

TROXLER[®] MMS

Moisture Measurement System

REAL TIME moisture content of aggregate
for asphalt plants.



Outline

- Influencing factors
- Current Issues
- MMS overview
- Explanation of MMS and what it measures
- MMS locations
- Benefits for Plant Owners
- Measurement Examples
- CMT: Calibration-Maintenance-Technology Improvements
- Regulatory Requirements (Licensing)
- Summary

Things that Impact Moisture

- Rain
- Washing aggregates
- Heat and sunlight



Current Issues at the Plant

- Fluctuations in moisture unknown throughout the day
- QC tech does not always get moistures (correctly)
- Available sensors break and wear easily
- QA disputes are hard to show data for
- Loader operator errors
- Rain delays

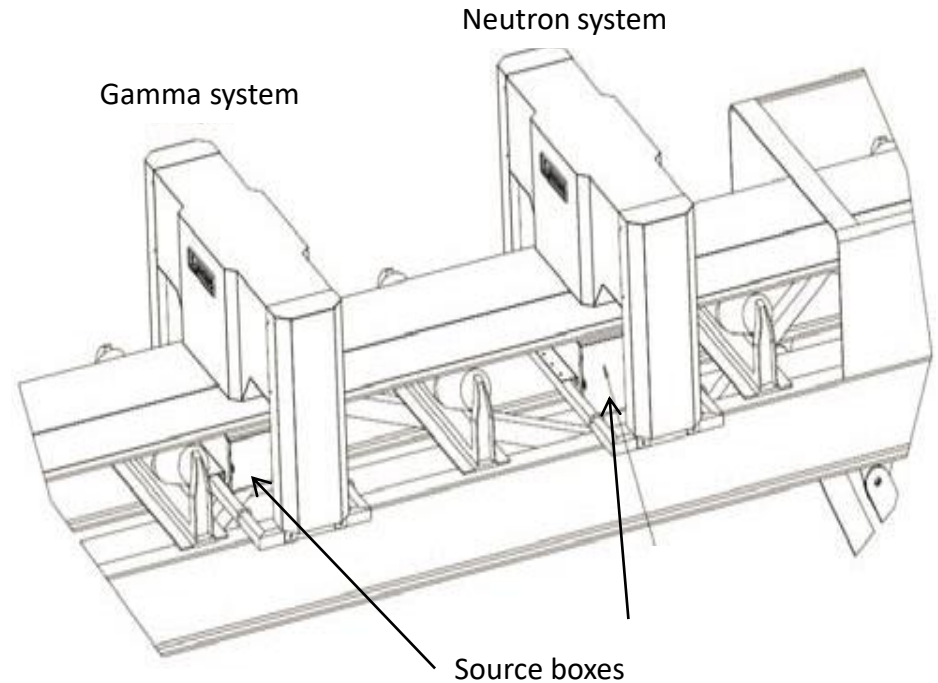
Moisture Measurement System - MMS

- Uses proven nuclear moisture and density measurement technology
- Measures any virgin aggregate with minimum 2" thickness
- Consistent, real-time numbers displayed in the control room
- Integration into control system for full automation with almost all systems on the market



MMS and what it measures

- It measures the moisture in an aggregate mix moving on the **virgin aggregate** conveyor belt
- There is ***no physical contact*** to the aggregate mix or belt
- Unlike microwave probes that require contact with the material in the bin or in the stream of aggregate on the belt, the ***MMS is situated above the belt*** with the sources below the belt.
- Measurements are made ***every second*** but the user can choose different averaging intervals.



Integration on ASTEC TC II



MMS – Moisture Measurement System

- The geometry of the system is designed to scan a large volume of the material on the belt and provide a continuous reading of the moisture content.
- A plant specific calibration provides accurate moisture content with a less than $\pm 0.5\%$ (by weight) precision for a 5.0 second measurement.



Current MMS Locations



- New Jersey
- North Carolina
- Pennsylvania
- Arkansas
- Wisconsin
- Texas
- Michigan
- Louisiana
- Minnesota
- Oklahoma
- California
- Florida
- Coming soon to Virginia

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- Improve production mix design
- Better control
- More efficient in fuel used and
- Fewer stockpile work
- On rainy days control

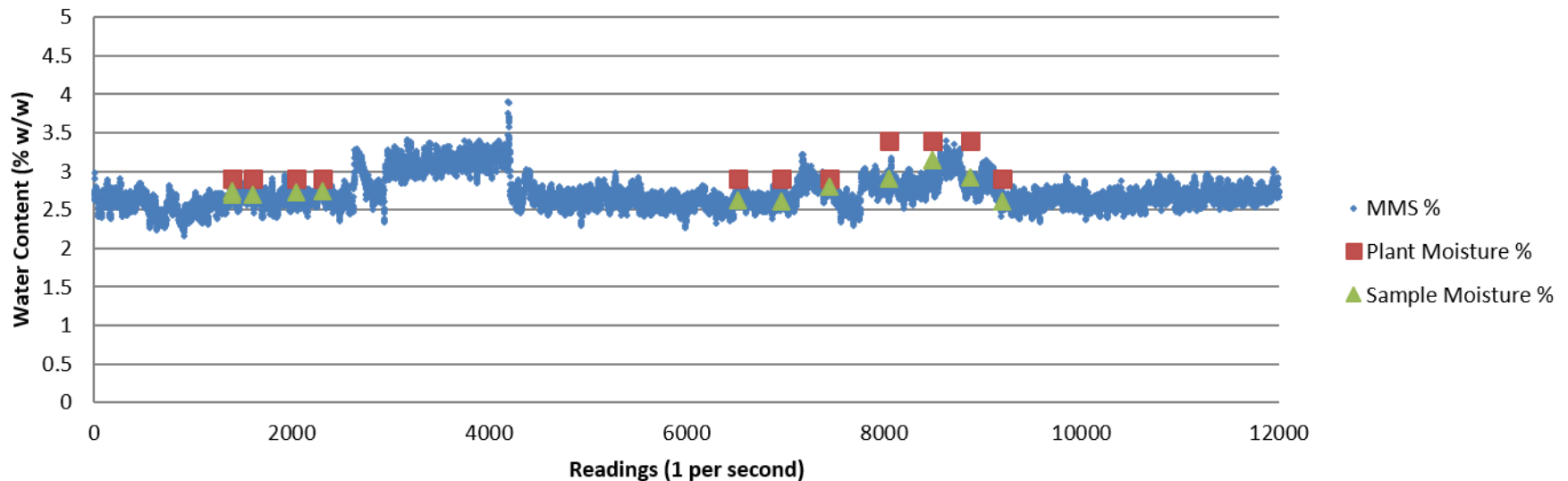


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Measurement Examples

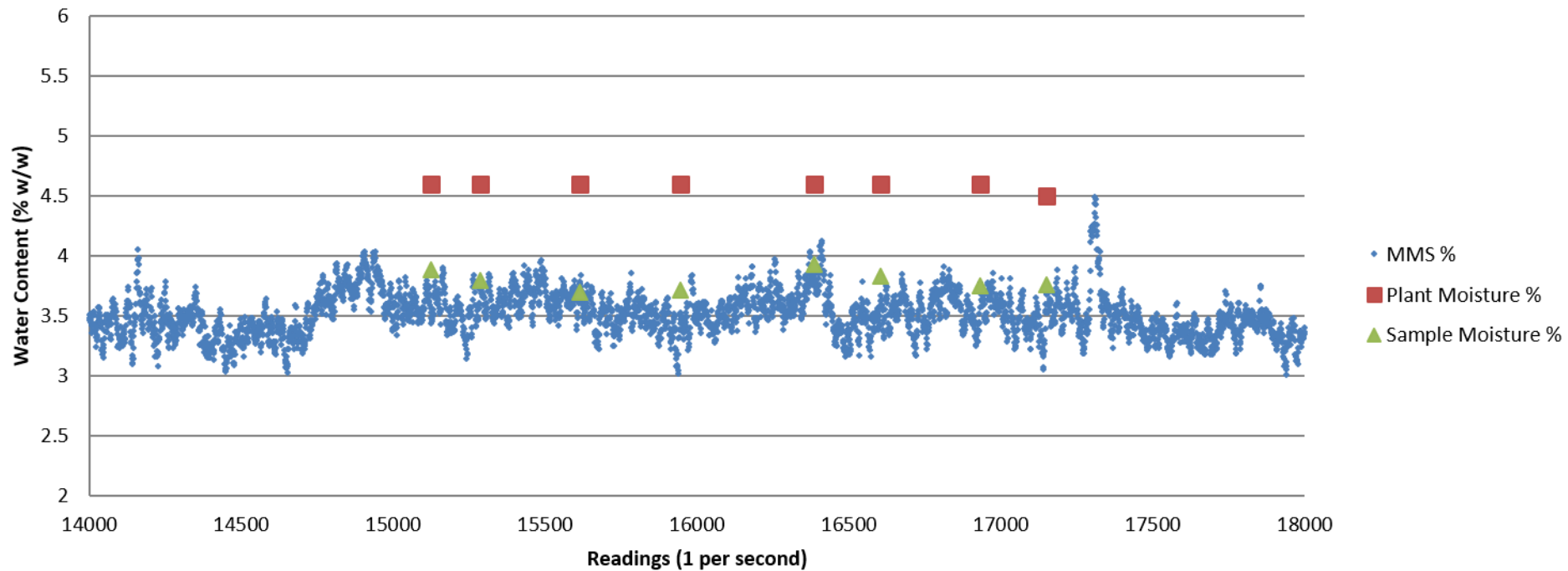
Water Content



Data collected showing the comparison between the MMS data vs. the oven dry results and the %M calculated by the plant (based on the oven dry).

Two days after a rain

Water Content 8/19/15



Cost Savings:

Knowing the moisture of aggregates in asphalt is very important because it leads to:

- Improve product quality and performance more like mix design
- More accurate binder contents since control systems do not count water weight as aggregate
- Shorter downtimes when it rains
- Energy savings (i.e. natural gas usage reduced because burner temp is better controlled during drying)

AC Savings Before and After Moisture Control

Table 2. Estimate of monthly asphalt binder usage for the plant in Pennsylvania.

Moisture Measurement Method Used in Plant Control	Month	Monthly Inventories (tons)		Average AC content in product
		AC	Mix	%
Moisture values from individual stockpiles	May	1112	24808	4.48%
	July	1014	23872	4.25%
	August	1241	28817	4.31%
Moisture values from the MMS	September	1462	36224	4.03%
	October	1236	29167	4.24%
	November	1608	39995	4.02%

Plant was running state mix during time frame, results were .25% reduction in AC waste which equated to \$180,000 in 2016. Cost of binder has increased over 40% between 2017 and 2019.

CMT: Calibration-Maintenance-Technology Improvements

Calibration By Troxler

- System is calibrated at the time of installation and annually thereafter by Troxler (2 – 4 day process)
- Full calibration takes about 3 to 6 hours of measurements on the belt
- Only one calibration for all materials is needed.
- Calibration is done at night or other time when plant is not running (no interruption of production)

Maintenance by Owner

- Cleaning the aggregate build up on surfaces (weekly)
- Standard count (weekly)

Maintenance by Troxler (Annual)

- Leak test
- Electronics replacements if needed
- Improvements to design

Technology Improvements (Annual)

- Software updates
- Hardware improvements
- Calibration improvements

Regulatory Requirements (Licensing)

- MMS is a generally licensed system
- In most states, Troxler will notify the state agency that the customer has received a MMS unit. In some states it is the customer who has to register the system within 30 days.
- Leak test every three years (Troxler will do the leak test and provide the report at time of calibration/ source installation)
- More info can be obtained from Troxler's Radiation Safety Group:

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Summary

- Water in the material ***changes*** throughout the day
- The current method ***assumes*** stationary values
- Real time moisture values help control the plant ***proactively***
- Can achieve ***efficiencies*** in binder input as well as energy savings
by changing moisture as it fluctuates



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