SHRP2 R06C Technology to Enhance Quality Control on Asphalt Pavements: Paver Mounted Thermal Profiler

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R06C Technologies to Enhance QC on Asphalt Pavements

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**Presenters:**
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- Harold Von Quintus, P.E., ARA
- Bill Stone, P.E., Missouri, DOT
- Peter Moulton, Pike Industries
- Ed Dalrymple, Chemung Contracting

Presentation will be available for viewing on the AASHTO SHRP2 website:
http://shrp2.transportation.org/Pages/R06C_RapidTechnologiesEnhanceQualityControl.aspx
R06C Technologies to Enhance QC on Asphalt Pavements

The Challenge: Develop solutions to measure and quantify non-uniformity of asphalt mixture at construction.

Localized non-uniform areas fail prematurely. Random testing seldom catches problem.

Increased use of night paving makes inspection more difficult.
R06C Technologies to Enhance QC on Asphalt Pavements

Thermal Profile during Placement: Pave-IR

Density uniformity after Compaction: Rolling Density Meter


Agenda

• Thermal Profiler Technology
• Equipment and Data Acquisition
• Field Demonstration Projects
• Application and Benefits
• Industry Perspectives and Views
• Questions and Answers
Webinar Objectives

• Describe use of the Paver Mounted Thermal Profiler Technology.
• Identify equipment and understand the installation and use of equipment & software.
• Discuss results/findings from the field demonstration projects.
• List contractor’s and agency’s opinions and/or perspective of the Thermal Profiler as a QC or QA tool.
Part 1: What is it and why use it?
Infrared Thermography Defined:

- The mapping of temperature contours (equal temperature) over the surface of a material.
- Contours are used to evaluate materials by measurement of their surface temperature and its variation.
Mat Temperature Measurements:

• **IR sensors, IR-Bar**; first device for continuous readings.
• **Pave-IR Scanner**; second generation device for continuous readings.
How is the thermal profile measured?
• Sensor—detects infrared radiation emitted from the mat.
• Scans the mat 6 to 10 ft. behind the screed.
• Creates thermal profile of the mat surface.
Thermal Profiler Technology

Why is it important?

• Aggregate segregation in mat = temperature differentials
• Non-uniform temperatures = non-uniform densities
Thermal Profiler Technology

- Lower mat temperatures in localized areas results in lower mat density (reduced compaction) and reduces the service life or increases maintenance.
Cold spots; areas with increased potential for:

- Fatigue cracks
- Raveling
- Pot holes
Thermal Profiler Technology

Thermal streaks with increased potential for longitudinal cracking and raveling.

Loss of service life or increase in maintenance costs.
Segregation – A difficult issue to resolve, when it is difficult to identify or confirm.
Part 2: Equipment Installation & Use and Data Acquisition
Equipment and Its Installation

Equipment

- Mast Base
- Mast Extension
- Mast Arm
- IR Scanner
- DMI
- GPS Unit
- Wiring
- Connection bolts & materials
Equipment and Its Installation

IR mast base and extension attached to paver.

Mounted Directly to Screed

Mounted to a Steel Plate Attached to Work Platform
Equipment and Its Installation

• IR Scanner attached to paver; scans mat behind screed in one direction.
• GPS attached to the mast arm.
DMI placed on wheel hub to measure distance during paving operation.
IR scan screen used to see/monitor mat temperatures in real time; attached to the mast post or extension.
Data Processing and Reports

Raw Temperature Profile; all data collected and retained in the data file.
Summary of Raw Data for One Lot
Avg. Temp. = 285 °F

<table>
<thead>
<tr>
<th>Basic Temperature Statistics (F)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>285.0</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>49.6</td>
</tr>
<tr>
<td>Minimum</td>
<td>76.1</td>
</tr>
<tr>
<td>Maximum</td>
<td>336.7</td>
</tr>
<tr>
<td>98.5 %-tile</td>
<td>321.6</td>
</tr>
<tr>
<td>1 %-tile</td>
<td>114.8</td>
</tr>
<tr>
<td>Temp. Differential</td>
<td>206.8</td>
</tr>
</tbody>
</table>

Not mat temperatures
Data Processing—eliminate invalid temperature measurements, 3 steps:
1. Eliminate measurement locations within 2 feet of the mat’s edge.
Data Processing and Reports

Data Processing—eliminate invalid temperature measurements, 3 steps:

2. Eliminate temperature readings < 170 °F and > 400 °F.

3. Eliminate data with paver stops greater than 60 seconds.

Data eliminated between locations:
- 2 feet behind measurement location of stop
- 8 feet in front of measurement location of stop

Step 3 can be excluded.
Data Processing and Reports

Summary of Processed Data for one day of paving

Raw IR data: $T_{avg.} = 296.2 \, ^\circ F$
Processed data: $T_{avg.} = 305 \, ^\circ F$
Temperature Differential Criteria, each 150 foot segment:

\[ \Delta T = T_{98.5} - T_{1.0} \]

- \( \Delta T \leq 25 \, ^\circ F \) \text{ Minor temperature difference}
- \( 25 \, ^\circ F < \Delta T \leq 50 \, ^\circ F \) \text{ Moderate temperature difference}
- \( \Delta T > 50 \, ^\circ F \) \text{ Severe temperature difference}
Review results in real time.
## Data Processing and Reports

### Report; Tex 244-F

**Tex 244-F**

**Thermal Profile Summary Report**

<table>
<thead>
<tr>
<th>Profile ID:</th>
<th>95sb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profile Number:</td>
<td>Letting Date:</td>
</tr>
<tr>
<td>Status:</td>
<td>Controlling CSJ.</td>
</tr>
<tr>
<td>County:</td>
<td>Spec Year:</td>
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<tr>
<td>Tested By:</td>
<td>Spec Item:</td>
</tr>
<tr>
<td>Test Location:</td>
<td>Special Provision:</td>
</tr>
<tr>
<td>Material Code:</td>
<td>Mix Type:</td>
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<tr>
<td>Material Name:</td>
<td></td>
</tr>
<tr>
<td>Producer:</td>
<td>Project Manager:</td>
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<tr>
<td>Area Engineer:</td>
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</table>

<table>
<thead>
<tr>
<th>Course/Lift</th>
<th>3</th>
<th>Temperature Differential Threshold</th>
<th>25.0</th>
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</thead>
<tbody>
<tr>
<td>Segment Length (ft):</td>
<td>150</td>
<td>Sensors Ignored:</td>
<td>-</td>
</tr>
</tbody>
</table>

### Locations without thermal segregation.

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>194.49</td>
<td>68.12354369 N, 46.16595824 W</td>
<td>193.00</td>
</tr>
<tr>
<td>2</td>
<td>192.99</td>
<td>68.12478903 W, 46.11681491 N</td>
<td>191.50</td>
</tr>
<tr>
<td>3</td>
<td>191.49</td>
<td>68.12478903 W, 46.11690104 N</td>
<td>190.00</td>
</tr>
<tr>
<td>4</td>
<td>189.99</td>
<td>68.12478903 W, 46.11680323 N</td>
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<td>5</td>
<td>186.49</td>
<td>68.12556918 W, 46.11690104 N</td>
<td>180.00</td>
</tr>
<tr>
<td>6</td>
<td>186.99</td>
<td>68.12585169 W, 46.11680078 N</td>
<td>185.49</td>
</tr>
<tr>
<td>7</td>
<td>185.49</td>
<td>68.12670974 W, 46.11690104 N</td>
<td>183.99</td>
</tr>
<tr>
<td>8</td>
<td>183.98</td>
<td>68.12671069 W, 46.11690104 N</td>
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<td>9</td>
<td>182.49</td>
<td>68.12610679 W, 46.11690104 N</td>
<td>181.00</td>
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<td>167.49</td>
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<td>68.12670974 W, 46.11690104 N</td>
<td>164.50</td>
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<tr>
<td>21</td>
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<td>25</td>
<td>158.49</td>
<td>68.12670974 W, 46.11690104 N</td>
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<td>155.50</td>
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<td>27</td>
<td>155.49</td>
<td>68.12670974 W, 46.11690104 N</td>
<td>154.00</td>
</tr>
</tbody>
</table>

### Thermal profile summary.

<table>
<thead>
<tr>
<th>Number of Profiles</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>25.0°F &lt; differential &lt;= 50.0°F</td>
<td>differential &gt; 50.0°F</td>
</tr>
<tr>
<td>28</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Percent</td>
<td>Percent</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Part 3: Field Demonstration Projects; Summary & Findings
### Field Demonstration Projects

All field demonstration projects; **effect of MTVs**:  

<table>
<thead>
<tr>
<th>Project</th>
<th>Delivery Truck Type</th>
<th>MTV Included</th>
<th>Percent Severe Temp. Differentials</th>
<th>Thermal Streaking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alaska</td>
<td>Bottom-Dump</td>
<td>Windrows</td>
<td>17</td>
<td>None</td>
</tr>
<tr>
<td><strong>EFL</strong></td>
<td><strong>End Dump</strong></td>
<td>No</td>
<td>83</td>
<td><strong>None</strong></td>
</tr>
<tr>
<td><strong>Illinois</strong></td>
<td><strong>End Dump</strong></td>
<td>No</td>
<td>40</td>
<td><strong>None</strong></td>
</tr>
<tr>
<td>Maine</td>
<td>End Dump</td>
<td>Yes</td>
<td>5</td>
<td>None</td>
</tr>
<tr>
<td>Missouri</td>
<td>End Dump &amp; Flow Boys</td>
<td>Yes</td>
<td>25</td>
<td>None</td>
</tr>
<tr>
<td>NJ</td>
<td>End Dump</td>
<td>Yes</td>
<td>21</td>
<td>None</td>
</tr>
<tr>
<td>Virginia</td>
<td>End Dump</td>
<td>Yes</td>
<td>5</td>
<td>None</td>
</tr>
<tr>
<td>NC</td>
<td>End Dump</td>
<td>Yes</td>
<td>18</td>
<td>None</td>
</tr>
<tr>
<td><strong>WV</strong></td>
<td><strong>End Dump</strong></td>
<td>No</td>
<td>41</td>
<td><strong>None</strong></td>
</tr>
<tr>
<td>WV</td>
<td>End Dump</td>
<td>Yes</td>
<td>5</td>
<td>None</td>
</tr>
</tbody>
</table>

Above includes paver stops.
Field Demonstration Projects

Multiple demonstration projects; *effect of loading trucks*:

- One dump of mix in truck bed – severe temp. differential
- Two dump, no stockpile – reduced temp. differential.

Properly loading trucks significantly reduced the number of severe temperature differentials.
Multiple demonstration projects; **effect of number of trucks:**

- Avg. temperature differential at start of paving project was about 30 °F.
- Avg. temperature differential after adding two trucks was about 15 °F.

Few trucks with high local traffic = more paver stops.

Two more trucks = fewer paver stops & more uniform temp.
Field Demonstration Projects

Multiple demonstration projects; **effect of number of trucks:**

- Significant paver delay between trucks.
- Reduced paver delay between successive trucks.

Extensive delay with screed heater on.

**EFFECT:** Less variability in mat density, and reduced contractor’s risk of being penalized.
Multiple demonstration projects; **effect of tarps**:

Properly installed and maintained tarps significantly reduced the temperature differentials by about 40 percent.
Multiple demonstration projects; **effect of loading trucks**:

Trucks with improperly installed tarps.  
Trucks with properly installed tarps.

Temperature differences between trucks.
Part 4: Application and Use
Application & Use

Perspective as a QA Tool:

• Continuous readings to evaluate mat uniformity through temperature uniformity.
• Uniform temperatures imply uniform densities, which usually mean lower maintenance.
Impact on Contractor’s compaction operation:

After recognizing the effect of temperature sensitive zone; VA DOT demonstration project.
Role of IR in Quality Assurance Programs:

1. Contractor QC plan
   - Monitor production/placement operations to minimize temperature differentials of mat.
   - Minimize risk of being penalized.
   - Forensic tool to trouble shoot low or non-uniform mat densities.

2. Agency acceptance plan
   - Reduce future distress and maintenance costs.
   - Dispute resolution.
Application & Use

IR role in QC plan, answering specific questions:

• What changes need to be made, if any?
  – Paver delays and speed.
  – Paver maintenance; augers, kick-back flights, slat conveyor, etc.
  – Number & loading of trucks
  – Tarps
  – Etc.

• When to make those changes?
IR role in QC plan—Missouri demonstration project:

- Increased communication between plant and paver to minimize temperature differentials of mat.
Application & Use

IR Role in Acceptance Plan

- Determine biased areas for sampling and testing: Washington DOT
- Modify QA process/suspend paving operations: Texas DOT
- Price adjustments for temperature: Minnesota and Missouri DOT and Quebec
  - Independent verification is an issue.
IR Role in Acceptance Plan; examples:

1. Identify cold spots
   - Alaska, Minnesota, Missouri, Quebec, Texas, Washington

2. Identify thermal streaks
   - Quebec
Percent within limits specification: higher variability implies greater risk for being penalized.
### PWL Specification, example.

<table>
<thead>
<tr>
<th>Air Voids</th>
<th>No IR Scanner Used for QC</th>
<th>IR Scanner Used for QC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Limit</td>
<td>8.0</td>
<td>8.0</td>
</tr>
<tr>
<td>Average</td>
<td>6.8</td>
<td>6.5</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>1.5</td>
<td>1.0</td>
</tr>
<tr>
<td>PWL</td>
<td>76</td>
<td>95</td>
</tr>
<tr>
<td>Percent Defective</td>
<td>24</td>
<td>5</td>
</tr>
</tbody>
</table>

Air voids = 100 – Percent compaction

\[ \mu = 6.5\text{ percent} \]
\[ \mu = 6.8\text{ percent} \]

No scanner used.

USL = 8 percent
Comments from Contractors and Agencies that have used the IR Scanner:

1. If the IR scanner technology saves one grind of a project, the equipment paid for itself; Maine DOT.
2. The IR scanner equipment is a self-policing tool.
3. Pike Industries purchased their first IR unit about 2 years ago and used it on a project in Vermont. Pike Industries found it to be a good tool to make real time adjustments.
4. It is a good forensic tool, compared to cores, especially to explain why an area has low density. A drop of 15 ºF can result in a significant drop in mat density.
5. The scanner helps in adding trucks for increased uniformity, adjusting practices, and shows the benefits of short hauling.
Comments from Contractors and Agencies that have used the IR Scanner:

6. Contractors see it as a **great training tool** for new operators or additional training for experienced crews.

7. The scanner data is a vivid **tool for showing how rideability is influenced by the uniformity of temperatures**.

8. Even though the EFL project had extensive thermal differences throughout the project, the contractor still achieved desired density – so **PaveIR is not the whole story**.

9. If the agencies provided the scanner equipment for free, then contractors would most likely take and use the equipment.
Part 5: Industry Perspective & Opinions

Bill Stone, Missouri DOT
Peter Moulton, Pike Industries
Ed Dalrymple, Chemung Contracting
Agency Perspective; Bill Stone, Research Administrator, Missouri DOT
MoDOT IR Updates

MoDOT Infrared Use Update
MoDOT-FHWA AID IR-IC Projects

- Funded by FHWA AID and MoDOT
- 13 Field Projects in FY 2017
- 7 Training Workshops
- 2017 IC and IR Specifications
- Protocols for IC-IR Field Projects
- Data Management via MoDOT SharePoint

(AID)-Accelerated Innovation and Deployment
<table>
<thead>
<tr>
<th>No.</th>
<th>Job No</th>
<th>District</th>
<th>County</th>
<th>Route</th>
<th>Start Date</th>
<th>End Date</th>
<th>Paving Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5P3117</td>
<td>CD</td>
<td>Morgan</td>
<td>52</td>
<td>5/9/2017</td>
<td>7/13/2017</td>
<td>19</td>
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<tr>
<td>2</td>
<td>4I3111</td>
<td>KC</td>
<td>Clay</td>
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<td>8/18/2017</td>
<td>Ongoing</td>
<td>7</td>
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<tr>
<td>3</td>
<td>3I3042</td>
<td>KC</td>
<td>Lafayette</td>
<td>70</td>
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<td>9/13/2017</td>
<td>18</td>
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<tr>
<td>4</td>
<td>2P3099</td>
<td>NE</td>
<td>Macon</td>
<td>36</td>
<td>5/8/2017</td>
<td>5/17/2017</td>
<td>7</td>
</tr>
<tr>
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<td>8/18/2017</td>
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</table>
MoDOT IR and IC Specifications

**Agency Perspective**

### Intelligent Compaction

**1.0 Description.** This work shall consist of collecting location, temperature, speed, and resistance measurements from properly instrumented rollers within the mainline paving limits and then submitting the Intelligent Compaction (IC) Data in the defined format. This provision shall apply for each lift of mainline pavement. This work shall be completed in accordance with the general principles set forth in AASHTO PP81-14, and specifically as stated in the following sections.

**2.0 IC Asphalt Rollers.** All asphalt rollers with the exception of the finish roller shall be properly instrumented. These instrumented rollers will be referred to as IC Rollers. Steel wheel rollers shall be self-propelled double-drum vibratory rollers equipped with accelerometers mounted to acquire signals from the vibratory response in the drum measuring the interactions between the rollers and compacted materials in order to evaluate the applied compaction effort known as the Intelligent Compaction Measurement Value (IC-MV). Rubber tire rollers will not be required to collect resistance measurements. IC Rollers shall be equipped with non-contact temperature sensors for measuring pavement surface temperatures as well as a Global Positioning System (GPS) to map the roller position history. A Roller Approval Form generally consistent with PP81 Appendix X4 'Department Approval of Instrumented Rollers for Use' shall be completed and submitted to the engineer prior to use of a roller for measurement of passes demonstrating that the roller meets the requirements of this provision.

### Infrared Scanning

**1.0 Description** This work shall consist of collecting the paving location, surface temperature and paver stops with a Contractor supplied, Contractor retained MOBA Pave-IR Infrared Scanner System for the each lift of mainline asphalt pavement. The Infrared (IR) scanner shall be used to continually monitor the surface temperature of the mat immediately behind the paver screed during paving operations in order to determine the temperature differential for each segment. The scanner itself mounts overhead at the back of the paver. Data from the scanner shall be automatically uploaded and processed through a wireless data connection.

**2.0 IR Scanning Equipment** The system consists of a temperature scanner, wheel speed sensor, GPS antenna, control panel and necessary cabling. The IR scanner shall measure the surface temperature over the complete paving width. The current position shall be recorded via the GPS antenna. The control panel shall feature all of the keys and displays necessary to control the system as well as the software (PaveApp) for data recording and visualization during the paving process. The system shall store the data locally on the memory stick and also upload the data directly to e-Routes Software that is available from MOBA and shall be supplied by the contractor for use on this project.

**3.0 Pave-IR Training.** A 2 - 4 hour training session will be provided by the Engineer. The Quality Control Staff and screed operator shall attend the training. This training will familiarize the contractor staff on the set-up, operational monitoring and software requirements as well as generation and interpretation of output reports. A trained screed operator and quality control staff shall be on site when the IR scanner is in use. If trained personnel are unavailable IR scanning and mainline paving shall not be performed.
Agency Perspective

IR-IC Data Management; MoDOT SharePoint Site
Agency Perspective

IR-IC Data Management; MoDOT SharePoint Site
Contractor’s Check List

<table>
<thead>
<tr>
<th>Route</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job No.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td></td>
<td></td>
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<tr>
<td>Contractor</td>
<td></td>
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</tr>
</tbody>
</table>

- Conduct IC GPS verification...
- Conduct IR scanner DMI calibration.
- Construct a trial section.
- Record and export IC data.
- Record and export daily production boundaries.
- Record IR scanner data.
- Record spot test data.
- Create a Veta project file for IC data.
- Produce MOBA IR Segment Report.
- Fill daily paving record form.
- Transmit all files to MoDOT SharePoint.
Agency Perspective

Contractor’s Daily Forms

<table>
<thead>
<tr>
<th>Route:</th>
<th>Job No.</th>
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</thead>
<tbody>
<tr>
<td>IC System:</td>
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<tr>
<td>IR System:</td>
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</tr>
<tr>
<td>GNSS Ref:</td>
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<td>Date:</td>
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<table>
<thead>
<tr>
<th>Start time:</th>
<th>Start Milepost:</th>
<th>Length (ft):</th>
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</thead>
<tbody>
<tr>
<td>Stop Time:</td>
<td>Stop Milepost:</td>
<td>HMA (tons):</td>
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GPS Verification

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<th>Nothing (m)</th>
<th>Easting (m)</th>
<th>Diff. (mm)</th>
<th>&lt; 30mm?</th>
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<tr>
<td>IC GPS</td>
<td></td>
<td></td>
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<tr>
<td>Rover</td>
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Trial Section

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<tr>
<th>Opt Passes</th>
<th>Patterns</th>
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</table>

Paving

<table>
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<tr>
<th>Direction</th>
<th>Lane</th>
<th>Lift</th>
<th>Width (ft)</th>
<th>Thickness (&quot;)</th>
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</thead>
</table>

Compaction

<table>
<thead>
<tr>
<th>Position</th>
<th>Roller</th>
<th>Passes</th>
<th>Static/Vib</th>
<th>Amp (mm)</th>
<th>Freq (vpm)</th>
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<tbody>
<tr>
<td>Breakdown</td>
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<tr>
<td>Intermediate</td>
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<td>Finishing</td>
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</table>
**Agency Perspective**

**RE’s Daily Check List**

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<thead>
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<th>Route</th>
<th>Job No.</th>
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<th>RE</th>
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</table>

- Record daily field diaries.
- Review IC Veta Project file submitted by contractor.
- Review IR segment report submitted by contractor.
- Transmit daily diaries to MoDOT SharePoint.

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
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<tbody>
<tr>
<td></td>
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</table>
Agency Perspective

IR and IC Equipment
Intelligent Compaction and Infrared Scanning

US24 Project Report

MoDOT Project No.: JIP3005

Submitted to

Missouri Department of Transportation
1617 Missouri Blvd.
Jefferson City MO 65102

By

The Transtec Group, Inc.
6111 Balcones Drive
Austin, Texas 78731
Agency Perspective

IR Data Analysis

- Low: 76
- Moderate: 20
- Severe: 4

Data Analysis Graph
Agency Perspective

IR & Paver Stops

IRI ALR

IRI ALR

Temperature (°F)

<table>
<thead>
<tr>
<th>Temperature (°F)</th>
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</thead>
<tbody>
<tr>
<td>350</td>
</tr>
<tr>
<td>325</td>
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MoDOT IC-IR Final Report

MoDOT Publication No. MODOT-17-NN
MoDOT Project TR201716/ TR201802

Intelligent Compaction and Infrared Scanning Field Projects with Consulting Support

Final Report

Submitted to

Missouri Department of Transportation
1617 Missouri Blvd.
Jefferson City MO 65102

December 2017

By

The Transtec Group, Inc.
6111 Balcones Drive
Austin, Texas 78731
IR Results - Good

Paving Dates

Percentage (%)

Low  Moderate  Severe

J5P3117  RT 52
IR Results - OK

Percentage (%)

Paving Days

Low  Moderate  Severe

J9P3161
RT 17
IR Results – Poor

J9P3296
RT 17

Surface Leveling Mix

Percentage (%)

Paving Dates

Low  Moderate  Severe
IR Segregation for All Projects

Average IR Segregation (%)

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Low Seg</th>
<th>Moderate Seg</th>
<th>Severe Seg</th>
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<tbody>
<tr>
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<tr>
<td>13</td>
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</tbody>
</table>
IR Segregation for All Contractors

![Bar chart showing the average IR segregation (%)](chart.png)

- **Contractor Code**: 1 to 8
- **Average IR Segregation (%)**
- **AVG % IR Low Seg**
- **Moderate Seg**
- **Severe Seg**
Outlooks in 2018

- IR-IC projects to be let
- Updated IR and IC Specs.
- 14 projects are targeted
- Additional Training
- Learning/Experiences
Industry Perspective

Contractor Perspective; Peter Moulton, Pike Industries; Maine
Contractor Perspective

Peter Moulton, Pike Industries

- MDOT Project WIN#023052.00 Fairfield/Skowhegan Cyclical Pavement Resurfacing
- 3/4” overlay with shim
- MOBA data made available by MDOT, Dale Peabody, Ulrich Amoussou-Gueno, Bruce Yeaton
- Pike Industries HMA placement
- ASMG project
Contractor Perspective

Getting Started:
1. Safety
2. Mounting equipment on paver.
3. Power to all pieces.
4. Setting the distance/DMI calibration.
5. Enter project information.
6. Start paving and collecting temperature data.
Small Section Data:

1. A & B minor thermal segregation.
2. Data area in a small section.
3. Speed and time charts.
4. Less than 25ºF variation.
Small Section Data, cont.:

A. Moderate thermal segregation:
   i. Major changes in temperature can be detected.
   ii. Variation less than 50°F but more than 25°F.
   iii. Paver slowed and stopped.

B. Severe thermal segregation:
   i. Speed of paver and time at any location are easily identified.
   ii. Variation more than 50°F.
   iii. Cold spot.
Project Data for a paving shift

- Trends are easily spotted
- Problem areas are easily spotted
- Number of times the paver stopped all day
- Different reports can be generated from data produced
Contractor Perspective

Trucking considerations
- MTV?
- Flow boys or dump trucks?
- Distance to the project.

Plant production considerations
- How many crews are lifting out of that plant?
- Weather forecast?
- Do we have production enough for continuous paving?

QC Considerations
- Are we making our own issues?
- Is compaction consistent?
- Are we following Best Paving Practices?
- Are we finding the information helpful?

Training/Decisions
- Have we taught the crew how to interpret the data?
- Do we know what to do if we see poor results?
- Have we taken the data and made any improvements?
- Demonstrating Best Practice will reflect consistency.
Contractor Perspective; Ed Dalrymple, Chemung Contracting; Virginia
To meet a uniform thermal reading the right equipment is necessary:

- Trucks with good beds.
- MTV’s with remixing capability, large enough to handle full loads 20 +/- tons,
- Follow me feature which allows paver and MTV works together.
- Paver Automation
Thermal readings showed the importance to assure that a continuous flow of material to the paver.

Adding trucks did not assure that supply, trucks by nature bunch or run in packs.

Added Fleetwatch GPS systems to trucks, set up Geo Fences to control stops on way to the paver.

Allowed for the implementation of e-tickets which assures the dump person will stay in place and monitors the movement of the paver.
Quality Control

- Uniform thickness is required to obtain uniform densities, ruts of 2” will not allow for uniform density.
- Use of incentives will encourage concentration of Quality standards.

Use of the right equipment to accomplish quality:
- Wider pavers eliminating joints
- Rollers that both vibrate and oscillate

Technicians that understand and guide speed and passes, as well as type of pass.
• Thermal imagining showed the need for a better understanding of all material properties & equipment abilities.
• Apprentice program developed by Germanna Community College, Virginia Asphalt Association and VDOT is used to meet those needs.
• Apprentices design mixes, operate and maintain plants, work in placing mix, & final testing. They are our future and they understand.

http://www.vaasphalt.org/program-of-study/
Contractor Perspective

Quality comes at a cost:

- Thermal imaging can offer better pavements, but it isn’t free.
- Incentives allow contractors to invest in equipment and people to obtain the incentive.
- Penalties result in contractors taking a defensive approach to avoid the penalty not maintain the quality.
R06C Technologies to Enhance QC on Asphalt Pavements

Ten 4-Hour Paver Mounted Thermal Profiler Workshops are Available to Agencies.

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kkurgan@aashto.org

FHWA: Steve Cooper
Tel: 443-257-7145
Stephen.J.Cooper@dot.gov

ARA: Joe Reiter
Tel: 217-356-4500
jreiter@ara.com
Part 6: Questions and Answers
Contacts for More Information:

- Stephen Cooper: Stephen.J.Cooper@dot.gov
- Kate Kurgan: kkurgan@aashto.gov
- Joe Reiter: jreiter@ara.com
- Harold Von Quintus: hvonquintus@ara.com

Websites:

- http://shrp2.transportation.org/Pages/R06C_RapidTechnologiesToEnhanceQualityControl.aspx