

SECTION 331
TYPE S ASPHALT CONCRETE

331-1 Description.

Construct a Type S-I, Type S-II or Type S-III Asphalt Concrete as specified by the Contract. When offered as alternates, either Type may be constructed. The composition and physical test properties for all mixes including Type S Asphaltic Concrete (S-I, S-II and S-III) are shown in Tables 331-1 and 331-2.

Where Type S Asphalt Concrete is specified in the Contract, if approved by the Engineer, Type S-III Asphalt Concrete may be selected as an alternate for the final surface when no friction course is specified, and as the final layer of structural course prior to the friction course. The Engineer will not permit Type S-II Asphaltic Concrete as the final layer prior to the friction course.

Meet the requirements for plant and equipment specified in Section 320. Meet the general construction requirements specified in Section 330.

Table 331-1 Bituminous Concrete Mixtures (Gradation Design Range)								
Type	Total Aggregate Passing Sieves ¹							
	3/4 inch [19.0 mm]	1/2 inch [12.5 mm]	3/8 inch [9.5 mm]	No. 4 [4.75 mm]	No. 10 [2.0 mm]	No. 40 [425 μm]	No. 80 [180 μm]	No. 200 [75 μm]
S-I ⁵	100	88-98	75-93	47-75	31-53	19-35	7-21	2-6
S-II ²	83-98	71-87	62-78	47-63	33-49	19-35	9-18	2-6
S-III ⁵		100	88-98	60-90	40-70	20-45	10-30	2-6
Type II		100	90-100	80-100	55-90			2-12
Type III		100	80-100	65-100	40-75	20-45	10-30	2-10
SAHM		100						0-12
ABC-1		100						0-12
ABC-2		100			55-90			0-12
ABC-3 ³	70-100			30-70	20-60	10-40		2-10
FC-2 ⁴		100	85-100	10-40	4-12			2-5
FC-3 ⁵		100	88-98	60-90	40-70	20-45	10-30	2-6

¹ In inches [mm] or sieves [μm].
² 100% passing 1 1/4 inch [31.5 mm] sieve and 94 to 100% passing 1 inch [25.0 mm] sieve.
³ 100% passing 1 1/2 inch [37.5 mm] sieve.
⁴ The Engineer may increase the design range for the No. 10 [2.00 mm] sieve for lightweight aggregates.
⁵ The Engineer may retain up to 1% on the maximum sieve size.

**Table 331-2 Non SI Units
Marshall Design Properties For Bituminous Concrete Mixes**

Mix Type	Minimum Marshall Stability (lbs.)	Flow** (0.01 in.)	Minimum VMA (%)	Air Voids (%)	Minimum Effective Asphalt Content (%)	VFA Voids Filled with Asphalt (%)
S-I	1,500*	8-13	14.5	4-5	***	65-75
S-II	1,500*	8-13	13.5	4-5	***	65-75
S-III	1,500*	8-13	15.5	4-6	***	65-75
Type II	500-750	7-15	18	5-16	6.0	-
Type III	750-1,000	7-15	15	5-12	5.5	-
SAHM	300-500	7-15	15	5-16	6.0	-
ABC-1	500	7-15	15	5-16	6.0	-
ABC-2	750	7-15	15	5-14	5.5	-
ABC-3	1,000	8-13	14	4-7	***	65-78
FC-2	-	-	-	-	-	-
FC-3	1,500	8-13	15.5	4-6	***	65-75

*The minimum Marshall Stability for Type S mixes used on limited access facilities (Interstate, Turnpike, and Expressways) shall be 1,800 lbs.

**The maximum Flow value during production shall not exceed one point more than shown in the Table.

***The ratio of the percentage by weight of total aggregate passing the No. 200 sieve to the effective asphalt content expressed as a percentage by weight of total mix shall be in the range of 0.6 to 1.2.

**Table 331-2 SI Units
Marshall Design Properties For Bituminous Concrete Mixes**

Mix Type	Minimum Marshall Stability (kN)	Flow** (mm)	Minimum VMA (%)	Air Voids (%)	Minimum Effective Asphalt Content (%)	VFA Voids Filled with Asphalt (%)
S-I	6.7*	2.0-3.3	14.5	4-5	***	65-75
S-II	6.7*	2.0-3.3	13.5	4-5	***	65-75
S-III	6.7*	2.0-3.3	15.5	4-6	***	65-75
Type II	2.2-3.3	1.8-3.8	18	5-16	6.0	-
Type III	3.3-4.4	1.8-3.8	15	5-12	5.5	-
SAHM	1.3-2.2	1.8-3.8	15	5-16	6.0	-
ABC-1	2.2	1.8-3.8	15	5-16	6.0	-
ABC-2	3.3	1.8-3.8	15	5-14	5.5	-
ABC-3	4.4	2.0-3.3	14	4-7	***	65-78
FC-2	-	-	-	-	-	-
FC-3	6.7	2.0-3.3	15.5	4-6	***	65-75

*The minimum Marshall Stability for Type S mixes used on limited access facilities (Interstate, Turnpike, and Expressways) shall be 8.0 kN.

**The maximum Flow value during production shall not exceed 0.25 mm more than shown in the Table.

***The ratio of the percentage by weight of total aggregate passing the 75m sieve to the effective asphalt content expressed as a percentage by weight of total mix shall be in the range of 0.6 to 1.2.

The Engineer will accept the work on a LOT to LOT basis in accordance with the applicable requirements of Sections 5, 6, and 9. The size of the LOT will be as specified in 331-5 for the bituminous mixture produced at the plant and as stipulated in 330-11 and 330-13 for the material placed on the roadway.

331-2 Materials.

331-2.1 General Specifications: Meet the requirements specified in Division III. Specific references are as follows:

- (1) Asphalt Cement Viscosity Grade AC-30916-1
- (2) Mineral Filler917-1 and 917-2
- (3) Coarse Aggregate, Stone, Slag or Crushed Gravel *Section 901
- (4) Fine Aggregate Section 902

*Use crushed gravel in asphalt concrete mixtures. In addition, the asphalt concrete mixtures containing crushed gravel as the coarse aggregate component must show no potential for stripping during laboratory testing, before mix design verification.

Reclaimed Portland Cement Concrete Pavement may be used as a coarse aggregate or screenings component subject to meeting all applicable specifications.

The Engineer will sample all materials shipped to the asphalt plant at their destination.

331-2.2 Specific Requirements:

331-2.2.1 Condition of Aggregate: Use clean aggregate containing no deleterious substances. Do not use coarse or fine aggregate which contains more than 0.5% of phosphate.

331-2.2.2 Fine Aggregate and Mineral Filler: In laboratory tests, and for the purpose of proportioning the paving mixture, consider all material passing the No. 10 [2.00 mm] sieve and retained on the No. 200 [75 µm] sieve as fine aggregate, and the material passing the No. 200 [75 µm] sieve as mineral filler.

331-2.2.3 Screenings: Do not use any screenings in the combination of aggregates containing more than 15% of material passing the No. 200 [75 µm] sieve. When two screenings are blended to produce the screening component of the aggregate, one of such screenings may contain up to 18% of material passing the No. 200 [75 µm] sieve, as long as the combination of the two does not contain over 15% material passing the No. 200 [75 µm] sieve. Screenings may be washed to meet these requirements.

331-2.2.4 Use of Reclaimed Asphalt Pavement (RAP): RAP may be used as a component material of the bituminous mixture subject to the following:

1. Assume responsibility for the design of asphalt mixes which incorporate RAP as a component part.

2. Do not allow RAP to exceed 60% by weight of total aggregates for Asphalt Base Courses nor more than 50% by weight of total aggregates for Structural and Leveling Courses. Do not use RAP in Friction Courses.

3. Mount a grizzly or grid with openings of a sufficient size to prevent clogging of the cold feed over the RAP cold bin.

Use a grizzly or grid over the RAP cold bin, in-line roller crusher, screen, or other suitable means to prevent oversized RAP material from showing up in the completed recycled mixture.

If oversized RAP material appears in the completed recycled mix, cease plant operations and take appropriate corrective action.

4. Ensure that the RAP material as stockpiled is reasonably uniform in characteristics and contains no aggregate particles which are soft or conglomerates of fines.

5. Ensure that the RAP has a minimum average asphalt content of 4% by weight of total mix. The Department reserves the right to sample the stockpile in order that this requirement is met.

When milling is required on the project and a Composition of Existing Pavement is included in the Contract Documents, and the Contractor elects to use the milled material as a component of the asphalt mixture, use the following procedures for obtaining representative samples for the mix design:

1. Cut ten 6-inch [150 mm] cores in area(s) approved by the Engineer. Fill the core holes immediately prior to opening to traffic.

2. Representative samples may also be obtained by milling the existing pavement to the full depth shown on the plans for pavement removal for a length of approximately 200 feet [60 m]. Immediately replace the pavement removed with the specified mix in the Contract.

3. Submit a request in writing to the Engineer for any variance from the above outlined methods of obtaining samples for mix designs.

When the RAP to be used as a component in a mix design is stockpiled from a previous DOT project and the Composition of Existing Pavement is known, design the mix and submit to the Department for verification.

When the composition of stockpiled RAP to be used as a component in a mix design is not known, design the mix as follows:

1. Submit a bag of RAP, composed of samples from several locations in the stockpile(s), to the Department at least four weeks prior to the planned start of mix design. The Engineer will run viscosities on the reclaimed asphalt pavement and furnish the information to the Contractor.

2. Run a minimum of six extraction gradation analyses of the RAP. Take the samples at random locations around the stockpile(s).

3. Request the Engineer to make a visual inspection of the stockpile(s) of RAP. Based on visual inspection, the Engineer will determine the suitability of the stockpiled materials.

4. When the proposed mix design is submitted to the Department for verification, submit the data from the extraction gradation analyses required above.

331-2.2.5 Recycling Agents: When RAP is approved for use as a component material, use a recycling agent meeting the requirements specified in 916-2 in the mix.

The Engineer will select the best formulation suited for the project and reserves the right to request reasonable changes throughout the construction duration.

331-2.2.6 Use of Recycled Crushed Glass: Recycled crushed glass may be used as a component of the bituminous mixture subject to the following:

1. Consider the recycled crushed glass a local material and meet all requirements specified in 902-6.

2. The percentage of recycled crushed glass in any bituminous mixture does not exceed 15% of the total aggregate weight.

3. The asphalt binder used with mixtures containing recycled crushed glass contains 0.5% anti-stripping agent from an approved source. The addition of the specified amount of anti-stripping agent must be certified by the supplier.

4. Test bituminous mixtures containing recycled crushed glass in accordance with AASHTO T 283 as part of the mix design approval. The minimum tensile strength ratio must not be less than 80%. An increase in the amount of anti-stripping agent may be necessary in order to meet this requirement.

5. Recycled crushed glass must not be used in friction course mixtures nor in structural course mixtures which are to be used as the final wearing course.

331-3 Permissible Variation for the Coarse Aggregate.

Size and uniformly grade or combine the aggregate or aggregates shipped to the job in such proportions that the resulting mixture meets the grading requirements of the mix design.

331-4 General Composition of Mixture.

331-4.1 General: Use a bituminous mixture composed of a combination of aggregate (coarse, fine or mixtures thereof), mineral filler, if required, and bituminous material. Ensure that not more than 20% by weight of the total aggregate used is silica sand or local materials as defined in Section 902.

Consider the silica sand and local materials contained in any RAP material, if used in the mix, in this limitation. Size, grade and combine the several aggregate fractions in such proportions that the resulting mixture meets the grading and physical properties of the verified mix design.

RAP meeting the requirements of 331-2.2.4 may be approved as a substitution for a portion of the combination of aggregates, subject to all applicable specification requirements being met.

331-4.2 Grading Requirements: In all cases, use a mix design within the design ranges specified in Table 331-1.

331-4.3 Mix Design:

331-4.3.1 General: Prior to the production of any asphaltic paving mixture, submit a mix design and representative samples of all component materials to the Department at least two weeks before the scheduled start of production. The Engineer will verify the mix design before use. Send a copy of the proposed mix design to the Engineer at the same time. (Open-graded mixes will be designed by the Engineer.) Furnish the following information:

1. The specific project on which the mixture will be used.
2. The source and description of the materials to be used.
3. The gradation and approximate proportions of the raw materials as intended to be combined in the paving mixture. The gradation of the component materials shall be representative of the material at the time of use.
4. A single percentage of the combined mineral aggregate passing each specified sieve. Degradation of the aggregate due to processing (particularly No. 200 [75 µm]) should be accounted for and identified for the applicable sieves.
5. A single percentage of asphalt by weight of total mix intended to be incorporated in the completed mixture, shown to the nearest 0.1%. For structural mixes (S-I, S-II and S-III) establish the optimum asphalt content at a level corresponding to a minimum of 4.5% air voids. For FC-3 mixes, establish optimum asphalt content at a level corresponding to a minimum of 5.0% air voids.
6. A single temperature at which the mixture is intended to be discharged from the plant.
7. The laboratory density of the asphalt mixture for all mixes except Open-Graded Friction Courses.
8. Evidence that the completed mixture will meet all specified physical requirements.
9. The name of the individual responsible for the Quality Control of the mixture during production.

331-4.3.2 Revision of Mix Design: Submit all requests for revisions to approved mix designs, along with supporting documentation, in writing to the Engineer. In order to expedite the revision process, a verbal revision request or discussion of the possibility of a revision request may be made, but must be followed up with a written request. The verified mix design will remain in effect until a change is authorized by the Engineer. In no case will the effective date of the revision be established earlier than the date of the first communication with the Engineer regarding the revision.

Provide a new mix design for any change in source of aggregate.

331-4.3.3 Resistance to Plastic Flow: Include with the submitted mix design test data showing that the material as produced will meet the requirements specified in Table 331-2 when tested in accordance with FM 1-T 245. Further, determine the bulk specific gravity of the laboratory compacted bituminous mixture in accordance with FM 1-T 166.

Determine the percent of unfilled voids and the percent of aggregate voids filled with asphalt using the maximum specific gravity of the bituminous mixture and on the asphalt content of each group of specimens prepared from the same sample. Determine maximum specific gravity of the bituminous mixture by FM 1-T 209.

331-4.4 Contractor's Quality Control:

331-4.4.1 Personnel: In accordance with the requirements of 330-2.2 provide the necessary quality control personnel. Ensure that the Quality Control Technician is certified by the Department and possesses a valid certificate of qualification. When it becomes evident to the Department that the Quality Control Technician cannot perform as required by the position, the Department will revoke the certification and require replacement with a certified technician.

331-4.4.2 Extraction Gradation Analysis: Sample the bituminous mixture at the plant in accordance with FM 1-T 168. With the exception of friction courses, determine the percent bitumen content of the mixture in accordance with FM 5-544, and determine the percent passing the standard sieves in accordance with FM 5-545. Determine the percent bitumen content and the percent passing the standard sieves for friction course mixtures in accordance with FM 5-563 and FM 1-T 030, respectively. If the Contractor and Engineer agree, FM 5-563 and FM 1-T 030 may be used for acceptance on all mixtures. Show all test results to the nearest 0.01. Carry all calculations to the nearest 0.001 and rounded to the nearest 0.01, in accordance with the Department's rules of rounding.

Run a minimum of one extraction gradation analysis of the mixture for each day's or part of a day's production and immediately following any change in the production process. Take the quality control sample of mixture for the extraction gradation analysis each day as soon as the plant operations have stabilized. Obtain the results in a timely manner (no later than the end of the day) so that adjustments can be made if necessary.

On initial use of a Type S or FC-3 mix design at a particular plant, as a minimum, run an additional extraction gradation analysis if more than 500 tons [450 metric tons] of mixture are produced on the first day of production.

Extraction gradation analysis will not be required on the days when mix production is less than 100 tons [90 metric tons]. However, when mix production is less than 100 tons [90 metric tons] per day on successive days, run the test when the accumulative tonnage on such days exceeds 100 tons [90 metric tons].

Use the target gradation and asphalt content as shown on the mix design. Any changes in target will require a change in the mix design in accordance with 331-4.3.2.

If the percentage of bitumen deviates from the optimum asphalt content by more than 0.55% or the percentage passing any sieve falls outside the limits shown in Table 331-3, make the necessary correction. If the results for two consecutive tests deviate from the optimum asphalt content by more than 0.55% or exceeds the limits as shown in Table 331-3 for any sieve, stop the plant operation until the problem has been corrected. In addition, if the results of two consecutive tests show an amount greater than 99.0% passing the 1/2 inch [12.5 mm] sieve for Type S-I, an amount greater than 99.0% passing the 3/4 inch [19.0 mm] sieve for Type S-II, or an amount greater than 99.0% passing the 3/8 inch [9.5 mm] sieve for Types S-III or FC-3, stop the plant operation until the problem has been corrected.

Maintain control charts showing the results of the extraction gradation analysis (bitumen content and sieve analysis).

Sieve Size	Percent Passing
1 inch [25.0 mm]	7
3/4 inch [19.0 mm]	7
1/2 inch [12.5 mm]	7
3/8 inch [9.5 mm]	7
No. 4 [4.75 mm]	7
No. 10 [2.00 mm]	5.5
No. 40* [*425 μm]	4.5
No. 80* [*180 μm]	3
No. 200 [75 μm]	2

*Does not apply to SAHM, ABC-1 or Type II.

331-4.4.3 Plant Calibration: At or before the start of mix production, perform a wash gradation on a set of hot bin samples for batch or continuous mix plants or belt cut for drum mix plants to verify calibration of the plant. When approved by the Engineer, extraction gradation analysis of the mix may be used to verify calibration of the plant. This extraction gradation analysis may also be used to fulfill the quality control requirements for the first days production.

331-4.4.4 Viscosity of Asphalt in Mixes Containing RAP: When RAP is a component material, the viscosity of the asphalt material in the bituminous mixture, determined by the Engineer in accordance with FM 1-T 202, shall be $6,000 \pm 2,000$ poises [600 ± 200 Pa·s]. This determination will be made on samples obtained by the Department on a random basis at a frequency of approximately one per 2,000 tons [1,800 metric tons] of mix.

If the viscosity is determined to be out of the specified tolerance, adjust the recycling agent formulation or blend of reclaimed asphalt material used in the mixture to bring the viscosity within tolerance.

331-5 Acceptance of the Mixture.

331-5.1 General: The Engineer will accept the bituminous mixture at the plant, with respect to gradation and asphalt content, on a LOT to LOT basis. The material will be tested for acceptance in accordance with the provisions of 330-2 and the following requirements. However, the Engineer will reject any load or loads of mixture which are unacceptable for reason of being excessively segregated, aggregates improperly coated, or of excessively high or low temperature for use in the work.

For initial use of a Type S or FC-3 mix design with a Florida limestone source north of the 28th parallel at a particular plant, limit the first day's production to a maximum of 300 tons [275 metric tons]. Resume production upon notification of acceptable Marshall properties as determined in accordance with 331-5.5

A standard size LOT at the asphalt plant will consist of 4,000 tons [3,600 metric tons] with four equal sublots of 1,000 tons [900 metric tons] each. As an exception, the first LOT for the initial use of a Type S or FC-3 mix design with a particular plant will consist of four sublots, the first subplot of 500 tons [450 metric tons] or the first day's production (300 tons [275 metric tons] maximum for mix design with a Florida limestone source north of the 28th parallel), the second subplot of 500 tons [450 metric tons], and the remaining two sublots of 1,000 tons [900 metric tons] each.

A partial LOT may occur due to the following:

- (1) the completion of a given mix type on a project.
- (2) an approved LOT termination by the Engineer due to a change in process, extended delay in production, or change in mix design.

If the partial LOT contains one or two sublots with their appropriate test results, then the previous full-size LOT will be redefined to include this partial LOT and the evaluation of the LOT will be

based on either five or six subplot determinations. If the partial LOT contains three sublots with their appropriate test results, this partial LOT will be redefined to be a whole LOT and the evaluation of it will be based on three subplot determinations.

When the total quantity of any mix is less than 3,000 tons [2,700 metric tons], the partial LOT will be evaluated for the appropriate number of sublots from n=1 to n=3. When the total quantity of any mix type is less than 500 tons [450 metric tons], the Department will accept the mix on the basis of visual inspection. The Department may run extraction and gradation analysis for information purposes; however, the provisions for partial payment will not apply.

On multiple project contracts, the LOT(s) at the asphalt plant will carry over from project to project.

331-5.2 Acceptance Procedures: Control all operations in the handling, preparation, and mixing of the asphalt mix so that the percent bitumen and the percents passing the No. 4, No. 10, No. 40 and No. 200 [4.75 mm, 2.00 mm, 425 µm and 75 µm] sieves will meet the approved job mix formula within the tolerance shown in Table 331-5.

Characteristic	Tolerance*
Asphalt Content (Extraction)	±0.55%
Asphalt Content (Printout)	±0.15%
Passing No. 4 [4.75 mm] sieve	±7.00%
Passing No. 10 [2.00 mm] sieve	±5.50%
Passing No. 40 [425 µm] sieve **	±4.50%
Passing No. 200 [75 µm] sieve	±2.00%

*Tolerances for sample size of n=1. See Table 331-6 for other sample sizes n=2 through n=6.
 **Applies only to Types S-I, S-II, S-III, and FC-3.

Acceptance of the mixture will be on the basis of test results on consecutive random samples from each LOT. One random sample will be taken from each subplot. The bituminous mixture will be sampled and tested at the plant as specified in 331-4.4.2.

Calculations for the acceptance test results for bitumen content and gradation (percentages passing No. 4, No. 10, No. 40 and No. 200 [4.75 mm, 2.00 mm, 425 µm and 75 µm] sieves) will be shown to the nearest 0.01. Calculations for arithmetic averages will be carried to the nearest 0.001 and rounded to the nearest 0.01 in accordance with the Department's rules of rounding.

Payment will be made on the basis of Table 331-6, "Acceptance Schedule of Payment". The process will be considered out of control when the deviation of any individual test result from the mix design falls in the 80% pay factor for the "one test" column of Table 331-6. When this happens, the LOT will be automatically terminated and production stopped. The approval of the Engineer will be required prior to resuming production of the mix. Acceptance of the LOT will then be determined in accordance with Table 331-6.

All acceptance tests will be completed on the same day the sample was taken, when possible, and on no occasion will they be completed later than the following work day.

Table 331-6 Acceptance Schedule of Payment (Asphalt Plant Mix Characteristics)						
Average of Accumulated Deviations of the Acceptance Tests from the Mix Design.						
Pay Factor	1-Test	2-Tests	3-Tests	4-Tests	5-Tests	6-Tests
Asphalt Cement Content (Extraction - FM 5-544 or 5-563)						
1.00	0.00-0.55	0.00-0.43	0.00-0.38	0.00-0.35	0.00-0.33	0.00-0.31
0.95	0.56-0.65	0.44-0.50	0.39-0.44	0.36-0.40	0.34-0.37	0.32-0.36
0.90	0.66-0.75	0.51-0.57	0.45-0.50	0.41-0.45	0.38-0.42	0.36-0.39
0.80*	over 0.75	over 0.57	over 0.50	over 0.45	over 0.42	over 0.39
Asphalt Cement Content (Printout)						
1.00	0.00-0.15	0.00-0.15	0.00-0.15	0.00-0.15	0.00-0.15	0.00-0.15
0.95	0.16-0.25	0.16-0.25	0.16-0.25	0.16-0.25	0.16-0.25	0.16-0.25
0.90	0.26-0.35	0.26-0.35	0.26-0.35	0.26-0.35	0.26-0.35	0.26-0.35
0.80*	over 0.35	over 0.35	over 0.35	over 0.35	over 0.35	over 0.35
No. 4 [4.75 mm] sieve**						
1.00	0.00-7.00	0.00-5.24	0.00-4.46	0.00-4.00	0.00-3.68	0.00-3.45
0.98	7.01-8.00	5.25-5.95	4.47-5.04	4.01-4.50	3.69-4.13	3.46-3.86
0.95	8.01-9.00	5.96-6.66	5.05-5.62	4.51-5.00	4.14-4.58	3.87-4.27
0.90	9.01-10.00	6.67-7.36	5.63-6.20	5.01-5.50	4.59-5.02	4.28-4.67
0.80*	over 10.00	over 7.36	over 6.20	over 5.50	over 5.02	over 4.67
No. 10 [2.00 mm] sieve**						
1.00	0.00-5.50	0.00-4.33	0.00-3.81	0.00-3.50	0.00-3.29	0.00-3.13
0.98	5.51-6.50	4.34-5.04	3.82-4.39	3.51-4.00	3.30-3.74	3.14-3.54
0.95	6.51-7.50	5.05-5.74	4.40-4.96	4.01-4.50	3.75-4.18	3.55-3.95
0.90	7.51-8.50	5.75-6.45	4.97-5.54	4.51-5.00	4.19-4.63	3.96-4.36
0.80*	over 8.50	over 6.45	over 5.54	over 5.00	over 4.63	over 4.36
No. 40 [425 µm] sieve**						
1.00	0.00-4.50	0.00-3.91	0.00-3.65	0.00-3.50	0.00-3.39	0.00-3.32
0.98	4.51-5.50	3.92-4.62	3.66-4.23	3.51-4.00	3.40-3.84	3.33-3.72
0.95	5.51-6.50	4.63-5.33	4.24-4.81	4.01-4.50	3.85-4.29	3.73-4.13
0.90	6.51-7.50	5.34-6.04	4.82-5.39	4.51-5.00	4.30-4.74	4.14-4.54
0.80*	over 7.50	over 6.04	over 5.39	over 5.00	over 4.74	over 4.54
No. 200 [75µm] sieve**						
1.00	0.00-2.00	0.00-1.71	0.00-1.58	0.00-1.50	0.00-1.45	0.00-1.41
0.95	2.01-2.40	1.72-1.99	1.59-1.81	1.51-1.70	1.46-1.63	1.42-1.57
0.90	2.41-2.80	2.00-2.27	1.82-2.04	1.71-1.90	1.64-1.80	1.58-1.73
0.80*	over 2.80	over 2.27	over 2.04	over 1.90	over 1.80	over 1.73
*If approved by the Engineer based on an engineering determination that the material is acceptable to remain in place, the Contractor may accept the indicated partial pay. Otherwise, remove and replace the material at no cost to the Department at any item.						
**When there are two or more reduced payments for these items in one LOT of material, only the greatest reduction in payment will be applied. CAUTION: This rule applies only to these four gradation test results.						
NOTES:						
(1) The No. 40 [425 µm] sieve applies to Type S-I, S-II, S-III and FC-3.						
(2) Deviations are absolute values with no plus or minus signs.						

331-5.3 Automatic Batch Plant With Printout: Acceptance determinations for asphalt content for mixtures produced by automatic batch plants with printout will be based on the calculated bitumen content using the printout of the weights of asphalt actually used. Acceptance determinations for

gradations (No. 4, No. 10, No. 40 and No. 200 [4.75 mm, 2.00 mm, 425 µm and 75 µm] sieves) will be based on the actual test results from extraction gradation analyses. Payment will be made based on the provisions of Table 331-6.

331-5.4 Acceptance on the Roadway: The bituminous mixture will be accepted on the roadway with respect to compacted density and surface tolerance in accordance with the applicable requirements of 330-11 and 330-13.

331-5.5 Additional Tests: The Engineer reserves the right to run any test at any time for informational purposes and for determining the effectiveness of the Contractor's quality control.

331-5.5.1 Determination of Marshall and Volumetric Properties: The Engineer will determine the Marshall and Volumetric Properties of the mix at a minimum frequency of one set per LOT, to determine whether or not the produced mix is meeting the specification requirements. The Department will sample and prepare test specimens and test them in accordance with FM 5-511 for Marshall stability and flow, FM 1-T 209 for maximum specific gravity, and FM 1-T 166 for density. Volumetric properties will be determined for Type S and FC-3 mixes only.

331-5.5.2 Failing Marshall Properties: When the average value of the specimens fails to meet specification requirements for stability or flow, the Engineer may stop the plant operations until all specification requirements can be met or until another verified mix design has been approved. Make revisions to a mix design in accordance with 331-4.3.2.

331-5.5.3 Failing Volumetric Properties (Type S and FC-3 mixes only): When the Engineer determines the air void content to be less than 3.0%, or greater than 6.5%, make appropriate adjustments to the mix. When the air void content is determined to be less than 2.5% or greater than 7.0% on any one test, or less than 3.0% on two consecutive tests, cease operations until the problem has been resolved.

331-5.5.4 Resuming Production: In the event that plant operations are stopped due to a failure to meet specification requirements, obtain the Engineer's approval before resuming production of the mix. Limit production to a maximum of 300 tons [270 metric tons]. At this time, the Marshall and volumetric properties of the mix will be verified. After the Marshall and volumetric properties are verified, full scale production of the mix may be resumed.

331-5.5.5 Disposition of In-Place Material: Any material in-place that is represented by the failing test results (low stability, high flow, or less than 2.5% air voids) will be evaluated by the Engineer to determine if removal and replacement is necessary. Remove and replace any in-place material, if required, at no cost to the Department.

331-6 Method of Measurement.

The quantity to be paid for will be the weight of the mixture, in tons [metric tons], completed and accepted. The weight will be determined as provided in 320-2 (including the provisions for the automatic recordation system).

The bid price for the asphalt mix will include the cost of the liquid asphalt or the asphalt recycling agent. There will be no separate payment or unit price adjustment for the bituminous material in the asphalt mix.

331-7 Basis of Payment:

Price and payment will be full compensation for all the work specified under this Section, including the applicable requirements of Sections 320 and 330.

Payment will be made under:

Item No.	331- 2-	Type S Asphaltic Concrete - per ton.
Item No.	2331- 2-	Type S Asphaltic Concrete - per metric ton.