

Standard Method of Test for

Preparation, Verification, and Acceptance of Asphalt Mix Formulas

SCDOT Designation: SC-T-80 (rev. 04/2024)

1. SCOPE

- 1.1 This method outlines the procedure for submitting asphalt job mix formulas for mixtures found in SC-M-402 and the Stone Matrix Asphalt (SMA) Special Provision to the SCDOT Office of Materials and Research for preparation, verification, and acceptance; and defines the allowances that can be made on revisions to asphalt job mix formulas.

2. REFERENCE DOCUMENTS

- 2.1 SC Test Procedures: T-68, T-70, T-75, T-83, T-88, T-90, T-96, T-102, T-103
- 2.2 SC Specifications: M-400, M-402, M-405, M-407, and SMA Special Provision
- 2.3 SC Forms: Lab Form 269 and SCDOT Mix Design Workbook Forms

3. SUMMARY OF TEST METHOD

- 3.1 The test method describes the process of submitting asphalt job mix formulas once the asphalt contractor has performed various tests on the mixture, and the Department's results are compared with the contractor's results. The results are checked against the contract specifications for asphalt mix formulas, and asphalt mixes are accepted when all of the mix criteria or specifications are followed according to the SCDOT.

Note: OGFC designs will follow SC-T-88 exclusively.

4. SIGNIFICANCE AND USE

- 4.1 Asphalt mixes are verified and accepted by the SCDOT to ensure that they meet all requirements set forth by the department. The significance of this procedure is to describe the required steps for submitting asphalt job mix formulas for SCDOT acceptance.

5. APPARATUS

- 5.1 Refer to reference documents for a list of equipment needed to complete each test for the submittal of a job mix formula (JMF).

6. ASPHALT JOB MIX FORMULA EXPIRATION

- 6.1 Job mix formulas are valid for four (4) years with a maximum of three (3) revisions. If additional revisions are required after the allowable three (3) have been made, a new job mix formula is required.

7. TEST SPECIMENS – JOB MIX FORMULA SUBMITTALS

- 7.1 The asphalt contractor's SCDOT certified Level II Asphalt Technician must submit the following items for verification of each job mix formula along with the appropriate forms, which are located in the SCDOT Mix Design Workbook. Required specimens and samples for JMF submittal will follow in Table 1. **Copies of all gyratory printouts are required to be submitted, as well as any stability and ITS graphs that are used for the mix design.** The forms will include Form 269, batch weighing sheets, moisture susceptibility (ITS), computation worksheet, volumetric worksheet, and performance test worksheets. Prepared specimens and batched samples (such as APA, Ideal CT, and BSG specimens, as well as MSG, drain-down, and blended aggregate samples) are also required for submittal. All testing must be performed in an SCDOT certified Asphalt Job Mix Preparation Laboratory in accordance with SC-M-405.
- 7.1.1 **Asphalt Binder:** when batched samples are required for job mix verification, submit one (1) unlined, clean and free from any contaminants, full quart can of the representative asphalt binder used for the mix design, and dosed accordingly with the chemical additive. Label the quart can with the contractor's name, plant location, performance grading of the asphalt binder, and the name and percent dosage of chemical additive by weight of asphalt binder.
- 7.1.2 **Bulk Gyratory Specimens:** prepare and submit three (3) bulk gyratory specimens, made at 115 ± 5 mm, for verification at Optimum Asphalt Content or Corrected Optimum Asphalt Content (COAC) as produced for state work. (ie: if only Optimum Asphalt Content mix design is requested, make specimens at Optimum Asphalt Content. If only COAC mix design is requested, make specimens at COAC. If both Optimum and COAC are requested, make specimens at both asphalt contents.) The submitted specimens must be different specimens made after the optimum asphalt binder content has been determined for the formula. COAC is not allowed for use in any Base mixes, Intermediate B Special, or SMA mixes.
- 7.1.3 **Stability Specimens:** prepare and submit three (3) stability specimens, made at 95 ± 5 mm and prepared at optimum binder content, for verification at optimum binder content or Corrected Optimum Asphalt Content (COAC) as produced for state work. The specimens must be different specimens made after the optimum asphalt binder content has been determined for the formula. Stability graphs and gyratory printouts from determining the optimum asphalt content are also to be submitted.
- 7.1.4 **Maximum Theoretical Specific Gravity (MSG) Sample:** prepare two (2) MSG samples at batch weight according to nominal maximum aggregate size and submit for verification at optimum binder content or Corrected Optimum Asphalt Content (COAC) as produced for state work.
- 7.1.5 **Batched Aggregate Check Samples (without Asphalt Binder):** submit three (3) blended aggregate samples for the bulk gyratory specimens, each prepared at batch

- weight, as check samples for OMR to mix and compact if necessary. If the mix design requires MSG testing, submit one (1) additional check sample of blended aggregate at desired batch weight according to nominal maximum aggregate size. Three (3) blended aggregate samples will be required for stability check samples. Mix designs including RAP or RAS must have separated, batched samples of the weighed recycled material used in the blended aggregate check samples. The RAP or RAS samples will be the same as the submitted weigh-up worksheets.
- 7.1.6 **Batched Aggregate for Visual Optimum Binder % (without Asphalt Binder):** submit three (3) blended aggregate samples at the desired batch weight according to nominal maximum aggregate size for visual verification of optimum binder. Mix designs including RAP or RAS must have separated, batched samples of the weighed recycled material used for the blended aggregate check samples. The RAP or RAS samples will be the same as the submitted weigh-up worksheets.
- 7.1.7 **APA Specimens:** submit six (6) gyratory specimens gyrated to a height of 75 ± 1 mm with 4.0 ± 1.0 percent air voids. These specimens are used for APA rut testing performed by the SCDOT.
- 7.1.8 **Ideal CT Specimens:** submit five (5) gyratory specimens gyrated to a height equal to 62 ± 1 mm, each with 7.0 ± 0.5 percent air voids. These specimens are used for Ideal Crack testing performed by the SCDOT. (NOTE: Surface C and D and Intermediate C mixes will also be accepted, but they are not required at this time.)
- 7.1.9 **ITS Specimens:** four (4) ITS pills will be gyrated and tested by the contractor at 95 ± 5 mm in height with 7 ± 1 percent air voids following SC-T-70. To determine which of the specimens are tested dry or wet, average the highest and lowest percent air void results and then average the remaining two. Whichever of the specimen averages is higher will be used as the dry specimens. All gyratory printouts and graphs are to be submitted with the mix design.
- 7.1.10 **Drain-Down Samples:** submit one (1) drain-down blended aggregate sample for OMR verification testing on SMA mixes. This will be a 1200g sample. The contractor submitted paperwork will note the maximum production temperature used. Submit the plate used to determine the drain-down. Mix designs that include RAP or RAS must have separated batched samples of the weighed recycled material used for the blended aggregate check samples. The RAP or RAS samples will be the same as the submitted weigh-up worksheets.
- 7.1.11 **Volume of Coarse Aggregate (VCA) Blended Aggregate Samples:** two (2) blended aggregate samples for verifying the VCA of the dry aggregate against the VCA of the asphalt mixture are required for SMA mixes. The amount for one (1) required sample will be determined using the *SMA Blending and Weight – VCA* worksheet in the Mix Design Program. If RAP is utilized in the SMA mix, the asphalt binder must be burned off the RAP aggregate before the blending and submittal of these aggregate samples.

7.1.12 **RAP/RAS:** submit the 10 most recent RAP/RAS stockpile sample results when a mix design includes one of these recycled materials. Include the average asphalt binder content and gradation. Determine the RAS gradation before the asphalt binder content has been burned off. Refer to SC-M-407 for RAP and RAS specifications.

TABLE 1: REQUIRED SPECIMEN SUBMITTALS PER MIX TYPE FOR SCDOT MIX DESIGN VERIFICATION

Mix Type	Gyratory Pills + Batched* Aggregate (BSG)	Stability Pills + Batched* Aggregate	Ideal CT Pills	MSG Samples + Batched* Aggregate	ITS Data	APA Pills	Batched* Aggregate for Visual Opt. AC%	VCA Batched Aggregate	Drain-Down Sample
Surface A and B Intermediate A, B, and B Special	X		X	X	X	X			
Surface C Intermediate C	X			X	X				
Surface D	X			X					
Surface E and PMTLSC Base C and D		X					X		
Base A, Base B, and Shoulder Widening							X		
SMA	X		X	X	X	X		X	X
OGFC	Refer to SC-T-88 for OGFC mix design acceptance								

* When Batched Aggregate Samples are submitted, one (1) can of representative asphalt binder, accordingly dosed with the percent of chemical additive, will also be submitted.

8. PROCEDURE – SCDOT VERIFICATION OF SUBMITTED SPECIMENS AND SAMPLES

- 8.1 Determine the Bulk Specific Gravities (BSG) of the gyratory specimens using SC-T-68. The Department’s average BSG of each set of specimens must compare within 0.020 of the contractor’s BSG determined from the *Volumetrics – COAC* worksheet in the Mix Design Program. The individual specimens submitted must also be within 0.020 of the average contractor’s BSG value.
- 8.2 Perform SC-T-83 to calculate the Maximum Theoretical Specific Gravity (MSG), and the Effective Specific Gravity (ESG). The Department’s test results must compare with the contractor’s ESG within 0.018.
- 8.3 If either sets of bulk gyratory cores, or the ESG, do not compare, then the Department will use the blended aggregate samples as check specimens. The check samples will be made at optimum or COAC asphalt binder content, depending on the design, using the asphalt binder supplied with the mix design submittal. If the specimens still do not compare to the contractor’s tests, the contractor will be required to redesign the mix, or perform additional testing as requested by the SCDOT. If the check specimen for

any non-comparison compares to the contractor's original specimen, then the original data will be accepted using the check samples.

- 8.4 Moisture susceptibility raw data, graphs, and worksheets will be reviewed and may be required to be verified. Moisture susceptibility is performed using SC-T-70. Mix designs in which the wet tensile strength falls below 65% psi, or in which the tensile strength ratio (TSR) falls below 85% will be required to be redesigned.
- 8.5 Stability specimens will be tested using SC-T-96 to ensure that the mix design stability values do not fall below the minimum specification as set forth in SC-M-402. Submitted gyratory printouts and graphs from optimum or COAC percent binder determination for stability will also be reviewed.
- 8.6 APA rut testing will be performed on the 75 mm gyratory specimens to check for rutting resistance.
- 8.7 Ideal cracking tests will be performed on the 62 mm gyratory specimens to collect data for establishing future specifications for minimum cracking index values. Once tested, the highest and the lowest value will be excluded, and the three (3) remaining values will be averaged and used for reporting the Ideal CT value of the asphalt mixture.
- 8.8 Batched aggregate samples that are submitted for visual optimum binder verification will be blended at optimum asphalt binder content or COAC to visually verify proper coating of aggregate.
- 8.9 VCA testing for SMA samples will be rodded and averaged together and then compared to the VCA of the asphalt mixture. The VCA of the dry aggregate must be greater than the VCA of the asphalt mixture or a redesign will be required.
- 8.10 Drain-down is performed using SC-T-90. SMA mixtures require a 99.7% retention minimum for asphalt binder during the mix design process. If drain-down is not met, redesign or the addition of cellulose fibers will be required.
- 8.11 Dynamic Modulus and additional cracking tests may be performed on mix designs on a random basis to collect data for future pavement design input.

9. "SAME AS" JOB MIX FORMULAS

- 9.1 Some job mix formulas are permitted as "same as" mix designs. "Same as" JMF's can occur when the contractor requests switching from hot mix to warm mix, from lime to LASA, is switching warm mix or LASA additives, is utilizing COAC, or if the contractor is using the mix design at multiple plants. The type of aggregate used and the gradations are to remain the same. Certain verification samples are required to be submitted with "same as" job mix formulas to verify the mix design's performance. A

new job mix number will be given to these “same as” mixes, and the changes will be noted on the new job mix formula.

- 9.2 **HMA to WMA (with lime):** when a contractor requests a “same as” mix design that involves going from hot mix to warm mix that uses a chemical additive and lime, the contractor must produce and submit three (3) bulk gyratory specimens at optimum or COAC binder % for verification of mixes with volumetric properties at the lower temperature.
- 9.3 **HMA to WMA (without lime):** When a contractor requests a “same as” mix design that involves going from hot mix and is already using a warm mix additive listed on QPL 77 to act as an anti-stripping additive, and there is no lime present in the mix, to warm mix, the contractor must produce and submit three (3) bulk gyratory specimens at optimum or COAC binder % for verification of mixes with volumetric properties at the lower temperature. There is no requirement to test moisture susceptibility (ITS) because it was tested using the same chemical additive in the hot mix.
- 9.4 **Converting between Opt. AC and COAC:** when a contractor requests a “same as” mix design that involves converting an approved Optimum Asphalt Content to Corrected Optimum Asphalt Content (COAC) or vice versa, the contractor can use the same aggregate gradations and bulk specimens that were used to determine the asphalt content for the approved mix. However, the contractor must also produce and submit three (3) bulk gyratory specimens and one (1) MSG sample for verification for volumetric properties with the new asphalt binder content, along with any performance testing (ITS, APA, and Ideal CT).
- 9.5 **Switching WMA Additives:** when the contractor requests a “same as” mix design that involves switching warm mix additives, the contractor must produce and submit three (3) bulk gyratory specimens at optimum or COAC binder % for verification of mixes with volumetric properties at the lower temperature. Moisture susceptibility (ITS) must also be determined and all paperwork submitted due to using a different WMA. Switching warm mix chemical additives will require a new QA/QC Plan to be submitted to outline the chemical additives used.
- 9.6 **Switching LASA Additives:** when a contractor switches LASA chemical additives from QPL 104, the contractor must determine moisture susceptibility (ITS) at normal HMA temperature and all paperwork submitted to the DAM and AME due to using a different LASA. (There is no requirement set in place to obtain a “same as” mix design for switching LASA sources, but the Department can ask for specimens for verification at any time.)
- 9.7 **Lime to LASA:** when the contractor requests a “same as” mix design that involves switching from lime to LASA, the contractor will remove the 1% lime and add the 1% increment to the screening product or baghouse fines. The contractor must produce and submit three (3) bulk gyratory specimens at optimum or COAC binder % for verification of mixes with volumetric properties at the HMA temperature. Moisture

susceptibility (ITS) must also be determined and all paperwork submitted to ensure the change to LASA does not affect the mixture negatively.

- 9.8 **Amine to Organosilane:** when the contractor requests a “same as” mix design that involves switching from an amine based chemical additive to an organosilane based chemical additive, whether LASA or WMA, the contractor must produce and submit three (3) bulk gyratory specimens at optimum or COAC binder % for verification of mix with volumetric properties at the HMA or WMA temperature. Moisture susceptibility (ITS) must also be determined and all paperwork submitted to ensure the change in chemistries does not affect the mixture negatively.

10. JOB MIX FORMULA REVISIONS

- 10.1 Per SC-M-400, when an asphalt mixture is not meeting the acceptance control limits, up to three (3) revisions are allowed. The revision allows the contractor to submit slight changes to a specific job mix formula based on results from production.
- 10.2 During the revision process, target gradation cannot change more than 3% from the combined gradation of the original mix design. Asphalt binder content (AC%) cannot change more than 0.3% from the original mix design’s target AC%. Air voids (AV%) cannot change more than 0.5% from the original mix design’s target AV%. Voids in mineral aggregate (VMA%) cannot change more than 1.0% from the original mix design’s target VMA%. On top of the limitations above, all revision changes must also fall within the design specifications set forth in SC-M-402.
- 10.3 Revision requests will be submitted to the OMR Mix Design Lab for approval and will be affective to the next LOT.
- 10.4 Revisions will be made to the job mix formula information sheet. Form 269 will remain unrevised to maintain the original mix design. A copy of the revised JMF information sheet will be distributed to the contractor’s QC Manager, Asphalt Materials Engineer (AME), Asphalt Verification Program Manager, and District Asphalt Manager (DAM).

11. CALCULATIONS

- 11.1 As per SC-T-68, SC-T-70, SC-T-75, SC-T-83, SC-T-90, SC-T-96, SC-T-102, SC-T-103.

12. REPORT

- 12.1 The Department will prepare a job mix formula information sheet with the contractor’s name, plant location, testing data, along with acceptance and expiration date. This information sheet will be kept on file at the Department, and a copy will be sent to the contractor.