

**Best Practices for Constructing and Specifying HMA Longitudinal Joints**

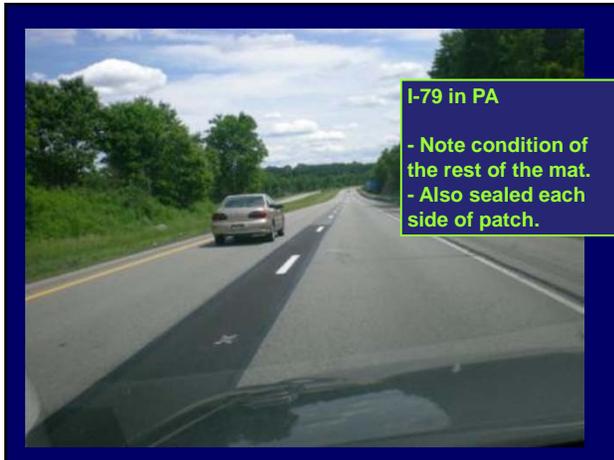
**A Co-operative Effort between AI and FHWA**



**Mark Buncher  
Asphalt Institute**

**Don't We Already Know How To Build a Longitudinal Joint?**

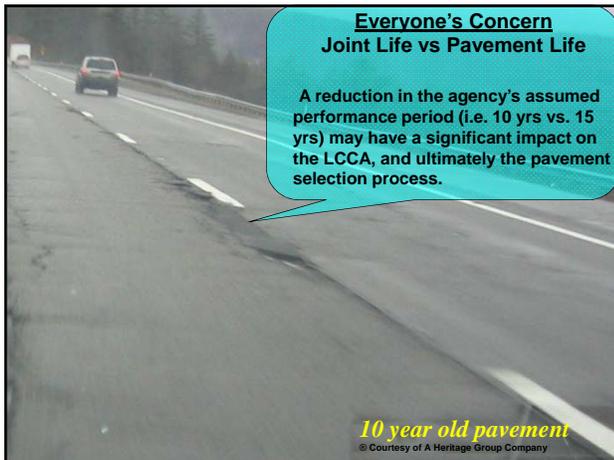




“ In recent years, it has become evident how critical longitudinal joint construction is to the life of the pavement structure.....

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

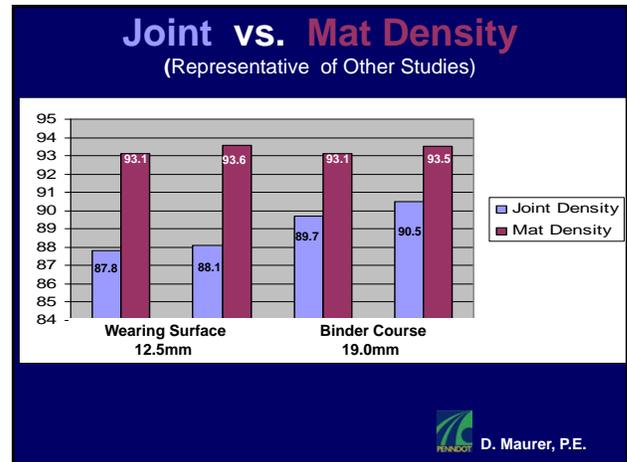
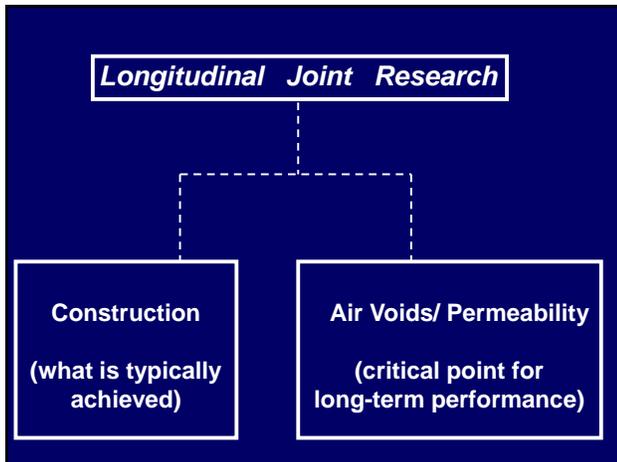


## PROJECT STEPS

- 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.
- Lots of best practices available
- 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



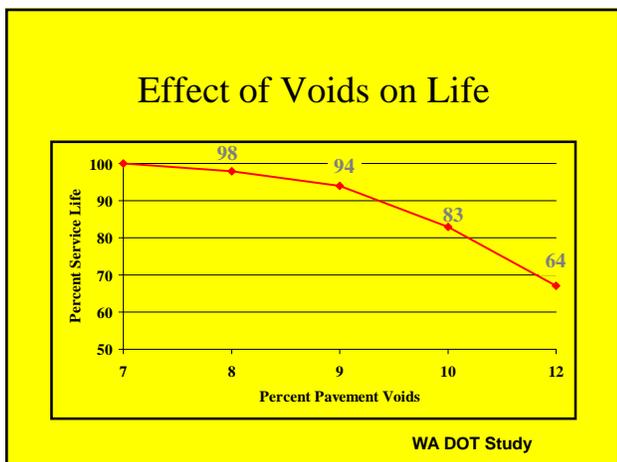
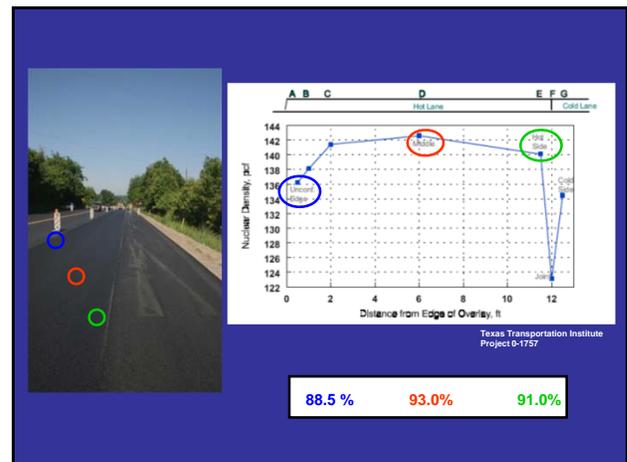
**Construction**

	Avg	Std Dev
2001 & 2002	89.5	
2003	90.3	1.62
2004	90.0	1.71
2005	90.7	1.31
2006	90.3	
2007	90.0	

**COLORADO**

"It is unreasonable to expect the average density of the longitudinal joint to achieve a density of 92%"

Connecticut



**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%

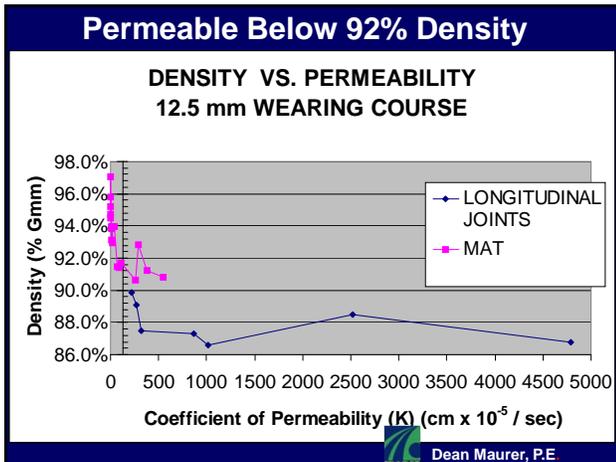
**Longitudinal Asphalt Pavement Joint Construction ..... Performance**  
- D. Morian, et al. Quality Engineering Solutions, NV

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%  $V_a$ )

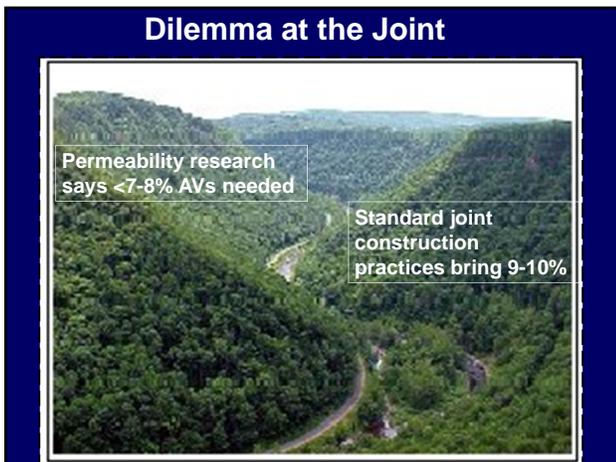
then 95% is 89% (11%  $V_a$ )

then 93% is 87% (13%  $V_a$ )



### Various Research Reports on Critical Air Void Level for Permeability

Report	Critical % AVs where permeable
<b>9.5 mm</b>	
E. Zube - California Dept. of Highways - 1962	8
L. Cooley, B. Prowell, R. Brown - NCAT - 2002	7.7
R. Mallick, et al - (fine graded)	8.5
<b>12.5 mm</b>	
B. Choubane, et al - Florida DOT - 1998	7
J. Westerman - Arkansas HTD - 1998	6
NCAT 03-02 - (coarse graded) - 2003	7



- ### Some Actual LJ Specs with Min. Density
- ❑ State 1: Cores, test only the hot side, minimum 92% of  $G_{mm}$
  - ❑ State 2: Cores, directly on the joint, minimum 88% of  $G_{mm}$
  - ❑ State 3: Gauge, cold side minimum 90% of  $G_{mm}$   
hot side minimum 92% of  $G_{mm}$
  - ❑ State 4: Cores, centered on the wedge or over butt,  
min. of 89% of  $G_{mm}$
- Many other variations being used. In some cases, perceived practice by HQ agency doesn't match actual practice in field.



## Proposed Specification?

**Cores -**  
Centered on butt joint, or middle of wedge

≥ 92% of  $G_{mm}$  : maximum bonus

Between 92% and 90%: seal and possible bonus

≥ 90% of  $G_{mm}$  : pay 100%

< 90% of  $G_{mm}$  : reduced payment



## Sealing the LJ




## 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

<p><u>Consultants</u></p> <ul style="list-style-type: none"> <li>• Jim Scherocman</li> <li>• Chuck Deahl</li> <li>• Jim Heddrich</li> <li>• Ron Corun</li> <li>• Larry Michael</li> <li>• Steve Neal</li> <li>• Brian Prowell</li> <li>• Tom Skinner</li> <li>• Frank Colella</li> <li>• Wes McNett</li> </ul>	<p><u>Sheldon Hayes Winners</u></p> <ul style="list-style-type: none"> <li>• Lindy Paving (PA) <sup>3</sup></li> <li>• P. Flanigan &amp; Sons (MD)</li> <li>• Duininc Bros (TX)</li> <li>• Thompson-McCully (MI)</li> <li>• DesMoines Asphalt &amp; Paving (IA)</li> <li>• K Barnett &amp; Sons (NM)</li> <li>• Norris Asphalt Paving (IA)</li> </ul>
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## Interview Questions

**LONGITUDINAL JOINT CONSTRUCTION INTERVIEW**

This survey is part of the Asphalt Institute's cooperative agreement, "Marking of Hot Mix Asphalt (HMA) Joint Construction Best Practices".

- 1) First your effort to be as straightforward as possible. How do you accomplish that?
  - a) Do you prefer a
    - i) Standard wedge joint
    - ii) Do you compact the wedge? (yes) (no)
    - iii) Start joint
- 2) Do you use pneumatic (yes) or (no). Your preference is
  - a) Joint Machine
  - b) No
- 4) Do you roll the unsupported edges by:
  - a) Stomp back 6-inches from the edge
  - b) Cracking the edge of the mat by machine
  - c) Other \_\_\_\_\_
- 5) When using a wedge joint do you tack the notch & wedge (yes) or (no) if yes, with
  - a) Random
  - b) PG grade Asphalt
  - c) Other \_\_\_\_\_ If yes, complete wedge or portion. *Ass. problems?*
- 6) When using a butt joint do you tack the vertical face (yes) or (no) if yes, with
  - a) Random
  - b) PG grade Asphalt
  - c) Other \_\_\_\_\_ If yes, complete wedge or portion. *Ass. problems?*
- 7) Have you ever used a proprietary joint adhesive (yes) or (no) if yes
  - a) What is it? \_\_\_\_\_ (yes) or (no)
  - b) Did it improve the performance of the joint? (yes) or (no)
- 8) Have you ever cast the cold joint back prior to placing the adjacent lane? (yes) or (no)
  - a) What is it? \_\_\_\_\_ (yes) or (no)
  - b) Did it improve the performance of the joint? (yes) or (no)
- 9) Have you ever used an infra-red heater on a longitudinal joint? (yes) or (no)
  - a) What is it? \_\_\_\_\_ (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? \_\_\_\_\_
- 11) What do you do with the overlap material?

- a) Push it back to the joint
- b) Do nothing
- c) Other \_\_\_\_\_

- 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 overlap 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 measure the longitudinal joint density (yes) or (no), if yes, how
  - a) Nuclear gauge or nuclear device
  - b) Core
  - c) Other \_\_\_\_\_
- 14) Which type of specification offers the best chance to long term joint performance?
  - a) Method \_\_\_\_\_
  - b) Minimum joint count density. "What is the practical minimum?" \_\_\_\_\_
  - c) No specification
- 15) Does a 1/8" 3mm max have a better chance for good performance than a 1/2" 5mm
  - a) Yes
  - b) No
- 16) Does a 1/8" 3mm max with a design asphalt content of 6.2% asphalt have a better chance for good performance than that same mix at 7% asphalt?
  - a) Yes
  - b) No
- 17) Could I do anything additional in "late season" paving to improve joint performance? \_\_\_\_\_
- 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 old was \_\_\_\_\_
- 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

Prefer Notch-Wedge or Butt Joint?

Evenly Divided

## 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

Dump Person

MTV

### Tack Coat

Full width of mat to minimize movement of unsupported edge

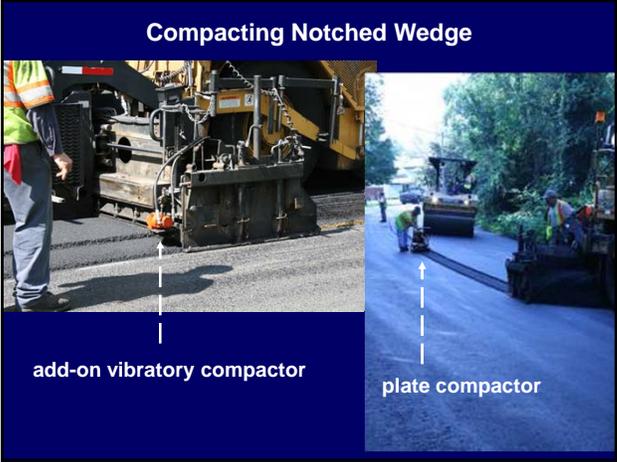
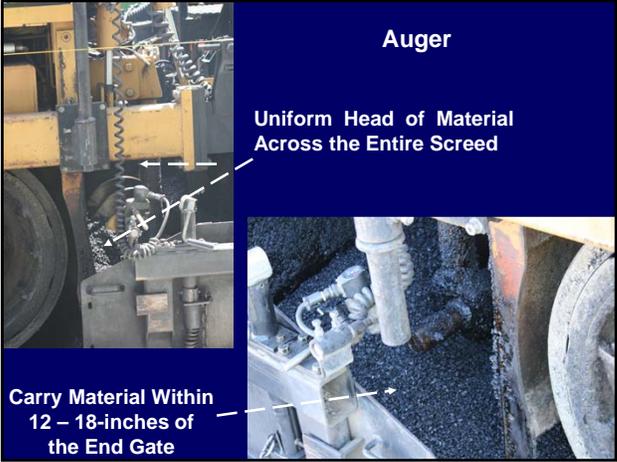
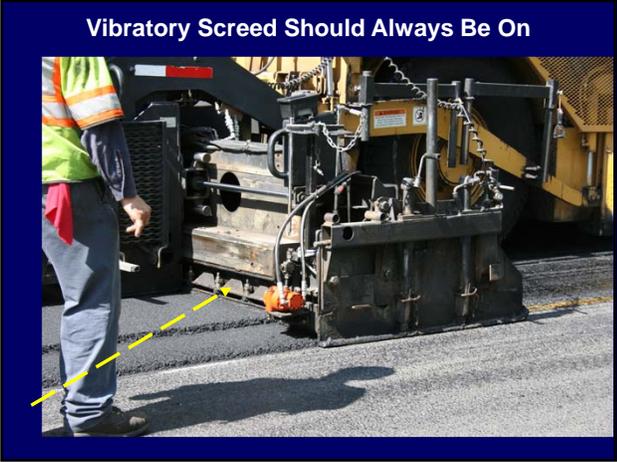
### First Pass Must Be Straight

Unanimous that a string line should be used to assure first pass is straight

Stringline

Skip Paint

Reference



**1st Roller Pass on Unsupported Edge**  
**50/50: Overhang vs. Stay Back 4-6"**

HOT

**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 ± 0.5 inches

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

Final overlap height: 0.1"

**Lute the Longitudinal Joint**

This lute person is doing a great job

**Rolling the Supported Edge**  
(many different opinions and approaches)

Stay off the Joint by 6" with 1<sup>st</sup> 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

**Quality Control and Acceptance of Joint Density**

Density Gauge      6-inch Core

**Other Options / New Products**

- Echelon paving
- Mill & pave one lane at a time
- Cut back joint
- Surface sealers over joint
- Joint Adhesives (hot rubberized asphalt)
- Joint Heaters

**The Best Longitudinal Joint**

**Echelon Paving**

**Rolled Hot**

I-295 in New Jersey

**Joint Heaters**

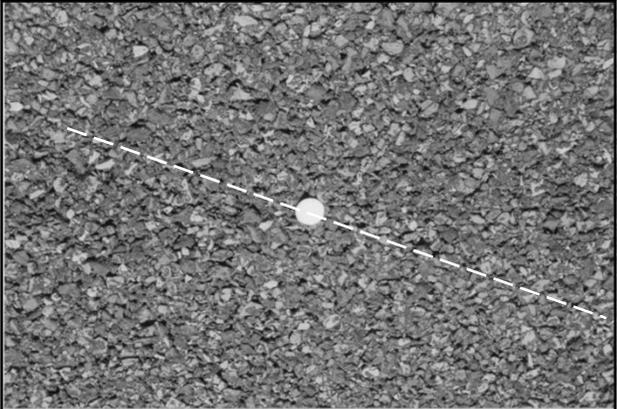
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**Surface Sealers**

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**GOAL**

I-68 project approximately 5 years old



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

**Thank You**

A photograph of a long, straight asphalt road stretching into the distance. The road is flanked by green trees and vegetation. The sky is clear and blue. The road has a white dashed center line and solid white edge lines.