Longitudinal Joints

Stephen R. Mueller, P.E., MPA
Pavement and Materials Engineer
FHWA Resource Center
Steve.Mueller@dot.gov
Topics to be discussed:

1) FHWA and the LJ Workshops.
2) Compaction Concepts.
3) Longitudinal Joint Recommendations.
FHWA Organization
Without Pavement, We Would Be Stuck in the Mud!
We’ve Come a Long Way.....
4 Million Miles of Roads
600,000 Bridges
Statistics We Should Know:

Federal = 3%
State = 20%
Local = 77%

2/3 are Paved (1/3 Unpaved)
94% of Paved have an Asphalt Surface
The Federal Role:

- Promote uniformity, quality, and safety aspects of highway construction and maintenance.
- Develop, promote, and provide new technologies and training.
- Stewardship of the Federal-aid program and its investments.
Society Depends on Our Public Infrastructure

Take Good Care of What We’ve Already Built!
When we repair or reconstruct our pavements - the goal is to do it right!
FHWA Pavement & Materials Program

Process to Deliver National Pavement Network That Is:

- Safe
- Cost Effective
- Long Lasting
- Effectively Maintained
Best Practices for Specifying and Constructing HMA Longitudinal Joints

A Cooperative Effort between Asphalt Institute & FHWA
West Virginia 4-hr Pilot Workshop
Jan 11, 2012
Tom Harman - “Overall this was a Home run”
Compaction of Longitudinal Joints – Challenging Issue for Years

- 1970’s and 1980’s – told not to test!
- Mid-1990’s – RMAUPG identified LJ’s as a major issue, created a LJ Task Force
- Much Research, Many Opinions
  - NCAT Study
  - NAPA – Notched Wedge Joint Publication
  - FHWA/AI Search for Best Practices – 2012 Workshops
Longitudinal Joints are Still a Challenge for Many Agencies.

Photo by James Scherocman, P.E
Various Approaches to Specs:

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

- **Method Spec**
  - One size fits All
  - Agency assumes some Risk
  - No Incentive for Innovation
  - Required State on-site Oversight

- **Density Spec**
  - Allows Innovation for Contractor
  - Balanced Risk, Includes Incentives & Disincentives
  - Not Appropriate for Small Jobs
  - Has Trigger for ex. Sealing/Over-banding

- **Tiered Spec**
  - Small jobs: Contractor follows Method Spec or Submits compaction plan
  - Larger Jobs: Density

INCREASING INNOVATION → INCREASING RISK
Proper Construction?

Photo by James Scherocman, P.E.
Rolling – Cold Side or Hot Side?

Photos by James Scherocman, P.E
You Get What You Inspect, Not What You Expect!

Measured Density?

Using cores......

Or a nuclear density gauge
The Weakest Link:
Poor Joint Performance is an Agency and Industry Concern

- LCCA
- Alternate Bid Competitiveness
- DOT Program Costs
- HMA Industry’s Livelihood
- the Travelling Public
Goal \( LJP = MP \)

Longitudinal Joint Performance equals Mat Performance
“We can't solve problems by using the same kind of thinking we used when we created them.”
30’ Screed – No Longitudinal Joint!
Fractured or crushed faces are best!
ASPHALT CEMENT

AT PAVING TEMPERATURES ASPHALT CEMENT IS A LUBRICATING FLUID!

AS IT COOLS, ASPHALT CEMENT BECOMES A GLUE-LIKE BINDER!
Balancing Production

- Trucking
- HMA Facility
- Paving
- Compaction
Safety - First, Last and Always…
Don’t depend on drivers to avoid you. Play it safe.
Watch your back and your buddies.
HMA Temperature / Segregation
Checking Temperatures
Tarping Loads
COMPACTION

GOOD COMPACTION LEADS TO GOOD PERFORMANCE
Compaction

The process of compressing a material into a smaller volume while maintaining the same mass.

Roll - Down

25 %?
Reasons For Compaction

- To prevent further consolidation
- To provide shear strength and resistance to rutting
- To ensure the mixture is waterproof (impermeable)
- To prevent excessive oxidation of the asphalt binder.
Rutting in Asphalt Layer

original profile

Wheel path consolidation

Improper compaction
Rutting in Asphalt Layer

original profile

weak asphalt layer

shear plane
Durability vs Air Voids

Cohesion vs Stability

Zone of Highest Durability

Flushing vs Raveling

% Air Voids
Raveling
Causes of Raveling

- Lack of Compaction
- Constructed in cold or wet weather
- Dirty aggregate - poor adhesion between the asphalt and the aggregate.
- Too little asphalt
- Overheating of mix
Typical Permeability vs. Voids

- **Permeability, k x 0.00001 cm/sec**
- **Air Voids, percent**

![Graph showing the relationship between permeability and air voids.](image-url)
Effect of Voids on Life

Percent Pavement Voids

Percent Loss Service Life

Washington State
Vibrating Screed
Static Steel Wheel Roller
Vibratory Roller
Reference Density Comparison

For 4% Voids Mix Design

- % of Laboratory Density
  - 100
  - 99
  - 98
  - 97

- % of Control Strip Density
  - 100
  - 96

- % of Maximum Theoretical Density
  - 100
  - 99
  - 98
  - 97

- % of Laboratory Density
  - 99
  - 95

- % of Control Strip Density
  - 99
  - 95

0 In-Place Air Voids

- 0
- 1
- 2
- 3
- 5
- 6
- 7
- 8
- 9
Holistic View of Compaction

IC Technologies

SafetyEDGE

Long Joint
Hot-Mix Asphalt Compaction

**SUMMARY**

- **YOU MUST** ADEQUATELY COMPACT HMA
- Get the Proper Air Voids in the Mix
  - (4%-8% air voids = 92%-96% MTD)
- KEEP THE MIX HOT!!!
- Understand the factors that affect compaction!
- ROLL THE MIX QUICKLY AND THOROUGHLY WITH GOOD EQUIPMENT!
- TEST FOR DENSITY!!!
We Know Unsupported Edge Will Have Lower Density

Proper Overlap

Sufficient Material for Roll-Down

Low Density Area
Joint vs. Mat Density
(Representative of Other Studies)

Wearing Surface
12.5mm

Binder Course
19.0mm

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<th>Mat Density</th>
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D. Maurer, P.E.
Two Goals

Best way To Build it.

Best way To Spec it.
Destined for Failure
Permeability can be Catastrophic
Various Approaches to Specs:

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

Method Spec
- One size fits All
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- Required State on-site Oversight

Performance Spec
- Allows Innovation for Contractor
- Balanced Risk, Includes Incentives & Disincentives
- Not Appropriate for Small Jobs
- Has Trigger for ex. Sealing/Over-banding

Increasing Innovation
Increasing Risk
Increasing Innovation
Increasing Risk
Increasing Innovation
Increasing Risk
Quality Control and Acceptance of Joint Density

Density Gauge

6-inch Core
Proposed QA Criteria for LJ Density Spec

**Six-inch Cores:** Located over center of butt joint, or middle of wedge on wedge joint

- \( \geq 92\% \text{ of } G_{mm} \): maximum bonus

- Between 92% and 90% of \( G_{mm} \): 100% pay, pro-rated bonus, and overband joint

- \(< 90\% \text{ of } G_{mm} \): reduced payment, and overband joint
Key Steps in Implementing New LJ Spec

- Agency and Industry Work Together
- Offer training (Best Practices, Alternatives)
- Try new technologies, products and methods. Measure effectiveness
- Establish baseline of existing joint densities by randomly selecting projects
- Implement min. density spec, but 1st year only show bonus/penalty without adding/subtracting dollars
- Incrementally increase min. density requirement to reach 90%, or possibly higher as it can be shown to be accomplished on regular basis
Construction Recommendations

- Echelon Paving
- Notched Wedge vs. Butt Joint
- BALANCED OPERATION
  - Must Take Care of the Basics!
- Tack Coat!
- Dump Person is a Key Person
Construction Recommendations

- Straight First Pass
- Use Automated Control Systems
- VIBRATORY SCREED – ALWAYS ON!!!!
- ROLLERS CLOSE TO THE PAVER
- DON’T BROADCAST HMA ACROSS MAT
- DON’T LUTE THE LONGITUDINAL JOINT
PLEASE REQUEST AND ATTEND THE
4 HOUR WORKSHOP !!!

“Best Practices for Specifying
and Constructing
HMA Longitudinal Joints”

A Cooperative Effort between
Asphalt Institute & FHWA
Partnerships Are Required

- FHWA
- Academia
- State DOTs
- Local Governments
- Private Sector
Partnerships are Required

- 1 FHWA
- 52 State DOTs (including DC and PR)
- 3,034 County governments;
- 35,933 Municipal, Town and Township governments.
- 4,140 Colleges and Universities
- ____ contractors/industry reps.

UNITED WE STAND....
THANK YOU!

Steve Mueller
FHWA Resource Center
Pavement and Materials Engineer
(720) 963-3213
Steve.Mueller@dot.gov