

The most recent aggregate quality test results within the past 12 months may be used for verification of JMF renewal or the Engineer may perform aggregate quality tests for verification of JMF renewal.

The Engineer verifies the JMF under section 39-1.02B except:

1. Engineer retains samples until you provide test results for your part on a *Contractor Job Mix Formula Renewal* form.
2. Department tests samples of materials obtained from the HMA production unit after you submit test results that comply with the specifications for the quality characteristics in section 39-1.02B.
3. After completion of the JMF re-verification document review, the Engineer verifies each proposed JMF within ~~Engineer verifies each proposed JMF within~~ 30 days of receiving verification samples.
4. You may not adjust the JMF due to a failed verification. ***This should be 20 days per 1Jan12 document.***
5. For each HMA type and aggregate gradation specified, the Engineer verifies at the Department's expense 1 proposed JMF renewal within a 12 month period.

If the Engineer verifies the JMF renewal, the Engineer provides you a *Caltrans Hot Mix Asphalt Verification* form.

39-1.02B(5) Job Mix Formula Acceptance

You may start HMA production if:

1. The Engineer's review of the JMF shows compliance with the specifications
2. The Department has verified the JMF within 12 months before HMA production
3. The Engineer accepts the verified JMF

39-1.02B(6) Job Mix Formula Modification

For an accepted JMF, you may change asphalt binder source or liquid antistrip producer one time during production.

Submit your modified JMF request a minimum of 10 business days before production. Each modified JMF submittal must consist of:

1. Proposed modified JMF on *Contractor Job Mix Formula Proposal* form, marked "Modified"
2. Mix design records on *Contractor Hot Mix Asphalt Design Data* form for the accepted JMF to be modified
3. JMF verification on *Hot Mix Asphalt Verification* form for the accepted JMF to be modified
4. Quality characteristics test results for the modified JMF as specified in section 39-1.02B(2). Perform tests at the mix design OBC as shown on the *Contractor Asphalt Mix Design Data* form

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With an accepted modified JMF submittal, the Engineer verifies each modified JMF within 7 business days of receiving all verification samples.

The Engineer verifies the modified JMF after the modified JMF HMA is placed on the project and verification samples are taken within the first 750 tons following sampling requirements in section 39-1.01C(4)E "Job Mix Formula Verification." The Engineer tests verification samples for compliance with:

1. Hamburg Wheel Track as shown in the table titled "HMA Mix Design Requirements"
2. Air void content at design value ±1.5 percent
3. Voids in mineral aggregate as shown in the table titled "HMA Mix Design Requirements"
5. Dust proportion, as shown in the table titled "HMA Mix Design Requirements"

The Engineer may test for moisture susceptibility, as shown in the table titled "HMA Mix Design Requirements"

If the modified JMF is verified, the Engineer revises your *Hot Mix Asphalt Verification* form to include the new asphalt binder source or new liquid antistrip producer. Your revised form will have the same expiration date as the original form.

If a modified JMF is not verified, stop production and any HMA placed using the modified JMF is rejected.

The Engineer deducts $2,000 from payments for each modified JMF verification. The Engineer deducts an additional $2,000 for each modified JMF verification that the Engineer tests for moisture susceptibility.

39-1.02B(7) WMA

If WMA technology is used, submit the following with your proposed JMF submittal:

1 MSDS for WMA technology
2. For WMA water injection foam technology:
   - 2.1. Name of technology
   - 2.2. Laboratory Procedure LP-12 test result for foamed bitumen expansion ratio dated within 12 months of submittal
   - 2.3. Laboratory Procedure LP-12 test result for foamed bitumen half-life dated within 12 months of submittal
   - 2.4. Optimum foaming water content
   - 2.5. Proposed HMA production temperature range
3. For WMA additive technology:
   - 3.1. Name of technology
   - 3.2. Percent admixture by weight of binder and percent admixture by total weight of HMA as recommended by the manufacturer
   - 3.3. Methodology for inclusion of admixture in laboratory-produced HMA
   - 3.4. Proposed HMA production temperature range

The HMA PPC must produce an electronic log of production data consisting of a series of snapshots captured at a maximum of 1-minute intervals throughout daily production. Each snapshot of production data must be a register of production activity at that 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. Collect and hold data for the duration of the contract and submit the electronic media, daily and upon request. The snapshot of production data must include the following:

1. Date of production
2. Production location
3. Time of day the data is captured
4. HMA mix type being produced and target binder rate
5. HMA additive type, brand, and target rate
6. Temperature of the binder and HMA mixture
7. For a continuous mix operation, the rate of flow of the dry aggregate calculated from the wet aggregate flow rate as determined by the conveyor scale
8. For a continuous mix plant operation, the rate of flow of the asphalt meter

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9. For a continuous mix plant operation, the rate of flow of HMA additive meter
10. For a batch plant operation, actual batch weights of all ingredients
11. Dry aggregate to binder ratio calculated from metered ingredient output
12. Dry aggregate to HMA additive ratio calculated from metered output

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At the end of each day's production shift submit electronic and printed media. Present data on electronic media in comma-separated values (CSV) or tab-separated values (TSV) format. Captured data, for the ingredients represented by production snapshot, must have allowances for sufficient fields to satisfy the amount of data required by these specifications and include data titles at least once per report.

39-1.02B(8)~~1C(2)(c)~~ Liquid Antistrip Treatment

If liquid antistrip (LAS) treatment is used, submit the following with your proposed JMF submittal:

1. MSDS for LAS.
2. One 1-pint sample.
3. Infrared analysis including copy of absorption spectra.
4. Certified copy of test results and an MSDS for each LAS lot.
5. Certificate of compliance for each LAS shipment. With each certificate of compliance, include:
   - 5.1. Your signature and printed name.
   - 5.2. Shipment number
   - 5.3. Material type.
   - 5.4. Material specific gravity
   - 5.5. Refinery.
   - 5.6. Consignee.
   - 5.7. Destination.
   - 5.8. Quantity.
   - 5.9. Contact or purchase order number.
   - 5.10. Shipment date
6. Proposed proportions for LAS. If you change the brand or type of LAS, submit a new JMF.

For each job site delivery of LAS, submit one 1/2-pint sample to METS. Submit shipping documents. Label each LAS sampling container with:

1. LAS type
2. Application rate
3. Sample date
4. Contract number

At the end of each day's production shift, submit production data in electronic and printed media. Present data on electronic media in tab delimited format. Use line feed carriage return with 1 separate record per line for each production data set. Allow sufficient fields for the specified data. Include data titles at least once per report. For each mixing operation type, submit the following items in order:

1. Batch mixing:
   - 1.1. Production date
   - 1.2. Time of batch completion
   - 1.3. Mix size and type
   - 1.4. Each ingredient's weight
   - 1.5. Asphalt binder content as a percentage of the total weight of mix
   - 1.6. LAS content as a percentage of the asphalt binder weight
2. Continuous mixing
   - 2.1. Production date
   - 2.2. Data capture time
   - 2.3. Mix size and type
   - 2.4. Flow rate of wet aggregate collected directly from the aggregate weigh belt
   - 2.5. Aggregate moisture content as percentage of the dry aggregate weight
   - 2.6. Flow rate of asphalt binder collected from the asphalt binder meter
   - 2.7. Flow rate of LAS collected from the LAS meter
   - 2.8. Asphalt binder content as percentage of the total weight of mix calculated from:

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2.8.1. Aggregate weigh belt output
2.8.2. Aggregate moisture input
2.8.3. Asphalt binder meter output

2.9. LAS content as percentage of the asphalt binder weight calculated from:
2.9.1. Asphalt binder meter output
2.9.2. LAS meter output

39-1.02B(9)~~1C(2)(d)~~ Lime Treatment

If aggregate lime treatment is used, submit the following with your proposed JMF:

1. Exact lime proportions for fine and coarse virgin aggregate with the proposed JMF
2. If marination is required, the averaged aggregate quality test results within 24 hours of sampling
3. For dry lime aggregate treatment, a treatment data log from the dry lime and aggregate proportioning device in the following order:
   3.1 Treatment date
   3.2. Time of day the data is captured
   3.3 Aggregate size being treated
   3.4. HMA type and mix aggregate size
   3.5. Wet aggregate flow rate collected directly from the aggregate weigh belt
   3.6. Aggregate moisture content, expressed as a percent of the dry aggregate weight
   3.7. Flow rate of dry aggregate calculated from the flow rate of wet aggregate
   3.8. Dry lime flow rate
   3.9. Lime ratio from the accepted JMF for each aggregate size being treated
   3.10. Lime ratio from the accepted JMF for the combined aggregate
   3.11. Actual lime ratio calculated from the aggregate weigh belt output, the aggregate moisture input, and the dry lime meter output, expressed as a percent of the dry aggregate weight
   3.12. Calculated difference between the authorized lime ratio and the actual lime ratio
4. For lime slurry aggregate treatment, a treatment data log from the slurry proportioning device in the following order:
   4.1. Treatment date
   4.2. Time of day the data is captured
   4.3. Aggregate size being treated
   4.4. Wet aggregate flow rate collected directly from the aggregate weigh belt
   4.5. Moisture content of the aggregate just before treatment, expressed as a percent of the dry aggregate weight
   4.6. Dry aggregate flow rate calculated from the wet aggregate flow rate
   4.7. Lime slurry flow rate measured by the slurry meter
   4.8. Dry lime flow rate calculated from the slurry meter output
   4.9. Authorized lime ratio for each aggregate size being treated
   4.10. Actual lime ratio calculated from the aggregate weigh belt and the slurry meter output, expressed as a percent of the dry aggregate weight
   4.11. Calculated difference between the authorized lime ratio and the actual lime ratio
   4.12. Dry lime and water proportions at the slurry treatment time

Each day during lime treatment, submit the treatment data log on electronic media in tab delimited format on a removable CD-ROM storage disk. Each continuous treatment data set must be a separate record using a line feed carriage return to present the specified data on 1 line. The reported data must include date, time at least once per report.

39-1.02B(10)~~1C(2)(e)~~ Asphalt Rubber Binder

For the asphalt rubber binder used, submit:

1. Log of production daily.
2. Certificate of compliance with test results for CRM and asphalt modifier with each truckload delivered to the HMA plant. The certificate of compliance for asphalt modifier must represent no more than 5,000 lbs.
3. Submit certified weight slips for the CRM and asphalt modifier furnished.

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Submit a certificate of compliance for the asphalt rubber binder. With the certificate of compliance, submit test results for CRM and asphalt modifier with each truckload delivered to the HMA plant. A certificate of compliance for asphalt modifier must not represent more than 5,000 lbs.

39-1.02B(11)~~1C(2)(f)~~ Reclaimed Asphalt Pavement

Submit QC test results for RAP gradation with the combined aggregate gradation within 2 days of taking RAP samples during HMA-SP (Type A) and ~~HMA-SP (Type C)~~ production.

39-1.02B(12)~~1C(3)~~ Quality Control Plan

With your proposed JMF submittal, submit a QC plan for HMA. The QC plan must describe the organization and procedures for:

1. Controlling HMA quality characteristics
2. Obtaining samples, including sampling locations
3. Establishing, implementing, and maintaining QC
4. Determining when corrective actions are needed
5. Implementing corrective actions
6. Taking samples, including location of sampling

The QCP must address the elements affecting HMA quality including:

1. Aggregate
2. Asphalt binder
3. Additives
4. Production
5. Paving

The QC plan must include aggregate quality control sampling and testing during lime treatment.

The Engineer reviews the QC plan within 5 business days from the submittal. Do not start HMA production until the Engineer authorizes the plan.

If QC procedures, personnel, tester qualifications, or lab accreditation status change, submit a QC plan supplement at least 3 business days before implementing proposed changes.

39-1.02B(13)~~1C(4)~~ Inertial Profiler

At least 5 business days before start of initial profiling or changing profiler or operator, submit:

1. IP certification issued by the Department. The certification must be not more than 12 months old.
2. Operator certification for the IP issued by the Department. The operator must be certified for each different model of IP device operated. The certification must be not more than 12 months old.
3. List of manufacturer's recommended test procedures for IP calibration and verification.

As an alternative to the IP and operator certification by the Department, an equivalent certification from the Texas Transportation Institute will be accepted if the certification is dated before July 1, 2013 and is not more than 12 months old.

Within 2 business days after cross correlation testing, submit ProVAL profiler certification analysis report for cross correlation test results performed on test section to the Engineer and to the electronic mailbox address:

smoothness@dot.ca.gov

Within 2 business days after each day of inertial profiling, submit profile data to the Engineer and to the electronic mailbox address:

smoothness@dot.ca.gov

The profiling data must include:

1. Raw profile data for each lane.

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2. ProVAL ride quality analysis report for IRIs of left and right wheel paths of each lane. Submit in pdf file format.
3. ProVAL ride quality analysis report for MRIs of each lane. Submit in pdf file format.
4. ProVAL smoothness assurance analysis report for IRIs of left wheel path. Submit in pdf file format.
5. ProVAL smoothness assurance analysis report for IRIs of right wheel path. Submit in pdf file format.
6. GPS data file for each lane in GPS exchange. Submit in GPS eXchange file format.
7. Manufacturer's recommended IP calibration and verification tests results.
8. AASHTO IP calibration and verification test results including bounce, block, and distance measurement instrument (DMI).

Submit the raw profile data in unfiltered electronic pavement profile file (PPF) format. Name the PPF file using the following naming convention:

YYYYMMDD_TTCCCRRR_D_L_W_S_X_PT.PPF

where:
YYYY = year
MM = Month, leading zero
DD = Day of month, leading zero
TT = District, leading zero
CCC = County, 2 or 3 letter abbreviation as shown in section 1-1.08
RRR = Route number, no leading zeros
D = Traffic direction as NB, SB, WB, or EB
L = Lane number from left to right in direction of travel
W = Wheel path as "L" for left, "R" for right, or "B" for both
S = Beginning station to the nearest foot (i.e., 10+20) or beginning post mile to the nearest hundredth (i.e., 25.06) no leading zero
X = Profile operation as "EXIST" for existing pavement, "INTER" for after prepaving smoothness correction, "PAVE" for after paving, and "CORR" for after final surface pavement correction
PT = Pavement type (i.e., HMA-SP, RHMA-SP-G, RHMA-O, RHMA-O, RHMA-G, etc.)

Within 2 business days of performing straightedge measurements, submit areas requiring smoothness correction. Identify locations of smoothness correction by:

1. Location Number
2. District-County-Route
3. Beginning station or post mile to the nearest 0.01 mile
4. For correction areas within a lane:
   4.1. Lane direction as NB, SB, EB, or WB
   4.2. Lane number from left to right in direction of travel
   4.3. Wheel path as "L" for left, "R" for right, or "B" for both
5. For correction areas not within a lane:
   5.1. Identify pavement area (i.e., shoulder, weight station, turnout)
   5.2. Direction and distance from centerline as "L" for left or "R" for right
6. Estimated size of correction area

39-1.02B(2)(C)(5) Data Cores

At least 3 business days before starting coring, submit proposed methods and materials for backfilling data core holes.

Submit a summary of data cores taken and a photograph of each data core to the Engineer and to:

Coring@dot.ca.gov

39-1.03 Mix Design

The HMA mix design must comply with AASHTO R 35 except:

1. Notes 3, 6, and 10 do not apply
2. AASHTO M 323 does not apply on combinations of aggregate gradations and asphalt binder contents to determine the OBC and HMA mixture qualities

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For HMA with WMA additive technology, produce HMA mix samples for your mix design using your methodology for inclusion of WMA admixture in laboratory produced HMA. For WMA water injection foam technology, the use of foamed asphalt for mix design is not required.

Your Hot Mix Asphalt Design Data form must show documentation on aggregate quality.

For HMA mixtures utilizing RAP the maximum binder replacement is 25.0 percent for surface course and 40.0 percent for lower courses.

For HMA with a binder replacement percent less than or equal to 25 percent of optimum binder content, you may request that the performance graded asphalt binder grade with upper and lower temperature classifications be reduced by 6 °C from the specified grade.

For HMA with a binder replacement greater than 25 percent of optimum binder content and less than or equal to 40 percent of optimum binder content, you must use a performance graded asphalt binder grade with upper and lower temperature classifications reduced by 6 °C from the specified grade.

The mix design must comply with the quality characteristics of the following table:

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Hot Mix Asphalt Mix Design Requirements

Quality characteristic	Test method	HMA-SP	
		Type A	RHMA-SP-G
Air voids content (%)[a] 1/4" and 3/8 gradings 1/2"and 3/4" gradings	AASHTO T 269[a]	$N_{initial}$ >8.0 N_{design} = 4.0 N_{max} >2.0	N_{design} Specification
Air voids content (%)[a] 1" gradings	AASHTO T 269[a]	$N_{initial}$ >8.0 N_{design} = 5.0 N_{max} >2.0	
Gyration Compaction[b] (number of gyrations)	AASHTO T 312	$N_{initial}$ 8 N_{design} 85 N_{max} 130	N_{design} 50–150[b]
Voids in mineral aggregate (% min.) 1/4" grading 3/8" grading 1/2" grading 3/4" grading 1" grading with NMAS=1" with NMAS=3/4"	SP-2 Asphalt Mixtures Volumetrics[c]	 16.5-19.5 15.5-18.5 14.5-17.5 13.5-16.5 13.5-16.5 13.5-16.5 14.5-17.5	 - - 16.0–23.0 18.0–23.0
Dust proportion 1/4" and 3/8 gradings 1/2"and 3/4" gradings 1" grading	SP-2 Asphalt Mixtures Volumetrics[c]	0.6–1.3 0.6–1.3 0.6–1.3	Report Only
Hamburg wheel track (minimum number of passes at 0.5 inch average rut depth) PG 58 PG 64 PG-70 PG-76 or higher	AASHTO T 324 (Modified)[d,e]	 10,000 15,000 20,000 25,000	 15,000 20,000 25,000
Hamburg wheel track (inflection point minimum number of passes) PG 58 PG 64 PG-70 PG-76 or higher	AASHTO T 324 (Modified)[d,e]	 10,000 10,000 12,500 15,000	 10,000 10,000 12,500
Moisture susceptibility (minimum dry strength, psi)	AASHTO T 283[d,f]	110	110
Moisture susceptibility (minimum wet strength, psi)	AASHTO T 283[d,f,g]	84	84

[a]Calculate the air voids content of each specimen using AASHTO T 275 to determine bulk specific gravity AASHTO T 209 Method A to determine theoretical maximum specific gravity. Under AASHTO T 209 use a digital monometer and pycnometer when performing AASHTO T 209.
[b]Superpave gyratory compactor ram pressure may be increased to a maximum of 825kPa, and specimens may be held at a constant height for a maximum of 90 minutes.
[c]Measure bulk specific gravity using AASHTO T 275.
[d]Test plant produced HMA.
[e]Test as specified in section 39-1.03A~~39-1.01D(1)~~.
[f]Test specimens must be 100mm or 150mm gyratory compacted HMA
[g]Freeze thaw required

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If the test results for AASHTO T 283 or AASHTO T 324 (Modified) for untreated plant produced HMA is less than minimum requirements for HMA-mix design, determine the plasticity index of the aggregate blend under California Test 204. The antistrip treatment must be based on plasticity index in compliance with the following table:

Hot Mix Asphalt Antistrip Treatment Options

Quality characteristic	Test method	Treatment requirement
Plasticity index Plasticity index from 4 to 10[a] Plasticity index less than 4	California Test 204	Dry hydrated lime with marination Lime slurry with marination Liquid Dry hydrated lime without marination Dry hydrated lime with marination Lime slurry with marination

[a]If the plasticity index is greater than 10, do not use that aggregate blend.

If the tensile strength ~~ratio~~ test result for treated plant produced RHMA-SP is less than the RHMA-SP-G mix design requirement for tensile strength ~~ratio~~, the minimum tensile strength ~~ratio~~ requirement is waived, but you must use any of the following antistrip treatments:

1. HMA aggregate lime treatment – slurry method
2. HMA aggregate lime treatment – dry lime method
3. Liquid antistrip treatment using 0.5 to 1.0 percent liquid antistrip

39-1.04~~1D~~ Quality Control and Assurance

39-1.04A~~1D(1)~~ General

AASHTO T 324 (Modified) is AASHTO T 324, "Hamburg Wheel-Track Testing of Compacted Hot Mix Asphalt (HMA)," with the following parameters:

1. Target air voids must equal 7 ± 1 percent for HMA-SP Type A, and HMA-SP ~~Type C~~
2. Specimen height must be 60 mm ± 1 mm
3. Number of test specimens must be 4 (2 test sets)
4. Do not average test sets
5. Test specimen must be a 150 mm gyratory compacted specimen
6. Test temperature must be set at
   a. ~~5.1~~ 113 ± 2 degrees F for PG 58
   b. ~~5.2~~ 122 ± 2 degrees F for PG 64
   c. ~~5.3~~ 131 ± 2 degrees F for PG 70 and above
7. Measurements for impression must be taken at every 100 passes
8. Inflection point defined as the number of wheel passes at the intersection of the creep slope and the stripping slope
9. Testing cut off must be set at 25,000 passes

During production, take samples under California Test 125.

If the Engineer requests, sample the following materials in the presence of the Engineer and place in labeled containers weighing no more than 50 lbs. each:

1. Coarse, fine, and supplemental fine aggregate from stockpiles, cold feed belts, or hot bins. Samples must include at least 150 pounds~~lbs~~. for each coarse aggregate, 100 pounds~~lbs~~. for each fine aggregate, and 10 pounds~~lbs~~. for each type of supplemental fines. The Department combines these aggregate samples to comply with the JMF target values submitted on *Contractor Job Mix Formula Proposal* form.
2. RAP from stockpiles or RAP system. Samples must be at least 100 pounds~~lbs~~.
3. Asphalt binder from the binder supplier. Samples must be in four 1-quart cylindrical shaped cans with open top and friction lids.

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4. Asphalt rubber binder with the components blended in the proportions to be used. Samples must be in four 1-quart cylindrical shaped cans with open top and friction lids.

Notify the Engineer at least 2 business days before sampling materials. For aggregate and RAP, split the samples into at least 4 parts. Submit 3 parts to the Engineer and use 1 part for your testing.

39-1.04~~B1D(3)~~ Quality Control Plan

Implement your QC plan. If a change to your QC plan is needed, do not implement the change without authorization.

39-1.04~~C1D(4)~~ Prepaving Conference

Meet with the Engineer at a prepaving conference at a mutually agreed time and place. Discuss the QC plan and the methods of performing production and paving work.

The following personnel must attend the prepaving conference:

1. Project Manager
2. Superintendent
3. HMA plant manager
4. HMA paving foreman
5. Technical representative for WMA technology (If WMA is utilized)

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39-1.04F1D(5) Quality Control Testing

Establish, maintain, and change a quality control system to ensure materials and work comply with the specifications. Submit quality control test results within 3 business days of a request.

Perform sampling and testing as specified in the following 4 tables:

Minimum Quality Control Requirements for Aggregate

Quality characteristic	Test method	Minimum sampling and testing frequency	HMA-SP			
			Type A	RHMA-SP-G	OGFC	Type B
Aggregate gradation[a]	AASHTO T 27	1 per 750 tons and any remaining part	JMF ± Tolerance[b]	JMF ± Tolerance[b]	JMF ± Tolerance	JMF ± Tolerance[b]
Sand equivalent (min.)[c]	AASHTO T 176		47	47	--	47
Aggregate moisture content at continuous mixing plants and RAP moisture content at continuous mixing plants and batch mixing plants	AASHTO T 329	1 per 1500 tons and any remaining part	Report Only--	--Report Only	--Report Only	--
Percent of crushed particles Coarse aggregate (%, min.) One fractured face Two fractured faces Fine aggregate (%, min) (Passing No. 4 sieve and retained on No. 8 sieve.) One fractured face	AASHTO T 335	One per 10,000 tons or 2 per project which-ever is more	 95 90 70	 -- 90 70	 90 90 90	 95 90 90
Los Angeles Rattler (%, max.) Loss at 100 rev. Loss at 500 rev.	AASHTO T 96		 12 40	 12 40	 12 40	 12 40
Flat and elongated particles (%, max. by weight @ 5:1) 1/4" thru 3/4" grading 1" grading	ASTM D 4791		Report only 10	Report only	Report only	10
Fine aggregate angularity (%, min.)	AASHTO T 304, Method A		45	45	--	45

[a]If RAP is used, test the combined aggregate gradation under Laboratory Procedure LP-9.
[b]Comply with the allowable tolerances in section 39-1.072E.
[c]Report the average of 3 tests from a single split sample. Use of a Sand Reader Indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, 4.8, 7.1.2, 8.4.2 and 8.4.3 do not apply.

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Minimum Quality Control Requirements for in Place HMA

Quality Characteristic	Test method	Minimum sampling and testing frequency	HMA-SP		
			Type A	RHMA-SP-G	OGFC
Asphalt binder content (%)	AASHTO T 308 Method A	1 per 750 tons and any remaining part	JMF - 0.3, + 0.5	JMF - 0.4, + 0.5	JMF - 0.4, + 0.5
HMA moisture content (%, max.)	AASHTO T 329	1 per 2,500 tons but not less than 1 per paving day	1.0	1.0	1.0
Air voids content (%)[a] 1/4" and 3/8 gradings 1/2"and 3/4" gradings 1" grading with PG64-28M all other binders	AASHTO T 269	One per 4,000 tons or 2 per 5 business days, which-ever is more	4 ± 1.5 4 ± 1.5 5 ± 1.5 4 ± 1.5	Specification ± 1.5	--
Voids in mineral aggregate (% min.) 1/4" grading 3/8" grading 1/2" grading 3/4" grading 1" grading with NMAS=1" with NMAS=3/4"	SP-2 Asphalt Mixtures Volumetrics[a]		16.5-19.5 15.5-18.5 14.5-17.5 13.5-16.5 12.5-15.5 12.5-15.5 13.5-16.5	-- -- 18.0–23.0 18.0–23.0	--
Dust proportion 1/4" and 3/8" gradings 1/2" and 3/4" gradings 1" grading	SP-2 Asphalt Mixtures Volumetrics[a]		0.6–1.3 0.6–1.3 0.6–1.3	Report only	--

[a]Determine bulk specific gravity using AASHTO T 275.

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Minimum Quality Control Requirements for in Place HMA

Quality Characteristic	Test method	Minimum sampling and testing frequency	HMA-SP		
			Type A	RHMA-SP-G	OGFC
Percent of theoretical maximum density (%) by core[a, b,c]	California Test 375	2 per paving day (min.)	92–97	92–97	--
Percent of theoretical maximum density by Nuclear gauge (%)[a, b, d]	California Test 375	3 per 250 tons but not less than 3 per paving day	92–97	92–97	--
Hamburg wheel track (minimum number of passes at 0.5 inch average rut depth) PG 58 PG 64 PG-70 PG-76 or higher	AASHTO T 324 (Modified)[e]	One per 10,000 tons or 1 per project which-ever is more	 10,000 15,000 20,000 25,000	 15,000 20,000 25,000 --	--
Hamburg wheel track (inflection point minimum number of passes) PG 58 PG 64 PG-70 PG-76 or higher	AASHTO T 324 (Modified)[e]		 10,000 10,000 12,500 15,000	 10,000 12,500 15,000 --	--
Moisture susceptibility (minimum dry strength, psi)	AASHTO T 283[f,g]	One per 10,000 tons or 1 per project which-ever is more	110	110	--
Moisture susceptibility (minimum wet strength, psi)	AASHTO T 283[f,g]		84	84	--

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[a]Determine theoretical maximum density if any of the following applies:

1. 1/2-inch, 3/8-inch, or 1/4-inch grading is used and the specified total paved thickness is at least 0.15 foot.
2. 1- inch and 3/4-inch aggregate grading is used and the specified total paved thickness is at least 0.20 foot.

[b]Determine percent of theoretical maximum density under California Test 375 except use:

1. AASHTO T 275 to determine in-place density of each density core instead of using the nuclear gauge in Part 4, "Determining In-Place Density By The Nuclear Density Device."
2. AASHTO T 209 Method A to determine theoretical maximum density instead of calculating test maximum density in Part 5, "Determining Test Maximum Density."

[c]Determine theoretical maximum density under AASHTO T 209 Method A at the frequency specified for Test Maximum Density in California Test 375, Part 5.D. Use a digital manometer and a pycnometer when performing AASHTO T 209.

[d]Verify gauge correlation to cores every 10,000 tons utilizing the average of two cores.

[e]Test as specified in section ~~39-1.01D(1),~~39-1.03A

[f]Test specimen must be 100mm or 150mm gyratory compacted specimens

[g]Freeze thaw required.

Miscellaneous Minimum Quality Control Requirements

Quality Characteristic	Test method	Minimum sampling and testing frequency	HMA		
			Type A	RHMA-SP-G	OGFC
Smoothness	LP-13	--	12-foot straightedge, localized roughness, and MRI	12-foot straightedge, localized roughness, and MRI	12-foot straightedge, localized roughness, and MRI
Asphalt rubber binder viscosity @ 375 °F (centipoises)	LP-11	Once per hour, minimum of 1 test per batch	--	1,500 – 4,000	1,500 – 4,000
Asphalt modifier	ASTM D 445 ASTM D 92 ASTM D 2007	1 per truckload delivered to the RHMA-G-SP production facility	--	Section 39-1.07~~2~~D~~(2)~~(b)	Section 39-1.07~~2~~D~~(2)~~(b)
Crumb rubber modifier	LP-10 CT 208 ASTM D 297	1 per truckload delivered to the RHMA-G-SP production facility	--	Section 39-1.07~~2~~D~~(2)~~(~~e~~e)	Section 39-1.07~~2~~D~~(2)~~(~~e~~e)

Prepare briquettes for air voids content and VMA determination. Report the average of 3 tests.

For any quality characteristic except smoothness, if 2 consecutive quality control test results for 1 day's production do not comply with the specifications:

1. Notify the Engineer
2. Take corrective action
3. Show how you will comply with the specifications before resuming production and placement on the State highway

For any quality characteristic except smoothness, if any 3 quality control test results for 1 day's production do not comply with the specifications:

1. Stop production

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2. Notify the Engineer
3. Take corrective action
4. Show how you will comply with the specifications before resuming production and placement on the State highway

39-1.04G~~1D(6)~~ Asphalt Rubber Binder

Take asphalt rubber binder samples from the feed line connecting the asphalt rubber binder tank to the HMA plant. Sample and test asphalt rubber binder under Laboratory Procedure LP-11. Use an AASHTO-certified laboratory for testing.

Test asphalt rubber binder for compliance with the viscosity requirements in section 39-1.02D(2)(d). During asphalt rubber binder production and HMA production using asphalt rubber binder, measure viscosity every hour with not less than 1 reading for each asphalt rubber binder lot. Each asphalt binder lot consist of 1 or multiple batches of combined asphalt binder, asphalt modifier, and CRM proportioned under section 39-1.02J(3). Log the measurements with the corresponding time and asphalt rubber binder temperature.

Sample and test gradation and wire and fabric content of CRM once per 10,000 lbs. of scrap tire CRM and once per 3,400 lbs. of high natural CRM. Sample and test scrap tire CRM and high natural CRM separately.

39-1.04H~~1D(7)~~ Aggregate

Laboratories testing aggregate qualities and preparing the mix design and JMF must be qualified under AASHTO Materials Reference Laboratory program (AMRL), and the Department's Independent Assurance Program. Take samples under California Test 125.

Determine the aggregate moisture content in continuous mixing plants at a rate of 1 per 1500 tons and any remaining part.

39-1.04I~~1D(8)~~ Reclaimed Asphalt Pavement

Sample and test processed RAP at a minimum frequency of 1 sample per 1000 tons with a minimum of 6 samples per fractionated stockpile to assure that its asphalt binder content and specific gravity meet the processed RAP quality characteristics. If a fractionated RAP stockpile is augmented, sample and test processed RAP quality characteristics at a minimum frequency of 1 sample per 500 tons of augmented RAP.

The quality characteristic for processed RAP asphalt binder content must be within ± 2.0 percent of the average fractionated RAP stockpile asphalt binder content when tested under ASTM D 2172 (Method B). If new fractionated RAP stockpiles piles are required, the average binder content of the new fractionated RAP stockpile must be within ± 2.0 percent of the average binder content of the original fractionated RAP stockpile.

The quality characteristic for maximum specific gravity for processed RAP, must be within ± 0.06 when tested under AASHTO T 209, of the average maximum specific gravity reported on page 4 of your *Contractor Hot Mix Asphalt Design Data* form.

During production, sample RAP twice daily and perform QC testing for:

1. Aggregate gradation at least once a day under Laboratory Procedure LP-9
2. Moisture content at least twice a day

39-1.04J~~1D(9)~~ Liquid Antistrip Treatment

For continuous mixing and batch mixing operations, sample asphalt binder before adding LAS. For continuous mixing operations, sample combined asphalt binder and LAS after the static mixer.

39-1.04K~~1D(10)~~ Aggregate Lime Treatment

For lime slurry aggregate treatment and dry lime aggregate treatment with marination, sample and test before treatment at the minimum frequencies shown in the following table:

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Aggregate Quality Control During Lime Treatment

Quality characteristic	Test method	Minimum sampling and testing frequency
Sand equivalent	AASHTO T 176	Once per 750 tons of untreated aggregate
Percent of crushed particles	AASHTO T 335	One per 10,000 tons or 2 per project whichever is more
Los Angeles Rattler	AASHTO T 96	
Fine aggregate angularity	AASHTO T 304 method A	
Flat and elongated particles	ASTM D4791	

Note: During lime treatment, sample coarse and fine aggregate from individual stockpiles. Combine aggregate in the JMF proportions. Run tests for aggregate quality in triplicate and report test results as the average of 3 tests.

For lime slurry aggregate treatment, determine the aggregate moisture content at least once during each 2 hours of treatment. Calculate moisture content under AASHTO T 329 and report it as a percent of dry aggregate weight. Use the moisture content calculations as a set point for the proportioning process controller.

39-1.05~~1D(11)~~ Production Start-up Evaluation

The Engineer evaluates HMA production and placement at production start-up.

Within the first 750 tons produced on the first day of HMA production, in the Engineer's presence and from the same production run, take samples of:

1. Aggregate
2. Asphalt binder
3. RAP
4. HMA

Sample aggregate from cold feed belts or hot bins. Take RAP samples from the RAP system. Sample HMA under California Test 125. You must identify your sampling location in your Quality Control Plan.

For aggregate, RAP, and HMA, split the samples into at least 4 parts and label their containers. Submit 3 split parts to the Engineer and keep 1 part.

You and the Engineer must test the split samples and report test results within 3 business days of sampling. If you proceed before receipt of the test results, the Engineer may consider the HMA placed to be represented by these test results.

Take 4-inch or 6-inch diameter density cores within the first 750 tons on the first day of HMA production. For each density core, the Engineer reports the bulk specific gravity determined under AASHTO T 275, Method A in addition to the percent of theoretical maximum density. You must test for in-place density at the density core locations and include them in your production tests for percent of theoretical maximum density.

39-1.05A~~1D(12)~~ Nuclear Gauge Density

During HMA placement determine HMA density using a nuclear gauge. On the 1st day of production, develop a correlation factor between cores and nuclear gauge under California Test 375.

Take a minimum of 3 nuclear gauge density readings for every 250 tons of HMA placed at random locations you select.

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39-1.05B~~1D(13)~~ Smoothness

39-1.05B(1)~~1D(13)a~~ General

Section 39-1.01D(13) includes specifications for measuring pavement smoothness with an inertial profiler (IP) and straightedge, analyzing the data with FHWA's engineering software ProVAL, and correcting deficient smoothness.

Test pavement smoothness using an IP except use a 12-foot straightedge at the following locations:

1. Traffic lanes less than 1,000 feet in length including ramps, turn lanes, and acceleration and deceleration lanes
2. HMA pavement within 3 feet from and parallel to the construction joint formed between curbs, gutters, or existing pavement
3. Areas within 15 feet of manholes
4. Shoulders
5. Weigh-in-motion areas
6. Miscellaneous areas such as medians, gore areas, turnouts, and maintenance pullouts

Where IP testing is required, pavement smoothness for each lane must be determined by the international roughness index (IRI) for the left and right wheel paths in an individual lane and then averaging the results. The average of the IRIs from the left and right wheel paths for the same lane is the mean roughness index (MRI) of the lane. The wheel paths are a pair of lines 3 feet from and parallel to the edge of a lane. Left and right wheel paths are based on the direction of travel.

Where IP testing is required, identify areas of localized roughness. Areas of localized roughness must be identified using the ProVAL smoothness assurance analysis by calculating continuous IRI for each wheel path with a 25-foot interval using a 250 mm filter.

Collect profiling data under AASSHTO R 56 and analyze data using 250 mm and IRI filters.

39-1.05B(2)~~1D(13)b~~ Inertial Profiler Calibration and Verification Tests

IP equipment must display a current certification decal with expiration date.

Operate the IP according to the manufacturer's recommendations and AASHTO R57-10 at 1-inch recording intervals.

Notify the Engineer 2 business days before performing IP calibration and verification testing.

Conduct the following IP calibration and verification tests in the Engineer's presence each day before performing inertial profiling:

1. Block test. Verify the height sensor accuracy under AASHTO R57-10, section 5.3.2.3.
2. Bounce test. Verify the combined height sensor and accelerometer accuracy under AASHTO R57-10, section 5.3.2.3.2.
3. DMI test. Calibrate the accuracy of the testing procedure under AASHTO R56-10, section 8.4.
4. Manufacturer's recommended tests.

Conduct cross correlation IP verification test in the Engineer's presence before performing initial profiling. Verify cross correlation IP verification test at least annually. Conduct 5 repeat runs of the IP on an authorized test section. The test section must be on an existing asphalt concrete pavement surface 0.1 mile long. Calculate a cross correlation to determine the repeatability of your device under Section 8.3.1.2 of AASHTO R56-10 using ProVAL profiler certification analysis with a 3 feet maximum offset. The cross correlation must be a minimum of 0.92.

For each 0.1 mile section, your IRI values must be within 10 percent of the Department's IRI values. The Engineer may order you to recalibrate your IP equipment and reprofile. If your results are inaccurate due to operator error, the Engineer may disqualify your IP operator.

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39-1.05B(3)~~1D(13)c~~ Acceptance Criteria

For areas that require pavement smoothness determined using an IP, the pavement surface must:

1. Have no areas of localized roughness with an IRI greater than 120 in/mi
2. Comply with the MRI requirements shown in the following tables for a 0.1 mile section:

HMA[a] Pavement Smoothness Acceptance Criteria

HMA thickness	MRI requirement
> 0.20 foot	60 in/mi or less
≤0.20 foot	75 in/mi or less

[a] Except OGFC

OGFC Pavement Smoothness Acceptance Criteria

OGFC placement on	MRI requirement
New construction, or HMA overlay	60 in/mi or less
Existing pavement	75 in/mi or less
Milled surface	75 in/mi or less

For areas that require pavement smoothness determined using a 12-foot straightedge, the HMA pavement surface must not vary from the lower edge of the straightedge by more than:

1. 0.01 foot when the straightedge is laid parallel with the centerline
2. 0.02 foot when the straightedge is laid perpendicular to the centerline and extends from edge to edge of a traffic lane
3. 0.02 foot when the straightedge is laid within 24 feet of a pavement conform

Pavement smoothness may be accepted based on your testing in the absence of the Department's testing.

39-1.05B(4)~~1D(13)d~~ Smoothness Testing

Notify the Engineer of start location by station and start time at least 2 business days before profiling.

Remove foreign objects on the pavement surface before profiling.

Mark the beginning and ending station on the pavement shoulder before profiling. Stationing must be the same when profiling more than one surface.

39-1.05B(5)~~1D(13)e~~ Inertial Profiler

While collecting the profile data to determine IRI, record the following locations in the raw profile data:

1. Begin and end of all bridge approach slabs
2. Begin and end of all bridges
3. Begin and end of all culverts visible on the roadway surface

Determine the MRI for 0.1-mile fixed sections using the ProVAL ride quality analysis with a 250 mm filter. Profile the left and right wheel paths of each lane. Calculate the MRI of each lane. A partial section less than 0.1 mile that is the result of an interruption to continuous pavement surface must comply with the MRI specifications for a full section. Adjust the MRI for a partial section to reflect a full section based on the proportion of a section paved.

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Determine the areas of localized roughness using a continuous IRI for each wheel path with a 25-foot interval using a 250 mm filter. Localized roughness greater than 120 in/mi must be corrected regardless of the IRI values of a 0.1-mile section.

Determine the MRI of the HMA, except OGFC. If the MRI of the final pavement surface is greater than the MRI acceptance requirement in the table titled "HMA Pavement Smoothness Acceptance Criteria" in section ~~39-1.01D(13)d~~39-1.05B(3), correct to the MRI acceptance requirement in the table.

The final surface of HMA must meet MRI acceptance requirements in the table titled "HMA Pavement Smoothness Acceptance Criteria" in section ~~39-1.01D(13)d~~39-1.05B(3) before placing HMA-O or RHMA-O.

Determine the MRI of the OGFC. If OGFC MRI is greater than the accepted value in the table titled "OGFC Pavement Smoothness Acceptance Criteria" in section ~~39-1.01D(13)c~~39-1.05B(3), correct to the MRI acceptance requirement in the table.

39-1.05B(6)~~1D(13)f~~ Straightedge

Measure areas that require 12-foot straightedge. If the straightedge measurement is greater than the accepted value in section ~~39-1.01D(13)a~~39-1.05B(1) , correct to the acceptance requirement.

39-1.05B(7)~~1D(13)g~~ Smoothness Correction

If the final surface of the pavement does not comply with section ~~39-1.01D(13)g~~39-1.05B(4), grind the pavement to within specified tolerances, remove and replace it, or place an overlay of HMA. Do not start corrective work until your method is authorized.

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Smoothness correction of the final pavement surface must leave at least 75 percent of the specified HMA thickness. If ordered, core the pavement at the locations determined by the Engineer. Coring, including traffic control, is change order work. Remove and replace deficient pavement areas where the overlay thickness is less than 75 percent of the thickness specified as determined by the Engineer.

If you choose to correct OGFC, the Engineer determines if the corrective method causes raveling. OGFC that is raveling must be removed and replaced.

Corrected HMA pavement areas must be uniform rectangles with edges:

1. Parallel to the nearest HMA pavement edge or lane line
2. Perpendicular to the pavement centerline

On ground areas not to be overlaid with OGFC, apply fog seal coat under section 37-2.

Where corrections are made within areas requiring testing with IP, reprofile the entire lane length with the IP device.

Where corrections are made within areas requiring testing with a 12-foot straightedge, retest the corrected area with the straightedge.

Use for HMA overlays including OGFC. Include bid items 390011, Prepaving Inertial Profiler.

39-1.05B(8)~~1D(13)h~~ Prepaving Inertial Profiler

Section ~~39-1.01D(13)i~~39-1.05B(9) applies to existing asphalt concrete areas receiving an HMA overlay. Comply with section ~~39-1.01D(13)a, 39-1.01D(13)c, and 39-1.01D(13)e~~ 39-1.05B(1), 39-1.05B(3) and 39-1.05(5) .

Before starting paving operations, perform prepaving IP measurements. Prepaving IP includes taking profiles of the existing pavement, analyzing the data with ProVAL to determine existing pavement IRI, MRI, and areas of localized roughness.

Identify areas of localized roughness greater than 140 in/mi.

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Use when the project includes an overlay:
1. Less than or equal to 0.20 foot thick
2. Without cold planning or milling
3. With existing average IRI from 100 in/mi to 170 in/mi
Include bid item 390020, Prepaving Grinding Day and SSP 39-6, pars. 4 and 5. The quantity for prepaving grinding day must be 3 or more.

39-1.05B(9)1D(13)i Prepaving Grinding

Section 39-1.01D(13)j 39-1.05B(9) applies to existing asphalt concrete areas receiving an HMA overlay of less than or equal to 0.20 foot.

Correct areas of localized roughness greater than 140 in/mi.

Prepaving grinding day includes correcting areas of localized roughness, taking profiles of the corrected areas, and submitting profile data as specified in section 39-1.01D(13)b 39-1.02N .

Notify the Engineer of those areas of localized roughness that cannot be corrected by prepaving grinding. The Engineer responds to your notification within 5 business days.

For those areas of localized roughness that cannot be corrected by grinding, the Engineer may order you to either (1) not correct the areas of localized roughness or (2) correct areas of localized roughness by a different method and take profiles of the corrected areas with an IP.

Corrective work not performed by prepaving grinding, including taking profiles of the corrected areas and associated traffic control, is change order work.

Correct prepaving areas of localized roughness that you predict will cause the final surface of HMA pavement to be noncompliant with the smoothness specifications. After correcting prepaving areas of localized roughness, take profiles of the corrected areas and submit profile data as specified in section 39-1.01D(13)b 39-1.02N .

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Dispose of grinding residue.

Pave within 7 days of correcting areas.

The final pavement surface must comply with section 39-1.01D(13)c 39-1.05B(3) .

If ordered not to correct areas of localized roughness, the smoothness specifications do not apply to the final pavement surface placed in those areas.

39-1.05C1D(14) Density Cores

Take 4-inch or 6-inch density cores to determine percent of theoretical maximum density. Take a minimum of 2 density cores each paving day from random locations you select. Backfill and compact holes with authorized material.

39-1.05D1D(15) Data Cores

Data core summary and data core digital photographs are required to document the pavement structural section. Take data cores that include the completed HMA pavement, underlying base, and subbase material. Protect data cores and surrounding pavement from damage.

Take 4-inch or 6-inch diameter data cores:

1. At the beginning, end, and every 1/2 mile within the paving limits of each route on the project
2. After all paving is complete
3. From the center of the specified lane

On a 2-lane roadway, take data cores from either lane. On a 4-lane roadway, take data cores from each direction in the outermost lane. On a roadway with more than 4 lanes, take data cores from the median lane and the outermost lane in each direction. After coring, backfill and compact core holes with authorized material.

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Each core must include the stabilized materials encountered. You may choose not to recover unstabilized material but you must identify the material. Unstabilized material includes:

1. Granular material
2. Crumbled or cracked stabilized material
3. Sandy or clayey soil

Prepare a summary for each data core, the summary must include:

1. Project identification number
2. Date cored
3. Core identification number
4. Type of materials recovered
5. Type and approximate thickness of unstabilized material not recovered
6. Total core thickness
7. Thickness of each individual material to within:
   7.1. For recovered material, 1/2 inch
   7.2. For unstabilized material, 1.0 inch
8. Location including:
   8.1. County
   8.2. Route
   8.3. Post mile
   8.4. Lane number
   8.5. Lane direction
   8.6. Station

Each data core digital photograph must include a ruler laid next to the data core. Each photograph must include:

1. The core
2. Project identification number
3. Core identification number
4. Date cored
5. County
6. Route
7. Post mile
8. Lane number
9. Lane direction

After data core summary and photograph submittal, dispose of cores.

39-1.06~~1D(16)~~ Engineer's Acceptance

The Engineer samples materials for testing under California Test 125 and tests under the applicable test method except samples may only be taken from one of the following:

1. ~~Plant, a truck, or a~~Automatic sampling device, with sample taken from truck
2. Mat behind the paver

The Engineer's sampling and testing is independent of your QC sampling and testing, statistically-based, and random.

If you request, the Engineer splits samples and provides you with a part.

The Engineer prepares 3 briquettes for air voids content and VMA determination. The Engineer reports the average of 3 tests.

The Engineer accepts HMA based on:

1. Accepted JMF
2. Authorized QC plan
3. Visual inspection

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4. Compliance quality characteristics of the following 4 tables:

HMA Aggregate Acceptance

Quality characteristic	Test method	HMA-SP (Type A)	HMA-SP RHMA-SP-G	HMA-SP OGFC
Aggregate gradation[a, b]	AASHTO T 27	JMF ± Tolerance[c]	JMF ± Tolerance[c]	JMF ± Tolerance[c]
Sand equivalent (min.)[d]	AASHTO T 176	47	47	--
Percent of crushed particles Coarse aggregate (%, min.) One fractured face Two fractured faces Fine aggregate (%, min) (Passing No. 4 sieve and retained on No. 8 sieve.) One fractured face	AASHTO T 335	 95 90 70	 -- 90 70	 90 90 90
Los Angeles Rattler (%, max.) Loss at 100 rev. Loss at 500 rev.	AASHTO T 96	 12 40	 12 40	 12 40
Fine aggregate angularity (%, min.)	AASHTO T 304 Method A	45	45	--
Flat and elongated particles (%, max. by weight @ 5:1) 1/4" and 3/8" gradings 1/2" and 3/4" gradings 1" grading	ASTM D 4791	 Report only Report only 10	 Report only Report only	Report only

[a]The Engineer determines combined aggregate gradations containing RAP under Laboratory Procedure LP-[illegible].
[b]"X" denotes the sieves the Engineer considers for the specified aggregate gradation.
[c]The tolerances must comply with the allowable tolerances in section ~~39-1.02E~~39-1.07E.
[d]The Engineer reports the average of 3 tests from a single split sample.

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HMA Mix Acceptance

Quality characteristic	Test method	HMA-SP		
		Type A	RHMA-SP-G	OGFC
Asphalt binder content (%)	AASHTO T 308 Method A	JMF -0.3, +0.5	JMF - 0.4, +0.5	JMF - 0.4, +0.5
HMA moisture content (%, max.)	AASHTO T 329	1.0	1.0	1.0
Air voids content (%) [a, b]	AASHTO T 269	4 ± 1.5	Specification ± 1.5	--
Voids in mineral aggregate, Laboratory produced HMA[d] (% min.)				
1/4" grading	SP-2 Asphalt Mixtures Volumetrics[c]		--	
3/8" grading		16.5-19.5	--	
1/2" grading		15.5-18.5		
3/4" grading		14.5-17.5	18.0–23.0	
1" grading		13.5-16.5	18.0–23.0	
with NMAS=1"		13.5-16.5		
with NMAS=3/4"		14.5-17.5		
Voids in mineral aggregate, Plant Produced HMA (% min.)				
1/4" grading	SP-2 Asphalt Mixtures Volumetrics[c]		--	
3/8" grading		15.5-18.5		
1/2" grading		14.5-17.5		
3/4" grading		13.5-16.5	18.0–23.0	
1" grading		12.5-15.5	18.0–23.0	
with NMAS=1"		12.5-15.5		
with NMAS=3/4"		13.5-16.5		
Dust proportion				
1/4" and 3/8" gradings	SP-2 Asphalt Mixtures Volumetrics[c]	0.6–1.3	Report only	--
1/2" and 3/4" gradings		0.6–1.3		
1" grading		0.6–1.3		
Percent of theoretical maximum density (%) by core[e f, g]	California Test 375	92–97	92–97	--

[a]The Engineer reports the average of 3 tests from a single split sample.

[b]The Engineer determines the bulk specific gravity of each lab-compacted briquette under AASHTO T 275 , and theoretical maximum specific gravity under AASHTO T 209, Method A.

[c]Determine bulk specific gravity using AASHTO T 275.

[d]The Engineer determines the laboratory prepared HMA value for mix design verification only.

[e]The Engineer determines percent of theoretical maximum density if any of the following:

1. 1/2-inch, 3/8-inch, or 1/4-inch grading is used and the specified total paved thickness is at least 0.15 foot.
2. 1 inch, and 3/4-inch aggregate grading is used and the specified total paved thickness is at least 0.20 foot.

[f]The Engineer determines percent of theoretical maximum density under California Test 375 except the Engineer uses:

1. AASHTO T 275 to determine in-place density of each density core instead of using the nuclear gauge in Part 4, "Determining In-Place Density By The Nuclear Density Device."
2. AASHTO T 209 Method A to determine theoretical maximum density instead of

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calculating test maximum density in Part 5, "Determining Test Maximum Density." The Engineer determines theoretical maximum density (AASHTO T 209 Method A) at the frequency specified for Test Maximum Density under California Test 375, Part 5. D.

HMA Acceptance In Place

Quality characteristic	Test method	HMA-SP		
		Type A	RHMA-SP-G	OGFC
Hamburg wheel track (minimum number of passes at 0.5 inch average rut depth)	AASHTO T 324 (Modified)[a]			
PG 58		10,000	15,000	--
PG 64		15,000	20,000	
PG-70		20,000	25,000	
PG-76 or higher		25,000	--	
Hamburg wheel track (inflection point minimum number of passes)	AASHTO T 324 (Modified)[a]			
PG 58		10,000	10,000	--
PG 64		10,000	12,500	
PG-70		12,500	15,000	
PG-76 or higher		15,000	--	
Moisture susceptibility (minimum dry strength, psi)	AASHTO T 283[b]	110	110	--
Moisture susceptibility (minimum wet strength, psi)	AASHTO T 283[b,c]	84	84	--

[a]Test as specified in section ~~39-1.01D(6)~~39-1.03A.
[b]Test specimens must be 100mm or 150mm gyratory compacted HMA
[c]Freeze thaw required.

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Miscellaneous Quality HMA Acceptance

Quality characteristic	Test method	HMA-SP		
		Type A	RHMA-SP-G	OGFC
Smoothness	LP-13	12-foot straightedge, localized roughness, and MRI	12-foot straightedge, localized roughness, and MRI	12-foot straightedge, localized roughness, and MRI
Asphalt rubber binder viscosity @ 375 °F (centipoises)	LP-11	--	1,500–4,000	1,500–4,000
Asphalt modifier	ASTM D 445 ASTM D 92 ASTM D 2007	--	Section 39-1.072D~~(2)~~(b)	Section 39-1.072D~~(2)~~(b)
Crumb rubber modifier	LP-10 CT 208 ASTM D 297	--	Section 39-1.072D~~(2)~~(b)	Section 39-1.072D~~(2)~~(ec)

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No single test result may represent more than the smaller of 750 tons or 1 day's production.

For any single quality characteristic except smoothness, if 2 acceptance test results for 1 day's production do not comply with the specifications:

1. Stop production.
2. Take corrective action.
3. In the Engineer's presence, take samples and split each sample into 4 parts. Test 1 part for compliance with the specifications and submit 3 parts to the Engineer. The Engineer tests 1 part for compliance with the specifications and reserves and stores 2 parts.
4. Demonstrate compliance with the specifications before resuming production and placement on the State highway.

The Engineer tests the density core you take from each 250 tons of HMA-SP (Type A), ~~HMA-SP (Type C)~~ and RHMA-SP-G production. The Engineer determines the percent of theoretical maximum density for each density core by determining the density core's density and dividing by the theoretical maximum density.

The Engineer determines the percent of theoretical maximum density from density cores taken from the final layer measured the full depth of the total paved HMA-SP (Type A), ~~HMA-SP (Type C)~~ and RHMA-SP-G thickness if any of the following applies:

1. 1-1/2-inch, 3/8-inch, or 1/4-inch aggregate grading is used and the specified total paved thickness is at least 0.15 foot and any layer is less than 0.15 foot.
2. 1-1 inch, or 3/4-inch aggregate grading is used and the specified total paved thickness is at least 0.20 foot and any layer is less than 0.20 foot.

If the percent of theoretical maximum density does not comply with the specifications, the Engineer may accept the HMA-SP (Type A), ~~HMA-SP (Type C)~~ and RHMA-SP-G and the Department deducts payment based on the factors shown in the following tables:

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Reduced Payment Factors for Percent of Theoretical Maximum Density

HMA-SP (Type A) and RHMA-SP-G Percent of Theoretical maximum density	Reduced Payment Factor	HMA-SP (Type A) and RHMA-G-SP Percent of Theoretical maximum density	Reduced Payment Factor
92.0	0.0000	97.0	0.0000
91.9	0.0125	97.1	0.0125
91.8	0.0250	97.2	0.0250
91.7	0.0375	97.3	0.0375
91.6	0.0500	97.4	0.0500
91.5	0.0625	97.5	0.0625
91.4	0.0750	97.6	0.0750
91.3	0.0875	97.7	0.0875
91.2	0.1000	97.8	0.1000
91.1	0.1125	97.9	0.1125
91.0	0.1250	98.0	0.1250
90.9	0.1375	98.1	0.1375
90.8	0.1500	98.2	0.1500
90.7	0.1625	98.3	0.1625
90.6	0.1750	98.4	0.1750
90.5	0.1875	98.5	0.1875
90.4	0.2000	98.6	0.2000
90.3	0.2125	98.7	0.2125
90.2	0.2250	98.8	0.2250
90.1	0.2375	98.9	0.2375
90.0	0.2500	99.0	0.2500
< 90.0	Remove and Replace	> 99.0	Remove and Replace

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Reduced Payment Factors for Percent of Theoretical Maximum Density

HMA-SP (Type C) Percent of Theoretical maximum density	Reduced Payment Factor	HMA-SP (Type C) Percent of Theoretical maximum density	Reduced Payment Factor
91.0	0.0000	96.0	0.0000
90.9	0.0125	96.1	0.0125
90.8	0.0250	96.2	0.0250
90.7	0.0375	96.3	0.0375
90.6	0.0500	96.4	0.0500
90.5	0.0625	96.5	0.0625
90.4	0.0750	96.6	0.0750
90.3	0.0875	96.7	0.0875
90.2	0.1000	96.8	0.1000
90.1	0.1125	96.9	0.1125
90.0	0.1250	97.0	0.1250
89.9	0.1375	97.1	0.1375
89.8	0.1500	97.2	0.1500
89.7	0.1625	97.3	0.1625
89.6	0.1750	97.4	0.1750
89.5	0.1875	97.5	0.1875
89.4	0.2000	97.6	0.2000
89.3	0.2125	97.7	0.2125
89.2	0.2250	97.8	0.2250
89.1	0.2375	97.9	0.2375
89.0	0.2500	98.0	0.2500
< 89.0	Remove and Replace	> 98.0	Remove and Replace

39-1.06A1D(17) Dispute Resolution

You and the Engineer must work together to avoid potential conflicts and to resolve disputes regarding test result discrepancies. Notify the Engineer within 5 business days of receiving a test result if you dispute the test result.

If you or the Engineer dispute each other's test results, submit quality control test results and copies of paperwork including worksheets used to determine the disputed test results. An independent third party (ITP) performs referee testing. Before the ITP participates in a dispute resolution, the ITP must be qualified under AASHTO Materials Reference Laboratory program (AMRL), and the Department's Independent Assurance Program. The ITP must be independent of the project. By mutual agreement, the ITP is chosen from:

1. A Department laboratory
2. A Department laboratory in a district or region not in the district or region the project is located
3. The Transportation Laboratory
4. A laboratory not currently employed by you or your HMA producer

If split QC or acceptance samples are not available, the ITP uses any available material representing the disputed HMA for evaluation.

39-1.072 MATERIALS

39-1.072A General

Use RAP aggregate for HMA-SP (Type A), and HMA-SP (Type C) as part of the virgin aggregate in a quantity up to a maximum of 25.0 percent of the aggregate blend.

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Do not use RAP aggregate for RHMA-SP-G and OGFC

For replace asphalt concrete surfacing use HMA-SP (Type A)

For the safety edge, use the same type of HMA used for the adjacent lane or shoulder.

For water injection WMA technology, the foaming bitumen must have the following quality characteristics:

Quality Requirements for Foaming Bitumen

Quality characteristic	Test method	Requirement
Expansion ratio (minimum)	LP-12	4
Half-life (seconds minimum)	LP-12	4

~~Use for OGFC if HMA is included in the project. Edit for type of HMA.~~

If OGFC is specified, t~~T~~reat aggregate for OGFC ~~aggregate~~ with the same antistrip treatment used for HMA .

For miscellaneous areas and dikes:

1. Choose the 3/8-inch or 1/2-inch HMA-SP (Type A) and aggregate gradations.
2. Minimum asphalt binder content must be 6.8 percent for 3/8-inch aggregate and 6.0 percent for 1/2-inch aggregate. If you request and the Engineer authorizes, you may reduce the minimum asphalt binder content.
3. Choose asphalt binder Grade PG 70-10 or use the same grade specified for HMA-SP.

39-1.072B Geosynthetic Pavement Interlayer

Geosynthetic pavement interlayer must comply with section 88 for paving fabric or paving mat.

39-1.072C Tack Coat

Tack coat must comply with the specifications for asphaltic emulsion or asphalt binder. Choose the type and grade.

Notify the Engineer if you dilute asphaltic emulsion with water. The weight ratio of added water to asphaltic emulsion must not exceed 1 to 1.

Measure added water either by weight or volume under section 9-1.02 or you may use water meters from water districts, cities, or counties. If you measure water by volume, apply a conversion factor to determine the correct weight.

With each dilution, submit:

1. Weight ratio of water to bituminous material in the original asphaltic emulsion
2. Weight of asphaltic emulsion before diluting
3. Weight of added water
4. Final dilution weight ratio of water to asphaltic emulsion

39-1.072D Asphalt Binder

39-1.072D(1) General

Asphalt binder in HMA must comply with section 92.

Use for HMA-SP (Type A). Enter asphalt binder grade. See Design Information Bulletin 86 to determine asphalt binder grade. Edit for multiple types and grades.

For HMA-SP (Type A), the grade of binder must be _____.

~~Use for HMA-SP (Type C). Enter asphalt binder grade. See Design Information Bulletin 86 to determine asphalt binder grade. Edit for multiple types and grades.~~

~~For HMA-SP (Type C), the grade of binder must be _____.~~

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Use for RHMA-SP-G. Enter asphalt binder grade. See Design Information Bulletin 86 to determine asphalt binder grade. Edit for multiple types and grades

For RHMA-SP-G, the grade of asphalt binder must be _____.

Use for HMA-O. Enter asphalt binder grade. See Design Information Bulletin 86 to determine asphalt binder grade. Edit for multiple binder grades.

For HMA-O, the grade of asphalt binder must be __.

Use for RHMA-O. Enter asphalt binder grade. See Design Information Bulletin 86 to determine asphalt binder grade. Edit for multiple binder grades.

For RHMA-O, the grade of asphalt binder must be __.

Use for replace asphalt surfacing. Use HMA-SP (Type A). Enter asphalt binder grade. Use PG64-16 or PG70-10 . Edit for multiple types and grades.

For replace asphalt surfacing, the grade of binder must be _____.

Asphalt binder for geosynthetic pavement interlayer must comply with section 92. Choose from Grades PG 64-10, PG 64-16, or PG 70-10.

LAS-treated asphalt binder must comply with the specifications for asphalt binder. Do not use LAS as a substitute for asphalt binder.

39-1.07~~2~~D(~~2~~) Asphalt Rubber Binder

39-1.07~~2~~D(~~2~~)(a) General

Use asphalt rubber binder in RHMA-SP-G, and RHMA-O. Asphalt rubber binder must be a combination of:

1. Asphalt binder
2. Asphalt modifier
3. CRM

The combined asphalt binder and asphalt modifier must be 80.0 ± 2.0 percent by weight of the asphalt rubber binder.

~~Pars. 1 and 2. Use for or RHMA-SP-G.~~

~~5. Edit the percent air voids in item 5. Determine percent air voids based on the following table:~~

~~Traffic~~	~~Region~~			
~~Index (10 yr)~~	~~Mountain~~	~~Valley~~	~~Coastal~~	~~Desert~~
~~0 - 5~~	~~3.0~~	~~3.0~~	~~3.0~~	~~3.0~~
~~5 - 10~~	~~4.0~~	~~4.0~~	~~4.0~~	~~5.0~~
~~>10~~	~~4.0~~	~~5.0~~	~~5.0~~	~~5.0~~

~~1~~

Determine the amount of asphalt rubber binder to be mixed with the aggregate for RHMA-SP-G as follows:

1. Base the calculations on the average of 3 briquettes produced at each asphalt rubber binder content.
2. Plot asphalt rubber binder content versus average air voids content for each set of three specimens and connect adjacent points with a best-fit curve.
3. Calculate voids in mineral aggregate (VMA) for each specimen, average each set, and plot the average versus asphalt rubber binder content.
4. Calculate the dust proportion and plot versus asphalt rubber binder content.
5. From the curve plotted in Step 2, select the theoretical asphalt rubber binder content at: ~~that has ___ percent air voids.~~
   5.1 4% air voids for PG64-16 or less.
   5.2 5% air voids for PG70-10 or greater.

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6. At the selected asphalt rubber binder content, evaluate corresponding dust proportion to verify compliance with requirements. If necessary, develop an alternate composite aggregate gradation to conform to the RHMA-SP-G requirements.
7. Record the asphalt rubber binder content in Step 5 as the Optimum Bitumen Content (OBC).
8. To establish a recommended range, use the OBC as the high value and 0.2 percent less as the low value. The recommended range must not extend below 7.5 percent by total weight of the mix. If the OBC is 7.5 percent, then there is no recommended range, and 7.5 percent is the recommended value.

2

Laboratory mixing and compaction must comply with AASHTO R 35, except the mixing temperature of the aggregate must be between 300 degrees F and 325 degrees F. The mixing temperature of the asphalt rubber binder must be between 375 degrees F and 425 degrees F. The compaction temperature of the combined mixture must be between 290 degrees F and 320 degrees F.

39-1.07~~2~~D(~~2~~)(b) Asphalt Modifier

Asphalt modifier must be a resinous, high flash point, and aromatic hydrocarbon and comply with:

Asphalt Modifier for Asphalt Rubber Binder

Quality characteristic	Test method	Requirement
Viscosity, m^2/s (x 10^{-6}) at 100 °C	ASTM D 445	X ± 3[a]
Flash Point, CL.O.C., °C	ASTM D 92	207 minimum
Molecular Analysis		
Asphaltenes, percent by mass	ASTM D 2007	0.1 maximum
Aromatics, percent by mass	ASTM D 2007	55 minimum

[a]The symbol "X" is the proposed asphalt modifier viscosity. "X" must be between 19 and 36. A change in "X" requires a new asphalt rubber binder design.

Asphalt Rubber Binder Reaction Design Profile

Test	Minutes of reaction [a]							Limits
	45	60	90	120	240	360	1440	
Cone penetration @ 77 °F, 0.10-mm (ASTM D 217)	X[b]				X		X	25–70
Resilience @ 77 °F, percent rebound (ASTM D 5329)	X				X		X	18 min.
Field softening point, °F (ASTM D 36)	X				X		X	125–165
Viscosity, centipoises (LP-11)	X	X	X	X	X	X	X	1,500–4,000

[a] Six hours (360 minutes) after CRM addition, reduce the oven temperature to 275 °F for 16 hours. After the 16-hour (1,320-minutes) cool down after CRM addition, reheat the binder to the reaction temperature expected during production for sampling and testing at 24 hours (1,440 minutes).
[b] "X" denotes required testing

Asphalt rubber modifier must be from 2.0 percent to 6.0 percent by weight of the asphalt binder in the asphalt rubber binder.

39-1.07~~2~~D(~~2~~)(c) Asphalt Rubber Binder Design and Profile

Submit a proposal for asphalt rubber binder design and profile. In the design, include the asphalt, asphalt

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modifier, and CRM and their proportions. The profile is not a performance specification and only serves to indicate expected trends in asphalt rubber binder properties during binder production. The profile must include the same component sources for the asphalt rubber binder used.

Design the asphalt rubber binder from testing you perform for each quality characteristic and for the reaction temperatures expected during production. The 24-hour (1,440-minute) interaction period determines the design profile. At a minimum, mix asphalt rubber binder components, take samples, and perform and record the tests shown in the following table:

39-1.07D(2)(d) Asphalt Rubber Binder

After interacting for at least 45 minutes, asphalt rubber binder must have the values for the quality characteristics shown in the following table:

Asphalt Rubber Binder

Quality characteristic	Test for quality control or acceptance	Test method	Value	
			Minimum	Maximum
Cone penetration @ 77 °F, 0.10 mm	Acceptance	ASTM D 217	25	70
Resilience @ 77 °F, percent rebound	Acceptance	ASTM D 5329	18	--
Field softening point, °F	Acceptance	ASTM D 36	125	165
Viscosity @ 375 °F, centipoises	Quality control	LP-11	1,500	4,000

39-1.07~~2~~D~~(2)~~(e) Crumb Rubber Modifier

CRM must consist of a ground or granulated combination of scrap tire CRM and high natural CRM. CRM must be 75.0 ± 2.0 percent scrap tire CRM and 25.0 ± 2.0 percent high natural CRM by total weight of CRM. Scrap tire CRM must be from any combination of automobile tires, truck tires, or tire buffings.

Sample and test scrap tire CRM and high natural CRM separately. CRM must comply with:

Crumb Rubber Modifier for Asphalt Rubber Binder

Quality characteristic	Test method	Requirement
Scrap tire CRM gradation (% passing No. 8 sieve)	LP-10	100
High natural CRM gradation (% passing No. 10 sieve)	LP-10	100
Wire in CRM (% max.)	LP-10	0.01
Fabric in CRM (% max.)	LP-10	0.05
CRM particle length (inch max.) [a]	--	3/16
CRM specific gravity [a]	California Test 208	1.1 – 1.2
Natural rubber content in high natural CRM (%) [a]	ASTM D 297	40.0 – 48.0

[a] Test at mix design and for Certificate of Compliance.

Only use CRM ground and granulated at ambient temperature. If steel and fiber are cryogenically separated, it must occur before grinding and granulating. Only use cryogenically produced CRM particles that can be ground or granulated and not pass through the grinder or granulator.

CRM must be dry, free-flowing particles that do not stick together. CRM must not cause foaming when combined with the asphalt binder and asphalt modifier. You may add calcium carbonate or talc up to 3 percent by weight of CRM.

39-1.07~~2~~E Aggregate

Aggregate must be clean and free from deleterious substances.

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Gradations are based on nominal maximum aggregate size (NMAS).

Use for HMA-SP (Type A). Enter the aggregate grading. Edit for multiple types and grades. Use the following table to determine the HMA grading.

Specified Total Thickness Range	Grading
0.08 foot – 0.125 foot	3/8-inch
0.125 foot – 0.20 foot	1/2-inch
0.20 foot and above	3/4-inch
DME must approve use	1-inch

The aggregate for HMA-SP (Type A) must comply with the _____ grading.

~~**Use for HMA-SP (Type C). Enter the aggregate grading. Use the following table to determine the HMA grading.**~~

~~Specified Total Thickness Range~~	~~Grading~~
~~0.25 foot and above. DME must approve use~~	~~1-inch~~

~~The aggregate for HMA-SP (Type C) must comply with the _____ grading.~~

Use for RHMA-SP-G. Edit for aggregate grading. Use "1/2-inch" grading if layer thickness is at least 0.10 foot and use "3/4-inch" grading if layer thickness is at least 0.20 foot. Edit for multiple grading.

The aggregate for RHMA-SP-G must comply with the _____ grading.

Use for HMA-O Edit for grading including multiple gradings. Use "3/8-inch" grading when layer thickness is from 0.06 foot to 0.08 foot. Use "1/2-inch" grading when layer thickness is 0.08 foot or more. With approval from the District Materials Engineer, use a "1-inch" grading when layer thickness is from 0.17 foot to 0.25 foot.

The aggregate for HMA-O must comply with the _____ grading.

Use for RHMA-O Edit for grading including multiple gradings. Use "3/8-inch" grading when layer thickness is from 0.06 foot to 0.08 foot. Use "1/2-inch" grading when layer thickness is 0.08 foot or more. Do not use "1-inch" grading

The aggregate for RHMA-O must comply with the _____ grading.

Use for HMA-SP (Type A). placed on bridge decks. Enter the aggregate grading. Edit for multiple types and grades. Use the following table to determine the HMA grading.

Specified Total Thickness Range	Grading
0.08 foot – 0.125 foot	3/8-inch
0.125 foot – 0.20 foot	1/2-inch
0.20 foot and above	3/4-inch

The aggregate for HMA-SP-(Type A) placed on the bridge decks must comply with the _____ grading.

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Use for replace asphalt concrete surfacing, HMA-SP (Type A). Enter the aggregate grading. Use the following table to determine the HMA grading.

Specified Total Thickness Range	Grading
0.08 foot – 0.125 foot	3/8-inch
0.125 foot – 0.20 foot	1/2-inch
0.20 foot and above	3/4-inch

The aggregate for replace asphalt concrete surfacing, HMA-SP-(Type A) must comply with the grading.

Aggregate gradation must be within the TV limits for the specified sieve size shown in the following tables:

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Aggregate Gradation
(Percentage Passing)
HMA-SP (Type A)

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1 inch HMA-SP (Type A)

Sieve Sizes	Target Value Limits	Allowable Tolerance
1"	100	—
3/4"	88-93	TV ± 5
1/2"	72-85	TV ± 6
3/8"	55-70	TV ± 6
No. 4	35-52	TV ± 7
No. 8	22-40	TV ± 5
No. 30	8-24	TV ± 4
No. 200	3–7	TV ± 2

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3/4-inch HMA-SP (Type A)

Sieve Sizes	Target Value Limits	Allowable Tolerance
1"	100	—
3/4"	90–98	TV ± 5
1/2"	70–90	TV ± 6
No. 4	42–58	TV ± 5
No. 8	29–43	TV ± 5
No. 30	10–23	TV ± 4
No. 200	2–7	TV ± 2

1/2-inch HMA-SP (Type A)

Sieve Sizes	Target Value Limits	Allowable Tolerance
3/4"	100	--
1/2"	95–98	TV ± 5
3/8"	72–85	TV ± 5
No. 4	52–69	TV ± 5
No. 8	35–55	TV ± 5
No. 30	15–30	TV ± 4
No. 200	2–8	TV ± 2

3/8-inch HMA-SP (Type A)

Sieve Sizes	Target Value Limits	Allowable Tolerance
1/2"	100	--
3/8"	95–98	TV ± 5
No. 4	55–75	TV ± 5
No. 8	30–50	TV ± 5
No. 30	15–35	TV ± 5
No. 200	2–9	TV ± 2

1/4-inch HMA-SP (Type A)

Sieve Sizes	Target Value Limits	Allowable Tolerance
3/8"	100	--
No. 4	95–98	TV ± 5
No. 8	70–80	TV ± 6
No. 30	34–45	TV ± 5
No. 200	2–12	TV ± 4

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(Percentage Passing)
RHMA-SP-G

1-inch HMA-SP (Type C)

Sieve Sizes	Target Value Limits	Allowable Tolerance
1"	100	—
3/4"	88-93	TV ± 5
1/2"	72-85	TV ± 6
3/8"	55-70	TV ± 6
No. 4	35-52	TV ± 7
No. 8	22-40	TV ± 5
No. 30	8-24	TV ± 4
No. 200	3–7	TV ± 2

Aggregate Gradation
(Percentage Passing)
Rubberized Hot Mix Asphalt - Gap Graded (RHMA-SP-G)

3/4-inch RHMA-SP-G

Sieve Sizes	Target Value Limits	Allowable Tolerance
1"	100	--
3/4"	95–98	TV ± 5
1/2"	83–87	TV ± 6
3/8"	65–70	TV ± 5
No. 4	28–42	TV ± 6
No. 8	14–22	TV ± 5
No. 200	0–6	TV ± 2

1/2-inch RHMA-SP-G

Sieve Sizes	Target Value Limits	Allowable Tolerance
3/4"	100	--
1/2"	90–98	TV ± 6
3/8"	83–87	TV ± 5
No. 4	28–42	TV ± 6
No. 8	14–22	TV ± 5
No. 200	0–6	TV ± 2

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Aggregate Gradation
(Percentage Passing)
Open Graded Friction Course (OGFC)

1-inch OGFC

Sieve Sizes	Target Value Limits	Allowable Tolerance
1 1/2"	100	--
1"	99–100	TV ± 5
3/4"	85–96	TV ± 5
1/2"	55–71	TV ± 6
No. 4	10–25	TV ± 7
No. 8	6–16	TV ± 5
No. 200	1–6	TV ± 2

1/2-inch OGFC

Sieve Sizes	Target Value Limits	Allowable Tolerance
3/4"	100	--
1/2"	95–100	TV ± 5
3/8"	78–89	TV ± 6
No. 4	28–37	TV ± 7
No. 8	7–18	TV ± 5
No. 30	0–10	TV ± 4
No. 200	0–3	TV ± 2

3/8-inch OGFC

Sieve Sizes	Target Value Limits	Allowable Tolerance
1/2"	100	--
3/8"	90–100	TV ± 6
No. 4	29–36	TV ± 7
No. 8	7–18	TV ± 6
No. 30	0–10	TV ±5
No. 200	0–3	TV ± 2

Aggregate gradation must be before the addition of asphalt binder and must include supplemental fines. The Engineer tests for aggregate grading under AASHTO T 27, note 4, and AASHTO T 11 do not apply. Use a mechanical sieve shaker. Aggregate shaking time must not exceed 10 minutes for both course and fine aggregate portions.

Choose a sieve size TV within each target value limits shown in the tables titled "Aggregate Gradation."

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Before the addition of asphalt binder and lime treatment, aggregate must comply with:

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Aggregate Quality

Quality characteristic	Test method	HMA-SP		
		Type A	RHMA-G-SP	OGFC
Percent of crushed particles Coarse aggregate (% min.) One fractured face Two fractured faces Fine aggregate (% min) (Passing No. 4 sieve and retained on No. 8 sieve.) One fractured face	AASHTO T 335	 95 90 70	 -- 90 70	 90 90 90
Los Angeles Rattler (% max.) Loss at 100 Rev. Loss at 500 Rev.	AASHTO T 96	 12 40	 12 40	 12 40
Sand equivalent (min.)[a, b]	AASHTO T 176	47	47	--
Fine aggregate angularity (% min.)	AASHTO T 304 Method A	45	45	--
Flat and elongated particles (% max. by weight @ 5:1)	ASTM D 4791	10	10	10

[a]Reported value must be the average of 3 tests from a single sample.
[b]Use of a Sand Reader Indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, 4.8, 7.1.2, 8.4.2 and 8.4.3 do not apply

39-1.072F Reclaimed Asphalt Pavement

For HMA-SP (Type A), and ~~HMA-SP (Type C)~~ substitute RAP aggregate for part of the virgin aggregate in a quantity up to a maximum of 25.0 percent of the aggregate blend.

Provide enough space for meeting all RAP handling requirements at your facility. Provide a clean, graded base, well drained area for stockpiles.

If RAP is from multiple sources blend the RAP thoroughly and completely before fractionating.

Fractionate RAP stockpiles into 2 sizes, a coarse fraction RAP retained on 3/8-inch screen, and a fine fraction RAP passing 3/8-inch screen. ***The Contractor may use coarse, fine or any combination thereof not to exceed the maximum specified RAP content.***

RAP Stockpile Fractionation Gradation Requirements

Quality Characteristic	Test Method	Requirement
Coarse	California Test 202[a]	100% passing the 1inch screen
Fine	California Test 202 [a]	98%-100% passing the 3/8 inch screen

[a]Maximum mechanical shaking time is 10 minutes

Isolate the processed RAP stockpiles from other materials. Store processed RAP in conical or longitudinal stockpiles. Processed RAP must not be agglomerated or be allowed to congeal in large stockpiles.

39-1.072G Liquid Antistrip

LAS total amine value must be 325 minimum when tested under ASTM D 2074.

Use only 1 LAS type or brand at a time. Do not mix LAS types or brands.

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Store and mix LAS under the manufacturer's instruction.

39-1.072H Lime

Lime for treating aggregate must be high-calcium hydrated lime and comply with section 24-2.02B.

39-1.072I Water

Water for lime treated aggregate must comply with section 24-2.02C.

39-1.082J Hot Mix Asphalt Production

39-1.08A2J(1) General

Produce HMA in a batch mixing plant or a continuous mixing plant.

HMA plants must be Department-qualified. Before production, the HMA plant must have a current qualification under the Department's Materials Plant Quality Program.

Weighing and metering devices used for the production of additive enhanced HMA must comply with the requirements of the MPQP. If a loss-in-weight meter is used for dry HMA additive, the meter must have an automatic and integral material delivery control system for the refill cycle

Proportion aggregate by hot or cold feed control. During production, you may adjust hot or cold feed proportion controls for virgin aggregate and RAP.

For HMA produced using WMA technology production of HMA must be at a temperature between 240 and 325 degrees F.

For the Method compaction, HMA produced using WMA technology must be produced at the temperatures specified in section 39-1.03C(2)

HMA-SP (Type A), and HMA-SP (Type C) will not exceed 25 percent RAP, by weight of the virgin aggregate. Do not use RAP with RHMA-SP-G, RHMA-O or OGFC.

39-1.08B2J(2) Mixing

Mix HMA ingredients into a homogeneous mixture of coated aggregates.

Asphalt binder must be from 275 to 375 degrees F when mixed with aggregate.

Asphalt rubber binder must be from 375 to 425 degrees F when mixed with aggregate.

When mixed with asphalt binder, aggregate must not be more than 325 degrees F except aggregate for OGFC with unmodified asphalt binder must be not more than 275 degrees F. Aggregate temperature specifications do not apply to RAP.

HMA must not be more than 325 degrees F.

39-1.08C2J(3) Asphalt Rubber Binder

Asphalt rubber binder blending plants must be authorized under the Departments Materials Plant Quality Program

Deliver both the CRM and high natural CRM in separate bags.

Either proportion and mix asphalt binder, asphalt modifier, and CRM simultaneously or premix the asphalt binder and asphalt modifier before adding CRM. If you premix asphalt binder and asphalt modifier, mix them for at least 20 minutes. When you add CRM, the asphalt binder and asphalt modifier must be from 375 to 440 degrees F.

Do not use asphalt rubber binder during the first 45 minutes of the reaction period. During this period, the asphalt rubber binder mixture must be between 375 degrees F and the lower of 425 or 25 degrees F below the asphalt binder's flash point indicated in the MSDS.

If any asphalt rubber binder is not used within 4 hours after the reaction period, discontinue heating. If the asphalt rubber binder drops below 375 degrees F, reheat before use. If you add more scrap tire CRM to the reheated asphalt rubber binder, the binder must undergo a 45-minute reaction period. The added scrap tire CRM must not exceed 10 percent of the total asphalt rubber binder weight. Reheated and

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reacted asphalt rubber binder must comply with the viscosity specifications for asphalt rubber binder in section 39-1.02D(2)39-1.04F. Do not reheat asphalt rubber binder more than twice.

39-1.08D Proportioning Warm Mix Asphalt Technologies

Proportion all ingredients by weight. The HMA plant process controller (PPC) must be the sole source of ingredient proportioning control and be fully interfaced with all scales and meters used in the production process. The addition of the HMA additive must be controlled by the PPC.

Calibrate the loss-in-weight meter by:

1. Including at least 1 complete system refill cycle during each calibration test run
2. Operating the device in a normal run mode for 10 minutes immediately before starting the calibration process
3. Isolating the scale system within the loss-in-weight feeder from surrounding vibration
4. Checking the scale system within the loss-in-weight feeder for accuracy before and after the calibration process and daily during mix production
5. Using a 15-minute or 250-pound-minimum test run size for a dry ingredient delivery rate of less than 1 ton/hr
6. Complying with the limits of Table B, "Conveyor Scale Testing Extremes," in the MPQP

Produce additive enhanced HMA by using either a continuous mixing or a batch type HMA plant.

Liquid ingredient additive, including a normally dry ingredient made liquid, must be proportioned with a mass flow meter at continuous mixing plants. Use a mass flow meter or a container scale to proportion liquid additives at batch mixing plants.

Continuous mixing plants using HMA additives must comply with the following:

1. Dry ingredient additives for continuous production must be proportioned with a conveyor scale or a loss-in-weight meter.
2. HMA PPC and ingredient measuring systems must be capable of varying all ingredient feed rates proportionate with the dry aggregate delivery at all production rates and rate changes.
3. Liquid HMA additive must enter the production stream with the binder. Dry HMA additive must enter the production stream at or before the mixing area.
4. If dry HMA additives are used at continuous mixing HMA plants, baghouse dust systems must return all captured material to the mix.
5. HMA additive must be proportioned to within ±0.3 percent of the target additive rate.

Batch mixing plants using HMA additives must comply with the following:

1. Metered HMA additive must be placed in an intermediate holding vessel before being added to the stream of asphalt binder as it enters the pugmill.
2. If a container scale is used, weigh additive before combining with asphalt binder. Keep the container scale separate from other ingredient proportioning. The container scale capacity must be no more than twice the volume of the maximum additive batch size. The container scale's graduations must be smaller than the proportioning tolerance or 0.001 times the container scale capacity.
3. Dry HMA additive proportioning devices must be separate from metering devices for the aggregates and asphalt binder. Proportion dry HMA additive directly into the pugmill or place in an intermediate holding vessel to be added to the pugmill at the appropriate time in the batch cycle. Dry ingredients for batch production must be proportioned with a hopper scale.
4. Zero tolerance for the HMA additive batch scale is ±0.5 percent of the target additive weight. The indicated HMA additive batch scale weight may vary from the preselected weight setting by up to ±1.0 percent of the target additive weight.

The HMA plant must have a sampling device in the feed line connecting the additive storage to the additive metering system. The sampling equipment must comply with California Test 125.

39-1.08E2J(4) Liquid Antistrip Treatment

Perform liquid antistrip treatment (LAS) when the HMA mix design determines LAS treatment of HMA is required. LAS must be from 0.5 to 1.0 percent by weight of asphalt binder.

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If 3 consecutive sets of recorded production data show actual delivered LAS weight is more than ±1 percent of the authorized mix design LAS weight, stop production and take corrective action.

If a set of recorded production data shows actual delivered LAS weight is more than ±2 percent of the authorized mix design LAS weight, stop production. If the LAS weight exceeds 1.2 percent of the asphalt binder weight, do not use the HMA represented by that data.

The continuous mixing plant controller proportioning the HMA must produce a production data log. The log consists of a series of data sets captured at 10-minute intervals throughout daily production. The data must be a production activity register and not a summation. The material represented by the data is the quantity produced 5 minutes before and 5 minutes after the capture time. For the duration of the Contract, collected data must be stored by the plant controller or a computer's memory at the plant.

The Engineer orders proportioning operations stopped for any of the following if you:

1. Do not submit data
2. Submit incomplete, untimely, or incorrectly formatted data
3. Do not take corrective actions
4. Take late or unsuccessful corrective actions
5. Do not stop production when proportioning tolerances are exceeded
6. Use malfunctioning or failed proportioning devices

If you stop production, notify the Engineer of any corrective actions taken before resuming.

39-1.08F2J(5) Aggregate Lime Treatment

Perform aggregate lime treatment when the HMA mix design determines aggregate lime treatment is required. Notify the Engineer at least 24 hours before the start of aggregate treatment.

Do not treat RAP.

For aggregate dry lime treatment, marinate aggregate if the plasticity index determined under California Test 204 is from 4 to 10.

For lime slurry aggregate treatment, treat aggregate separate from HMA production, stockpile and marinate the aggregate.

If marination is required:

1. Treat and marinate coarse and fine aggregates separately.
2. Treat the aggregate and stockpile for marination only once.
3. Treat the aggregate separate from HMA production.

The lime ratio is the pounds of dry hydrated lime per 100 lbs. of dry virgin aggregate expressed as a percentage. Water content of slurry or untreated aggregate must not affect the lime ratio.

Aggregate gradations must have the lime ratio ranges shown in the following table:

Aggregate gradation	Lime ratio percent
Coarse	0.4–1.0
Fine	1.5–2.0
Combined	0.8–1.5

You may reduce the combined aggregate lime ratio for OGFC to 0.5 from 1.0 percent.

The lime ratio for fine and coarse aggregate must be within ±0.2 percent of the lime ratio in the accepted JMF. The lime ratio must be within ±0.2 percent of the authorized lime ratio when you combine the individual aggregate sizes in the JMF proportions. The lime ratio must be determined before the addition of RAP.

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The device controlling lime and aggregate proportioning must produce a treatment data log. The log consists of a series of data sets captured at 10-minute intervals throughout daily treatment. The data must be a treatment activity register and not a summation. The material represented by a data set is the quantity produced 5 minutes before and 5 minutes after the capture time. For the duration of the Contract, collected data must be stored by the controller.

If 3 consecutive sets of recorded treatment data indicate deviation more than 0.2 percent above or below the lime ratio in the accepted JMF, stop treatment.

If a set of recorded treatment data indicates a deviation of more than 0.4 percent above or below the lime ratio in the accepted JMF, stop treatment and do not use the material represented by that set of data in HMA.

If 20 percent or more of the total daily treatment indicates deviation of more than 0.2 percent above or below the lime ratio in the accepted JMF, stop treatment and do not use the day's treated aggregate in HMA.

If you stop treatment for noncompliance, you must implement corrective action and successfully treat aggregate for a 20-minute period. Notify the Engineer before beginning the 20-minute treatment period.

39-1.08F(1)~~2J(6)~~ Proportioning Dry Lime

Proportion dry lime by weight with a continuous operation.

If you use a batch-type proportioning operation for HMA production, control proportioning in compliance with the specifications for continuous mixing plants. Use a separate dry lime aggregate treatment operation from HMA batching operations including:

1. Pugmill mixer
2. Controller
3. Weigh belt for the lime
4. Weigh belt for the aggregate

If using a continuous mixing operation for HMA without lime marinated aggregates, use a controller that measures the blended aggregate weight after any additional water is added to the mixture. The controller must determine the quantity of lime added to the aggregate from the aggregate weigh belt input in connection with the manually input total aggregate moisture, the manually input target lime content, and the lime proportioning system output. Use a continuous aggregate weigh belt and pugmill mixer for the lime treatment operation in addition to the weigh belt for the aggregate proportioning to asphalt binder in the HMA plant. If you use a water meter for moisture control for lime treatment, the meter must comply with Materials Plant Quality Program manual.

At the time of mixing dry lime with aggregate, the aggregate moisture content must ensure complete lime coating. The aggregate moisture content must not cause aggregate to be lost between the point of weighing the combined aggregate continuous stream and the dryer. Add water for mixing and coating aggregate to the aggregate before dry lime addition. Immediately before mixing lime with aggregate, water must not visibly separate from aggregate.

The HMA plant must be equipped with a bag-house dust system. Material collected in the dust system must be returned to the mix.

39-1.08F(2)~~2J(7)~~ Proportioning Lime Slurry

Proportion lime and water with a continuous or batch operation.

Add lime to the aggregate as slurry consisting of mixed dry lime and water at a ratio of 1 part lime to from 2 to 3 parts water by weight. The slurry must completely coat the aggregate.

Immediately before mixing lime slurry with the aggregate, water must not visibly separate from the aggregate.

39-1.08F(3)~~2J(8)~~ Mixing Dry Lime and Aggregate

Mix aggregate, water, and dry lime with a continuous pugmill mixer with twin shafts. Immediately before mixing lime with aggregate, water must not visibly separate from the aggregate. Store dry lime in a

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uniform and free-flowing condition. Introduce dry lime to the pugmill in a continuous operation. The introduction must occur after the aggregate cold feed and before the point of proportioning across a weigh belt and the aggregate dryer. Prevent loss of dry lime.

The pugmill must be equipped with paddles arranged to provide sufficient mixing action and mixture movement. The pugmill must produce a homogeneous mixture of uniformly coated aggregates at mixer discharge.

If the aggregate treatment operation is stopped longer than 1 hour, clean the equipment of partially treated aggregate and lime.

Aggregate must be completely treated before introduction into the mixing drum.

39-1.08F(4)2J(9) Mixing Lime Slurry and Aggregate

Proportion lime slurry and aggregate by weight in a continuous operation.

39-1.0G2J(10) Production

Before virgin aggregate is treated, it must comply with the aggregate quality specifications. Do not test treated aggregate for quality control except for gradation. The Department does not test treated aggregate for acceptance except for gradation.

The Engineer determines the combined aggregate gradation during HMA production after you have treated the aggregate.

Treated aggregate must not have lime balls or clods.

For any of the following, the Engineer orders proportioning operations stopped if you:

1. Do not submit the treatment data log
2. Do not submit the aggregate quality control data for marinated aggregate
3. Submit incomplete, untimely, or incorrectly formatted data
4. Do not take corrective actions
5. Take late or unsuccessful corrective actions
6. Do not stop treatment when proportioning tolerances are exceeded
7. Use malfunctioning or failed proportioning devices

If you stop treatment, notify the Engineer of any corrective actions taken and conduct a successful 20-minute test run before resuming treatment.

If marination is required, marinate treated aggregate in stockpiles from 24 hours to 60 days before using in HMA. Do not use aggregate marinated longer than 60 days.

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39-1.092K Spreading and Compacting Equipment

39-1.09A2K(1) General

Paving equipment for spreading must be:

1. Self-propelled
2. Mechanical
3. Equipped with a screed or strike-off assembly that can distribute HMA the full width of a traffic lane
4. Equipped with a full-width compacting device
5. Equipped with automatic screed controls and sensing devices that control the thickness, longitudinal grade, and transverse screed slope

Install and maintain grade and slope references.

The screed must produce a uniform HMA surface texture without tearing, shoving, or gouging.

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The paver must not leave marks such as ridges and indentations unless you can eliminate them by rolling.

Rollers must be equipped with a system that prevents HMA from sticking to the wheels. You may use a parting agent that does not damage the HMA or impede the bonding of layers.

In areas inaccessible to spreading and compacting equipment:

1. Spread the HMA by any means to obtain the specified lines, grades and cross sections.
2. Use a pneumatic tamper, plate compactor, or equivalent to achieve thorough compaction.

39-1.09B2K(2) Method Compaction Equipment

For method compaction, each paver spreading HMA must be followed by 3 rollers:

1. One vibratory roller specifically designed to compact HMA. The roller must be capable of at least 2,500 vibrations per minute and must be equipped with amplitude and frequency controls. The roller's gross static weight must be at least 7.5 tons.
2. One oscillating type pneumatic-tired roller at least 4 feet wide. Pneumatic tires must be of equal size, diameter, type, and ply. The tires must be inflated to 60 psi minimum and maintained so that the air pressure does not vary more than 5 psi.
3. One steel-tired, 2-axle tandem roller. The roller's gross static weight must be at least 7.5 tons.

Each roller must have a separate operator. Rollers must be self-propelled and reversible.

Compact RHMA-G-SP under the specifications for compacting HMA except do not use pneumatic-tired rollers.

Compact OGFC with steel-tired, 2-axle tandem rollers. If placing over 300 tons of OGFC per hour, use at least 3 rollers for each paver. If placing less than 300 tons of OGFC per hour, use at least 2 rollers for each paver. Each roller must weigh between 126 to 172 pounds per linear inch of drum width. Turn the vibrator off.

~~Pars. 3 and 4. Use if RHMA-SP-G, HMA-O, or RHMA-O, is specified.~~

39-1.09C2K(3) Material Transfer Vehicle

~~3~~

A material transfer vehicle (MTV) must be used when placing RHMA-SP-G, HMA-O, or RHMA-O.

4

The MTV must:

1. Either receive HMA directly from trucks or use a windrow pickup head to load it from a windrow deposited on the roadway surface.
2. Transfer HMA directly into the paver's receiving hopper or feed system.
3. Remix the HMA with augurs, before loading the paver.
4. Have sufficient capacity to prevent stopping the paver.

39-1.10 CONSTRUCTION

39-1.10A3A General

Do not pave HMA on a wet pavement or frozen surface.

You may deposit HMA in a windrow and load it in the paver if:

1. Paver is equipped with a hopper that automatically feeds the screed
2. Loading equipment can pick up the windrowed material and deposit it in the paver hopper without damaging base material
3. Activities for deposit, pickup, loading, and paving are continuous
4. HMA temperature in the windrow does not fall below 260 degrees F

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You may place HMA in 1 or more layers on areas less than 5 feet wide and outside the traveled way, including shoulders. You may use mechanical equipment other than a paver for these areas. The equipment must produce uniform smoothness and texture.

HMA handled, spread, or windrowed must not stain the finished surface of any improvement, including pavement.

Do not use petroleum products such as kerosene or diesel fuel to release HMA from trucks, spreaders, or compactors.

HMA must be free of:

1. Segregation
2. Coarse or fine aggregate pockets
3. Hardened lumps

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39-1.10B Miscellaneous Areas and Dikes

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Use para 1 if a self-propelled spreader and vibratory rollers are not required miscellaneous areas, delete para 2 and 3.

1

For miscellaneous areas and dikes, prepare the area to receive HMA. Preparing the area includes excavating and backfilling as needed. Spread HMA in 1 layer and compact to the specified lines and grades.

Use para 2 and 3 if a self-propelled spreader and vibratory rollers are required miscellaneous areas, delete para 1.

2

For miscellaneous areas and dikes, prepare the area to receive HMA. Preparing the area includes excavating and backfilling as needed. Spread with a self-propelled spreader. After spreading, miscellaneous HMA must be ready for compacting without further shaping.

3

Compact miscellaneous HMA with a vibratory roller providing a minimum of 7,000 lb centrifugal force. With the vibrator on, compact at least 3 complete coverages over each layer, overlapping to prevent displacement. The speed of the vibratory roller in miles per hour must not exceed the vibrations per minute divided by 1,000. If the layer thickness is less than 0.08 foot, turn the vibrator off. Complete the 1st coverage before the mixture's temperature drops below 250 degrees F.

The finished surface must be:

1. Textured uniformly
2. Compacted finely
3. Without depressions, humps, and irregularities
4. In compliance with the straightedge specifications for smoothness

39-1.10C Replace Asphalt Concrete Surfacing

39-1.10C(1) General

Remove existing asphalt concrete surfacing and underlying base and replace with HMA. The Engineer determines the exact limits of replaced asphalt concrete surfacing.

Place replacement HMA under section 39-1.03(C)2.

Replace asphalt concrete in a lane before the lane is specified to be opened to traffic under section 12-4.

Before removing asphalt concrete, outline the replacement area and cut neat lines with a saw or grind to full depth of the existing asphalt concrete. Do not damage asphalt concrete and base remaining in place.

Dispose of removed material.

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If the base is excavated beyond the specified plane, replace it with HMA. The Department does not pay for this HMA.

39-1.10D03B Surface Preparation

39-1.10D03B(1) General

Prepare subgrade or apply tack coat to surfaces receiving HMA. If specified, place geosynthetic pavement interlayer over a coat of asphalt binder.

39-1.10D(2) Reserved Grinding

39-1.10D(3)03B(2) Subgrade

Subgrade to receive HMA-SP (Type A), or HMA-SP (Type C) must comply with the compaction and elevation tolerance specifications in the sections for the material involved. Subgrade must be free of loose and extraneous material. If HMA-SP (Type A), or HMA-SP (Type C) is paved on existing base or pavement, remove loose paving particles, dirt, and other extraneous material by any means including flushing and sweeping.

39-1.10D(4)03B(3) Tack Coat

Apply tack coat:

1. To existing pavement including planed surfaces
2. Between HMA layers
3. To vertical surfaces of:
   3.1. Curbs
   3.2. Gutters
   3.3. Construction joints

Use only if the District Materials Engineer recommends a specific tack coat grade for bridge decks. Insert the grade.

Tack coat for bridge decks must be grade asphaltic emulsion.

Before placing HMA, apply tack coat in application at the minimum residual rate specified for the condition of the underlying surface:

Tack Coat Application Rates for HMA

HMA over:	Minimum Residual Rates (gal/sq yd)		
	CSS1/CSS1h, SS1/SS1h and QS1h/CQS1h Asphaltic Emulsion	CRS1/CRS2, RS1/RS2 and QS1/CQS1 Asphaltic Emulsion	Asphalt Binder and PMRS2/PMCRS2 and PMRS2h/PMCRS2h Asphaltic Emulsion
New HMA (between layers)	0.02	0.03	0.02
Existing AC and PCC pavement	0.03	0.04	0.03
Planed pavement	0.05	0.06	0.04

Tack Coat Application Rates for OGFC

OGFC over:	Minimum Residual Rates (gal/sq yd)		
	CSS1/CSS1h, SS1/SS1h and QS1h/CQS1h Asphaltic Emulsion	CRS1/CRS2, RS1/RS2 and QS1/CQS1 Asphaltic Emulsion	Asphalt Binder and PMRS2/PMCRS2 and PMRS2h/PMCRS2h Asphaltic Emulsion
New HMA	0.03	0.04	0.03
Existing AC and PCC pavement	0.05	0.06	0.04
Planed pavement	0.06	0.07	0.05

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If you dilute asphaltic emulsion, mix until homogeneous before application.

Apply to vertical surfaces with a residual tack coat rate that will thoroughly coat the vertical face without running off.

If you request and the Engineer authorizes, you may:

1. Change tack coat rates
2. Omit tack coat between layers of new HMA during the same work shift if:
   2.1. No dust, dirt, or extraneous material is present
   2.2. Surface is at least 140 degrees F

Immediately in advance of placing HMA, apply additional tack coat to damaged areas or where loose or extraneous material is removed.

Close areas receiving tack coat to traffic. Do not track tack coat onto pavement surfaces beyond the job site.

Asphalt binder tack coat temperature must be from 285 to 350 degrees F when applied.

39-1.10D(5)~~03B(4)~~ Geosynthetic Pavement Interlayer

Place geosynthetic pavement interlayer in compliance with the manufacturer's recommendations.

Before placing the geosynthetic pavement interlayer and asphalt binder:

1. Repair cracks 1/4 inch and wider, spalls, and holes in the pavement. Repairing cracks is change order work.
2. Clean the pavement of loose and extraneous material.

Immediately before placing the interlayer, apply 0.25 gallon +/- 0.03 gallon of asphalt binder per square yard of interlayer or until the fabric is saturated. Apply asphalt binder the width of the geosynthetic pavement interlayer plus 3 inches on each side. At interlayer overlaps, apply asphalt binder on the lower interlayer the same overlap distance as the upper interlayer.

Align and place the interlayer with no overlapping wrinkles, except a wrinkle that overlaps may remain if it is less than 1/2 inch thick. If the overlapping wrinkle is more than 1/2 inch thick, cut the wrinkle out and overlap the interlayer no more than 2 inches.

The minimum HMA thickness over the interlayer must be 0.12 foot thick including conform tapers. Do not place the interlayer on a wet or frozen surface.

Overlap the interlayer borders between 2 inches and 4 inches. In the direction of paving, overlap the following roll with the preceding roll at any break.

You may use rolling equipment to correct distortions or wrinkles in the interlayer.

If asphalt binder tracked onto the interlayer or brought to the surface by construction equipment causes interlayer displacement, cover it with a small quantity of HMA.

Before placing HMA on the interlayer, do not expose the interlayer to:

1. Traffic except for crossings under traffic control and only after you place a small HMA quantity
2. Sharp turns from construction equipment
3. Damaging elements

Pave HMA on the interlayer during the same work shift.

39-1.11~~03C~~ Transporting, Spreading, and Compacting

39-1.11A~~03C(1)~~ General

You may deposit HMA in a windrow and load it in the paver if:

1. Paver is equipped with a hopper that automatically feeds the screed

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2. Loading equipment can pick up the windrowed material and deposit it in the paver hopper without damaging base material
3. Activities for deposit, pick-up, loading, and paving are continuous
4. HMA temperature in the windrow does not fall below 260 degrees F

Use if RHMA-SP-G, HMA-O, or RHMA-O is specified.

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HMA deposited in a windrow on the roadway surface must not extend more than 100 feet in front of the loading equipment or MTV.

You may pave HMA in 1 or more layers on areas less than 5 feet wide and outside the traveled way including shoulders. You may use mechanical equipment other than a paver for these areas. The equipment must produce a uniform smoothness and texture.

HMA handled, spread, or windrowed must not stain the finished surface of any improvement including pavement.

Do not use petroleum products such as kerosene or diesel fuel to release HMA from trucks, spreaders, hand tools or compactors.

HMA must be free of:

1. Segregation
2. Coarse or fine aggregate pockets
3. Hardened lumps

Longitudinal joints in the top layer must match specified lane edges. Alternate longitudinal joint offsets in lower layers at least 0.5 foot from each side of the specified lane edges. You may request other longitudinal joint placement patterns.

Until the adjoining through lane's top layer has been paved, do not pave the top layer of:

1. Shoulders
2. Tapers
3. Transitions
4. Road connections
5. Driveways
6. Curve widening
7. Chain control lanes
8. Turnouts
9. Turn pockets

If the number of lanes change, pave each through lane's top layer before paving a tapering lane's top layer. Simultaneous to paving a through lane's top layer, you may pave an adjoining area's top layer including shoulders. Do not operate spreading equipment on any area's top layer until completing final compaction.

39-1.15-93C(1) Leveling

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If a leveling course using HMA-SP (Type A), or HMA-SP (Type C) is specified, fill and level irregularities and ruts with HMA-SP (Type A) before spreading HMA over base, existing surfaces, or bridge decks. You may use mechanical equipment other than a paver for these areas. The equipment must produce a uniform smoothness and texture. HMA used to change an existing surface's cross slope or profile is not a paid for as HMA leveling course.

If placing HMA against the edge of existing pavement, sawcut or grind the pavement straight and vertical along the joint and remove extraneous material without damaging the surface remaining in place. If placing HMA against the edge of a longitudinal or transverse construction joint and the joint is damaged or not placed to a neat line, sawcut or grind the pavement straight and vertical along the joint and remove

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extraneous material without damaging the surface remaining in place. Repair or remove and replace damaged pavement at your expense.

39-1.11C~~03C(1)~~ Compaction

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Rolling must leave the completed surface compacted and smooth without tearing, cracking, or shoving. Complete finish rolling activities before the pavement surface temperature is:

1. Below 150 degrees F for HMA-SP (Type A), or ~~HMA-SP (Type C)~~ with unmodified binder
2. Below 140 degrees F for HMA-SP (Type A), or ~~HMA-SP (Type C)~~ with modified binder
3. Below 200 degrees F for RHMA-SP-G

If a vibratory roller is used as a finish roller, turn the vibrator off.

Do not use a pneumatic tired roller to compact RHMA-SP-G.

If a 3/4-inch aggregate grading is specified, you may use a 1/2-inch aggregate grading if the specified paved thickness is from 0.15 to 0.20 foot thick.

Spread and compact HMA as specified for method compaction in section 39-1.03C(2) for any of the following conditions:

1. Specified paved thickness is less than 0.15 foot.
2. Specified paved thickness is less than 0.20 foot and a 3/4-inch aggregate grading is specified and used.
3. Specified paved thickness is less than 0.25 foot and a 1-inch aggregate grading is specified and used.
4. You spread and compact at:
   4.1. Asphalt concrete surfacing replacement areas
   4.2. Leveling courses
   4.3. Areas the Engineer determines conventional compaction and compaction measurement methods are impeded

Do not open new HMA pavement to traffic until its mid-depth temperature is below 160 degrees F.

If you request and the Engineer authorizes, you may cool HMA-SP (Type A), or ~~HMA-SP (Type C)~~ with water when rolling activities are complete. Apply water under section 17.

Spread sand at a rate between 1 pound and 2 pounds per square yard on new RHMA-SP-G, and RHMA-O pavement when finish rolling is complete. Sand must be free of clay or organic matter. Sand must comply with section 90-1.03C(3). Keep traffic off the pavement until spreading sand is complete.

39-1.11C(1)~~03(C)~~ Method Compaction

Pave HMA in maximum 0.25-foot thick compacted layers.

If the surface to be paved is both in sunlight and shade, pavement surface temperatures are taken in the shade.

Spread HMA-SP (Type A), or ~~HMA-SP (Type C)~~ only if atmospheric and surface temperatures are:

Minimum Atmospheric and Surface Temperatures

Compacted Layer Thickness, feet	Atmospheric,°F		Surface,°F	
	Unmodified Asphalt Binder	Modified Asphalt Binder[a]	Unmodified Asphalt Binder	Modified Asphalt Binder[a]
< 0.15	55	50	60	55
0.15 – 0.25	45	45	50	50

[a]Except asphalt rubber binder.

If the asphalt binder for HMA-SP (Type A), or ~~HMA-SP (Type C)~~ is:

1. Unmodified asphalt binder, complete:

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1.1. First coverage of breakdown compaction before the surface temperature drops below 250 degrees F
1.2. Breakdown and intermediate compaction before the surface temperature drops below 190 degrees F
1.3. Finish compaction before the surface temperature drops below 150 degrees F

2. Modified asphalt binder, complete:
   2.1. First coverage of breakdown compaction before the surface temperature drops below 240 degrees F
   2.2. Breakdown and intermediate compaction before the surface temperature drops below 180 degrees F
   2.3. Finish compaction before the surface temperature drops below 140 degrees F

For RHMA-SP-G:

1. Only spread and compact if the atmospheric temperature is at least 55 degrees F and the surface temperature is at least 60 degrees F.
2. Complete the first coverage of breakdown compaction before the surface temperature drops below 285 degrees F.
3. Complete breakdown and intermediate compaction before the surface temperature drops below 250 degrees F.
4. Complete finish compaction before the surface temperature drops below 200 degrees F.
5. If the atmospheric temperature is below 70 degrees F, cover loads in trucks with tarpaulins. The tarpaulins must completely cover the exposed load until you transfer the mixture to the paver's hopper or to the pavement surface.

For HMA-O with unmodified asphalt binder:

1. Only spread and compact if the atmospheric temperature is at least 55 degrees F and the surface temperature is at least 60 degrees F.
2. Complete first coverage using 2 rollers before the surface temperature drops below 240 degrees F.
3. Complete all compaction before the surface temperature drops below 200 degrees F.
4. If the atmospheric temperature is below 70 degrees F, cover loads in trucks with tarpaulins. The tarpaulins must completely cover the exposed load until you transfer the mixture to the paver's hopper or to the pavement surface.

For HMA-O with modified asphalt binder except asphalt rubber binder:

1. Only spread and compact if the atmospheric temperature is at least 50 degrees F and the surface temperature is at least 60 degrees F.
2. Complete first coverage using 2 rollers before the surface temperature drops below 240 degrees F.
3. Complete all compaction before the surface temperature drops below 180 degrees F.
4. If the atmospheric temperature is below 70 degrees F, cover loads in trucks with tarpaulins. The tarpaulins must completely cover the exposed load until you transfer the mixture to the paver's hopper or to the pavement surface.

For RHMA-O:

1. Only spread and compact if the atmospheric temperature is at least 55 degrees F and surface temperature is at least 60 degrees F.
2. Complete the 1st coverage using 2 rollers before the surface temperature drops below 280 degrees F.
3. Complete compaction before the surface temperature drops below 250 degrees F.
4. If the atmospheric temperature is below 70 degrees F, cover loads in trucks with tarpaulins. The tarpaulins must completely cover the exposed load until the mixture is transferred to the paver's hopper or to the pavement surface.

For RHMA-SP-G and OGFC, tarpaulins are not required if the time from discharge to truck until transfer to the paver's hopper or the pavement surface is less than 30 minutes.

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HMA compaction coverage is the number of passes needed to cover the paving width. A pass is 1 roller's movement parallel to the paving in either direction. Overlapping passes are part of the coverage being made and are not a subsequent coverage. Do not start a coverage until completing the prior coverage.

Start rolling at the lower edge and progress toward the highest part.

Perform breakdown compaction of each layer of HMA-SP (Type A), HMA-SP (Type C) and RHMA-SP-G with 3 coverages using a vibratory roller. The speed of the vibratory roller in miles per hour must not exceed the vibrations per minute divided by 1,000. If the HMA-SP (Type A), HMA-SP (Type C) or RHMA-SP-G layer thickness is less than 0.08 foot, turn the vibrator off.

The Engineer may order fewer coverages if the HMA-SP (Type A), or RHMA-SP-G layer thickness is less than 0.15 foot.

The Engineer may order fewer coverages if the HMA-SP (Type C) layer thickness is less than 0.20 foot.

Perform intermediate compaction of each layer of HMA-SP (Type A), HMA-SP (Type C) or RHMA-SP-G with 3 coverages using a pneumatic-tired roller at a speed not to exceed 5 mph.

Perform finish compaction of HMA-SP (Type A), HMA-SP(Type C) and RHMA-SP-G with 1 coverage using a steel-tired roller.

Compact OGFC with 2 coverages using steel-tired rollers.

39-1.11D03D Rumble Strips

Pars. 1–110. Use for rumble strips in new or existing material.

Variations in width and location of rumble strips, including centerlines, require a recommendation from the Traffic Safety Research Branch. Centerline rumble strips, if recommended, should use a separate 1-time item code.

Edit for rumble strips in existing asphalt concrete (i.e., use the term "existing asphalt concrete.")

Pars. 15 – 26. Use only 1 par.

If the method (ground-in or rolled-in) is not a choice, edit par. 5 and delete par. 6.

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15

Construct rumble strips in the top layer of HMA surfacing by ground-in or rolled-in methods.

26

Choose between ground-in or rolled-in rumble strips.

37

Select the method and equipment for constructing ground-in indentations.

48

Do not construct rumble strips on structures or approach slabs.

59

Construct rumble strips within 2 inches of the specified alignment. The grinding equipment must be equipped with a sighting device enabling the operator to maintain the rumble strip alignment.

160

Indentations must comply with the specified dimensions within 0.06 inch in depth and 10 percent in length and width.

171

The Engineer orders grinding or removal and replacement of noncompliant rumble strips to bring them within specified tolerances. Ground surface areas must be neat and uniform in appearance.

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182

The grinding equipment must be equipped with a vacuum attachment to remove residue from the roadbed.

193

Dispose of removed material.

1014

On ground areas, apply fog seal coat under section 37-2.

39-1.11E1.03E Vertical Joints

Use on 2-lane highways where the thickness of HMA is 0.15 foot or less and the vertical joint between lanes is to be kept to a minimum. Do not use this par. with Para 28.

1

If you perform half-width paving, at the end of each day's work the distance between the ends of adjacent surfaced lanes must not be greater than can be completed in the following day of normal paving.

2 Use on projects or portions of projects with HMA surfacing thicker than 0.15 foot. Delete this par. if Para 13 is used.

Do not leave a vertical joint more than 0.15 foot high between adjacent lanes open to traffic.

3 Use when shoulders or median borders are to be paved.

Before opening the lane to public traffic, pave shoulders and median borders adjacent to a lane being paved.

4 Use if a vertical joint is not allowed between lanes open to traffic, regardless of thickness.

Place HMA on adjacent traveled way lanes so that at the end of each work shift the distance between the ends of HMA layers on adjacent lanes is between 5 to 10 feet. Place additional HMA along the transverse edge at each lane's end and along the exposed longitudinal edges between adjacent lanes. Hand rake and compact the additional HMA to form temporary conforms. You may place Kraft paper or another approved bond breaker under the conform tapers to facilitate the taper removal when paving operations resume.

39-1.11F Tapered Notched Wedge

For divided highways with an HMA lift thickness greater than 0.15 foot, you may construct a 1-foot wide tapered notched wedge joint as a longitudinal joint between adjacent lanes open to traffic. A vertical notch of 0.75 inch maximum must be placed at the top and bottom of the tapered wedge.

The tapered notched wedge must retain its shape while exposed to traffic. Pave the adjacent lane within 1 day.

Construct the tapered portion of the tapered notched wedge with an authorized strike-off device. The strike-off device must provide a uniform slope and must not restrict the main screed of the paver.

You may use a device attached to the screed to construct longitudinal joints that will form a tapered notched wedge in a single pass. The tapered notched wedge must be compacted to a minimum of 91 percent compaction.

Perform QC testing on the completed tapered notch wedge joint as follows:

1. Perform field compaction tests at the rate of 1 test for each 750-foot section along the joint. Select random locations for testing within each 750-foot section.
2. Perform field compaction tests at the centerline of the joint, 6 inches from the upper vertical notch, after the adjacent lane is placed and before opening the pavement to traffic.
3. Determine maximum density test results.
4. Determine percent compaction of the longitudinal joint as the ratio of the average of the field compaction values and the maximum density test results.

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For acceptance of the completed tapered notch wedge joint, take two 4- or 6-inch diameter cores 6 inches from the upper vertical notch of the completed longitudinal joint for every 3,000 feet at locations designated by the Engineer. Take cores after the adjacent lane is placed and before opening the pavement to traffic. Cores must be taken in the presence of the Engineer and must be marked to identify the test sites. Submit the cores. One core will be used for determination of the field density and 1 core will be used for dispute resolution. The Engineer determines:

1. Field compaction by measuring the bulk specific gravity of the cores under AASHTO T 275, Method A
2. Percent compaction as the ratio of the average of the bulk specific gravity of the core for each day's production to the maximum density test value

in the Engineer's verification testing and in the computation of any quality factor and process control.

Determine percent compaction values each day the joint is completed and submit values within 24 hours of testing. If the percent compaction of 1 day's production is less than 91 percent, that day's notched wedge joint is rejected. Discontinue placement of the tapered notched wedge and notify the Engineer of changes you will make to your construction process in order to meet the specifications.

39-1.11G Shoulders, Medians, and Other Road Connections

Until the adjoining through lane's top layer has been paved, do not pave the top layer of:

1. Shoulders
2. Tapers
3. Transitions
4. Road connections
5. Driveways
6. Curve widenings
7. Chain control lanes
8. Turnouts
9. Turn pockets

If the number of lanes changes, pave each through lane's top layer before paving a tapering lane's top layer. Simultaneous to paving a through lane's top layer, you may pave an adjoining area's top layer, including shoulders. Do not operate spreading equipment on any area's top layer until completing final compaction.

39-1.11H~~03F~~ Widening

1 Use for widening if new structural section is to be placed to the elevation of the existing surfacing for the entire length of the project before placing the uppermost layer of HMA-TYPE A-SP. If a surface treatment other than HMA is to be placed on the existing pavement, edit "HMA" to match the surface treatment. Delete "on both sides of the existing pavement," if widening is only on one side. Delete para 1 and 2.

If widening existing pavement, construct new structural section on both sides of the existing pavement to match the elevation of the existing pavement's edge for the project's entire length before placing HMA over the existing pavement.

2 Use when widening is not continuous for the entire length of the project, and new structural section is to be constructed to the elevation of the existing surfacing at each location of widening before placing the uppermost layer of HMA surfacing at each location. If a surface treatment other than HMA is to be placed on the existing pavement, edit "HMA" to match the surface treatment. Delete "on both sides of the existing pavement," if widening is only on one side. Delete para 1 and 3.

If widening existing pavement, construct new structural section on both sides of the existing pavement to match the elevation of the existing pavement's edge at each location before placing HMA over the existing pavement.

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3 Use when the structural section is to be constructed to the elevation of the existing surfacing for the specified lengths before placing the uppermost layer of HMA surfacing at each location. If a surface treatment other than HMA is to be placed on the existing pavement, edit "HMA" to match the surface treatment. Fill in the increment. Delete "on both sides of the existing pavement," if widening is only on one side. Delete para 1 and 2.

If widening existing pavement, construct new structural section on both sides of the existing pavement to match the elevation of the existing pavement's edge in increments of at least _____ feet before placing HMA over the existing pavement.

39-1.11I Edge Treatment

The edge of roadway where the safety edge treatment is to be placed must have a solid base free of debris such as loose material, grass, weeds, or mud. Grade areas to receive the safety edge as required.

The safety edge treatment must be placed monolithic with the adjacent lane or shoulder and shaped and compacted with a device attached to the paver.

The device must be capable of shaping and compacting HMA to the required cross section as shown. Compaction must be by constraining the HMA to reduce the cross sectional area by 10 to 15 percent. The device must produce a uniform surface texture without tearing, shoving, or coupling and must not leave marks such as ridges and indentations. The device must be capable of transition to cross roads, driveways, and obstructions.

For safety edge treatment, the angle of the slope must not deviate by more than ± 5 degrees from the angle shown. Measure the angle from the plane of the adjacent finished pavement surface.

If paving is done in multiple lifts, the safety edge treatment must be placed with each lift.

Short sections of hand work are allowed to construct transitions for safety edge treatment.

39-1.11~~J~~~~03G~~ Conform Tapers

1 Use when conform tapers are used in place of paving shoulders and/or median borders.

Place shoulder conform tapers concurrently with the adjacent lane's paving.

2 DO NOT use for paving driveways and road connections. This paragraph covers the short conform taper at the edge of pavement.

Place additional HMA-SP (Type A) along the pavement's edge to conform to road connections and private drives. Hand rake, if necessary, and compact the additional HMA to form a smooth conform taper.

39-1.12~~04~~ PAYMENT

The weight of each HMA mixture shown in the Bid Item List is the combined mixture weight.

If tack coat, asphalt binder, and asphaltic emulsion are paid as separate bid items, their bid items are measured under section 92 or section 94.

If recorded batch weights are printed automatically, the bid item for HMA is measured by using the printed batch weights, provided:

1. Total aggregate and supplemental fine aggregate weight per batch is printed. If supplemental fine aggregate is weighed cumulatively with the aggregate, the total aggregate batch weight must include the supplemental fine aggregate weight.
2. Total asphalt binder weight per batch is printed.
3. Each truckload's zero tolerance weight is printed before weighing the first batch and after weighing the last batch.
4. Time, date, mix number, load number and truck identification is correlated with a load slip.
5. Copy of the recorded batch weights is certified by a licensed weigh master and submitted.

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Place hot mix asphalt dike of the type specified is measured along the completed length.

Place hot mix asphalt (miscellaneous areas) is measured as the in-place compacted area.

If replace asphalt concrete surfacing is shown the bid item for replace asphalt concrete is measured based on the specified dimensions and any adjustments ordered.

HMA dike is paid for as place hot mix asphalt dike of the type specified in the Bid Item List and by weight for hot mix asphalt.

HMA specified to be placed in miscellaneous areas is paid for as place hot mix asphalt (miscellaneous area) and by weight for hot mix asphalt.

If HMA (miscellaneous area) is shown, the bid item for place hot mix asphalt (miscellaneous area) is limited to the areas shown and is in addition to the bid items for the materials involved.

1. Use if HMA (miscellaneous area) locations to be paid for as place hot mix asphalt (miscellaneous area) are not shown. Edit as required including deletion of nonapplicable facilities. Otherwise delete.

If HMA (miscellaneous area) is not shown, the bid item for place hot mix asphalt (miscellaneous area) is limited to ditches, overside drains, aprons at the ends of drainage structures, and _____, and is in addition to the bid items for the materials involved.

HMA-SP (Type A) for dike and miscellaneous areas are measured by weight.

Geosynthetic pavement interlayer is measured by the square yard for the actual pavement area covered.

If there is no bid item for tack coat, payment for tack coat for miscellaneous areas is included in payment for the hot mix asphalt used in miscellaneous areas.

The Department does not adjust the unit price for an increase or decrease in the tack coat quantity. Section 9-1.06 does not apply.

If the dispute resolution independent third party determines the Department's test results are correct, the Engineer deducts the independent third party's testing costs from payments. If the independent third party determines your test results are correct, the Department pays the independent third party's testing costs.

If centerline rumble strips are recommended and rumble strips on the shoulder is also planned, use separate items including the appropriate shoulder rumble strip items.

Rumble strips are measured by the station along the length of the rumble strips without deductions for gaps between indentations.

Pars. 1 and 2. Use if a total thickness of HMA less than 0.20 foot is to be placed on existing asphalt concrete pavement and the average IRI is greater than 100 in/mi and less than 170 in/mi.

1

The Department does not adjust the unit price for an increase or decrease in the prepaving grinding day quantity.

2

If the Engineer determines more time is required for prepaving grinding than the Contract allows for and if prepaving grinding is a controlling activity, the Engineer makes a time adjustment.

DRAFT DO NOT USE IN PROJECTS