PennDOT District 11

Best Practices and Innovations
August 1, 2018

Doug Thompson, P.E.
Acting Assistant District Executive
Construction Division
Agenda

- Dual Paving
- District 11 SMA Projects
- #8 Stone/Milling Exchange
- 19mm High RAP Paving
- e-Ticketing
- Long Life Asphalt Pavement
- Hands On Local Acceptance
- 6.3mm Thin Overlay Projects
- SR 28 Pavement Design
Dual Paving

We try to utilize dual paving as much as possible in District 11 as long as it’s feasible with MPT.
Stone Matrix Asphalt (SMA)

- 2012:
  - ECMS #75908, SR 79 Section A54, Allegheny County, placed 126,017 SY
- 2015:
  - ECMS #87746, SR 79 Section A59, Allegheny County, placed 186,426 SY
- 2016:
  - ECMS #28397, SR 51 Section A87, Allegheny County, placed 151,678 SY
- 2017:
  - ECMS #28587, SR 376 Section A49, Allegheny County, placed 285,119 SY
- 2018:
  - Completed
    - ECMS #105446, SR 4003 Section A23, Allegheny County, placed 100,586 SY
  - Ongoing
    - ECMS #88438, SR 19, Section A72, Allegheny County, placing 54,173 SY
    - ECMS #110594, SR 376 Section A64, Allegheny County, placing 221,951 SY
PennDOT District 11

Jason Zang, P.E.
Acting Principal Assistant Construction Engineer
• Utilizing market value/competition

• No. 8 Type A SRL=H stone or/blended with recycled No. 8 delivered in exchange for millings.

• Delivered to department sites for use with chipping crew

• Cost of $23.32/ton contract vs $38.86/ton virgin

• Savings of $220,046 in 2018
#8 Stone

- 2017 used approximately 10,495 tons of #8’s
- Returned approx. 31,500 tons of millings

- 2018 estimated around 14,160 tons of #8’s
- Returned approx. 29,700 tons of millings
19mm High Rap Paving

High Rap utilized in base repair and paving/overlay projects around county
19mm High Rap Paving Summary

- 19mm binder mix, PG 64-22, .03 to <3.0 million ESALS design

- Broken into three parts of department pickup, vendor delivery, and vendor delivery with millings haul
<table>
<thead>
<tr>
<th>State Route</th>
<th>Tonnage</th>
<th>Mileage</th>
</tr>
</thead>
<tbody>
<tr>
<td>51</td>
<td>1,200</td>
<td>3.0</td>
</tr>
<tr>
<td>3057</td>
<td>1,768</td>
<td>4.4</td>
</tr>
<tr>
<td>3078</td>
<td>3,080</td>
<td>7.7</td>
</tr>
<tr>
<td>3080</td>
<td>208</td>
<td>.5</td>
</tr>
<tr>
<td>3089</td>
<td>1,888</td>
<td>4.7</td>
</tr>
<tr>
<td>3109</td>
<td>40</td>
<td>.2</td>
</tr>
<tr>
<td>4021</td>
<td>900</td>
<td>2.3</td>
</tr>
<tr>
<td>4027</td>
<td>25</td>
<td>.1</td>
</tr>
<tr>
<td>4039</td>
<td>4,600</td>
<td>7.8</td>
</tr>
<tr>
<td>4041</td>
<td>1,000</td>
<td>2.5</td>
</tr>
<tr>
<td>4049</td>
<td>10</td>
<td>.1</td>
</tr>
<tr>
<td><strong>12 Total Routes</strong></td>
<td><strong>14,719 tons</strong></td>
<td><strong>33.3 Miles</strong></td>
</tr>
</tbody>
</table>

Routes split between Pine Creek and Findlay sections
• Virgin cost of $52.4/ton
• Rap cost of $39.97/ton
• Average savings of $12.43/ton

• 2018 total cost saving of $180,246.16
PennDOT District 11

Brian Myler, P.E.
District Materials Engineer
Why Electronic Tickets?

• Eliminate paper tickets
• No more lost tickets
• Provide materials and tonnage verification
• No time-consuming ticket sorting
• Quickly summarize tickets for contractor payments
• Reduce worksite hazards
• Ticket information is now “data” for potential future use and analysis
Why GPS Tracking?

Information can be used for analysis and forensics of vehicle’s location at various times throughout its trip

For instance:

- Designed to reduce costs associated with over-trucking or under-trucking
- Eliminate bottle-necks at paver and/or Plant
- Hold drivers accountable for performance and production
- Optimize cycle times – move more tonnage
- Virtual shift tickets to automate payroll processes
- Scales integration to help with job costing / future bidding
- Alerts / Notifications to management when benchmarks fall outside of norm
- Track paver speed for production
Electronic Ticketing Pilots

- In 2017, District 11 Piloted e-Ticketing on 4 Group Roadway projects in Allegheny County.
- The District’s Special Provision included:
  - e-Ticketing
  - GPS Tracking
- Another Special Provision was also added for tracking the delivery of milled materials to a specified plant or stockpile site.
Special Provisions Overview

• GPS tracking of all equipment associated with paving and milling operations

• Full GPS integration with plant scale system

• Ability to measure and track material from plant to final placement destination

• Provide the data real-time with a web-based system compatible with iOS and windows environments
### 2017 District 11 Pilot Projects

<table>
<thead>
<tr>
<th>Project</th>
<th>Contractor</th>
<th>Plant</th>
<th>eTicket Management System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allegheny Group 1</td>
<td>A. Folino Construction Inc.</td>
<td>Lindy Paving Inc.</td>
<td>Earthwave Technologies: Fleet Watcher</td>
</tr>
<tr>
<td>Allegheny Group 2</td>
<td>A. Liberoni, Inc</td>
<td>Lane Construction Corp.</td>
<td>Zonar GPS System / Libra Systems e-Ticketing</td>
</tr>
<tr>
<td>Allegheny Group 3</td>
<td>A. Folino Construction Inc.</td>
<td>Lindy Paving Inc.</td>
<td>Earthwave Technologies: Fleet Watcher</td>
</tr>
<tr>
<td>Allegheny Group 4</td>
<td>Tresco Paving Corp.</td>
<td>Tresco Asphalt Supply Co.</td>
<td>Earthwave Technologies: Fleet Watcher*</td>
</tr>
</tbody>
</table>

*Manual eTicketing for an offline plant.*
FleetWatcher Features

- GPS and Ticketing all in one system.
- System is fully integrated with the Asphalt Plant
- Ticket data is available in a CSV file format
Fleet Watcher Feedback

• Benefits
  – Easy to set-up
  – Data can be used as trucking payroll
  – Real-time fleet monitoring/driver behavior
  – Fleet optimization potential
  – Milling operations much safer

• Issues
  – Erroneous truck readings when dual paving
  – Difficult to identify material sample locations
  – Asset numbers difficult to locate on trucks
  – Constant coordination with GPS unit if owner/operator outfit employed
  – Scale integration not possible for “off-line” plants
• The Group 4 Project supplier had a Windows 98 offline computer system to manage the ticketing process.
• This did not allow for the automated ticketing in the Fleet Watcher System.
• To solve this issue, the ticket information was loaded on a flash drive and then downloaded onto an online computer to load into Fleet Watcher.
• This was done at the end of the shift.
Zonar GPS and Libra e-Ticket Features

- Zonar is the GPS tracking system
- Libra is the ticketing system at a Lane Plant
- Ticket data available in a CSV file format
**Zonar GPS and Libra e-Ticket Feedback**

- **Benefits**
  - Web based access to both systems.
  - Tickets are never lost, ticket is always accessible.
  - Much safer during Paving and Milling operations.
  - Ability to know when trucks are loaded and current location.

- **Issues**
  - Difficult switching back and forth between the two separate systems.
  - Broker Trucks difficult to manage GPS units.
- 3 Group Paving Projects in Allegheny County

- These will include a few modifications to the special provision
  - Better vehicle identification
  - Consider appropriate asset management when dual mill or paving operations take place to insure vehicles appropriately register in the appropriate zone.
  - Each delivery ticket must allow an available space for inspectors to add information pertaining to material waste, temperature, stations, yield results and other comments. The entered information must also identify the users name.
  - At completion of the project, provide all ticket information in an acceptable electronic data file to the Department.
• MTV Required
• Longitudinal Joint Density Specification
• **RIDE SPECIFICATION OPTIONAL**
• Tack Coat Every Layer (New Section 460)
• % **WITHIN TOLERANCE (PWT) ACCEPTANCE**
• **INCENTIVIZE CRITICAL ELEMENTS (I.E. MAT DENSITY)**
• **PERFORMANCE TESTING**
LLAP Performance Tests

- Disk-Shaped Compact Tension (DCT) Testing
- Semicircular Bend (SCB) Testing
- Semicircular Bend at Intermediate Temperature (SCBIT) Testing
- Texas Overlay Testing
- Rutting Susceptibility Testing
Long Life Asphalt (LLAP)

SR 279 – A83

TRUMBULL
SR 279-A83

- Contract Cost: $87,947,686.73
- Total Tonnage – 185,000 Tons
- PWT-HOLA ~ 74 Lots
  - Binder Course – 2 ½”
  - SMA Wearing Course – 1 ½”
- Performance Testing of Proposed Mix Designs (*For Information Only*)
- Performance Verification Sampling (*For Information Only*)
  - Only testing 2 lots – one last season and one this season
• PWT-HOLA - 12 Lots
• Performance Testing for acceptance
  – SMA Wearing Course – 1 ½" Depth
• Performance Verification Sampling
  – 2 additional cores per sublot as per spec
  – 120 additional cores!
• Planned Usage
  – SR 28-A55 – Planned Let: 11/2/17
• Contract Cost: $18,385,803.42
• Total Tonnage = 39,318 Tons
• PWT-HOLA - 12 Lots
  – SMA Wearing Course - 1 ½” Depth
• Performance Testing Includes:
  – Proposed Mix Designs
  – Testing for acceptance
• Performance Verification Sampling
  – 2 additional cores per sublot as per spec
  – 120 additional cores!
  – Tests performed changed to just DCT, I-FIT, Hamburg
Planned Usage Moving Forward

SR 28-A55
Let: 11/2/17
Contract Cost: $34,342,898.65
Total Tons = 150,663 Tons
Lessons Learned

• Field Perspective:
  – Performance samples should not be taken at same location as acceptance cores
  – Care must be taken to keep cores organized and logged (Station/offset)
Lessons Learned

- Lab Perspective:
  - Conditioning time for DCT should be minimum needed to make plug
  - 25mm is not applicable to these tests
  - With 10 cores per lot, it is hard to perform all tests called out for in spec due to possible invalid tests requiring
  - Give yourself time during mix design phase to perform tests
Pros

• Potential to provide a more balanced mix design.
• Potential to give producers more flexibility in the mix design process
• Currently, high number of samples need to be taken
• Potential for error in documentation is high due to number of samples
• Number of testing facilities able to perform necessary tests is currently low – Long lead times
• Insufficient time to perform additional up-front mix design changes and performance testing
Hands-on Local Acceptance (HOLA)

• Performing local acceptance since 2004

• Advantages
  – Results are available 5 to 6 days sooner
  – More control on what to test
    • We’re able to prioritize the more critical lots
    • This helps maintain quality on the project and also to keep it on schedule.
Hands-on Local Acceptance (HOLA)

- 2017 Statistics
  - Total Lots – 131
  - Staff
    - 2 TCIs at Lindy – Full Time (April-November)
      - SR 279 A83 – 88,000 Tons
      - SR 376 B09 – 39,318 Tons
      - McKnight Road – 31,985 Tons
      - Perry Highway – 42,336 Tons
    - 1 TCI at Lane – Part Time (April-November)
      - SR 65 A53
      - SR 65 B30
  - Two days per lot
Hands-on Local Acceptance (HOLA)

- **2018 Projects (110 Lots)**
  - SR 279 A83
  - SR 65 B30
  - SR 28 A55

- **100% HOLA Projection**
  - 741,522 Tons
  - Approximately 300 Lots
  - April-November
    - 4 TCIs
6.3 mm thin overlay

• 2013:
  – SR 376 Beaver County, placed 165,500 SY @ ¾” thick

• 2014:
  – SR 79 Allegheny County, placed 258,600 SY @ ¾” thick

• 2016:
  – SR 4009 Allegheny County, placed 1,400 SY @ 1” thick

• 2019:
  – SR 376 Allegheny County, 70,000 SY planned @ 1” thick
SR28 A55 Pavement Design Solution

- 13.7 Miles of 1984 Reinforced Concrete Pavement
  - 2009 CPR
  - 2004 CPR
• CBR
### SR28 A55 Pavement Design Solution

#### Scope?

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patch &amp; Overlay</td>
<td>$30,000,000</td>
</tr>
<tr>
<td>Break &amp; Seat/Rubbilization</td>
<td>$35,000,000</td>
</tr>
<tr>
<td>Unbonded Concrete Overlay</td>
<td>$50,000,000</td>
</tr>
<tr>
<td>Reconstruction</td>
<td>$53,000,000</td>
</tr>
</tbody>
</table>
• Patch & Overlay
  – Complex joint pattern
    • Difficult to match underlying joints with sawcut.
    • Subsequent projects have increasing likelihood of missed sawcuts.

• Break & Seat/Rubbilization
  – Resolves complex joint pattern problem.
  – Saves money versus reconstruction.
### Rubbilization

- Recommended for reinforced concrete
- NOT recommended for poor subgrade
- Increased construction variability
  - Fail proof-roll
  - Exposed rebar must be removed
- More expensive ($4/SY)
- Weaker structure

### Break & Seat

- Not recommended for reinforced concrete
- Less affected by poor subgrade
- Less to go wrong during construction
- Less expensive ($2/SY)
- Stronger structure
SR28 A55 Pavement Design Solution

- Original estimate was based on C&S w/ 6” bituminous overlay
- Pub 242 wants a **16.5” bituminous overlay**!

<table>
<thead>
<tr>
<th>Existing Materials to be Overlaid</th>
<th>Layer Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cement Concrete (Good condition, &lt; 5% patching)</td>
<td>0.40</td>
</tr>
<tr>
<td>Cement Concrete (Fair condition, &lt; 10% patching)</td>
<td>0.30</td>
</tr>
<tr>
<td>Cement Concrete (Failed - no patching or &gt; 10% patching)</td>
<td>0.25</td>
</tr>
<tr>
<td>Cracked/Break and Seated Cement Concrete</td>
<td>0.25</td>
</tr>
<tr>
<td>Bituminous Concrete</td>
<td>0.30</td>
</tr>
<tr>
<td>Cold Recycled Bituminous Concrete</td>
<td>0.30</td>
</tr>
<tr>
<td>Full Depth Reclamation</td>
<td></td>
</tr>
<tr>
<td>Pulverization</td>
<td>0.11</td>
</tr>
<tr>
<td>Calcium Chloride and similar additives</td>
<td>0.14</td>
</tr>
<tr>
<td>Asphalt Stabilization</td>
<td>0.25 - 0.30</td>
</tr>
<tr>
<td>Chemical Stabilization</td>
<td>0.32 - 0.35</td>
</tr>
<tr>
<td>Scarified Bituminous Concrete</td>
<td>0.14</td>
</tr>
<tr>
<td>Brick with Rigid Base</td>
<td>0.40</td>
</tr>
<tr>
<td>Brick with Flexible Base</td>
<td>0.20</td>
</tr>
<tr>
<td>Crushed Aggregate Base Course</td>
<td>0.14</td>
</tr>
<tr>
<td>Crushed Aggregate Base Course, Type DG</td>
<td>0.18</td>
</tr>
<tr>
<td>Miscellaneous Existing Materials (CP-2, AT-1, HEs, Oil Bond Stone, Bit. Road Mixes)</td>
<td>0.20</td>
</tr>
<tr>
<td>Subbase; New Construction, Reconstruction, or Existing to be Overlayed*</td>
<td></td>
</tr>
<tr>
<td>Open Graded Subbase</td>
<td>0.11</td>
</tr>
<tr>
<td>No. 2A Subbase</td>
<td>0.11</td>
</tr>
<tr>
<td>Asphalt Treated Permeable Base Course (ATPBC)</td>
<td>0.20</td>
</tr>
<tr>
<td>Cement Treated Permeable Base Course (CTPBC)</td>
<td>0.20</td>
</tr>
<tr>
<td>Rubblized Cement Concrete</td>
<td>0.20</td>
</tr>
</tbody>
</table>

AASHTO 93 suggests layer coefficient between 0.20 to 0.35
Overlay thickness **16.5”** to **13.5”**
SR28 A55 Pavement Design Solution

- Other help
  - Frost heave
  - Subgrade Resilient Modulus adjustment
    - CBR*1500 instead of CBR*1000
    - Lab testing showed in-situ density similar as that used for CBR test

- 8.5” Bituminous Overlay

Is this going to be OK???
• Overlay thickness?
  - NAPA Rubbilization Design Guide

8.0”
SR28 A55 Pavement Design Solution

- Break and seat on reinforced concrete?
  - Illinois SR 97, reflective cracking survey of 3” bituminous overlay of reinforced concrete pavement

![Graph showing distance between cracks over time for different overlays.]
SR28 A55 Pavement Design Solution

- Initial:
  - C&S w/16.5” Bituminous Overlay; Cost est. $50,000,000

- Actual:
  - C&S w/8.5” Bituminous Overlay; Cost act. $35,000,000

$15 Million DIFFERENCE
Structural Coefficient
Break & Seat
Subgrade Modulus Correlation