2015 Ohio Transportation Engineering Conference
Columbus, OH

SS806 – Asphalt Concrete with Joint Density for Multi-Lane Highways
Craig Landefeld, P.E.
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Are you $#@!-ing crazy!!

• Why Change?
• Research
• SS806 Highlights
• 2014 Data
• Trial Projects
Why SS806?

- Longitudinal Joint Deterioration
Why SS806?

- Longitudinal Joint Deterioration
Why SS806?

- Slot Paving is $$$ Expensive $$$
  - $35-60k / Mi. of joint
  - On Avg. 2yrs before Resurfacing
Air Voids (AV) are the single most important property of an asphalt mixture.

- In-place AV = 3 to 8%
- Permeability increases rapidly as AV > 8%

Figure 4. Relationship between air voids and permeability in Georgia Study (after Brown, Collins, and Brownfield).
NCAT Report 02-03

- 6yr Evaluation of different joint construction types.
- Joint Adhesive and Cut-back performed best.
- Recommend Spec Joint Density = Mat - 2%
- Take cores centered on joint.

Table 1. Summary Statistics for Density and Air Voids of Cores Taken at the Joint and Away From the Joint

<table>
<thead>
<tr>
<th>Section No. and Joint Type</th>
<th>Density at the Joint, kg/m³</th>
<th>Air Voids at the Joint, Percent</th>
<th>Air Voids* 305 mm (12 in) Away From the Joint on Cold Side</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>Std. Dev.</td>
<td>Mean</td>
<td>Std. Dev.</td>
</tr>
<tr>
<td>1. Joint maker</td>
<td>2252</td>
<td>23</td>
<td>9.2</td>
</tr>
<tr>
<td>2. Rolling From Hot Side</td>
<td>2224</td>
<td>36</td>
<td>10.3</td>
</tr>
<tr>
<td>3. Rolling From Cold Side</td>
<td>2248</td>
<td>59</td>
<td>9.3</td>
</tr>
<tr>
<td>4. Rolling from Hot Side 152 mm Away</td>
<td>2233</td>
<td>32</td>
<td>10.0</td>
</tr>
<tr>
<td>5. Cutting Wheel</td>
<td>2264</td>
<td>53</td>
<td>8.7</td>
</tr>
<tr>
<td>6. Edge Restraining Device</td>
<td>2289</td>
<td>45</td>
<td>7.7</td>
</tr>
<tr>
<td>7. Rubberized Joint Material</td>
<td>2160</td>
<td>38</td>
<td>12.9</td>
</tr>
<tr>
<td>8. New Jersey Wedge 3:1</td>
<td>2113</td>
<td>54</td>
<td>14.8</td>
</tr>
</tbody>
</table>

* Based on Theoretical Maximum Density (TMD) of 2480 kg/m³
Asphalt Institute
Longitudinal Joint Workshop

Various Approaches

No LJ Spec
- High Agency Risk
- No Incentive for Quality

Method Spec
- One size fits all
- Agency assumes some risk
- No Incentive for Innovation
- Requires on-site oversight by agency

Density Spec
- Allows innovation for contractor
- Balances risk, includes incentives & disincentives
- May have triggers (i.e. sealing/overbanding
- Not appropriate for small jobs
Various Research Projects on Critical Air Void Level for Permeability

<table>
<thead>
<tr>
<th>Mix Size</th>
<th>Researcher(s)</th>
<th>Institution</th>
<th>Year</th>
<th>Critical Void Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.5 mm Mixes</td>
<td>E. Zube</td>
<td>California Dept. of Highways</td>
<td>1962</td>
<td>8.0</td>
</tr>
<tr>
<td></td>
<td>L. Cooley, B. Prowell, R. Brown</td>
<td>NCAT</td>
<td>2002</td>
<td>7.7</td>
</tr>
<tr>
<td>12.5 mm Mixes</td>
<td>B. Choubane, et al</td>
<td>Florida DOT</td>
<td>1998</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>J. Westerman</td>
<td>Arkansas HTD</td>
<td>1998</td>
<td>6</td>
</tr>
</tbody>
</table>
Proposed Acceptance Criteria for an LJ Density Spec

Six-inch Cores located either directly over visible joint for butt joint, or middle of wedge for wedge joint. This gives a 50/50 split, in order to average the $G_{mm}$ of both lots.

- $> 92\%$ of $G_{mm}$: maximum bonus
- Between $92\%$ and $90\%$ of $G_{mm}$: 100% pay, pro-rated bonus, need to “overband” or “surface seal” joint
- $< 90\%$ of $G_{mm}$: reduced payment, overband or surface seal joint
Why SS806?

- Why is 446 not enough??
  - 2013 coring research – 4% avg. density drop in 4”
  - 446 Joint cores are not adequate.

![446 Joint Core Diagram](image)
Why SS806?

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  - 446 Joint cores are not adequate.
## PA: How Did it Work?

### Longitudinal Joint Data Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Density Lots</th>
<th>Avg. Joint Density</th>
<th>Avg. Roadway Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>18</td>
<td>87.8%</td>
<td>93.9%</td>
</tr>
<tr>
<td>2008</td>
<td>43</td>
<td>88.9%</td>
<td>94.1%</td>
</tr>
<tr>
<td>2009</td>
<td>29</td>
<td>89.2%</td>
<td>94.1%</td>
</tr>
<tr>
<td>2010</td>
<td></td>
<td>No data, transition to PWL spec.</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>
</tr>
<tr>
<td>2013</td>
<td>167</td>
<td>91.4%</td>
<td>93.9%</td>
</tr>
</tbody>
</table>
SS806 Highlights

- 10 - (4") Mat Cores / Day (Just like 446).
- Mat Core Lot = Days Production
- Lot Averaged for pay factor.
- Pay Table Same as 446.05-2. w/ 2% Incentive
SS806 Highlights

- **Joint Core Lot = Entire Cold Joint**
- **Exclusions:**
  - Ramps
  - Pavement abutting existing pavement
  - Areas 15 ft from obstructions
  - Small areas approved by Engineer
- **Joint Sublot = 2500 LF**
- **1- (6”) Core / Sublot**
- Divide sublots before paving
  - Give the plan to engineer early.
- Provide **Random Locations**
  - Give locations as you go.
- **Keep track of paving days!!**
  - Lab will need placement dates for both courses to average MSG.
  - Schematic layout may be helpful.
- **SS875 Hot Applied Joint Adhesive**
SS806 Highlights

- 6”- Cores to be centered about joint.
- Engineer to witness coring and take immediate possession.
- Ensure holes are properly filled.
- Contractor may take QC / Sister cores.
SS806 Highlights

- What is PWL? ... Why PWL? ...... Statistics Lie !!!!!

- What is PWL (Percent Within Limits)
  - Statistical estimation of spec. compliance

- Why PWL (Can't we just use an average!)
  - Takes variability into account
  - Rewards consistency

![Graph showing specification limit and quality level with red and blue areas indicating out of specification and in specification respectively.]

![Image of a child with a sign reading "Mommy, I'm scared of the government."
SS806 Highlights

Final Spec Goals
- LL = 90% Average MSG
- 2% Potential Incentive
- 10% Max Disincentive

1Year Implementation
- LL = 90% Average MSG
- 2% Potential Incentive
- 5% Max Disincentive
- Larger full pay range

<table>
<thead>
<tr>
<th>LOT PWT</th>
<th>Pay Factor Surface Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>PWT ≥ 90</td>
<td>( \frac{(PWT - 90)}{10} \times 0.02 + 1 )</td>
</tr>
<tr>
<td>PWT = 71 to 89</td>
<td>1.00</td>
</tr>
<tr>
<td>PWT = 50 to 70</td>
<td>( 1 - \frac{(70 - PWT)}{20} \times 0.10 )</td>
</tr>
<tr>
<td>PWT ≤ 49</td>
<td>0.90</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LOT PWT</th>
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</tr>
</thead>
<tbody>
<tr>
<td>PWT ≥ 90</td>
<td>( \frac{(PWT - 90)}{10} \times 0.02 + 1 )</td>
</tr>
<tr>
<td>PWT = 61 to 89</td>
<td>1.00</td>
</tr>
<tr>
<td>PWT = 50 to 60</td>
<td>( 1 - \frac{(60 - PWT)}{10} \times 0.05 )</td>
</tr>
<tr>
<td>PWT ≤ 49</td>
<td>0.95</td>
</tr>
</tbody>
</table>
Why SS806?

- 2014 Joint Core Research:
  - Allow coring per SS806 on 446 project.
  - Void in bottom of core is problem:
  - Starving the joint is a problem.
  - Current 446 Methods are not adequate.
  - There will be a learning curve.
  - Pay Factors are Achievable / Challenging
Poor Density

SS806 ASPHALT CONCRETE WITH JOINT DENSITY CALCULATOR

Test Data
86.5%
88.1%
81.0%
83.9%
84.7%
85.0%
83.1%
83.0%

Spec Lower Limit: 90%

N: 8
X: 84.4%
S: 0.0206
QL: -2.7100
(+ PWT: 100
(- PWT: 0
PWT: 0
Pay Factor: 90.0%

PWL Distribution

Series1
Series2
Full Pay
### SS806 Asphalt Concrete with Joint Density Calculator

<table>
<thead>
<tr>
<th>Test Data</th>
<th>Spec Lower Limit</th>
<th>90%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N: 15</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X: 93.5%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>S: 0.0108</td>
<td></td>
</tr>
<tr>
<td></td>
<td>QL: 3.1982</td>
<td></td>
</tr>
<tr>
<td>92.9%</td>
<td>(+) PWT: 100</td>
<td></td>
</tr>
<tr>
<td>93.1%</td>
<td>(-) PWT: 0</td>
<td></td>
</tr>
<tr>
<td>94.8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>94.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>90.8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>93.6%</td>
<td></td>
<td></td>
</tr>
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<td></td>
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<tr>
<td>92.8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>94.1%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>95.6%</td>
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<td></td>
</tr>
<tr>
<td>92.6%</td>
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<td></td>
</tr>
<tr>
<td>93.1%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>94.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>92.8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>93.3%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PWT: 100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pay Factor: 102.2%</td>
<td></td>
</tr>
</tbody>
</table>

#### PWL Distribution

- **Out of Spec**
- **In Spec**
Statistics Lie!!!!

- Negative payfactor with one bad test is unlikely.
- Negative payfactor with good data and one exceptional test is **very** unlikely.
- Consistency! Consistency!! Consistency!!!
- More data is better.

*If you don't measure...*
*...You can't Manage*
*...You can't Control*
*...You can't Improve*
*You lose money!*
2015 Trial Projects

- Interstate / Interstate Lookalikes
- Get some experience with SS806
  - District Experience
  - Contractor Experience
- Evaluate spec performance.
- Projects will have Item 806 (No Plan Note)
2015 Trial Projects

- D1
- D3
- D6
- D10
Questions??

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