Longitudinal Joint Experience

Jay Behnke, P.E.

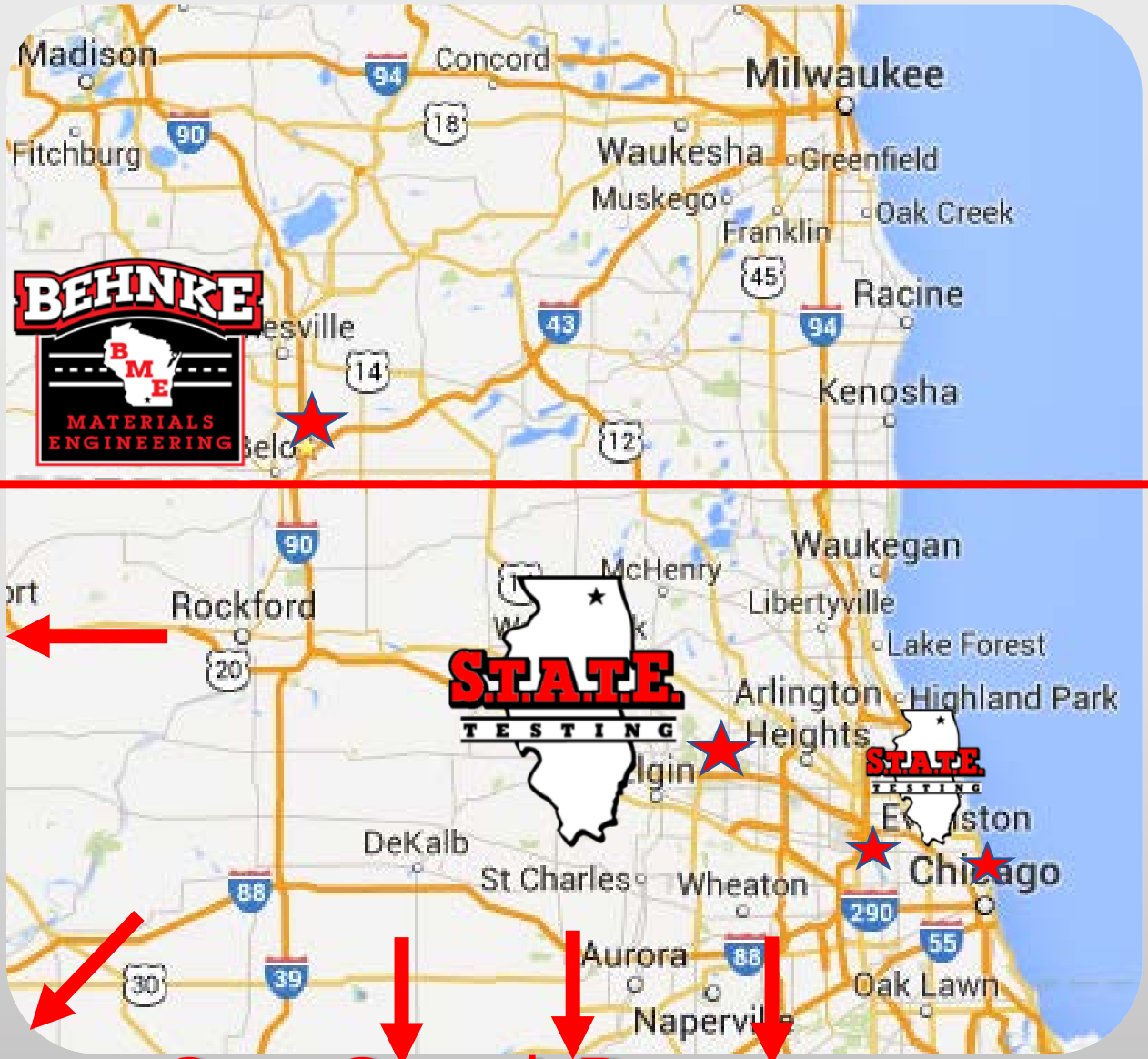
Owner/President S.T.A.T.E. Testing, LLC

2017 Illinois Bituminous Paving Conference

December 12, 2017

Wisconsin

Illinois



Our Sand Box

Industry Accomplishments

- Rutting
  - Moving from Marshall to Superpave, Volumetrics
- Tackling segregation
  - MTD, lower Va, smaller NMAS
- Stripping
  - T283, Hamburg
- Cracking
  - DCT, IFIT, Recovered PG Grading

Longitudinal Joints

WEAK LINK

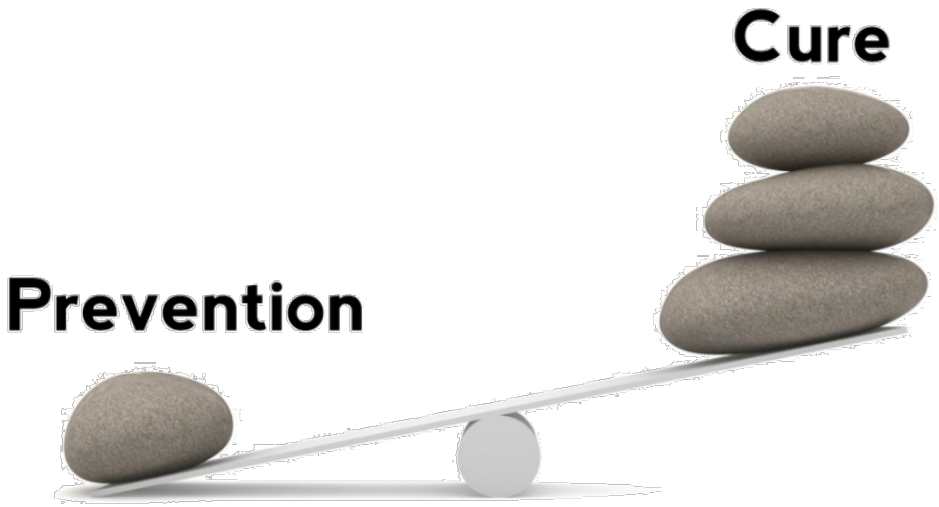
Weak Link….

Water Intrusion Into Pavement

Maintenance Expensive and Disruptive

How do we fix this issue?

Preventing Longitudinal Joint failure is MUCH cheaper than maintaining a joint throughout the life of the pavement



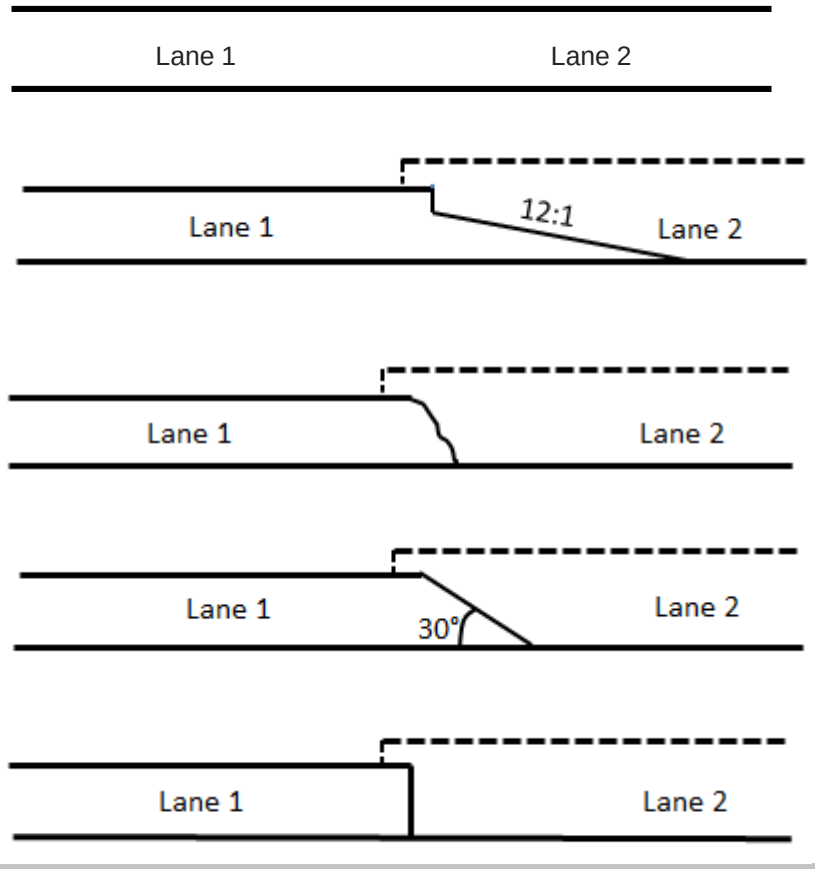
Many agencies are getting involved

WHRP Longitudinal Joint Study

- Researched in-place data for:
- Joint Type (vertical, notched wedged etc.)
- Joint Method (rolling on, overhang or back from joint)

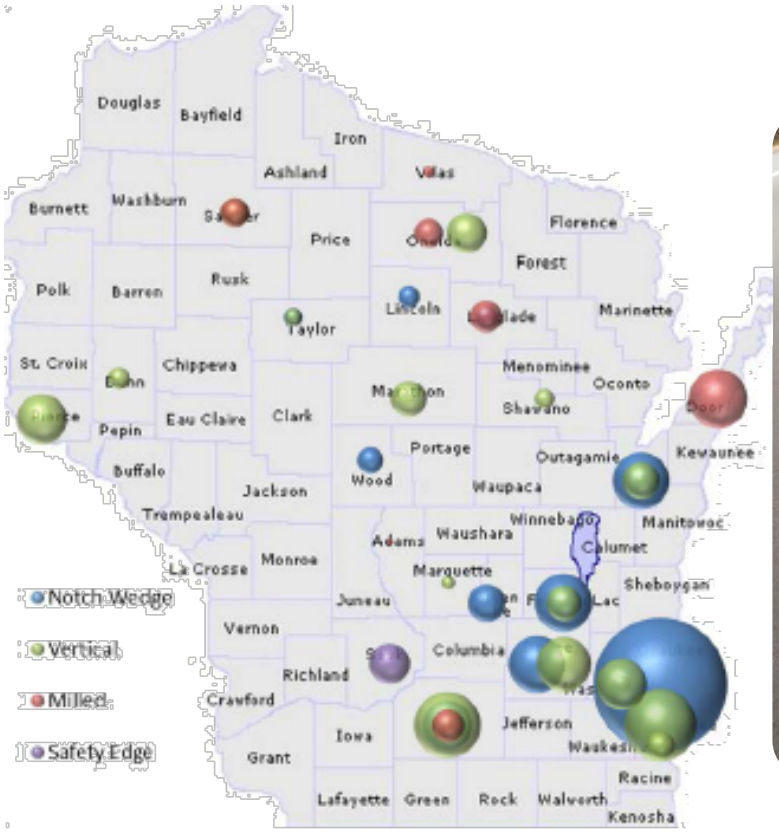
Longitudinal Joint Type

- Echelon
- Notched Wedge
- Normal Vertical
- Safety Edge
- Milled



WisDOT Joint Data

- 1400 data sets
- 28 projects
- No joint density > 93%



WHRP Study Recommendations

- Joint Type:
  - Notched Wedge / Mill out wedge
- Joint Method:
  - Unconfined: Stay back from edge with Roller
    (WI uses fine graded mixes)
  - Confined: Type of rolling pattern did not make a difference

WHRP Study Recommendations

Further research should include the evaluation of various joint sealers. New products include a void reducing asphalt membrane that is applied before paving to fill the void spaces in the longitudinal joint from the bottom up. Appendix G is the Illinois Department of Transportation (IDOT) Void Reducing Asphalt Membrane specification.

Also, in lieu of a monetary penalty, the research team recommends requiring the application of a top-applied joint sealer, at the contractor's expense, when the contractor does not achieve compaction of the longitudinal joint.

Heated joints resulted in higher densities for all joint types where data was available. Heated joints increased densities by 0.7, 1.2 and 1.5% for milled, vertical, and notched wedge, respectively.

Make it better??

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IDOT District 4 Mill Wide Pave Wide Experiment Approach

CONSTRUCTION SEQUENCE FOR MILLING AND PAVING (SMART) (*REVISED 11-22-2016*)

The following is the sequence for milling and paving:

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1. Mill the first lane 6" wider than the centerline.
2. Clean and prepare surface as per Article 406.05 of the Standard Specifications prior to placement of the HMA surface.
3. Pave the first lane 6" wider than the centerline to the longitudinal vertical face of the adjacent lane.
4. Mill the adjacent lane to the existing centerline, removing the additional 6" width of the initial mat.
5. Clean and prepare the surface as per Article 406.05 of the Standard Specifications prior to the placement of the HMA surface. The HMA Tack Coat shall be sprayed the full width of the lane and also lapped onto the adjacent lane a distance not to exceed 4". In addition, the vertical face of the adjacent mat shall be thoroughly tacked by means of a dedicated spray nozzle, mounted at a 45 degree angle, aimed toward the face.
6. Placement of this HMA Surface shall require the use of a joint-matching device in lieu of a longitudinal averaging ski. The compacted height of this lane shall be either exactly flush, or no more than 1/32" higher, to the adjacent lane to ensure the joint has sufficient material for adequate compaction. During placement, the side plate of the screed shall not exceed ½" overlap onto the adjacent lane.

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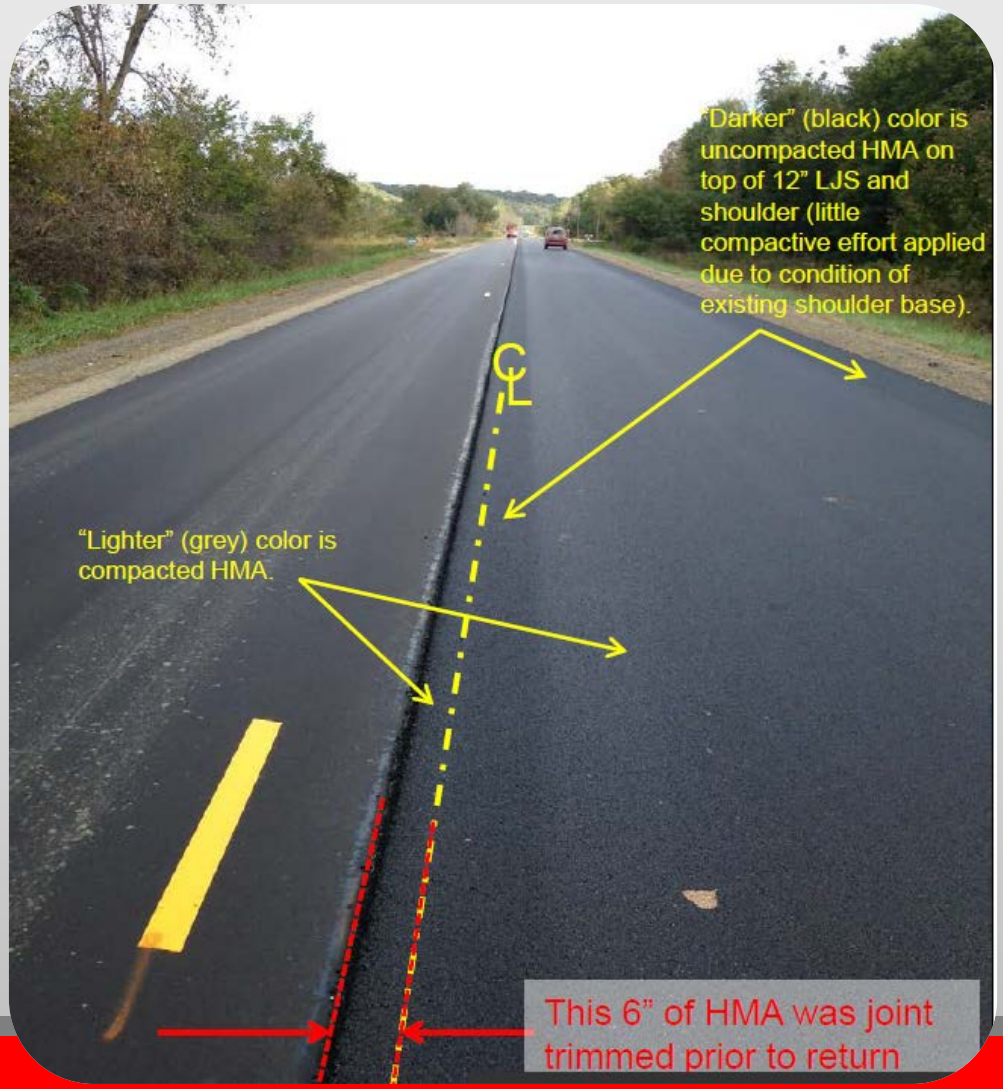
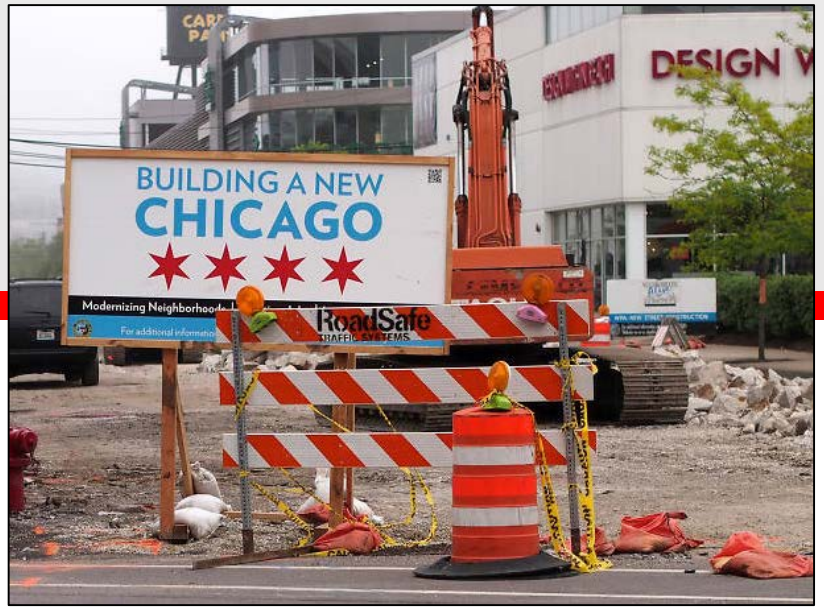
D-4 Pave Wide Mill Wide



Concerns:

1. Urban Areas
   - Time factor
   - Perception
2. Permeability
   - Isn't fully addressed



Agree to Disagree

Mill off unconfined joint?

Hey – Teddy Brosevelt!

Why not LJS?

Need to prevent Permeability

- Increase density (obviously)
- Brother from a Different Mother:
  - Longitudinal Joint Seal (LJS) – IDOT
  - Void Reducing Asphalt Material (VRAM) - Tollway
  - J-Band = Joint Band – Heritage proprietary

Illinois Department of Transportation

IDOT Policy and Spec March 2017

Illinois Department of Transportation

Memorandum

To:	Regional Engineers Attn: Program Development Engineers
From:	Brian Pfeifer
Subject:	Special Provision for HMA – Longitudinal Joint Sealant
Date:	March 31, 2017

This special provision was developed to improve the performance of centerline and lane-to-lane joints for full-depth HMA pavements and HMA overlays.

The designer must specify which lifts of the HMA shall receive the sealant on the plans.

- Full-Depth HMA Pavements – under the surface lift and under the top binder lift

Illinois Department of Transportation

Suppliers (3 on IDOT list)

Illinois Department of Transportation
Bureau of Materials

QUALIFIED PRODUCER LIST OF CERTIFIED SOURCES FOR LONGITUDINAL JOINT SEALANT

September 15, 2017

This list supersedes the August 26, 2016 list.

CBM Specification, "Hot-Mix Asphalt – Longitudinal Joint Sealant"
Effective: March 1, 2016
Revised: January 17, 2017

To learn more about the certification procedure click on the bookmark to the left, "Procedure for Certifying a New Longitudinal Joint Sealant".

Source	Location	Source Number
Asphalt Materials, Inc.	Indianapolis, IN	423-01
Emulsicoat, Inc.	Urbana, IL (Saline Court)	2260-03
Tri-State Asphalt	Morris, IL	3900-01

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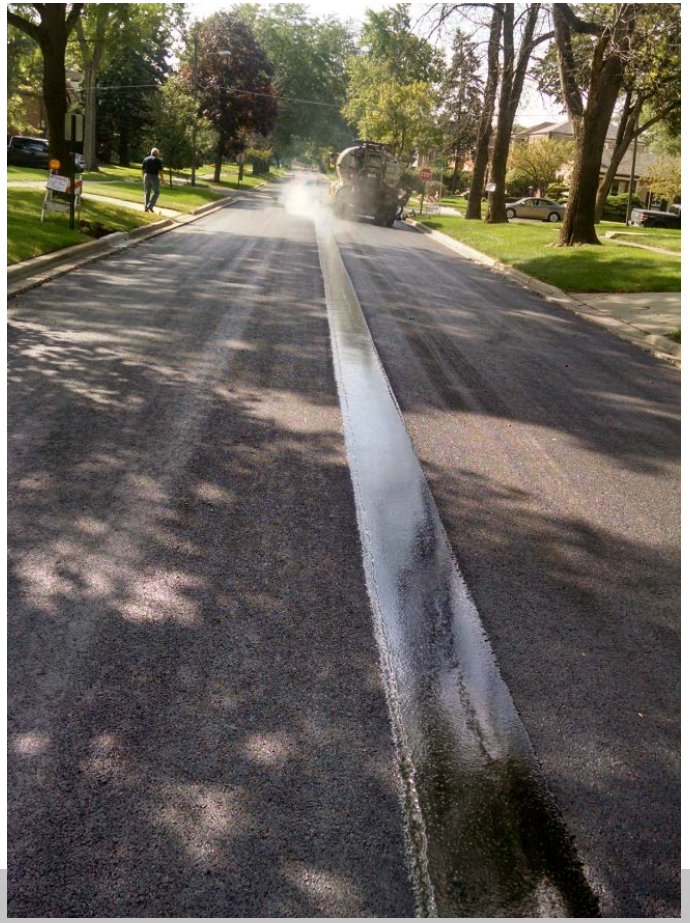
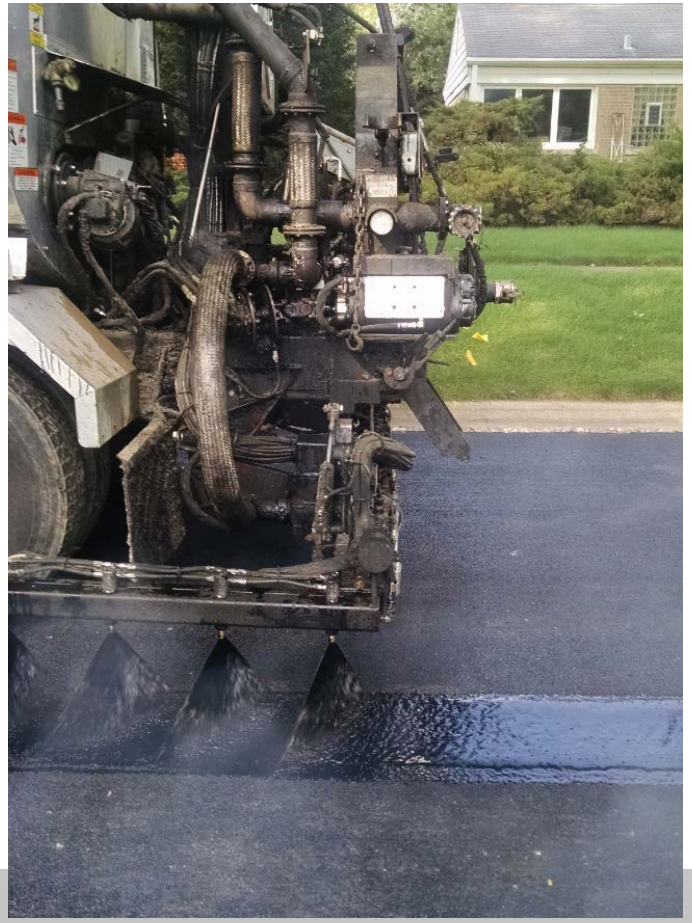
Application Rates:





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Bid Tabs on I-55 in 2016

60Y65
ILLINOIS DEPARTMENT OF TRANSPORTATION

PAGE: 1
10/03/16 08:57:08
LETTING DATE: 07/29/2016
LETTING ITEM NUMBER: 007
RESPONSIBLE DISTRICT: 01
BIDS LOCKED: Y
SECTION: 2014-079RS,BR&T
ESTIMATE:

UNIT PRICE TABULATION OF BIDS
LETTING TYPE: SCHEDULED
CONTRACT NUMBER: 60Y65

COUNTY: WILL DUPAGE COOK

SUMMARY OF CONTRACTOR BIDS

Z0033700 LONG JOINT SEALANT 568,396.000 FOOT

3069	0.7500	426,297.00
426,297.00		
4813	1.3000	738,914.80
738,914.80		
1560	1.0000	568,396.00

Please Note:

- These are large quantities
- LJS is at 12” (for SMA) & 15% less
- LJS should be 18” for dense graded

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Long Term Experience 14 Years Later

Route 26 Conventional Joint

Route 26 with Joint Sealant

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No Maintenance After 14 Years

Route 50 Conventional

Route 50 J-Band

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Distributors Improving

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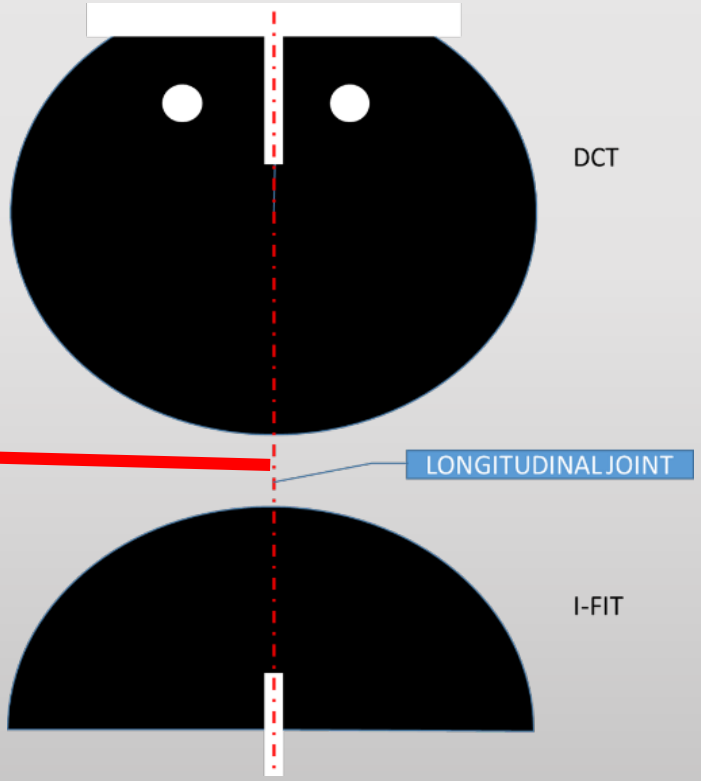
DuPage County

- Wanted improved longitudinal joint performance
- Started specifying alternative methods in 2013
  - Echelon Paving
  - Infra-red Joint Heater
  - J-Band
- Performance testing on joint cores

Tested Right ON the Joint!



DuPage County

- Joint treatment types tested:
  - J-Band (Bid @ $2.80 per foot)
  - Echelon (Incidental)
  - Infra-red Joint Heater (Incidental)
- 4 x 150mm cores directly over the joint
- Performance test results (DCT & I-FIT)

DuPage County – Gary Ave.

2016 DuPage North - Gary Avenue					
Mix Type	Vir AC	Section Type	DCT (J/m^2)	I-FIT (FI)	Ave Density
N70E	SBS PG70-28	J-Band	675.5	41.0	98.9[1]
N70E	SBS PG70-28	Echelon	485.5	14.7	94.1
N70E	SBS PG70-28	Joint Heater	418.5	12.3	90.4
1 - Gmm calculated from cores					

ROCK STAR **Results!**

DuPage County – Hobson Rd.

2016 DuPage South - Hobson Road					
Mix Type	Vir AC	Section Type	DCT (J/m^2)	I-FIT (FI)	Ave Density
N70E	SBS PG70-28	J-Band	395.5	48.5	95.7[1]
N70E	SBS PG70-28	Echelon	418.5	10.7	93.3
N70E	SBS PG70-28	Joint Heater	340.0	11.0	92.8
1 - Gmm calculated from cores					

Conclusions DuPage County.

LJS and Echelon are the only approved methods going forward

I-88 Tollway Trials

- Tollway Trials and Innovations
  - RAP fractionation
  - Warm mix mandate
  - RAS implementation
  - GTR trials and use
  - And a whole lot of other ones!

  - LJS in 2015

Torque Test

Brought to you by:

Illinois Tollway

INTERSTATE
ILLINOIS
88

The Heritage Group

V-RAM

Evaluation and Performance of:

Joint-Band, a Void Reducing Asphalt Material (VRAM)

Introduction

One type of failure associated with Hot Mix Asphalt (HMA) and Warm Mix Asphalt (WMA) pavements occurs at the longitudinal joints. During placement one or both of the edges of the mat will be unconfined and density at these edges will be lower than across the rest of the mat because there is nothing to hold that edge. This typically makes the outside of the mat less dense and more permeable. This edge will most likely be cold when the adjacent lane is placed, and depending on how well it was constructed, the resulting longitudinal joint may also be permeable. Water may infiltrate either through the mat or the joint and, during freeze/thaw, may cause the joint to deteriorate.

I-88 Field Trials

- Migration
- Hamburg
- Single Edge Notch Disk
- Torque Test

Table 1

Upward J-Band Migration				
	Core No.	Overall Core Thickness (cm)	Average Migration from interface (cm)	Migration %
Joint	1	5.0	4.0	80
	2	4.5	2.3	51
	3	4.5	2.5	56

Table 2

Core No.	Type	No. Passes	Rut Depth (mm)	Average Rut Depth (mm)
14-15	Control	20,000	7.29	8.56
19-20	Control	20,000	9.83	
	nd	20,000	9.55	

Table 3

SINGLE-EDGE NOTCHED DISK (SEND) FRACTURE TEST

Specimen	Diameter (mm)	Thickness (mm)	Notch depth (mm)	Ligament Length (mm)	Max Load (kN)	Fracture Energy (J/m²)	Aver Fracture En
1	150.0	69.5	14.5	55.0	12.82	1470.6	
2	150.0	69.0	13.0	56.0	12.80	1415.5	142
3	150.0	60.5	14.5	46.0	9.19	1482.2	
4	150.0	59.0	12.5	46.5	8.92	1328.0	
1A	150.0	65.5	14.5	51.0	10.89	1359.5	
2A	150.0	65.5	14.5	51.0	11.21	1397.2	130
3A	150.0	64.5	14.0	50.5	10.07	1069.8	
4A	150.0	66.5	13.5	53.0	10.57	1373.9	

Specimens 1-4 contained J-Band between SMA surface and underlying asphalt layer
Specimens 1A-4A taken as controls in sections without J-Band material

Table 4

Core Number	Core Type	Diameter at Interface (mm)	Peak Torque (N-m)	Interlayer Bond Strength (kPa)	Interlayer Shear Strength (psi)	Average Interlayer Shear Strength (psi)
1	w/o Jband	91.5	160	798.2	115.8	124.0
2	w/o Jband	91.6	194	964.6	139.9	
3	w/o Jband	91.7	140	698.9	100.6	
4	w/o Jband	91.8	195	968.3	139.7	
5	With Jband	89.8	120	633.3	91.9	95.6
6	With Jband	90.1	115	600.9	87.2	
7	With Jband	85.5	120	733.7	106.4	
8	With Jband	91.7	135	669.1	97	

Learning Experience

- Flushing observed after application on SMA
- Application rate reduced in current IDOT specification

Hamburg Results

Core No.	Type	No. Passes	Rut Depth (mm)	Average Rut Depth (mm)
14-15	Control	20,000	7.29	8.56
19-20	Control	20,000	9.83	
4-5	J-Band	20,000	9.55	7.21
9-10	J-Band	20,000	4.87	

Flushed areas did not show increased rutting potential

CDOT All Aboard!

CDOT
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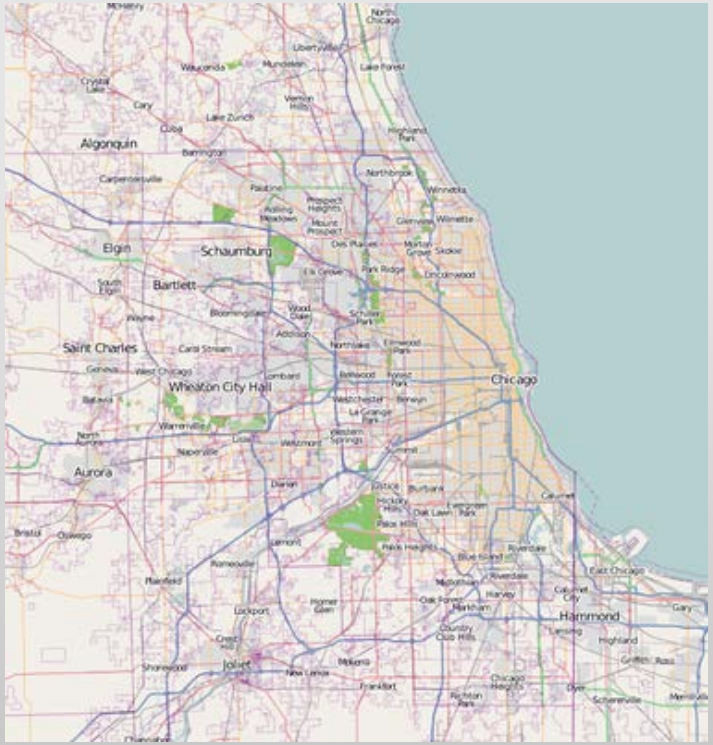
TESTING

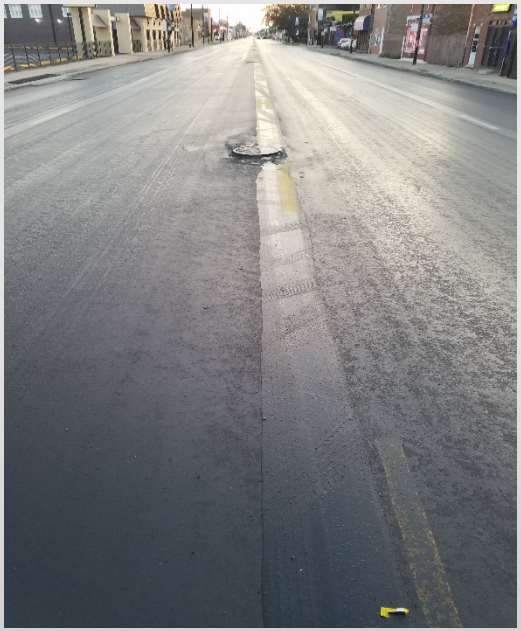
CDOT Arterial Resurfacing Program 2016

- Contract divided into four quadrants of City
- Each required joint treatment on one street
- Trials used IDOT Longitudinal Joint Treatment
- Two completed in 2016
- Two completed in 2017



LJS Constructibility

- Sets up in a few minutes
- Does not pick up under traffic. (Note tire tracks but no pickup)



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DCT Results – CDOT

Location	Core Numbers	HMA Mixture Type	% ABR	RAS	Virgin Asphalt Grade	DCT Value (J/m²)	J-Band
Belmont EB	1 & 2	N70 D	19	N	PG 58-28	584.6	Y
Belmont WB	3 & 4	N70 D	19	N	PG 58-28	628.2	Y
					Average	**606.4**	Y
Irving Park Rd WB	5 & 6	N70 E	19	N	*PG 70-28	385.6	N
Irving Park Rd EB	7 & 8	N70 E	19	N	*PG 70-28	418.0	N
					Average	**401.8**	N

*PG 70-28 is SBS polymerized

ROCK STAR **Results!**

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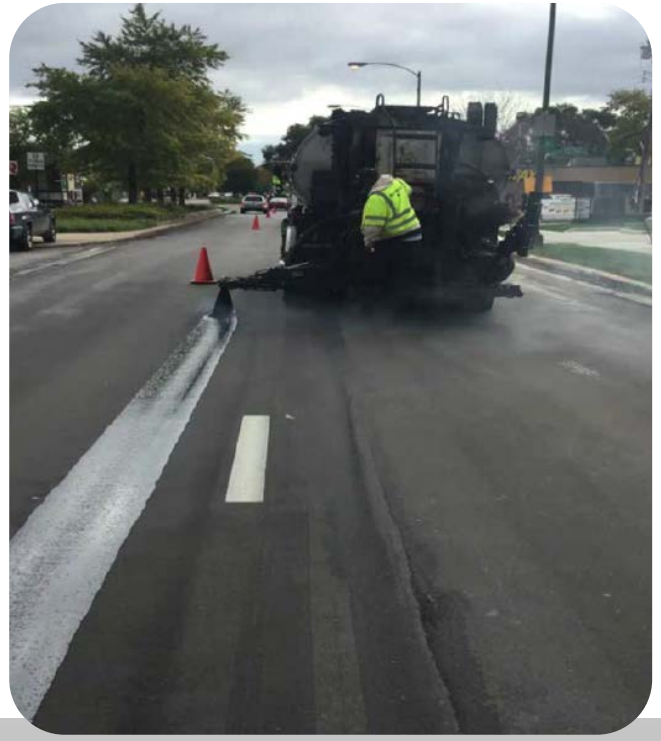
DCT Results at Joint

- DCT higher for lower quality mix with a neat PG58-28 AC than mix with SBS polymer PG70-28

- Filling voids with the LJS has a greater effect on the mix properties at joint than polymer AC.

CDOT Field Experience

- Experience positive
- Will be using on more projects



CDOT Implementation 2017

- City-wide Term Contracts (3 year term, 4 set areas, mixes, etc.) included LJS
- 79,000 LF for the quantity per contract area
- Bigane Paving low bidder on all four contracts
- Unit price was $3.00 to $3.50 /LF on each contract

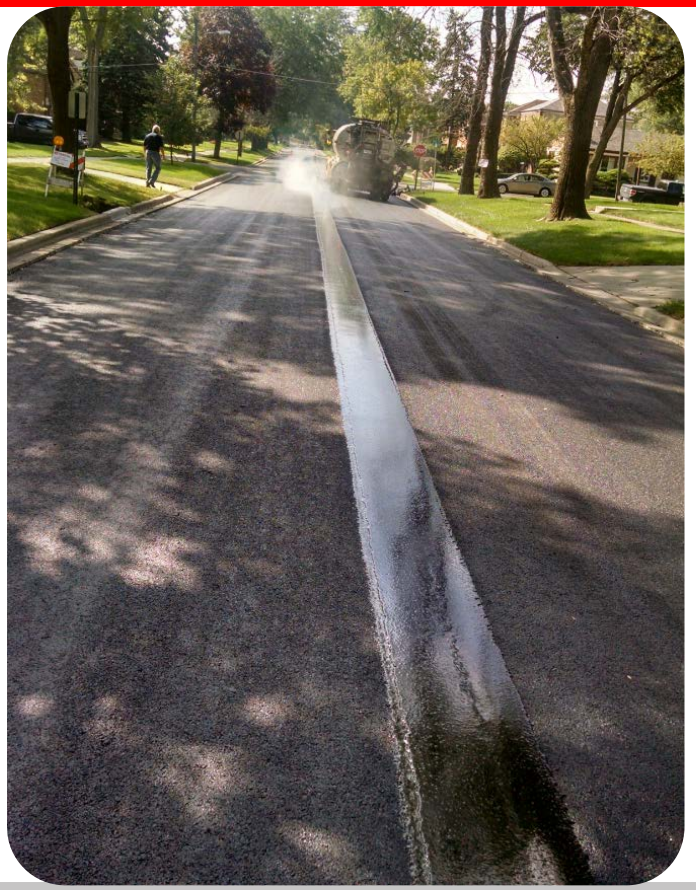
CDOT Arterial 2017

- Bid opening was late fall 2017
  - North 183,285ft; $2.00/ft
  - Central 161,780ft; $2.00/ft
  - South 140,178ft; $2.00/ft
  - Far South 201,172ft; $1.95/ft
- Started paving this year (Cold temps/No Issues)
- Will finish balance in 2018
- ALL locations get LJS!!

Conclusion

- Variety of approaches to improve performance at joint – most don't work
- My recommendation is ….

LJS



Questions?