

**SECTION 155**

**ASPHALT SURFACING AND ASPHALT RECYCLING EQUIPMENT**

**155.1 EQUIPMENT FOR HEATING ASPHALT MATERIALS**

a. Use equipment for heating asphalt materials at project asphalt plant sites by one of the following methods:

- Circulate steam, hot gases or hot oil through coils of a tank.
- Circulate the asphalt material around a system of heated coils or pipes.
- Circulate the asphalt material through a system of coils or pipes enclosed in a heated jacket.
- Other approved means subject to the requirements of this specification.

Construct the heating device to prevent direct flame from striking the surface of the coils, pipes or jacket through which the asphalt material is circulated. Operate the heating device in a manner that shall not damage or change the characteristics of the asphalt material.

b. Railroad tank cars or truck tankers that have defective coils, or from which the coils have been removed, shall be rejected by the Engineer, unless the Contractor can provide satisfactory auxiliary means for heating the asphalt material without contamination and introducing moisture. Do not use a tanker connection or any other equipment by means of which free steam can be introduced directly into the asphalt material as a means of agitation or auxiliary heating.

**155.2 ASPHALT DISTRIBUTOR**

a. Use equipment for the distribution of asphalt materials equipped with the following:

- Tachometers;
- Pressure gauge;
- Adjustable length spray bars;
- Separate power unit and pump on the distributing system or hydrostatic drive system;
- Heating coils and burner;
- Thermometer well and accurate thermometer;
- Measuring sticks; and
- Quick opening gate in the dome.

Mount all distributors and supply tanks on trucks or trailers equipped with pneumatic tires. Design the units so that no rutting or other injury to the road surface shall result. Provide sufficient power to maintain the desired speed of the equipment during operation.

The tachometer designating the speed of the truck shall be a separate operating unit attached to the truck. Equip the tachometer with a large gauge approximately 5.5 inches in diameter and graduated in units so the speed of the truck can be determined within limits of approximately 10 feet per minute. Locate the gauge so that it can be easily read at all times by both the driver and the Engineer.

Equip the distributor with either a tachometer attached to the pump shaft and calibrated to indicate revolution per minute, or a pressure gauge placed in the distributing system and calibrated to indicate pounds per square inch or gallons per minute by which the flow of asphalt materials can be regulated.

The spray bars and nozzles shall be constructed to accomplish the following:

- Permit adjustment for length in increments of 1 foot for any length up to 16 feet;
- Permit vertical adjustment of all nozzles to the desired height above the road surface and conforming to the roadway crown;
- Permit lateral shifting of the entire spray bar during operation;
- Prevent clogging of the nozzles; and
- Provide positive and immediate cut-off when distribution of asphalt material ceases.

The power unit and pump distribution system requirements are as follows:

- Capacity of a minimum of 250 gallons per minute;

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- Equipped with a bypass into the supply tank;
- Capable of distributing a uniform and constant flow of asphalt material through all nozzles at a pressure between 30 to 50 pounds per square inch; and
- Capable of being calibrated and adjusted to accurately distribute asphalt material within 0.01 gallon per square yard for any quantity from 0.1 to 1 gallon per square yard.

**b.** Calibrate and check all distributors before using on a KDOT project. The calibration of the tank and preparation of the certificate shall be performed by the DME in the District in which the distributor is first used. Provide all equipment, materials and assistance necessary for the calibration.

The DME will give a certificate of approval to the distributor operator indicating the record of the calibration and check. Keep this certificate in the distributor at all times and make it available to the Engineer in charge on each project on which the distributor is used. Failure to present the certificate shall require a re-check, and if deemed necessary, a re-calibration of the distributor before it may be used on a project. The certificate may be revoked at any time due to unsatisfactory performance of the distributor. It shall be returned only when satisfactory repairs or adjustments have been made.

Each subsequent year, the operation of the distributor must be checked by the Engineer the first time it is used. When the operation is found to be satisfactory, the distributor may be used. The Engineer making the check will sign and date the certificate.

### **155.3 STORAGE OR SURGE BINS**

**a.** When a storage or surge bin is used with any type of plant, the following items are required as a minimum.

(1) Design, equip and use the bin to prevent segregation.

(2) Protect the belt leading from the drum discharge to the bin to prevent heat loss due to wind blowing on the material.

(3) Use a "Gob-Hopper" or other type of device approved by the Engineer to help prevent segregation of the mix as it falls into the bin or silo.

(4) Use a Tel-Tale device located at the top of the tapered portion of the bottom of the bin to indicate when the level of the asphalt mixture in the bin has been lowered to that point. In the case of special designed bins (such as full length tapered bins), locate the device at the point designated by the Engineer. Do not lower the mixture below this point except to clean out the bin, when plant operations are being terminated at the end of the day and such other times as deemed necessary by the Engineer.

Interconnect the Tel-Tale device with the controls of the gate in the bottom of the bin to close the gate automatically when the mixture in the bin has been lowered to the level of the Tel-Tale device. Provide a means of over-riding these controls solely for the purpose of cleaning out the bin at the termination of plant operation. The material in the bottom of the bin below the device may be used when the bin is cleaned out, provided the Engineer approves the material.

(5) Do not keep hot asphalt mixtures in storage or surge bins longer than 3 hours without prior approval by the Engineer.

**b.** See subsection **155.6a.(6)** for use of surge or storage bins.

**c.** If the Engineer determines that segregation is occurring, use of storage or surge bins may be prohibited.

### **155.4 ASPHALT PAVER**

Acceptable asphalt pavers are self-contained, power-propelled units, equipped with an automatically controlled activated screed or strike-off assembly, and heated if necessary. They are capable of spreading and finishing courses of asphalt material in lane widths applicable to the specified section and thickness shown in the Contract Documents. Pavers used for shoulders and similar construction shall be capable of spreading finishing courses of asphalt material to the width shown in the Contract Documents.

Equip the paver with an approved automatic screed control system capable of grade reference and transverse slope control. The automatic controls shall include a system of sensor operated devices that sense and follow a reference line or surfaces on one or both sides of the paver as required. Maintain the screed at the proper

elevation at each end by controlling the elevation of one end while automatically controlling the transverse slope, or by controlling the elevation of each end independently.

With the screed or strike-off assembly, produce a finished surface of the required evenness and texture without tearing, shoving or gouging the mixture.

Equip the paver with a receiving hopper having sufficient capacity for a uniform and continuous spreading operation. Equip the hopper with a distribution system to place the mixture uniformly in front of the screed. Pickup attachments used to feed the hopper may not exert any vertical load on the paver and shall be capable of picking up and loading substantially all of the material on the surface.

When laying mixtures, the paver shall be capable of being operated at variable forward speeds consistent with satisfactory laying of the mixture.

## **155.5 MATERIAL TRANSFER DEVICE**

Mobile conveyors, shuttle buggies, material transfer vehicles, materials transfer paver and pick-up devices are considered material transfer devices. Provide a self-propelled material transfer device, capable of moving independent of the paver or attached to the paver. Equip the materials transfer device to perform additional mixing of the material, and then deposit the mixture into the paver at a uniform temperature and consistency.

Paver hopper inserts shall be required when spillage of the HMA occurs during transfer of the material.

## **155.6 HOT MIX ASPHALT (HMA) PLANTS**

Plants used for the manufacture of HMA shall consist of a drum mix plant, batch plant or continuous mix plant. Provide equipment complying with the requirements specified below, having capacity to adequately handle the proposed asphalt construction, and meeting the approval of the Engineer.

Continued use of any hot mix plant is on the condition that the Contractor is fully responsible for producing material that complies with contract requirements.

### **a. Requirements for All HMA Plants.**

(1) Uniformity. Design, coordinate and operate the plants to produce a uniform mixture.

(2) Proportioning Equipment. The Engineer may require locking or sealing of any automated proportioning equipment that can be manually manipulated.

(3) Heating and Storage Tanks for Asphalt Material. Use storage tanks for asphalt material that have sufficient capacity to provide for continuous operation. They shall be capable of uniformly heating and holding the asphalt material at the required temperature range without damaging or changing its characteristics. Direct flame against the tanks is prohibited. Design the circulating system to obtain proper and continuous circulation during the operating period. Provide an accurate procedure for determining the amount of asphalt material in the tanks at any time. Document and substantiate the calibration data. Situate and construct the tanks so the level of material can be safely and accurately measured at any time. Set the tanks as nearly level as possible. Include a means of obtaining samples of asphalt material from the delivery line to the plant in the system.

(4) Cold Feed Aggregate Bins. Provide separate cold feed bins for each aggregate size used, unless blending is permitted by methods approved by the Engineer. Use cold feed bins with sufficient capacity to maintain a continuous flow of material. Construct the bins to prevent any spilling or leakage from one bin to another. Each bin shall have a belt feeder equipped with an adjustable gate or an adjustable drive, or both, that can be calibrated and controlled. Provide a uniform distribution of aggregate on the conveyor belt. Equip each bin with a device that shall detect any reduction or interruption of aggregate flow and actuate a visual or audible signal at locations approved by the Engineer.

(5) Thermometric Equipment. Equip the plant with a sufficient number of thermometric instruments to control the temperature of the aggregate and the asphalt material. Use instruments capable of recording temperature on a chart over each 24-hour period with a maximum chart gradation of 15 minutes and 10°F. Use a 24-hour clock or designate AM and PM on the chart. The Engineer shall retain all temperature records as part of the contract records. Install the units separate from the plant in a readily accessible location.

Locate the actuating unit for recording temperature either in the storage tank or in the feed line between the pump and the discharge valve.

Locate the actuating unit for recording aggregate temperature and HMA as specified for each type of plant.

(6) Use of Storage Bins and Batchers. When used with a storage bin, design and operate these plants so the transfer of HMA from the drum to the storage bin shall not cause segregation of the mix, and the batcher can be operated according to **subsection 602.4a.(3)(d)**.

Equip all storage bins with controls capable of maintaining a specified minimum level or amount of HMA in the bin at all times during production.

If the amount of HMA in the bin can be determined by reading the output of load cells or other approved sensors, the Engineer shall specify the minimum amount of material in tons. Otherwise, the minimum level of HMA is the top of the tapered portion of the bin or at the point designated by the Engineer on special designed bins.

Set the controls to close and lock the bin gate when the specified minimum amount or level is reached. Override of the lock is permitted only to clean out the bin at the end of a production run.

Equip every storage bin with a batcher at the top, located so the HMA is discharged vertically from the batcher into the center of the bin. The Engineer may approve other equipment such as a rotating chute. Do not load the storage bin directly from a belt or other conveyor. Cover the belts carrying HMA to prevent excess heat loss.

Establish control of the batcher gates so the batcher shall operate as specified in **subsection 602.4a.(3)(d)** throughout the output range of the plant.

(7) Dust Collectors. Equip the plant with an approved dust collector, bag house or other type of collector that complies with limit particulate emissions standards.

Dispose of all waste material in a suitable manner.

Equip the plant to prevent particulate leakage.

(8) Air Emission Permit. Provide a copy of an Air Emission Permit issued by the Kansas Department of Health and Environment (KDHE) to the Engineer before installing a hot mix plant. It is the Contractor's responsibility and expense to satisfy the KDHE requirements.

(9) Safety Requirements. Provide adequate and safe access to sampling points and other locations where checking of plant operations is necessary. Thoroughly guard and protect all gears, pulleys, chains, sprockets and other dangerous moving parts. When required by the Engineer, provide access to the top of truck bodies by a platform or other suitable device to enable the Engineer to obtain samples and temperature data.

**b. Requirements for Drum Mix Plants.**

(1) General. Specifically design the plant for drum mixing and to be capable of satisfactorily heating, drying and mixing the HMA.

(2) Cold Aggregate Feed System. Use belt scales for positive weight measurement of the combined cold aggregates. Continuously record the amount of cold aggregate using a non-set-back recorder. The belt scale shall be accurate within 2% by weight of the material being measured over any given period of time. Calibrate the belt scales at intervals as directed by the Engineer. Provide a weight system automatically coupled with the asphalt flow to maintain the required proportions.

(a) Sampling. Provide safe, adequate and convenient facilities for obtaining representative samples of the combined cold aggregate. Provide a sampling device capable of producing a sample of proper size (large enough to be representative, but small enough to be carried safely by 2 people) from the full width of the combined aggregate flow, while the plant is operating at regular production rate.

(b) Recycled Material Conveyor. If the plant is used for recycling, a weighing system is required to control delivery of virgin aggregate and recycled material components to the drum. Equip the system with interlocking mechanisms that shall accurately deliver virgin aggregates, Reclaimed Asphalt Pavement (RAP) and Recycled Asphalt Shingles (RAS) in proper proportions. Belt scales for the RAP and RAS shall comply with **subsection 155.6b.(2)**.

(c) Moisture Compensation. Include a moisture compensation device in the cold feed system to correct for the moisture in the aggregate passing over the belt scales.

(d) Weather Protection. Protect belt scales from the effect of wind and weather.

(3) Asphalt Material Feed System. Supply asphalt material to the mixing drum through a continuously registering cumulative indicating meter by a pump specifically designed for drum mix plants. Locate the meter in the asphalt material so it shall register the discharge to the drum. Provide a means to divert the flow into a container for calibration. Supply the meter with a non-set-back register accurate within 2% by weight of the material measured in any given period of time. The register shall record only material delivered to the drum.

(4) Mineral Filler Feed System. Introduce and uniformly disperse fly ash and similar mineral fillers into the drum mixer at the point of introduction of the asphalt without loss to the dust collector system. Use a non-set-back register to record the quantity of mineral filler discharged into the mixer. Equip the delivery system with

variable speed to interlock with the aggregate weigh belt so the total aggregate weight including the mineral filler is indicated to the asphalt proportioning system. Provide a device to indicate that mineral filler is being delivered uniformly to the drum that shall activate a visible or audible signal to the plant operator if the flow is reduced or interrupted.

(5) Calibration of Feed Systems. Enable easy calibration of the aggregate weighing system and the asphalt material meter system. The calibration methods are subject to approval by the Engineer, who may require a schematic diagram of the system.

(6) Mixing Drum. Equip the drum with automatic burner controls to prevent damage to the aggregate or asphalt material. Keep the discharge temperature of the mixture within the range specified in **DIVISION 600** for the type of asphalt material being used. Install the activating unit for recording the asphalt mixture temperature in the discharge chute of the drum mixer.

Use a rate of flow through the drum such that the aggregate and asphalt material form a homogeneous mixture with all particles uniformly coated. Do not exceed the manufacturer's rated capacity.

### c. Requirements for Hot Mix Batch Plants.

(1) Dryer. Include one or more dryers in the plant that continuously agitate the aggregate during the heating and drying process. Use dryers that dry and heat all aggregate to specified requirements.

(2) Aggregate Temperature. Install the actuating unit for recording the aggregate temperature where the hot materials flow over it during the proportioning operation.

(3) Hot Aggregate Storage Unit. Configure the unit so the aggregate shall not be segregated and can be discharged into the weigh hopper in a manner that shall not affect the accuracy of weighing.

(4) Weigh Box or Hopper. Include a means for accurately weighing the aggregate in a weigh box or hopper suspended on scales, and of ample size to hold a full batch without running over. The gate shall close tightly so no material is allowed to leak into the mixer while a batch is being weighed.

(5) Asphalt Control. The weigh bucket shall be non-tilting with a loose sheet metal cover. Make the length of the discharge opening or spray bar greater than  $\frac{3}{4}$  the length of the mixer, and make it discharge directly into the mixer. Heat the asphalt material bucket, its discharge valve or valves and spray bar. Provide an asphalt material bucket with a capacity a minimum of 15% in excess of the weight of asphalt material required in any batch. Have a heated quick-acting, non-drip, charging valve located directly over the asphalt material bucket.

Locate a scale dial with a capacity of a minimum of 15% in excess of the quantity of asphalt material used in a batch in full view of the mixer operator. Automatically control the flow of asphalt material to begin when the dry mixing period is over, and all of the asphalt material required for one batch shall be discharged in less than 15 seconds after the flow has started. If an approved metering device is used to control the amount of asphalt material, provide a valve and outlet for checking the meter in the section of line between the charging valve and the spray bar.

(6) Scales. Scales may be of the beam, springless dial or electronic type that complies with **subsection 152.2**. Equip beam scales with a Tel-Tale dial that shall start to function when the load being applied is within 100 pounds of that required. The dials shall be compounding, with full complements of index pointers. Do not place dials to give excessive parallax errors. Locate all dials to be plainly visible to the operator at all times.

(7) Control of Mixing Time. Equip the mixer:

- with an accurate time lock to control the operations of a complete mixing cycle;
- to lock the weigh box gate after charging the mixer until the mixer gate closes at completion of the cycle; and
- to lock the asphalt material bucket throughout the dry mixing period and lock the mixer gate throughout the dry and wet mixing periods.

The dry mixing period is defined as the interval of time between the opening of the weigh box gate and the start of introduction of asphalt material. The wet mixing period is the interval of time between the start of introduction of asphalt material and the opening of the mixer gate.

Perform the setting of time intervals in the presence of the Engineer. The Engineer will then lock the case covering the timing device until such time as a change is to be made in the timing device.

(8) Mixer. Use an approved type of batch mixer capable of producing a uniform mixture.

If not enclosed, equip the mixer box with a dust hood to prevent loss of dust.

The clearance of blades from all fixed or moving parts may not exceed 1 inch, if the maximum size of the aggregate is less or equal to 1 inch. The clearance may not exceed  $1 \frac{1}{4}$  inches, if the maximum size of the aggregate in the mix exceeds 1 inch.

**155.7 SELF-PROPELLED AGGREGATE SPREADER**

Use a spreader that is supported by a minimum of 4 wheels with pneumatic tires on 2 axles. Equip the spreader with a means of applying the larger cover coat materials to the surface ahead of the smaller cover coat material so that the required amount of material is deposited uniformly over the full width of the asphalt material.

**155.8 SURFACE RECYCLE EQUIPMENT**

**a. Pre-Heating Unit.** Use a self-propelled heating unit, adjustable in width, with ports permitting fuel and forced air injection for proper combustion without excessive smoke. The unit shall be under a closed or shielded hood, capable of heating asphalt pavement to a temperature that allows milling or scarifying to the specified depths. Equip each unit with a water spray system used to wet the adjacent vegetation.

**b. Heating Milling Unit.** Use a self-propelled unit capable of milling, heating and windrowing the asphalt pavement that is being processed, and meeting **subsection 155.8a**. In addition, equip this unit with automatic grade controls to mill the desired depth of material to be processed.

**c. Heating Scarifying Unit.** Use a self-propelled unit capable of heating and scarifying the asphalt pavement that is being processed, and meeting **subsection 155.8a**.

**d. Tunnel Heater.** Use a self-propelled unit capable of heating the underlying pavement while shielding the previously milled material from direct flame, preventing the material from catching on fire and meeting **subsection 155.8a**. The tunnel heater may be equipped with a milling unit. In this case, the tunnel heater shall also meet **subsection 155.8b**.

**e. Distributor-Paving Unit.** Use a single unit that uniformly distributes the rejuvenator at the stipulated rate onto the scarified or milled material and mixes them together using a minimum of 2 telescopic milling heads. This equipment also screeds and finishes the scarified or milled material similar to an asphalt paver specified in **subsection 155.4**.

**f. Milling-Mixing-Paving Unit.** Use a unit complying with **subsection 155.8b**. The rejuvenator shall be added uniformly at the stipulated rate onto the scarified or milled material and mixed with a minimum of 2 telescopic milling heads. Alternatively, the rejuvenator may be added directly to the milling heads provided the applied rate is uniform across the width of the HIR material. This equipment shall also screed and finish the scarified or milled material similar to an asphalt paver specified in **subsection 155.4**. Alternatively, a self propelled independent paver complying with the asphalt paver specification in **subsection 155.4** may be used after the mixing operation.

**155.9 COLD RECYCLED ASPHALT PAVEMENT EQUIPMENT (LIME SLURRY/FLY ASH)**

**a. General.** Provide a self-propelled machine capable of cutting and removing the asphalt pavement (to the dimensions specified in the Contract Documents) in one pass. Equip the cutting machine with automatic controls capable of maintaining a uniform grade and cross slope.

Equip to pulverize the reclaimed asphalt pavement (RAP) material to specified requirements without contamination from the subgrade material. The RAP material processing unit shall consist of a closed loop system with a crusher and a scalper screen, or other approved devices capable of reducing the RAP material to the specified gradation.

Provide the mixing unit with a continuous weighing system for the processed RAP material, and be coupled with meters to maintain the proper proportion of RAP material, liquid binder, set retarder (used only with fly ash) and water. Meter all water (including water added by the milling machine) introduced into the mix. If delivery of RAP material is stopped, automatically shut off the liquid binder, set retarder (used only with fly ash) and water pumps. Provide positive means for calibrating the weight measurement device and the additive metering devices.

Apply the additives in a mixing chamber that is capable of mixing the pulverized pavement material and additive to a homogeneous mixture. Equip the additive system to maintain the binder amount within plus or minus 0.2% of the specified application rate and to shut off automatically if delivery of RAP material is stopped. Place the mixture in a windrow or load it into trucks so segregation does not occur.

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Place the recycled mixture without segregation using a self-propelled asphalt paver complying with **subsection 155.4**. If a pick-up machine is used to feed the windrow into the paver hopper, provide one capable of picking up the entire windrow down to the underlying materials.

Provide self-propelled vibratory steel and pneumatic rollers to establish the rolling procedure. The vibratory steel roller may also be used as a static steel roller.

**b. Lime Slurry.** Equip the milling chamber with spray bars to incorporate hydrated lime slurry and water into the RAP. The metering device for the spray bars is calibrated to, and controlled by the continuous weighing system for the RAP.

Provide slaking equipment specifically manufactured for this purpose. Equip transport, tank trucks or trailers with mechanical agitators.

**c. Fly Ash.** Provide equipment to introduce set retarder and water into the mix independent of one another.

### 155.10 HOT POUR CRACK SEALANT EQUIPMENT

Provide a machine used for pouring cracks, capable of mixing the asphalt and rubber or other specified material in the specified proportions into a homogeneous mixture at the specified temperatures. Use a double boiler melter with a permanently attached temperature gauge to continuously verify sealant temperature in the material tank. Do not use units with a solvent flush system for clean out, due to the risk of solvent contamination to the sealant. Use a melter with a heat chamber for hose storage and valve heating, or an air flush system to eliminate the need for a solvent flush clean-up system. Provide material tank mixing with a reversible paddle agitator in a vertical tank configuration. Use units similar to those purchased by KDOT Maintenance under Spec: MS 168, latest version.

### 155.11 MODIFIED SLURRY SEAL EQUIPMENT

**a. Mixing Equipment.** Use a self-propelled mixing machine capable of delivering and proportioning the aggregate, mineral filler, water, additives and emulsified asphalt to a revolving multi-blade dual mixer, and discharging the thoroughly mixed product. Provide storage capacity for all components to maintain a supply in the proportioning controls. Operate the machine continuously while loading, to eliminate unnecessary construction joints.

Provide individual volume or weight controls for proportioning each material to be added to the mix. Calibrate and properly mark each material control device. Provide controls accessible for ready calibration and placed so the Engineer may determine the amount of each material used at any time.

Equip the mixing machine with a water pressure system and nozzle spray bar to provide a water spray immediately ahead of and outside the spreader box as required.

Equip the machine with opposite side driving stations to optimize longitudinal alignment. Equip the machine to allow the mix operator to have full control of the forward and reverse speed during application of the material.

**b. Spreading Equipment.** Equip the machine with opposite side driving stations to optimize longitudinal alignment. Configure the machine to allow the mix operator to have full control of the forward and reverse speed during application of the material.

Spread the paving mixture uniformly by means of a mechanical laydown box attached to the mixer and equipped with paddles to agitate and spread the materials through the box. Design and operate the paddles so all the fresh mix shall be agitated to prevent the mixture from setting up in the box or causing side buildup and lumps. Flexible seals in the front and rear shall be in contact with the road to prevent loss of mixture from the box.

Equip the box with lateral movement controls. The rear flexible strike-off shall be adjustable. Rut filling equipment requires adjustable steel strike-off plates. Design and operate the spreader box and rear strike-off so a uniform consistency is achieved to produce a free flow of material to the rear strike-off without causing skips, lumps or tears in the finished surface. When directed by the Engineer, provide a secondary strike-off to improve surface texture. Use a secondary strike-off with the same adjustments as the rear flexible strike-off. Spread the mixture to fill cracks and minor surface irregularities and leave a uniform application of slurry on the surface. When directed by the Engineer, provide a secondary strike-off to improve surface texture. The secondary strike-off shall have the same adjustments as the rear flexible strike-off.

Operate the spreader to prevent the loss of the paving mixture when surfacing super-elevated curves. Keep the box clean and free of build up of asphalt and aggregate.