PennDOT Longitudinal Joint Density Efforts

February 5, 2014

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PennDOT’s History at Joints

- In 2006, PennDOT specs required joints to be constructed according to a QC plan
- Many QC plans silent about joints
- No measurement of joint density
- Joint quality usually judged by smoothness across the joint
- Some performance issues
But, even visually good joints can bite!!!
Joint Issues in Past
Very costly solutions

By doing this.

How much longer would the road have lasted with a good joint?

Fixing this...
History of PA Joint Density Effort

- Pennsylvania began an effort to improve joint density in 2006-07 with study
- Began measuring joint density in 2007 directly on the joint
- Adopted a best practices (method spec) approach for 2008 construction
History of PA Joint Density Effort

• >1% increase in density in 1st year alone
• More was hoped for 2009 once everyone was comfortable with the new process

<table>
<thead>
<tr>
<th>Year</th>
<th>Density Lots</th>
<th>Avg. Joint Density</th>
<th>Avg. Roadway Density</th>
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<td>2007</td>
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History of PA Joint Density Effort

- Slight increase in 2009 less than hoped
- By end of 2009 looking for higher density

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Keeping water out of our joints

• Most research suggested that
  ➢ densities should be about 92% to minimize permeability
  ➢ Joint densities below 89 to 90% had an exponential increase in permeability

• Bottom line, we needed better joint density that we were achieving on many of the projects
Joint Density Incentive/Disincentive

• For 2010 PennDOT began looking to an end result joint density specification
  o Financial incentive for high density
  o Financial disincentive for low density
  o Contractor innovation to provide optimal joint densities (contractor chooses construction method)
How we sample joints

- The maximum theoretical specific gravity (Gmm) for each core is the average of Lane 1 and Lane 2.
Project Selection Criteria

Density Specification for:

- Surface courses
- RPS pavements (PA’s highest level of projects)
- National Highway System
- 12,500 feet of testable joint
- Pavement on both sides of joint must be cored
Cores cut directly on finished joints every 2500 ft.

1 Lot = five joint cores (12,500 ft)

Maximum Dollar Amounts
- Incentive = $5,000/lot
- Disincentive = $10,000/lot
Graphic Illustration of PWT

Lower Spec Limit = 90% Gmm

Started at 89% lower spec limit, raised to 90% current
Impact on Lot Payment Summary

-$10,000

Disincentive

No Pay Adjustment

Incentive

+$5,000

Full bonus for lots with average density ≥ 92.0%
Corrective Action

- Lots with avg. density < 88% Gmm require corrective action
- Contractor must seal the joint with PG 64-22 at no cost
- Very few lots require corrective action
Contractor Innovation

Tandem pavers for a hot joint
Contractor Innovation

Vibrating Wedge Maker

Density QC Testing of Joint
## Longitudinal Joint Data Summary

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<tr>
<td>2010</td>
<td>No data, transition to PWL spec.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>137</td>
<td>91.1%</td>
<td>94.1%</td>
</tr>
<tr>
<td>2012</td>
<td>162</td>
<td>91.6%</td>
<td>94.0%</td>
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<tr>
<td>2013</td>
<td>168</td>
<td>91.4%</td>
<td>93.9%</td>
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Data analysis from 2011 - 2013
Warm Mix vs Hot Mix

2011-Present Cores

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Average Joint Density

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Mix Size and Type

Cores

- 9.5mm: 1434
- 12.5mm: 679
- GG/SMA: 195

Average Joint Density

- 9.5mm: 91.1%
- 12.5mm: 91.6%
- GG/SMA: 92.2%
• 1,082 linear miles of joint tested
• 2,285 joint core samples
• 161 total projects
• 3.6% increase in joint density from outset
• Approx. $1,000 per mile
Why Joint Density?

- Lower permeability reduces chance for moisture damage
- Higher density reduces the permeability of the pavement in place.
Joint Density Spec. Impacts

- Improved density is expected to lead to better long term performance
- Anticipated lower maintenance costs
Questions?