Study to Develop Recommended Best Practices for Constructing and Specifying HMA Longitudinal Joints

A Co-operative Effort between AI and FHWA

Mark Buncher, Ph.D., P.E.
Asphalt Institute
Don’t We Already Know How To Build a Longitudinal Joint?
I-81 in Pennsylvania
I-84 Connecticut
I-79 in PA

- Note condition of the rest of the mat.
- Also sealed each side of patch.
“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”

Kentucky Transportation Center
College of Engineering
Current Project Team

– AI
  • Mark Buncher
  • Carlos Rosenberger
  • AI Regional Engineers

– FHWA
  • Tom Harman
  • Michael Arasteh
  • Stephen Cooper

– PA State Asphalt Paving Association
  • Gary Hoffman
PROJECT STEPS

• FHWA “Benchmark” Survey to Divisions
• Literature Review
• Identify What We Know/ Things We Don’t
• Interview 19 Experts
• Visit Five Select State DOTs
• Draft/ Final Report
• Develop Training Tools
Takeaways from FHWA Survey to 52 Division Offices

• 1/2 of states not satisfied with overall performance of L-Joints.

• 2/3rds of states have a L-Joint spec
  – Half of those (17) have a LJ density spec
    • Range from 89% - 92% min TMD
  – Other half were method specs
    • From Joint Adhesive to very prescriptive

• Great start to point us in the right direction, but no definitive answers
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
### 19 Experts Interviewed

<table>
<thead>
<tr>
<th>Consultants</th>
<th>Sheldon Hayes Winners</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jim Scherocman</td>
<td>Lindy Paving (PA)</td>
</tr>
<tr>
<td>Chuck Deahl</td>
<td>P. Flanigan &amp; Sons (MD)</td>
</tr>
<tr>
<td>Jim Heddrich</td>
<td>Duininck Bros (TX)</td>
</tr>
<tr>
<td>Ron Corun</td>
<td>Thompson-McCully (MI)</td>
</tr>
<tr>
<td>Larry Michael</td>
<td>DesMoines Asphalt &amp; Paving (IA)</td>
</tr>
<tr>
<td>Steve Neal</td>
<td>K Barnett &amp; Sons (NM)</td>
</tr>
<tr>
<td>Brian Prowell</td>
<td>Norris Asphalt Paving (IA)</td>
</tr>
<tr>
<td>Tom Skinner</td>
<td></td>
</tr>
<tr>
<td>Frank Colella</td>
<td></td>
</tr>
<tr>
<td>Wes McNett</td>
<td></td>
</tr>
</tbody>
</table>

**Interview Questions**

**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) Notched wedge joint
   b) Butt Joint

3) Do you use paving automation (yes) or (no). Your preference is:
   a) Joint Matcher
   b) Ski

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

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 onto the cold material?
    a) __________________________

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) Corer
    c) Other __________________________

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

15) Does a 5.8% PG mix have a better chance for good performance than a 12.5% PG?
    a) Yes
    b) No

16) Does a 5.8% PG mix with a design asphalt content of 6.2% asphalt have a better chance for good performance than that same mix at 5.7% asphalt?
    a) Yes
    b) No

17) Could you 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).
    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 your assistance in improving the performance of longitudinal joints. Thank You
Do the Experts Agree?

Not Always
The Best Longitudinal Joint

Echelon Paving

 Rolled Hot

I-295 in New Jersey
Echelon Paving Longitudinal Joint

Joint passes between $0.25$
But, the need to maintain traffic limits the opportunities to pave in echelon

Consequently, most longitudinal joints are built with a cold joint
Prefer Notch-Wedge or Butt Joint?

Evenly Divided
Wedge 3:1 to 12:1

1st pass

2nd pass

1/2 to 3/4-inch

NMAS

Wedge 3:1 to 12:1

2nd pass
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
Trucking
Compaction
Paving

Dump Person

MTV
Tack Coat

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

Unanimous that a string line should be used to assure first pass is straight
Great Results
Tough to get proper overlap (1””) with next pass
Paver on Automatic w/ Joint Matcher
Vibratory Screed Should Always Be On
Auger

Uniform Head of Material Across the Entire Screed

Carry Material Within 12 – 18-inches of the End Gate
This is unacceptable
Auger not extended to within 12 to 18-inches of the end gate.

The result - SEGREGATION at joint
Seated on the Existing Surface
1st Roller Pass on Unsupported Edge
50/50: Overhang vs. Stay Back 4-6”
Caution: Watch for lateral movement and stress crack

Rolling Unsupported Edge
(First Paver Pass)

Edge of drum inside unsupported edge
Can cause cracking near the edge and lateral mix movement at the unsupported edge
Quality Control, Monitor Joint Density
Tack the Joint! (Butt or Wedge)

Emulsion, or

PG asphalt or Proprietary Joint Adhesive
Matching Joint

Proper Overlap: $1.0 \pm 0.5$ inches

Sufficient Depth of HMA to avoid “starving” joint and “bridging” with roller

After all rolling, desired height diff. about $0.1”$
This lute person is doing a great job
Bumping Joint Properly

Don’t push across!
Rolling the Supported Edge
(many different opinions and approaches)

Stay off the Joint by 6” with 1st Pass to Avoid Bridging

but, watch for stress cracks along the edge of the drum. May be more of a concern with rolling unsupported edge
Other Options / New Products

- Mill & Pave One Lane at a Time
- Cut Back Joint
- Wedge Compactors
- Joint Heaters
- Joint Adhesives (hot rubberized asphalt)
- Surface Sealers Over Joint
Cutting Back the Joint

B. Prowell photos
Joint Heaters
Application of proprietary joint adhesive
Surface Sealers
Thank You