# *Florida Department of Transportation*

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January 26, 2014

Khoa Nguyen
Director, Office of Technical Services
Federal Highway Administration
545 John Knox Road, Suite 200
Tallahassee, Florida 32303

Re: State Specifications and Estimates Office
Section **334LAP**
Proposed Specification: **334LAP Superpave Asphalt for LAP (Off-System) REVISED**

Dear Mr. Nguyen:

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

The changes are proposed by Tanya Nash of the State Materials Office to allow the use of Warm Mix Asphalt and to update the local agency specification to the current language of Sections 320, 330, and 334 of the FDOT specifications as applicable for off-system local agency projects.

Please review and transmit your comments, if any, within two weeks. Comments should be sent via email to SP965DS or daniel.scheer@dot.state.fl.us.

If you have any questions relating to this specification change, please call me at 414-4130.

Sincerely,

Signature on File

Daniel Scheer, P.E.
State Specifications Engineer

DS/ft
Attachment
cc: Florida Transportation Builders' Assoc.
State Construction Engineer

**~~HOT MIX *SUPERPAVE*~~*SUPERPAVE* ASPHALT FOR LAP (OFF-SYSTEM).**
**(REV ~~11-17-11~~*10-13-14~~10-15-14~~1-26-15*) (FA ~~2-27-12~~)**

## SECTION 334
## ~~HOT MIX~~*SUPERPAVE* ASPHALT FOR LAP (OFF-SYSTEM)

**334-1 Description.**

**334-1.1 General:** Construct ~~a~~ *a Superpave asphalt pavement (consisting of either* Hot Mix Asphalt (HMA) *or Warm Mix Asphalt (WMA))* ~~pavement~~ based on the type of work specified in the Contract and the Asphalt Work Categories as defined below. Meet the applicable requirements for plants, equipment, and construction requirements as defined below. Use a*n asphalt mix, either* HMA *or WMA,* ~~mix that~~ *which* meets the requirements of this specification.

**334-1.2 Asphalt Work Mix Categories:** Construction of ~~Hot Mix A~~*a*sphalt ~~P~~*p*avement will fall into one of the following work categories:

**334-1.2.1 Asphalt Work Category 1:** Includes the construction of ~~bike~~ *shared use* paths and miscellaneous asphalt.

**334-1.2.2 Asphalt Work Category 2:** Includes the construction of new ~~HMA~~ *asphalt* turn lanes, paved shoulders and other non-mainline pavement locations.

**334-1.2.3 Asphalt Work Category 3:** Includes the construction of new mainline ~~HMA~~ *asphalt* pavement lanes, milling and resurfacing.

**334-1.3 Mix Types:** Use the appropriate ~~HMA~~ *asphalt* mix as shown in Table 334-1.

Table 334-1
~~HMA~~ *Asphalt* Mix Types

| Asphalt Work Category | Mix Types | Traffic Level | ESALs (millions) |
|---|---|---|---|
| 1 | Type SP-9.5~~(1)~~ | A | <0.3 |
| 2 | Structural Mixes: Types SP-9.5 or SP-12.5~~(1)~~<br>Friction Mixes: Types FC-9.5 or FC-12.5~~(1)~~ | B | 0.3 to <3 |
| 3 | Structural Mixes: Types SP-9.5 or SP-12.5<br>Friction Mixes: Types FC-9.5 or FC-12.5 | C | ≥3 |

~~(1) Equivalent mixes may be approved as determined by the Engineer. For example, Marshall S-III mixture type is equivalent to Superpave SP-9.5, Marshall S-I is equivalent to Superpave SP-12.5, and Marshall FC-3 is equivalent to Superpave FC-9.5.~~

A Type SP or FC mix one traffic level higher than the traffic level specified in the Contract may be substituted, at no additional cost (i.e. Traffic Level B may be substituted for Traffic Level A, etc.). Traffic levels are as defined in Section 334 of the *Florida Department of Transportation's (FDOT's)* ~~Department's Standard~~ Specifications ~~for Road and Bridge Construction~~.

**334-1.4 Gradation Classification:** ~~HMA mixes are classified as either coarse or fine, depending on the overall gradation of the mixture. Coarse and fine mixes are defined in 334-~~

~~3.2.2. Use only fine mixes.~~ *The Superpave mixes are classified as fine and are defined in 334-3.2.2.*

The equivalent AASHTO nominal maximum aggregate size Superpave mixes are as follows:

Type SP-9.5, FC-9.5 ..... 9.5 mm
Type SP-12.5, FC-12.5 ..... 12.5 mm

**334-1.5 Thickness:** The total pavement thickness of the ~~HMA~~ *asphalt* pavement will be based on a specified spread rate or plan thickness as shown in the Contract Documents. Before paving, propose a spread rate or thickness for each individual layer meeting the requirements of this specification, which when combined with other layers (as applicable) will equal the plan spread rate or thickness. When the total pavement thickness is specified as plan thickness, the plan thickness and individual layer thickness will be converted to spread rate using the following equation:

$$\text{Spread rate (lbs/yd}^2) = t \times G_{mm} \times 43.3$$

where: $t$ = Thickness (in.) (Plan thickness or individual layer thickness)
$G_{mm}$ = Maximum specific gravity from the mix design

For target purposes only, spread rate calculations shall be rounded to the nearest whole number.

**334-1.5.1 Layer Thicknesses:** Unless otherwise called for in the Contract Documents, the allowable layer thicknesses for ~~HMA~~ *asphalt* mixtures are as follows:

Type SP-9.5, FC-9.5 .....3/4 –*to* 1-1/2 inches
Type SP-12.5, FC-12.5 ..... 1-~~-~~1/2 –*to* 2-1/2 inches

**334-1.5.2 Additional Requirements:** The following requirements also apply to ~~HMA~~ *asphalt* mixtures:

1. When construction includes the paving of adjacent shoulders (less than or equal to 5 feet wide), the layer thickness for the upper pavement layer and shoulder shall be the same and paved in a single pass, unless otherwise called for in the Contract Documents.

2. For overbuild layers, use the minimum and maximum layer thicknesses as specified above unless called for differently in the Contract Documents. On variable thickness overbuild layers, the minimum allowable thickness may be reduced by 1/2 inch, and the maximum allowable thickness *will*~~may~~ be *as specified below,*~~increased by 1/2 inch,~~ unless called for differently in the Contract Documents.

*Type SP-9.5……3/8 to 2 inches*
*Type SP-12.5……..1/2 to 3 inches*

*3. Variable thickness overbuild layers may be tapered to zero thickness provided the contract documents require a minimum of 1-1/2 inches of mix placed over the variable thickness overbuild layer.*

**334-1.6 Weight of Mixture:** The weight of the mixture shall be determined as provided in 320-3.2 of the ~~Florida Department of Transportation (~~FDOT~~)~~ *S*~~s~~pecifications.

**334-2 Materials.**

**334-2.1 Superpave Asphalt Binder:** Unless specified elsewhere in the Contract or in 334-2.3.3, use a PG 67-22 asphalt binder from the FDOT's ~~Qualified~~ *Approved* Products List

(~~Q~~*A*PL). If the Contract calls for an alternative *asphalt* binder, meet the requirements of FDOT Specifications Section 336 or 916, as appropriate.

**334-2.2 Aggregate:** Use aggregate capable of producing a quality pavement.

For Type FC mixes, use an aggregate blend that consists of crushed granite, crushed Oolitic limestone, other crushed materials (as approved by FDOT for friction courses per Rule 14-103.005, Florida Administrative Code), or a combination of the above. Crushed limestone from the Oolitic formation may be used if it contains a minimum of 12% silica material as determined by FDOT Test Method FM 5-510 and FDOT grants approval of the source prior to its use. As an exception, mixes that contain a minimum of 60% crushed granite may either contain:

1. Up to 40% fine aggregate from other sources; or,
2. A combination of up to 20% RAP and the remaining fine aggregate from other sources.

A list of aggregates approved for use in friction courses may be available on the FDOT's State Materials Office website. The URL for obtaining this information, if available, is: ftp://ftp.dot.state.fl.us/fdot/smo/website/sources/frictioncourse.pdf.

**334-2.3 Reclaimed Asphalt Pavement (RAP) Material:**

**334-2.3.1 General requirements:** RAP may be used as a component of the asphalt mixture, ~~if approved by the Engineer~~*provided the RAP meets* ~~. Usage of RAP is subject to~~ the following requirements:

1. ~~Limit the amount of RAP material used in the mix to a maximum of 50% by weight of total aggregate.~~*When using a PG 76-22 (PMA), or PG 76-22 (ARB) asphalt binder, limit the amount of RAP material used in the mix to a maximum of 20% by weight of total aggregate. As an exception, amounts greater than 20% RAP by weight of total aggregate can be used if no more than 20% by weight of total asphalt binder comes from the RAP material.*
2. Provide stockpiled RAP material that is reasonably consistent in characteristics and contains no aggregate particles which are soft or conglomerates of fines.
3. Provide RAP material having a minimum average asphalt *binder* content of 4.0% 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% 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 to verify that this requirement is met.
4. 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 recycle mixture. If oversized RAP material appears in the completed recycle mix, take the appropriate corrective action immediately. If the appropriate corrective actions are not immediately taken, stop plant operations.

**334-2.3.2 Material Characterization:** Assume responsibility for establishing the asphalt binder content, gradation, ~~viscosity~~ and bulk specific gravity ($G_{sb}$) of the RAP material based on a representative sampling of the material.

**334-2.3.3 Asphalt Binder for Mixes with RAP:** Select the appropriate asphalt binder grade based on Table 334-2. ~~Maintain the viscosity of the recycled mixture within the range of 5,000 to 15,000 poises.~~ *The Engineer reserves the right to change the asphalt binder type and grade during production based on characteristics of the RAP asphalt binder.*

| Table 334-2<br>Asphalt Binder Grade for Mixes Containing RAP | |
|---|---|
| Percent RAP | Asphalt Binder Grade |
| ~~< 20~~*0 - 15* | PG 67-22 |
| ~~20 – 29~~*16 – 30* | PG *58-22*~~64-22~~ |
| ~~≥~~ > 30 | ~~Recycling Agent~~*PG 52-28* |

**334-3 Composition of Mixture.**

**334-3.1 General:** Compose the asphalt mixture using a combination of aggregates, mineral filler, if required, and asphalt binder material. Size, grade and combine the aggregate fractions to meet the grading and physical properties of the mix design. Aggregates from various sources may be combined.

**334-3.2 Mix Design:**

**334-3.2.1 General:** Design the asphalt mixture in accordance with AASHTO R 35-~~09~~*12*, except as noted herein. Submit the proposed mix design with supporting test data indicating compliance with all mix design criteria to the Engineer. Prior to the production of any asphalt mixture, obtain the Engineer's conditional approval of the mix design. If required by the Engineer, send representative samples of all component materials, including asphalt binder to a laboratory designated by the Engineer for verification. As an exception to these requirements, use a currently approved FDOT Mix Design.

*Warm mix technologies (additives, foaming techniques, etc.) listed on the Department's website may be used in the production of the mix. The URL for obtaining this information, is: http://www.dot.state.fl.us/statematerialsoffice/quality/programs/warmmixasphalt/index.shtm.*

The Engineer will consider any marked variations from original test data for a mix design or any evidence of inadequate field performance of a mix design as sufficient evidence that the properties of the mix design have changed, and at his discretion, the Engineer may no longer allow the use of the mix design.

**334-3.2.2 Mixture Gradation Requirements:** Combine the aggregates in proportions that will produce an asphalt mixture meeting all of the requirements defined in this specification and conform to the gradation requirements at design as defined in AASHTO M 323-~~07~~*12*, Table 3. Aggregates from various sources may be combined.

**334-3.2.2.1 Mixture Gradation Classification:** Plot the combined mixture gradation on an FHWA 0.45 Power Gradation Chart. Include the Control Points from AASHTO M323-~~07~~*12*, Table-3, as well as the Primary Control Sieve (PCS) Control Point from AASHTO M323-~~07~~*12*, Table 4. Fine mixes are defined as having a gradation that passes above or through the primary control sieve control point. ~~Use only fine mixes.~~

**334-3.2.3 Gyratory Compaction:** Compact the design mixture in accordance with AASHTO T312-~~09~~*12, with the following exceptions: use~~d~~ the number of gyrations at $N_{design}$ as designed in Table 334-3*. ~~Use the number of gyrations as defined in AASHTO R35-09, Table 1.~~

| *Table 334-3*<br>*Gyratory Compaction Requirements* | |
|---|---|
| *Traffic Level* | *$N_{design}$ Number of Gyrations* |

| | |
|---|---|
| *A* | *50* |
| *B* | *65* |
| *C* | *75* |

**334-3.2.4 Design Criteria:** Meet the requirements for nominal maximum aggregate size as defined in AASHTO M323-~~07~~*12*, as well as for relative density, VMA, VFA, and dust-to-binder ratio as specified in AASHTO M323-~~07~~*12*, Table 6. *$N_{initial}$ and $N_{maximum}$ requirements are not applicable.*

**334-3.2.5 Moisture Susceptibility:** Test 4 inch specimens in accordance with *FDOT Test Method* 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~~*pounds per square inch*~~i~~. If necessary, add a liquid anti-stripping agent from the FDOT's ~~Qualified~~ *APL*~~Products List~~ or hydrated lime in order to meet these criteria.

In lieu of moisture susceptibility testing, add a liquid anti-stripping agent from the FDOT's ~~Qualified Products List~~*APL*. Add 0.5% liquid anti-stripping agent by weight of *asphalt* binder.

**334-3.2.6 Additional Information:** In addition to the requirements listed above, provide the following information on each mix design:

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 FDOT source number and the FDOT product code of the aggregate components furnished from an FDOT approved source (if required).
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.
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%.
8. A target temperature *for* ~~at which~~ the mixture *at the plant (mixing temperature)* ~~is to be discharged from the plant~~ and a target *temperature for the mixture at the* roadway *(compaction* temperature*)*. Do not exceed a target temperature of 330°F for *PG 76-22 (PMA) and PG 76-22 (ARB)* ~~modified~~ asphalt~~s~~ *binders,* and 315°F for unmodified asphalt *binder*s.
9. Provide the physical properties achieved at four different asphalt binder contents. One shall be at the optimum asphalt content, and must conform to all specified physical requirements.
10. The name of the mix designer.
11. The ignition oven calibration factor.
12. *The warm mix technology, if used.*

**334-4 Process Control.**

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 to control the process.

**334-5 General Construction Requirements.**

**334-5.1 Weather Limitations:** Do not transport asphalt mix from the plant to the roadway unless all weather conditions are suitable for the ~~lay~~*pav*ing operations.

**334-5.2 Limitations of ~~Laying~~ *Paving* Operations:**

**334-5.2.1 General:** Spread the mixture only when the surface upon which it is to be placed has been previously prepared, is intact, firm, *dry, clean,* and *the tack, with acceptable spread rate, is* properly *broken*~~cured, and is dry~~. ~~*Assure*~~*Ensure* ~~*that*~~ *all granular base materials are properly primed and all asphalt base materials are properly tacked, prior to paving.*

**334-5.2.2 Air Temperature:** *Place the mixture only when the air temperature in the shade and away from the artificial heat meets the requirements of Table 334-4. The minimum ambient temperature requirement may be reduced by 5°F when using a warm mix technology, if mutually agreed to by both the Engineer and the Contractor.* ~~Spread the mixture only when the air temperature in the shade and away from artificial heat is at least 40ºF for layers greater than 1 inch (100 lb per square yard) in thickness and at least 45ºF for layers 1 inch (100 lb per square yard) or less in thickness (this includes leveling courses). The minimum temperature requirement for leveling courses with a spread rate of 50 lb per square yard or less is 50ºF.~~

| *Table 334-4*<br>*Ambient Air Temperature Requirements for Paving* | |
|---|---|
| *Layer Thickness or Asphalt Binder Type* | *Minimum Temperature (°F)* |
| *≤1 inch* | *50* |
| *Any mixture > 1 inch containing a PG asphalt binder with a high temperature designation ≥ 76°C* | *45* |
| *Any mixture > 1 inch containing a PG asphalt binder with a high temperature designation < 76°C* | *40* |

**334-5.3 Mix Temperature:** Heat and combine the ingredients of the mix in such a manner as to produce a mixture with a temperature at the plant and at the roadway, within a range of plus or minus 30ºF from the target temperature as shown on the mix design. Reject all loads outside of this range. *For warm mix asphalt, the Contractor may produce the first five loads of the production day and at other times when approved by the Engineer, at a hot mix asphalt temperature not to exceed 330°F for purposes of heating the asphalt paver. For these situations, the upper tolerance of +30°F does not apply.*

**334-5.4 Transportation of the Mixture:** ~~Transport the mixture in vehicles previously cleaned of all foreign material. After cleaning, thinly coat the inside surface of the truck bodies with soapy water or an asphalt release agent as needed to prevent the mixture from adhering to the beds. Do not allow excess liquid to pond in the truck body. Do not use diesel fuel or any other hazardous or environmentally detrimental material as a coating for the inside surface of the truck body. Cover each load at all times.~~*Transport the mix in trucks of tight construction, which prevents the loss of material and the excessive loss of heat and previously cleaned of all foreign material. After cleaning, thinly coat the inside surface of the truck bodies with soapy water or an*

*asphalt release agent as needed to prevent the mixture from adhering to the beds. Do not allow excess liquid to pond in the truck body. Do not use a release agent that will contaminate, degrade, or alter the characteristics of the asphalt mix or is hazardous or detrimental to the environment. Petroleum derivatives (such as diesel fuel), solvents, and any product that dissolves asphalt are prohibited. Provide each truck with a tarpaulin or other waterproof cover mounted in such a manner that it can cover the entire load when required. When in place, overlap the waterproof cover on all sides so* ~~that~~ *it can be tied down. Cover each load during cool and cloudy weather and at any time it appears rain is likely during transit with a tarpaulin or waterproof cover. Cover and tie down all loads of friction course mixtures.*

**334-5.5 Preparation of Surfaces Prior to Paving:**

**334-5.5.1 Cleaning:** Clean the surface of all loose and deleterious material by the use of power brooms or blowers, supplemented by hand brooming where necessary.

**334-5.5.2 Patching and Leveling Courses:** As shown in the plans, bring the existing surface to proper grade and cross-section by the application of patching or leveling courses.

**334-5.5.3 Application over Surface Treatment:** Where an asphalt mix is to be placed over a surface treatment, sweep and dispose of all loose material from the paving area.

**334-5.5.4 Tack Coat:** Use a rate of application as defined in Table 334-*5*~~3~~. Control the rate of application to be within plus or minus 0.01 gal~~.~~*lon* per square yard of the target application rate. The target application rate may be adjusted by the Engineer to meet specific field conditions. Determine the rate of application as needed to control the operation. When using ~~RA-550~~*PG 52-28*, multiply the target rate of application by 0.6.

Table 334-*5*~~3~~
Tack Coat Application Rates

| Asphalt Mixture Type | Underlying Pavement Surface | Target Tack Rate (gal/yd$^2$) |
|---|---|---|
| Base Course, Structural Course, Dense Graded Friction Course | Newly Constructed Asphalt Layers | 0.0~~2~~*3* minimum |
| | Milled Surface or Oxidized and Cracked Pavement | 0.06 |
| | Concrete Pavement | 0.08 |
| ~~Open Graded Friction Course~~ | ~~Newly Constructed Asphalt Layers~~ | ~~0.05~~ |
| | ~~Milled Surface~~ | ~~0.07~~ |

**334-5.6** ~~**Paving**~~***Placing Mixture*:**

**334-5.6.1 Alignment of Edges:** With the exception of pavements placed adjacent to curb and gutter or other true edges, place all pavements by the stringline method to obtain an accurate, uniform alignment of the pavement edge. Control the unsupported pavement edge to ensure that it will not deviate more than plus or minus 1.5 inches from the stringline.

**334-5.6.2 Rain and Surface Conditions:** Immediately cease transportation of asphalt mixtures from the plant when rain begins at the roadway. Do not place asphalt mixtures while rain is falling, or when there is water on the surface to be covered. Once the rain has stopped and water has been removed from the tacked surface to the satisfaction of the Engineer and the temperature of the mixture caught in transit still meets the requirements as specified in 334-5.3, the Contractor may then place the mixture caught in transit.

**334-5.6.3 Checking Depth of Layer:** Check the depth of each layer at frequent intervals to ensure a uniform spread rate that will meet the requirements of the Contract.

**334-5.6.4 Hand ~~Spreading~~*Work*:** In limited areas where the use of the spreader is impossible or impracticable, spread and finish the mixture by hand.

**334-5.6.5 Spreading and Finishing:** Upon arrival, dump the mixture in the approved paver, and immediately spread and strike-off the mixture to the full width required, and to such loose depth for each course that, when the work is completed, the required weight of mixture per square yard, or the specified thickness, is secured. Carry a uniform amount of mixture ahead of the screed at all times.

**334-5.6.6 Thickness Control:** Ensure the spread rate is within 10% of the target spread rate, as indicated in the Contract. When calculating the spread rate, use, at a minimum, an average of five truckloads of mix. When the average spread rate is beyond plus or minus 10% of the target spread rate, monitor the thickness of the pavement layer closely and adjust the construction operations.

If the Contractor fails to maintain an average spread rate within plus or minus 10% of the target spread rate for two consecutive days, the Engineer may elect to stop the construction operation at any time until the issue is resolved.

When the average spread rate for the total structural or friction course pavement thickness exceeds the target spread rate by ~~±~~*plus or minus50* ~~lbs~~ *pounds* per s*quare* y*ard* for layers ~~≥~~ *greater than or equal to* 2.~~5~~ *5* inches or exceeds the target spread rate by ~~±~~*plus or minus* ~~25~~ *25* ~~lbs~~ *pounds* per s*quare* y*ard* for layers ~~<~~ *less than* 2.~~5~~ *5* inches, address the unacceptable pavement in accordance with 334-5.10.4, unless an alternative approach is agreed upon by the Engineer.

**334-5.7 Leveling Courses:**

**334-5.7.1 Patching Depressions:** Before spreading any leveling course, fill all depressions in the existing surface as shown in the plans.

**334-5.7.2 Spreading Leveling Courses:** Place all courses of leveling with an asphalt paver or by the use of two motor graders, one being equipped with a spreader box. Other types of leveling devices may be used upon approval by the Engineer.

**334-5.7.3 Rate of Application:** When using Type SP-9.5 ~~(fine graded)~~ for leveling, do not allow the average spread of a layer to be less than 50 pounds per square yard or more than 75 pounds per square yard. The quantity of mix for leveling shown in the plans represents the average for the entire project; however, the Contractor may vary the rate of application throughout the project as directed by the Engineer. When leveling in connection with base widening, the Engineer may require placing all the leveling mix prior to the widening operation.

**334-5.8 Compaction:** For each paving or leveling train in operation, furnish a separate set of rollers, with their operators.

When density testing for acceptance is required, select equipment, sequence, and coverage of rolling to meet the specified density requirement. Regardless of the rolling procedure used, complete the final rolling before the surface temperature of the pavement drops to the extent that effective compaction may not be achieved or the rollers begin to damage the pavement.

When density testing for acceptance is not required, use a rolling pattern approved by the Engineer.

Use hand tamps or other satisfactory means to compact areas which are inaccessible to a roller, such as areas adjacent to curbs, headers, gutters, bridges, manholes, etc.

**334-5.9 Joints.**

**334-5.9.1 Transverse Joints:** Construct smooth transverse joints, which are within 3/16 inch of a true longitudinal profile when measured with a 15 foot manual straightedge *meeting the requirements of FDOT Test Method FM 5-509*. These requirements are waived for transverse joints at the beginning and end of the project and at the beginning and end of bridge structures, if the deficiencies are caused by factors beyond the control of the Contractor such as no milling requirement, as determined by the Engineer. When smoothness requirements are waived, construct a reasonably smooth transitional joint.

**334-5.9.2 Longitudinal Joints:** For all layers of pavement except the leveling course, place each layer so that longitudinal construction joints are offset 6 to 12 inches laterally between successive layers. Do not construct longitudinal joints in the wheel paths. The Engineer may waive these requirements where offsetting is not feasible due to the sequence of construction.

**334-5.10 Surface Requirements:** Construct a smooth pavement with good surface texture and the proper cross slope.

**334-5.10.1 Texture of the Finished Surface of Paving Layers:** Produce a finished surface of uniform texture and compaction with no pulled, torn, raveled, crushed or loosened portions and free of segregation, bleeding, flushing, sand streaks, sand spots, or ripples. Correct any area of the surface that does not meet the foregoing requirements in accordance with 334-5.10.4.

*In areas not defined to be a density testing exception per 334-6.4.1, obtain for the Engineer, three 6 inch diameter roadway cores at locations visually identified by the Engineer to be segregated. The Engineer will determine the density of each core in accordance with FDOT Test Method FM 1-T- 166 and calculate the percent $G_{mm}$ of the segregated area using the average $G_{mb}$ of the roadway cores and the representative PC- $G_{mm}$ for the questionable material. If the average percent $G_{mm}$ is less than 90.0, address the segregated area in accordance with 334-5.10.4.*

**334-5.10.2 Cross Slope:** Construct a pavement surface with cross slopes in compliance with the requirements of the Contract Documents.

**334-5.10.3 Pavement Smoothness:** Construct a smooth pavement meeting the requirements of this Specification. Furnish a 15 foot manual and a 15 foot rolling straightedge meeting the requirements of *FDOT Test Method* FM 5-509.

**334-5.10.3.1 Straightedge Testing:**

**334-5.10.3.1.1 Acceptance Testing:** ~~Using a rolling~~*Perform* straightedge~~,~~ test*ing in the outside wheel path of each lane for* the final (top) layer of the pavement. Test all pavement lanes where the width is constant using a rolling straightedge and document all deficiencies on a form approved by the Engineer. Notify the Engineer of the location and time of all straightedge testing a minimum of 48 hours before beginning testing.

**334-5.10.3.1.2 Final (Top) Pavement Layer:** At the completion of all paving operations, straightedge the final (top) layer either behind the final roller of the paving train or as a separate operation. Address all deficiencies in excess of 3/16 inch in accordance with 334-5.10.4, unless waived by the Engineer. Retest all corrected areas.

**334-5.10.3.1.3 Straightedge Exceptions:** Straightedge testing will not be required in the following areas: shoulders, intersections, tapers, crossovers, sidewalks, ~~bicycle/~~shared use paths, parking lots and similar areas, or in the following areas when they are less than ~~250~~ *250* feet in length: turn lanes, acceleration/deceleration lanes and side streets. *The limits of the intersection will be from stop bar to stop bar for both the mainline and side streets.* In the event the Engineer identifies a surface irregularity in the above areas that is determined to be objectionable, straightedge and address all deficiencies in excess of 3/~~8~~ *8* inch in accordance with 334-5.10.4.

**334-5.10.4 Correcting Unacceptable Pavement:** Correct deficiencies in the pavement layer by removing and replacing the full depth of the layer, extending a minimum of 50 feet on both sides *(where possible)* of the defective area for the full width of the paving lane, at no additional cost.

**334-6 Acceptance of the Mixture.**

**334-6.1 General:** The asphalt mixture will be accepted based on the Asphalt Work Category as defined below:

1. Asphalt Work Category 1 – Certification by the Contractor as defined in 334-6.2.
2. Asphalt Work Category 2 – Certification and process control testing by the Contractor as defined in 334-6.3.
3. Asphalt Work Category 3 – Process control testing by the Contractor and acceptance testing by the Engineer as defined in 334-6.4.

**334-6.2 Certification by the Contractor:** On Asphalt Work Category 1 construction, the Engineer will accept the mix on the basis of visual inspection. Submit a Notarized Certification of Specification Compliance letter on company letterhead to the Engineer stating that all material produced and placed on the project meets the requirements of the Specifications. The Engineer may run independent tests to determine the acceptability of the material.

**334-6.3 Certification and Process Control Testing by the Contractor:** On Asphalt Work Category 2 construction, submit a Notarized Certification of Specification Compliance letter on company letterhead to the Engineer stating that all material produced and placed on the project meets the requirements of the Specifications, along with supporting test data documenting all process control testing as described in 334-6.3.1. If required by the Contract, utilize an Independent Laboratory as approved by the Engineer for the process control testing. The mix will also require visual acceptance by the Engineer. In addition, the Engineer may run independent tests to determine the acceptability of the material. Material failing to meet these acceptance criteria will be addressed as directed by the Engineer such as but not limited to acceptance at reduced pay, delineation testing to determine the limits of the questionable material, removal and replacement at no cost to the agency, or performing an Engineering analysis to determine the final disposition of the material.~~.~~

**334-6.3.1 Process Control Sampling and Testing Requirements:** Perform process control testing at a frequency of once per day. Obtain the samples in accordance with FDOT Method FM 1-T 168. Test the mixture at the plant for gradation ($P_{-8}$ and $P_{-200}$) and asphalt binder content ($P_b$). Measure the roadway density with 6 inch diameter roadway cores at a minimum frequency of once per 1,500 feet of pavement with a minimum of three cores per day.

Determine the asphalt binder content of the mixture in accordance with *FDOT Method* FM 5-563. Determine the gradation of the recovered aggregate in accordance

with *FDOT Method* FM 1-T 030. Determine the roadway density in accordance with *FDOT Method* FM 1-T 166. The minimum roadway density will be based on the percent of the maximum specific gravity (Gmm) from the approved mix design. If the Contractor or Engineer suspects that the mix design Gmm is no longer representative of the asphalt mixture being produced, then a new Gmm value will be determined from plant-produced mix*, in accordance with FDOT Method FM 1-T 209,* with the approval of the Engineer. Roadway density testing will not be required in certain situations as described in 334-6.4.1. Assure that the asphalt binder content, gradation and density test results meet the criteria in Table 334-4.

| Table 334-4<br>Process Control and Acceptance Values | |
|---|---|
| Characteristic | Tolerance |
| Asphalt Binder Content (percent) | Target ± 0.55 |
| Passing No. 8 Sieve (percent) | Target ± 6.00 |
| Passing No. 200 Sieve (percent) | Target ± 2.00 |
| Roadway Density (daily average) | Minimum ~~91.5~~*90.0*% of Gmm |
| ~~Roadway Density (any single core)~~ | ~~Minimum 88.0 % of Gmm~~ |

**334-6.4 Process Control Testing by the Contractor and Acceptance Testing by the Engineer:** On Asphalt Work Category 3, perform process control testing as described in 334-6.3.1. In addition, the Engineer will accept the mixture at the plant with respect to gradation ($P_{-8}$ and $P_{-200}$) and asphalt binder content ($P_b$). The mixture will be accepted on the roadway with respect to density. The Engineer will sample and test the material as described in 334-6.3.1. The Engineer will randomly obtain at least one set of samples per day. Assure that the asphalt content, gradation and density test results meet the criteria in Table 334-4. Material failing to meet these acceptance criteria will be addressed as directed by the Engineer such as but not limited to acceptance at reduced pay, delineation testing to determine the limits of the questionable material, removal and replacement at no cost to the agency, or performing an Engineering analysis to determine the final disposition of the material.

**334-6.4.1 Acceptance Testing Exceptions:** When the total quantity of any mix type in the project is less than 500 tons, the Engineer will accept the mix on the basis of visual inspection. The Engineer may run independent tests to determine the acceptability of the material.

Density testing for acceptance will not be performed on widening strips or shoulders with a width of 5 feet or less, variable thickness overbuild courses, leveling courses, any asphalt layer placed on subgrade (regardless of type), miscellaneous asphalt pavement, ~~bike/~~shared use paths, crossovers, or any course with a specified thickness less than 1 inch or a specified spread rate less than 100 *pounds* ~~lb~~ per square yard. Density testing for acceptance will not be performed on asphalt courses placed on bridge decks or approach slabs*; compact these courses in static mode only*. In addition, density testing for acceptance will not be performed on the following areas when they are less than 1,000 feet continuous in length: turning lanes, acceleration lanes, deceleration lanes, shoulders, parallel parking lanes, or ramps. Density testing for acceptance will not be performed in intersections. The limits of the intersection will be from stop bar to stop bar for both the mainline and side streets. Compact these courses in accordance with a standard rolling procedure approved by the Engineer. In the event that the rolling procedure deviates from the approved procedure, placement of the mix will be stopped.

**334-7 Method of Measurement.**

For the work specified under this Section, the quantity to be paid for will be the weight of the mixture, in tons.

The bid price for the asphalt mix will include the cost of the liquid asphalt ~~or the asphalt recycling agent~~ and the tack coat application as specified in 334-5.5.4. There will be no separate payment or unit price adjustment for the asphalt binder material in the asphalt mix.

**334-8 Basis of Payment.**

**334-8.1 General:** Price and payment will be full compensation for all the work specified under this Section.

**SUPERPAVE ASPHALT FOR LAP (OFF-SYSTEM).**
**(REV1-26-15) (FA)**

## SECTION 334
## SUPERPAVE ASPHALT FOR LAP (OFF-SYSTEM)

**334-1 Description.**

**334-1.1 General:** Construct a Superpave asphalt pavement (consisting of either Hot Mix Asphalt (HMA) or Warm Mix Asphalt (WMA)) based on the type of work specified in the Contract and the Asphalt Work Categories as defined below. Meet the applicable requirements for plants, equipment, and construction requirements as defined below. Use an asphalt mix, either HMA or WMA, which meets the requirements of this specification.

**334-1.2 Asphalt Work Mix Categories:** Construction of asphalt pavement will fall into one of the following work categories:

**334-1.2.1 Asphalt Work Category 1:** Includes the construction of shared use paths and miscellaneous asphalt.

**334-1.2.2 Asphalt Work Category 2:** Includes the construction of new asphalt turn lanes, paved shoulders and other non-mainline pavement locations.

**334-1.2.3 Asphalt Work Category 3:** Includes the construction of new mainline asphalt pavement lanes, milling and resurfacing.

**334-1.3 Mix Types:** Use the appropriate asphalt mix as shown in Table 334-1.

Table 334-1
Asphalt Mix Types

| Asphalt Work Category | Mix Types | Traffic Level | ESALs (millions) |
|---|---|---|---|
| 1 | Type SP-9.5 | A | <0.3 |
| 2 | Structural Mixes: Types SP-9.5 or SP-12.5<br>Friction Mixes: Types FC-9.5 or FC-12.5 | B | 0.3 to <3 |
| 3 | Structural Mixes: Types SP-9.5 or SP-12.5<br>Friction Mixes: Types FC-9.5 or FC-12.5 | C | ≥3 |

A Type SP or FC mix one traffic level higher than the traffic level specified in the Contract may be substituted, at no additional cost (i.e. Traffic Level B may be substituted for Traffic Level A, etc.). Traffic levels are as defined in Section 334 of the Florida Department of Transportation's (FDOT's) Specifications.

**334-1.4 Gradation Classification:** The Superpave mixes are classified as fine and are defined in 334-3.2.2.

The equivalent AASHTO nominal maximum aggregate size Superpave mixes are as follows:

Type SP-9.5, FC-9.5 ..... 9.5 mm
Type SP-12.5, FC-12.5 ..... 12.5 mm

**334-1.5 Thickness:** The total pavement thickness of the asphalt pavement will be based on a specified spread rate or plan thickness as shown in the Contract Documents. Before paving, propose a spread rate or thickness for each individual layer meeting the requirements of this specification, which when combined with other layers (as applicable) will equal the plan spread rate or thickness. When the total pavement thickness is specified as plan thickness, the plan thickness and individual layer thickness will be converted to spread rate using the following equation:

$$\text{Spread rate (lbs/yd}^2) = t \times G_{mm} \times 43.3$$

where: $t$ = Thickness (in.) (Plan thickness or individual layer thickness)
$G_{mm}$ = Maximum specific gravity from the mix design

For target purposes only, spread rate calculations shall be rounded to the nearest whole number.

**334-1.5.1 Layer Thicknesses:** Unless otherwise called for in the Contract Documents, the allowable layer thicknesses for asphalt mixtures are as follows:

Type SP-9.5, FC-9.5 .....3/4 to 1-1/2 inches
Type SP-12.5, FC-12.5 ..... 1-1/2 to 2-1/2 inches

**334-1.5.2 Additional Requirements:** The following requirements also apply to asphalt mixtures:

1. When construction includes the paving of adjacent shoulders (less than or equal to 5 feet wide), the layer thickness for the upper pavement layer and shoulder shall be the same and paved in a single pass, unless otherwise called for in the Contract Documents.

2. For overbuild layers, use the minimum and maximum layer thicknesses as specified above unless called for differently in the Contract Documents. On variable thickness overbuild layers, the minimum allowable thickness may be reduced by 1/2 inch, and the maximum allowable thickness will be as specified below, unless called for differently in the Contract Documents.

Type SP-9.5……3/8 to 2 inches
Type SP-12.5……..1/2 to 3 inches

3. Variable thickness overbuild layers may be tapered to zero thickness provided the contract documents require a minimum of 1-1/2 inches of mix placed over the variable thickness overbuild layer.

**334-1.6 Weight of Mixture:** The weight of the mixture shall be determined as provided in 320-3.2 of the FDOT Specifications.

**334-2 Materials.**

**334-2.1 Superpave Asphalt Binder:** Unless specified elsewhere in the Contract or in 334-2.3.3, use a PG 67-22 asphalt binder from the FDOT's Approved Products List (APL). If the Contract calls for an alternative asphalt binder, meet the requirements of FDOT Specifications Section 336 or 916, as appropriate.

**334-2.2 Aggregate:** Use aggregate capable of producing a quality pavement.

For Type FC mixes, use an aggregate blend that consists of crushed granite, crushed Oolitic limestone, other crushed materials (as approved by FDOT for friction courses per

Rule 14-103.005, Florida Administrative Code), or a combination of the above. Crushed limestone from the Oolitic formation may be used if it contains a minimum of 12% silica material as determined by FDOT Test Method FM 5-510 and FDOT grants approval of the source prior to its use. As an exception, mixes that contain a minimum of 60% crushed granite may either contain:

1. Up to 40% fine aggregate from other sources; or,
2. A combination of up to 20% RAP and the remaining fine aggregate from other sources.

A list of aggregates approved for use in friction courses may be available on the FDOT's State Materials Office website. The URL for obtaining this information, if available, is: ftp://ftp.dot.state.fl.us/fdot/smo/website/sources/frictioncourse.pdf.

**334-2.3 Reclaimed Asphalt Pavement (RAP) Material:**

**334-2.3.1 General requirements:** RAP may be used as a component of the asphalt mixture, provided the RAP meets the following requirements:

1. When using a PG 76-22 (PMA), or PG 76-22 (ARB) asphalt binder, limit the amount of RAP material used in the mix to a maximum of 20% by weight of total aggregate. As an exception, amounts greater than 20% RAP by weight of total aggregate can be used if no more than 20% by weight of total asphalt binder comes from the RAP material.
2. Provide stockpiled RAP material that is reasonably consistent in characteristics and contains no aggregate particles which are soft or conglomerates of fines.
3. Provide RAP material having a minimum average asphalt binder content of 4.0% 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% 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 to verify that this requirement is met.
4. 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 recycle mixture. If oversized RAP material appears in the completed recycle mix, take the appropriate corrective action immediately. If the appropriate corrective actions are not immediately taken, stop plant operations.

**334-2.3.2 Material Characterization:** Assume responsibility for establishing the asphalt binder content, gradation, and bulk specific gravity ($G_{sb}$) of the RAP material based on a representative sampling of the material.

**334-2.3.3 Asphalt Binder for Mixes with RAP:** Select the appropriate asphalt binder grade based on Table 334-2. The Engineer reserves the right to change the asphalt binder type and grade during production based on characteristics of the RAP asphalt binder.

Table 334-2
Asphalt Binder Grade for Mixes Containing RAP

| Percent RAP | Asphalt Binder Grade |
|---|---|
| 0 - 15 | PG 67-22 |
| 16 – 30 | PG 58-22 |
| > 30 | PG 52-28 |

**334-3 Composition of Mixture.**

**334-3.1 General:** Compose the asphalt mixture using a combination of aggregates, mineral filler, if required, and asphalt binder material. Size, grade and combine the aggregate fractions to meet the grading and physical properties of the mix design. Aggregates from various sources may be combined.

**334-3.2 Mix Design:**

**334-3.2.1 General:** Design the asphalt mixture in accordance with AASHTO R 35-12, except as noted herein. Submit the proposed mix design with supporting test data indicating compliance with all mix design criteria to the Engineer. Prior to the production of any asphalt mixture, obtain the Engineer's conditional approval of the mix design. If required by the Engineer, send representative samples of all component materials, including asphalt binder to a laboratory designated by the Engineer for verification. As an exception to these requirements, use a currently approved FDOT Mix Design.

Warm mix technologies (additives, foaming techniques, etc.) listed on the Department's website may be used in the production of the mix. The URL for obtaining this information, is:
http://www.dot.state.fl.us/statematerialsoffice/quality/programs/warmmixasphalt/index.shtm.

The Engineer will consider any marked variations from original test data for a mix design or any evidence of inadequate field performance of a mix design as sufficient evidence that the properties of the mix design have changed, and at his discretion, the Engineer may no longer allow the use of the mix design.

**334-3.2.2 Mixture Gradation Requirements:** Combine the aggregates in proportions that will produce an asphalt mixture meeting all of the requirements defined in this specification and conform to the gradation requirements at design as defined in AASHTO M 323-12, Table 3. Aggregates from various sources may be combined.

**334-3.2.2.1 Mixture Gradation Classification:** Plot the combined mixture gradation on an FHWA 0.45 Power Gradation Chart. Include the Control Points from AASHTO M323-12, Table-3, as well as the Primary Control Sieve (PCS) Control Point from AASHTO M323-12, Table 4. Fine mixes are defined as having a gradation that passes above or through the primary control sieve control point.

**334-3.2.3 Gyratory Compaction:** Compact the design mixture in accordance with AASHTO T312-12, with the following exceptions: use the number of gyrations at $N_{design}$ as designed in Table 334-3.

Table 334-3
Gyratory Compaction Requirements

| Traffic Level | $N_{design}$ Number of Gyrations |
|---|---|
| A | 50 |
| B | 65 |
| C | 75 |

**334-3.2.4 Design Criteria:** Meet the requirements for nominal maximum aggregate size as defined in AASHTO M323-12, as well as for relative density, VMA, VFA, and dust-to-binder ratio as specified in AASHTO M323-12, Table 6. $N_{initial}$ and $N_{maximum}$ requirements are not applicable.

**334-3.2.5 Moisture Susceptibility:** Test 4 inch specimens in accordance with FDOT Test Method 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 pounds per square inch. If necessary, add a liquid anti-stripping agent from the FDOT's APL or hydrated lime in order to meet these criteria.

In lieu of moisture susceptibility testing, add a liquid anti-stripping agent from the FDOT's APL. Add 0.5% liquid anti-stripping agent by weight of asphalt binder.

**334-3.2.6 Additional Information:** In addition to the requirements listed above, provide the following information on each mix design:

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 FDOT source number and the FDOT product code of the aggregate components furnished from an FDOT approved source (if required).
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.
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%.
8. A target temperature for the mixture at the plant (mixing temperature) and a target temperature for the mixture at the roadway (compaction temperature). Do not exceed a target temperature of 330°F for PG 76-22 (PMA) and PG 76-22 (ARB) asphalt binders, and 315°F for unmodified asphalt binders.
9. Provide the physical properties achieved at four different asphalt binder contents. One shall be at the optimum asphalt content, and must conform to all specified physical requirements.
10. The name of the mix designer.
11. The ignition oven calibration factor.
12. The warm mix technology, if used.

**334-4 Process Control.**

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 to control the process.

**334-5 General Construction Requirements.**

**334-5.1 Weather Limitations:** Do not transport asphalt mix from the plant to the roadway unless all weather conditions are suitable for the paving operations.

**334-5.2 Limitations of Paving Operations:**

**334-5.2.1 General:** Spread the mixture only when the surface upon which it is to be placed has been previously prepared, is intact, firm, dry, clean, and the tack, with acceptable

spread rate, is properly broken. Ensure all granular base materials are properly primed and all asphalt base materials are properly tacked, prior to paving.

**334-5.2.2 Air Temperature:** Place the mixture only when the air temperature in the shade and away from the artificial heat meets the requirements of Table 334-4. The minimum ambient temperature requirement may be reduced by 5°F when using a warm mix technology, if mutually agreed to by both the Engineer and the Contractor. Table 334-4 Ambient Air Temperature Requirements for Paving

| Layer Thickness or Asphalt Binder Type | Minimum Temperature (°F) |
|---|---|
| ≤1 inch | 50 |
| Any mixture > 1 inch containing a PG asphalt binder with a high temperature designation ≥ 76°C | 45 |
| Any mixture > 1 inch containing a PG asphalt binder with a high temperature designation < 76°C | 40 |

**334-5.3 Mix Temperature:** Heat and combine the ingredients of the mix in such a manner as to produce a mixture with a temperature at the plant and at the roadway, within a range of plus or minus 30ºF from the target temperature as shown on the mix design. Reject all loads outside of this range. For warm mix asphalt, the Contractor may produce the first five loads of the production day and at other times when approved by the Engineer, at a hot mix asphalt temperature not to exceed 330°F for purposes of heating the asphalt paver. For these situations, the upper tolerance of +30°F does not apply.

**334-5.4 Transportation of the Mixture:** Transport the mix in trucks of tight construction, which prevents the loss of material and the excessive loss of heat and previously cleaned of all foreign material. After cleaning, thinly coat the inside surface of the truck bodies with soapy water or an asphalt release agent as needed to prevent the mixture from adhering to the beds. Do not allow excess liquid to pond in the truck body. Do not use a release agent that will contaminate, degrade, or alter the characteristics of the asphalt mix or is hazardous or detrimental to the environment. Petroleum derivatives (such as diesel fuel), solvents, and any product that dissolves asphalt are prohibited. Provide each truck with a tarpaulin or other waterproof cover mounted in such a manner that it can cover the entire load when required. When in place, overlap the waterproof cover on all sides so it can be tied down. Cover each load during cool and cloudy weather and at any time it appears rain is likely during transit with a tarpaulin or waterproof cover. Cover and tie down all loads of friction course mixtures.

**334-5.5 Preparation of Surfaces Prior to Paving:**

**334-5.5.1 Cleaning:** Clean the surface of all loose and deleterious material by the use of power brooms or blowers, supplemented by hand brooming where necessary.

**334-5.5.2 Patching and Leveling Courses:** As shown in the plans, bring the existing surface to proper grade and cross-section by the application of patching or leveling courses.

**334-5.5.3 Application over Surface Treatment:** Where an asphalt mix is to be placed over a surface treatment, sweep and dispose of all loose material from the paving area.

**334-5.5.4 Tack Coat:** Use a rate of application as defined in Table 334-5. Control the rate of application to be within plus or minus 0.01 gallon per square yard of the target application rate. The target application rate may be adjusted by the Engineer to meet specific field conditions. Determine the rate of application as needed to control the operation. When using PG 52-28, multiply the target rate of application by 0.6.

| Table 334-5<br>Tack Coat Application Rates | | |
|---|---|---|
| Asphalt Mixture Type | Underlying Pavement Surface | Target Tack Rate ($gal/yd^2$) |
| Base Course, Structural Course, Dense Graded Friction Course | Newly Constructed Asphalt Layers | 0.03 minimum |
| | Milled Surface or Oxidized and Cracked Pavement | 0.06 |
| | Concrete Pavement | 0.08 |
| | | |
| | | |

**334-5.6 Placing Mixture:**

**334-5.6.1 Alignment of Edges:** With the exception of pavements placed adjacent to curb and gutter or other true edges, place all pavements by the stringline method to obtain an accurate, uniform alignment of the pavement edge. Control the unsupported pavement edge to ensure that it will not deviate more than plus or minus 1.5 inches from the stringline.

**334-5.6.2 Rain and Surface Conditions:** Immediately cease transportation of asphalt mixtures from the plant when rain begins at the roadway. Do not place asphalt mixtures while rain is falling, or when there is water on the surface to be covered. Once the rain has stopped and water has been removed from the tacked surface to the satisfaction of the Engineer and the temperature of the mixture caught in transit still meets the requirements as specified in 334-5.3, the Contractor may then place the mixture caught in transit.

**334-5.6.3 Checking Depth of Layer:** Check the depth of each layer at frequent intervals to ensure a uniform spread rate that will meet the requirements of the Contract.

**334-5.6.4 Hand Work:** In limited areas where the use of the spreader is impossible or impracticable, spread and finish the mixture by hand.

**334-5.6.5 Spreading and Finishing:** Upon arrival, dump the mixture in the approved paver, and immediately spread and strike-off the mixture to the full width required, and to such loose depth for each course that, when the work is completed, the required weight of mixture per square yard, or the specified thickness, is secured. Carry a uniform amount of mixture ahead of the screed at all times.

**334-5.6.6 Thickness Control:** Ensure the spread rate is within 10% of the target spread rate, as indicated in the Contract. When calculating the spread rate, use, at a minimum, an average of five truckloads of mix. When the average spread rate is beyond plus or minus 10% of the target spread rate, monitor the thickness of the pavement layer closely and adjust the construction operations.

If the Contractor fails to maintain an average spread rate within plus or minus 10% of the target spread rate for two consecutive days, the Engineer may elect to stop the construction operation at any time until the issue is resolved.

When the average spread rate for the total structural or friction course pavement thickness exceeds the target spread rate by plus or minus50 pounds per square yard for layers greater than or equal to 2.5 inches or exceeds the target spread rate by plus or minus 25 pounds per square yard for layers less than 2.5 inches, address the unacceptable pavement in accordance with 334-5.10.4, unless an alternative approach is agreed upon by the Engineer.

**334-5.7 Leveling Courses:**

**334-5.7.1 Patching Depressions:** Before spreading any leveling course, fill all depressions in the existing surface as shown in the plans.

**334-5.7.2 Spreading Leveling Courses:** Place all courses of leveling with an asphalt paver or by the use of two motor graders, one being equipped with a spreader box. Other types of leveling devices may be used upon approval by the Engineer.

**334-5.7.3 Rate of Application:** When using Type SP-9.5for leveling, do not allow the average spread of a layer to be less than 50 pounds per square yard or more than 75 pounds per square yard. The quantity of mix for leveling shown in the plans represents the average for the entire project; however, the Contractor may vary the rate of application throughout the project as directed by the Engineer. When leveling in connection with base widening, the Engineer may require placing all the leveling mix prior to the widening operation.

**334-5.8 Compaction:** For each paving or leveling train in operation, furnish a separate set of rollers, with their operators.

When density testing for acceptance is required, select equipment, sequence, and coverage of rolling to meet the specified density requirement. Regardless of the rolling procedure used, complete the final rolling before the surface temperature of the pavement drops to the extent that effective compaction may not be achieved or the rollers begin to damage the pavement.

When density testing for acceptance is not required, use a rolling pattern approved by the Engineer.

Use hand tamps or other satisfactory means to compact areas which are inaccessible to a roller, such as areas adjacent to curbs, headers, gutters, bridges, manholes, etc.

**334-5.9 Joints.**

**334-5.9.1 Transverse Joints:** Construct smooth transverse joints, which are within 3/16 inch of a true longitudinal profile when measured with a 15 foot manual straightedge meeting the requirements of FDOT Test Method FM 5-509. These requirements are waived for transverse joints at the beginning and end of the project and at the beginning and end of bridge structures, if the deficiencies are caused by factors beyond the control of the Contractor such as no milling requirement, as determined by the Engineer. When smoothness requirements are waived, construct a reasonably smooth transitional joint.

**334-5.9.2 Longitudinal Joints:** For all layers of pavement except the leveling course, place each layer so that longitudinal construction joints are offset 6 to 12 inches laterally between successive layers. Do not construct longitudinal joints in the wheel paths. The Engineer may waive these requirements where offsetting is not feasible due to the sequence of construction.

**334-5.10 Surface Requirements:** Construct a smooth pavement with good surface texture and the proper cross slope.

**334-5.10.1 Texture of the Finished Surface of Paving Layers:** Produce a finished surface of uniform texture and compaction with no pulled, torn, raveled, crushed or loosened portions and free of segregation, bleeding, flushing, sand streaks, sand spots, or ripples. Correct any area of the surface that does not meet the foregoing requirements in accordance with 334-5.10.4.

In areas not defined to be a density testing exception per 334-6.4.1, obtain for the Engineer, three 6 inch diameter roadway cores at locations visually identified by the Engineer to be segregated. The Engineer will determine the density of each core in accordance

with FDOT Test Method FM 1-T 166 and calculate the percent $G_{mm}$ of the segregated area using the average $G_{mb}$ of the roadway cores and the representative PC $G_{mm}$ for the questionable material. If the average percent $G_{mm}$ is less than 90.0, address the segregated area in accordance with 334-5.10.4.

**334-5.10.2 Cross Slope:** Construct a pavement surface with cross slopes in compliance with the requirements of the Contract Documents.

**334-5.10.3 Pavement Smoothness:** Construct a smooth pavement meeting the requirements of this Specification. Furnish a 15 foot manual and a 15 foot rolling straightedge meeting the requirements of FDOT Test Method FM 5-509.

**334-5.10.3.1 Straightedge Testing:**

**334-5.10.3.1.1 Acceptance Testing:** Perform straightedge testing in the outside wheel path of each lane for the final (top) layer of the pavement. Test all pavement lanes where the width is constant using a rolling straightedge and document all deficiencies on a form approved by the Engineer. Notify the Engineer of the location and time of all straightedge testing a minimum of 48 hours before beginning testing.

**334-5.10.3.1.2 Final (Top) Pavement Layer:** At the completion of all paving operations, straightedge the final (top) layer either behind the final roller of the paving train or as a separate operation. Address all deficiencies in excess of 3/16 inch in accordance with 334-5.10.4, unless waived by the Engineer. Retest all corrected areas.

**334-5.10.3.1.3 Straightedge Exceptions:** Straightedge testing will not be required in the following areas: shoulders, intersections, tapers, crossovers, sidewalks, shared use paths, parking lots and similar areas, or in the following areas when they are less than 250 feet in length: turn lanes, acceleration/deceleration lanes and side streets. The limits of the intersection will be from stop bar to stop bar for both the mainline and side streets. In the event the Engineer identifies a surface irregularity in the above areas that is determined to be objectionable, straightedge and address all deficiencies in excess of 3/8 inch in accordance with 334-5.10.4.

**334-5.10.4 Correcting Unacceptable Pavement:** Correct deficiencies in the pavement layer by removing and replacing the full depth of the layer, extending a minimum of 50 feet on both sides (where possible) of the defective area for the full width of the paving lane, at no additional cost.

**334-6 Acceptance of the Mixture.**

**334-6.1 General:** The asphalt mixture will be accepted based on the Asphalt Work Category as defined below:

1. Asphalt Work Category 1 – Certification by the Contractor as defined in 334-6.2.
2. Asphalt Work Category 2 – Certification and process control testing by the Contractor as defined in 334-6.3.
3. Asphalt Work Category 3 – Process control testing by the Contractor and acceptance testing by the Engineer as defined in 334-6.4.

**334-6.2 Certification by the Contractor:** On Asphalt Work Category 1 construction, the Engineer will accept the mix on the basis of visual inspection. Submit a Notarized Certification of Specification Compliance letter on company letterhead to the Engineer stating that all material produced and placed on the project meets the requirements of the Specifications. The Engineer may run independent tests to determine the acceptability of the material.

**334-6.3 Certification and Process Control Testing by the Contractor:** On Asphalt Work Category 2 construction, submit a Notarized Certification of Specification Compliance letter on company letterhead to the Engineer stating that all material produced and placed on the project meets the requirements of the Specifications, along with supporting test data documenting all process control testing as described in 334-6.3.1. If required by the Contract, utilize an Independent Laboratory as approved by the Engineer for the process control testing. The mix will also require visual acceptance by the Engineer. In addition, the Engineer may run independent tests to determine the acceptability of the material. Material failing to meet these acceptance criteria will be addressed as directed by the Engineer such as but not limited to acceptance at reduced pay, delineation testing to determine the limits of the questionable material, removal and replacement at no cost to the agency, or performing an Engineering analysis to determine the final disposition of the material.

**334-6.3.1 Process Control Sampling and Testing Requirements:** Perform process control testing at a frequency of once per day. Obtain the samples in accordance with FDOT Method FM 1-T 168. Test the mixture at the plant for gradation ($P_{-8}$ and $P_{-200}$) and asphalt binder content ($P_b$). Measure the roadway density with 6 inch diameter roadway cores at a minimum frequency of once per 1,500 feet of pavement with a minimum of three cores per day.

Determine the asphalt binder content of the mixture in accordance with FDOT Method FM 5-563. Determine the gradation of the recovered aggregate in accordance with FDOT Method FM 1-T 030. Determine the roadway density in accordance with FDOT Method FM 1-T 166. The minimum roadway density will be based on the percent of the maximum specific gravity (Gmm) from the approved mix design. If the Contractor or Engineer suspects that the mix design Gmm is no longer representative of the asphalt mixture being produced, then a new Gmm value will be determined from plant-produced mix, in accordance with FDOT Method FM 1-T 209, with the approval of the Engineer. Roadway density testing will not be required in certain situations as described in 334-6.4.1. Assure that the asphalt binder content, gradation and density test results meet the criteria in Table 334-4.

Table 334-4
Process Control and Acceptance Values

| Characteristic | Tolerance |
|---|---|
| Asphalt Binder Content (percent) | Target ± 0.55 |
| Passing No. 8 Sieve (percent) | Target ± 6.00 |
| Passing No. 200 Sieve (percent) | Target ± 2.00 |
| Roadway Density (daily average) | Minimum 90.0% of Gmm |

**334-6.4 Process Control Testing by the Contractor and Acceptance Testing by the Engineer:** On Asphalt Work Category 3, perform process control testing as described in 334-6.3.1. In addition, the Engineer will accept the mixture at the plant with respect to gradation ($P_{-8}$ and $P_{-200}$) and asphalt binder content ($P_b$). The mixture will be accepted on the roadway with respect to density. The Engineer will sample and test the material as described in 334-6.3.1. The Engineer will randomly obtain at least one set of samples per day. Assure that the asphalt content, gradation and density test results meet the criteria in Table 334-4. Material failing to meet these acceptance criteria will be addressed as directed by the Engineer such as but not limited to acceptance at reduced pay, delineation testing to determine the limits of the

questionable material, removal and replacement at no cost to the agency, or performing an Engineering analysis to determine the final disposition of the material.

**334-6.4.1 Acceptance Testing Exceptions:** When the total quantity of any mix type in the project is less than 500 tons, the Engineer will accept the mix on the basis of visual inspection. The Engineer may run independent tests to determine the acceptability of the material.

Density testing for acceptance will not be performed on widening strips or shoulders with a width of 5 feet or less, variable thickness overbuild courses, leveling courses, any asphalt layer placed on subgrade (regardless of type), miscellaneous asphalt pavement, shared use paths, crossovers, or any course with a specified thickness less than 1 inch or a specified spread rate less than 100 pounds per square yard. Density testing for acceptance will not be performed on asphalt courses placed on bridge decks or approach slabs; compact these courses in static mode only. In addition, density testing for acceptance will not be performed on the following areas when they are less than 1,000 feet continuous in length: turning lanes, acceleration lanes, deceleration lanes, shoulders, parallel parking lanes, or ramps. Density testing for acceptance will not be performed in intersections. The limits of the intersection will be from stop bar to stop bar for both the mainline and side streets. Compact these courses in accordance with a standard rolling procedure approved by the Engineer. In the event that the rolling procedure deviates from the approved procedure, placement of the mix will be stopped.

**334-7 Method of Measurement.**

For the work specified under this Section, the quantity to be paid for will be the weight of the mixture, in tons.

The bid price for the asphalt mix will include the cost of the liquid asphalt and the tack coat application as specified in 334-5.5.4. There will be no separate payment or unit price adjustment for the asphalt binder material in the asphalt mix.

**334-8 Basis of Payment.**

**334-8.1 General:** Price and payment will be full compensation for all the work specified under this Section.