MISSOURI'S USE OF THE IR SCANNER

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Alabama Transportation Conference
February 9, 2017

Pave IR - Infrared Scanner
A System used to Map the Thermal Profile of Freshly Placed Hot Asphalt Pavement Directly Behind Paver.

Infrared Scanner
- Equipment
  - Travel/Speed Sensor
  - On-Board Monitor
  - Infrared Scanner
  - GPS Antenna
  - Mast Arm

How it Works

Thermal Profile
- A map of the Temperatures as they exist on the Surface of the Fresh Asphalt
- Color Coding Temperatures provides a Excellent Visualization of the Temperature Differentials

Example: Severe Thermal Segregation
2400 Feet of Roadway

Pave Project Manager
- Project Properties
Pave Project Manager
- Map Diagram

Easily Locate Areas of Concern

Pave Project Manager
- Speed Diagram

Pave Project Manager
- Temperatures

Real Time Information at the Plant or Anywhere

Interference
Interferences are automatically excluded by the program. Temperature Use Threshold 176 F
Report Summary

- Reports Thermal Segregation
- 150 Foot Profiles
- Currently Following Texas Standard 244-F
- Ignores High 1.5% & Low 1% Temps
- Masks out Paver Stops
  - 2 Ft before & 8 Ft After

Breakdown of Profiles

Sections Without Segregation

Sections With

Temperature Distribution

Mean: 301 °F
Median: 256 °F

Areas Above 350 °F

Summary of Locations with Temperature Exceeding 350 °F

1+ Minute Stops
eRoutes Website
- Download Site
- Facilitates Storage of the Data
- Details Each Data Set with Key Information
- Marks the Location of each Run on the Map

A Second Software Option
- Manages both IC and IR Data
- Continuously Being Improved through a Joint Pooled Fund

VETA
Available Free @
www.IntelligentCompaction.com

Veta Software
IR Temperature Data

Thermal Profile

Paver Stops
**Veta Analysis**

Option not to Remove Paver Stops

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**IR Scanner’s History**

- IR Scanner created by partnership with TTI, MOBA and TxDOT.
- TTI brought the concept of the infrared temperature bar to near maturity by 2007, designing it to collect, process and display thermal scans of a paving mat in real time.
- MOBA started working with TTI in 2008 and in 2009 put out their first version of a working PAVE-IR Bar.
- Texas included a optional provision in their Dec 2009 Letting which included a incentive for IR Bar usage.
- By early 2014 a prototype of the IR scanner was being tested.

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**MoDOT History with Scanner**

- Demoed Unit in Conjunction with the IC proof of Concept study on US 63 South of Columbia with APAC in 2014.
- In 2015 MoDOT acquired a unit through the SHPR 2 Implementation Program

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**Trial Project**

Route: I-29
Project: J112213
Contract: 141121-A01
Contractor: Herzog Contracting Corp.
Counties: Andrew, Buchanan
Project Office: Chillicothe

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**Field Visit by ARA**

- Part of the R06C Implementation Assistance Program
- Density Readings taken at both Hot and Cold Spots in the Mat
- Field Cores taken to correlated with Non-Nuclear Density Measurements
- The Consultant ARA will be completing a paper on findings from implementation.
Infrared Scanning Showcase

St. Joseph, MO
June 1, 2016

States Presenting
- Alaska
- Minnesota
- Texas
- Missouri

Field Visits included
- Asphalt Plant
- Paver

MoDOT Receives Accelerated Innovation and Deployment (AID) Grant

AID Grant Details
- Approximately $750k in grant funding—requires 20% match
- Incorporates Intelligent Compaction and Infrared Scanning in up to 10 projects
- Consultant to be hired to provide on-site evaluation during the IC/IR projects
- Technical Report

AID Grant Projects
1. MO 52, Morgan
2. I-29, Clay
3. I-70, Lafayette
4. US 36, Macon
5. US 24, Randolph
6. US 24, Chariton
7. MO 17, Texas
8. US 61, Jefferson
9. US 69, Daviess
10. MO 5, Cooper
11. MO 17, Texas
12. MO 1, Cooper
13. MO 1, Texas
Projects Require both...
Intelligent Compaction & Infrared (IR) Scanning

IR Requirements
- Submittals (by Contractor)
- Daily MOBA IR Segment Report
- Mandatory Training (MoDOT Provided)
- Initially $5 Incentive/Disincentive per 150 Feet of Lane.
- Pay Item Included

IR Scanner Costs
Infrared Scanner Equipment Cost ~ $32,000
Annual Cloud Data Transfer Cost ~ $1,500

IR Scanner Costs
Contract Costs (Statewide Startup)

<table>
<thead>
<tr>
<th>Total Contracts</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cost</td>
<td>$264,059.81</td>
</tr>
<tr>
<td>Average Cost per Project</td>
<td>$20,312</td>
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<tr>
<td>Approximate Price per Ton</td>
<td>$1 per Ton</td>
</tr>
</tbody>
</table>

Advantages
- Thermal Profile available in real-time on site to facilitate trouble shooting

Advantages
Profile ranking available at the completion of each 150 foot segment
Provides a Incredible Daily Record

The Results
Infrared Scanning
- Surface Temperature behind paver develops a Thermal Profile.
- Incentive / Disincentive
- Identify and Reduce Thermal Segregation

Missouri is using both IR and IC Together

Intelligent Compaction
The Roller
- GPS Antenna
- Onboard Monitor
- Temperature Sensors
- Accelerometer
- Vibratory Resistance

The Results
Intelligent Compaction
- Optimum Pass Count
- % Coverage at Optimum Pass Count
- Incentive / Disincentive
- Resistance of Underlying Material
- Areas Needing More Effort
- Compaction Surface Temperature

The Combined Results
Complete Mapping
- No Longer Relying on Statistical Evaluation from a Single Core
- Real-time Quality Control Tool

Moving Forward
- Correlate Field Performance to Specification
- Evaluate
  - Report Findings
  - Job Special Provision

Roller Pass Coverage
Thermal Profile
Moving Forward

- Lead to Performance Based Specification
- Sec 403 First (SMA, Superpave)
- Anticipating Expansion in 2018
  - Larger Group of Projects
  - Potentially Rework Density Requirement Structure
    - Reduction in Coring

Thank You