Florida Department of Transportation

CHARLIE CRIST
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605 Suwannee Street
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STEPHANIE KOPELOUSOS
SECRETARY

January 22, 2010

Monica Gourdine
Program Operations Engineer
Federal Highway Administration
545 John Knox Road, Suite 200
Tallahassee, Florida 32303

Re: Office of Design, Specifications
Section 334
Proposed Specification: **3340203 Superpave Asphalt Concrete.**

Dear Ms. Gourdine:

We are **resubmitting**, for your approval, two copies of the above referenced Supplemental Specification.

These changes were proposed by Greg Sholar of the State Materials Office to

- require the measurement of gyratory mold diameters in accordance with FM 5-585;
- allow different application rates for new anti-strip additives;
- require the contractor to enter process control data into LIMS;
- specify pay factors for partial LOTs when no sample was obtained;
- specify the maximum mix target temperature for different binders;
- require the first LOT for a new mix design be limited to 2000 tons;
- eliminate the requirements for the initial production LOT; and,
- change the time for LOT termination.

Please review and transmit your comments, if any, within two weeks. Comments should be sent via Email to ST986RP or rudy.powell@dot.state.fl.us.

If you have any questions relating to this specification change, please call Rudy Powell, State Specifications Engineer at 414-4280.

Sincerely,

Rudy Powell, Jr., P.E.
State Specifications Engineer

RP/dt

Florida Department of Transportation

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Attachment
cc: Gregory Jones, Chief Civil Litigation
Florida Transportation Builders' Assoc.
State Construction Engineer

SUPERPAVE ASPHALT CONCRETE.
(REV *1-22*~~11~~*-10*~~7-29-09~~)

SECTION 334-2.3.1 (of the Supplemental Specifications) is deleted and the following substituted:

334-2.3.1 General requirements: RAP may be used as a component of the asphalt mixture subject to the following requirements:

1. When using a PG 76-22 Asphalt Binder, limit the amount of RAP material used in the mix to a maximum of 20 percent by weight of total aggregate. As an exception, amounts greater than 20 percent RAP by weight of total aggregate can be used if no more than 20 percent by weight of the total asphalt binder comes from the RAP material.

2. Assume full responsibility for the design, production and construction of asphalt mixes which incorporate RAP as a component material.

3. Use RAP from an FDOT approved stockpile or RAP that has an FDOT furnished Pavement Composition Data Sheet.

4. Provide stockpiled RAP material that is reasonably consistent in characteristics and contains no aggregate particles which are soft or conglomerates of fines.

5. Provide RAP material having a minimum average asphalt binder content of 4.0 percent by weight of ~~total mix~~*RAP*. As an exception, when using fractionated RAP, the minimum average asphalt binder content for the coarse portion of the RAP shall be 2.5 percent by weight of the coarse portion of the RAP. The coarse portion of the RAP shall be the portion of the RAP retained on the No. 4 sieve. The Engineer may sample the stockpile(s) to verify that this requirement is met.

SUBARTICLE 334-3.2.4 (of the Supplemental Specifications) is deleted and the following substituted:

334-3.2.4 Gyratory Compaction: Compact the design mixture in accordance with AASHTO T 312-08, with the following exception: use the number of gyrations at N_{design} as defined in Table 334-3. *Measure the inside diameter of gyratory molds in accordance with FM 5-585.*

Table 334-3
Gyratory Compaction Requirements

Traffic Level	N_{design} Number of Gyrations
A	50
B	65
C	75
D	100
E	100

SUBARTICLE 334-3.2.6 (of the Supplemental Specifications) is deleted and the following substituted:

334-3.2.6 Moisture Susceptibility:

1. For Traffic Level A and B mixtures, use a liquid anti-strip additive, which is on the Department's Qualified Products List, at a rate of 0.5% by weight of the asphalt binder. *Other rates of anti-strip additive may be used upon approval of the Engineer.*

2. For Traffic Level C through E mixtures, test 4 inch specimens in accordance with FM 1-T 283. Provide a mixture having a retained tensile strength ratio of at least 0.80 and a minimum tensile strength (unconditioned) of 100 psi. If necessary, add a liquid anti-stripping agent, which is on the Department's Qualified Products List or hydrated lime (meeting the requirements of Section 337) in order to meet these criteria.

SUBARTICLE 334-3.2.7 (of the Supplemental Specifications) is deleted and the following substituted:

334-3.2.7 Additional Information: In addition to the requirements listed above, provide the following information with each proposed mix design submitted for verification:

1. The design traffic level and the design number of gyrations (N_{design}).
2. The source and description of the materials to be used.
3. The DOT source number and the DOT product code of the aggregate components furnished from a DOT approved source.
4. The gradation and 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. Compensate for any change in aggregate gradation caused by handling and processing as necessary.
5. A single percentage of the combined mineral aggregate passing each specified sieve. Degradation of the aggregate due to processing (particularly material passing the No. 200 sieve) should be accounted for and identified.
6. The bulk specific gravity (G_{sb}) value for each individual aggregate and RAP component, as identified in the Department's aggregate control program.
7. A single percentage of asphalt binder by weight of total mix intended to be incorporated in the completed mixture, shown to the nearest 0.1 percent.
8. A target temperature for the mixture at the plant (mixing temperature) and a target temperature for the mixture at the roadway (compaction temperature) in accordance with 330-6.3. Do not exceed a target temperature of 330°F ~~for modified asphalts (PG 76-22, ARB-5, and ARB-12)~~*for PG 76-22 asphalt binders, 320°F for ARB-12 asphalt binders,* ~~-~~and 315°F for *ARB-5 and* unmodified asphalt~~s~~ *binders*.
9. Provide the physical properties achieved at four different asphalt binder contents. One of which shall be at the optimum asphalt content, and must conform to all specified physical requirements.
10. The name of the CTQP Qualified Mix Designer.

11. The ignition oven calibration factor.
12. The warm mix technology, if used.

ARTICLE 334-4 (of the Supplemental Specifications) is deleted and the following substituted:

334-4 Contractor Process Control (for Option 1 Mixture Acceptance).

Assume full responsibility for controlling all operations and processes such that the requirements of these Specifications are met at all times. Perform any tests necessary at the plant and roadway for process control purposes. *Enter all Process Control test data into the Department's Laboratory Information Management System (LIMS) database.* The Engineer will not use these test results in the acceptance payment decision.

Address in the Quality Control Plan how Process Control failures will be handled. When a Process Control failure occurs, investigate, at a minimum, the production process, testing equipment and/or sampling methods to determine the cause of the failure, and make any necessary changes to assure compliance with these Specifications. Obtain a follow up sample immediately after corrective actions are taken to assess the adequacy of the corrections. In the event the follow-up Process Control sample also fails to meet Specification requirements, cease production of the asphalt mixture until the problem is adequately resolved to the satisfaction of the Quality Control Manager.

SUBARTICLE 334-5.1.1.1 (of the Supplemental Specifications) is deleted and the following substituted:

334-5.1.1.1 Sampling and Testing Requirements: Obtain the samples in accordance with FM 1-T 168. Obtain samples at the plant of a sufficient quantity to be split into three smaller samples; one for Quality Control, one for Verification and one for Resolution testing; each sample at approximately 35 pounds. The split samples for Verification testing and Resolution testing shall be reduced in size and stored in three boxes each. The approximate size of each box must be 12" x 8" x 4". Provide, label and safely store sample boxes in a manner agreed upon by the Engineer for future testing.

The asphalt content of the mixture will be determined in accordance with FM 5-563. In the event the FM 5-563 ignition oven goes out of service during production, the Contractor may elect to use a replacement oven at another location for no more than 72 hours while the oven is being repaired. The gradation of the recovered aggregate will be determined in accordance with FM 1-T 030. Volumetric testing will be in accordance with AASHTO T312-08 and FM 1-T 209. *Measure the inside diameter of gyratory molds in accordance with FM 5-585.* Prior to testing volumetric samples, condition the test-sized sample for one hour ± five minutes at the target roadway compaction temperature in a covered, shallow, flat pan, such that the mixture temperature at the end of the one hour conditioning period is within ± 20° F of the roadway compaction temperature. Test for roadway density in accordance with FM 1-T 166.

SUBARTICLE 334-5.1.2 (of the Supplemental Specifications) is deleted and the following substituted:

334-5.1.2 *Full* LOT*s*~~ Sizes:~~ ~~LOT sizes will be either 2,000 tons or 4,000 toThe Initial Production LOT of all mix designs used on a project shall consist of 2,000 tons, subdivided into four equal sublots of 500 tons each. Following the Initial Production LOT, e~~*E*~~ach~~ ~~remaining~~ LOT will be defined (as selected by the Contractor prior to the start of the LOT) as either (1) 2,000 tons, with each LOT subdivided into four equal sublots of 500 tons each, or (2) 4,000 tons~~ (as authorized by the Engineer per 334-5.1.2.1)~~, with each LOT subdivided into four equal sublots of 1,000 tons each. *As an exception to this, the initial LOT of all new mix designs shall be defined as 2,000 tons, subdivided into four equal sublots of 500 tons each.* Before the beginning of a LOT, the Engineer will develop a random sampling plan for each sublot and direct the Contractor on sample points, based on tonnage, for each sublot during construction.

~~In the event a LOT is terminated per 334-5.1.4.4, the LOT size upon resuming production of the mixture will be 2000 tons until the requirements of 334-5.1.2.1 are met.~~

~~**334-5.1.2.1 Criteria for 4,000 ton LOTs:** At the completion of the Initial Production LOT, the quality of the as-produced material will be evaluated by the Engineer. Begin the option of 4,000 ton LOT sizes only when authorized by the Engineer based upon the Quality Control test results for the Initial Production LOT meeting the following:~~

~~1. A minimum Pay Factor of 0.90 for each asphalt quality characteristic as defined in 334-8.2.~~

~~2. A favorable comparison with the Verification test results. Comparisons between the Quality Control and Verification test results will be based on between-laboratory precision values shown in Table 334-6.~~

~~3. A coefficient of permeability of less than 125 x 10^{-5} cm/s on each roadway core as determined in accordance with FM 5-565. Permeability criteria apply only to coarse mixes when the average density for the sublot is less than 93.00 percent of G_{mm}, or when an individual density value is less than 91.00 percent of G_{mm}.~~

~~In the event that the Initial Production LOT does not meet these criteria, limit production LOT sizes to 2,000 tons with 500 ton sublots until these criteria are met.~~

~~**334-5.1.2.2 Partial LOTs:** A partial LOT is defined as a LOT size that is less than a full LOT. A partial LOT may occur due to the following:~~

~~1. The completion of a given mix type or mix design on a project.~~

~~2. LOTs will be closed 20 calendar days after the start of the LOT. (Time periods other than 20 days may be used if agreed to by both the Engineer and the Contractor.)~~

~~3. A LOT is terminated per 334-5.1.4.4.~~

~~All partial LOTs will be evaluated based on the number of tests available, and will not be redefined.~~

SUBARTICLE 334-5.1.3 (of the Supplemental Specifications) is deleted and the following substituted:

~~**334-5.1.3 Initial Production Requirements:** The Initial Production LOT of all mix designs shall be established at 2,000 tons. During this period demonstrate the capability to produce and place the mixture as specified unless waived by the Engineer. If necessary, during this time, make adjustments to the mix design, as defined in 334-3.3. Any target value adjustments to the mix design will result in the LOT being closed and evaluated for payment purposes per 334-8. Do not begin 4,000 ton LOT sizes until a 2,000 ton initial production LOT (for each mix design) has been successfully completed, or is waived by the Engineer.~~

~~At the sole option of the Engineer, the requirement for an Initial Production LOT may be waived based on evidence of satisfactory production, placement and performance on previous projects for that particular mix.~~

~~**334-5.1.3.1 Plant Sampling and Testing Requirements:** Obtain one random sample of mix per sublot in accordance with 334-5.1.1.1 as directed by the Engineer. Test the Quality Control split sample for gradation, asphalt binder content and volumetrics in accordance with 334-5.1.1.1. Complete all Quality Control testing within one working day from the time the samples were obtained.~~

~~**334-5.1.3.2 Roadway Sampling and Testing Requirements:** Obtain five 6 inch diameter roadway cores within 24 hours of placement at random locations as directed by the Engineer within each sublot. Test these Quality Control samples for density in accordance with 334-5.1.1.1. The G_{mm} used for the density evaluation will be based on the Quality Control test result for the corresponding sublot.~~

~~On coarse mixes when the average density for an Initial Production sublot is less than 93.00 percent of G_{mm}, or an individual core density is less than 91.00 percent of G_{mm}, cut five 6 inch diameter roadway cores (at locations determined by the Engineer) and have them evaluated for permeability in accordance with FM 5-565 by a laboratory as approved by the Engineer. If approved by the Engineer, the original cores cut for density testing purposes may be used to evaluate permeability.~~

~~**334-5.1.3.3 Verification of Initial Production LOT:** For Verification purposes the Engineer will test a minimum of one split sample as described in 334-5.1.1.1 from the Initial Production LOT at the completion of the LOT. If the split Verification sample has cooled, reheat to the target roadway compaction temperature for 1 ½ hours ± 5 minutes prior to reducing to appropriate sample size and conditioning. The plant and roadway random samples shall be from the same sublot. However, for situations where roadway density is not required for the random sublot chosen, then another sublot shall be randomly chosen for roadway density only. Results of the testing and analysis for the LOT will be made available to the Contractor within one working day from when the LOT is completed.~~

~~The Verification test results will be compared with the corresponding Quality Control test results based on the between-laboratory precision values shown in Table 334-6.~~

~~If all of the specified mix characteristics compare favorably, then the LOT will be accepted, with payment based on the Quality Control results for the LOT.~~

~~If any of the results do not compare favorably, then the split Resolution samples from the LOT will be sent to the Resolution laboratory for testing, as described in 334-5.1.6.~~

~~**334-5.1.3.4 Acceptance of Initial Production LOT:** The Initial Production LOT shall be considered a single LOT and will receive a Composite Pay Factor as determined in 334-8, based on results of the verified Quality Control tests, or as determined by the Resolution System.~~

334-5.1.3 Partial LOTs: *A partial LOT is defined as a LOT size that is less than a full LOT. A partial LOT may occur due to the following:*

l. The completion of a given mix type or mix design on a project.

2. Closure~~Termination~~ of the LOT due to time. LOTs will be closed 3~~23~~0 calendar days after the start of the LOT. ~~(~~Time periods other than 3~~23~~0 calendar days may be used if agreed to by both the Engineer and the Contractor.~~)~~

3. A LOT is terminated per 334-5.1.4.4.

All partial LOTs will be evaluated based on the number of tests available, and will not be redefined.

SUBARTICLE 334-8.2 (of the Supplemental Specifications) is deleted and the following substituted:

334-8.2 Pay Factors:

334-8.2.1 Partial LOTs: *For Partial LOTs where no random sample is obtained due to insufficient tonnage, a Composite Pay Factor of 1.00 shall be applied.*

334-8.2.~~1~~ *2* Two or Less Sublot Test Results: In the event that two or less sublot test results are available for a LOT, Pay Factors will be determined based on Table 334-8, using the average of the accumulated deviations from the target value. (Deviations are absolute values with no plus or minus signs.) Use the 1-Test column when there is only one sublot test result and use the 2-Tests column when there are two sublots.

Table 334-8
Small Quantity Pay Table

Pay Factor	1 Sublot Test Deviation	2 Sublot Test Average Deviation
Asphalt Binder Content		
1.05	0.00-0.23	0.00-0.16
1.00	0.24-0.45	0.17-0.32
0.90	0.46-0.55	0.33-0.39
0.80	>0.55	>0.39
No. 8 Sieve		
1.05	0.00-2.25	0.00-1.59
1.00	2.26-4.50	1.60-3.18
0.90	4.51-5.50	3.19-3.89
0.80	>5.50	>3.89
No. 200 Sieve		
1.05	0.00-0.55	0.00-0.39

Table 334-8 Small Quantity Pay Table		
Pay Factor	1 Sublot Test Deviation	2 Sublot Test Average Deviation
1.00	0.56-1.10	0.40-0.78
0.90	1.11-1.50	0.79-1.06
0.80	>1.50	>1.06
Air Voids (Coarse Mixes)		
1.05	0.00-0.55	0.00-0.39
1.00	0.56-1.10	0.40-0.78
0.90	1.11-2.00	0.79-1.41
0.80	2.01-2.25	1.42-1.59
0.70	2.26-2.50	1.60-1.77
0.55	>2.50	>1.77
Air Voids (Fine Mixes)		
1.05	0.00-0.50	0.00-0.35
1.00	0.51-1.00	0.36-0.71
0.90	1.01-1.70	0.72-1.20
0.80	1.71-2.00	1.21-1.41
0.70	2.01-2.50	1.42-1.77
0.55	>2.50	>1.77
Density (Coarse Mixes) Note [1]		
1.05	0.00-0.50	0.00-0.35
1.00	0.51-1.00	0.36-0.71
0.95	1.01-1.50	0.72-1.06
0.90	>1.50	>1.06
Density (Fine Graded Mixtures) Note [1]		
1.05	0.00-0.50	0.00-0.35
1.00	0.51-1.00	0.36-0.71
0.95	1.01-2.00	0.72-1.41
0.90	2.01-3.00	1.42-2.12
0.80	>3.00	>2.12

Notes:
[1] Each density test result is the average of five cores. The target density for coarse mixes is 94.50 percent of G_{mm}. The target density for fine mixes is 93.00 percent of G_{mm} (92.00 percent when compaction is limited to the static mode or for layers specified to be one inch thick). When compaction is limited to the static mode, no vibratory mode in the vertical direction will be allowed. Other vibratory modes will be allowed, if approved by the Engineer. In this case, the target density for fine mixes is 92.00 percent of G_{mm}.

334-8.2.2~~.2~~*.3* Three or More Sublot Test Results: When three or more sublot test results are available for a LOT, the variability-unknown, standard deviation method will be used to determine the estimated percentage of the LOT that is within specification limits. The number of significant figures used in the calculations will be in accordance with requirements of AASHTO R 11-06, Absolute Method.

334-8.2.2~~.2~~*.3*.1 Percent Within Limits: The percent within limits (PWL) and Pay Factors for the LOT will be calculated as described below. Variables used in the calculations are as follows:

x = individual test value (sublot)
n = number of tests (sublots)
s = sample standard deviation
$\Sigma(x^2)$ = summation of squares of individual test values
$(\Sigma x)^2$ = summation of individual test values squared
Q_U = upper quality index
———USL = upper specification limit (target value plus upper specification limit from Table 334-9)
Q_L = lower quality index
———LSL = lower specification limit (target value minus lower specification limit from Table 334-9)
P_U = estimated percentage below the USL
P_L = estimated percentage above the LSL

(1) Calculate the arithmetic mean $\left(\overline{X}\right)$ of the test values:

$$\overline{X} = \frac{\sum x}{n}$$

(2) Calculate the sample standard deviation (s):

$$s = \sqrt{\frac{n\sum\left(x^2\right) - \left(\sum x\right)^2}{n(n-1)}}$$

(3) Calculate the upper quality index (Q_U):

$$Q_U = \frac{\text{USL} - \overline{\text{X}}}{\text{s}}$$

(4) Calculate the lower quality index (Q_L):

$$Q_L = \frac{\overline{X} - LSL}{s}$$

(5) From Table 334-10, determine the percentage of work below the USL (P_U).

(6) From Table 334-10, determine percentage of work above the LSL (P_L)
Note: If USL or LSL is not specified; percentages within (USL or LSL) will be 100.

(7) If Q_U or Q_L is a negative number, then calculate the percent within limits for Q_U or Q_L as follows: enter Table 334-10 with the positive value of Q_U or Q_L and obtain the corresponding percent within limits for the proper sample size. Subtract this number from 100.00. The resulting number is the value to be used in the next step (Step 8) for the calculation of quality level.

(8) Calculate the percent within limits (PWL) = $(P_U + P_L) - 100$

(9) Calculate the Pay Factor (PF) for each quality characteristic using the equation given in 334-8.2.23.2.

Table 334-9 Specification Limits	
Quality Characteristic	Specification Limits
Passing No. 8 sieve (percent)	Target ± 3.1
Passing No. 200 sieve (percent)	Target ± 1.0
Asphalt Content (percent)	Target ± 0.40
Air Voids - Coarse Mixes (percent)	4.00 ± 1.40
Air Voids - Fine Mixes (percent)	4.00 ± 1.20
Density - Coarse Mixes (percent of G_{mm}):	94.50 ± 1.30
Density - Fine Mixes (percent of G_{mm}):	93.00 + 2.00, - 1.20 (1)
Note (1): If the Engineer (or Contract Documents) limits compaction to the static mode only, or for all one-inch thick lifts, compaction shall be in the static mode. No vibratory mode in the vertical direction will be allowed. Other vibratory modes will be allowed, if approved by the Engineer. In either case, the specification limits will be as follows: 92.00 + 3.00, -1.20 percent of G_{mm}. No additional compensation, cost or time, shall be made.	

Table 334-10 Percent Within Limits				
Quality Index	Percent within Limits for Selected Sample Size			
	n = 3	n = 4	n = 5	n = 6
0.00	50.00	50.00	50.00	50.00
0.05	51.38	51.67	51.78	51.84
0.10	52.76	53.33	53.56	53.67
0.15	54.15	55.00	55.33	55.50
0.20	55.54	56.67	57.10	57.32
0.25	56.95	58.33	58.87	59.14
0.30	58.37	60.00	60.63	60.94
0.35	59.80	61.67	62.38	62.73
0.40	61.26	63.33	64.12	64.51
0.45	62.74	65.00	65.84	66.27
0.50	64.25	66.67	67.56	68.00
0.55	65.80	68.33	69.26	69.72
0.60	67.39	70.00	70.95	71.41
0.65	69.03	71.67	72.61	73.08
0.70	70.73	73.33	74.26	74.71
0.75	72.50	75.00	75.89	76.32
0.80	74.36	76.67	77.49	77.89
0.85	76.33	78.33	79.07	79.43
0.90	78.45	80.00	80.62	80.93
0.95	80.75	81.67	82.14	82.39

Table 334-10 Percent Within Limits				
Quality Index	Percent within Limits for Selected Sample Size			
	n = 3	n = 4	n = 5	n = 6
1.00	83.33	83.33	83.64	83.80
1.05	86.34	85.00	85.09	85.18
1.10	90.16	86.67	86.52	86.50
1.15	97.13	88.33	87.90	87.78
1.20	100.00	90.00	89.24	89.01
1.25	100.00	91.67	90.54	90.19
1.30	100.00	93.33	91.79	91.31
1.35	100.00	95.00	92.98	92.37
1.40	100.00	96.67	94.12	93.37
1.45	100.00	98.33	95.19	94.32
1.50	100.00	100.00	96.20	95.19
1.55	100.00	100.00	97.13	96.00
1.60	100.00	100.00	97.97	96.75
1.65	100.00	100.00	98.72	97.42
1.70	100.00	100.00	99.34	98.02
1.75	100.00	100.00	99.81	98.55
1.80	100.00	100.00	100.00	98.99
1.85	100.00	100.00	100.00	99.36
1.90	100.00	100.00	100.00	99.65
1.95	100.00	100.00	100.00	99.85
2.00	100.00	100.00	100.00	99.97
2.05	100.00	100.00	100.00	100.00
2.10	100.00	100.00	100.00	100.00
2.15	100.00	100.00	100.00	100.00
2.20	100.00	100.00	100.00	100.00
2.25	100.00	100.00	100.00	100.00
2.30	100.00	100.00	100.00	100.00
2.35	100.00	100.00	100.00	100.00
2.40	100.00	100.00	100.00	100.00
2.45	100.00	100.00	100.00	100.00
2.50	100.00	100.00	100.00	100.00
2.55	100.00	100.00	100.00	100.00
2.60	100.00	100.00	100.00	100.00
2.65	100.00	100.00	100.00	100.00

334-8.2.2~~2~~*3*.2 Pay Factors (PF): Pay Factors will be calculated by using the following equation:

Pay Factor = (55 + 0.5 x PWL) / 100

The PWL is determined from Step (8) of 334-8.2.~~2~~*3*.1.

SUBARTICLE 334-8.3 (of the Supplemental Specifications) is deleted and the following substituted:

334-8.3 Composite Pay Factor (CPF): A Composite Pay Factor for the LOT will be calculated based on the individual Pay Factors (PF) with the following weighting applied: 35 percent Density (D), 25 percent Air Voids (V_a), 25 percent asphalt binder content (P_b), 10 percent Passing No. 200 (P_{-200}) and 5 percent Passing No. 8 (P_{-8}). Calculate the CPF by using the following formula:

CPF = [(0.350 x PF D) + (0.250 x PF V_a) + (0.250 x PF P_b) + (0.100 x PF P_{-200}) + (0.050 x PF P_{-8})]

Where the Pay Factor (PF) for each quality characteristic is determined in either 334-8.2.~~1~~*2* or 334-8.2.~~2~~*3*, depending on the number of sublot tests. Note that the number after each multiplication will be rounded to the nearest 0.01.

The pay adjustment shall be computed by multiplying the Composite Pay Factor for the LOT by the bid price per ton.

SUPERPAVE ASPHALT CONCRETE.
(REV 1-22-10)

SECTION 334-2.3.1 (of the Supplemental Specifications) is deleted and the following substituted:

334-2.3.1 General requirements: RAP may be used as a component of the asphalt mixture subject to the following requirements:

1. When using a PG 76-22 Asphalt Binder, limit the amount of RAP material used in the mix to a maximum of 20 percent by weight of total aggregate. As an exception, amounts greater than 20 percent RAP by weight of total aggregate can be used if no more than 20 percent by weight of the total asphalt binder comes from the RAP material.

2. Assume full responsibility for the design, production and construction of asphalt mixes which incorporate RAP as a component material.

3. Use RAP from an FDOT approved stockpile or RAP that has an FDOT furnished Pavement Composition Data Sheet.

4. Provide stockpiled RAP material that is reasonably consistent in characteristics and contains no aggregate particles which are soft or conglomerates of fines.

5. Provide RAP material having a minimum average asphalt binder content of 4.0 percent by weight of RAP. As an exception, when using fractionated RAP, the minimum average asphalt binder content for the coarse portion of the RAP shall be 2.5 percent by weight of the coarse portion of the RAP. The coarse portion of the RAP shall be the portion of the RAP retained on the No. 4 sieve. The Engineer may sample the stockpile(s) to verify that this requirement is met.

SUBARTICLE 334-3.2.4 (of the Supplemental Specifications) is deleted and the following substituted:

334-3.2.4 Gyratory Compaction: Compact the design mixture in accordance with AASHTO T 312-08, with the following exception: use the number of gyrations at N_{design} as defined in Table 334-3. Measure the inside diameter of gyratory molds in accordance with FM 5-585.

Table 334-3
Gyratory Compaction Requirements

Traffic Level	N_{design} Number of Gyrations
A	50
B	65
C	75
D	100
E	100

SUBARTICLE 334-3.2.6 (of the Supplemental Specifications) is deleted and the following substituted:

334-3.2.6 Moisture Susceptibility:

1. For Traffic Level A and B mixtures, use a liquid anti-strip additive, which is on the Department's Qualified Products List, at a rate of 0.5% by weight of the asphalt binder. Other rates of anti-strip additive may be used upon approval of the Engineer.

2. For Traffic Level C through E mixtures, test 4 inch specimens in accordance with FM 1-T 283. Provide a mixture having a retained tensile strength ratio of at least 0.80 and a minimum tensile strength (unconditioned) of 100 psi. If necessary, add a liquid anti-stripping agent, which is on the Department's Qualified Products List or hydrated lime (meeting the requirements of Section 337) in order to meet these criteria.

SUBARTICLE 334-3.2.7 (of the Supplemental Specifications) is deleted and the following substituted:

334-3.2.7 Additional Information: In addition to the requirements listed above, provide the following information with each proposed mix design submitted for verification:

1. The design traffic level and the design number of gyrations (N_{design}).

2. The source and description of the materials to be used.

3. The DOT source number and the DOT product code of the aggregate components furnished from a DOT approved source.

4. The gradation and 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. Compensate for any change in aggregate gradation caused by handling and processing as necessary.

5. A single percentage of the combined mineral aggregate passing each specified sieve. Degradation of the aggregate due to processing (particularly material passing the No. 200 sieve) should be accounted for and identified.

6. The bulk specific gravity (G_{sb}) value for each individual aggregate and RAP component, as identified in the Department's aggregate control program.

7. A single percentage of asphalt binder by weight of total mix intended to be incorporated in the completed mixture, shown to the nearest 0.1 percent.

8. A target temperature for the mixture at the plant (mixing temperature) and a target temperature for the mixture at the roadway (compaction temperature) in accordance with 330-6.3. Do not exceed a target temperature of 330°F for PG 76-22 asphalt binders, 320°F for ARB-12 asphalt binders, and 315°F for ARB-5 and unmodified asphalt binders.

9. Provide the physical properties achieved at four different asphalt binder contents. One of which shall be at the optimum asphalt content, and must conform to all specified physical requirements.

10. The name of the CTQP Qualified Mix Designer.

11. The ignition oven calibration factor.
12. The warm mix technology, if used.

ARTICLE 334-4 (of the Supplemental Specifications) is deleted and the following substituted:

334-4 Contractor Process Control (for Option 1 Mixture Acceptance).

Assume full responsibility for controlling all operations and processes such that the requirements of these Specifications are met at all times. Perform any tests necessary at the plant and roadway for process control purposes. Enter all Process Control test data into the Department's Laboratory Information Management System (LIMS) database. The Engineer will not use these test results in the acceptance payment decision.

Address in the Quality Control Plan how Process Control failures will be handled. When a Process Control failure occurs, investigate, at a minimum, the production process, testing equipment and/or sampling methods to determine the cause of the failure, and make any necessary changes to assure compliance with these Specifications. Obtain a follow up sample immediately after corrective actions are taken to assess the adequacy of the corrections. In the event the follow-up Process Control sample also fails to meet Specification requirements, cease production of the asphalt mixture until the problem is adequately resolved to the satisfaction of the Quality Control Manager.

SUBARTICLE 334-5.1.1.1 (of the Supplemental Specifications) is deleted and the following substituted:

334-5.1.1.1 Sampling and Testing Requirements: Obtain the samples in accordance with FM 1-T 168. Obtain samples at the plant of a sufficient quantity to be split into three smaller samples; one for Quality Control, one for Verification and one for Resolution testing; each sample at approximately 35 pounds. The split samples for Verification testing and Resolution testing shall be reduced in size and stored in three boxes each. The approximate size of each box must be 12" x 8" x 4". Provide, label and safely store sample boxes in a manner agreed upon by the Engineer for future testing.

The asphalt content of the mixture will be determined in accordance with FM 5-563. In the event the FM 5-563 ignition oven goes out of service during production, the Contractor may elect to use a replacement oven at another location for no more than 72 hours while the oven is being repaired. The gradation of the recovered aggregate will be determined in accordance with FM 1-T 030. Volumetric testing will be in accordance with AASHTO T312-08 and FM 1-T 209. Measure the inside diameter of gyratory molds in accordance with FM 5-585. Prior to testing volumetric samples, condition the test-sized sample for one hour ± five minutes at the target roadway compaction temperature in a covered, shallow, flat pan, such that the mixture temperature at the end of the one hour conditioning period is within ± 20° F of the roadway compaction temperature. Test for roadway density in accordance with FM 1-T 166.

SUBARTICLE 334-5.1.2 (of the Supplemental Specifications) is deleted and the following substituted:

334-5.1.2 Full LOTs: Each LOT will be defined (as selected by the Contractor prior to the start of the LOT) as either (1) 2,000 tons, with each LOT subdivided into four equal sublots of 500 tons each, or (2) 4,000 tons, with each LOT subdivided into four equal sublots of 1,000 tons each. As an exception to this, the initial LOT of all new mix designs shall be defined as 2,000 tons, subdivided into four equal sublots of 500 tons each. Before the beginning of a LOT, the Engineer will develop a random sampling plan for each sublot and direct the Contractor on sample points, based on tonnage, for each sublot during construction.

SUBARTICLE 334-5.1.3 (of the Supplemental Specifications) is deleted and the following substituted:

334-5.1.3 Partial LOTs: A partial LOT is defined as a LOT size that is less than a full LOT. A partial LOT may occur due to the following:

l. The completion of a given mix type or mix design on a project.

2. Closure of the LOT due to time. LOTs will be closed 30 calendar days after the start of the LOT. Time periods other than 30 calendar days may be used if agreed to by both the Engineer and the Contractor.

3. A LOT is terminated per 334-5.1.4.4.

All partial LOTs will be evaluated based on the number of tests available, and will not be redefined.

SUBARTICLE 334-8.2 (of the Supplemental Specifications) is deleted and the following substituted: **334-8.2 Pay Factors:**

334-8.2.1 Partial LOTs: For Partial LOTs where no random sample is obtained due to insufficient tonnage, a Composite Pay Factor of 1.00 shall be applied.

334-8.2.2 Two or Less Sublot Test Results: In the event that two or less sublot test results are available for a LOT, Pay Factors will be determined based on Table 334-8, using the average of the accumulated deviations from the target value. (Deviations are absolute values with no plus or minus signs.) Use the 1-Test column when there is only one sublot test result and use the 2-Tests column when there are two sublots.

Table 334-8
Small Quantity Pay Table

Pay Factor	1 Sublot Test Deviation	2 Sublot Test Average Deviation
Asphalt Binder Content		
1.05	0.00-0.23	0.00-0.16
1.00	0.24-0.45	0.17-0.32
0.90	0.46-0.55	0.33-0.39

Table 334-8 Small Quantity Pay Table		
Pay Factor	1 Sublot Test Deviation	2 Sublot Test Average Deviation
0.80	>0.55	>0.39
No. 8 Sieve		
1.05	0.00-2.25	0.00-1.59
1.00	2.26-4.50	1.60-3.18
0.90	4.51-5.50	3.19-3.89
0.80	>5.50	>3.89
No. 200 Sieve		
1.05	0.00-0.55	0.00-0.39
1.00	0.56-1.10	0.40-0.78
0.90	1.11-1.50	0.79-1.06
0.80	>1.50	>1.06
Air Voids (Coarse Mixes)		
1.05	0.00-0.55	0.00-0.39
1.00	0.56-1.10	0.40-0.78
0.90	1.11-2.00	0.79-1.41
0.80	2.01-2.25	1.42-1.59
0.70	2.26-2.50	1.60-1.77
0.55	>2.50	>1.77
Air Voids (Fine Mixes)		
1.05	0.00-0.50	0.00-0.35
1.00	0.51-1.00	0.36-0.71
0.90	1.01-1.70	0.72-1.20
0.80	1.71-2.00	1.21-1.41
0.70	2.01-2.50	1.42-1.77
0.55	>2.50	>1.77
Density (Coarse Mixes) Note [1]		
1.05	0.00-0.50	0.00-0.35
1.00	0.51-1.00	0.36-0.71
0.95	1.01-1.50	0.72-1.06
0.90	>1.50	>1.06
Density (Fine Graded Mixtures) Note [1]		
1.05	0.00-0.50	0.00-0.35
1.00	0.51-1.00	0.36-0.71
0.95	1.01-2.00	0.72-1.41
0.90	2.01-3.00	1.42-2.12
0.80	>3.00	>2.12

Notes:
[1] Each density test result is the average of five cores. The target density for coarse mixes is 94.50 percent of G_{mm}. The target density for fine mixes is 93.00 percent of G_{mm} (92.00 percent when compaction is limited to the static mode or for layers specified to be one inch thick). When compaction is limited to the static mode, no vibratory mode in the vertical direction will be allowed. Other vibratory modes will be allowed, if approved by the Engineer. In this case, the target density for fine mixes is 92.00 percent of G_{mm}.

334-8.2.3 Three or More Sublot Test Results: When three or more sublot test results are available for a LOT, the variability-unknown, standard deviation method will be used to determine the estimated percentage of the LOT that is within specification limits. The number of significant figures used in the calculations will be in accordance with requirements of AASHTO R 11-06, Absolute Method.

334-8.2.3.1 Percent Within Limits: The percent within limits (PWL) and Pay Factors for the LOT will be calculated as described below. Variables used in the calculations are as follows:

x = individual test value (sublot)
n = number of tests (sublots)
s = sample standard deviation
$\Sigma(x^2)$ = summation of squares of individual test values
$(\Sigma x)^2$ = summation of individual test values squared
Q_U = upper quality index
USL = upper specification limit (target value plus upper specification limit from Table 334-9)
Q_L = lower quality index
LSL = lower specification limit (target value minus lower specification limit from Table 334-9)
P_U = estimated percentage below the USL
P_L = estimated percentage above the LSL

(1) Calculate the arithmetic mean $\left(\overline{X}\right)$ of the test values:

$$\overline{X} = \frac{\sum x}{n}$$

(2) Calculate the sample standard deviation (s):

$$s = \sqrt{\frac{n\sum\left(x^2\right) - \left(\sum x\right)^2}{n(n-1)}}$$

(3) Calculate the upper quality index (Q_U):

$$Q_U = \frac{\text{USL} - \overline{\text{X}}}{\text{s}}$$

(4) Calculate the lower quality index (Q_L):

$$Q_L = \frac{\overline{X} - LSL}{s}$$

(5) From Table 334-10, determine the percentage of work below the USL (P_U).

(6) From Table 334-10, determine percentage of work above the LSL (P_L)
Note: If USL or LSL is not specified; percentages within (USL or LSL) will be 100.

(7) If Q_U or Q_L is a negative number, then calculate the percent within limits for Q_U or Q_L as follows: enter Table 334-10 with the positive value of Q_U or Q_L and obtain the corresponding percent within limits for the proper sample size. Subtract this number from 100.00. The resulting number is the value to be used in the next step (Step 8) for the calculation of quality level.

(8) Calculate the percent within limits (PWL) = ($P_U + P_L$) - 100

(9) Calculate the Pay Factor (PF) for each quality characteristic using the equation given in 334-8.2.3.2.

Table 334-9
Specification Limits

Quality Characteristic	Specification Limits
Passing No. 8 sieve (percent)	Target ± 3.1
Passing No. 200 sieve (percent)	Target ± 1.0
Asphalt Content (percent)	Target ± 0.40
Air Voids - Coarse Mixes (percent)	4.00 ± 1.40
Air Voids - Fine Mixes (percent)	4.00 ± 1.20
Density - Coarse Mixes (percent of G_{mm}):	94.50 ± 1.30
Density - Fine Mixes (percent of G_{mm}):	93.00 + 2.00, - 1.20 (1)

Note (1): If the Engineer (or Contract Documents) limits compaction to the static mode only, or for all one-inch thick lifts, compaction shall be in the static mode. No vibratory mode in the vertical direction will be allowed. Other vibratory modes will be allowed, if approved by the Engineer. In either case, the specification limits will be as follows: 92.00 + 3.00, -1.20 percent of G_{mm}. No additional compensation, cost or time, shall be made.

Table 334-10
Percent Within Limits

Quality Index	Percent within Limits for Selected Sample Size			
	n = 3	n = 4	n = 5	n = 6
0.00	50.00	50.00	50.00	50.00
0.05	51.38	51.67	51.78	51.84
0.10	52.76	53.33	53.56	53.67
0.15	54.15	55.00	55.33	55.50
0.20	55.54	56.67	57.10	57.32
0.25	56.95	58.33	58.87	59.14
0.30	58.37	60.00	60.63	60.94
0.35	59.80	61.67	62.38	62.73
0.40	61.26	63.33	64.12	64.51
0.45	62.74	65.00	65.84	66.27
0.50	64.25	66.67	67.56	68.00
0.55	65.80	68.33	69.26	69.72

Table 334-10 Percent Within Limits				
Quality Index	Percent within Limits for Selected Sample Size			
	n = 3	n = 4	n = 5	n = 6
0.60	67.39	70.00	70.95	71.41
0.65	69.03	71.67	72.61	73.08
0.70	70.73	73.33	74.26	74.71
0.75	72.50	75.00	75.89	76.32
0.80	74.36	76.67	77.49	77.89
0.85	76.33	78.33	79.07	79.43
0.90	78.45	80.00	80.62	80.93
0.95	80.75	81.67	82.14	82.39
1.00	83.33	83.33	83.64	83.80
1.05	86.34	85.00	85.09	85.18
1.10	90.16	86.67	86.52	86.50
1.15	97.13	88.33	87.90	87.78
1.20	100.00	90.00	89.24	89.01
1.25	100.00	91.67	90.54	90.19
1.30	100.00	93.33	91.79	91.31
1.35	100.00	95.00	92.98	92.37
1.40	100.00	96.67	94.12	93.37
1.45	100.00	98.33	95.19	94.32
1.50	100.00	100.00	96.20	95.19
1.55	100.00	100.00	97.13	96.00
1.60	100.00	100.00	97.97	96.75
1.65	100.00	100.00	98.72	97.42
1.70	100.00	100.00	99.34	98.02
1.75	100.00	100.00	99.81	98.55
1.80	100.00	100.00	100.00	98.99
1.85	100.00	100.00	100.00	99.36
1.90	100.00	100.00	100.00	99.65
1.95	100.00	100.00	100.00	99.85
2.00	100.00	100.00	100.00	99.97
2.05	100.00	100.00	100.00	100.00
2.10	100.00	100.00	100.00	100.00
2.15	100.00	100.00	100.00	100.00
2.20	100.00	100.00	100.00	100.00

Table 334-10 Percent Within Limits				
Quality Index	Percent within Limits for Selected Sample Size			
	n = 3	n = 4	n = 5	n = 6
2.25	100.00	100.00	100.00	100.00
2.30	100.00	100.00	100.00	100.00
2.35	100.00	100.00	100.00	100.00
2.40	100.00	100.00	100.00	100.00
2.45	100.00	100.00	100.00	100.00
2.50	100.00	100.00	100.00	100.00
2.55	100.00	100.00	100.00	100.00
2.60	100.00	100.00	100.00	100.00
2.65	100.00	100.00	100.00	100.00

334-8.2.3.2 Pay Factors (PF): Pay Factors will be calculated by using the following equation:

Pay Factor = (55 + 0.5 x PWL) / 100

The PWL is determined from Step (8) of 334-8.2.3.1.

SUBARTICLE 334-8.3 (of the Supplemental Specifications) is deleted and the following substituted:

334-8.3 Composite Pay Factor (CPF): A Composite Pay Factor for the LOT will be calculated based on the individual Pay Factors (PF) with the following weighting applied: 35 percent Density (D), 25 percent Air Voids (V_a), 25 percent asphalt binder content (P_b), 10 percent Passing No. 200 (P_{-200}) and 5 percent Passing No. 8 (P_{-8}). Calculate the CPF by using the following formula:

CPF = [(0.350 x PF D) + (0.250 x PF V_a) + (0.250 x PF P_b) + (0.100 x PF P_{-200}) + (0.050 x PF P_{-8})]

Where the Pay Factor (PF) for each quality characteristic is determined in either 334-8.2.2 or 334-8.2.3, depending on the number of sublot tests. Note that the number after each multiplication will be rounded to the nearest 0.01.

The pay adjustment shall be computed by multiplying the Composite Pay Factor for the LOT by the bid price per ton.