Longitudinal Joints of Hot Mix Asphalt (HMA) Pavements in Tennessee

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TDOT Materials & Tests

Longitudinal Joint Failures

- In 2006, the Department determined that poor HMA longitudinal joint construction and premature longitudinal joint failures were affecting the overall life of HMA pavements in Tennessee.

Longitudinal Joint Failures

- Premature longitudinal joint failures provide pavements with the ability to ravel, propagate cracks throughout the mainline, and ultimately destroy the pavement prior to reaching its desired design life.

Longitudinal Joint Failures

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Joint Study

- In 2007, the Department agreed to fund a research project with the University of Tennessee to investigate the cause of and solutions for premature longitudinal joint failure.

Project Objectives

- Investigate the fundamental mechanisms of longitudinal joint failure
- Evaluate available technologies and construction practices that may mitigate longitudinal joint failure
- Recommend potential changes to TDOT specifications

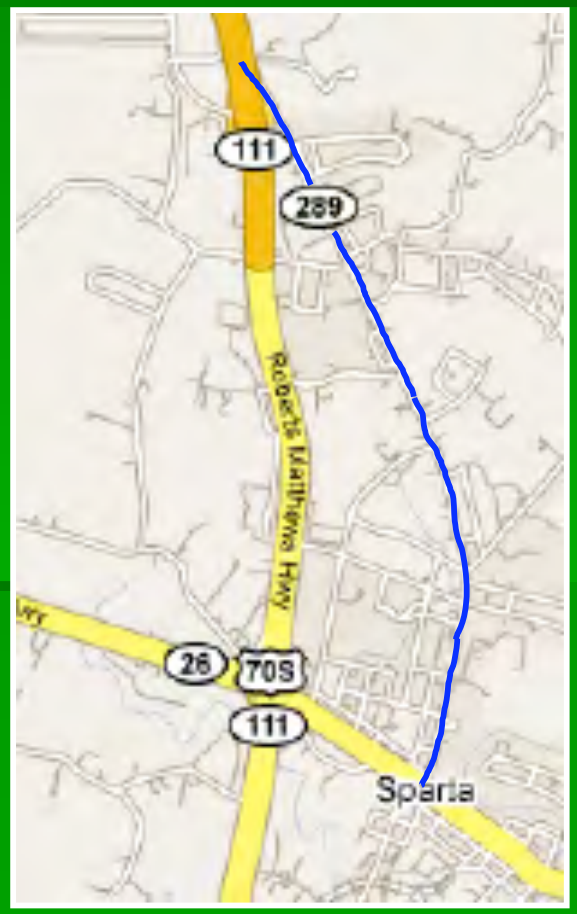
Project Scope

- Perform literature review
- Select field projects
- Evaluate various products and construction techniques
- Perform field and laboratory testing
- Observe field projects annually

Field Project – Sparta, TN

- CNG155 – White County, Sparta, TN
- SR 289 / Spring Street from SR111 to Hwy 70 / W. Bockman Way
- 2.65 miles
- 2 Lanes, plus occ. Center turn lane
- 7 Products / Treatments, 2 Control Sections
- Highways, Inc.

CNG155 – SR289 – White Co.



Products / Treatments

- Crafco Joint Adhesive, Crafco Inc.
- Jointbond, Pavement Technology
- Pavon Crack Sealer
- Replay, Pavement Restorations Inc.
- Joint Heater, Heat Design Equipment, Inc
- SS-1 emulsion
- TST-1p emulsion

Product / Treatment Layout

Section Number	Length	Test Variable
Begin at bridge near SR111		
---	1000’	Equipment heating and stabilizing
1	1000’	Crafco joint adhesive
2	1000’	Pavement Technology, Jointbond
C1	1000’	CONTROL SECTION
3	550’	Pavon crack sealer
---	450’	No tests[1]
4	960’	Replay
---	???	1st turn lane section. No tests.
C2	1000’+	Heat Design Equipment[2]
---	???	2nd turn lane section. No tests.
5	1000’	Basic emulsion
6	1000’	Polymer emulsion
C3	1553’	CONTROL SECTION
End at Rite Aid near Hwy 70 / West Bockman Way		

Crafco Joint Adhesive

- Polymerized asphalt
- Hot-applied prior to second pass
- 350-400°F

Crafco Joint Adhesive

Crafco Joint Adhesive

JointBond, Pavement Technology Inc.

- Polymerized Maltene Emulsion
- Sprayed after 2nd pass
- Penetrates, stabilizes, seals
- Does not affect / cover striping

JointBond, Pavement Technology Inc.

JointBond, Pavement Technology Inc.

JointBond, Pavement Technology Inc.

Pavon Crack Sealer

- Cationic latex-polymerized asphalt emulsion
- Applied at ambient temperature.
- Applied prior to 2nd pass

Pavon Crack Sealer

Pavon Crack Sealer

RePlay, Biospan Technolgies Inc.

- Pavement Restorations, Inc.
- Spray-applied sealer
- Contains polymer
- Sprayed after 2nd pass
- Penetrates, seals
- Agricultural oil, 30% soybean based

RePlay, Biospan Technolgies Inc.

RePlay, Biospan Technolgies Inc.

Joint Heater, Heat Design Equipment

- Propane fueled, infrared heater
- Heats existing cold side prior to paving joint
- Can be attached to paver or towed ahead
- Various sizes, setups
- Heated existing asphalt up to 230°F

Joint Heater, Heat Design Equipment

Joint Heater, Heat Design Equipment

Joint Heater, Heat Design Equipment

SS-1 Emulsion

- Common material, typically used as tack coat
- Anionic emulsion
- No polymer
- Can be applied 60-140°F
- Can be diluted with water

SS-1 Emulsion

SS-1 Emulsion

TST-1p Emulsion

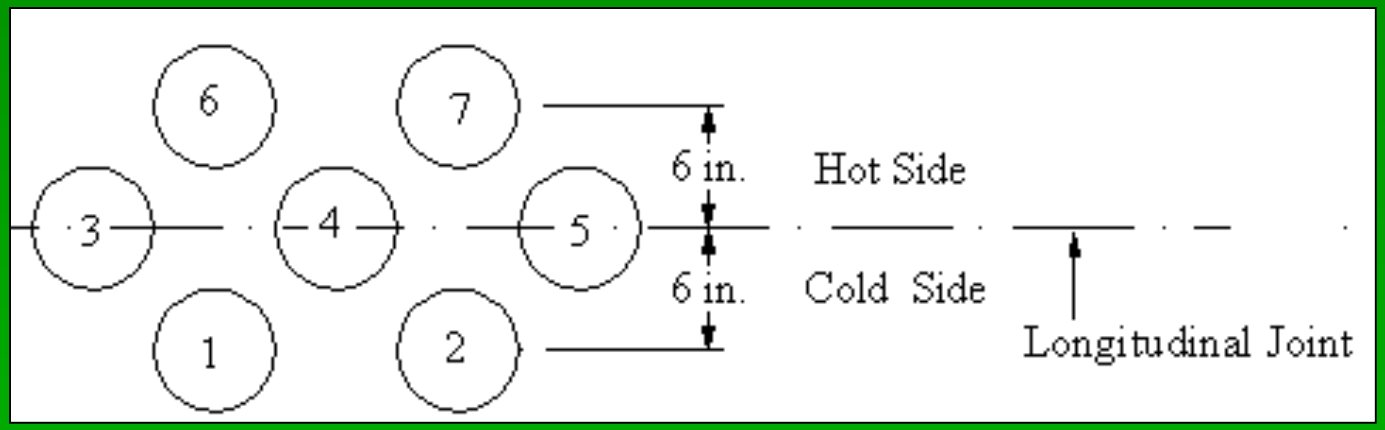
- Also an emulsion which can be used as tack coat
- Polymerized
- Higher elasticity
- Can be applied 60-140°F
- Can be diluted with water

TST-1p Emulsion

TST-1p Emulsion

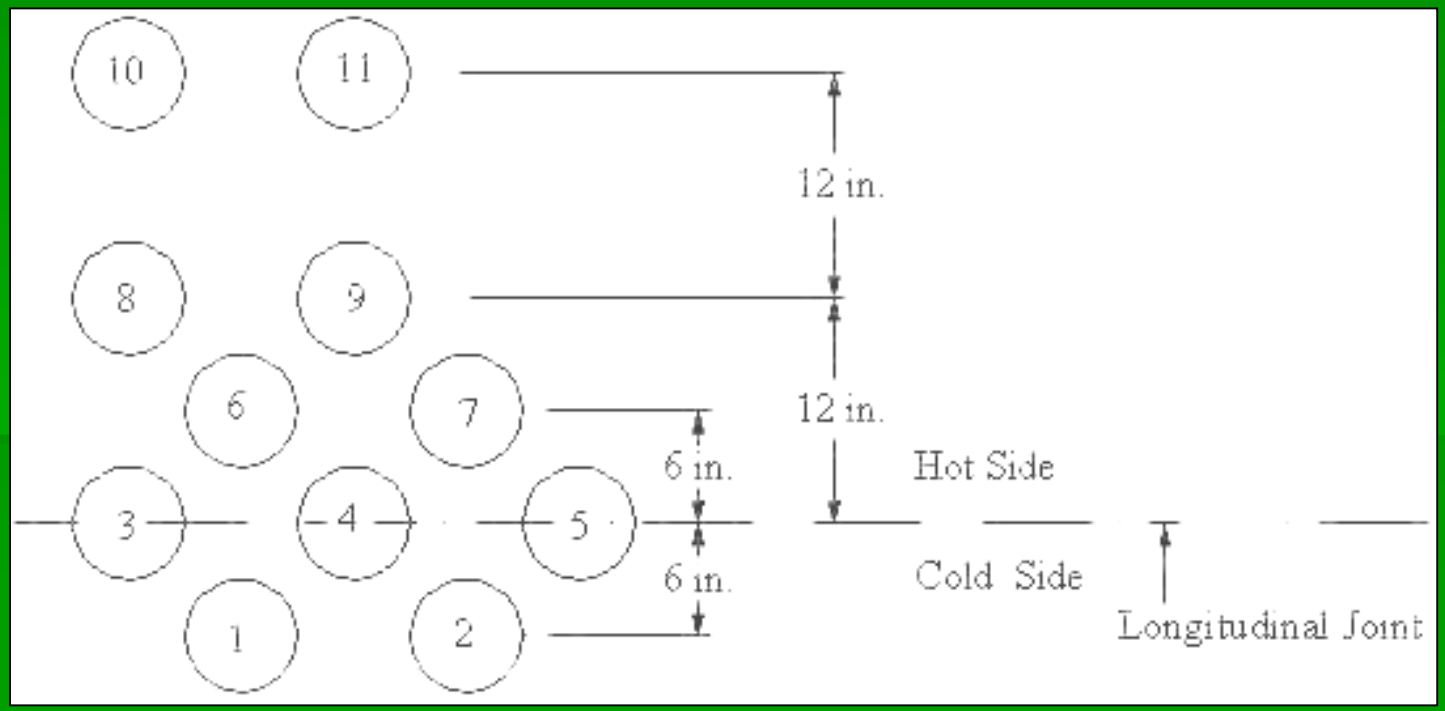
Coring

- Main pattern



Coring

- Alternate pattern



Coring

Coring

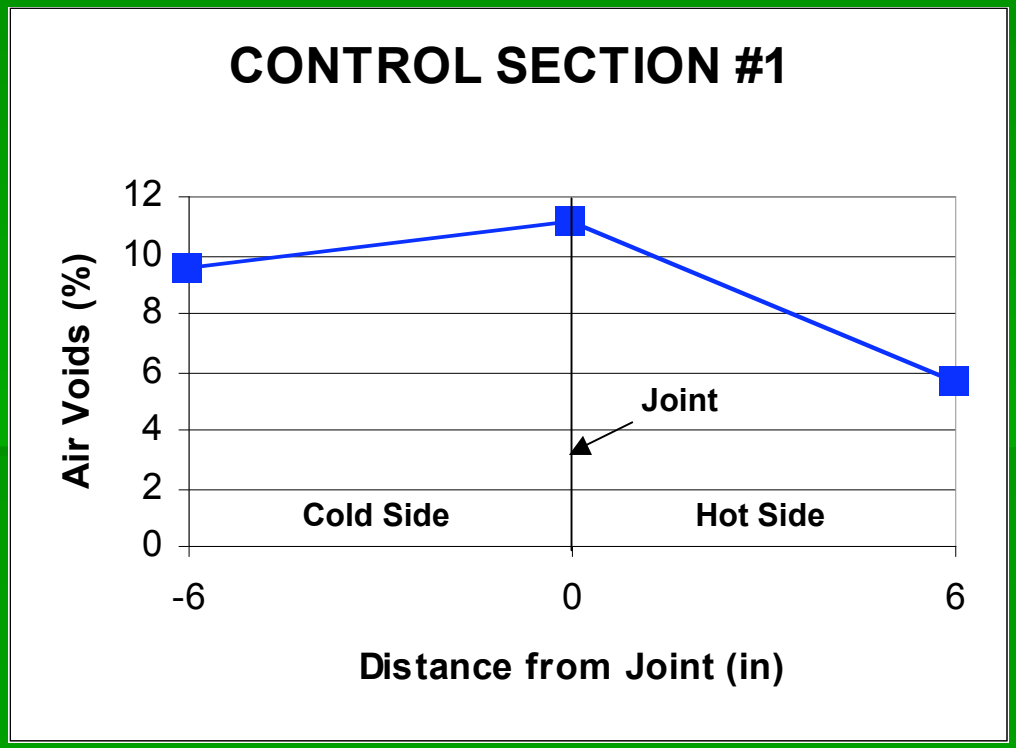
Coring

Current Test Results

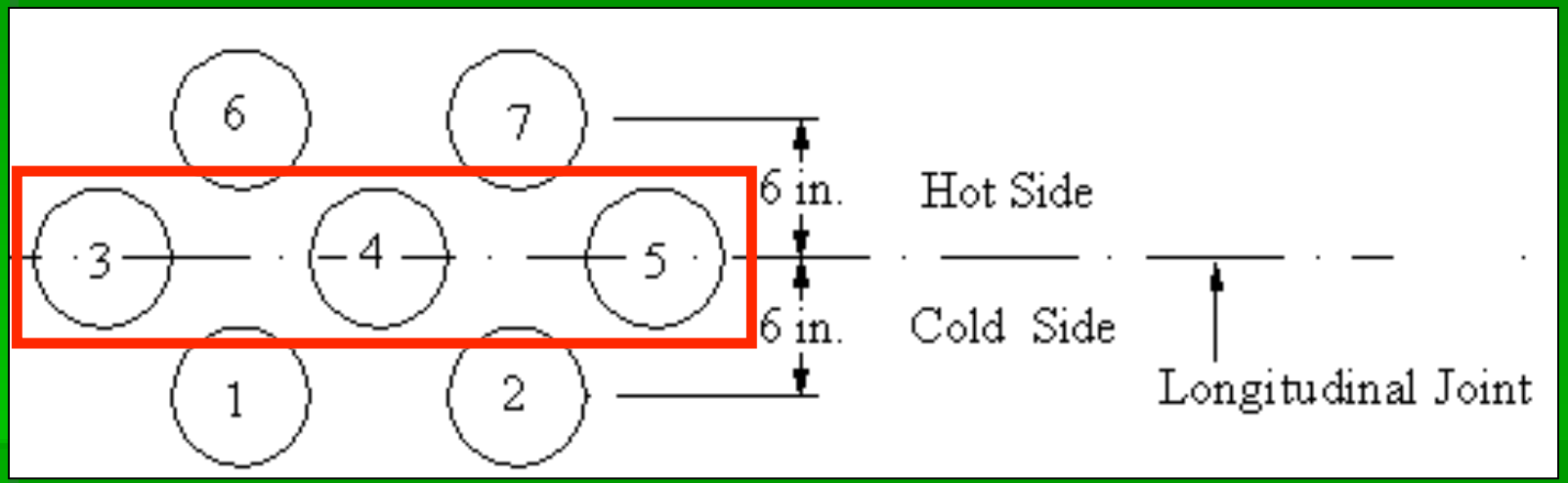
- After paving, over 100 cores were taken
- Cores were sent to the University of Tennessee, Knoxville
- Current test results include density/air voids and permeability

Air Void Results

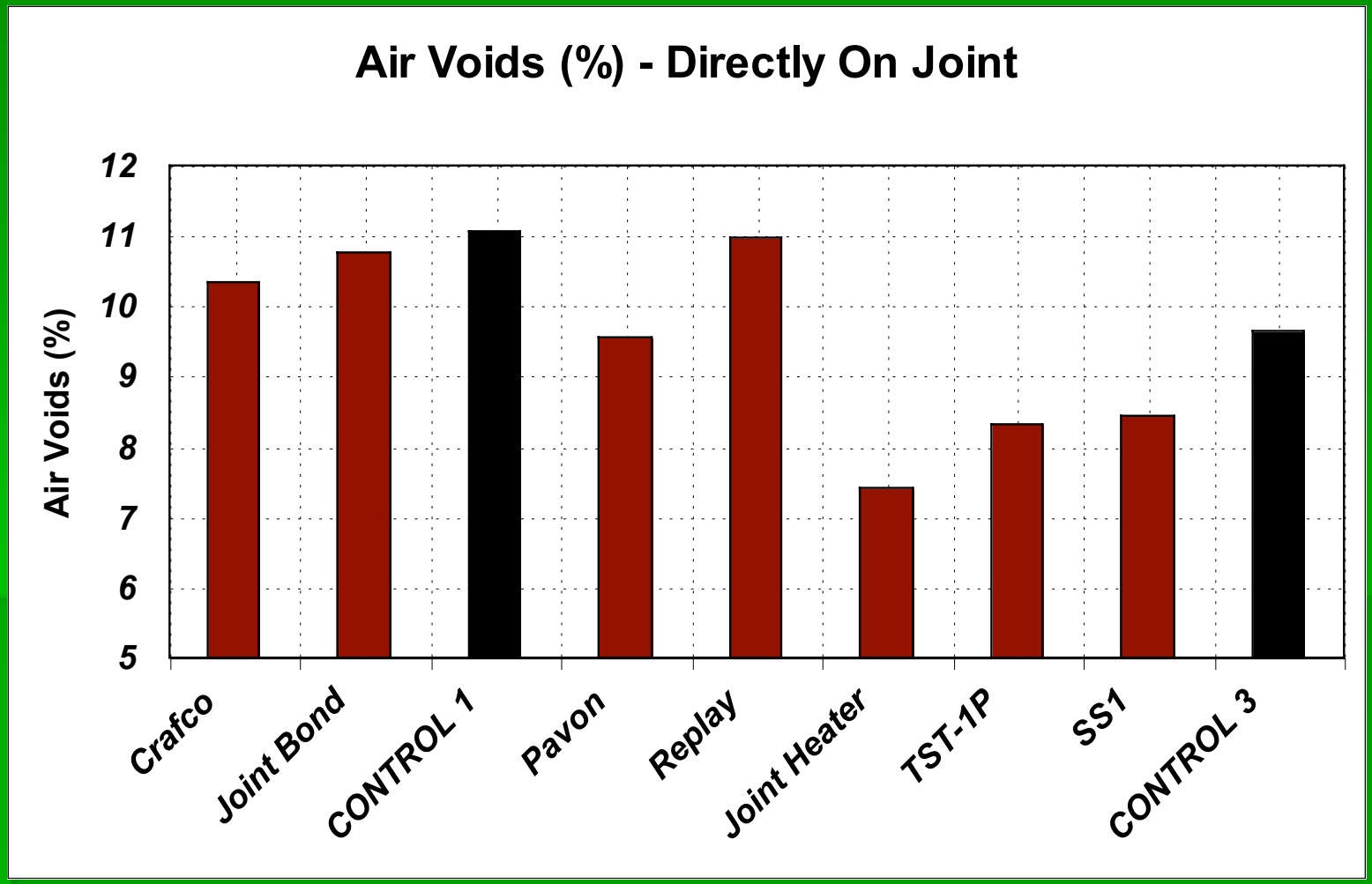
- Typical Air Void Cross-section



Air Void Results



Air Void Results



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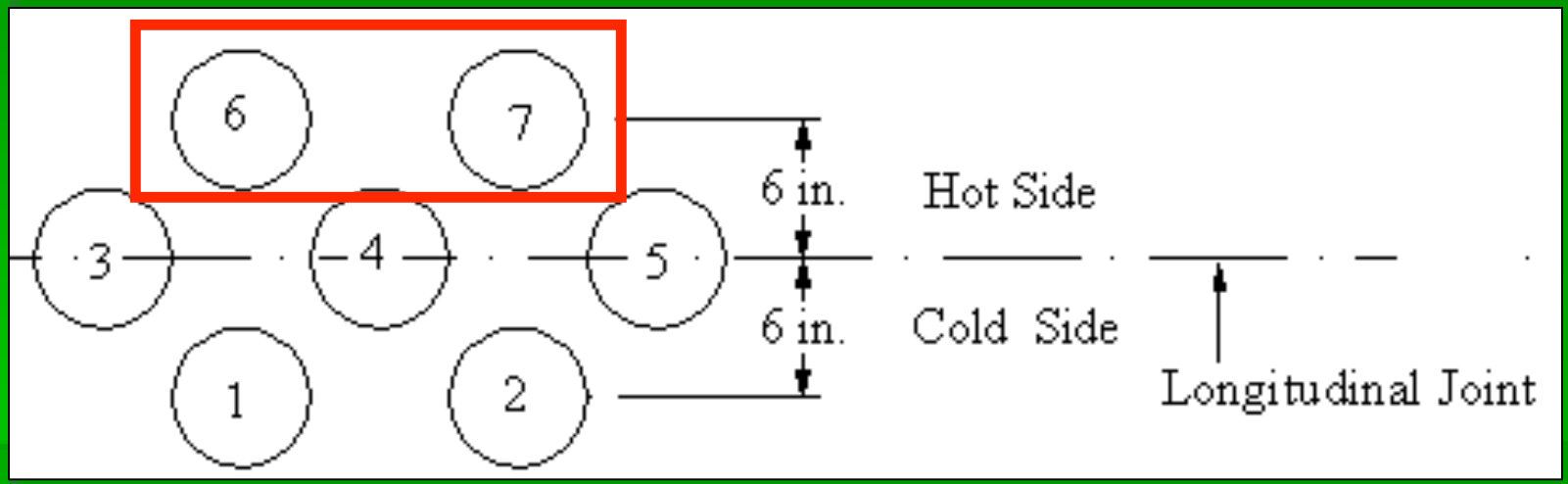

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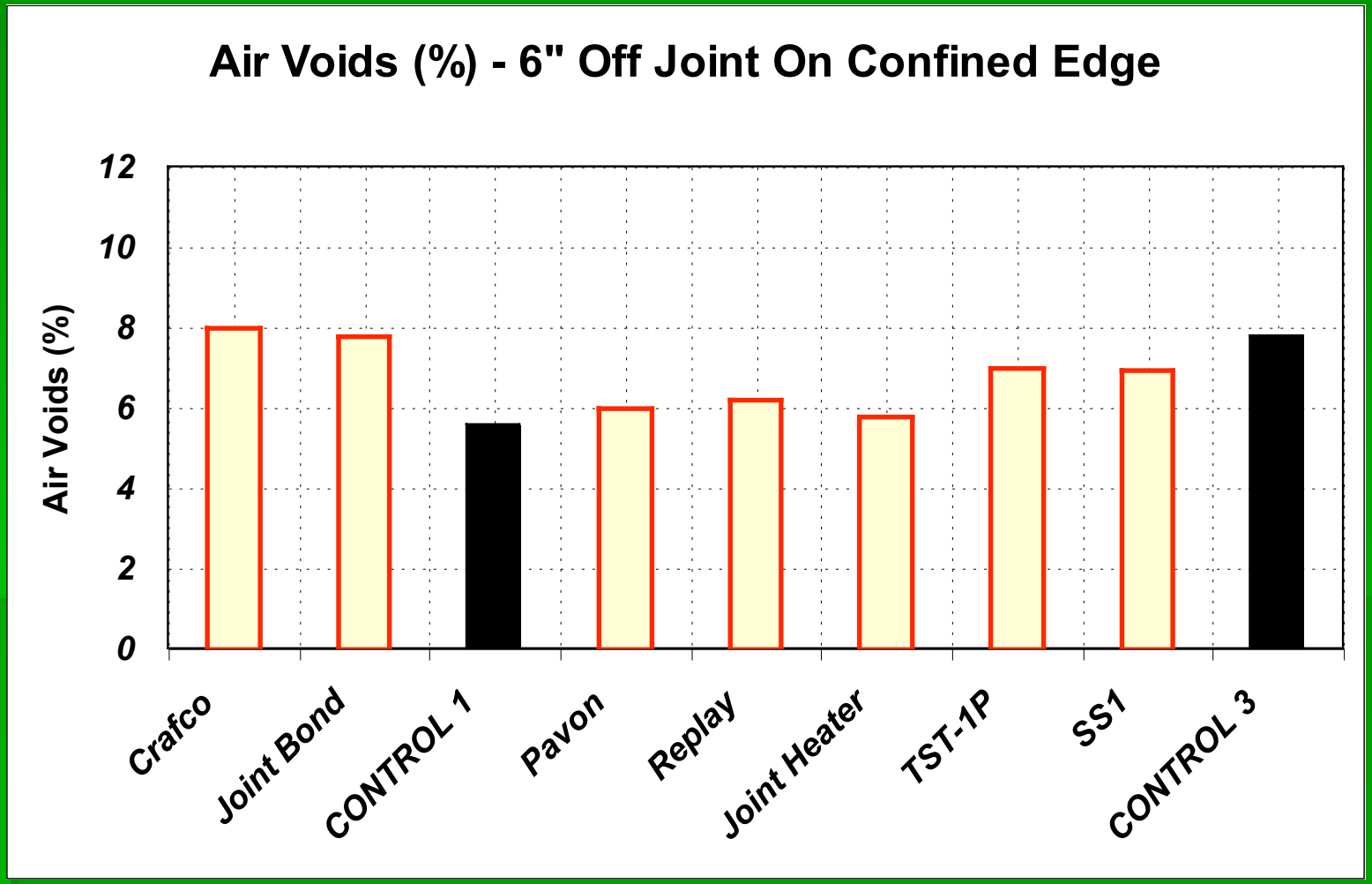

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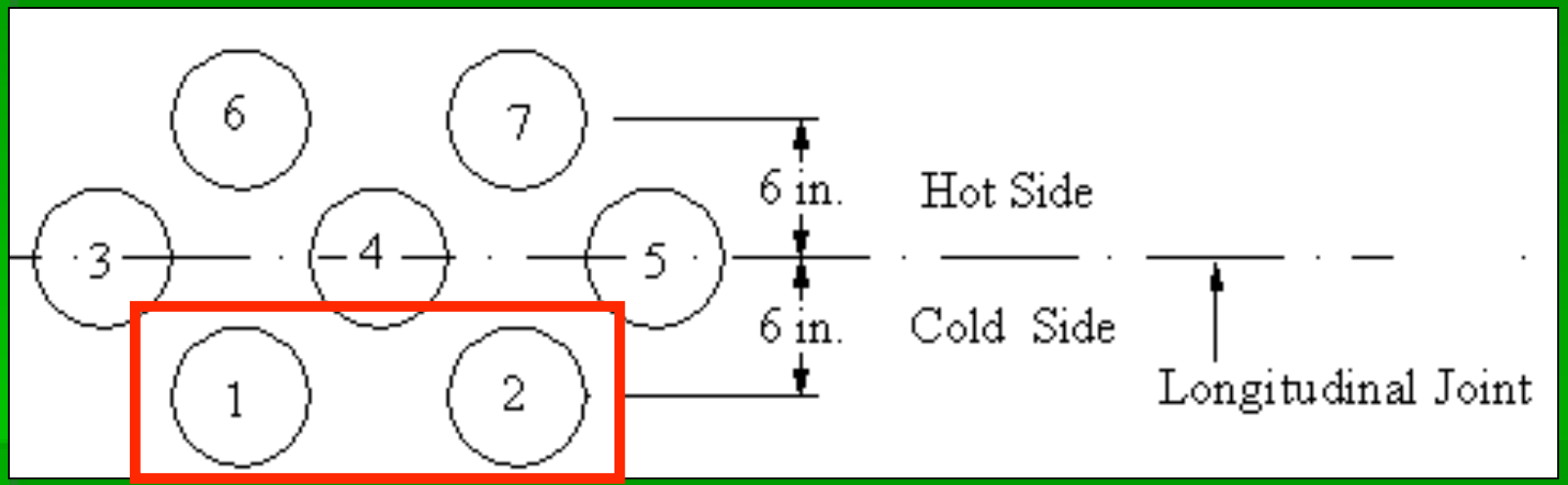

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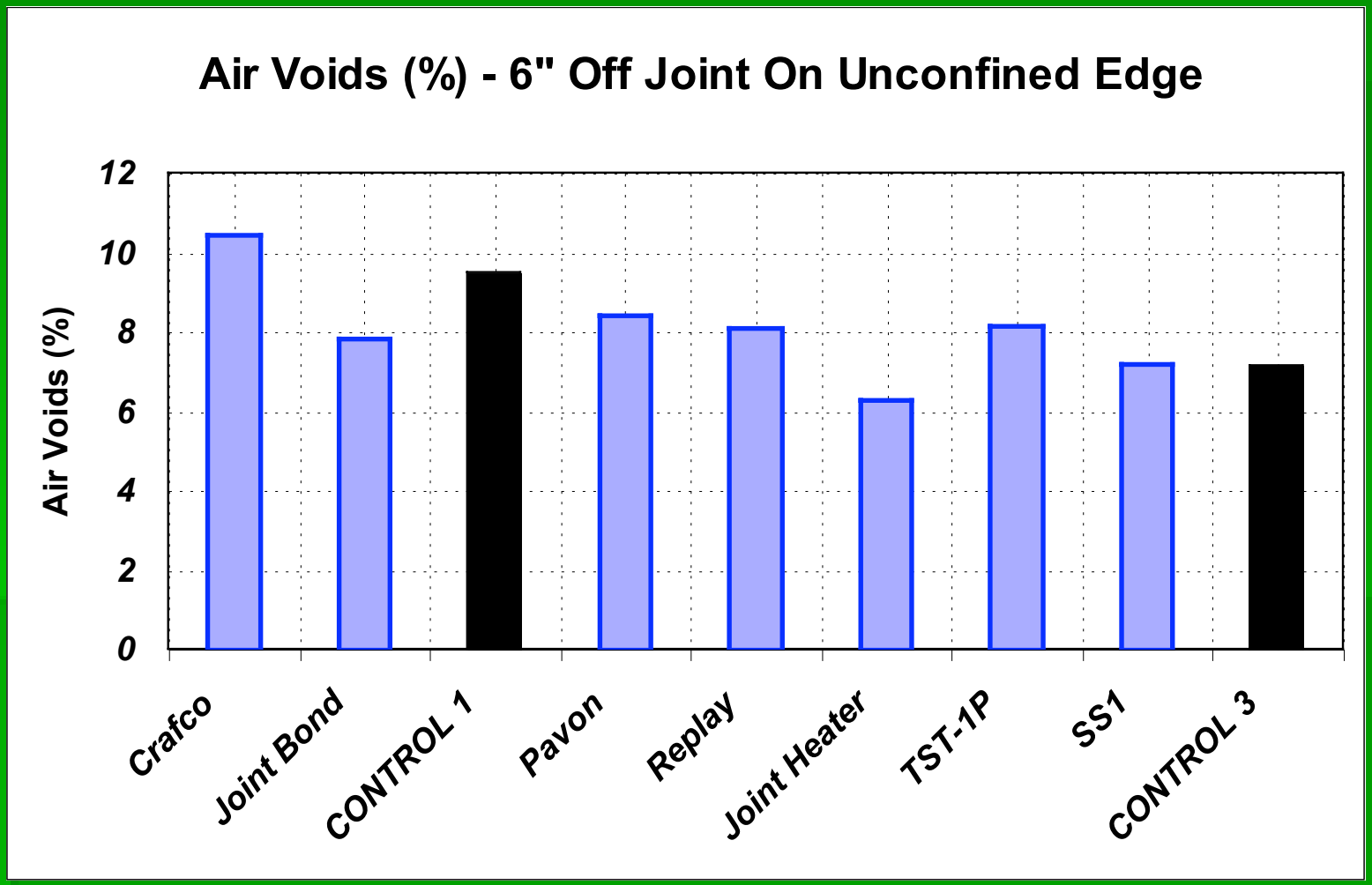


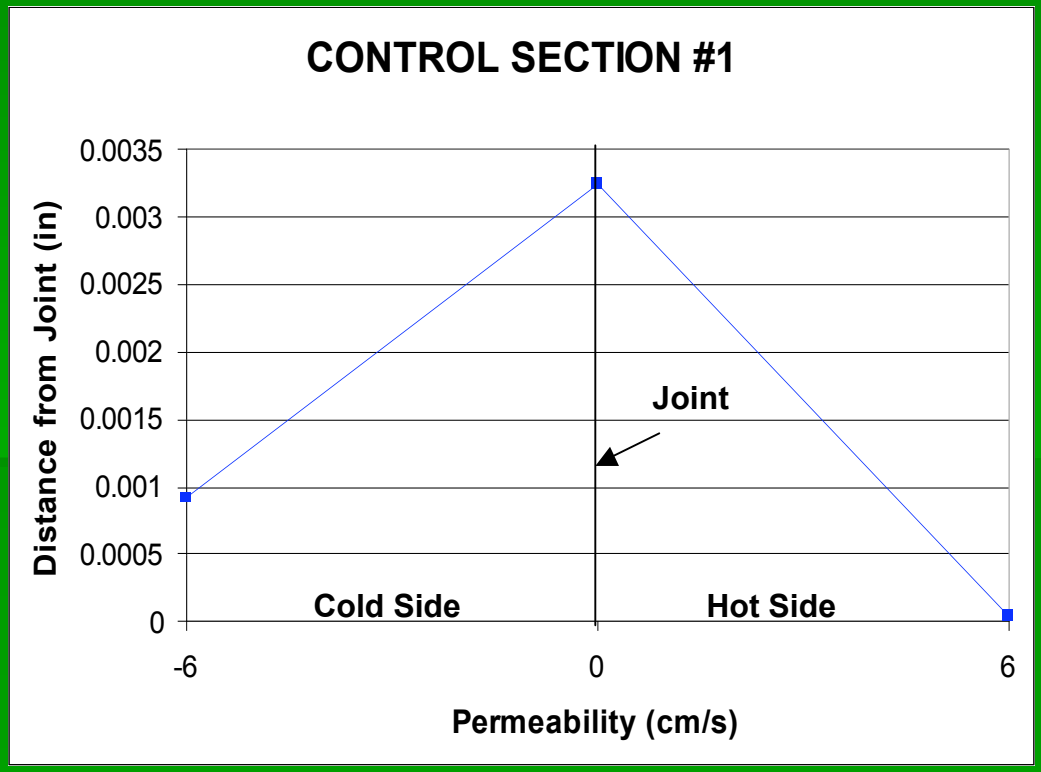
Permeability Testing

- Florida DOT Method
- Measures water permeability of asphalt laboratory specimens
- Units of cm/s

Permeability Testing

Permeability Testing

- Typical Permeability Cross-section



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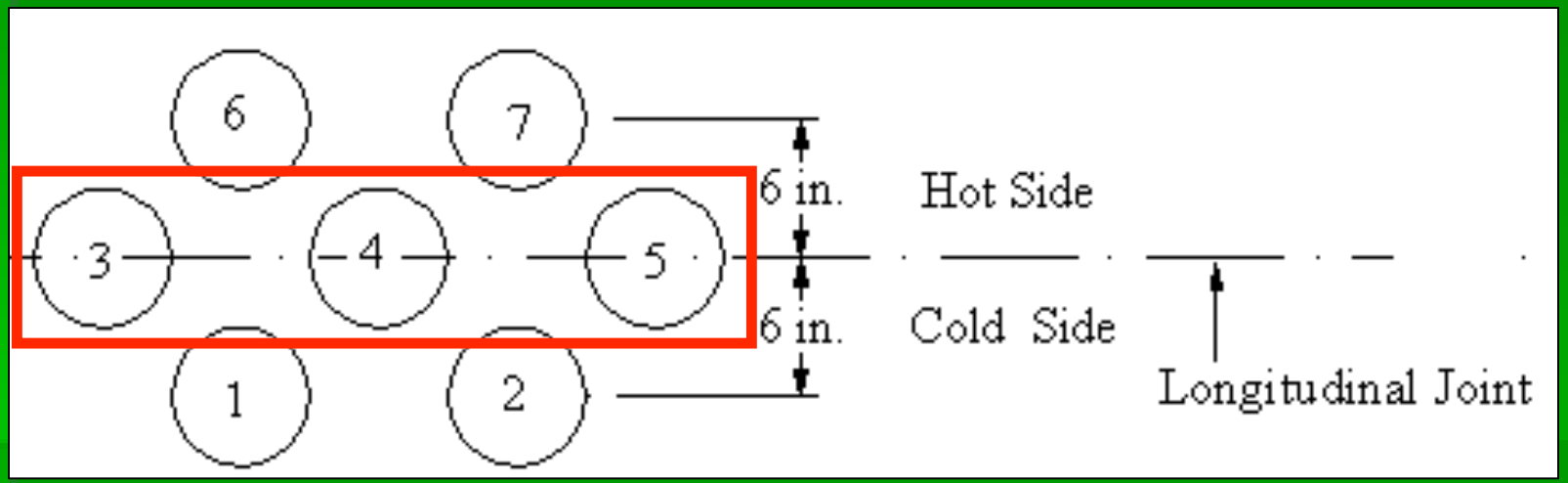

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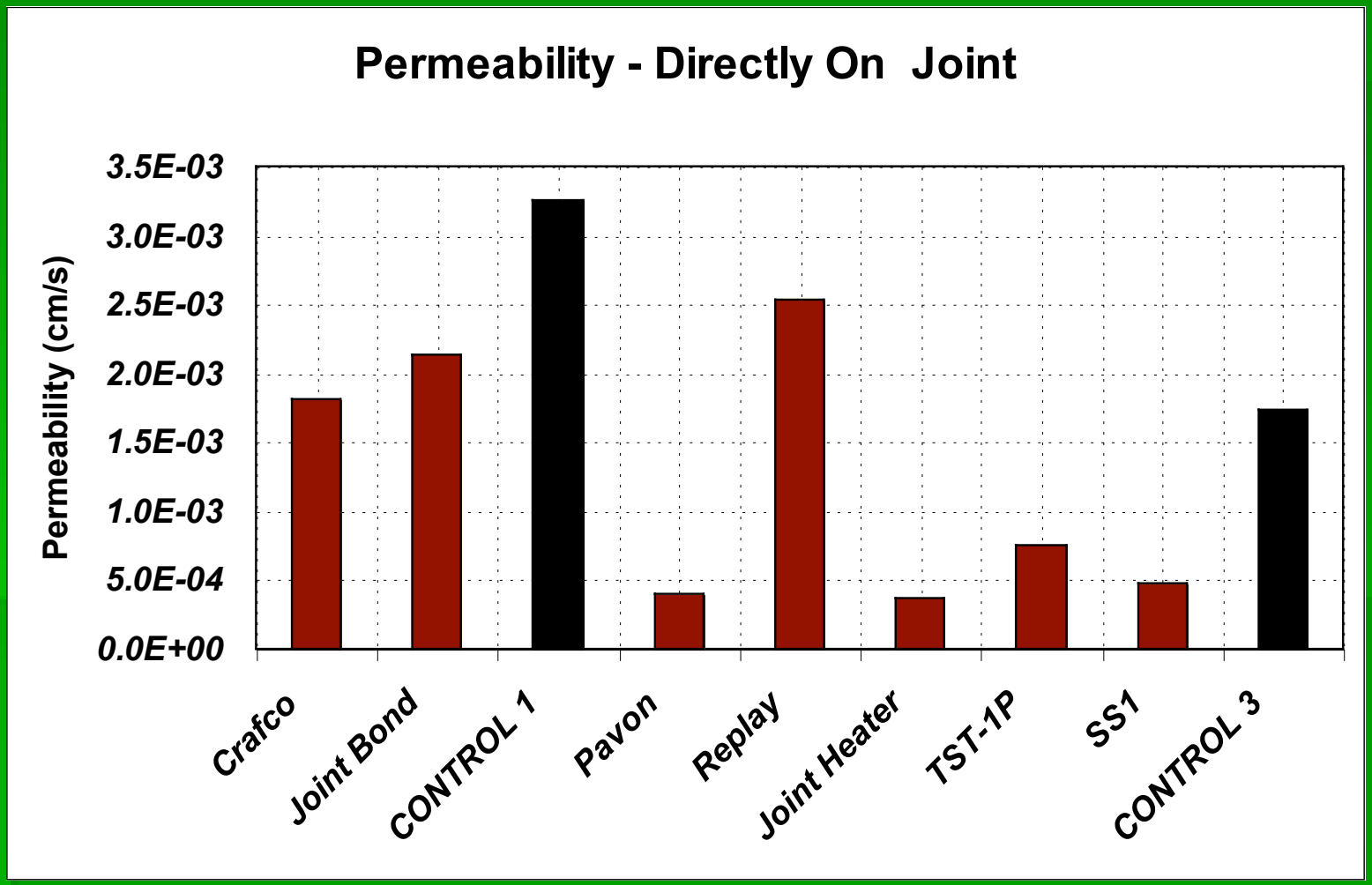

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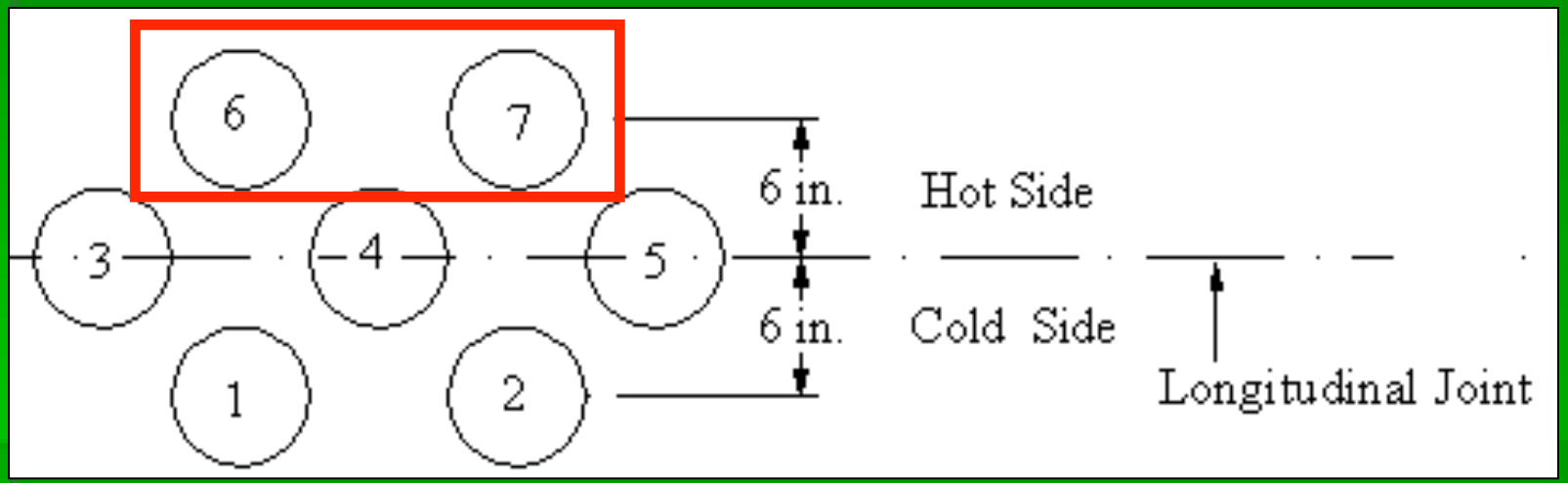

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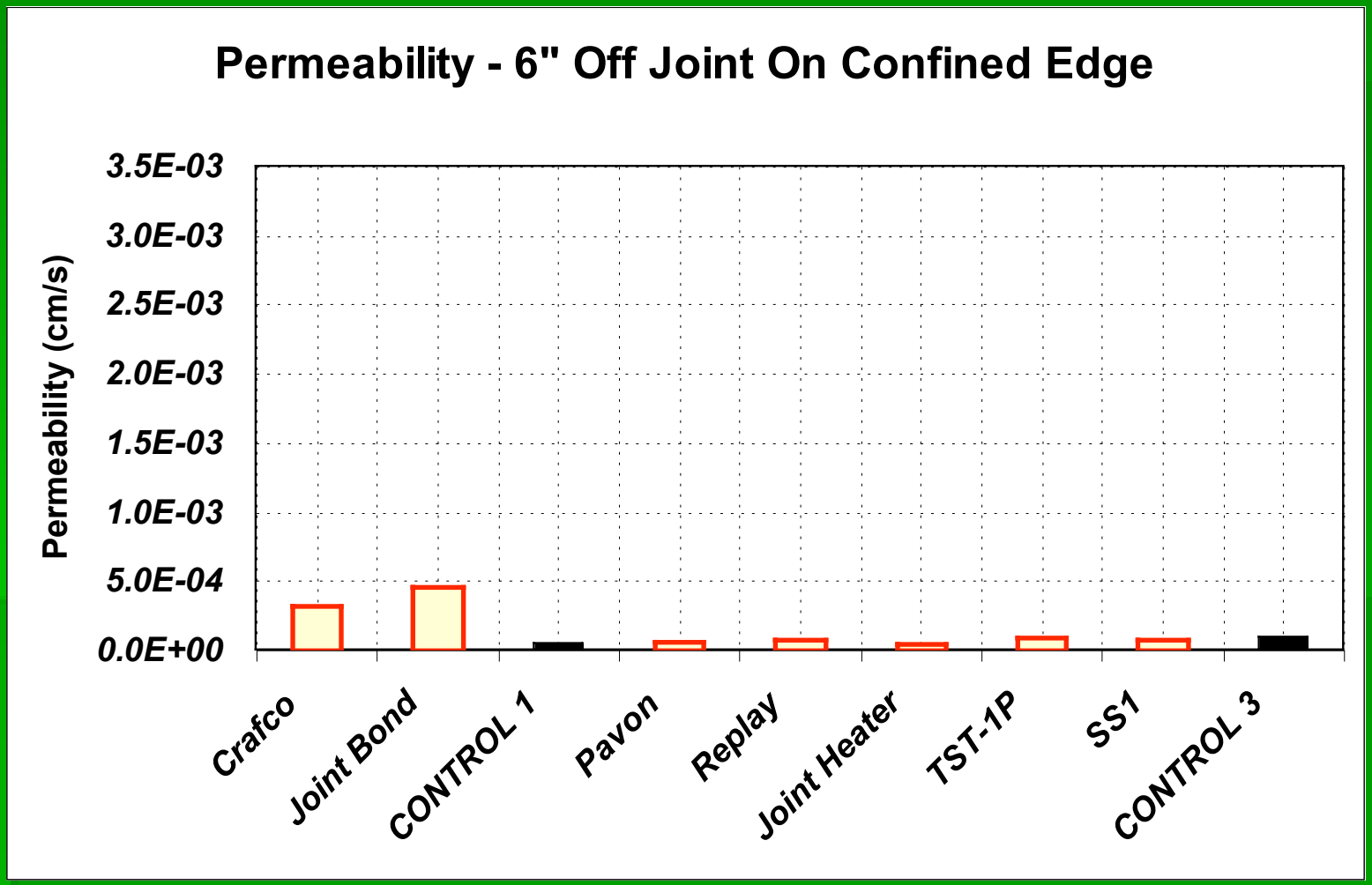

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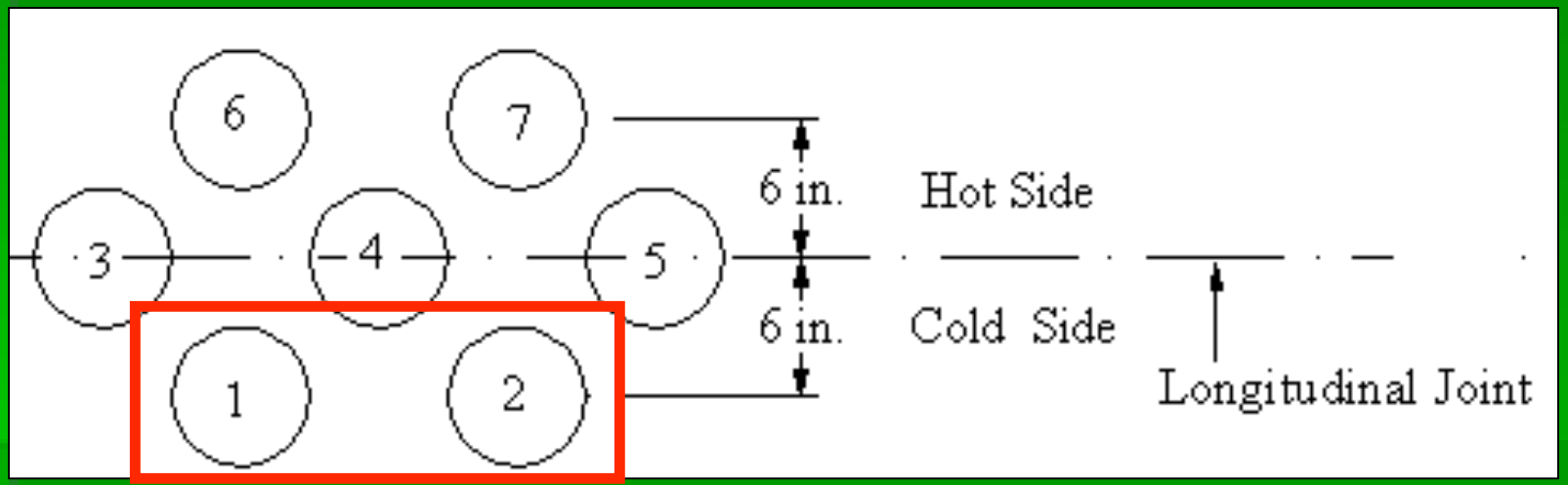

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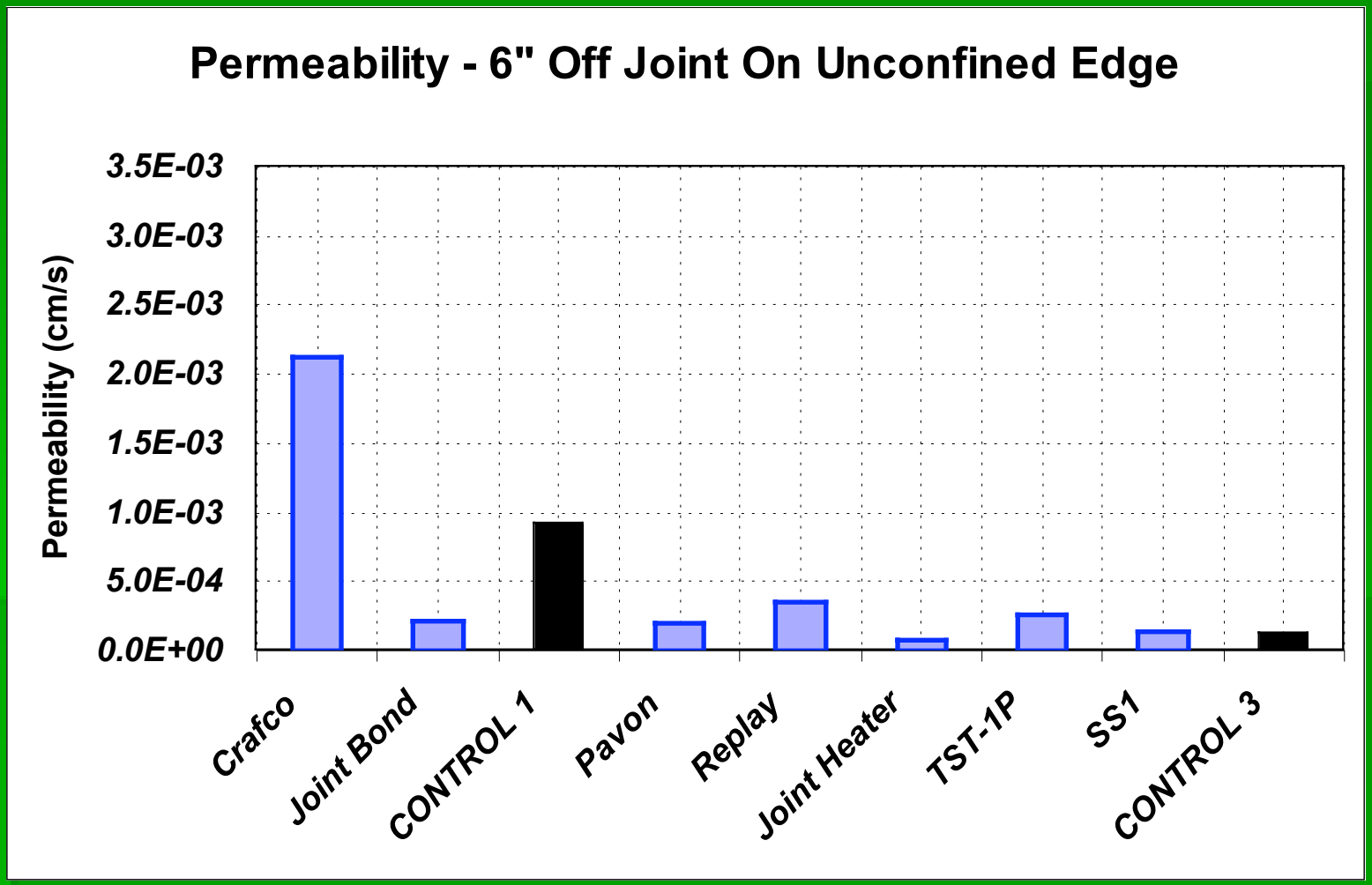

Additional Testing / Observation

- Signs were placed on site to provide clear indication of the location of test sections with the intention of periodic observation of the performance of each treatment.
- Documentation of test section, product, application, and sign locations should be available soon upon request.

Additional Testing / Observation

- The University is currently testing cores for Dissipated Creep Strain Energy (DCSE).
- Additional cores will be sent to an independent laboratory to be tested with X-Ray Computerized Tomography (CT).

Additional Testing / Observation

Additional Testing / Observation

Additional Testing / Observation

Special Thanks

- Highways, Inc.
- City of Sparta, TN
- Crafco, Pavement Technology Inc., Pavon Corp., Pavement Restorations Inc., Marathon Asphalt.
- Many others!!!

QUESTIONS??