Trouble-Shooting Asphalt Content Problems

Asphalt content is controlled differently in a drum-mix type plant and a batch type plant. Therefore, trouble-shooting asphalt content issues requires a completely different approach with each style facility.

To understand where to look to correct asphalt content variations with each of these facilities, it is first advisable to review how asphalt content is controlled in each of them, and discuss best practices and issues that can complicate asphalt content control in each facility.

Drum-Mix Plants

With a drum-mixer style plant, the asphalt flow is ratio-controlled by the automation based on the plant’s belt scale signals.

Belt scales measure the virgin aggregate and reclaimed aggregate flow continuously. The mix formula entered by the operator determines the asphalt flow requirements. The material moistures entered by the operator allow the control system to adjust the wet belt scale signals to dry rates. The control automation thus determines the proper flow of the asphalt cement and sends a signal to the asphalt flow control device for the proper amount of AC. Watching the belt scales and watching the asphalt flow meter, the control system will automatically adjust the asphalt cement flow to maintain the proper quantity of asphalt against the belt scale signals.

Obviously, for the asphalt content to be correct, the belt scales need to be properly calibrated so they represent accurate flow over all the production rates the plant will run, and the asphalt meter needs to be properly calibrated over the rate which the plant will run. Calibrating over these different speed ranges is a very important point.

In addition, we know the following factors can affect asphalt content accuracy.

- Mechanical items like multiple splices, screen vibration, roller buildup, the lack of wind guards, or the lack of belt tensioning assemblies can affect scale accuracy.
- Some belt scales are affected by climates that have extreme ambient temperature swings during the day (40°F or more). This needs to be checked and monitored. This condition is frequently associated with a scale that cannot “maintain zero”, has to be “re-zeroed” during the day, or does not return to “zero” at the end of a run.
- Material moistures must be properly entered in the automation.
− When using ignition ovens to determine AC content, it is important to first ascertain that there is no moisture in the mix prior to run an AC content test.

− Asphalts of different viscosities or performance grades can have different meter calibration factors. This should be checked prior to using different asphalt cements and applies to all types of meters. Sometimes the mix formula allows you to store the calibration factor or specific gravity for the asphalt being run. Frequently it does not, and must be entered by the operator.

− These different calibration factors can be affected by the temperature of the liquid asphalt cement flowing through the meter. This is different than the automatic adjustments in weight per gallon or specific gravity based on material temperature. This relates to the flow characteristics through the metering head. This needs to be checked prior to using different asphalt cements. Liquid asphalt temperature needs to be monitored during production. Control systems do not adjust for this, so the operator must watch this, and if this proves to be a factor for the asphalt cement being run, adjustments in the set point for the asphalt content or a change to the calibration factor must be made to compensate for this during production.

− Some asphalt cements of the same grade, but from different suppliers, also have different meter calibration factors. This needs to be checked prior to production.

− The asphalt content of the RAP or shingles typically is not part of the mix formula. This input is typically made elsewhere in the control system. The correct AC content in the RAP or shingles needs to be entered for the material being run, and needs to be adjusted by the operator when changing material stockpiles prior to the mix change.

− Segregation that might occur in the drum, in the mixing area, in the bucket elevator or slat conveyors, in the batchers or “gob hoppers”, in the silos, or in the truck loading process, can affect not only gradation of the mix sampled, but also the asphalt content of the mix sampled.

− Baghouse dust return irregularities can affect dust to binder ratios, gradation, and may also affect asphalt content percentages in the final mix.

Note that when diagnosing asphalt content issues, it is wise to first determine if the error is consistent.

− Consistent AC content errors, either high or low, typically point to calibration issues or improper data entered into the control system (like the wrong meter calibration factor for the asphalt cement being run, or the incorrect specific gravity of the asphalt cement being run, or the incorrect asphalt content in the RAP or shingles being run).

− Inconsistent asphalt content typically points to segregation problems or problems with the asphalt flow control mechanism (belt scales and asphalt meters are reading correctly, but the control system cannot control the quantity of the asphalt cement correctly if the flow control device is worn or damaged).

Watching the stability of the displayed flow rate signals during a run and recording their variability can be a useful tool in determining the cause of asphalt content problems. These
signals will “move” but should not vary significantly. How much they should move is a debatable issue. If they are moving significantly, say +/- 3-5% or more, they are signaling information that can be predictive to diagnosing the cause of asphalt content errors.

− The easiest way to check this is to acquire an assistant to mark time, say 5 second intervals, and have him signal that time period so you can record the displayed rate on those exact time intervals.

− Record a significant number of samples - say 50.

− Record the virgin aggregate scale rate, the reclaimed ingredients scale rate, and the asphalt flow meter rate, as each of these are used by the control system to control asphalt flow.

− Calculate the range and variability of these readings.

− If one or both of the belt scale rates is moving significantly, the control system will attempt to track this signal and regulate asphalt flow to these signals. For the asphalt flow rate to be stable the scale signals must be stable. Finding the root cause of the scale signal instability problem will typically “solve” the asphalt content problem.

− If the asphalt meter flow rate is the only erratic reading, suspect a mechanical or electrical flow control problem. The control system is probably having trouble controlling the flow of the asphalt cement. The control system will use the meter feedback as an “input” to regulate flow. If the meter feedback is not what is desired, but it cannot adequately regulate the flow with the flow control device, the displayed asphalt meter signal will be erratic. Solving the problem of the asphalt flow control will typically solve the asphalt content problem and stabilize the meter signal. If the asphalt cannot be controlled manually to a stable rate, the problem is typically an electronic motor drive problem.

**Batch Type Plants**

Batch type plants control asphalt content completely different than drum-mix style plants.

With a batch type plant, the asphalt quantity is weighed in a scale device designed to weigh the asphalt cement. This is typically referred to as the asphalt “weigh scale” or “weigh bucket”, which is a term left over from the original batch type plants from the early 1900’s that actually used a “bucket” to measure asphalt cement.

Asphalt scales or “weigh buckets” need to be calibrated to make sure they weigh accurately. This typically involves hanging known weights on the device to make sure the scale instrument is recording the correct weight.
A complication that exists with batch type plants is that calibrating with static weights can sometimes be different than weighing dynamically under production. If the lever arms or load cells attached to the scale are worn or not tight, an inaccurate weight reading can occur during mix production. The automation will recognize the signal, but this signal may not actually represent the true weight. The same can apply to the aggregate weigh hopper. This can be diagnosed by weighing several “batches” into a truck, and then comparing the batch weights from the automation against actual weights in the truck measured with a truck scale. By weighing aggregate only first, then weighing aggregate with asphalt, one can determine if both scales are working correctly or if only one is a problem. Remember, the accuracy of the aggregate weigh scale and the asphalt weigh scale both affect AC content accuracy.

Also, with a batch plant the asphalt cement is introduced into the pugmill down an asphalt injection pipe, either with the aid of a separate asphalt injection pump or by gravity. This pipe spans the breadth of the pugmill and has multiple holes in it with the goal of distributing the asphalt evenly into the pugmill. If some of these holes become plugged, asphalt may be deposited mostly on one side of the mixer. Depending on the effectiveness of the pugmill during the wet-mix cycle time, the asphalt may or may not be distributed evenly through the batch. The condition of the tips and arms in the pugmill also affect this. This can be diagnosed by deposited one full size batch directly into a truck (only one), sampling from multiple points and comparing the asphalt content from these different samples. By checking extracted gradations at the same time you can also determine whether or not the pugmill is creating a homogenous aggregate mixture in addition to homogenous asphalt content.

Like a drum-mixer, segregation downstream of the mixing process can also result in tested mix that is inaccurate in asphalt content or gradation. If this problem is suspected, the same type of segregation diagnostic practices used for drum type plants can be employed for batch type plants.

With this as background information, the following diagnostic tables can now be useful when “Trouble-Shooting” Asphalt Content Problems.
## Trouble-Shooting Asphalt Content Problems in Drum-Mix Plants

<table>
<thead>
<tr>
<th>AC Content</th>
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</thead>
<tbody>
<tr>
<td><strong>High</strong></td>
<td>Belt scale is reading artificially high due to calibration problem, rock in pivot point, accumulated fines on belt, wind effect on belt, or drastic ambient temperature variations.</td>
<td>Asphalt meter reading artificially low, due to incorrect specific gravity of the asphalt cement, incorrect calibration factor with the liquid asphalt cement being run, temperature swings to the liquid asphalt cement that impact metering accuracy. AC% in reclaimed materials higher than entered. Incorrect moisture setting in automation (to low). Ignition oven used for testing &amp; moisture in mix. Mix segregation – also check extracted gradations.</td>
</tr>
<tr>
<td><strong>Low</strong></td>
<td>Belt scale is reading artificially low due to calibration problem, rock in pivot point, wind effect on belt, or drastic ambient temperature changes.</td>
<td>Asphalt meter reading artificially high, due to incorrect specific gravity of the asphalt cement, incorrect calibration factor with the liquid asphalt cement being run, temperature swings to the liquid asphalt cement that impact metering accuracy. AC% in reclaimed materials lower than entered. Incorrect moisture setting in automation (too high). Mix segregation – also check extracted gradations.</td>
</tr>
<tr>
<td><strong>Varies</strong></td>
<td>Unstable asphalt flow control device – automation cannot control. Erratic belt scale signals causing AC flow to vary. Temperature fluctuations in metered asphalt cement with ACs that are temperature sensitive. Ambient temperature fluctuations affecting belt scale accuracy. Fluctuations in AC content in reclaimed materials. Changing material moistures not being entered. Ignition oven testing &amp; moisture sometimes in mix. Mix segregation – also check extracted gradations.</td>
<td></td>
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</tbody>
</table>
## Trouble-Shooting Asphalt Content Problems in Batch Type Plants

| AC Content High | Lack of consistent and accurate weighing in either aggregate weigh hopper or AC weigh hopper.  
| | Lack of homogenous mixing due to flow characteristics from AC pipe into mixer.  
| | Lack of homogenous mixing due to condition of pugmill tips and shanks.  
| | Inaccurate AC content in reclaimed materials entered into plant automation (actual higher than entered).  
| | Mix segregation “downstream” of mixing – check extracted gradations as well as AC content. |

| AC Content Low | Lack of consistent and accurate weighing in either aggregate weigh hopper or AC weigh hopper.  
| | Lack of homogenous mixing due to flow characteristics from AC pipe into mixer.  
| | Lack of homogenous mixing due to condition of pugmill tips and shanks.  
| | Inaccurate AC content in reclaimed materials entered into plant automation (actual lower than entered).  
| | Mix segregation “downstream” of mixing – check extracted gradations as well as AC content. |

| AC Content Varies | Lack of consistent and accurate weighing in either aggregate weigh hopper or AC weigh hopper.  
| | Lack of homogenous mixing due to flow characteristics from AC pipe into mixer.  
| | Lack of homogenous mixing due to condition of pugmill tips and shanks.  
| | AC content in reclaimed materials varying.  
| | Mix segregation “downstream” of mixing – check extracted gradations as well as AC content. |