

# Paving By The Numbers



# Important Safety Information

Most accidents involving product operation, maintenance and repair are caused by failure to observe basic safety rules and precautions. An accident can often be avoided by recognizing potentially hazardous situations before an accident occurs. A person must be alert to potential hazards. This person should also have the necessary training, skills and tools to perform these functions properly.

Improper operation, lubrication, maintenance or repair of this product can be dangerous and could result in injury or death.

Do not operate or perform any lubrication, maintenance or repair on this product, until you have read and understood the operation, lubrication, maintenance and repair information.

The hazards are identified by the “Safety Alert Symbol” and followed by a “Signal Word” such as “WARNING” as shown below.



The meaning of this safety alert symbol is as follows:

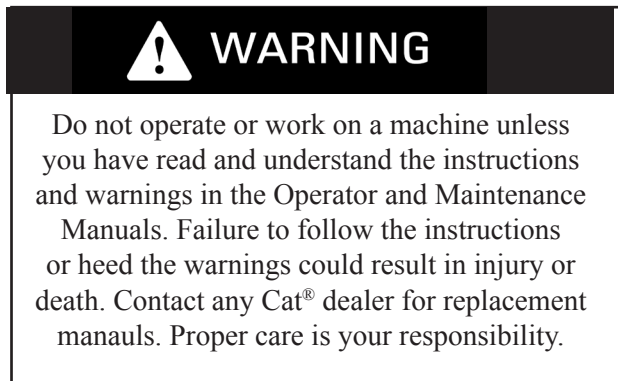
**Attention! Become Alert! Your Safety is Involved.**

The message that appears under the warning, explaining the hazard, can be either written or pictorially presented.

Operation that may cause product damage are identified by NOTICE labels on the product and in this presentation.

Caterpillar cannot anticipate every possible circumstance that might involve a potential hazard. The warnings in this presentation and on the product are therefore not all inclusive. If a tool, procedure, work method or operating technique not specifically recommended by Caterpillar is used, you must satisfy yourself that it is safe for you and others. You should also ensure that the product will not be damaged or made unsafe by the operation, lubrication, maintenance or repair procedures you choose.

The information, specifications, and illustrations in this presentation are on the basis of information available at the time it was written. The specifications, illustrations and other items can change at any time. These changes can effect the service given to the product. obtain the complete and most current information available.



## Paving By The Numbers

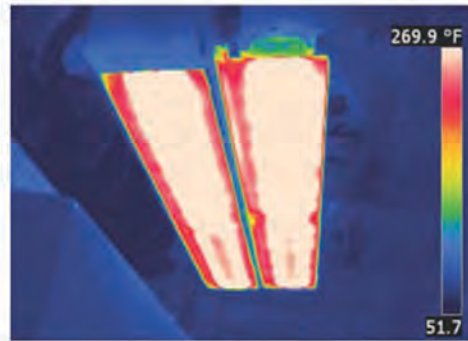


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Producing a smooth asphalt surface with a uniform finish is not as simple as saying “one—two—three.” But a well-trained paver crew, which follows a set of established fundamental practices, will avoid many of the problems that affect mat quality.

The purpose of this presentation is to review the steps you should follow each time you get ready to pull off the joint and start paving.



- **Heat the screed**
  - ✓ **Electric element**
  - ✓ **Diesel Fired**
  - ✓ **Liquid propane**
- **Prevents asphalt sticking to screed**

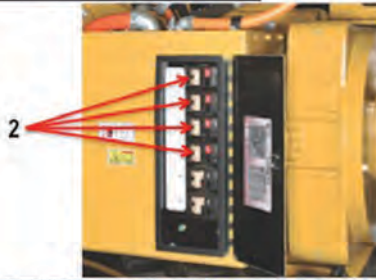
### STEP 1

Step 1 is heat the screed plates. If the screed is cold, you have to heat it before beginning to pave to prevent asphalt sticking to the screed plates. There are several types of screed heaters on Cat screeds, diesel fired, liquid propane and electric element. In this presentation, we will talk about the electric screed heat only. If you need information on the Diesel or Liquid Propane screed heat, please refer to the Operation & Maintenance Manual (O&MM) for that screed.

On Cat extendable-type screeds, each screed frame section is equipped with a heater. One on each screed extender and two on the main screed.



- **Electric Element**
  - ✓ Place generator switch (1) in the ON position
  - ✓ Place generator circuit breakers (2) in the ON position



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## STEP 1 (continued)

### Electric Element

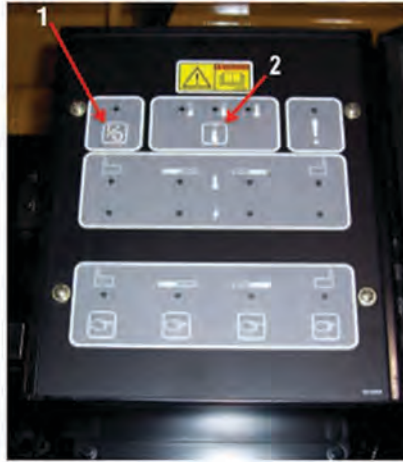
Locate the generator switch and move it to the ON position. On Cat machines, depending on the machine model, this switch will be located on the left console (shown) or on the center console.

Located on the generator are the circuit breakers for each section of the screed. Move them all to the ON position.

Start with the screed approximately 25-76 mm (1-3") off of the ground. If the screed is at maximum height, wind can effect the performance of the heaters. Also if the screed is on the ground, the ground acts as a heat sink and it will take longer for the screed to come up to temperature.

## Paving by the Numbers

## STEP 1



- **Electric Element**
- ✓ Depress push pad (1) to turn the system ON
- ✓ Wait for self test to complete and temperature will default to low
- ✓ Depress push pad (2) until desired temperature is illuminated

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### STEP 1 (continued)

Depress the push pad (1) to turn the system on. The system will go through a self test where all the lamps will flash several times independently and then all together.

Once the self test is complete, the system will default to the Low temperature setting.

If you want to change the setting to Medium or High, depress the push pad (2) until the desired temperature is illuminated.

## Paving by the Numbers

## STEP 1



- **Electric Element**
- ✓ **When lamps (1) are illuminated, screed is heating.**
- ✓ **When any 3 of the lamps in row (2) are illuminated, screed is ready to pave.**

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### STEP 1 (continued)

When an element is powered, the corresponding screed lamp will illuminate (1).

When the screed has reached the set point temperature that was selected, the ready lamp (2) will illuminate.

When any 3 of the screed sections are up to the set point temperature, the remaining section is very close to the set point so paving can begin.



- **Adjust Tow Point Cylinders**

- ✓ **Adjust both tow points to "0" then raise the tow point the thickness of the mat to be laid.**
- ✓ **Each mark is 20 mm. Example: If the mat being laid is 50 mm (2 in), adjust the tow point to 50 mm (2 in) above "0"**

### STEP 2

Step 2 is adjusting the tow point cylinder.

After the screed has warmed up, adjust the tow point cylinder on both sides of the machine.

Tow point scales differ depending on screed type but regardless of the type of scale you have each mark indicates 2 cm (3/4 in). On a vibratory screed (AS3301C, AS3251C, AS2252C, AS2302C) the "0" is 14 cm above the lowest mark on the scale. Move the tow point cylinder to "0" then raise the tow point the thickness of the mat being laid. For example, if the mat being laid is 5 cm (2 in), move the tow point up 5 cm (2 in) above "0".



## Paving by the Numbers

## STEP 3



Rear  
Mounted  
Extensions



Front  
Mounted  
Extensions

- **Set Paving Width**
  - ✓ **Set the extenders width according to job specs**
  - ✓ **Use scales on extenders**
  - ✓ **Equal extender width on both sides whenever possible.**

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### STEP 3

Step 3 is setting the desired paving width.

With the screed still raised, move the extenders out to the specified paving width. Each extender has a scale which shows how far the extender is moved out from the main screed.

It's good paving practice to balance the extender width so the forces against each extender are equalized. For example, if you need a total of 1.2 m (4 ft) of extender, move the left and right extenders out an equal amount of .6 m (2 ft.) on each side.



- **Set Main Screed Crown**
- ✓ **Set screed crown to job specs**
- ✓ **Scale location changes depending on screed**

### STEP 4

Step 4 is setting the main screed crown to the specifications of the job.

Use the crown indicator scale located in the center of the screed to set the crown. Before using the indicator scale, be sure that it is properly calibrated to the screed. The crown indicator scale is located in different locations depending on the type of screed you have.

## Paving by the Numbers

## STEP 5



Rear Mounted Extenders



Front Mounted Extenders



- **Set Extender Height**
  - ✓ *Rear mounted extenders 6 mm (1/4 in) above zero*
  - ✓ *Front mounted extenders 6 mm (1/4 in) below zero*
  - ✓ *Switch located in each screed control box*

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### Step 5

Step 5 is setting the height of the extenders.

You want to set the height of the extenders so they match the height of the main screed. When the extender height is right, there are no transition marks in the mat.

Extender height is adjusted with a switch in each screed control box on vibratory screeds.

Screeds normally run with a 6 mm (1/4 in) nose-up angle of attack. Therefore, on a screed with rear mounted extenders, set the extender height 6 mm (1/4 in) above the zero point on the scale. Do this for both left and right extenders. If the screed has front mounted extenders, lower both extenders 6 mm (1/4 in) below the zero point on the scale.

Again, make sure that the height indicators have been calibrated to the extenders.



Rear Mounted Extenders

Front Mounted Extenders



- **Set the Extender Slope**
- ✓ *Set extender slope to job specs*
- ✓ *Scale location changes depending on screed*

### STEP 6

Step 6 is setting the slope of the extenders to the specifications of the job.

If there is no requirement for extender slope, set the indicator at zero on both sides. Location of slope indicator changes depending on screed type.

Again, make sure that the Slope indicators have been calibrated to the extenders.



- **Lower the Screed**
  - ✓ **Lower the screed onto the starting reference**
  - ✓ **Select a starting reference that is the proper thickness**
  - ✓ **Support main screed and extender screed**
  - ✓ **Reference length 0.9 - 1.2 m (3-4')**

### STEP 7

Step 7 is positioning the starting references under the screed.

Select a starting reference whose thickness matches the mat depth and the rate of compaction. Normally, the mat will compact about 6 mm (1/4 in per inch) per 25 mm of mat depth. For example, to get a 50 mm (2 in) compacted mat, use a starting reference which is 64 mm (2 1/2 in) thick.

Use two references. Position them so they completely support both the main screed and the screed extender from front to back. The normal length is between 0.9 - 1.2 m (3-4 ft).

When the starting references are in position, lower the screed so it rests on both references.

**NOTE:** When paving with the extenders beyond the halfway point, an additional starting reference for the extender may be required.

**NOTE:** Ensure that the end gates are adjusted so the screed rests on the starting reference and not the end gate.

## Paving by the Numbers

## STEP 7



- **Lower the Screed**
- ✓ **Make sure the screed lift switch is in the lower or "float" position on BOTH consoles**

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### STEP 7 (Continued)

Remember to leave the screed RAISE/LOWER switch in the lower or "float" position on BOTH consoles.

## Paving by the Numbers

## STEP 7



- **Lower the Screed**
- ✓ **Move the machine forward to remove the slack from the tow point**

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### STEP 7 (Continued)

Step 7 also includes removing the slack from the tow point. Move the machine forward until the tow arm roller contacts the tow point frame.



- **Null The Screed**
  - ✓ *Turn one thickness screw until no resistance is felt*
  - ✓ *Repeat for the other depth crank*
  - ✓ *Check the first side again*
  - ✓ *Null one side at a time*

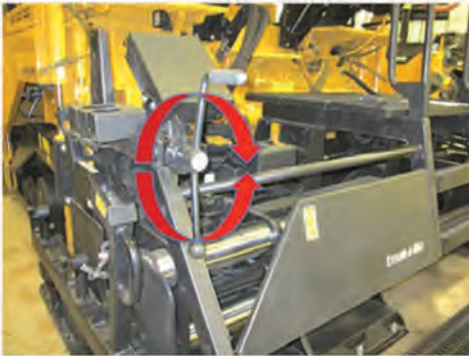
### STEP 8

Step 8 is nulling the screed.

Use the manual depth control cranks to null the screed. Turn the crank in either direction until no resistance is felt. This ensures that the full weight of the screed is supported by the starting reference. Move to the other side and follow the same nulling procedure. Be sure the crank turns freely. Then, go back to the other side. Make sure the crank still turns freely.

**NOTE:** Repeat this until both sides have no resistance.





- **Null The Screed**
  - ✓ Turn depth crank in direction of increase until tension is felt
  - ✓ Set other depth crank the same way
  - ❖ **NOTE:** Optional thickness screws allow clockwise or counter-clockwise increase

### STEP 8 (Continued)

Then, turn the depth crank in the direction that increases mat thickness until resistance is felt.

On the other side, turn the crank until you feel resistance.

On other types of screeds, you may have to turn the depth cranks one or more revolutions to set the angle of attack. Follow the manufacturer's guidelines for the screed you're setting up.

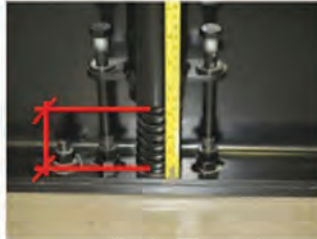
**NOTE:** Optional thickness screws allow for clockwise or counter clockwise rotation of the screw to increase the angle of attack.

## Paving by the Numbers

## STEP 9



75 mm (3 in)



### • *Position End Gates*

- ✓ *Lower end gates to contact grade*
- ✓ *Raise or lower guide tubes to create float space*
- ✓ *75 mm (3 in) gap between ski and guide tube*

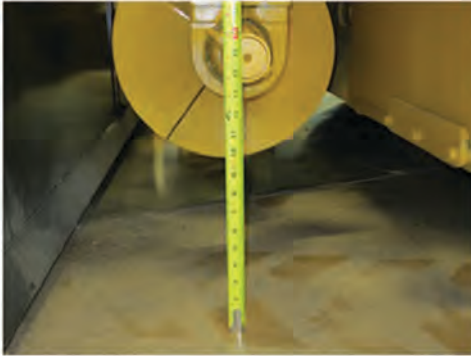
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### STEP 9

Step 9 is positioning the end gates.

End gates on both ends of the screed retain material at the proper width. They float on the grade. First, lower the end gate until it touches the grade. Next, raise or lower the guide tubes to create space for the spring-loaded skis to move up and down over any grade irregularities. The space should be about 76 mm (3 in).



- **Set Auger Height**
- **Auger height affects mat texture**
- ✓ **Auger height 50 mm (2 in) above mat is right for most mixes**
- ✓ **Fine tune according to mix**

### STEP 10

Step 10 is setting the auger height.

The height of the augers in relation to the depth of the uncompacted mat has an effect on the texture and finish of the mat.

If the augers are too low, you'll probably see an open texture and maybe material segregation. If the augers are too high, the head of material will likely be too high which will cause the screed to climb. Different mixes react differently to auger height adjustment, but as a rule, set the auger height at least 5 cm (2 in) above the height of the uncompacted mat.

From the bottom of the auger to the center of the auger shaft is 203 mm (8 in). Now add 50 mm (2 in) to that. Then add the thickness of mat to be paved. The total is the distance from the centerline of the auger shaft to the grade. Adjust the auger up or down until the dimension is reached.

Fine tune the auger height after paving starts if the mix is very coarse or very tender.

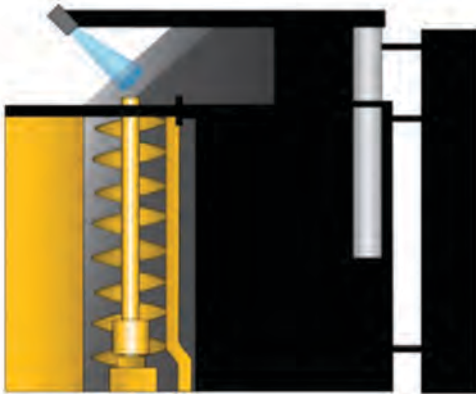


- *Position Feeder Sensors*
- *Paddle Sensor*
- ✓ *Raise paddle arm to 45 degree angle*
- ✓ *Position paddle arm on mounting hardware 460 mm (18") outboard of the last auger segment*

### STEP 11

Step 11 is setting the position of the feeder sensors.

You want to position the paddle type feeder sensors so they are sensing the active pile of material about 460 mm (18 in) away from the last auger segment. With the paddle-type sensor, the paddle arm should be at a 45 degree angle at the 460 mm (18 in) distance.



- **Position Feeder Sensors**
- **Sonic feeder sensors**
- ✓ **Perpendicular to the live material flow.**
- ✓ **460 mm (18 in) - 760 mm (30 in) away from the material**
- ✓ **Target moving material**

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### STEP 11 (Continued)

Step 11 is setting the position of the feeder sensors.

Sonic feeder sensors should be set perpendicular to the material flow 460 mm (18 in) - 76 cm (30 in) away from the material. Always target the moving material.



- **Manually Fill Auger Chamber**

- ✓ *With the machine at low idle*
- ✓ *Use conveyor manual override switches on the operator's console*
- ✓ *Convey material out until material just touches auger shaft*

### STEP 12

Step 12 is filling the auger chamber in front of the screed until the material is covering one half the auger.

Fill the chamber with the engine at low idle, one side at a time, alternating between the conveyor and auger. This helps prevent material from being pulled under the machine and overfilling the chambers.

**NOTE:** Do not fill the chamber using the conveyor and auger switches together or by using the screed override switches. This will overfill the chambers and cause a bump on take off.

Using the manual override switches on the operator's console, alternately convey and auger material to the auger chamber and out to the ends of the augers.

The goal is to fill the auger chamber evenly on both sides.

Use one conveyor switch at a time to move material out until it just touches the auger shaft.



- **Manually Fill Auger Chamber**
  - ✓ *With the machine at low idle*
  - ✓ *Manually auger material across screed face*
  - ✓ *Auger material out to establish 1/2 level*
  - ✓ *Do not overfill*

### STEP 12 (Continued)

Then, use the manual auger switch to move material out to the end of the screed. The correct head of material is one that covers one half of the augers.

Always fill the auger chamber using the manual mode at low idle and be careful not to overfill.

Overfilling the auger chamber will result in a bump when starting off the transverse joint.



- **Manually Fill Auger Chamber**
- ✓ **Using a shovel, hand fill area between last auger and end gate**
- ❖ **NOTE: Do not fill in area in front of screed extender on rear-mounted extender screeds**

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### STEP 12 (Continued)

Don't force material out to the end gate. You'll probably overfill the chamber. Instead, move some material with a shovel to the end gate even with the main screed.

**NOTE:** Do not fill in the area directly in front of the extender on rear-mounted extender screeds. This area will be filled by material automatically as the paver pulls forward off the starting reference.





- **Set Feeder Controls**
  - ✓ *Place conveyor switches in Auto (up)*
  - ✓ *Place auger switches in Auto (up)*

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### STEP 13

Step 13 is setting all feeder controls.

When you have filled the auger chamber half full—no more, no less—put the conveyor and auger mode switches on the operator's console to Auto.

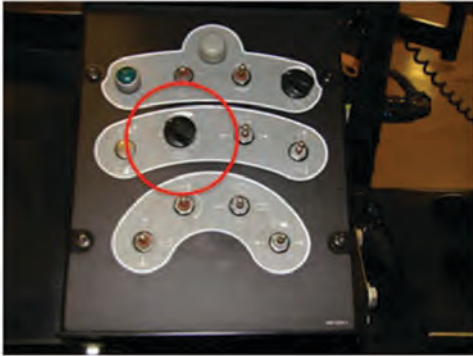


- **Set Feeder Controls**
- ✓ **Adjust conveyor ratio control dials to 10 o'clock position**

### STEP 13 (Continued)

The conveyor ratio control dials are located on the left side of the console on the operator's station. Turn the ratio control dials clockwise to about the 10 o'clock position.

You can fine tune these dials when you start paving.



- **Set Feeder Controls**
- ✓ **Adjust mix height dials to 10 o'clock position**

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### STEP 13 (Continued)

Next is adjusting feeder controls. Turn the mix height dials in both screed control boxes to the 10 o'clock position.

You can fine tune these dials when you start paving.



- **Set Accessory Functions**
- ✓ **Set Grade Controls to specification**
- ✓ **Set Slope Control to specification**

### STEP 14

Step 14 is setting the accessory functions of the machine

Set up the automatic grade and slope controls if equipped. Set your system up according to the specifications of the job.



- **Set Accessory Functions**
- ✓ **Activate any accessory functions on the Advisor panel**
- ✓ **Choices are different per machine**

## STEP 14 (Continued)

Step 14 is also a good time to activate accessory functions for your machine. Machines can have Friction Steering, Automatic Engine Speed Control, Auto Conveyor/Auger Fill, Screed Raise Lock and Screed Lower Lock. These are functions selected with the soft keys on the left of the Advisor panel.

## Paving by the Numbers

## STEP 14



- Set Accessory Functions
- ✓ Check Control menu settings

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### STEP 14 (Continued)

Step 14 is also a good time to access the Control Menu in the Advisor panel. From this menu various settings can be activated or de-activated or adjusted.

## Paving by the Numbers

## STEP 14



- **Set Accessory Functions**
- ✓ **Check Control menu settings**
- ✓ **Access Config Params**
- ✓ **Verify settings and adjust if necessary**

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### STEP 14 (Continued)

Also from the control menu, you can access the “Config Params” to check and adjust the various settings in this menu.



- ***Pull Off Starting Reference***
- ✓ ***Speed control dial at zero***
- ✓ ***PAVE mode, high idle, brakes released, and propel lever full forward.***
- ✓ ***Turn speed dial up until calculated paving speed is reached***

### STEP 15

Now we're ready for step 15—pulling off the starting reference.

Start with the speed control dial set at zero—that's fully counterclockwise.

Make sure the gear selector is in the PAVE mode, the engine throttle is set at high idle, the parking brakes are released, and the propel lever is moved all the way forward.

Then, turn the speed control dial clockwise until the calculated paving speed is reached.

**NOTE:** When calculated speed is reached, use the propel lever to stop and start the machine. This will bring the machine back to the same calculated paving speed after each stop.





- ***Pull Off Starting Reference***
- ***As paving begins***
  - ✓ ***Screed persons check material level at outboard end of augers***
  - ✓ ***Adjust mix height controls if needed to maintain material level at 1/2 auger***

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### STEP 15 (Continued)

Screed personnel observe the level of material at the outboard ends of the auger shafts to see if the auger shafts are one half covered.

There are individual material height dials on the screed control boxes which are adjusted to control the height of material at the outboard ends.



- **Pull Off Starting Reference**
- **As paving begins**
  - ✓ **Operator checks center area of auger chamber.**
  - ✓ **Adjust conveyor ratio controls if necessary to maintain material level at 1/2 auger**

### **STEP 15** *(Continued)*

As the paver comes up to speed, the operator should look down at the auger chamber. The goal is to maintain the mix level and maintain an auger speed of 20 to 40 rpm.

Use the independent left and right conveyor ratio controls to adjust the auger speed.



- ***Pull Off Starting Reference***
- ***As paving stabilizes***
  - ✓ ***Check auger speed***
  - ✓ ***Keep auger speed in 20-40 RPM range***
  - ✓ ***Avoid ON / OFF operation***

### STEP 15 (Continued)

As the paving operation stabilizes, the operator should check the speed of auger rotation. The augers should be turning uniformly in the range of 20-40 rpm.

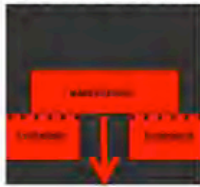
To slow down the augers, the operator turns the ratio control dials clockwise. This action sends more mix to the auger chamber. To increase auger speed, turn the conveyor ratio control dials counterclockwise.

By all means, avoid erratic or ON/OFF operation of the augers. These conditions tend to create material segregation stripes in the mat and loss of smoothness.

## Paving by the Numbers

## STEP 15

No Separation Marks In Mat  
(Front Mounted Extenders)



No Separation Marks In Mat  
(Rear Mounted Extenders)



- ***Pull Off Starting Reference***
- ***Screed personnel***
- ✓ ***Check for transition marks***
- ✓ ***Mat should be uniform***

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### STEP 15 (Continued)

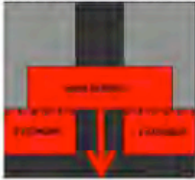
As paving speed and feeder system operation are stabilized, screed personnel should look for transition marks between the main screed and screed extenders.

If screed height, angle of attack and slope are correct, the mat should have a uniform texture across the full width of the mat and there should be no longitudinal lines present.

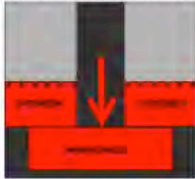
## Paving by the Numbers

## STEP 15

Extender Screeds Too Low  
(Front Mounted Extenders)



Extender Screeds Too Low  
(Rear Mounted Extenders)



- ***Pull Off Starting Reference***
- ***Extender too low, mark in line with inner edge of extension***
- ✓ ***Raise extender until transition line disappears***

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### STEP 15 (Continued)

If an extender is set too low, there will be a longitudinal transition mark in line with the inner edge of the screed extender. The mat will be thinner behind the screed extender.

Use the extender height switch to raise the extender until no transition mark is present.

Extender Screeds Too High  
(Front Mounted Extenders)



Extender Screeds Too High  
(Rear Mounted Extenders)



- **Pull Off Starting Reference**
- **Extender too high, mark in line with outer edge of main screed**
- ✓ **Lower extender until transition line disappears**

### STEP 15 (Continued)

If an extender is set too high, there will be a longitudinal transition mark in line with the outer edge of the main screed. The mat will be thicker behind the screed extender.

Use the power height switch to lower the extender until no transition mark is present.

## Paving by the Numbers



- ✓ *Keep speed constant*
- ✓ *Speed changes cause bumps or dips*
- ✓ *Adjust feeder system if speed must be changed.*

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One of the most important fundamentals of smooth paving is maintaining a consistent paving speed.

Normally, you can set up the paver to pave smoothly at any speed that matches the delivery of mix to the job site. The important thing is to keep the speed constant on all systems.

If the paving speed is changed drastically, the screed will either rise or fall and mat smoothness will suffer.

Also, if paving speed changes, the demands on the feeder system change. So the feeder system controls will have to be adjusted to match the new material demands.

For quality paving results, always follow the basic fundamentals of paver set-up and keep the operation consistent.

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