Best Practices for Constructing and Specifying HMA Longitudinal Joints
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A Co-operative Effort between AI and FHWA

- FHWA Survey
- Literature Search
- Interviews (Consultants & Contractors)
- State Visits
- Miscellaneous (joint adhesive, joint heater)
- Report
- Training program
Don’t We Already Know How To Build a Longitudinal Joint?
Joint has been replaced, but note condition of the rest of the mat; very good. Also note the joint has been repaired two different times.
“In recent years, it has become evident how critical longitudinal joint construction is to the life of the pavement structure…..

Many pavements have been, or are in the process of being, resurfaced as a direct or indirect result of longitudinal joint deterioration”
Joint life vs Pavement life.

A reduction in the performance period may have a significant impact on the life cycle analysis, and ultimately the pavement selection process.
Joint vs Mat Density

<table>
<thead>
<tr>
<th></th>
<th>Conditioned</th>
<th>Control</th>
<th>Conditioned</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wearing Surface</td>
<td>87.8</td>
<td>88.1</td>
<td>93.1</td>
<td>93.5</td>
</tr>
<tr>
<td>12.5mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Binder Course</td>
<td>89.7</td>
<td>90.5</td>
<td>93.1</td>
<td></td>
</tr>
<tr>
<td>19.0mm</td>
<td></td>
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D. Maurer, P.E.
“It is unreasonable to expect the average density of the longitudinal joint to achieve a density of 92%”
Different pavement from graph
Effect of Voids on Life
Methods for Evaluating Longitudinal Joint Quality in Asphalt Pavements
- S. Williams, et al. Univ. of Arkansas

Good Joint Performance 97% of the Mat
Fair 93 to 97%
Poor < 93%

Longitudinal Asphalt Pavement Joint Construction ..........Performance
- D. Morian, et al. Quality Engineering Solutions

Significantly better performance 98% of the Mat 12 years
vs 95% of the Mat 8 years

Assume mat is 94% of $G_{mm}$, then 98% of 94% is 92% (8% $V_a$)
then 95% is 89% (11% $V_a$)
then 93% is 87% (13% $V_a$)
Permeability
Sometimes Catastrophic
Permeable Below 92% Density

DENSITY VS. PERMEABILITY
12.5 mm WEARING COURSE

Coefficient of Permeability (K) (cm x 10^{-5} / sec)
## Permeability

<table>
<thead>
<tr>
<th>Size</th>
<th>Author(s)</th>
<th>Year</th>
<th>% Air Voids</th>
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<tbody>
<tr>
<td>9.5 mm</td>
<td>E. Zube - California Dept. of Highways</td>
<td>1962</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>R. Mallick, et al - (fine graded)</td>
<td></td>
<td>8.5</td>
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<tr>
<td>12.5 mm</td>
<td>B. Choubane, et al – Florida DOT</td>
<td>1998</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>J. Westerman – Arkansas HTD</td>
<td>1998</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>NCAT 03-02 – (coarse graded)</td>
<td>2003</td>
<td>7</td>
</tr>
</tbody>
</table>
Cores -

Centered on butt joint, or middle of wedge

92% of $G_{mm}$ maximum bonus

Between 92% and 90% →

90% of $G_{mm}$ pay 100% →

< 90% of $G_{mm}$ reduced payment →
Maybe We Don’t Already Know How to Build a Longitudinal Joint?

• What We Know
  – Certain Steps Everyone Agrees On

• What We Don’t Know
  – Differing Opinions on Other Steps
  – Developed Questionnaire for Experts
    • Interview Consultants, Manufacturers and Contractors (Sheldon Hayes winners since 2000)
    • Compile and Analyze Findings
Experts to Be Interviewed

Consultants
• Jim Scherocman
• Chuck Deahl
• Jim Heddrich
• Ron Corun
• Larry Michael
• Steve Neal
• Brian Prowell
• Tom Skinner
• Frank Colella
• Wes McNutt

Sheldon Hayes Winners
• Lindy Paving (PA)
• P. Flanigan & Sons (MD)
• Duininck Bros (TX)
• Thompson-McCully (MI)
• DesMoines Asphalt & Paving (IA)
• K Barnett & Sons (NM)
• Norris Asphalt Paving (IA)
LONGITUDINAL JOINT CONSTRUCTION INTERVIEW

This survey is part of the Asphalt Institute’s cooperative agreement, “Marketing of Hot Mix Asphalt (HMA) Joint Construction Best Practices.”

1) First pass must be as straight as possible. How do you accomplish that?

2) Do you prefer a
   a) Notched wedge joint
   b) Butt Joint

3) Do you use paver automation (yes) or (no), Your preference is
   a) Joint Matcher
   b) Ski

4) Do you roll the unsupported edges by:
   a) Staying back 6 inches from the edge
   b) Overlapping the edge of the mat by 6 inches
   c) Others

5) When using a wedge joint do you tack the notch & wedge (yes) or (no) if yes, with
   a) Emulsion
   b) PG-grade Asphalt
   c) Other ___________________________ if yes, complete wedge or portion. Any problems?

6) When using a butt joint do you tack the vertical face (yes) or (no) if yes, with
   a) Emulsion
   b) PG-grade Asphalt
   c) Other ___________________________ If yes, complete wedge or portion. Any problems?

7) Have you ever used a proprietary joint adhesive, (yes) or (no), if (yes)
   a) Was it practical? (Yes) or (no)
   b) Did it improve the performance of the joint? (Yes) or (no)

8) Have you ever cut the cold joint back prior to placing the adjacent lane? (Yes) or (no)
   a) Was it practical? (Yes) or (no)
   b) Did it improve the performance of the joint? (Yes) or (no)

9) Have you ever used an infrared heater on a longitudinal joint? (Yes) or (no)
   a) Was it practical? (Yes) or (no)
   b) Did it improve the performance of the joint? (Yes) or (no)

10) How much do you overlap the hot material on to the cold material?
    a) Other ___________________________

11) What do you do with the overlap material?

12) Do you roll the second pass
    a) From the hot side overlapping onto the cold
    b) From the cold side overlapping onto the hot
    c) Make the first pass staying back from the joint and overlapping onto the cold with the second pass
    d) Start rolling on the outside edge and working into the joint
    e) Other ___________________________

13) Do you monitor the longitudinal joint density (yes) or (no), if yes, how
    a) Nuclear gage or similar device
    b) Core
    c) Other ___________________________

14) Which type of specification offers the best chance to long term joint performance?
    a) Method
    b) Minimum percent density. What is the practical minimum? ________%
    c) No specification

15) Does a fine 9.5mm mix have a better chance for good performance than a 12.5mm?
    a) Yes
    b) No

16) Does a 9.5mm mix with a design asphalt content of 6.2% asphalt have a better chance for good performance than the same mix at 5.7% asphalt?
    a) Yes
    b) No

17) Could I do anything additional in “late season” paving to improve joint performance?
    a) ______________

18) Have you ever been required to seal the surface of a longitudinal joint as part of the contract? (Yes) or (no). If yes, what did you use to seal the joint?
    a) The material was ___________________________
    b) The width of the seal was ________-inches

19) What are the other “Tips that make the difference”? List as many as you like.
    
    *
    *
    
    We sincerely appreciate you assistance in improving the performance of longitudinal joints. Thank You
Do the Experts Agree?

Not Always
Prior Planning

- Select joint (butt or wedge) best suited for that job
- Choose smallest NMAS that will do the job
- Consider using a “fine” gradation
- Lift thickness = NMAS x 4, exception “fine” gradation x 3
- Longitudinal joint should be included in construction plan & sequence
GETTING STARTED OFF RIGHT

Plant  Paving

Trucking  Compaction

Dump Person  MTV
Prefer Notch-Wedge or Butt Joint?

Pretty evenly divided
Tack Coat

Full width of mat to minimize movement of unsupported edge
First Pass Straight Must Be Straight

Stringline  
Skip Paint  
Reference
Paver on Automatic w/ Joint Matcher
Vibratory Screed

Always be ON
Auger

Uniform Head of Material Across the Entire Screed

Carry Material Within 12 – 18-inches of the End Gate
Rolling the Unsupported Edge

Overhang the Edge
Quality Control, Monitor Joint Density
Tack the Wedge
Overlap Existing Lane

Overlap 1.0 to 1.5-inches

Sufficient Depth on 2nd lane

Final overlap height 0.1
Lowest void is at the joint. This is not always the case, but it is the norm. Is the void the result of not getting sufficient material to the joint (insufficient overlap?)

Cas Bognacki, Port Authority of NY & NJ
Lute the Longitudinal Joint

This lute person is doing a great job
Rolling the Supported Edge

Stay off the Joint with 1st Pass to Avoid Bridging,

but, be on the lookout for stress cracks that may develop along the edge of the drum
Rolling the Supported Edge

Stay off the Joint with 1st Pass to Avoid Bridging,

but, be on the lookout for stress cracks that may develop along the edge of the drum
GOAL

I-68 project approximately 5 years old
I-68 project approximately 5 years old
(same project, same location as previous slide)
Thank You

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