

## Memorandum

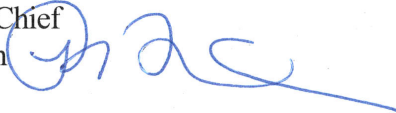
*Serious drought.  
Help Save Water!*

**To:** DEPUTY DISTRICT DIRECTORS, Construction  
DEPUTY DIVISION CHIEF, Structure Construction  
CONSTRUCTION MANAGERS  
SENIOR CONSTRUCTION ENGINEERS  
RESIDENT ENGINEERS

**Date:** June 22, 2016

**File:** Division of Construction  
CPD 16-8

**From:** RACHEL FALSETTI, Chief  
Division of Construction



**Subject:** **HOT MIX ASPHALT WITH RECLAIMED ASPHALT PAVEMENT**

Recently there has been attention on some nationwide projects with premature failures of hot mix asphalt with high asphalt binder replacement from reclaimed asphalt pavement, recycled asphalt shingles, or both. The type of failure is cracking that could be caused by excessive stiffness of the blended asphalt binder. To immediately address the issue of excessive asphalt binder stiffness, the California Department of Transportation has implemented a non-standard special provision with new requirements for hot mix asphalt (HMA) with more than 15 percent reclaimed asphalt pavement (RAP) to ensure that the ultimate asphalt binder stiffness is within the requirements for asphalt binder specified for the project.

For existing projects with Type A HMA that have a job mix formula (JMF) containing, by weight, greater than 15 percent RAP aggregate in the aggregate blend, a change order must be executed to require the contractor to produce asphalt binder blending charts. The blending charts will show the maximum allowable RAP pavement binder ratios (RPBR) that may be used given the project's specified asphalt binder, and the properties of the virgin binder and recovered binder from RAP.

The blending charts must be prepared following the procedures in Section 11.4 of the seventh edition of *MS-2 Asphalt Mix Design Methods* by the Asphalt Institute. Producing the blending charts requires plotting the direct shear rheometer and bending beam rheometer specified limits based on the project specified performance grade for asphalt binder, and the true grades of both the virgin asphalt binder and recovered RAP binder. A blending chart spreadsheet may be used to perform this step and is available at:

<http://www.dot.ca.gov/hq/construc/hma/>

RAP binder extraction must be done under AASHTO T 164, Method A. RAP asphalt binder recovery must be done under either ASTM D 1856 or AASHTO R 59. For the virgin asphalt binder, the contractor may choose to use maximum theoretical critical temperatures of the performance grade or determine the critical temperatures by testing the virgin asphalt binder. True grading of the binders must include high, intermediate, and both low critical temperatures determined under AASHTO T 313 and AASHTO T 315.

Plotting blending charts performs two primary checks of a proposed JMF. The proposed RPBR must be no greater than the lowest maximum RPBR pulled from the high, intermediate, and low temp blending charts, and the percent RAP aggregate in the aggregate blend must be no greater than the maximum RAP aggregate in the aggregate blend as determined by the lesser of the maximum RPBR and JMF, or 25 percent. The blending chart spreadsheet performs these checks.

Attachment 1 shows four example blending charts. Example 1 of this attachment shows a previously completed JMF where the resulting blended binder is too stiff and can no longer be used. Examples 2a, 2b and 2c are potential alternatives that could be considered during the redesign of the JMF.

Submit completed blending charts to Kee Foo, Division of Maintenance, and Pete Spector, Division of Construction, for evaluation to determine if any further action must be taken.

If an existing JMF has a RPBR that is not within the range of RPBR limits shown on the critical high, intermediate, or low temperature blending charts, further action could include either or both:

1. Lowering the virgin binder temperature grade by one or two grades to allow for higher RAP content.
2. Reducing the percentage of RAP used in the HMA.

For either case, a new JMF will be required and a change order written to compensate the contractor for the new JMF, and additional costs of using less RAP and more virgin binder or additional costs for the lower temperature grade of asphalt binder. Exceptions to issuing a change order requiring a new JMF may be approved by Pete Spector, Division of Construction on a case by case basis. Factors that will be considered are the amount of HMA remaining to be placed under the previously approved JMF, an analysis of how far outside the specification limits is the combined asphalt binder based on the blending charts.

The following additional quality control testing would need to be implemented by change order:

1. Critical temperatures of RAP recovered binder under AASHTO T 313 and AASHTO T 315 at the frequency of 1 for every 500 tons of augmented RAP stockpile.
2. If the actual critical temperatures of the virgin asphalt binder are used for blending charts, determine critical temperatures of virgin binder under AASHTO T 313 and AASHTO T 315 at the frequency of 1 for every 5 days of HMA production.

The contractor must determine the blended binder grade using blending charts found in the seventh edition of *MS-2 Asphalt Mix Design Methods* each time the critical temperatures are determined.

A sample change order memorandum, sample change order, and a Federal Highway Administration (FHWA) blanket prior approval for determining true grades of virgin and reclaimed RAP binders, and producing blending charts are attached to this directive.

For projects where the determined RPBR is more than the new maximum allowed RPBR, unless an exception is provided, a second change order will be required to develop a new JMF and perform additional quality control testing during HMA production. This change order will also provide for any necessary adjustment of time and cost to address any changes to the original authorized JMF.

For the second change order, attached are a sample change order memorandum, sample change order, sample calculations for replacing RAP aggregate with virgin aggregate, and an FHWA blanket prior approval for this work. This directive serves as delegation of authority from the Division of Construction and approval from the FHWA for this change order, except when any of the following apply to the change order:

1. The language is altered.
2. The total absolute value exceeds \$200,000.
3. Contract time is extended by more than 50 days.

If you have any questions or comments regarding this directive, contact Kee Foo, Division of Maintenance, at [kee.foo@dot.ca.gov](mailto:kee.foo@dot.ca.gov) or (916) 274-6077, or Pete Spector, Division of Construction, at [pete.spector@dot.ca.gov](mailto:pete.spector@dot.ca.gov) or (916) 227-7306.

- Attachments:
1. Example Blending Charts
  2. Sample Change Order Memorandum—Asphalt Binder Blending Charts
  3. Sample Change Order—Asphalt Binder Blending Charts
  4. Asphalt Binder Blending Charts, FHWA Form CA-358 (c), “Record of Blanket Prior Approval for Major Contract Change Order”
  5. Sample Change Order Memorandum—New JMF Based on Maximum RPBR
  6. Sample Change Order—New JMF Based on Maximum RPBR
  7. Sample Backup Calculations to Support Agreed Unit Price for Replacing RAP Aggregate with Virgin Aggregate
  8. New JMF Based on Maximum RPBR, FHWA Form CA-358 (c), “Record of Blanket Prior Approval for Major Contract Change Order”