

SECTION 320
HOT BITUMINOUS MIXTURES-
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 requirements for the equipment to be used in the construction of the pavements and bases.

320-2 Requirements for All Plants.

320-2.1 The Overall Plant:

320-2.1.1 General: Design, manufacture, coordinate, and operate the asphalt plant in a manner that will consistently produce a mixture within the job mix tolerances and temperatures specified.

320-2.1.2 Electronic Weigh Systems with Automatic Ticket Printout: Equip the asphalt plant with of the following three electronic weigh systems capable of automatically printing a delivery ticket:

1. Automatic batch plant with printout (in accordance with 320-2.3).
2. Electronic weigh system on hopper beneath a surge or storage bin.
3. Electronic weigh system on the truck scales. 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) Type of mix.
- (f) Place for hand-recording mix temperature.
- (g) Truck number.
- (h) Gross, tare, and net weights (as applicable).
- (i) Accumulated total of mix.
- (j) Tons [metric tons].

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.

320-2.2 Truck Scales:

320-2.2.1 Scale Requirements: Weigh plant-mixed hot bituminous mixture, whether from batch, continuous mix, or drum mixer plants, on certified truck scales furnished by the Contractor, regardless of the method of measurement for payment. However, when the Contractor provides a fully automatic batch plant equipped with an automatic recordation system approved by the Engineer, the Contractor may use the automatic recordation system to determine the net weight of each truck load.

The Engineer may approve other electronic weight systems to determine the weight of asphalt mix being loaded into a truck. Use a system that has an automatic printout, is certified every six months by an approved certified scale technician, and meets weekly comparison checks with certified truck scales as specified in 320-2.3. The Engineer will allow a maximum permissible deviation of 8 pounds per ton [4 kg per metric ton] of load.

Use scales of the type which 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 recertify such fact every six months, either by the Bureau of Weights and Measures or by a registered scale technician.

320-2.2.2 Checking Truck Scales: Check the accuracy of the truck scales at the commencement of production and thereafter at least once a week during production by the following:

(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 the gross weight will be recorded by the Engineer for the comparison checks. 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.

(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 [4 kg per metric ton] of load.

(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 [2.6 kilometers per liter] for the fuel consumption rate, and 115 ounces per gallon [860 grams per liter] 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 the required scales 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 asphaltic concrete, at no additional cost to the Department.

320-2.3 Automatic Printer System: In lieu of truck scales, the Contractor may 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.

For the purpose of project recordation, the Department will take ownership of the original weight printed delivery tickets, tapes, or digital records, including the records of off-project mixes furnished during production runs for the Department.

Certify the batch scales and the accuracy of the automatic printer at least once every six months. Ensure that an approved certified scale technician furnishes such certification. Check the accuracy of the batch scales and printer system at the commencement of production and thereafter at least once a week during production for the Department by the following:

(a) The Engineer will randomly select a loaded truck of asphalt mix and record the truck number, tare and gross weights of the truck 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. The Engineer will record the gross weight of the loaded truck. If another certified truck scale is not available within a reasonable distance, the Engineer may permit a set of certified truck scales owned by the Contractor to be used.

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

(d) Compare the net weight of the asphalt mix from the Contractor's delivery ticket to the net weight of the asphalt mix as determined by the certified truck scale weights. The maximum permissible deviation is 8 pounds per ton [4 kg per metric ton] of load.

(e) Use the fuel adjustment as specified in 320-2.2.3 (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 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, 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 batch scales and certify the accuracy of the printer. While the printer system is out of tolerance and before its adjustment, the Contractor may continue production only if he makes provisions to use a set of certified truck scales to determine the truck weights.

In the event of a malfunction of the automatic printer and if the plant is equipped with an electronic display, the Engineer may complete the blank automatic delivery ticket from the electronic display until the printer can be repaired but for a period not to exceed 48 hours.

320-2.4 Equipment for Preparation of Bituminous Material: Equip bituminous material storage tanks to heat liquid asphalt under effective and positive control to the temperatures required for the various mixtures. Heat using hot-oil, steam, electricity, or other means whereby no flame comes in contact with the tank. 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 [90 to 200°C], either in the storage tank or in the bituminous feed line.

320-2.5 Cold Feed: Provide a separate cold bin for each component of the fine and coarse aggregates required by the design mix. Equip the cold bins with accurate mechanical means for feeding the aggregates uniformly into the dryer in the proportions required for the finished mix to maintain uniform production and temperature.

320-2.6 Dryer: Provide a dryer of any satisfactory design for heating and drying the mineral aggregates. Use a dryer capable of heating the aggregates 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.

320-2.7 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 [2.00 mm] screen.) In addition, equip the gradation unit with a scalping screen to restrict the maximum size of the aggregates.

320-2.8 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.

320-2.9 Bituminous Control Unit: Provide a satisfactory means, either by weighing, metering, or volumetric measuring, to obtain the proper amount of bituminous 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.

320-2.10 Pugmills: For all pugmills, do not exceed a clearance of 1 inch [25 mm] 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 [20 mm] from its original dimensions, replace or restore it to its original dimensions. Operate the pugmills in the manner recommended by the manufacturer.

320-2.11 Sampling of Hot Aggregates: Provide a convenient and accurate means for obtaining samples of hot aggregates from each bin before the material enters the pugmill.

320-2.12 Hot Storage or Surge Bins: Use hot storage or surge bins with the Engineer's approval.

320-2.13 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 or production methods 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 Requirements for Batch Plants.

320-3.1 Batch Scales: For scales for any weigh box or hopper, use either the beam type or the springless-dial type of a standard make and design, sensitive to 0.5% of the maximum load that may be required. Have a registered scale technician certify the accuracy of the scales every six months, or as often as the Engineer may deem necessary to ensure their continued accuracy. When the batch scales of a fully automatic plant are equipped with an automatic recordation system approved by the Engineer, the Contractor may use the automatic recordation system to record the individual batch weights and the net weight per truck load in lieu of the use of trucks scales.

320-3.2 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.

320-3.3 Volumetric Meter:

320-3.3.1 Design: When measuring the bituminous material volumetrically, equip the plant with an automatic volumetric meter. Use a volumetric meter designed and constructed to automatically measure the required amount of liquid asphalt into each batch, within a tolerance of 0.4%. Use a dial, which indicates the amount of bituminous material, with a sensitivity of at least 1 1/5 inches [8 mm] movement of the pointer per gallon [liter], or 0.2 in/lb [11 mm/kg]. Use a meter with a capacity at least 10% in excess of the volume of bituminous material used in any batch, constructed so that any dial setting may be locked and will automatically reset after the addition of bituminous material to each batch. Place the dial in full view of the mixer operator.

320-3.3.2 Arrangement: Hot-oil or steam jacket any part of the meter that is a part of the bituminous feed line. Use one or more jacketed spray bars whose individual lengths are not less than 75% of the length of the pugmill to deliver the liquid asphalt to the mixer. Use spray bar openings of a size and spacing which will provide a uniform application of the bituminous material for the full length of the spray bar.

320-3.3.3 Checking the Meter: Provide a valve and outlet in the section of the feed line between the charging valve and the spray bar. Provide platform scales with a capacity of 150 pounds [70 kg] to check the delivery of the volumetric meter.

320-3.4 Mixer Unit: 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 [1 metric ton] unless permission for lesser capacity is approved by the Engineer.

320-3.5 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 Requirements for Continuous-Mix Plants.

320-4.1 Gradation Control Unit:

320-4.1.1 Aggregate: Use a plant that includes a means for accurately proportioning each bin size of aggregate by volumetric measurement, and a feeder mounted under the bin compartments. Provide each bin with an accurately controlled individual gate which forms an orifice for volumetrically measuring the material drawn from each respective bin compartment. The orifice shall be rectangular, with one dimension adjustable by positive mechanical action, and shall be provided with a lock. Provide indicators on each gate to show the gate opening in inches and decimals of an inch [millimeters]. Equip the aggregate proportioning feeder with a revolution counter.

320-4.1.2 Mineral Filler: Proportion mineral filler (if needed) separately from a suitable hopper equipped with an adjustable positive feed which is accurately and conveniently calibrated. Use feeder equipment for the mineral filler that is approved by the Engineer.

320-4.1.3 Interlocking: Interlock, or calibrate, the mineral filler feed, the asphalt feed, and all aggregate feeds so that they give the specified proportions uniformly.

320-4.1.4 Sampling Devices: Equip gradation units with sampling devices mounted as an integral part of the unit for use in calibration and for obtaining hot bin samples.

320-4.1.5 Indicator Lights: Equip the bins with lights which indicate when the material in any of the bins falls below the required level for accurate proportioning. Use the burning light as the signal that adequate material is in the bin. Whenever the material in any of the bins falls below the required level, suspend mixing operations and refill the bins to the required level.

320-4.2 Weight Calibration of Aggregate Feed: Use a plant that includes a means for calibration of gate openings by the use of weight test samples. For the materials fed out of the bins through individual orifices, provide a bypass to a suitable test box, and confine each compartmented material in a separate section or box. Equip the plant to handle test samples weighing up to 300 pounds [135 kg] and to weigh them on accurate platform scales.

320-4.3 Synchronization of Aggregate and Bitumen Feed: Provide a satisfactory means to afford positive interlocking control between the flow of aggregate from the bins and the flow of bitumen from the meter or other proportioning source. Accomplish this control by interlocking mechanical means or any positive method approved by the Engineer.

320-4.4 Mixer Unit:

320-4.4.1 General: Use a plant that includes a continuous mixer of the twin-shaft pugmill type, either hot-oil or steam jacketed, and is capable of producing a uniform mix within the job mix tolerances specified. Equip the pugmill with an adjustable dam or gate at the discharge end to control the mixing time and the level of material passing through the pugmill. Provide the drive mechanism of the shafts with a clutch that stops the action of the pugmill when the flow of material is stopped.

320-4.4.2 Paddles: Use adjustable and reversible paddles to retard the flow of mix through the pugmill. Use the paddle settings as recommended by the manufacturer. Advance paddles in the discharge end of the pugmill by 90 degree intervals, for a distance of at least 75% of the length of the shaft.

320-4.4.3 Discharge Hopper: Use a mixer unit with a discharge hopper equipped with bottom-dump gates. Do not dump the mix until after filling the discharge hopper.

320-5 Special Requirements for Drum Mixer Plants.

320-5.1 General: Use drum mixer plants specially designed and constructed for the process. Obtain the Engineer's approval for the drum mixer and auxiliary equipment prior to the start of production.

320-5.2 Calibrated Cold Feed Proportioning: Use a cold feed capable of being calibrated to ensure full control of the mix gradation.

320-5.3 Weight Measurements of Aggregate: Maintain positive weight measurement of the combined cold feed to allow regulation of the cold feed gates and to permit automatic correction for variations in load.

320-5.4 Synchronization of Aggregate Feed and Bituminous Material Feed: Couple the bituminous feed control with the total aggregate weight device, including the RAP feed, in such a manner as to automatically vary the bitumen feed rate as necessary to maintain the required proportions.

320-6 Paving Equipment.

320-6.1 Mechanical Spreading and Screeding Equipment:

320-6.1.1 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.

320-6.1.2 Automatic Screed Control: For all asphalt courses, with the exception of open-graded friction mixes, placed with mechanical spreading and finishing equipment in pavement widths of 20 feet [6 m] or greater, equip the paving machine with automatic longitudinal screed controls of either the skid type or the traveling stringline type. Ensure that the length of the skid or traveling stringline is at least 25 feet [7.5 m]. On the final layer of base, overbuild, and structural courses, and for friction courses, use the joint matcher in lieu of the skid or traveling stringline on all passes after the initial pass. Furnish a paving machine equipped with electronic transverse screed controls when required by the Contract Documents.

320-6.1.3 Inflation of Tires: When using paving machines equipped with pneumatic tires, the Engineer may require that the tires be ballasted.

320-6.1.4 Screed Width: Provide paving machines on full width lanes that have a screed width greater than 8 feet [2.5 m]. 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 [1.2 m] 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 [600 mm] 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.

320-6.2 Motor Graders: Provide two motor graders for spreading leveling courses. Equip them with a blade that is at least 2 feet [0.6 m] longer than the width of the lane being leveled. Use motor graders that are rated at not less than 6 tons [5.5 metric 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 [4.5 m]. Equip the front motor grader with a spreader box capable of spreading the mix at the required rate.

320-6.3 Rollers:

320-6.3.1 Steel-Wheeled Rollers: Provide tandem steel-wheeled rollers. For the seal rolling, use rollers that weigh between 5 and 12 tons [4.5 and 11 metric tons], and for the final rolling, use rollers that weigh between 8 and 12 tons [7 and 11 metric tons].

320-6.3.2 Traffic Rollers: Provide self-propelled, pneumatic-tired traffic rollers equipped with at least seven smooth-tread, low pressure tires. Maintain the tire pressure between 50 and 55 pounds [345 and 380 kPa]. Use rollers that weigh between 6 and 10 tons [5.5 and 9 metric tons]. Do not use wobble-wheeled rollers.

320-6.3.3 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.

320-6.4 Trucks: Transport the mix in trucks of tight construction, which prevents the loss of material and the excessive loss of heat. 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. Equip the trucks with chains on the tail gates to limit the size of the opening while unloading into the paver.

320-6.5 Coring Equipment: Furnish a suitable saw or drill for obtaining the required density cores.

320-6.6 Hand Tools: Provide the necessary hand tools such as rakes, shovels, etc., and a suitable means for keeping them clean.