

ORINATION FORM

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Specification: 320

Subject: Hot Bituminous Mixtures - Plant, Methods, and Equipment

Origination date: May 13, 2011

Originator: Jim Musselman

Office/Phone: State Materials Office / 352.955.2905

Problem statement: 1. Sections 320 and 330 were outdated and had extensive overlap, i.e. 320 had roadway related items and 330 had asphalt plant items.

Proposed solution: 1. Several meetings were held with representatives from the Department and Industry to revise both specifications.

Information source: 1. Department personnel from Central Office and the Districts and Industry.

Recommended Usage Note: All asphalt projects.

Estimated fiscal impact, if implemented: None.

Implementation of these changes, if and when approved, will begin with the January 2012 letting.

For State Specifications Office Use Only

Begin date:

File Number:

Scheduled completion date:

Implementation date:

Implementation team member:

Usage Note:

Notes:



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M E M O R A N D U M

DATE: June 2, 2011

TO: Specification Review Distribution List

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

SUBJECT: Proposed Specification: **3200000 Hot Mix Asphalt – Plant Methods and Equipment.**

In accordance with Specification Development Procedures, we are sending you a copy of a proposed specification change.

These changes are proposed by Jim Musselman of the State Materials Office to provide an overall update of the Section. Sections 320 and 330 have overlapped with each Section containing roadway and plant requirements. Section 320 will now address plant requirements and Section 330 will address roadway requirements.

Please share this proposal with others within your responsibility. Review comments are due within four weeks and should be sent to Mail Station 75 or to my attention via e-mail at SP965RP or rudy.powell@dot.state.fl.us. Comments received after **June 30, 2011** may not be considered. Your input is encouraged.

RP/cah
Attachment

**HOT MIX ASPHALT – PLANT METHODS AND EQUIPMENT.
(REV 5-18-11)**

SECTION 320 (Pages 241 - 247) is deleted and the following substituted:

**SECTION 320
HOT ~~BITUMINOUS MIXTURES~~ *MIX ASPHALT* -
PLANT, ~~METHODS,~~ AND EQUIPMENT**

320-1 General.

This Section specifies the ~~plant and methods of operation for preparing all plant mixed hot bituminous mixtures for surface courses and bases, and the~~ *basic equipment and operational requirements for ~~the equipment to be hot mix asphalt (including warm mix asphalt) production facilities that is~~ used in the construction of ~~the asphalt~~ pavements and bases. *Establish and maintain a quality control system that provides assurance that all materials and products submitted for acceptance meet Contract requirements.**

320-2 *Quality Control (QC) Requirements for All Plants.*

320-2.1 *Minimum Producer ~~Quality Control~~ QC Requirements:* *Perform as a minimum the following activities:*

1. *Stockpiles:*
 - a. *Assure materials are placed in the correct stockpile;*
 - b. *Assure good stockpiling techniques;*
 - c. *Inspect stockpiles for separation, contamination, segregation, ~~etc~~ and other similar items;*
 - d. *Properly identify and label each stockpile.*
2. *Incoming Aggregate:*
 - a. *Obtain gradations and bulk specific gravity (G_{sb}) values from aggregate supplier for reference;*
 - b. *Determine the gradation of all component materials; and routinely compare gradations and G_{sb} values to mix design.*
3. *Cold Bins:*
 - a. *Calibrate the cold gate/feeder belt for each material;*
 - b. *Determine cold gate/feeder belt settings;*
 - c. *Observe operation of cold feeder for uniformity;*
 - d. *Verify accuracy of all settings;*
 - e. *Verify that the correct components are being used, and that all modifiers ~~and~~ or additives or both are being incorporated into the mix.*
4. *Batch Plants:*
 - a. *Determine percent used and weight to be pulled from each bin to assure compliance with the mix design;*
 - b. *Check mixing time;*
 - c. *Check operations of weigh bucket and scales.*
5. *Drum Mixer Plants:*
 - a. *Determine aggregate moisture content;*

b. Calibrate the weigh bridge on the charging conveyor.

6. Control Charts: Maintain ~~quality control~~QC data and charts (updated daily) for all ~~Quality Control~~QC Sampling and Testing and make available upon demand. Provide the following charts:

- a. All components used to determine the composite pay factor (No. 8 sieve, No. 200 sieve, asphalt binder content, air voids, and density) by LOT;
- b. Gradation of incoming aggregate;
- c. Gradation, asphalt binder content and maximum specific gravity (G_{mm}) of RAP;
- d. Any other test result or material characteristic (as determined by the Contractor) necessary for process control.

The above listed minimum activities are to be considered normal activities necessary to control the production of hot mix asphalt at an acceptable quality level. Depending on the type of process or materials, some of the activities listed may not be necessary and in other cases, additional activities may be required. The frequency of these activities will also vary with the process and the materials. When the process varies from the defined process average and variability targets, the frequency of these activities will be increased until the proper conditions have been restored.

320-2.2 Minimum Process Control Testing Requirements: Perform, as a minimum, the following activities at the testing frequencies provided in Table 320-1. ~~Quality Control~~QC tests used in the acceptance decision may be used to fulfill these requirements.

<i>Table 320-1</i>		
<i>Asphalt Plant - Materials Testing Frequencies</i>		
<i>Material</i>	<i>Property</i>	<i>Minimum Testing Frequency</i>
<i>Aggregate</i>	<i>Gradation</i>	<i>Once per 1,000 tons of incoming aggregate</i>
<i>Aggregate</i>	<i>Moisture Content (stockpiled aggregate or combined cold feed bin)</i>	<i>Once per day</i>
<i>Asphalt Mix</i>	<i>Asphalt Binder Content</i>	<i>If daily production > 100 tons, once per day; If daily production > 1,000 tons, twice per day.</i>
<i>Asphalt Mix</i>	<i>Bulk Specific Gravity (G_{mb})</i>	<i>If daily production > 100 tons, once per day; If daily production > 1,000 tons, twice per day.</i>
<i>Asphalt Mix</i>	<i>Gradation</i>	<i>If daily production > 100 tons, once per day; If daily production > 1,000 tons, twice per day.</i>
<i>Asphalt Mix</i>	<i>Maximum Specific Gravity (G_{mm})</i>	<i>If daily production > 100 tons, once per day; If daily production > 1,000 tons, twice per day.</i>
<i>Asphalt Mix</i>	<i>Temperature</i>	<i>Each of first 5 loads, then once every 5 loads thereafter per day per mix design.</i>
<i>RAP</i>	<i>Asphalt Binder Content</i>	<i>Once per 1,000 tons RAP</i>

RAP	Gradation	Once per 1,000 tons RAP
RAP	Maximum Specific Gravity (Gmm)	Once per 5,000 tons RAP
RAP	Recovered Viscosity	Once per 5,000 tons RAP

320-2.3 Personnel Qualifications: Provide ~~Quality Control~~QC Technicians in accordance with Section 105.

320-2.4 Hot Mix Asphalt Testing Laboratory Requirements: Furnish a fully equipped asphalt laboratory at the production site. The ~~laboratory~~ laboratory must be qualified under the Department's Laboratory Qualification Program, as described in Section 105. In addition, the laboratory shall meet the following requirements:

1. Area - The effective working area of the laboratory shall be a minimum of 180 ft², with a layout of which will facilitate multiple tests being run simultaneously by two technicians. This area does not include the space for desks, chairs and file cabinets. Any variations shall be approved by the Engineer.

2. Lighting - The lighting in the lab must be adequate to illuminate all areas of the work.

3. Temperature Control - Equip the lab with heating and air conditioning units that provide a satisfactory working environment.

4. Ventilation - Equip the lab with exhaust fans that will remove all hazardous fumes from within the laboratory in accordance with OSHA requirements.

5. Equipment and Supplies - Furnish the lab with the necessary sampling and testing equipment and supplies for performing contractor ~~Quality Control~~QC and Department Verification Sampling and Testing. A detailed list of equipment and supplies required for each test is included in the appropriate FDOT, AASHTO, or ASTM Test Method.

6. Calibration of the Superpave Gyrotory Compactor - Calibrate the Superpave Gyrotory Compactor in accordance with the manufacturer's recommendations. The calibration frequency shall be the more frequent interval of the manufacturer's recommendation or once per year as stated in AASHTO R 18. Identify in the Quality Control Plan (QCP) the established frequencies and document all calibrations.

7. Personal Computer - Provide a personal computer capable of running a Microsoft ExcelTM spreadsheet program, along with a printer.

8. Communication - Provide a telephone and fax machine (with a private line) for the use of the testing facility's ~~quality control~~QC personnel. In addition, provide an ~~internet~~ internet connection capable of uploading data to the Department's database and for e-mail communications.

320-3 Requirements for All Plants.

320-3.1 General: Design, manufacture, coordinate, and operate the asphalt plant in a manner that will consistently produce a mixture within the ~~job mix~~appropriate tolerances and temperatures specified.

320-23.2 Electronic Weigh Systems: Equip the asphalt plant with an electronic weigh system that: 1) has an automatic printout, 2) is certified every six months by an approved certified scale technician, and 3) meets ~~weekly~~monthly comparison checks with certified truck scales as specified in 320-23.2.4. Weigh all plant produced hot mix asphalt on the electronic weigh system, regardless of the method of measurement for payment.

Include, as a minimum, the following information on the printed delivery ticket:

- (a) Sequential load number.

- (b) Project number.
- (c) Date.
- (d) Name and location of plant.
- (e) Mix design number.
- (f) Place for hand-recording mix temperature.
- (g) Truck number.
- (h) Gross, tare, and net tonnage per truck (as applicable).
- (i) Daily total tonnage of mix for the mix design.

Print the delivery ticket with an original and at least one copy. Furnish the original to the Engineer at the plant and one copy to the Engineer at the paving site.

Utilize any one of the following three electronic weigh systems:

320-23.2.1 Electronic Weigh System on the Truck Scales: Provide an electronic weigh system on all truck scales, which is equipped with an automatic recordation system that is approved by the Engineer. Use scales of the type that directly indicate the total weight of the loaded truck. Use scales meeting the requirements for accuracy, condition, etc., of the Bureau of Weights and Measures of the Florida Department of Agriculture, and re-certify such fact every six months, either by the Bureau of Weights and Measures or by a registered scale technician.

320-23.2.2 Electronic Weigh System on ~~Hopper-Hoppers~~ Beneath a Surge or Storage Bin: Provide an electronic weigh system on the hopper (hopper scales or load cells) beneath the surge or storage bin, which is equipped with an automatic recordation system approved by the Engineer.

320-23.2.3 Automatic Batch ~~Plant~~Plants with Printout: For batch plants, provide an approved automatic printer system which will print the individual or cumulative weights of aggregate and liquid asphalt delivered to the pugmill and the total net weight of the asphalt mix measured by hopper scales or load cell type scales. Use the automatic printer system only in conjunction with automatic batching and mixing control systems that have been approved by the Engineer.

320-23.2.4 ~~Weekly~~Monthly Electronic Weigh System Comparison Checks: Check the accuracy of the electronic weighing system at the commencement of production and thereafter at least once a ~~week~~month during production by one of the following two methods: *and maintain a record of the weights in the Scale Check Worksheet (675-030-27).*

320-23.2.4.1. Electronic Weigh ~~Systems~~System on Truck Scales:

- (a) The Engineer will randomly select a loaded truck of asphalt mix and record the truck number and gross weight from the Contractor's delivery ticket.
- (b) Weigh the selected truck on a certified truck scale, which is not owned by the Contractor and record the gross weight for the comparison check. If another certified truck scale is not available, the Engineer may permit another set of certified truck scales owned by the Contractor to be used. The Engineer may elect to witness the scale check.
- (c) The gross weight of the loaded truck as shown on the Contractor's delivery ticket will be compared to the gross weight of the loaded truck from the other certified truck scale. The maximum permissible deviation is 8 pounds per ton of ~~gross weight of the loaded truck~~load, based on the certified truck scale weight.
- (d) If the distance from the asphalt plant to the nearest certified truck scale is enough for fuel consumption to affect the accuracy of the comparison checks, a fuel adjustment may be calculated by using the truck odometer readings for the distance

measurement, and 6.1 miles per gallon for the fuel consumption rate, and 115 ounces per gallon for fuel weight.

(e) During production, when an additional certified truck scale is not available for comparison checks, the Engineer may permit the Contractor to weigh the truck on his certified scales used during production and then weigh it on another certified truck scale, as soon the other scale is available for the comparison checks.

In addition to the periodic checks as specified above, check the scales at any time the accuracy of the scales becomes questionable. When such inaccuracy does not appear to be sufficient to seriously affect the weighing operations, the Engineer will allow a period of two calendar days for the Contractor to ~~effect~~*conduct* the required ~~scales~~*scale* check. However, in the event the indicated inaccuracy is sufficient to seriously affect the mixture, the Engineer may require immediate shut-down until the accuracy of the scales has been checked and necessary corrections have been made. Include the cost of all scale checks in the bid price for asphalt concrete, at no additional cost to the Department.

320-2.3.2.4.2. ~~For Electronic Weigh Systems~~*System* on Hoppers Beneath a Surge or Storage ~~Bins~~*Bin* and Automatic Batch Plants with Printout:

(a) The Engineer will randomly select a loaded truck of asphalt mix and record the truck number, and the net weight of the asphalt mix from the Contractor's delivery ticket.

(b) Weigh the selected truck on a certified truck scale, which is not owned by the Contractor and record the gross weight for the comparison check. If another certified truck scale is not available, the Engineer may permit another set of certified truck scales owned by the Contractor to be used. The Engineer may elect to witness the scale check.

(c) Deliver the asphalt mix to the project, then weigh the selected empty truck on the same certified truck scales. Record the tare weight of the truck.

(d) Compare the net weight of the asphalt mix from the delivery ticket to the calculated net weight of the asphalt mix as determined by the certified truck scale weights. The maximum permissible deviation is 8 pounds per ton of load, based on the certified truck scale weight.

(e) Use the fuel adjustment as specified in 320-2.3.2.4.1(d), when the distance from the asphalt plant to the nearest certified truck scale is enough for fuel consumption to affect the accuracy of the comparison checks.

(f) During production, when an additional certified truck scale is not available for comparison checks, the Engineer may permit the Contractor to load a truck with aggregate from the pugmill, surge or storage bin, and follow the above procedures to conduct the comparison checks as soon as certified truck scale is available.

If the check shows a greater difference than the tolerance specified above, then recheck on a second set of certified scales. If the check and recheck indicate that the printed weight is out of tolerance, have a certified scale technician check the electronic weigh system and certify the accuracy of the printer. While the system is out of tolerance and before its adjustment, the Engineer may allow the Contractor to continue production only if provisions are made to use a set of certified truck scales to determine the truck weights.

320-2.3 ~~Equipment for Preparation.~~*3 Asphalt Binder: Meet the following requirements:*

320-3.3.1 Transportation: *Deliver the asphalt binder to the asphalt plant at a temperature not to exceed 370°F, and equip the transport tanks with sampling and temperature sensing devices meeting the requirements of **Bituminous Material:300-3.2.***

320-3.3.2 Storage: Equip ~~bituminous material~~ *asphalt binder* storage tanks to heat ~~the liquid asphalt~~ *under effective and positive control* ~~binder~~ to the temperatures required for the various mixtures. Heat ~~using hot oil, steam, electricity, or other means whereby~~ *the material in such a manner that* no flame comes in contact with the ~~tank~~ *binder*. ~~Heat and/or insulate all pipe lines and fittings.~~ Use a circulating system of adequate size to ensure proper and continuous circulation during the entire operating period. ~~Use steam or hot oil jacketed pipe lines and fittings to prevent heat loss.~~ Locate a thermometer, reading from 200 to 400°F, either in the storage tank or in the ~~bituminous~~ *asphalt binder* feed line. *Maintain the asphalt binder in storage within a range of 230 to 370°F in advance of mixing operations.* Locate a sampling device on the discharge piping exiting the storage tank or at a location as approved by the Engineer.

320-23.4 Aggregate: *Meet the following requirements:*

320-3.4.1 Stockpiles: *Place each aggregate component in an individual stockpile, and separate each from the adjacent stockpiles, either by space or by a system of bulkheads. Prevent the intermingling of different materials in stockpiles at all times. Identify each stockpile, including RAP, as shown on the mix design.*

Form and maintain stockpiles in a manner that will prevent segregation. If a stockpile is determined to be segregated, (~~or if the Engineer determines the stockpile to be segregated~~) discontinue the use of the material on the project until the appropriate actions have been taken to correct the problem.

320-3.4.2 Blending of Aggregates: *Stockpile all aggregates prior to blending or placing in the cold feed bins. If mineral filler or hydrated lime is required in the mix, feed or weigh it in separately from the other aggregates.*

320-3.4.2.1 Cold Feed Bin: Provide a separate cold *feed* bin for each component of the fine and coarse ~~aggregates~~ *aggregate* required by the ~~mix~~ *design mix*. Equip the cold *feed* bins with accurate mechanical means for feeding the ~~aggregates~~ *aggregate* uniformly into the dryer in the proportions required for the finished mix to maintain uniform production and temperature. When using RAP as a component material, *prevent any oversized RAP from being incorporated into the completed mixture by the use of:* a grizzly or grid over the RAP ~~cold~~ bin; in-line roller *or impact* crusher; screen; or other suitable means ~~to prevent oversized RAP material from showing up in the completed recycled mixture~~. If oversized RAP material appears in the completed recycled mix, take the appropriate corrective action immediately. If the appropriate corrective actions are not immediately taken, stop plant operations.

Use separate bin compartments in the cold aggregate feeder that are constructed to prevent any spilling or leakage of aggregate from one cold feed bin to another. Ensure that each cold feed bin compartment has the capacity and design to permit a uniform flow of aggregates. Mount all cold feed bin compartments over a feeder of uniform speed, which will deliver the specified proportions of the separate aggregates to the drier at all times. If necessary, equip the cold feed bins with vibrators to ensure a uniform flow of the aggregates at all times.

320-23.4.2.2 Gates and Feeder Belts: *Provide each cold feed bin compartment with a gate and feeder belt, both of which are adjustable to assure the aggregate is proportioned to meet the requirements of the mix design.*

320-3.4.3 Screening Unit: *Remove any oversized pieces of aggregate by the use of a scalping screen. Do not return this oversized material to the stockpile for reuse unless it has been crushed and reprocessed into sizes that will pass the scalping screen. Ensure that the quantity of aggregates being discharged onto the screens does not exceed the capacity of the screens to actually separate the aggregates into the required sizes.*

320-3.5 Dryer: Provide a dryer of ~~any~~-satisfactory design for heating and drying the ~~mineral aggregates~~-*aggregate*. Use a dryer capable of heating the ~~aggregates~~*aggregate* to within the specified temperature range for any mix, and equip the dryer with an electric pyrometer placed at the discharge chute to automatically register the temperature of the heated aggregates.

320-23.6 Bituminous Asphalt Binder Control Unit: Provide a satisfactory means, either by weighing, metering, or volumetric measuring, to obtain the proper amount of ~~bituminous asphalt binder~~ material in the mix, within the tolerance specified for the ~~job mix~~. ~~Provide either steam or hot oil jacketing for maintaining the bituminous material at the specified temperature in the pipe lines, meters, weigh buckets, spray bars, and other containers of flow lines.~~*mix design.*

320-23.7 Contractor's Responsibilities: Acceptance of any automatic delivery ticket printout, electronic weight delivery ticket, other evidence of weight of the materials or approval of any particular type of ~~materials~~*material* or production ~~methods~~*method* will not constitute agreement by the Department that such matters are in accordance with the Contract Documents and it shall be the Contractor's responsibility to ensure that the materials delivered to the project are in accordance with the Contract Documents.

320-3 Special Additional Requirements for Batch Plants.

320-3.14.1 Heating and Drying: *Heat and dry the aggregate before screening. Control the temperature of the aggregate so the temperature of the completed mixture at the plant falls within the permissible range allowed by this Section.*

320-4.2 Gradation Unit: Provide plant screens capable of separating the fine and coarse aggregates and of further separating the coarse aggregate into specific sizes. ~~(The coarse aggregate is defined as the aggregate retained on the No. 10 screen.)~~ In addition, equip the gradation unit with a scalping screen to restrict the maximum size of the aggregates. *In the event that the plant is equipped with cold feed bins that are capable of adequately controlling the gradation of the mixture, the use of plant screens is optional.*

320-4.3.2 Hot Bins: Provide storage bins of sufficient capacity to supply the mixer when it is operating at full capacity. Provide hot bins with divided compartments to ensure separate and adequate storage of the appropriate fractions of the aggregate. Equip each compartment with an overflow chute of suitable size and location to prevent any backing up of material into other bins.

~~320-3.3 Sampling of Hot Aggregate:~~ ~~Provide a convenient and accurate means for obtaining samples of hot aggregates from each bin before the material enters the pugmill.~~

~~320-3 320-4.4 Weigh Box or Hopper:~~ Equip the batch plant with a means for accurately weighing each bin size of aggregate and the mineral filler into the weigh box or hopper. ~~Suspend the weigh box or hopper on scales. Use a weigh box or hopper of ample size to hold a full batch without running over. Support it on fulcrums and knife edges, so constructed that they will not be thrown out of alignment or adjustment during batching operations. Use gates both on the hot bins and on the weigh box or hopper that are constructed to prevent leakage.~~

~~320-3.5 Pugmills:~~ For all pugmills, do not exceed a clearance of 1 inch between the paddle tips and the lining of the pugmill. For pugmills with both long and short paddle arms,

apply this requirement to the long arms only. When any paddle is worn more than 3/4 inch from its original dimensions, replace or restore it to its original dimensions. Operate the pugmills in the manner recommended by the manufacturer. Use a plant with a batch mixer of the twin shaft pugmill type, hot oil or steam jacketed, and capable of producing a uniform mixture within the job mix tolerance specified. Set paddles to produce a circular or "runaround" action in the pugmill. Ensure that the depth of the material in the pugmill does not extend above the tips of the paddles. Use a pugmill with a capacity of at least 1 ton unless permission for lesser capacity is approved by the Engineer.

~~320-3.6 Control of Mixing Time:~~ Use a plant that is equipped with a positive means to control the time of mixing and to ensure the completion of the mixing cycle designated by the Engineer. Provide all timing devices and bypass switches with a means for being locked into the desired position as directed by the Engineer.

320-4 Special *320-4.5 Pugmills: Utilize a pugmill capable of mixing the aggregate and the asphalt binder.*

320-5 Additional Requirements for Drum Mixer Plants.

320-45.1 Weight Measurements of Aggregate: Equip the plant with a weigh-in-motion scale ~~that is~~ capable of measuring the quantity of aggregate (and RAP) entering the dryer.

320-45.2 Synchronization of Aggregate Feed and ~~Bituminous Material~~ *Asphalt Binder* Feed: Couple the ~~bituminous asphalt binder~~ feed control with the total aggregate weight device, including the RAP feed, in such a manner as to automatically vary the asphalt binder feed rate as necessary to maintain the required proportions.

320-45.3 Hot Storage or Surge Bins: Equip the plant with either a surge bin or storage silo that is capable of storing an adequate amount of material to assure a uniform and consistent product.

320-5 Paving Equipment.

320-5.1 Mechanical Spreading and Screeding Equipment:

~~320-5.1.1 General:~~ Provide mechanical spreading and screeding equipment of an approved type that is self-propelled and can be steered. Equip it with a receiving and distribution hopper and a mechanical screed. Use a mechanical screed capable of adjustment to regulate the depth of material spread and to produce the desired cross-section.

~~320-5.1.2 Automatic Screed Control:~~ For all asphalt courses, placed with mechanical spreading and finishing equipment, equip the paving machine with automatic longitudinal screed controls of either the skid type, traveling stringline type, or non-contact averaging ski type. Ensure that the length of the skid, traveling stringline, or non-contact averaging ski is at least 25 feet. On the final layer of base, overbuild, and structural courses, and for friction courses, use the joint matcher in lieu of the skid, traveling stringline, or non-contact averaging ski on all passes after the initial pass. Furnish a paving machine equipped with electronic cross slope controls.

~~320-5.1.3 Inflation of Tires:~~ When using paving machines equipped with pneumatic tires, the Engineer may require that the tires be ballasted.

~~320-5.1.4 Screed Width:~~ Provide paving machines on full width lanes that have a screed width greater than 8 feet. Do not use extendable screed strike-off devices that do not provide preliminary compaction of the mat in place of fixed screed extensions. The Contractor may use a strike-off device on irregular areas that would normally be done by hand and on shoulders 4 feet or less in width. When using the strike-off device on shoulders in lieu of an

~~adjustable screed extension, the Contractor must demonstrate the ability to obtain an acceptable texture, density, and thickness.~~

~~When using an extendable screed device to extend the screed's width on the full width lane or shoulder by 24 inches or greater, the Engineer will require an auger extension, paddle, or kicker device unless the Contractor provides written documentation from the manufacturer that these are not necessary.~~

~~**320-5.2 Motor Graders:** Provide two motor graders for spreading leveling courses. Equip them with a blade that is at least 2 feet longer than the width of the lane being leveled. Use motor graders that are rated at not less than 6 tons and are self-propelled and power-controlled. Mount them on smooth tread or rib-type tires (no lug types allowed) with a wheel base of at least 15 feet. Equip the front motor grader with a spreader box capable of spreading the mix at the required rate.~~

~~**320-5.3 Rollers:**~~

~~**320-5.3.1 Steel-Wheeled Rollers:** Provide compaction equipment capable of meeting the density requirements described in these Specifications. In the event that density testing is not required, provide a tandem steel-wheeled roller weighing 5 to 15 tons for seal rolling, and for the final rolling, use a separate roller with a weight of 5 to 15 tons. Variations from these requirements shall be approved by the Engineer.~~

~~**320-5.3.2 Traffic Rollers:** Provide compaction equipment capable of meeting the density requirements described in these Specifications. In the event that density testing is not required, provide a self-propelled, pneumatic-tired traffic roller equipped with at least seven smooth-tread, low pressure tires, equipped with pads or scrapers on each tire. Maintain the tire pressure between 50 and 55 psi or as specified by the manufacturer. Use rollers with a minimum weight of 6 tons. Do not use wobble-wheeled rollers. Variations from these requirements shall be approved by the Engineer.~~

~~**320-5.3.3 Prevention of Adhesion:** Do not allow the mixture to adhere to the wheels of any rollers. Do not use fuel oil or other petroleum distillates to prevent adhesion. Do not use any method which results in water being sprinkled directly onto the mixture.~~

~~**320-5.4 Trucks:**~~ **320-6 Preparation of the Mixture.**

***320-6.1 Mixing:** After the aggregate is dried and properly proportioned, mix the aggregate, along with any other components, with the asphalt binder to produce a thoroughly and uniformly coated mixture.*

***320-6.2 Storage:** If necessary, store the asphalt mixture in a surge bin or hot storage silo for a maximum of 72 hours. For FC-5 mixtures, store the asphalt mixture in a surge bin or hot storage silo for a maximum of one hour.*

***320-6.3 Mix Temperature:** Produce the mixture with a temperature within the master range as defined in Table 320-2.*

***320-6.3.1 Test Requirements:** Determine the temperature of the completed mixture using a quick-reading thermometer through a hole in the side of the loaded truck immediately after loading. Locate a 1/4 inch hole on both sides of the truck body within the middle third of the length of the body, and at a distance from 6 to 10 inches above the surface supporting the mixture. If a truck body already has a hole located in the general vicinity of the specified location, use this hole. At the Engineer's discretion, the Contractor may take the temperature of the load over the top of the truck in lieu of using the hole in the side of the truck.*

***320-6.3.2 Test Frequency:** The normal frequency for taking asphalt mix temperatures will be for each day, for each design mix on the first five loads and one out of every*

five loads thereafter. Take the temperature of the asphalt mix at the plant and at the roadway before the mix is placed at the normal frequency. Record the temperature on the front of the respective delivery ticket. The Engineer shall review the plant and roadway temperature readings and may take additional temperature measurements at any time.

If any single load at the plant or at the roadway is within the master range shown in Table 320-2 but does not meet the criteria shown in Table 320-3 (for single measurements or the average of five consecutive measurements), the temperature of every load will be monitored until the temperature falls within the specified tolerance range in Table 320-3; at this time the normal frequency may be resumed.

320-6.3.3 Rejection Criteria: Reject any load or portion of a load of asphalt mix at the plant or at the roadway with a temperature outside of its respective master range shown in Table 320-2. Notify the Engineer of the rejection immediately.

<i>Table 320-2</i>	
<i>Mix Temperature Master Range Tolerance</i>	
<i>Location</i>	<i>Acceptable Temperature Tolerance</i>
<i>Plant</i>	<i>Mixing Temperature $\pm 30^{\circ}F$</i>
<i>Roadway</i>	<i>Compaction Temperature $\pm 30^{\circ}F$</i>

<i>Table 320-3</i>	
<i>Mix Temperature Tolerance From Verified Mix Design</i>	
<i>Any Single Measurement</i>	<i>$\pm 25^{\circ}F$</i>
<i>Average of Any Five Consecutive Measurements</i>	<i>$\pm 15^{\circ}F$</i>

320-7 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 diesel fuel or any other hazardous or environmentally detrimental material as a coating for the inside surface of the truck body.* 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.*

~~320-5.5 Coring Equipment:~~ Furnish a suitable saw or drill for obtaining the required density cores.

~~320-5.6 Hand Tools:~~ Provide the necessary hand tools such as rakes, shovels, etc., and a suitable means for keeping them clean.