ASPHALT PAVING

FACTORS THAT AFFECT THE SCREED

The screed will float at the same position as long as all factors that affect the screed remain unchanged.

A floating screed is towed by the tractor portion of the paver and supported by the bituminous material that passes under the screed nose. When the paver takes off from the starting reference, reaches the planned speed and develops uniform operation of the material feed system, the screed will float at that position unless one of the factors is changed.

Paving Speed. As described in the previous section, the speed of the paver affects how the screed floats. The screed can reach its planing angle and its equilibrium point at any speed. As long as the speed remains the same, the screed maintains its vertical position. When the speed changes, the screed reacts because the shear factor also changes.

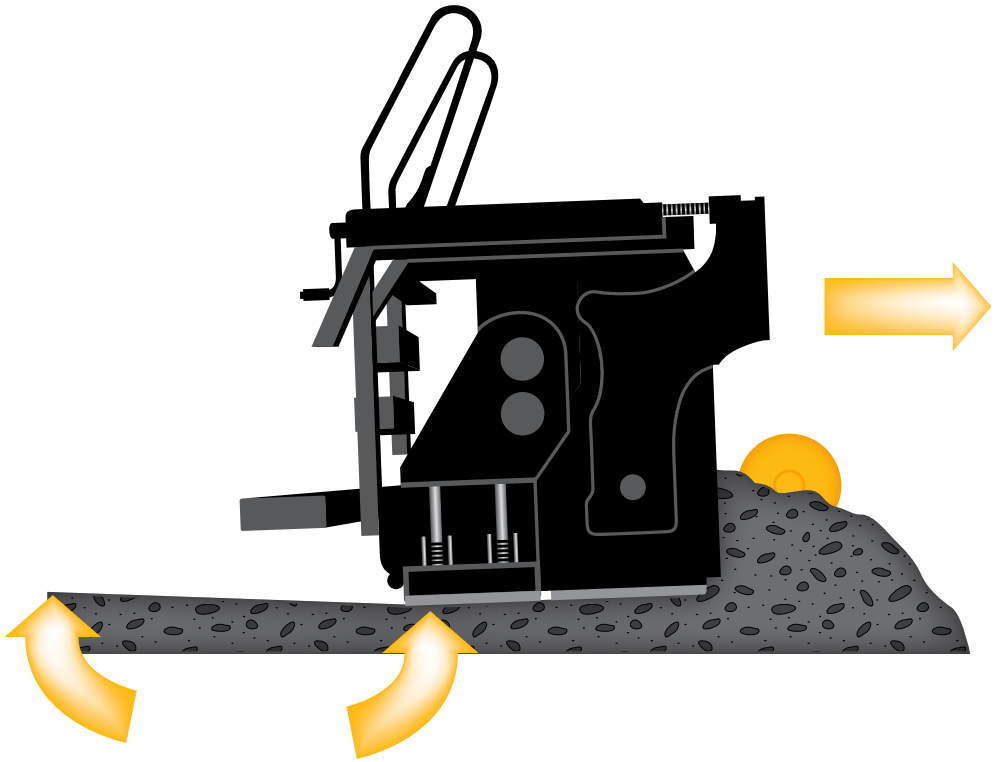
Factors that affect the screed:

1. **Paving Speed**
2. **Head of Material**
3. **Screed Adjustments**
4. **Type of Mix**
5. **Temperature of Mix**
6. **Grade Conditions**

User Tip: *A common time for the operator to increase the paving speed is when haul units begin to accumulate in front of the paver. Or, the operator may increase the paving speed at the end of a pull when the last truck is being paved out. Caterpillar recommends paving at a continuous, calculated speed with the understanding that there may be times when several haul units accumulate in front of the paver. Resist the temptation to pave faster. High-speed paving will not increase production. The paver will simply stop more often waiting for mix, and quality will suffer.*

Increasing the paving speed will cause the screed to drop.

When the paving speed is increased, more energy is available to push the head of material in front of the screed. Less material flows under the nose of the screed and layer thickness decreases. If the automatic grade control system is in use, the system will detect the change in layer thickness and call for a correction. Still, there will be a dip in the bituminous layer, resulting in increased roughness.

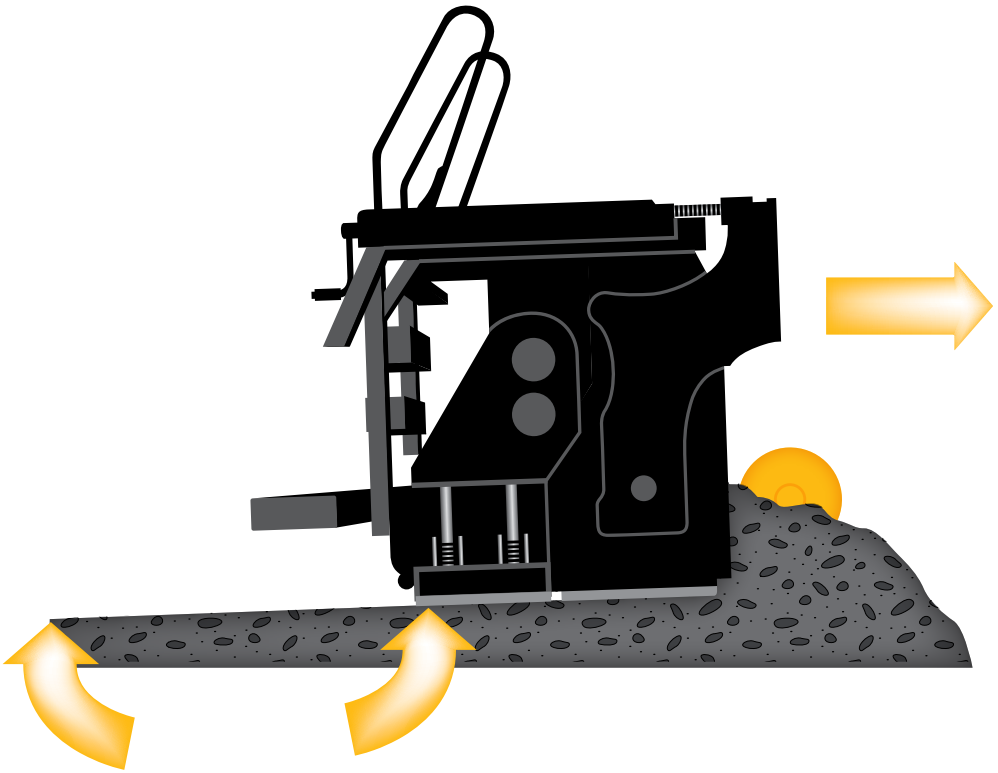


Note for tamper screeds: *If the paving speed increases and the tamper and vibration speeds remain constant, the distance between tamper impacts increases. Less material will be consolidated under the screed and the thickness will decrease. To maintain the correct layer thickness at a higher working speed, increase the tamper and vibration speeds accordingly.*

Decreasing the paving speed will cause the screed to climb.

When the paving speed is decreased, less energy is available to push the material in the auger chamber. The screed has a tendency to ride up the head of material and more mix passes under the screed.

Note for tamper screeds: *When working speed is decreased, impacts delivered by the tamper bar are closer together and more mix passes under the screed. To restore the balance between working speed and tamper forces, the speed of the tamper bar must be decreased.*



User Tip: *A common time for the operator to decrease the paving speed is when there is only one truck in front of the paver and no more in sight. Or, the operator may decrease the paving speed during truck exchanges to avoid running low on material in the hopper while continuing to pave. Short stops during truck exchanges or waiting for more material are not necessarily bad events. But, many operators have been trained to avoid, as much as possible, stopping the paver. Caterpillar recommends paving at a continuous, calculated speed with the understanding that short stops are often unavoidable.*

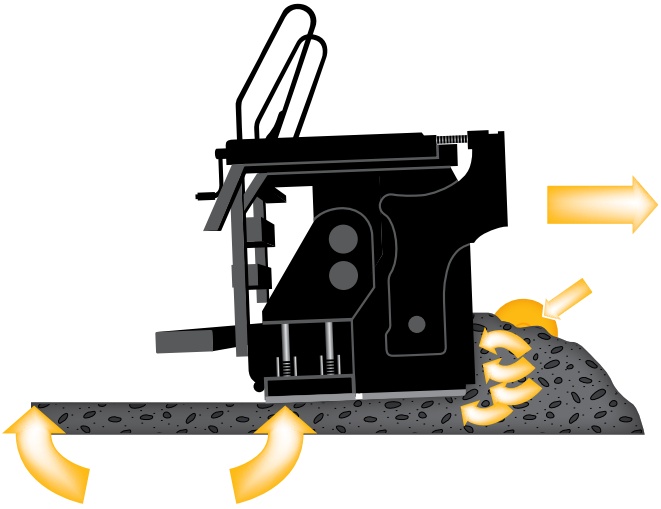
Material Feed System. Another factor that affects how the screed floats is the operation of the material feed system. The goal of the paving crew is to adjust the material feed system to create a continuous flow at uniform speed through the paver and in front of the screed.

The head of material in the auger chamber should cover one half, or slightly more than one half, of the augers.

The target for the paver operator and screed operators is to cover one half, to slightly more than one half, of the augers. Once the correct head of material is created, the crew must maintain it. Remember, the head of material in the auger chamber is the weight, or resistance, felt by the screed.

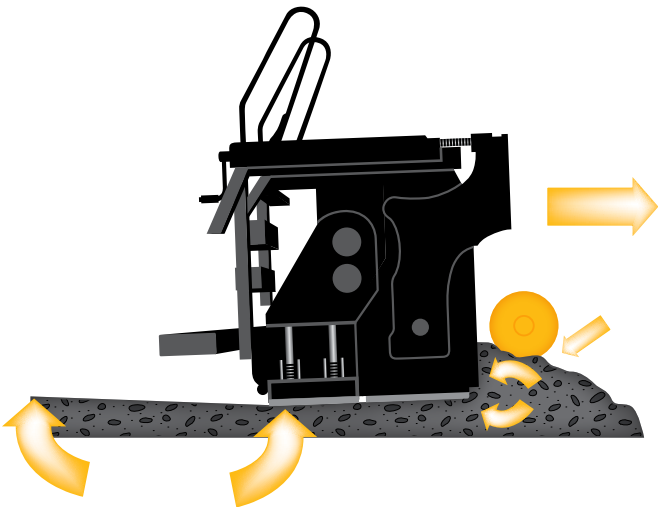
When the resistance to paving energy stays the same, then the screed stays at equilibrium and maintains its vertical position. Ride quality will be improved and the appearance of the bituminous layer enhanced.

Covering about half of the augers with material enables the mix to move efficiently toward the end gates at the full paving width. If the augers are overloaded, the material begins to compact in the auger chamber by its own weight and does not move as well. Auger overloading also requires more power and increases wear on the auger segments.



The screed height drops when the head of material decreases.

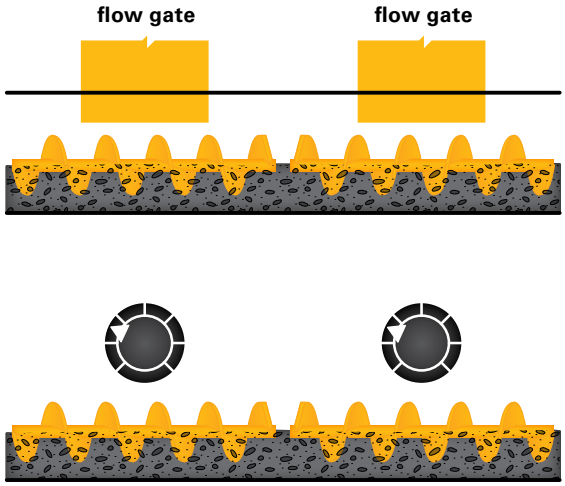
The screed will dive if the head of material in the auger chamber decreases. The loss of layer thickness happens very quickly and the screed may begin to drag aggregates. Many times the crew does not have to see this happening. They can hear the feeder system hydraulics begin to rapidly turn the augers as the feeder sensors detect the drop in material. Running low on mix in the auger chamber is considered a big mistake—one of the factors that has a big affect on quality.



User Tip: *There are several times that the head of material can diminish while paving. One is when paving under automatic slope control, because the screed will continue producing the correct slope at the surface of the layer. The screed may be laying a very thin layer or very thick layer if it is correcting for slope errors in the base. A very thick mat requires more material and can temporarily create a low head of material, until the feeder system catches up. The second possibility for running low on mix in the auger chamber is paving during truck exchanges. Some operators are trained to never stop between haul units. If the haul unit with a fresh supply of material is slow to position itself in front of the paver, the material in the hopper will run low, the conveyors will run low, and the head of material will run low.*

Controlling the head of material in the auger chamber and delivering a continuous flow of material through the paver requires coordination by the paver and the screed operators.

The paver operator has primary control of material delivery from the hopper through the tunnels and into the auger chamber. The material that drops off the conveyors into the auger chamber can be regulated in two ways, depending on the type of paver.



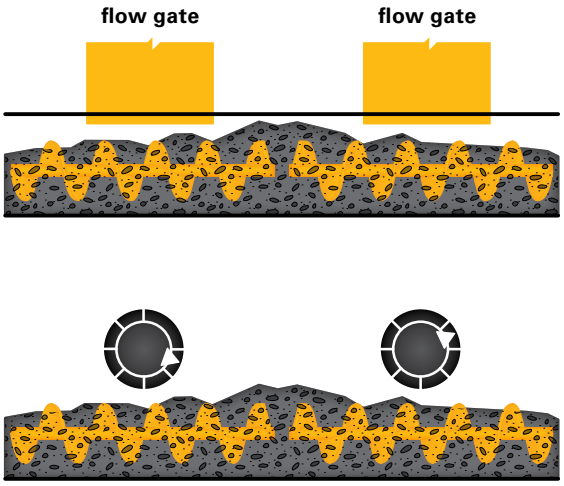
The position of the flow gates or the setting of the ratio control dials determines the level of material in the center of the auger chamber.

Some pavers have flow gates that are located over the left and right conveyor tunnels, on the rear wall of the hopper. Flow gates are strike-off devices used to meter the amount of material that flows back to the auger chamber. The height of each flow gate is independently adjustable.

Other pavers do not have flow gates, so the right and left conveyor tunnels are completely open. Those pavers have ratio control dials at the operator's station. Adjusting the ratio control dials regulates the speed of the conveyors.

Both flow gates and ratio control dials have the same affect on the material feed system. They control the volume of material that enters the auger chamber and, thus, they control the head of material in the center of the auger chamber.

If the operator raises the flow gates too high or turns up the ratio control dials too much, the auger chamber will be flooded and the head of material in the center of the auger will be too high. When there is too much material coming back on the conveyors, the rotational speed of the left and right augers will decrease. The augers may stop completely or run too slowly. The augers should not stop or operate in an ON / OFF mode during normal paving operations. Lower the flow gates or turn down the ratio control dials to speed up the rotation of the augers.

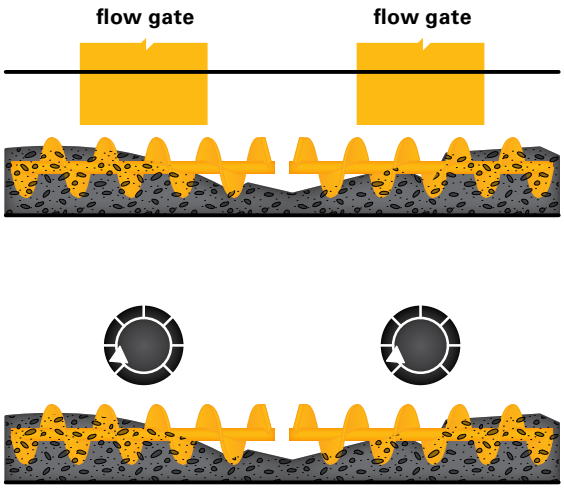


The head of material in the center of the auger will be too high if the flow gates are open too high, or the ratio control dials are set too high.

Conversely, if the flow gates are lowered too much or the ratio control dials are set too low, the center of the auger chamber will run low on mix and the head of material will be too low. When there is not enough material flowing back on the conveyors, the rotation of the augers will be too high.

The ideal range for auger speed is between 20 and 40 rotations per minute. If the auger speed is too high, continuous stripes of segregated aggregates may appear in the bituminous layer. If the auger speed is too slow or ON and OFF, random patches of segregated aggregates may appear. (More information about causes of stripe segregation and patch segregation are found in Unit 8.)

In addition to the appearance of various types of segregation, incorrect auger speed can also cause variations in the pre-compaction of mix in the auger chamber. Maintaining the correct auger speed takes teamwork on the part of the paver operator and the screed operator(s).



The head of material in the center of the auger will be too low if the flow gates are lowered too much, or the ratio control dials are set too low.

User Tip: *On most pavers, controls for flow gate height and conveyor speed (ratio control dials) are found at the operator's station on top of the paver. It is the paver operator who has the ultimate responsibility for controlling the volume of material coming into the auger chamber and, therefore, ultimate control of auger speed. The controls available for the screed operators can temporarily affect auger speed. The crew must understand this relationship.*

Screed operators control the head of material at the outer end of the auger shafts by adjusting the mix height dials at the screed control panels. To increase the head of material at the end of the auger shafts, turn the mix height dial clockwise. To decrease the head of material at the end of the auger shafts, turn the dial counter-clockwise. Adjusting the mix height dial affects the sensitivity of the material feed sensors that are aimed at the material emerging from the auger chamber.

Mix height dials at the screed control panels regulate the head of material at the ends of the auger shafts.

There are two types of feeder sensors: mechanical and sonic. Mechanical sensors contact the head of material as it flows through the auger chamber. As the material pushes against the paddle, the paddle turns a rheostat-type switch. As the paddle rotates outward, the sensor begins to slow the feeder system. As the paddle rotates inward, the sensor speeds the delivery of material. Adjusting the mix height dial controls where the sensor starts to slow the feeder system, or the point at which the system is shut off.

Mechanical feeder sensors contact the material as it flows out of the auger chamber.

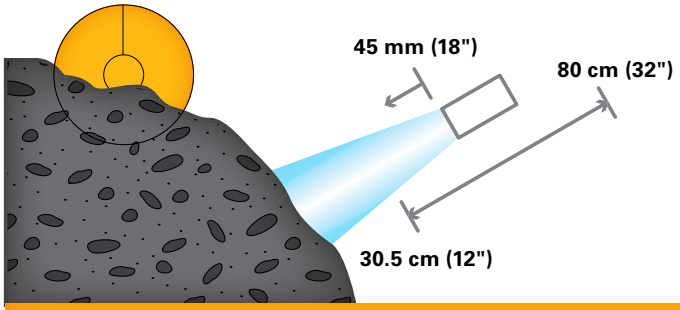
User Tip: *Mixes that include modified asphalt cement are often sticky. Mix can build up on the tractor bulkhead and can interfere with the motion of a mechanical feeder sensor. The crew needs to periodically clean the tractor bulkhead to avoid erratic feeder system operation.*

The other type of feeder sensor is a sonic-type sensor. This sensor emits sound pulses. Echoes bounce off the material coming out of the auger chamber. The sonic sensor monitors the time it takes for the echoes to return to measure the distance between the sensor and the target. There are several principles that are important to know about sonic feeder sensors.

The working range for a sonic feeder sensor is between 30-80 cm (12-32"). If the target is closer than 30 cm (12"), the feeder system for that side of the paver will shut off. If the target for a sonic feeder sensor is beyond 80 cm (32"), then the feeder system for that side of the paver will run at full speed. The recommended distance from the target for sonic feeder sensors is 45 cm (18").

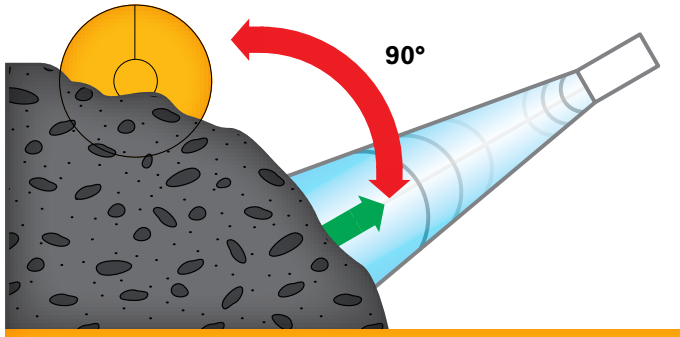
Sonic feeder sensors emit sound pulses that rebound off the material coming out the auger chamber and back to the sensor.

Aiming a sonic feeder sensor is extremely important. It emits a given number of sound pulses per second. In order to be accurate as a measurement device, the sensor must receive the same number of returning echoes. If the sensor is aimed at an incorrect angle, some of the echoes will not return to the sensor and the feeder system will operate erratically.



Sonic feeder sensors must be positioned the correct distance away from the intended target.

User Tip: *If difficulty is encountered getting the feeder system to run smoothly at the desired speed and desired head of material, the first troubleshooting step should be to re-aim the sonic sensor until the system operates properly. As an aid to aiming the sensor, use a tape measure or folding ruler extended to 45 cm (18"). Hold the ruler on the end of the sensor and see what the ruler is contacting at that distance. Check the angle and make sure that the sensor is pointed directly at the target.*

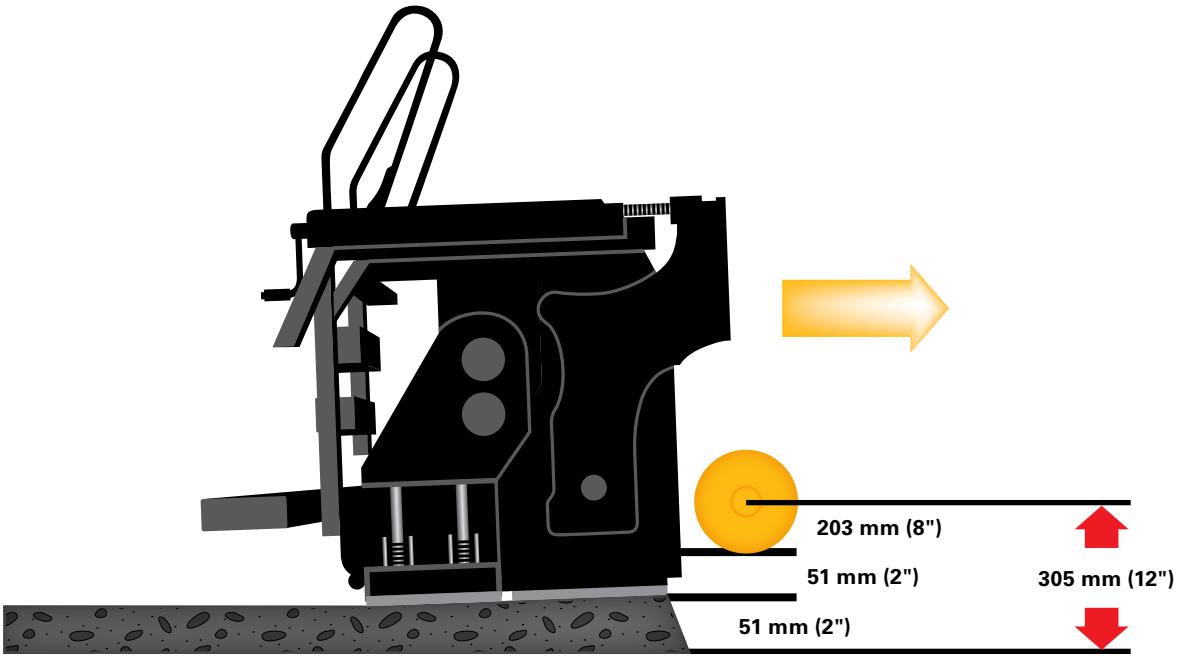


Sonic feeder sensors must be aimed perpendicular to the intended target.

Selecting the best target is another key to smooth feeder system operation when using sonic feeder sensors. Ideally, the sensor should be aimed at the material coming off the front side of the auger shaft. This material is moving toward the screed end gate, which is the outer edge of the bituminous layer. If this material is targeted, the mix height dial will help control how the material flows out and where it contacts the end gate. Do not aim the sensor at the grade or too far back on material that is stagnant. Always aim the sensor at moving material.

The target for the sonic sensor should be the active head of material coming off the front side of the auger shaft.

User Tip: *One of the most difficult applications when using a sonic feeder sensor is paving at a width that is the same as the basic screed width. In other words, the end gate at the screed extender is drawn all the way in, and no material is flowing from the auger chamber. In that situation, the sensor will have to be aimed straight down. Try to keep the sensor at least 30 cm (12") away from the target. Or, if mechanical sensors are available, install them. Mechanical sensors make it easier to control the feeder system at narrow paving widths.*



Adjust auger height to avoid creating auger shadows in the surface of the bituminous layer.

On many pavers, the height of the auger shaft is adjustable. When preparing the paver for operation, lower the augers until they are about 5 cm (2") above the surface of the layer for mixes with a maximum aggregate size of 13 mm (0.5") or smaller. For mix designs with aggregates 19 mm (0.75") or larger, position the augers 8 cm (3") above the layer.

If the augers are too low, they will leave dark shadows in the surface of the bituminous layer. The layer will appear tight in the center and will have open texture (shadows) on either side of center, the same length as the left and right auger shafts. Then, the layer will appear tight again at the edges. If this texture pattern develops, gradually raise the augers until the appearance of the layer is uniform.

User Tip: *Here's an easy way to measure auger height. Assume that the augers are 40 cm (16") in diameter. The center of the auger shaft will be 20 cm (8") above the bottom of the augers. The bottom of the augers should be 5 cm (2") above the layer. Assume that the layer is 5 cm (2") thick. Lower the augers before filling the auger chamber. Measure from the center of the auger shaft to the grade. When the distance is 30 cm (12"), the auger height is correct for that layer thickness. Add 2.5 cm (1") to auger height when using a large-stone mix.*