

818 BITUMINOUS CONCRETE MIXTURES**818.01 GENERAL**

The Contractor shall submit to the Chief Engineer for approval a job mix formula for each type of bituminous mixture proposed for use. Approval of a job mix formula for a specific project, purpose, or use does not approve its use for any other project, purpose, or use.

Production of bituminous mixtures shall not commence until an approved job mix formula has been obtained in accordance with these specification requirements. Any deviation from the approved job mix formula or approved source of materials shall require the approval by the Chief Engineer.

The Contractor shall allow 30 working days to receive approval or rejection of a proposed job mix formula after it has been submitted to the Chief Engineer for approval.

It is the Contractor's responsibility to furnish the Chief Engineer the necessary quantity of materials for each proposed job mix formula to yield 75 pounds of bituminous mixture, with each job mix formula submitted. Each job mix formula submitted for approval shall include the following information:

1. Name of project and location.
2. Name of Contractor.
3. Name of producer or supplier.
4. Name and class or type of bituminous mixture.
5. Proposed use of bituminous mixture.
6. Name, source, and amount (percent by weight of total mixture) of all ingredient materials proposed for use, including:
 - a. Bitumen
 - b. Coarse aggregate
 - c. Fine aggregate
 - d. Mineral filler
 - e. Hydrated Lime or Liquid Anti Strip Additive
 - f. Other
7. Gradation of combined aggregate and mineral filler, expressed by percent passing required sieve sizes.
8. Mixing temperature.
9. Temperature of mix when delivered to the spreader and finisher.
10. Gradation test results for each aggregate size and source proposed.
11. Gradation test results of composite mixture.

12. Tests performed on the total mixture shall be prepared in conformance with AASHTO M323.

A maximum of one primary and one alternate job mix formula per mix type will be approved per contractor and/or supplier per calendar year. An alternate job mix formula is either an alternate supplier or a single supplier with different combinations of materials.

818.02 DESIGN CRITERIA

Job mix formulas for bituminous mixtures submitted for approval as required in [818.01](#) shall be based on the following:

- (A) **MIX DESIGN** –The Contractor shall develop a Superpave mix design in conformance with AASHTO R-35. HMA Superpave mixes, i.e. 12.5 mm surface course, 9.5 mm leveling and surface course, and 19.0 mm and 25.0 mm base course or as directed by the Chief Engineer, shall conform to the specifications for Superpave Volumetric Mix Design, AASHTO M-323-04, and shall be designed for thirty (30) million Equivalent Axle Loading (ESAL).

The Contractor shall not use crushed, re-cycled asphalt pavement material (RAP) or crushed glass roof shingles from manufacturing waste.

- (B) **AGGREGATES** – Aggregates shall conform to Section [803.03](#), [803.04](#) and AASHTO MP 2, with the exception that the aggregate retained on the No. 4 sieve shall be tested for flat and elongated particles in conformance with ASTM D4791.

- (C) **MIX DESIGN APPROVAL** –Documents containing the data from the Contractor’s laboratory study shall be submitted to the Chief Engineer for tentative approval at least two weeks prior to paving operations, using DDOT-approved AASHTO software, and shall include the following:

- (1) Mix designation and Contract Number shall be on Contract Documents
- (2) Source and percentage of aggregate
- (3) Source, percentage, and grade of performance graded asphalt binder
- (4) Anticipated gradation and proportion of each component aggregate
- (5) Combined cold feed grading, extracted grading, or ignited grading
- (6) Plant where HMA mix will be produced
- (7) Plant target mixing temperature based on viscosity of 0.22 Pascal second.
- (8) Percent passing No. 200 sieve removed by dust collection system
- (9) Ratio of dust to binder material on effective asphalt
- (10) Maximum specific gravity at the target binder content
- (11) Mix design grading plotted on 0.45 power gradation chart
- (12) Tensile strength ratio and worksheet
- (13) The gyratory compaction curve for N_{max}
- (14) The bulk specific gravity at N_{Design} gyrations

- (15) the air void content (percent Va) at N_{initial} , N_{design} , and N_{max} gyrations.
- (16) The voids in the mineral aggregate (percent VMA) and the voids filled with asphalt (percent VFA) at N_{Design} gyrations (TP4)
- (17) The slope of the gyratory compaction curve

(D) ALL CONSENSUS AND SOURCE PROPERTIES

- (1) Coarse aggregate angularity
- (2) Flat and elongated
- (3) Sand equivalent
- (4) Uncompacted void content of fine aggregate
- (5) Bulk and apparent specific gravity of coarse and fine aggregate
- (6) Absorption of coarse and fine aggregate

Mix designs submitted to the Chief Engineer for approval shall be accompanied by a quantity of job mix formula aggregate and appropriate amount of required PG binder for ignition oven calibration.

If previous construction or performance experience has shown the proposed job mix design to be unsatisfactory, the Chief Engineer may require the Contractor to submit a more suitable design.

If the Contractor proposes to change the source of aggregate used in the mix, the revised mix design shall be submitted with the information required. The conditions set forth above relative to initial submission shall apply. If a change in the Performance Grade binder source becomes necessary, DDOT requires an anti-stripping additive test in conformance with ASTM D 4867 before giving the final approval; DDOT approved anti-stripping is required in all AC mixtures.

- (E) FIELD VERIFICATION OF MIX DESIGN**—After receiving the tentative approval for the mix design from the Engineer, the Contractor shall conduct a field verification of the mix at the beginning of production in each plant. The certified personnel shall perform field verification. The verification samples shall be prepared as specified in AASHTO R-35-04. The Contractor shall notify the Chief Engineer at least two working days in advance of the scheduled verification.

(F) VERIFICATION EVALUATION

- (1) Initial verification shall consist of four samples tested for the parameters of the approved mix design.

These samples shall be randomly drawn from the first days' production. If the production of the first day is less than 500 tons, the Contractor may spread verification testing over the number of days needed to accumulate 500 tons. The verification testing shall be completed on the day when the production has reached 500 tons. The Contractor shall evaluate the verification test results.

- (2) If the mix produced by the plant conforms to the parameters, production may proceed without any changes. If the Contractor has submitted mixes with identical aggregate combinations and differing asphalt contents associated with changes in

ESAL loads, verification will be limited to volumetric analysis at the discretion of the Chief Engineer.

- (3) If the mix produced by the plant does not conform to the parameters, then an adjustment to the asphalt content or gradation may be made to bring the mix design requirements within acceptable levels.

Permissible adjustment limitations between approved Mix Design and Adjusted Mix Design are as follows:

Test Property % *	Permissible Adjustment
Larger than 1/2 inch sieve	±5
1/2 inch through No. 4 sieves	±4
No. 8 through No. 100 sieves	±3
No. 200 sieves	±1
Binder content	±0.2

* The permissible adjustment for all mixes shall establish a job mix formula having targets outside the restricted zone. Superpave mixes shall be within control points.

When an adjustment is made to the mix design, a second verification shall be performed to ensure that the modified mix conforms to all design requirements. The time and tonnage limitations shall be as specified in (a) above. Material produced during this verification will be subject to removal as specified at the discretion of the Chief Engineer if it does not conform to specifications.

If the adjusted mix conforms to the mix design parameters, production may proceed; if it does not conform, production shall be suspended and a new mix design shall be submitted to the Chief Engineer for approval. The new mix design shall be designed as specified in AASHTO R-35-04.

- (4) Subsequent mix designs submitted due to non-conformance will be subject to removal at the discretion of the Chief Engineer. If the mix does not conform to (2) above during initial verification, production for the mix shall be suspended until the Chief Engineer takes corrective action.

(G) PAVEMENT CORES - The Contractor shall obtain pavement cores at the direction of the Chief Engineer within twenty-four (24) hours after lay-down.

(H) STONE FILLED SHEET ASPHALT JOINT REPAIR AND SPALLS - The fine aggregate shall meet the requirements of [803.03 \(B\)](#). Anti-strip additive or hydrated lime shall be added as needed to meet the requirements stated in [803.03\(B\)](#). Stone filled asphalt shall have the following properties:

Property	Min	Max
Sieve Size		
% passing by weight		
3/8 inch	100	
No. 4	95	100

No. 10	75	95
No. 40	40	70
No. 80	15	40
No.200(a)	8	

- (a) The maximum dust to asphalt ratio by weight shall be 1.5 for stone filled asphalt.

Stability		
Lbs (AASHTO T245)		
Minimum	1000	
Flow		
0.01 in.		
(AASHTO T 245)	8	16
Air Voids, %	4	10
VMA, %		
Minimum		20
Plant Temp., ° F		
Aggregate, Max		350
Binder, Max		350
Mixture, Max		350
Street Temp., ° F avg		315

Fine aggregates for stone-filled sheet asphalt surface shall meet the quality requirements of [803.03\(A\)](#). The gradation of the fine aggregates or combination of fine aggregates shall be such that it will produce the specified bituminous mixture properties when combined with other mixed ingredients. The combined fine aggregates shall consist of not less than forty (40) percent by weight of crushed stones Grade No. 10 from an approved source containing from eight (8) to fifteen (15) percent fines passing the No. 200 sieve.

- (I) The potential moisture damage on all paving mixtures shall be evaluated in accordance with ASTM D 4867 without the freezing cycle. The minimum retained strength shall not be less than 75 percent of the unconditioned pair of test samples. When the minimum retained strength can not be obtained with anti-strip additive, hydrated lime in slurry form shall be used in place of or in addition to the anti-strip additive.
- (J) Proposed bituminous job mix formulas shall be adjusted by the addition or change of an anti-strip additive or hydrated lime.
- (K) The minimum percent coated particles after boiling (D.C. Test Method B 102) shall be 95 for all mixes.