INTELLIGENT PAVING SPEC & PROJECTS

59th Annual Asphalt Contractors’ Workshop / MN Quality Initiative Workshop

Rebecca Embacher

February 19, 2015
IMPLEMENTATION
TIME LINE
Thermal Profiling and Intelligent Compaction
Advancement of Technologies is increasing accountability of both the Agency and Contractor

Implementation of New Technologies

- ↑ Life of Pavements
- ↓ Annual Maintenance Costs
## New Technologies

<table>
<thead>
<tr>
<th>Technology</th>
<th>QC</th>
<th>QA</th>
<th>Deployment</th>
<th>Piloting / Development</th>
<th>Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intelligent compaction</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermal Profiling</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intelligent Construction Data Monitoring System (Veda)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Digital Test Roller (Ames Compaction Test Rolling Device)</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>3D Production Monitoring System (3D-PMS) – Muck Excavation</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Ground Penetrating Radar</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>
Percent of MnDOT Projects meeting project selection requirements.

- **2014**: (10%)
- **2015**: (10-15%)
- **2016**: (40-50%)
- **2017**: (50-75%)
- **2018**: (100%)
Applications

- Intelligent Compaction (IC) is recommended for use with 2353, only when used in conjunction with 2360

<table>
<thead>
<tr>
<th>Technology</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intelligent Compaction (IC)</td>
<td>2211, 2215, 2331, 2353*, 2360, 2365</td>
</tr>
<tr>
<td>Paver Mounted Infrared Thermal (PMIT) System</td>
<td>2360, 2365</td>
</tr>
</tbody>
</table>

- *IC is recommended for use with 2353, only when used in conjunction with 2360

≥ 8 Lane Miles

Cellular Coverage (at least one time per day)
Thermal Mounted Infrared Temperature System is recommended for use in conjunction with IC on Asphalt Pavement Applications
- Geospatial Coverage
  - 100% Global Navigation Satellite System (GNSS) Coverage within project limits.
    - Intelligent Compaction: ± 2 inches Horizontally
    - Paver Mounted Infrared Temperature System: ± 4 feet Horizontally
**Department will complete QA on Summary Reports**
Randomly review production days.
- 10% of total number of production days requiring technology, or
- Minimum of 2 randomly selected days, whichever greater.

**OMRR – MnDOT Office of Materials and Road Research**
Veda

Intelligent Compaction – All Current Vendors

Paver Mounted Infrared Temperature System – Scanning System & Static Bar

Future Imports: GPR, Smoothness (ProVal Export), Digital Test Rolling

QC / QA Spot Tests
April 7th – Full day IC workshop in Shoreview, MN. (Arden Hills Training Center)
April 8th - Half-day equipment demonstration in Maplewood, MN.
(Office of Materials and Road Research)

Either one, or both days may be attended.

This training is intended for those who are ready to implement Intelligent Compaction (IC). The workshop will familiarize attendees with intelligent compaction technologies and Veda software. Hands-on software training is provided. The second day includes IC equipment demonstration.

Presented by the FHWA Intelligent Compaction Technical Support Service Center.

Registration and details:
http://www.dot.state.mn.us/materials/icdmwshop.html
Online Training Course for Veda

- Awarded Funding
- Working on Contract
- Scheduled Length = 6 months
WEBSITE
Advanced Materials and Technology
Advanced Materials & Technology (AMT)

Methods
- Intelligent Compaction
- Paver Mounted Infrared Temperature System for Thermal Profiles
- 3D Production Monitoring System
- Digital Test Rolling

Misc
- Advanced Materials and Technology Manual (10/31/2014)
- Implementation Schedule
- 2015 Projects

Intelligent Construction Data Management (ICDM) System
- Veda (stores, maps, and analyzes geospatial data)
- Pooled Fund Solicitation 1381 Enhancements to Intelligent Construction Data Management System (Veda) and Implementation

http://www.dot.state.mn.us/materials/advancedmaterialsandtechnology.html
- Definitions
- Check Lists
- Best Practices
PAVER MOUNTED INFRARED TEMPERATURE SYSTEM

2015 Specification Changes
Approval of Paver Mounted Infrared Temp. System

- No longer required, but recommended
- AMT Manual Section 4.3
  - Calibration of GNSS Accuracy
  - Calibration of Infrared Temp. Sensor(s) Accuracy
  - Calibration of DMI Accuracy

Photo Courtesy of Moba Corporation
Field Review of Thermal Profiles by Department

- AMT Manual Section 4.4
- Recommend review of profiling data and/or thermal summary on the system display:
  - First 100 Tons of Production
  - About 1,000 ton intervals, thereafter, for each day of production

Images Courtesy of Moba Corporation
(S-xx.4.G.1) 2015 Analyses using Veda
– Affects Monetary Price Adjustments
  • Thermal Segregation
  • Project Percent Coverage

<table>
<thead>
<tr>
<th>File</th>
<th>Date</th>
<th>Time</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>256°F</td>
<td>18633.5E</td>
<td>0.000000000°E, 0.000000000°N</td>
<td>374.34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>253°F</td>
<td>18706.0E</td>
<td>0.000000000°E, 0.000000000°N</td>
<td>374.34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>255°F</td>
<td>18706.0E</td>
<td>0.000000000°E, 0.000000000°N</td>
<td>374.34</td>
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<td></td>
</tr>
</tbody>
</table>

25% of Files of one 2014 project!
Evaluate thermal segregation using 100% of data.

- Lower GNSS accuracy – prevent mass filtering/cleaning of data
- Ensure measurements are not capturing shoulders, turn lanes, adjacent pavement.
(S-xx.3.B) Ensure that no brackets, or other obstructions are located in the measurement area.
More Detailed Clarification of Thermal Segregation Calculations

- **S-xx.3.G.2.a** 150-ft sublots
- **S-xx.3.G.2.b** Excludes temperatures < 180°F
- **S-xx.3.G.2.c** Exclude thermal profile data with 2 ft prior to and 8 ft after paver stops greater than 1 min. in length
S-xx.3.G.2.d-e  Exclusion of data less than 1 percentile and greater than the 98.5 percentile
S-xx.3.H.1 Monetary Price Adjustment – Thermal Coverage

No longer connected to lump sum payment (2016.601 Quality Management – Lump Sum).

<table>
<thead>
<tr>
<th>Thermal Coverage (%)</th>
<th>Total Price Adjustment Per Lift</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 70</td>
<td>No Price Adjustment</td>
</tr>
<tr>
<td>&lt; 70</td>
<td>Total Price Adjustment (Deduct) = (20 × TC – $1500) × (LM)</td>
</tr>
</tbody>
</table>

where:
TC = Thermal Coverage for given lift, %
LM = Total Number of Lane Miles for the given lift, miles

(this value includes the driving lanes of the paving operation where use of the PMIT system is required)
INTELLIGENT COMPACTION

2015 Specification Changes
2015 Construction Season

- Use of County Coordinate System File and Geoid Model for Site Calibration
- Alternating Control Points placed for one more season.
Reference name of the **Material**, **Lift**, and **Lane** currently being compacted.

- Asphalt Pavement Surface/Wear Course *(Layer ID = HMA L2SB)*
- Asphalt Pavement Base Course *(Layer ID = HMA L1SB)*
- Base *(Layer ID = Pre-grind NB, SFDR-NB, CL5NB, CL5SB)*
- Subbase *(Layer ID = Select Granular)*

Example: Trimble’s System
Effects of Incorrect Layer IDs on Roller Coverage

Project Percent Coverage (PPC), %

- Incorrect Layer IDs
- Actual
All rollers are required to be instrumented.

Instrumented rollers are required for all compaction efforts.
## S-x.3.C.2 Measurement Passes

### Table S-xx.5

<table>
<thead>
<tr>
<th>Specification</th>
<th>Measurement Pass Location</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Subbase</strong></td>
<td>All roller passes on the Top of Subgrade. (When the depth is within 6 ft (2 m) of Grading Grade.)</td>
</tr>
<tr>
<td>2105 / 2106</td>
<td>All roller passes on final Grading Grade Lift.</td>
</tr>
<tr>
<td><strong>Bases, CIR</strong></td>
<td>All roller passes on each Lift.</td>
</tr>
<tr>
<td>2211, 2215, 2331</td>
<td></td>
</tr>
<tr>
<td><strong>Asphalt Pavement</strong></td>
<td>All roller passes on each Lift.</td>
</tr>
<tr>
<td>2353, 2360, 2365</td>
<td></td>
</tr>
</tbody>
</table>

100% Mainline including Control Strips
S-x.3.G Monetary Price Adjustment – Roller Coverage

No longer connected to lump sum payment (2016.601 Quality Management Special – Lump Sum).

<table>
<thead>
<tr>
<th>Roller Coverage (RC) (%)</th>
<th>Total Price Adjustment Per Lift</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 70</td>
<td>No Price Adjustment</td>
</tr>
<tr>
<td>&lt; 70</td>
<td>[= (20 \times RC - $1400) \times (LM)]</td>
</tr>
</tbody>
</table>

where:
- PPC = Project Percent Coverage, %
- LM = Total Number of Lane Miles for the given lift, miles
  (this value includes the driving and auxiliary lanes of the paving/grading operation where use of the IC system is required)
Questions?

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