




What effects does thermal segregation have on pavement life?

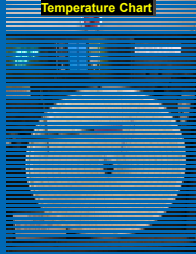
- Premature failure due to fatigue cracking, raveling, and moisture damage.
- Increased roughness
- In 2005 TTI published research reports outlining the relationship between thermal segregation and density at the paver using the MOBA Pave IR Bar. Reports 0-4577-2 & 5-4577-01-1
- Texas Materials North has been using the MOBA Pave IR Bar/Scanner since 2004




Where does thermal segregation start?





Plant Temperature Control Device



Temperature Chart




Thermocouple



Issues with Temp Chart and Thermocouples


- Thermocouples may not be calibrated regularly
- Thermocouples not cleaned regularly (buildup on probe)
- Slow temperature response time
- Difficult to track temperature performance for energy/gas efficiency
- Minimum to zero monitoring of temperature performance
- No remote temperature monitoring capabilities



Benefits of a Plant IR Monitoring System

Both IR monitoring systems can measure and record the highs and lows of mixture temperatures from a preset targeted temperature.

- Immediate temperature response time
- Mix temperatures are recorded electronically and can be easily monitored for temperature consistency
- Exporting files make it easy to email temperature data
- Ability to login remotely to monitor real-time mix temperatures
- Improve overall plant operation processes by monitoring standard deviations and percent within limits



Performance Benefits of the Plant IR System

- Reduction of energy usage
- Reduce carbon output (lower EDP values)
- Reduce waste (start up/switchovers/rejected)
- Improve loader operations
- Reduce thermal segregation
- Improve operator temperature control
- Uniform mixture viscosity
- Uniform roadway compaction
- Improvement in ride quality
- Improvement in pavement life



Sustainability

- Warm Mix specification compliance targeted to improve mix performance and lower carbon emissions
- New specifications needed to promote WMA using this technology
- Industry environmental pressures (better neighbors)
- Infrastructure Bill - Federal Carbon Reduction Program
- Texas is eligible to receive \$641 million over the next 5 years from 2022-2027



MOBA Plant IR System (PIRS)

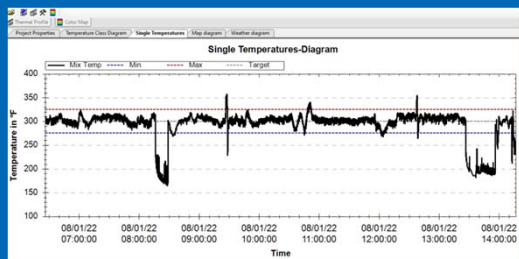


Plant IR Data

PIRS-Report		Leads recorded					
Project Site		Start	End	Min	Max	Rolls	
Report Date	08/01/22						
Company	CRH	08/01/2022 11:04:26	11:08:41	181.6 F	08/01/2022 07:14:23	07:23:25	3613 F
Job	Highway	08/01/2022 13:31:30	13:31:48	656.7 F	08/01/2022 07:29:26	07:29:33	128 F
Site	17	08/01/2022 12:02:00	13:02:19	221.1 F	08/01/2022 07:23:14	07:23:28	128 F
Site Code	17000	08/01/2022 07:25:02	07:25:08	212.1 F	08/01/2022 07:23:40	07:23:42	125 F
Plant	MOBILITY 01-204	08/01/2022 07:28:53	07:29:01		08/01/2022 07:28:53	07:29:04	128 F
Roll	08/01/2022 14:28:01	08/01/2022 07:29:13	07:29:17		08/01/2022 07:29:11	07:29:17	128 F
Temperature							
	Temp	Min	Max				
Roll	168	157	332			168	
Summary							
Established Temperature Control Range from Target Temperature							
Roll	168	157	332			168	
PIRS %							
Temperature							
Min	Max	avg	Rolls				
157.0 F	332.0 F	168.0 F	168			168	



MOBA PIRS Graph Report




Highway Data Systems USA – Technologies

Monitor Plant Production Temperature	Digitize Paper Ticket Loaded Truck Temperature Reporting Tracking Of Material To Site Paver Crew Knows ETA Of Material GPS Delivery Location of Every Load	Paver Monitoring Unloaded Material Delivery Temperatures Thermal Segregation Monitoring Mat Temperatures	Roller Monitoring Rolling Temperatures Recorded Roller Passes Recorded Roller Equipped High Accuracy GPS




Highway Data System Plant IR Technology

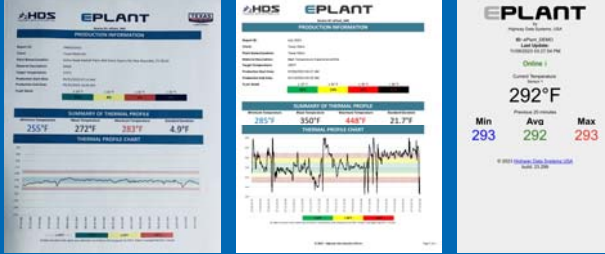



Tex-253-F "Thermal Profile of Plant Produced Asphalt Mixtures," this is a new proposed test method to instruct how to properly perform a thermal profile within a HMA plant. This method will provide a continuous "thermal profile" and allow for better temperature control within the plant.

Infra-Red sensor captures material as it falls from drum into drag slat.
 Sensor has built in air system to keep lens clean of spilling/dirt
 Signal is sent cellularly to tablet in control room and secure website for QC department.
 User defined reports generated from secure portal




Highway Data System IR Technology





Plant IR Monitoring System

- Is this system good for my operation?
- Can this system improve plant process control during production?
- Can this system reduce energy, gas, and/or fuel consumption?
- Can this system reduce startup/switchover waste?
- Can this system improve the ride quality?
- Can this system improve mix viscosity for uniform compaction?
- Can this system improve placement bonus?
- Can this system improve pavement life?




Loaded Truck Temperature Reporting



Infra-Red Sensor Captures Material Temperature as it is loaded into truck

Temperature Information is captured and matched with consignment note.

Information is sent via cellular system to secure tablet in control room and to authorized users who have access via secure portal.




Loaded Truck Temperature Reporting

Reporting : System Can Monitor Three Asphalt Silos & Will Provide Loaded Truck Temperature Information*
 All Data Stored On Secure U.S Based Servers For One Year.
 Access Provided To Authorized Users Only.
 Authorized User Can Generate Reports Based On Job #, Silo #, Material Type.
 Reports Generated As Needed & Users Discretion.

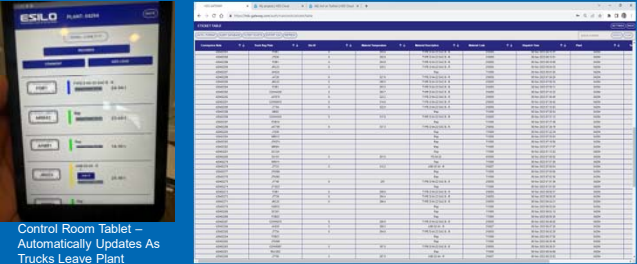
User Provides: 110v Power Supply within 8-12 ft of Middle Silo (Of Typical 3 Silo Setup)

Cellular: A Cellular Signal Is Used, Cell Boosters & Multi Network Sim Cards Are Available.

Calibration: The Units Three Temperature Sensors Are Required To Be Calibrated Annually.
 Annual Calibration & Data Costs, Covers Three Replacement Calibrated Sensors, Which Will Be Replaced By H.D.S Staff At Your Plant Annually.
 By Replacing The Three Calibrated Temperature Sensors On Site Annually, We Mitigating Down Time, To A Minimum.




Loaded Truck Temperature Reporting




Control Room Tablet – Automatically Updates As Trucks Leave Plant

Online Secure Portal – For Authorized Users Updates In Real Time As Trucks Leave Plant




Materials Delivery Management

E-Load System





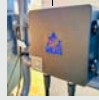
- As a paper ticket is created at the scale house, H.D.S is sent a digital copy of the information.
- Using site reference/project numbers, H.D.S then sends the ticket information to the paver/shuttle buggy at which the material will be unloaded.

When the material is unloaded, a site operative presses the yellow button that corresponds to the vehicle's ID #. A GPS pin, and all the ticket information is then associated around that point

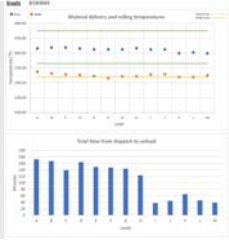


Paver Monitoring

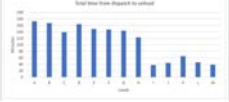
E-Tec System

E-Tec Delivery Temperature Monitor





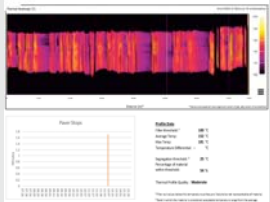
Placing Two IR Sensors on Paver Augers or Shuttle buggy means Temperature Information is captured continuously as material is delivered to site and GPS temperature information is captured digitally.




Paver Monitoring

VisIR Paver Mounted System

VisIR Paver Mounted Thermal Segregation Profiler

Paver is equipped with Thermal Segregation Camera



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