

# Asphalt Drum Level Monitoring

A practical guide to asphalt drum level monitoring, covering the reader intent, the relationship to asphalt drum level monitoring, key evaluation criteria, common risks, and the information the intended project audience should confirm before taking the next step.



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In the production of Hot Mix Asphalt (HMA), maintaining precise control over material flow and storage is essential for both product quality and operational safety. Asphalt drum level monitoring refers to the continuous measurement of materials—ranging from raw aggregates and liquid bitumen to the finished asphalt mix—within the various stages of a mixing plant. Whether dealing with a parallel-flow drum, a counter-flow drum, or the subsequent storage silos, the environment is characterized by extreme temperatures, heavy dust, and viscous vapors.

Selecting the correct instrumentation for these conditions requires an understanding of how different measurement technologies interact with the physical properties of asphalt components. This guide examines the principles of level measurement in asphalt applications, provides selection criteria for engineering teams, and outlines best practices for installation and maintenance.

## **| Measurement Principles for Asphalt Applications**

Before selecting a specific sensor for asphalt drum level monitoring, it is necessary to understand the physics behind the most common industrial measurement technologies. In asphalt plants, the primary challenge is the combination of high heat and a high-interference environment.

## **| Radar Level Measurement (FMCW)**

Frequency Modulated Continuous Wave (FMCW) radar is the industry standard for high-accuracy level monitoring in asphalt production. The sensor emits a continuous signal with a changing frequency. The difference between the emitted frequency and the reflected frequency from the material surface is proportional to the distance.

**Advantages:** Non-contact measurement, unaffected by dust, pressure, or steam. High-frequency radar (such as 80 GHz) offers a narrow beam angle, which is critical for avoiding internal obstructions like mixing flights or agitators.

**Suitability:** Ideal for finished asphalt storage silos and aggregate bins.

## | Ultrasonic Level Measurement

Ultrasonic sensors use the "time-of-flight" principle, emitting sound waves that bounce off the material surface. The sensor measures the time taken for the echo to return.

Limitations: Sound speed is heavily dependent on air temperature and density. In asphalt drums where temperatures can fluctuate between 120°C and 180°C, and where heavy vapors are present, ultrasonic signals can become attenuated or inaccurate.

Suitability: Generally restricted to cold aggregate bins or water tanks within the plant facility.

## | Guided Wave Radar (GWR)

GWR utilizes a probe (cable or rod) to guide a low-energy microwave pulse to the material surface. When the pulse hits a medium with a different dielectric constant, it reflects back to the transmitter.

Limitations: Because asphalt and bitumen are highly viscous and sticky, material buildup on the probe can cause "ghost" signals or bridge the probe to the tank wall, leading to false readings.

Suitability: Best used for liquid bitumen storage tanks if the probe is regularly maintained or coated with PTFE.

## | Challenges in Asphalt Drum Environments

Monitoring levels within or immediately following the asphalt drum presents unique technical hurdles that standard industrial sensors may not survive without proper configuration.

1. High Temperatures: Asphalt is typically produced at temperatures between 150°C and 170°C (300°F to 340°F). Sensors must be rated for high-temperature operation or equipped with cooling extensions.

2. **Dust and Particulates:** The drying process in the drum generates significant amounts of dust. This dust can coat sensor faces, potentially blinding ultrasonic or optical sensors.
3. **Bitumen Vapors:** Liquid bitumen releases heavy vapors that can condense on cooler surfaces. If these vapors condense on a sensor lens, they can harden into a thick, insulating layer.
4. **Mechanical Vibration:** Asphalt drums are massive rotating pieces of machinery. Sensors mounted on or near the drum must be resilient to constant industrial vibration.

## Technology Selection Table

The following table provides a comparison of technologies used for asphalt drum level monitoring and associated storage applications.

| Technology   | Typical Application    | Temperature Resistance   | Dust Tolerance | Maintenance Requirement |
|--------------|------------------------|--------------------------|----------------|-------------------------|
| 80 GHz Radar | Finished Asphalt Silos | Excellent (with cooling) | High           | Low                     |
| 26 GHz Radar | Aggregate Bins         | Good                     | Moderate       | Medium                  |
| Ultrasonic   | Cold Feed Bins         | Poor                     | Low            | High                    |
| Capacitance  | Bitumen Tanks          | Moderate                 | N/A            | High (due to coating)   |
| Laser        | Surge Hoppers          | Moderate                 | Low            | Very High               |

## Practical Selection and Engineering Considerations

When specifying a system for asphalt drum level monitoring, engineers must look beyond the basic measurement range. The following factors are critical for long-term reliability:

## | Dielectric Constant ( $\epsilon_r$ )

Radar sensors rely on the dielectric constant of the material to reflect the signal. Aggregates and asphalt have relatively low dielectric constants (typically between 2 and 4). This means the reflected signal is weaker than it would be from water or metal. Modern FMCW radar units, such as those found on the Main Page of specialized instrument providers, are designed with high sensitivity to track these low-dielectric materials accurately.

## | Beam Angle and Internal Obstructions

In surge bins and storage silos, internal structures such as ladders, support struts, or the drum's discharge chute can create false echoes. A narrower beam angle (e.g., 3° to 6°) allows the signal to pass between these obstructions and hit the material surface directly. 80 GHz radar systems are particularly effective here as they allow for smaller process connections while maintaining a tight beam.

## | Process Connections and Purging

To prevent bitumen vapors from condensing on the sensor lens, a "purging" system is often recommended. This involves a small inlet for compressed air that creates a positive pressure curtain in front of the sensor face, keeping it clean and cool.

## | Installation Guidelines

Correct installation is as important as selecting the right technology. For asphalt drum level monitoring, follow these engineering best practices:

1. **Avoid the Fill Stream:** Never mount a level sensor directly above the point where material enters the silo or bin. The falling material will interfere with the signal and may damage the sensor.

2. **Nozzle Height:** If using a mounting nozzle, ensure the sensor face extends slightly past the end of the nozzle or that the nozzle is short enough to prevent "ringing" (internal reflections within the pipe).
3. **Orientation:** For solid materials like aggregates or hot mix asphalt, the material forms a cone (repose angle). The sensor should be positioned approximately one-third of the radius from the tank wall to get an average level reading.
4. **Thermal Isolation:** Use a heat-insulating flange or a stand-off pipe if the process temperature exceeds the sensor's electronics rating (usually 80°C for the housing).

## | Limitations and Risks

While modern instrumentation is robust, there are inherent limitations to asphalt drum level monitoring:

**The "Dead Zone":** All non-contact sensors have a minimum distance (blocking distance) where they cannot measure. If the asphalt reaches this height, the sensor will lose the signal or report an error.

**Coating and Buildup:** In the surge hopper, asphalt is extremely sticky. If a massive buildup occurs on the sensor face despite purging, the signal will eventually fail. Periodic visual inspections are mandatory.

**Signal Attenuation:** In extremely tall silos (over 30 meters), the combination of low dielectric material and heavy dust can weaken the radar return signal. In these cases, high-power transmitters or parabolic antennas may be required.

## | Frequently Asked Questions (FAQ)

**Q:** Can I use a laser level sensor for asphalt monitoring?

**A:** Laser sensors are highly accurate but perform poorly in dusty environments. In an asphalt plant, the dust generated during the mixing and drying process usually makes laser sensors impractical without constant cleaning.

**Q:** How do I handle the high temperatures in a finished asphalt silo?

A: Use a radar sensor with a high-temperature antenna (rated up to 250°C or higher) and ensure the electronics housing is separated from the process via a thermal barrier or cooling fins.

Q: Why is my radar sensor showing a full tank when it is empty?

A: This is often caused by "false reflections" from internal silo structures or a heavy buildup of bitumen on the sensor face. Check the mounting position and ensure the air purge system is functioning.

Q: Is it possible to measure the level inside the rotating drum itself?

A: Measuring the level inside a rotating drum with non-contact sensors is generally not feasible due to the rotation and internal flights. Instead, level is monitored in the surge bin at the drum's discharge or via load cells supporting the drum assembly.

## **| Conclusion**

Effective asphalt drum level monitoring is a balance between choosing high-performance technology and implementing smart mechanical protection. Radar remains the most reliable choice for the harsh conditions of HMA production, provided that engineers account for the material's dielectric properties and the extreme thermal environment. By following standardized installation procedures and selecting instruments designed for industrial automation, plant operators can ensure continuous production and minimize the risk of costly overflows or equipment damage. For a comprehensive range of instruments suited for these applications, engineers can Review product options and application support to find the specific configuration required for their facility.