

Update of Connecticut Advanced Pavement Laboratory Project SPR-2249

Comparison of the Use of a Notched Wedge Joint vs. Traditional Butt Joints in Connecticut

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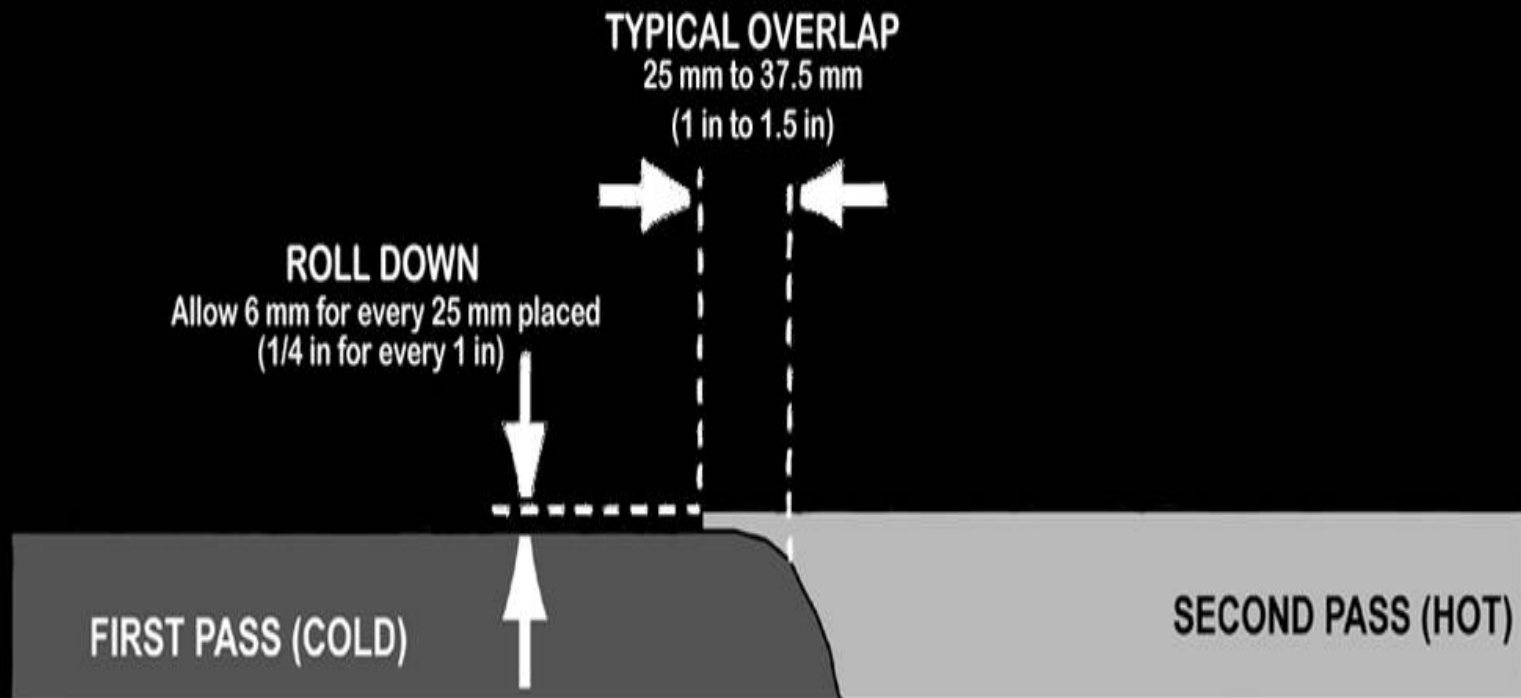
The Problem



Causes

- Insufficient material at the joint during construction
- Inadequate density at the joint
- Lack of confined edge during 1st pass
- Inadequately compacted edge material to compact against during second pass

- Connecticut traditionally uses the vertical or “Butt” Joint



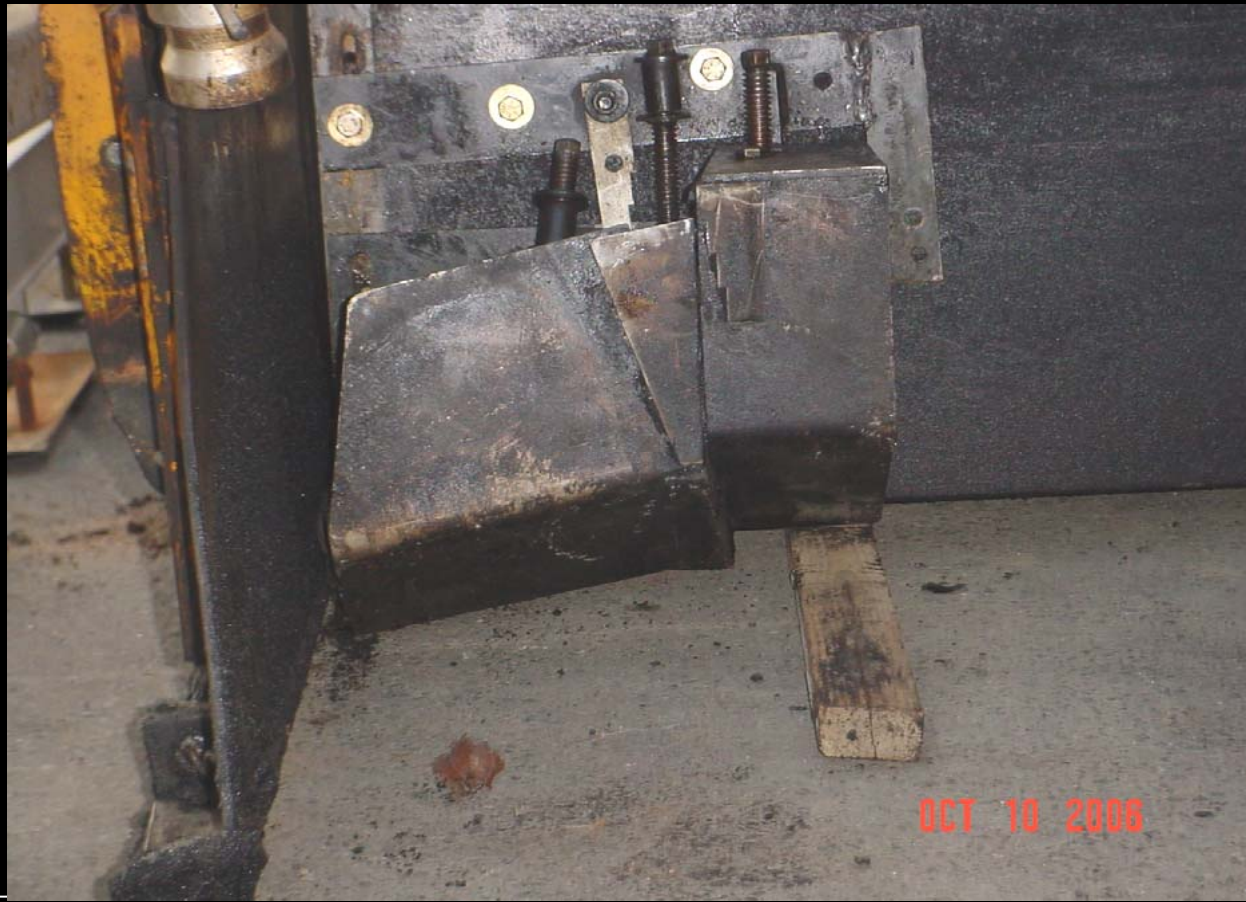
Project Objectives

- Establish state of the practice
- Conduct comprehensive literature review
- Evaluate several new construction projects using the butt joint
- Evaluate several new projects using the notched wedge joint
- Make analytical and statistical comparisons between quality parameters measured for each joint construction technique

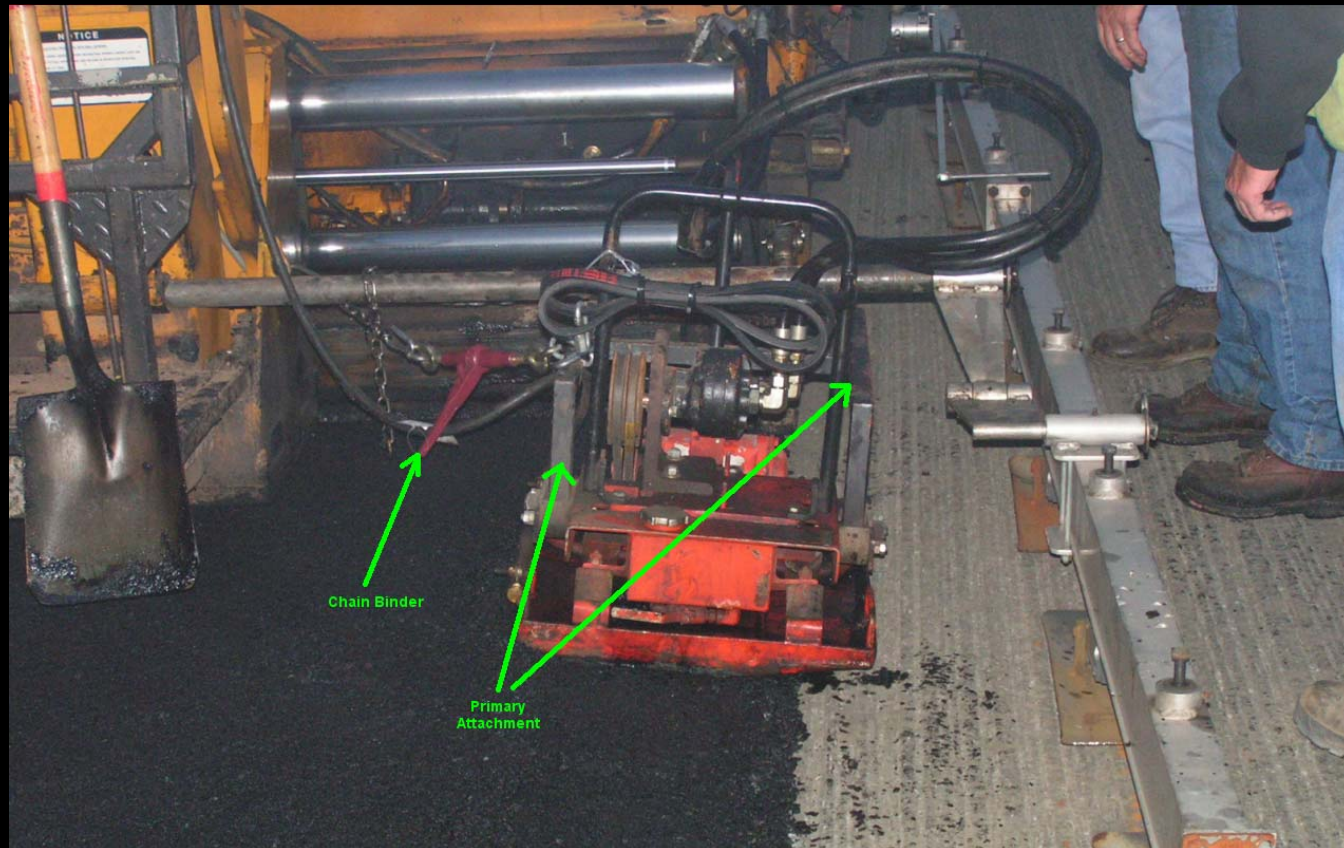
2006 Construction Season Evaluation of Longitudinal Joints in Connecticut

- 8 projects evaluated in 2006 season
- 2 Notched Wedge projects
- 7 Butt Joint Projects (one project included both)
- Investigated the overall density of the joint location
- Nuclear Density as well as Volumetric density of cut cores

Notched Wedge Device

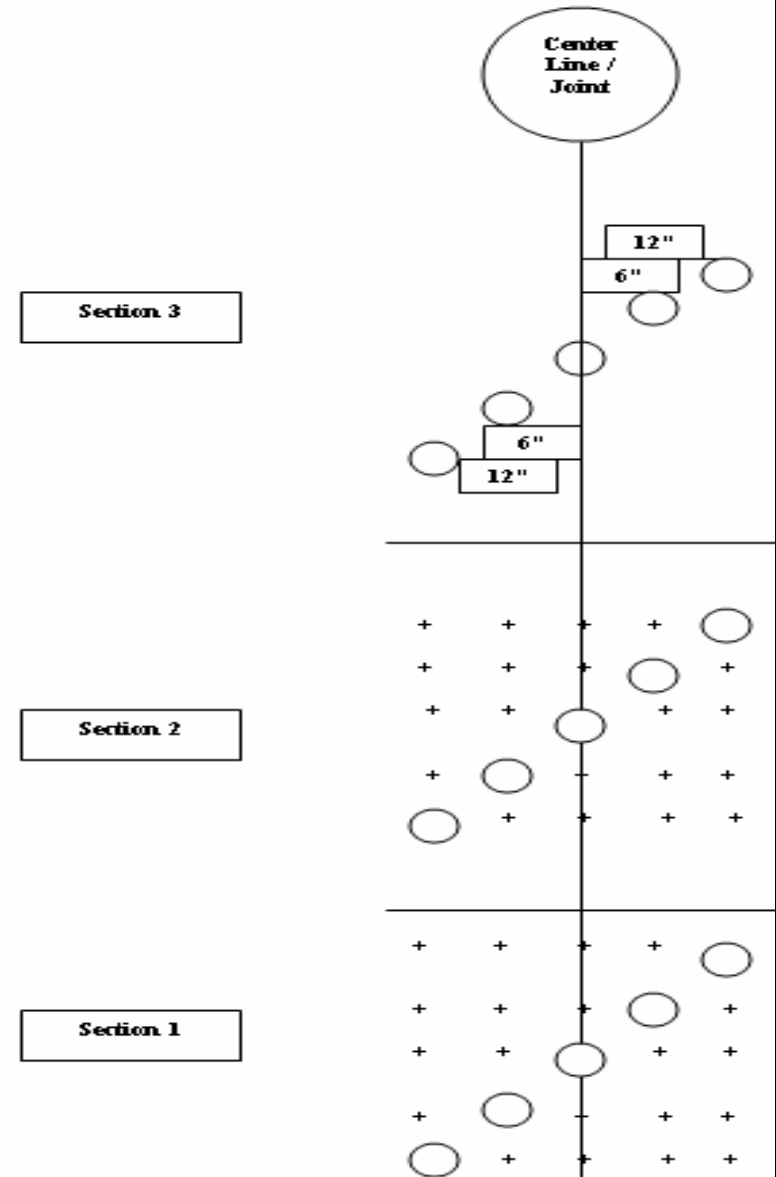


Notched Wedge Joint Setup

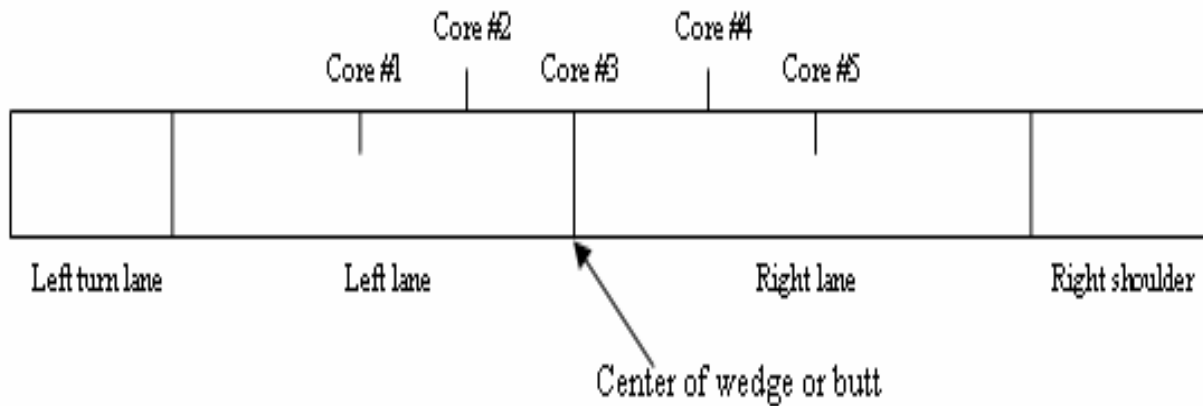


Measurement & Evaluation of Longitudinal Joints (Plan View)

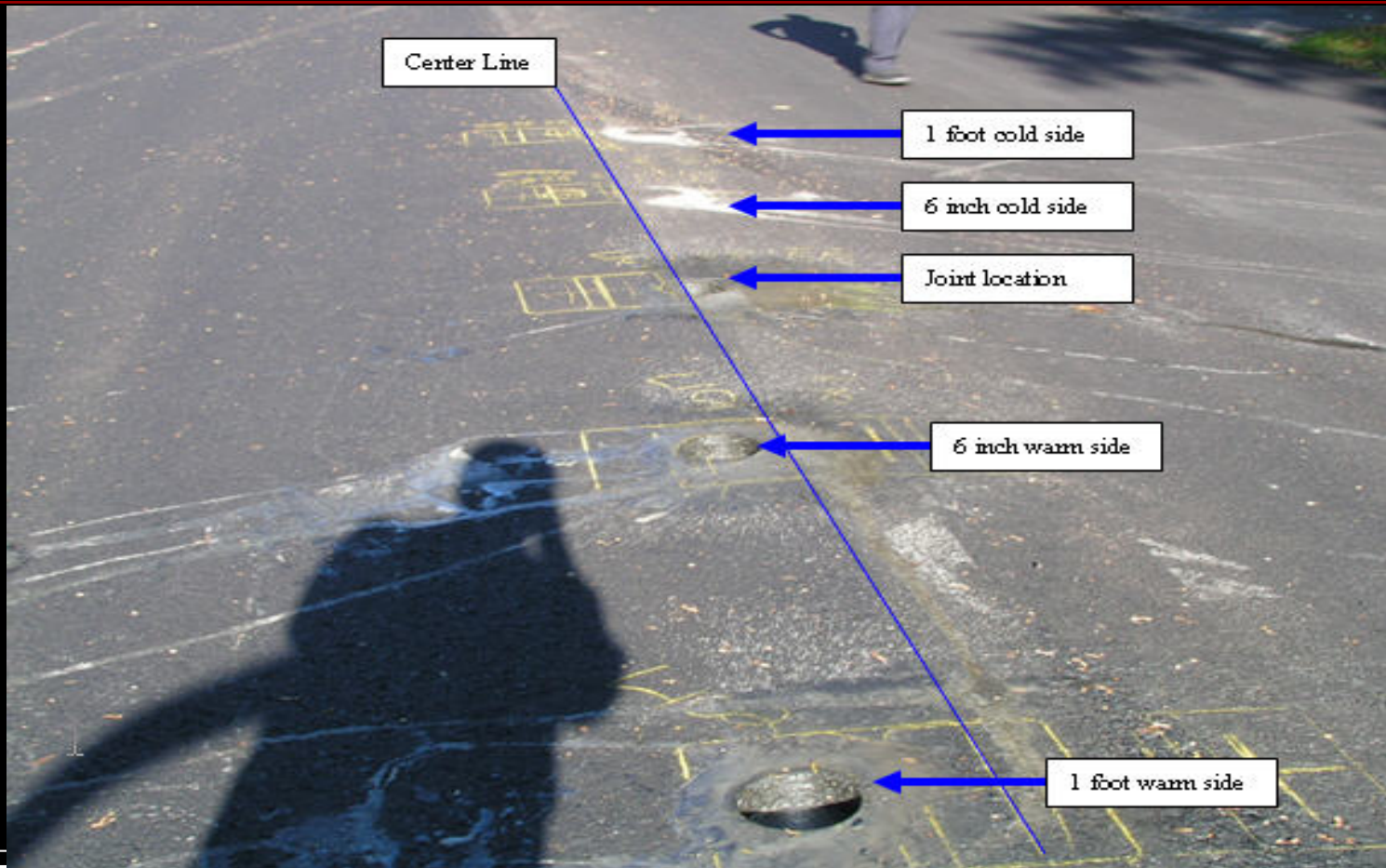
- ~ 2-3 sections per day
- 25 Nuclear measurement locations per section (60 sec counts) avg. of 2 readings
- Rotate gauge 180 degrees between readings
- 5 cores per section
- Cores at 1', 6", 0, 6", 1'
- 5 longitudinal feet between cores



Joint Evaluation Protocol (Cross Sectional View)

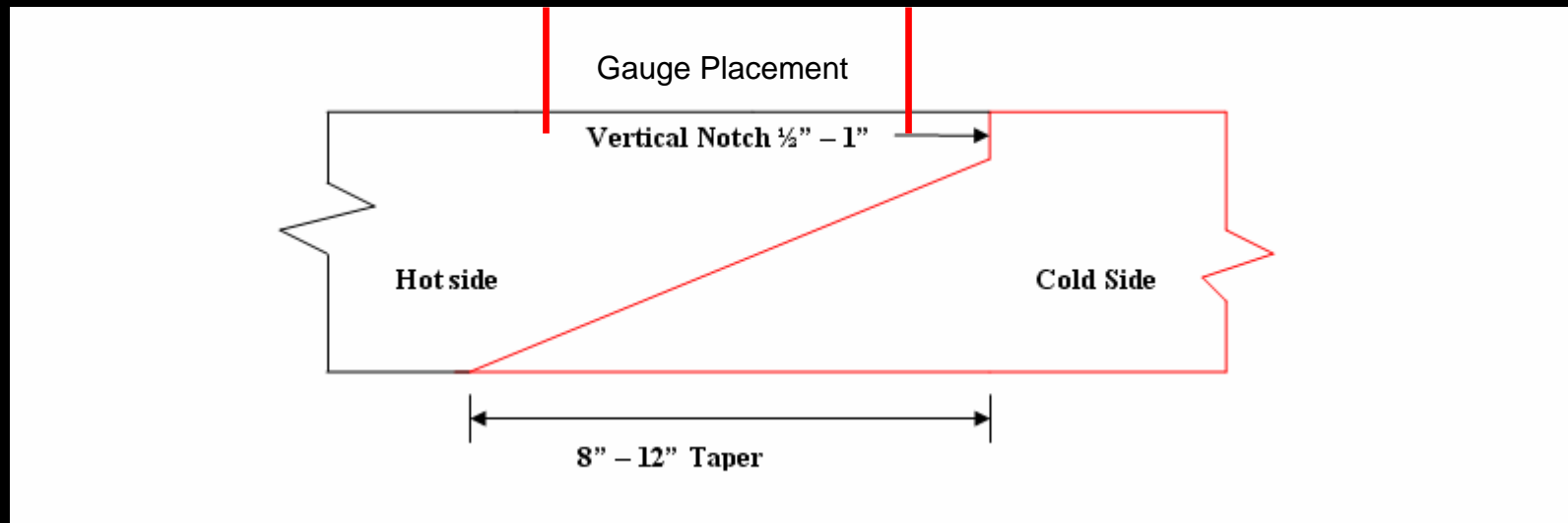


Typical longitudinal joint data collection section - Image



Defining the Joint Location on Notched Wedge Projects

Gauge was placed directly over the wedge portion of the notched wedge joint

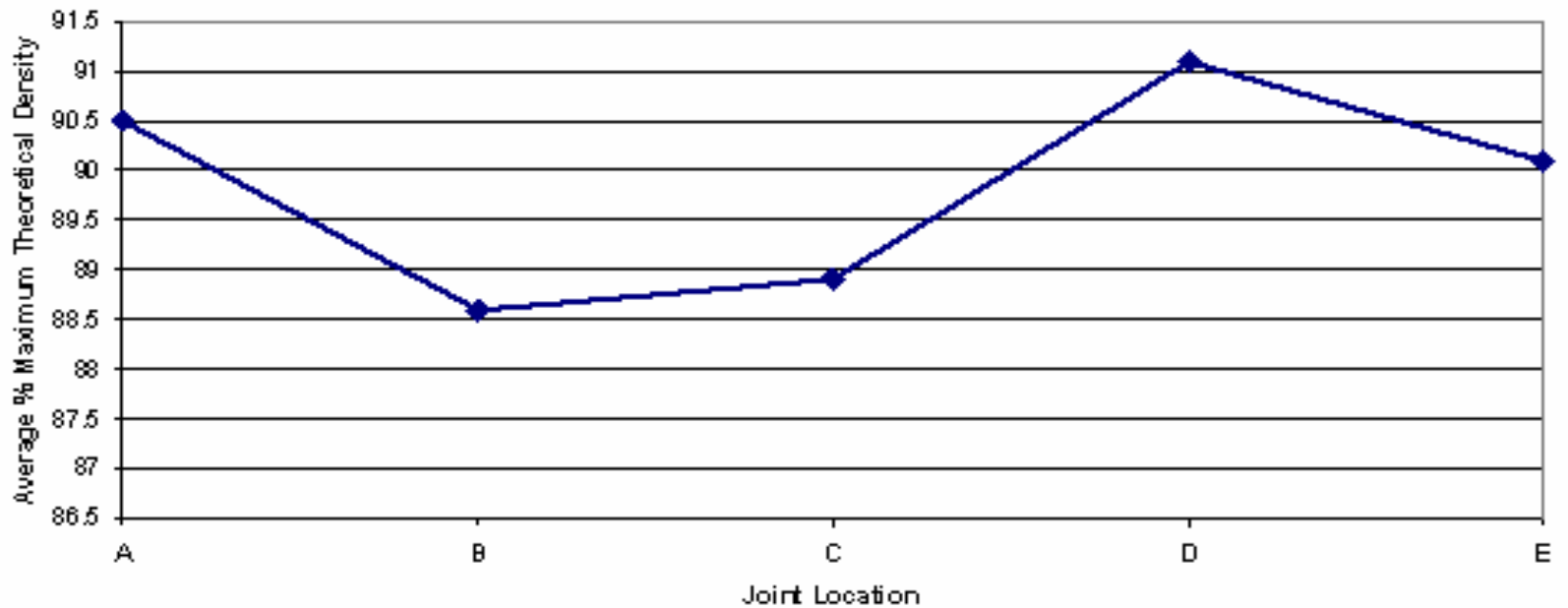


2006 Notched Wedge Joint Data Collection

- 7 Sections of data collected
- 35 total Notched wedge joint cores complete with nuclear density measurements
- 9 damaged cores were unusable
- Used all nuclear density data

Nuclear Density by Profile Location (Notched Wedge Joint)

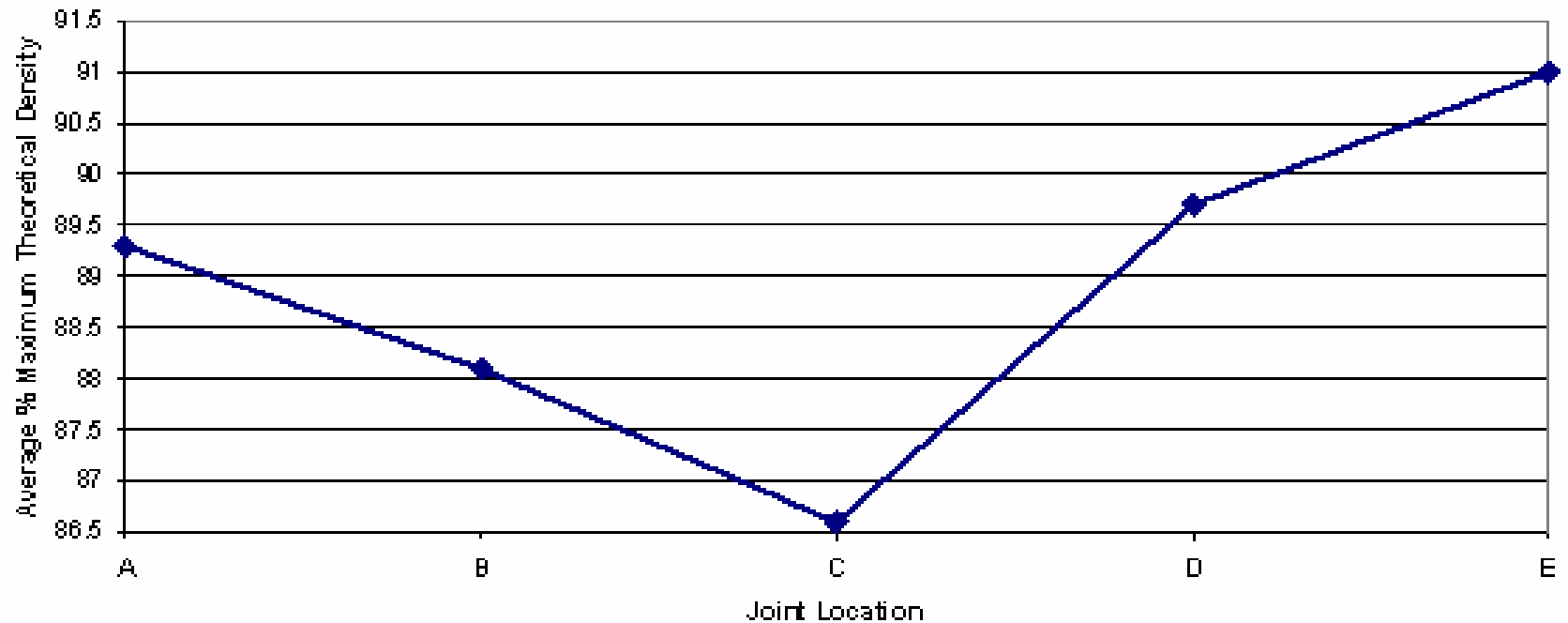
Average % Nuclear Density by Profile Location (Notched Wedge Joints)



A = 1 foot cold side B = 6 inches cold side C = joint location D = 6 inches hot side E = 1 foot hot side

Volumetric Density by Profile Location (Notched Wedge Joint)

Average % Volumetric Core Density by Profile Location (Notched Wedge Joints)



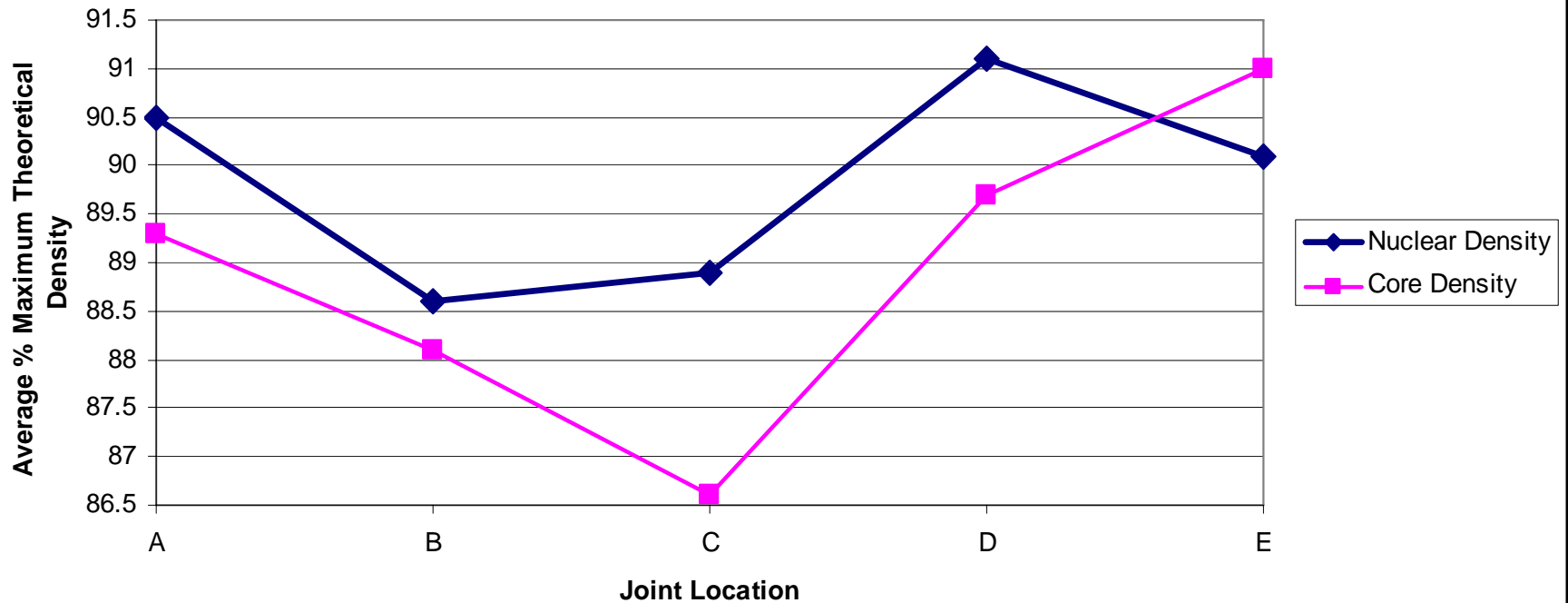
A = 1 foot cold side B = 6 inches cold side C = joint location D = 4 inches hot side E = 1 foot hot side

2006 Notched Wedge Projects Preliminary Review

- Cold side density seems to measure lower than warm side density
- There is a significantly steep jump in density from the joint location to six inches on the hot side
- Nuclear Gauge typically gave higher density than the core volumetric value on Notched wedge pilot projects

Notched Wedge Core Density vs. Nuclear Density

Average % Nuclear Density vs. Core Density by Profile Location (Notched Wedge Joints)



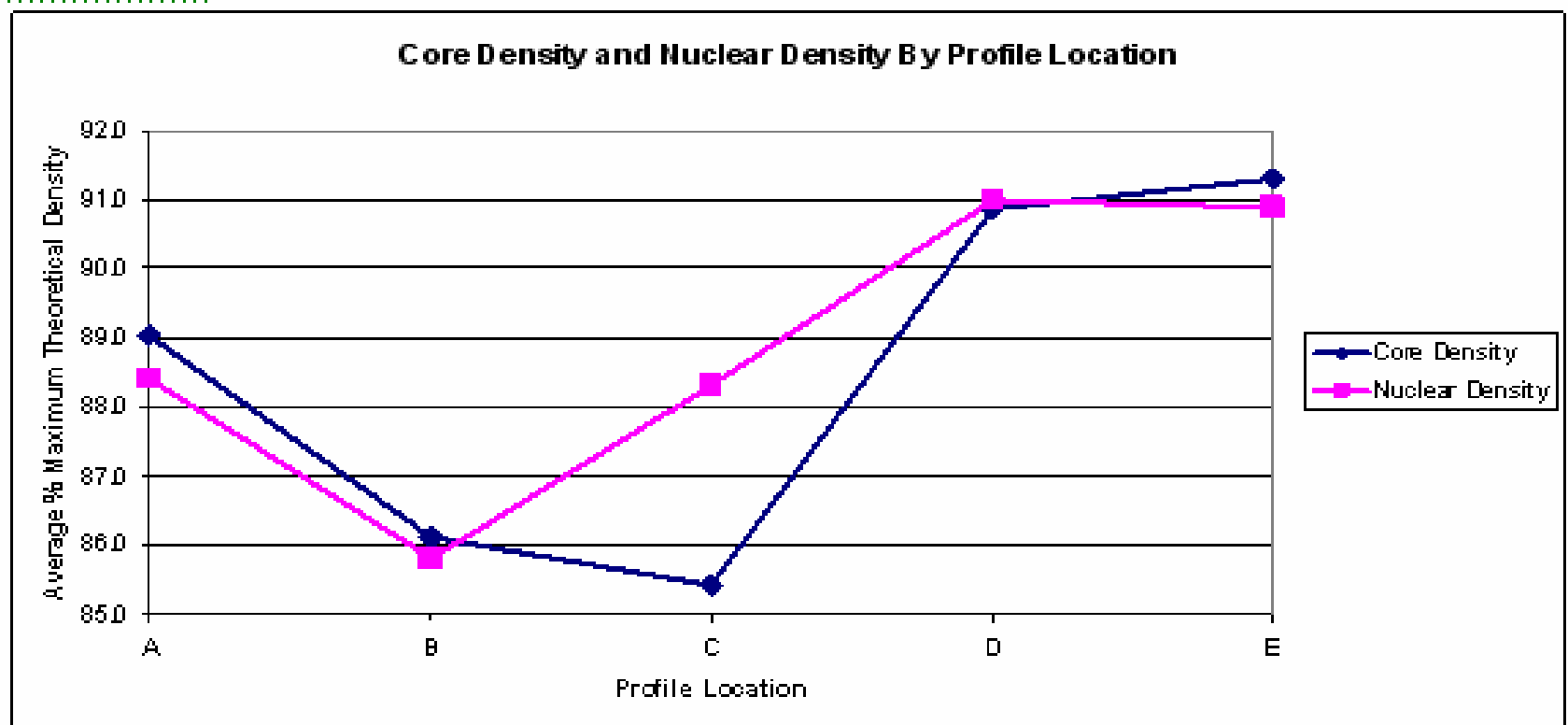
2006 Butt Joint Data Collection

- 30 sections of data collected
- 150 total cores
- 13 damaged cores were unusable
- Nuclear density data collected for all but 8 sections which were analyzed days after paving

2006 Butt Joint Projects Preliminary Review

- Cold side density seems to measure lower than warm side density
- There is a significantly steep jump in density from the joint location to six inches on the hot side
- Current version of nuclear gauge correction procedure brought nuclear density values more in line with core density values

Nuclear and Volumetric Density by Profile Location (Butt Joint)



A = 1 foot cold side B = 6 inches cold side C = joint location D = 4 inches hot side E = 1 foot hot side

Data Comparison so far - inconclusive

- Insufficient amount of data to make any determinations. Inadequate sample size for notched wedge joint data.

Joint Location (within the density profile)	A	B	C	D	E
Butt Joint Data					
Sample Size	110	110	110	110	110
Average Density	88.7	85.8	88.8	91.7	91.6
Joint Location (within the density profile)	A	B	C	D	E
Notched Wedge Joint Data					
Sample Size	35	35	35	35	35
Average Density (%MTD)	90.5	88.6	88.9	91.1	90.1

2007 Notched Wedge Joint Data Collection

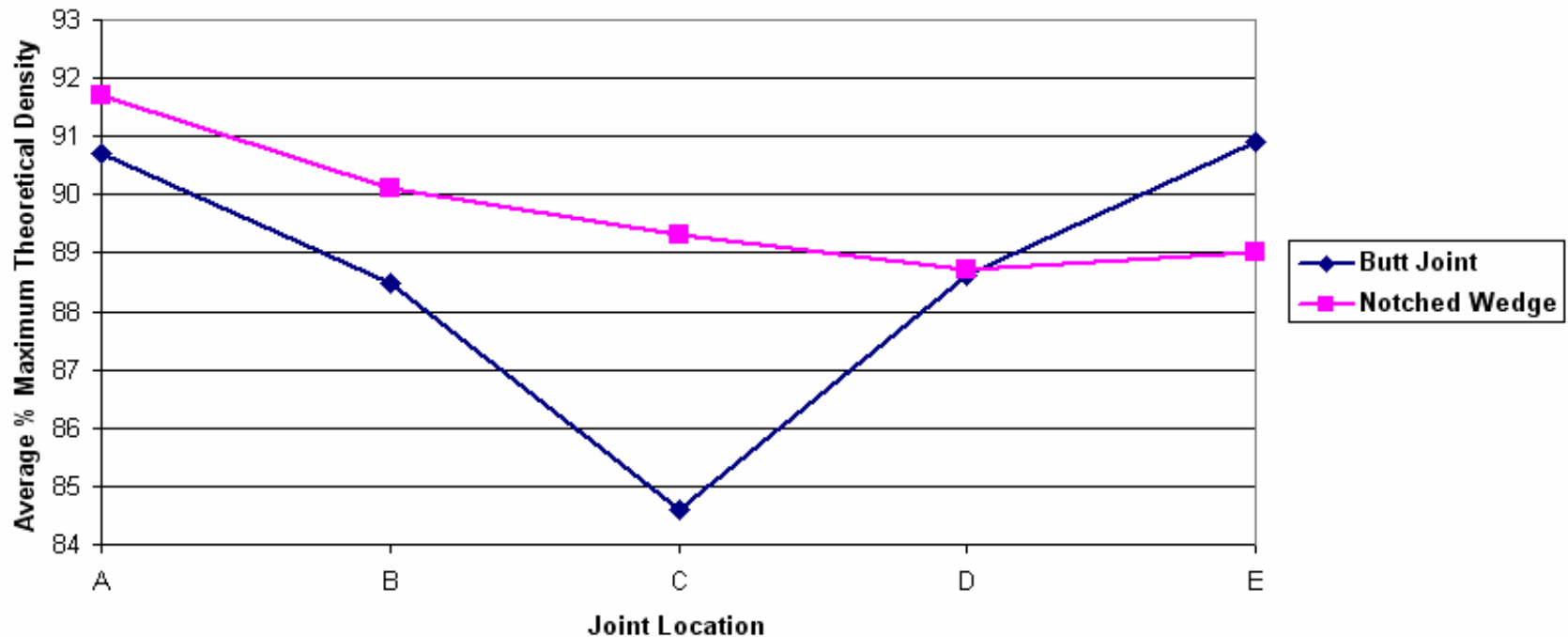
- 13 Sections of data collected
- 8 sections notched wedge
- 40 total notched wedge cores
- 5 sections butt joint
- 25 total butt joint cores
- 65 total cores complete with nuclear density measurements
- To date, 2007 sections from the same construction project

2007 Notched Wedge vs. Butt Joint Project Preliminary Review

- Overall Average density is improved along the joint with the use of the notched wedge joint
- Density profile is more consistent and smooth with the notched wedge joint
- Major drop off in density at the joint location is virtually eliminated with the notched wedge joint

2007 Notched Wedge Density vs. Butt Joint Density. (Based on very limited data)

2007 Preliminary Analysis of Core Data



A few notes:

- All results are preliminary
- Still insufficient amount of data
- Correction factor has not yet been applied to 2007 nuclear density data – all 2007 data is based on core density
- All cores tested using AASHTO T 331 (Corelok®)

Overall Preliminary Conclusions

- There is a lower average density value 6 inches on the cold side of the joint than there is 6 inches on the hot side of the joint for both the notched wedge joint comparisons as well as the butt joint comparisons shown in previous slides

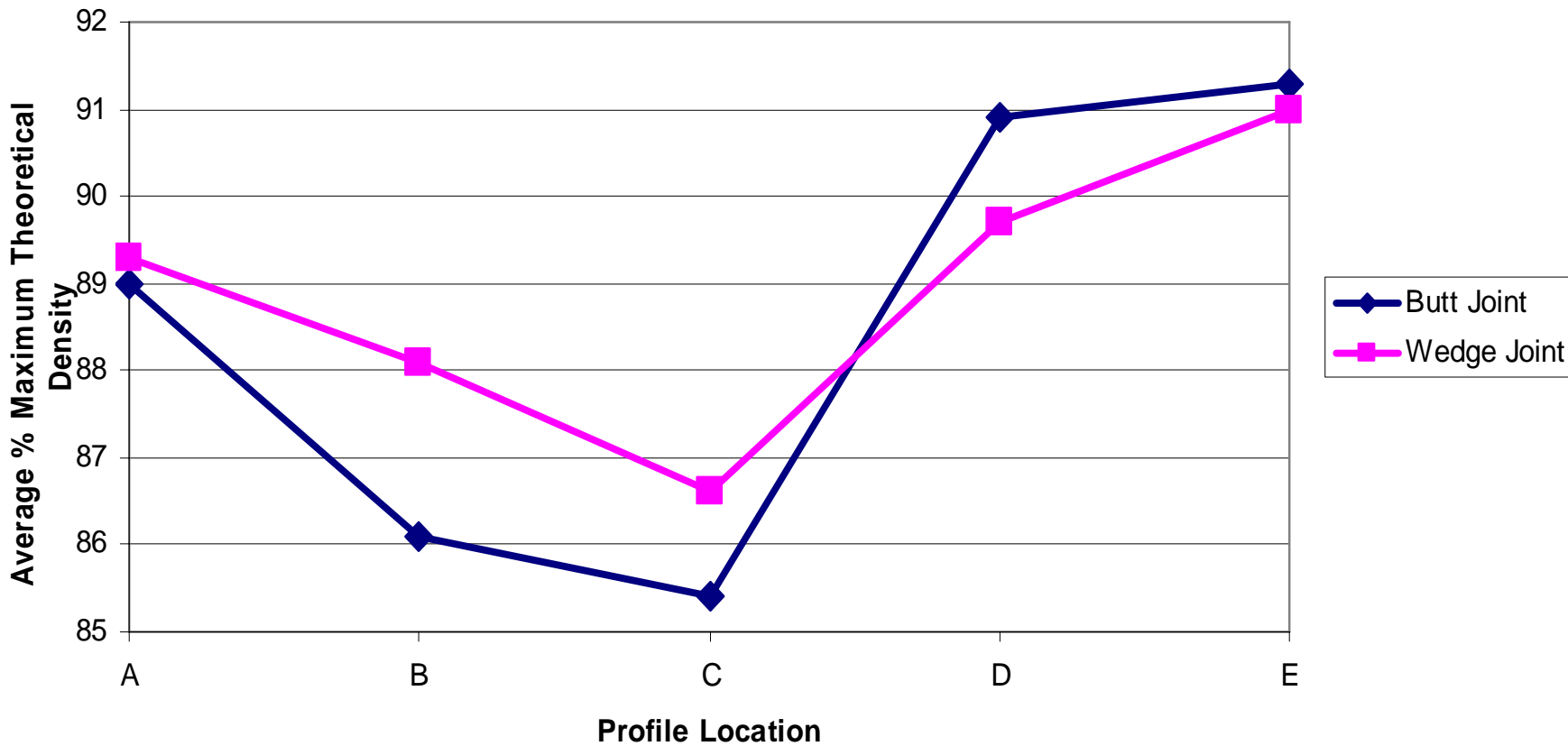
Overall Preliminary Conclusions

- The use of the notched wedge joint did not impede the paving process during the three investigated pilot projects.

Overall Preliminary Conclusions

- Less variability in density moving across the notched wedge joint than butt joint

Comparison: Butt Joint Vs. Notched Wedge Joint (Volumetric Core Density)



Overall Preliminary Conclusions

- There is a need for further comparison of joint quality and density performance between the notched wedge joint and the traditionally used butt joint

Where do we go from here?

- Correct all nuclear measurements taken during 2007
- Conduct analyses of 2007 nuclear data
- Collect data from several more projects for evaluation during remainder of 2007 construction season. Analyze during winter/spring
- Currently in process of examining a butt joint constructed with a rubberized joint adhesive material
- Conclude analysis

Thank you!

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