USE OF INFRARED HEATERS ON LONGITUDINAL JOINTS
BEST PRACTICES

2014 OHMPA ROAD TOUR
Guelph, Kingston, Sudbury, GTA
Bob Kieswetter P. Eng
“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”
Longitudinal Joint Problems

Mark Buncher, Ph.D., P.E.
Asphalt Institute

I-84 Connecticut
Joint Construction Problems also on Airports

- FAA recommends cutting the uncompacted edge of cold lane

- Here we show Longitudinal Joint Failure as a result of poor compaction
Compaction is Important: Especially on Runway Pavements!

What is the Problem?

The first pull of the paver generally leaves an area of low density along the unconfined longitudinal edges of the mat.
Compaction is Important

Poor Compaction means high voids
Higher voids means shorter service life
Typical voids at a joint +12% equates to -35% service life

* slide from Vince Aurillio, Asphalt Institute presentation to Swift Conference 2005
Compaction is Important: Especially on Runway Pavements!

- FAA recommends cutting of the uncompacted edge, not always done
- Lack of edge support means lack of density
- Extreme example of poor edge
- FAA recommends cutting of the uncompacted edge, not always done
A lot of time density at the joint is not even checked on highways.

Ref: Texas Transportation Institute
• High permeability at a typical joint
Longitudinal Joint Construction Solution

Mark Buncher, Ph.D., P.E.
Asphalt Institute

The Best Longitudinal Joint

Echelon Paving

Rolled Hot

I-295 in New Jersey
INFRARED HEATERS CAN REPLACE ECHELON PAVING

Jean Lesage International Airport, Quebec City, First Paver attached

INFRARED HEATERS STARTING IN 1995 IN QUEBEC TO MEET TEMPERATURE SPEC

Highway 40 at Quebec City, First Trailer Unit
Joint Heater Advancements / Operator friendly

1995 HDE paver attached

2013 HDE paver attached
Infrared heating: the transfer of radiant energy from a hot surface through the air to cooler surfaces, without the use of an air mover. No energy loss until the infrared rays hit the asphalt then energy is transformed to penetrating heat.
• Ignition of propane occurs behind emitting surface... ... no direct flame
• The 1400 to 1500 F infrared surface emits high intensity infrared rays
• The radiation is absorbed by asphalt, quickly penetrates and turns to heat
• No deterioration of asphalt ...... same as re-heating up a lab sample
• No open flame that will burn surface before heat penetration
• On the left below is a ceramic mat, on the right a tube heater
LJ Construction: Re-heating is a SOLUTION

- Heat the JOINT to 200 to 250°F (95 to 120°C)
- Recompact with the New Hot Lane

US Hwy 70, Tennessee, 2007
The immediate trial results, obtained from testing core samples, revealed that no one method could be classified as superior. All test sections produced lane edges with exceptional compaction rates of 95% or more. The trials proved that contractors were fully capable of producing quality lane edges without the use of any additional equipment or new techniques. Follow-up investigations, conducted at four and six-year milestones, determined the joints to be performing excellently with no cracking or defects evident.
TDOT LONGITUDINAL JOINT RESEARCH UPDATE

MISSISSIPPI QUALITY ASPHALT CONFERENCE (QAC) – February 2010

Mark Woods, P.E. –
TDOT Materials & Tests
Test Results: Joint heater had lowest air voids (highest density) & lowest permeability
The infrared heater exhibited the best performance among all the joint construction techniques used in the study. The infrared heater was effective in reducing air void content and water permeability, and increasing IDT strength. The air voids distribution obtained from the X-ray CT images shows that the effectiveness of infrared heater in improving joint quality was through increasing the compaction degree of longitudinal joint deep to the overlay bottom and thus making the joint denser.

Journal of Materials in Civil Engineering. Submitted November 23, 2009; accepted April 16, 2010;

• Dr Baoshan Huang
Joint heater came out on the top of the list for performance
Techniques for Improving Longitudinal Joint Performance in Asphalt Pavements

Case Study: Heliport Conversion Project, CFB Shearwater, Halifax NS

Robert McLure, M.Eng., P.Eng
Hatch Mott MacDonal Ltd.
Best Practice for Good Longitudinal Joints
Echelon Paving

ie: A hot joint makes the best joint

LaFarge Construction echelon paving runway at Dartmouth, NS, 2007 includes joint heater
Achieved a Mat Density Base HMA - 94.4 Surface 95.1

Heated Joints - 94.1 no failures

Where only Cut joints used 92.6 and several failures, these were fixed

Minimal non-conformances were experienced

The quality of the placed HMAC on this project was considered to be very good, especially considering that paving was done in late October and November.

The longitudinal joints are all well bonded and tight and the surface tolerances were all within the specified parameters
Summary:
“Best way to avoid problems with cold joints is to eliminate them.
Echelon paving and joint heaters are very effective.”
BEST PRACTICES
BP 1: Choose a practical and economical heater

- Less powerful tube heater
- Propane vapour draw
- On/off operation

- Full infrared
- But electric power

- Full infrared
- Liquid draw propane
- Adjustable heat
BP 2: Ensure heater is infrared… no flame

- Full surface infrared ensures sufficient infrared emission
- Flame type overheats surface then relies on conduction
BP 3: Balance heater length with speed/ambient temp

- Adjustable heat with pressure
- High/low operation for delays
- Liquid draw means constant pressure

HDE JMH 400PA  400,000 Btu
HDE JMH 300PA  300,000 Btu
HDEJMH  500PA 500,000 Btu
BP 4: Straddle the cold edge

- heated width 18” (450 mm)
- About 12” (300 mm on cold lane)
BP 5: Stay under 275°F (175°C) on re-heat

- Heat the JOINT to 200 to 250°F (95 to 120°C)
- Recompact with the New Hot Lane

US Hwy 70, Tennessee, 2007
BP 6 Match reheated edge with new mix temperature

- if heated joint too hot: roller marks
- If heated joint too cold: smashed aggregate/no bitumen coverage

- The joint heat was just at 200 °F in these photos taken at the extension box of the Carlson Screed.
- The goal is to weld the joint without scorching the mix.
The joint between the overlays remains one of the most persistent problems encountered in the paving industry.

A consistent temperature will lead to consistency in the welding of the joints.

This joint heater when used with an MTV to provide no-stop paving, can lead to faultless joints.
BP 8 : Ensure operator training/comfort

2013 Runway Reconstruction : Fort Drum, NY: No density Failures
White House 2005 and 2008

In 2004 FHWA let a tender for a synthetic asphalt in front of the White House
Clear synthetic resin and two colored aggregates
Resembles an old rustic pavement
Contractor was supposed to pave in echelon with 5 pavers across the project
Ended up two with ravelling joints that were not accepted
They were close to milling up 2 million dollars of pavement (800/ton)
Longitudinal Joint Problem Solved

Contractor, asked HDE to work with them on re-heating and repairing joint
Test Section in Richmond Battlefield Park, close to Richmond VA
On approval worked for two days on Pennsylvania Ave
First, we had to get through security
INFRARED LONGITUDINAL JOINT REPAIR

MR75 Mini Recycler
100,000 Btu infrared heater over a 2” screen deck
Heated fresh material to be added to failed joint

JMH 400T, 400,000 Btu
Heated joint for pre-set time
Monitored temperature closely
Synthetic resin binder stickier, lower burn point than conventional
Turned black easily if overheated
INFRARED LONGITUDINAL JOINT REPAIR

Heated fresh material is added to the heated deteriorated joint

Fresh material is luted
Vibratory compaction across the joint
DD24 Dual Drum by Dura Pac

Compaction occurred close behind heater
Final compaction along joint for smoothness
Federal Highways accepted the job and contractor got his money
Project verified infrared does not affect asphalt properties
In 2008 HDE was called back to help fix new cracks over concrete joints for the inauguration parade. 2005 repair was still good.
**WHAT'S ON THE HORIZON?**

**HIP Longitudinal Joint Repair at 5 ft/minute**