ASPHALT COMPACTION

INCONSISTENT DENSITY

Many public works departments now require not only high asphalt layer density, but also consistent density. There may be pay factors associated with standard deviation derived from multiple core measurements or percent within engineering limits derived from multiple core measurements.

One of the responsibilities of the paving crew is to present a uniform asphalt layer to the initial phase compactor. Behind the paver, to the extent possible, the mat should be:

- Uniform screed laid density
- Uniform thickness
- Uniform temperature

Consistent operation of the paver and the initial phase compactor are key to achieving consistent density.

User Tip: *Caterpillar recommends periodic checks of screed-laid density across the width of the mat and checks of surface temperature across the width of the mat. The public works department may have written specifications for uniformity of screed-laid density and mat surface temperature. As a rule, the density of the mat should vary by no more than 60 kg/m³ (5 lb/ft³) across the width of the mat. Surface temperature should not vary by more than 10° C (23° F) across the width of the mat.*

Each compactor in the compaction process, especially the initial phase compactor, must also be consistent in the approach to achieving consistently high density. Each compactor must work in such a manner that creates:

- Uniform pattern
- Uniform compaction force
- Uniform working speed
- Uniform temperature zone

Maintaining a consistent pattern and consistent density behind the paver can be challenging.

Some operators have difficulty repeating the same pattern as they follow the paver. They do not always hit each portion of the mat the same number of times. Therefore, density checks made by the quality control technician will vary. When this happens, the quality control technician or supervisor must work with the compactor operator to define the pattern and make sure that the pattern is being repeated.

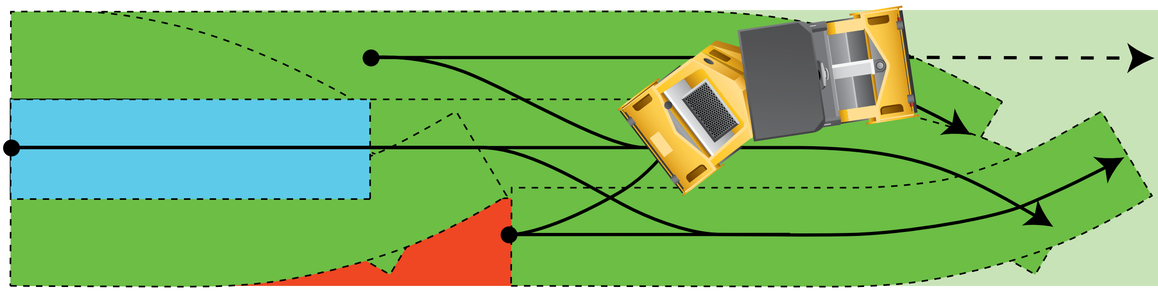
Also, verify that the paving speed has not been changed. Often changes in paving speed are not communicated to the compaction team and the quality control team. A rolling pattern that has been working well is suddenly causing the compactor to fall behind the paver and to be working in a lower temperature zone, for example. The compactor falls behind because the paving speed has been increased. And, the operator tries to alter the rolling pattern to stay close to the paver.

Never change paving speed without doing two things. First, communicate the speed change to the compaction team. Second, verify that the initial phase compactor can keep up if the speed is being increased.

New technology helps operators maintain consistency of rolling patterns.

Options are available for asphalt compactors to help operators maintain uniform rolling patterns. Screens in the operator's compartment can be programmed to show the operator where the roller is located on the mat and how much of the pattern has been completed.

Global positioning systems provide very accurate maps of rolling patterns. The control can be programmed with the required number of passes. Then, the screen will display different colors as the passes are completed. The operator no longer has to guess at the end of the pattern for reversing. And, there is less chance that the operator will miss any of the areas in the pattern because the screen provides immediate feedback for quick corrective action.



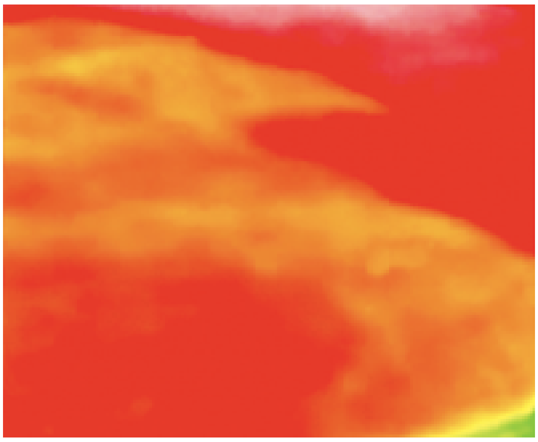
Example of a pass-counting map.

Infrared sensors send temperature data to the display in the operator's compartment.

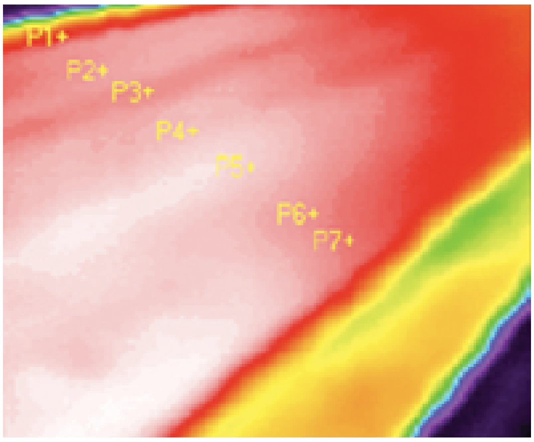
Infrared temperature sensors are another option for some asphalt compactors. On Cat models, sensors are installed on the front and rear of the machine. The sensors are continually cleaned by compressed air that keeps dust, fumes and moisture away from the sensor lenses. The temperature systems are accurate and provide constant, visual reference at the operator's station display. Not only does the operator know where the machine is located in relation to the defined rolling pattern, the operator knows where the machine is located relative to the desired temperature zone.

Large temperature variations are caused by long paver stops. The portion of the mat under the screed remains hot because it is confined. The portion of the mat just behind the screed loses heat because it is exposed to the elements.

Heat loss depends on mat thickness, air temperature and wind speed. If the mat temperature varies by more than 15° C (30° F), there is likely to be significant density variation. To help promote uniform density, limit paver stops to no more than five minutes.



Temperature variation caused by 10-minute paver stop. Screed imprint seen in infrared image is not visible in digital image.



Temperature variation caused by thin mat on the shoulder side.

In some instances, mat thickness varies across the width of the mat. The thinner portion will lose heat at a faster rate than the thicker portion. In the example shown above, the shoulder was higher than the driving lane in this area of the project. The mat laid over the driving lane was the specified 50 mm (2"). The mat thickness diminished to around 25 mm (1") over the shoulder. The density of the mat varied significantly due to temperature variation and also due to the thin mat having a low ratio of layer thickness to aggregate size. In this instance, all density checks taken in the shoulder failed to meet the minimum requirement, while all density checks taken in the driving lane passed the density requirement.

There is always a reason why density is variable. If you are troubleshooting density variability, look for variability in the paving process, mat temperature, rolling patterns, and rolling speed.

User Tip: *Temperature sensing and display are especially important when compacting mixes that have a tender zone. The operator can use the temperature display to verify that the initial compactor is staying ahead of the tender zone or that the intermediate compactor is staying behind the tender zone.*

Summary: *Compaction issues can be caused by a range of factors. Poor drum system maintenance, lack of planning, incorrect equipment selection, and inadequate operator training are just some of the factors that can cause problems during the compaction process. Certain mixes are more difficult to lay down and compact than others. In those cases, experimentation on the job may be the only solution when a mix is being used for the first time. What a crew learns from working on one project should be remembered and put to use on others when similar issues are encountered.*