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Using Density, Permeability, Infiltration, and Absorption to Assess the Quality of HMA Longitudinal Joints

Transportation Research Board 90th Annual Meeting
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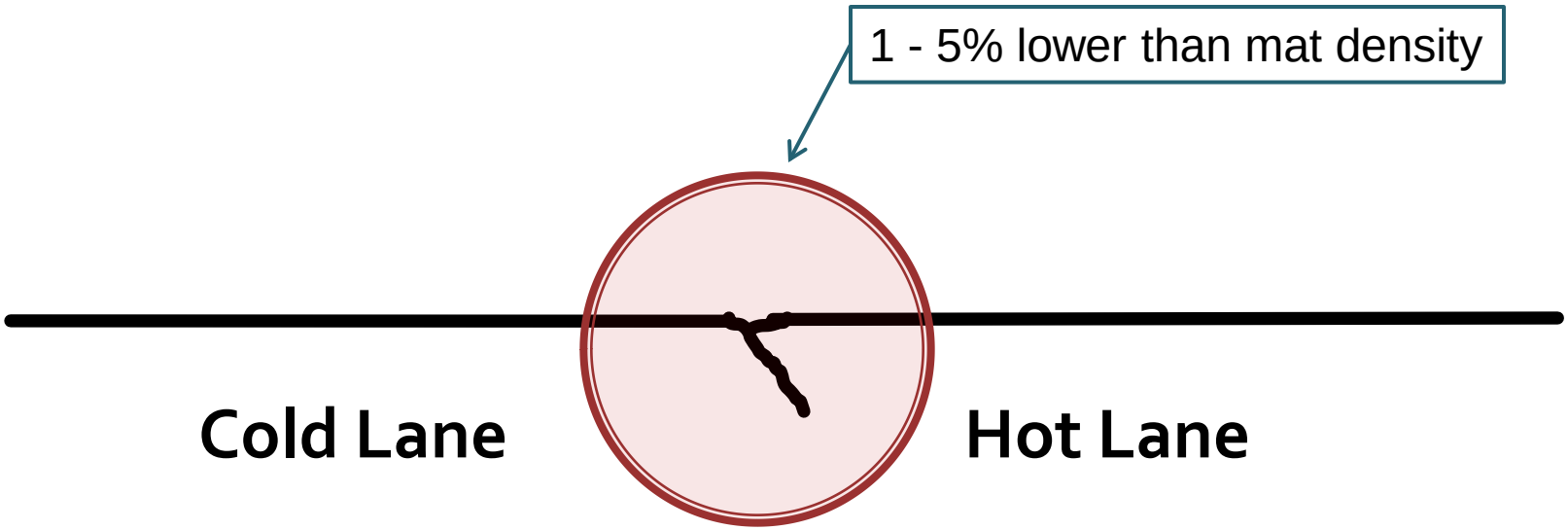
The Problem



The Problem

The Cause?

- Low Density
- Permeability
- Gradation

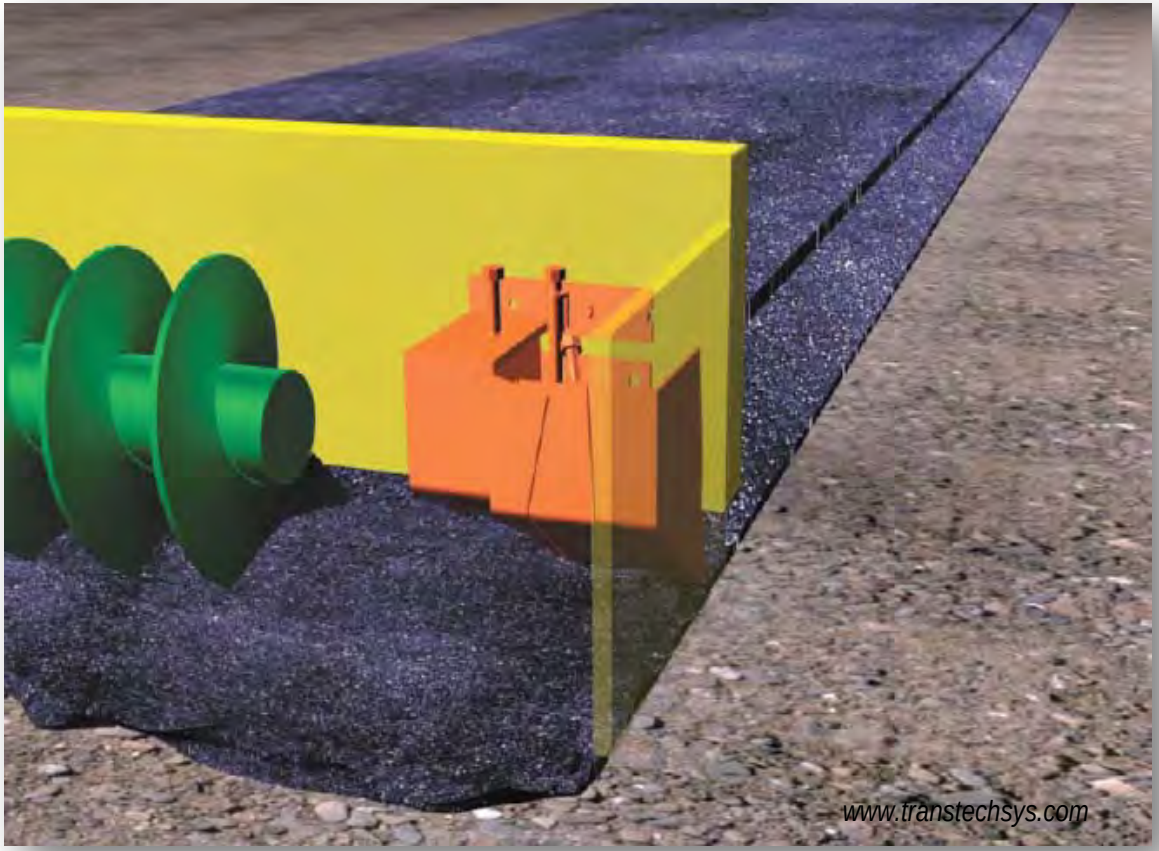
- *What should we measure?*

Project Site #1

Project Site #2

Notched Wedge Joint Maker (NW)

- Overlap
- Safety Edge
- Aggregate Interlock



Notched Wedge (NW)

CrafCo Joint Adhesive (CF)

- Bond cold and hot side of joint
- Reduce permeability

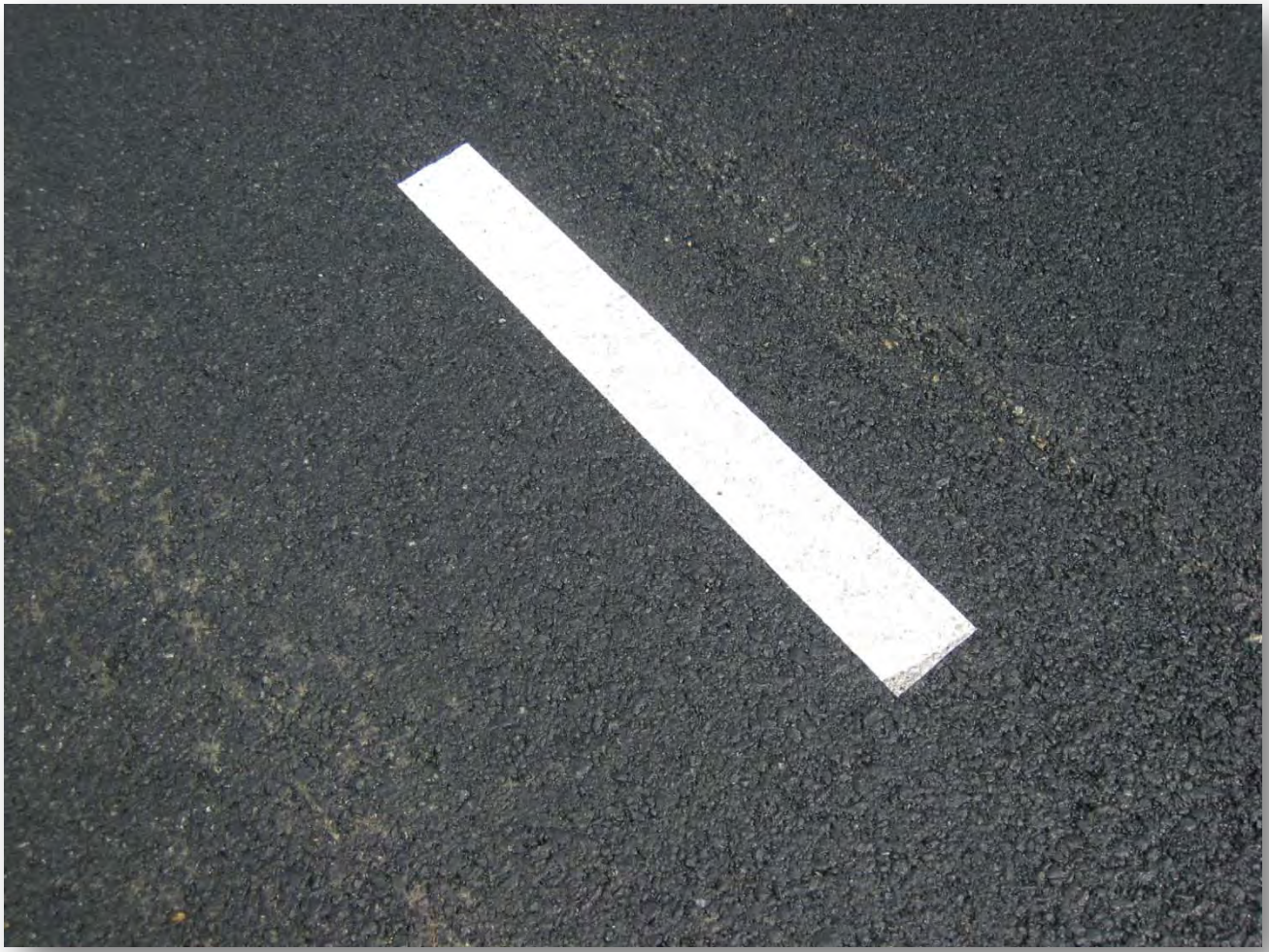
CrafCo Joint Adhesive (CF)

JOINTBOND® (JB)

- Polymerized emulsion
- Penetrates surface
- Stabilizes joint

JOINTBOND® (JB)

JOINTBOND®



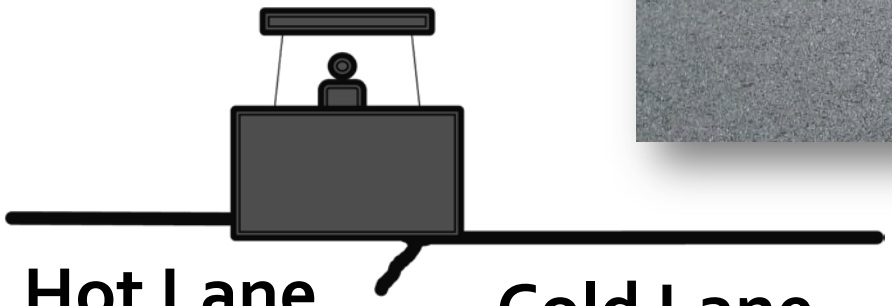
Joint Heater (JH)

Joint Heater (JH)

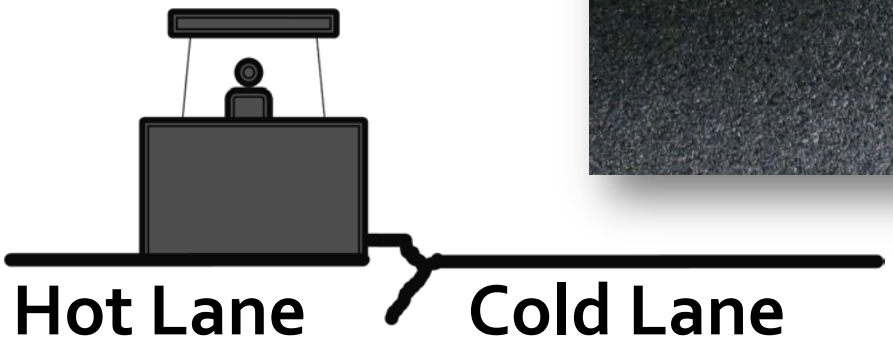
Tack Coat SS-1 (TC)

- Same as used for mainline paving operations

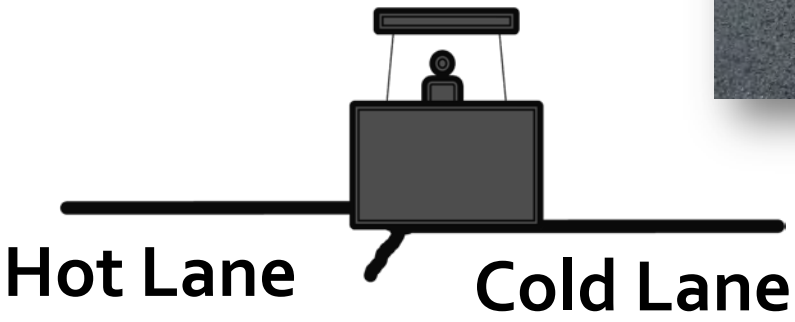
Hot Overlap (HO)



Hot Pinch (HP)



Cold Roll (CR)



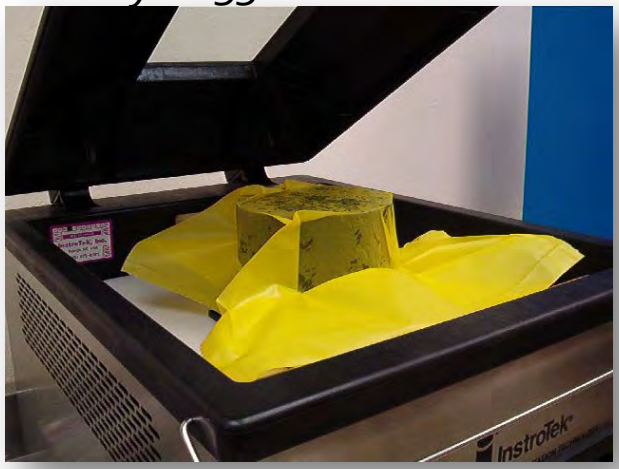
Test Methods

Nuclear Density

Permeability / Infiltration

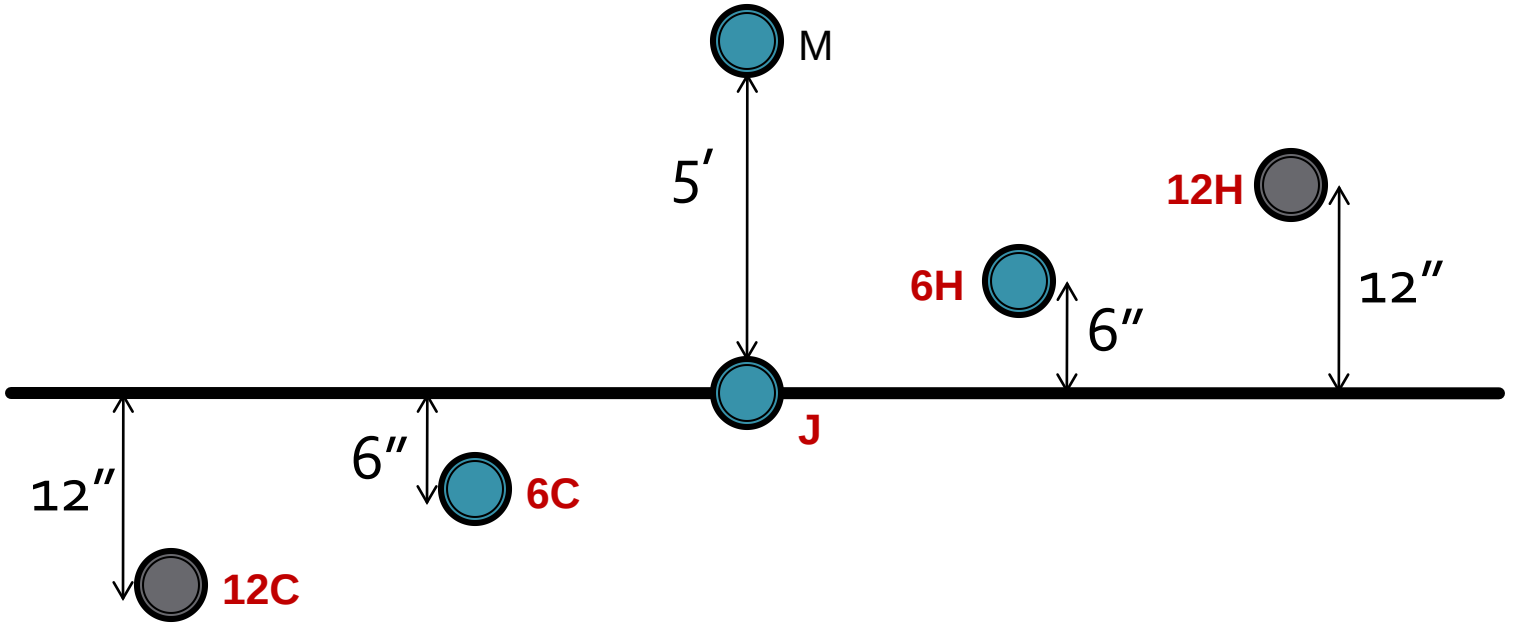
Density – T166 / Absorption

Density – T331

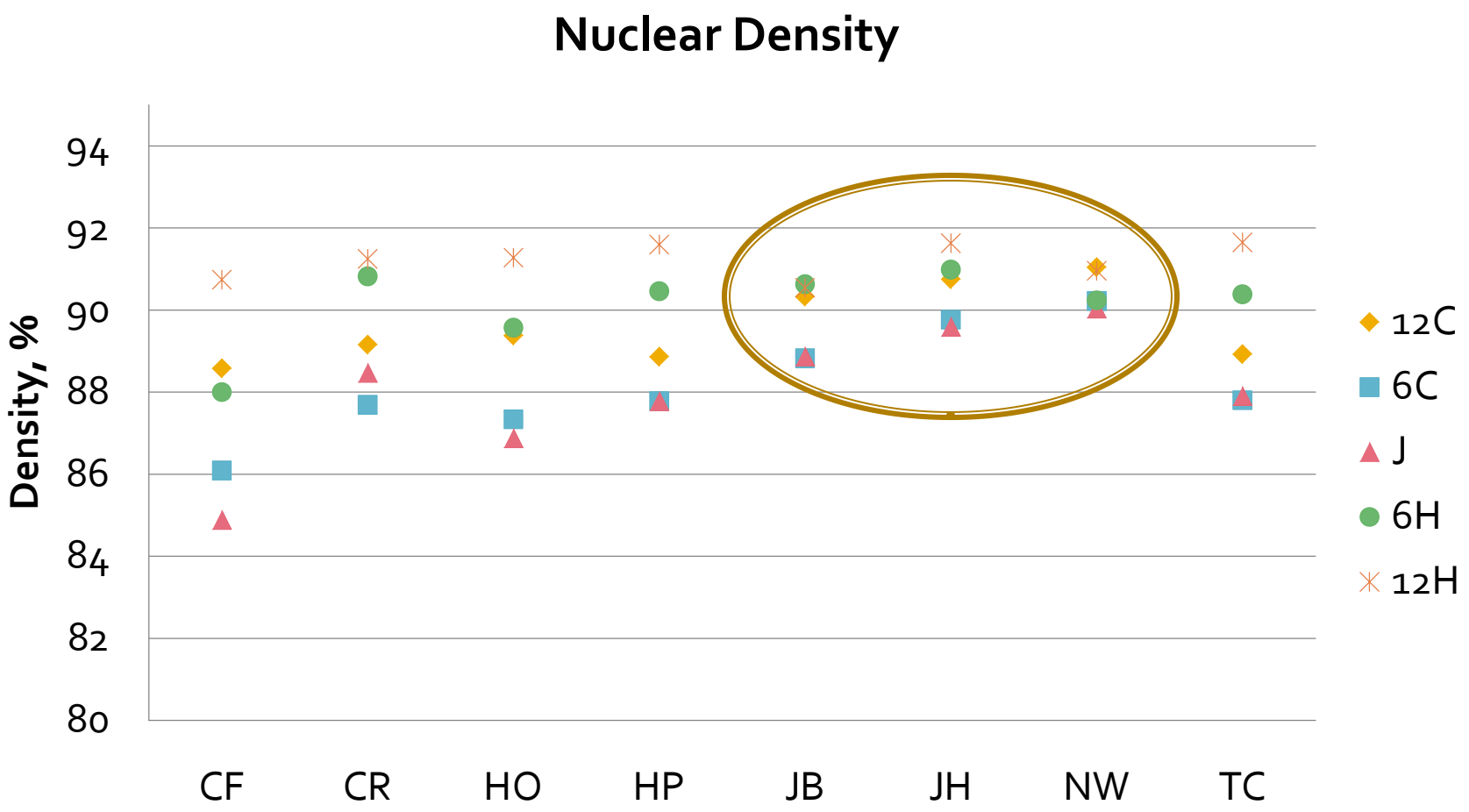


Testing Plan

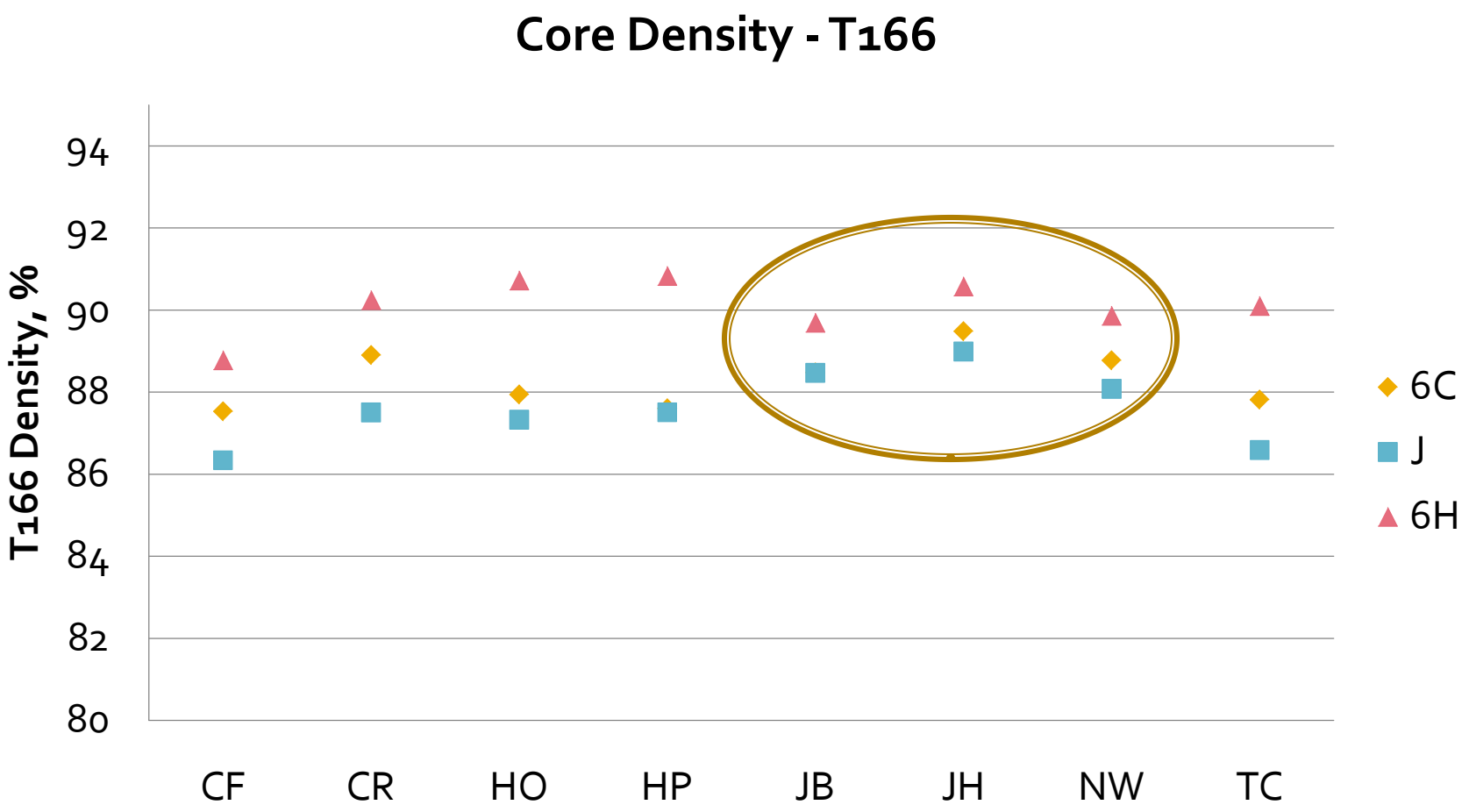
- 2 Projects
  - 500 ft sections for each of 8 methods
  - 3 locations in each section



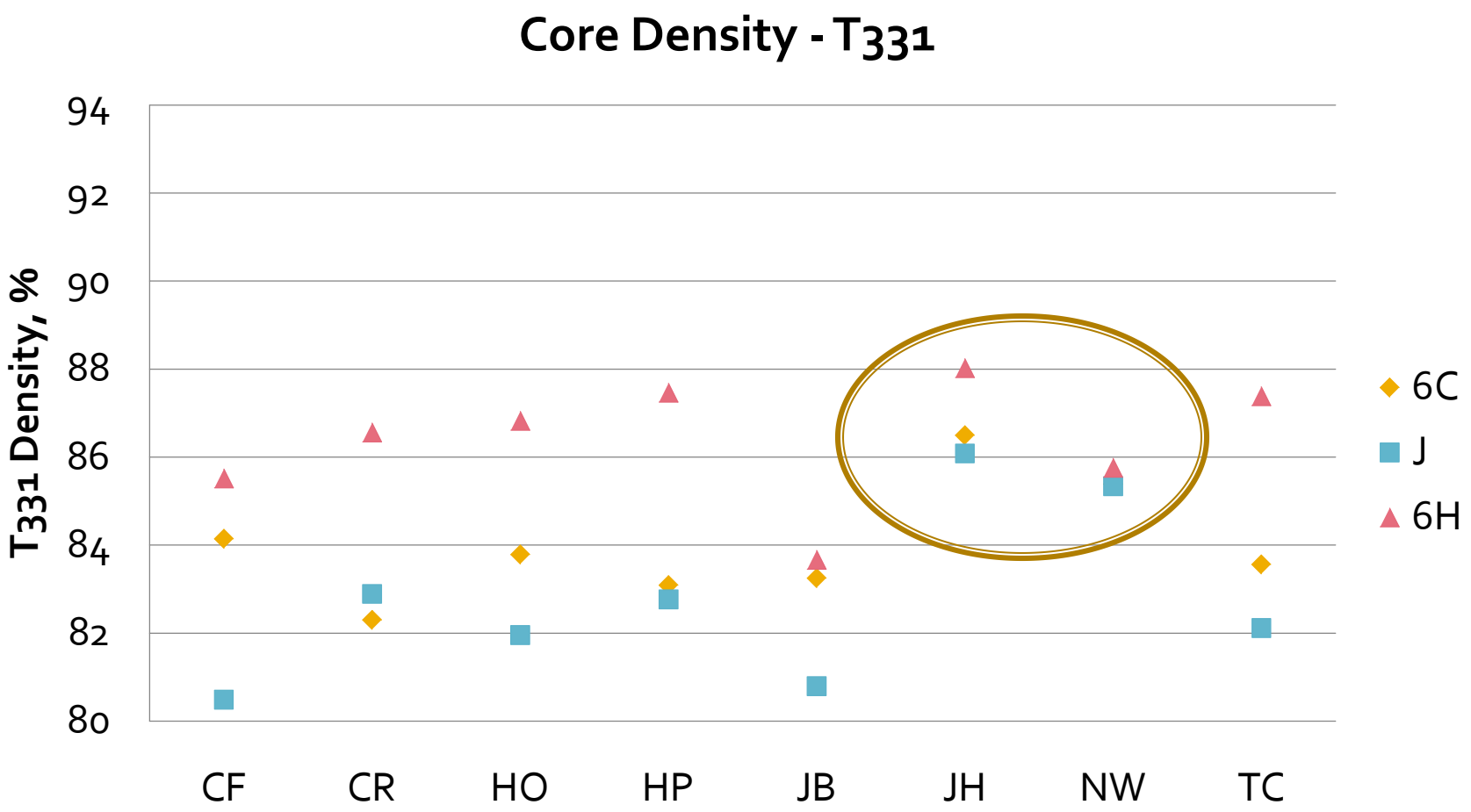
Distance from Joint



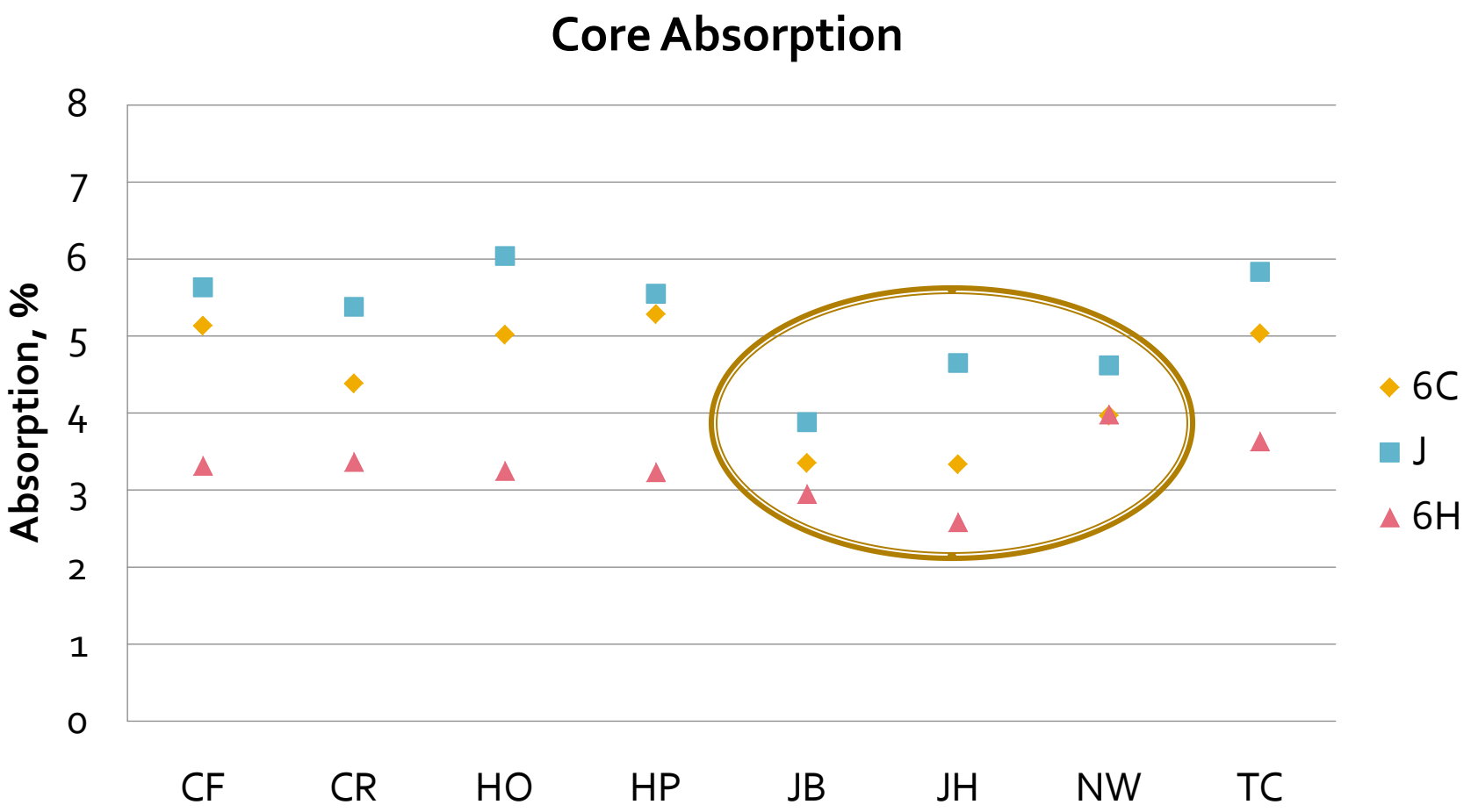
Distance from Joint



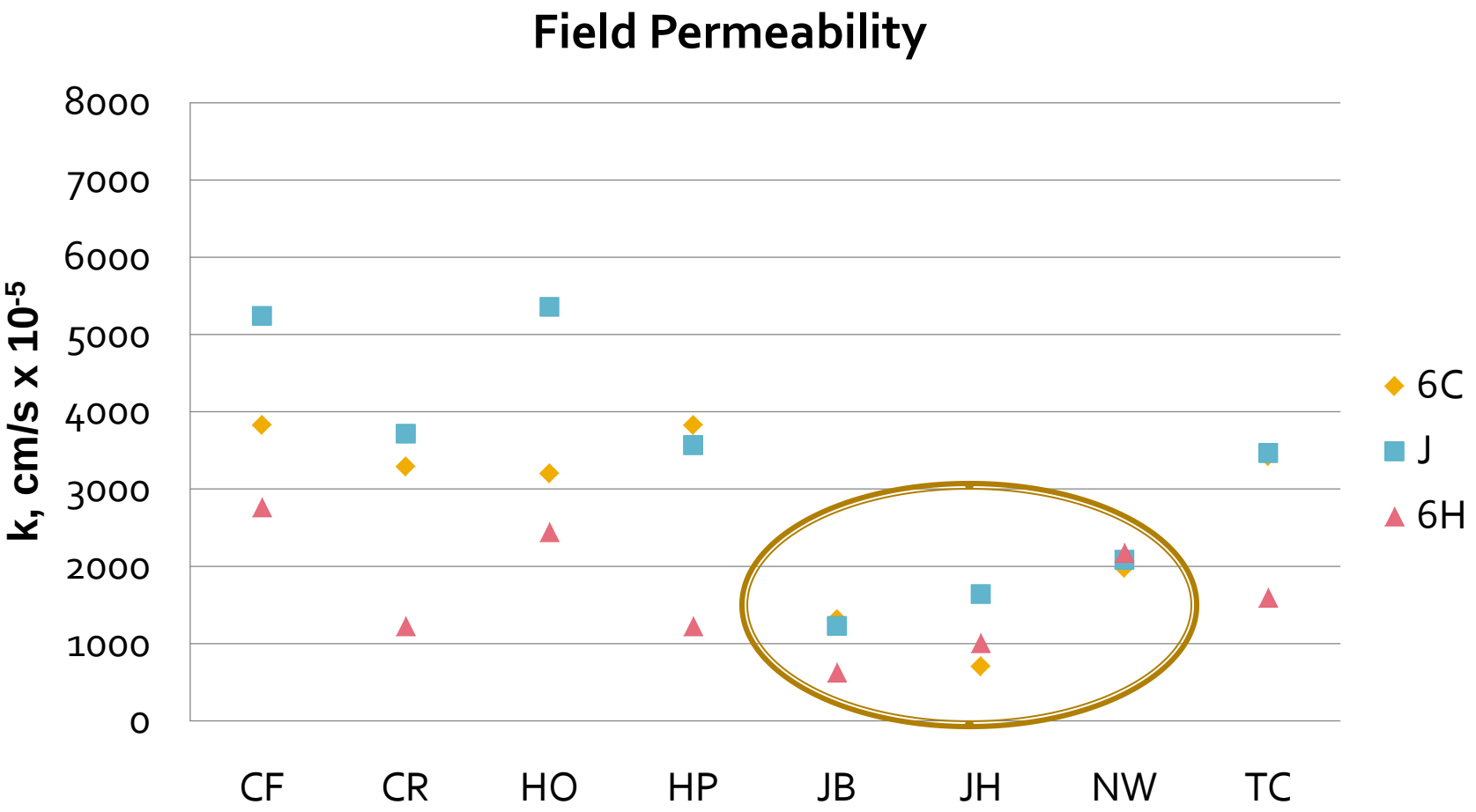
Distance from Joint



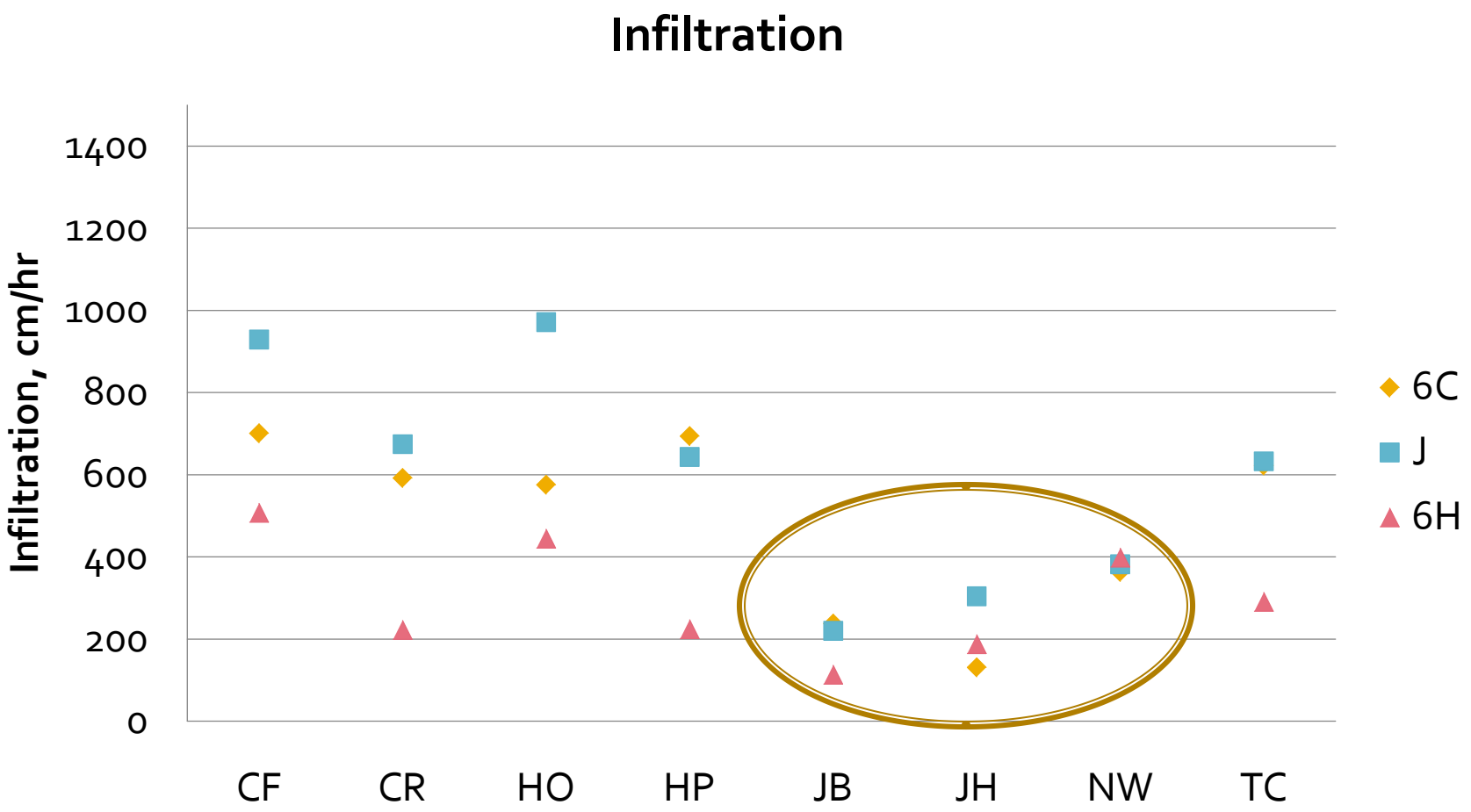
Distance from Joint



Distance from Joint



Distance from Joint



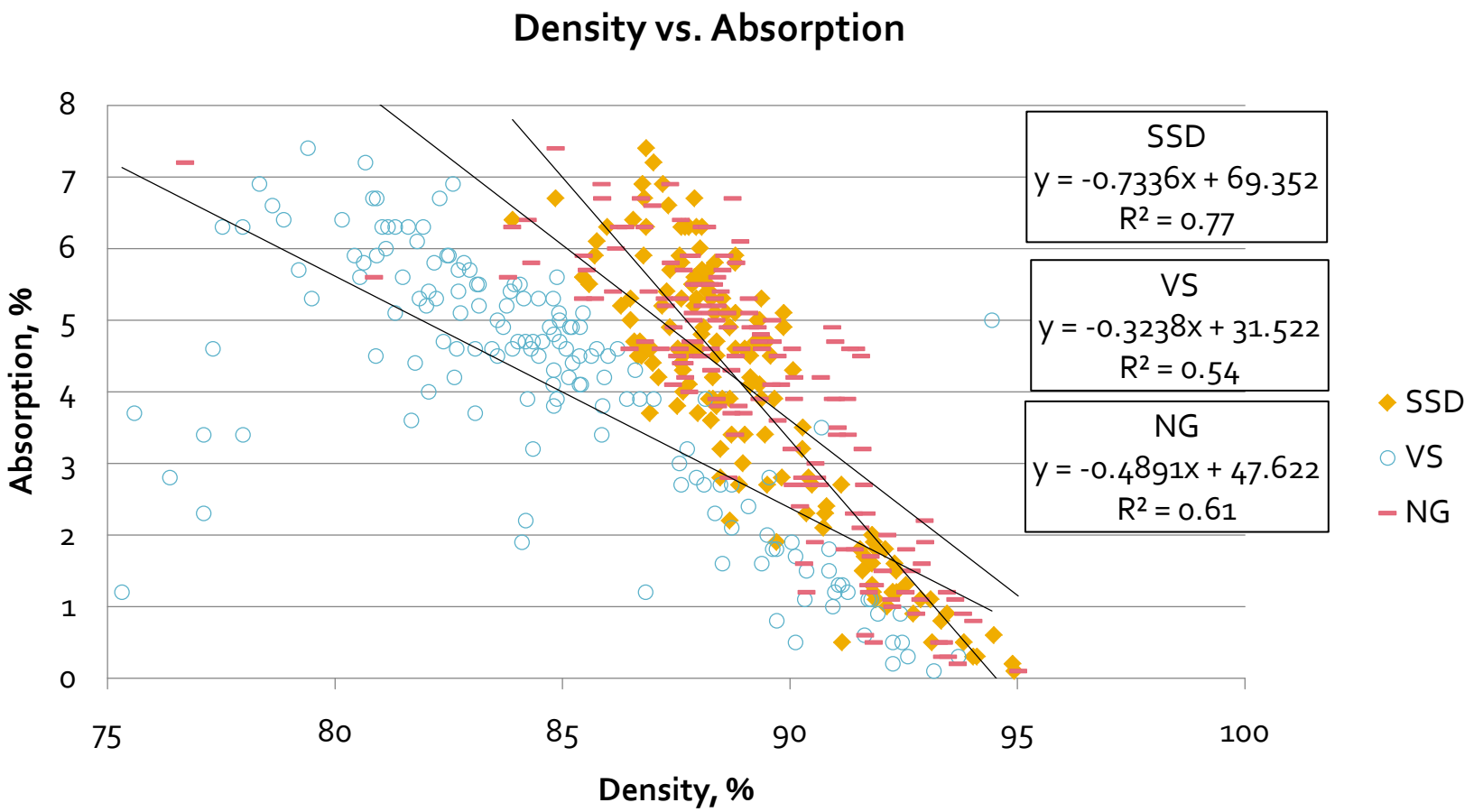
Statistically Speaking. . .

- Construction method – significant
- Distance from joint – significant
- Interaction – significant
  - Permeability / Infiltration
    - JB and JH – Low permeability at and away from the joint
    - Others – High permeability at joint, lower values away from the joint

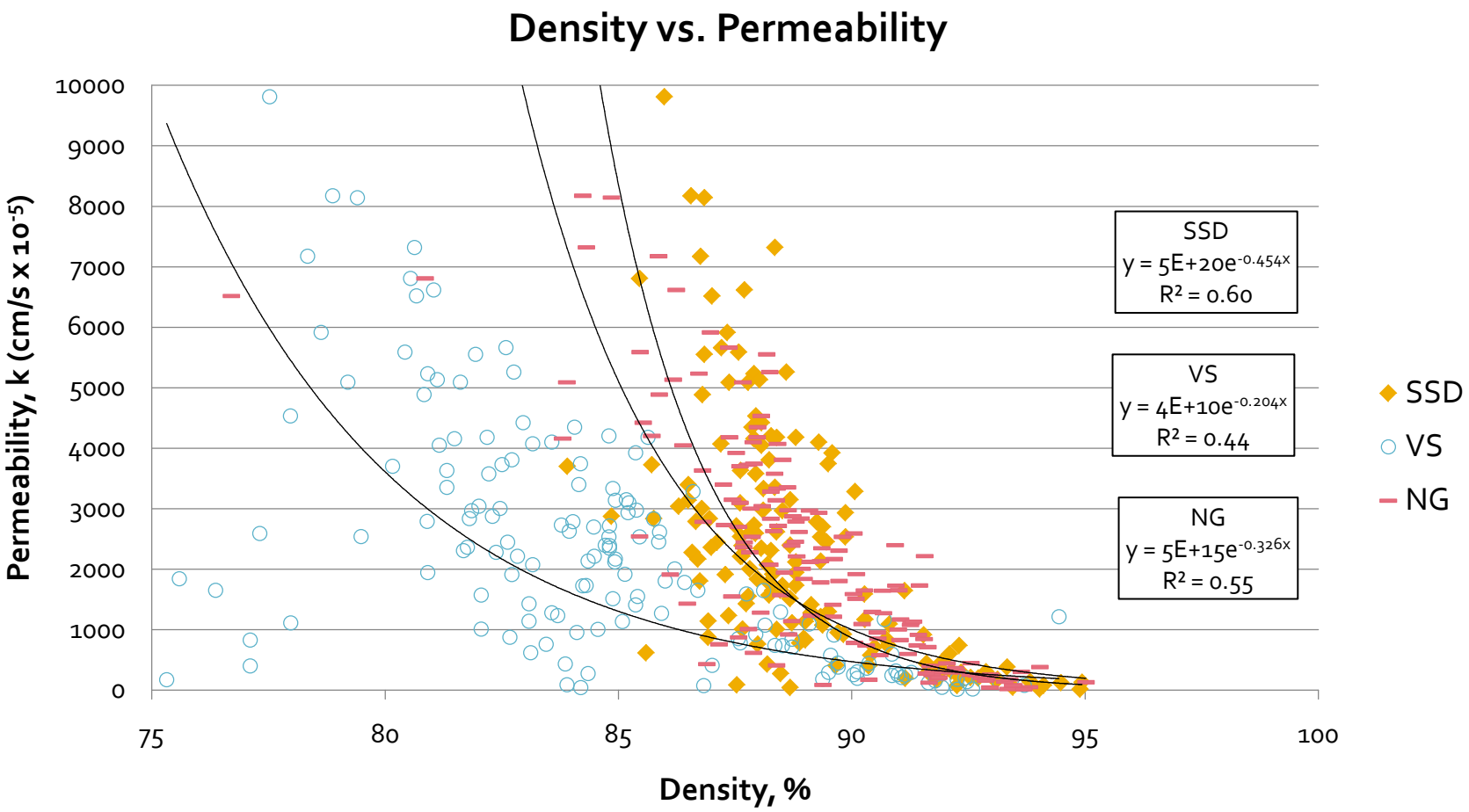
Discrimination

Nuclear Density	T166	T331	Absorption	Permeability	Infiltration
JH	JH	JH	JB	JB	JB
NW	JB	NW	JH	JH	JH
JB	NW	HO	NW	NW	NW
CR	HO	TC	CR	TC	TC
HP	CR	CR	CF	CR	CR
TC	TC	CF	HO	HP	HP
HO	HP	HP	TC	CF	CF
CF	CF	JB	HP	HO	HO

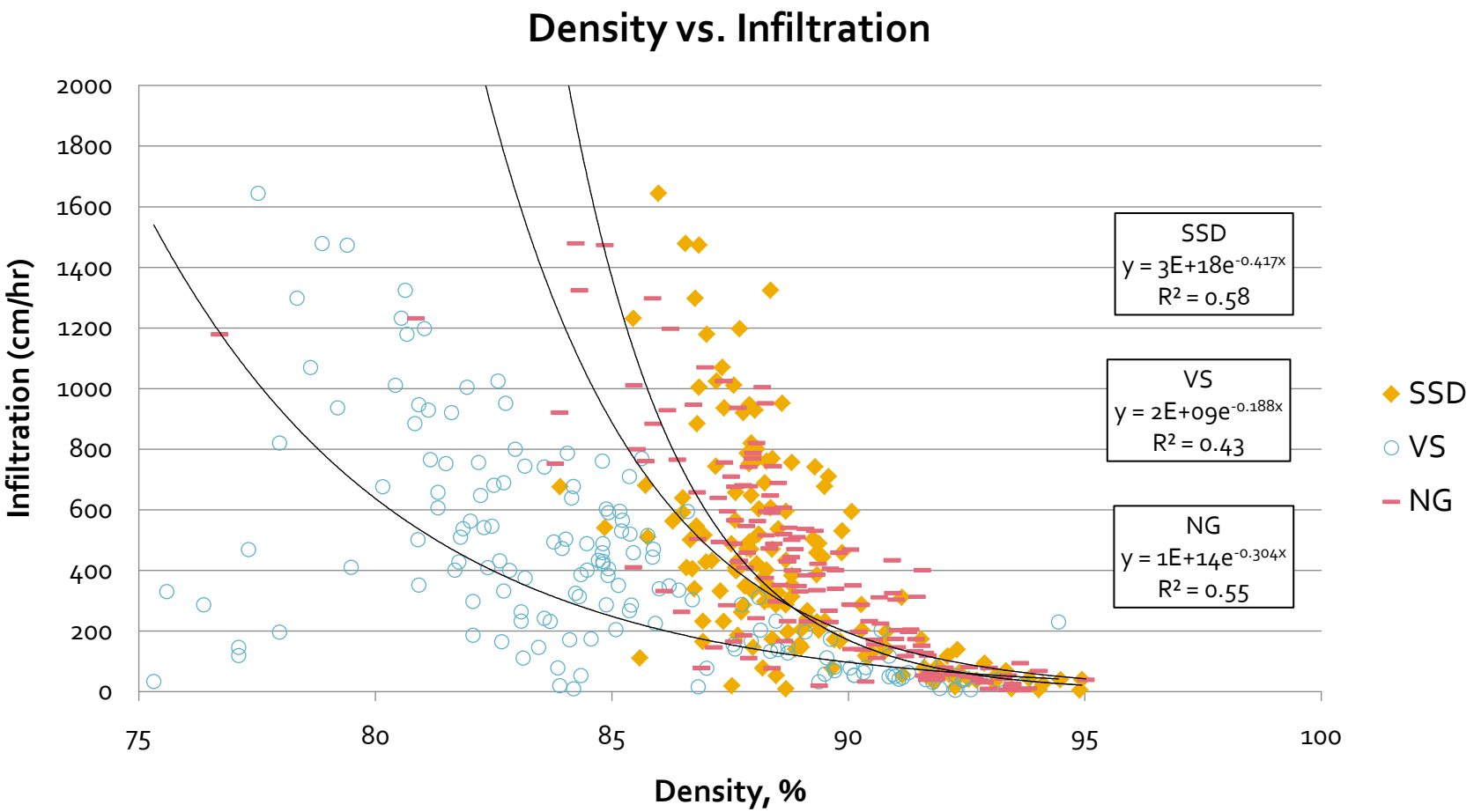
Density vs. Absorption



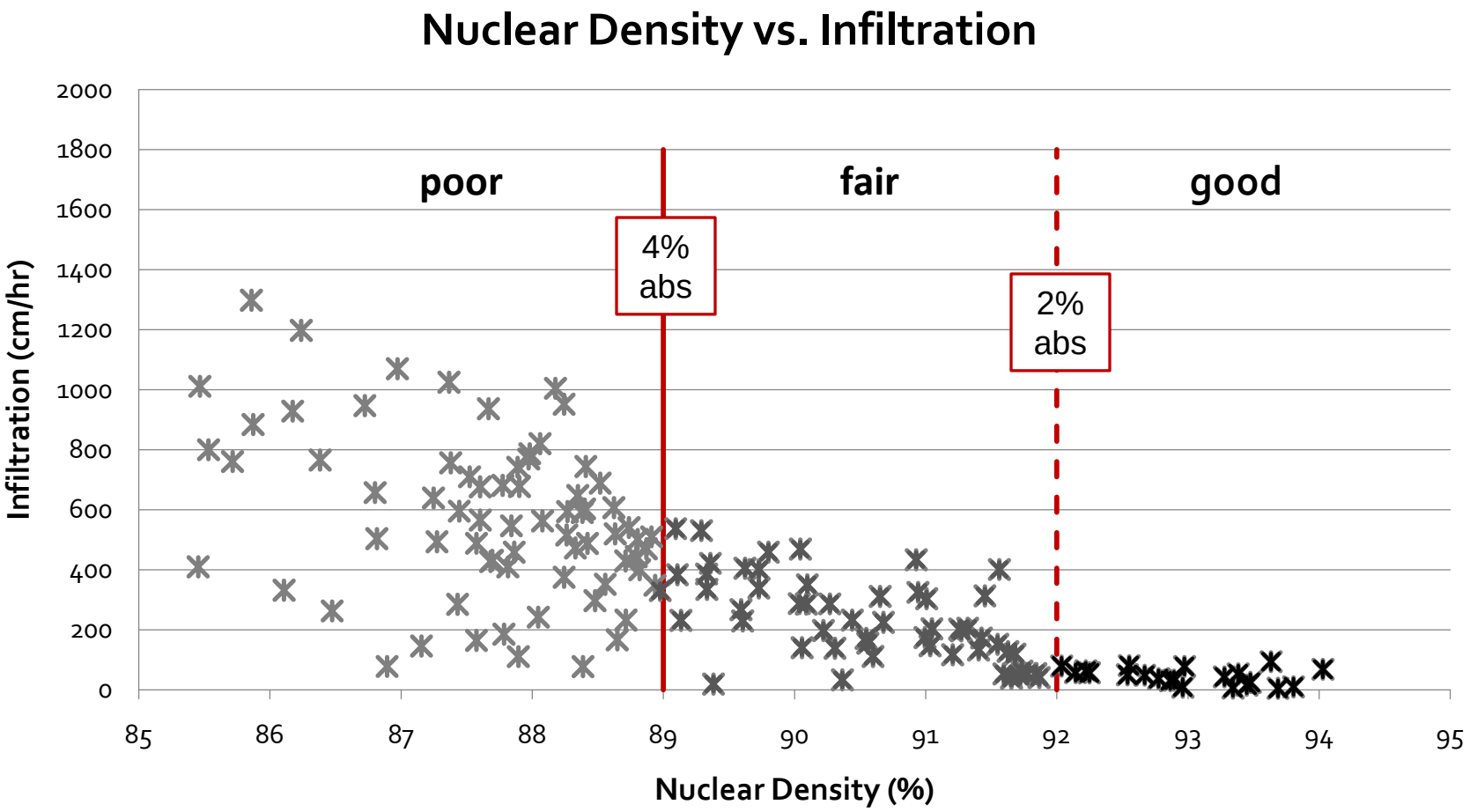
Density vs. Permeability



Density vs. Infiltration



Data Groupings



Conclusions

- Joint Heater
- Joint Bond
- Notched Wedge

} Best Performers

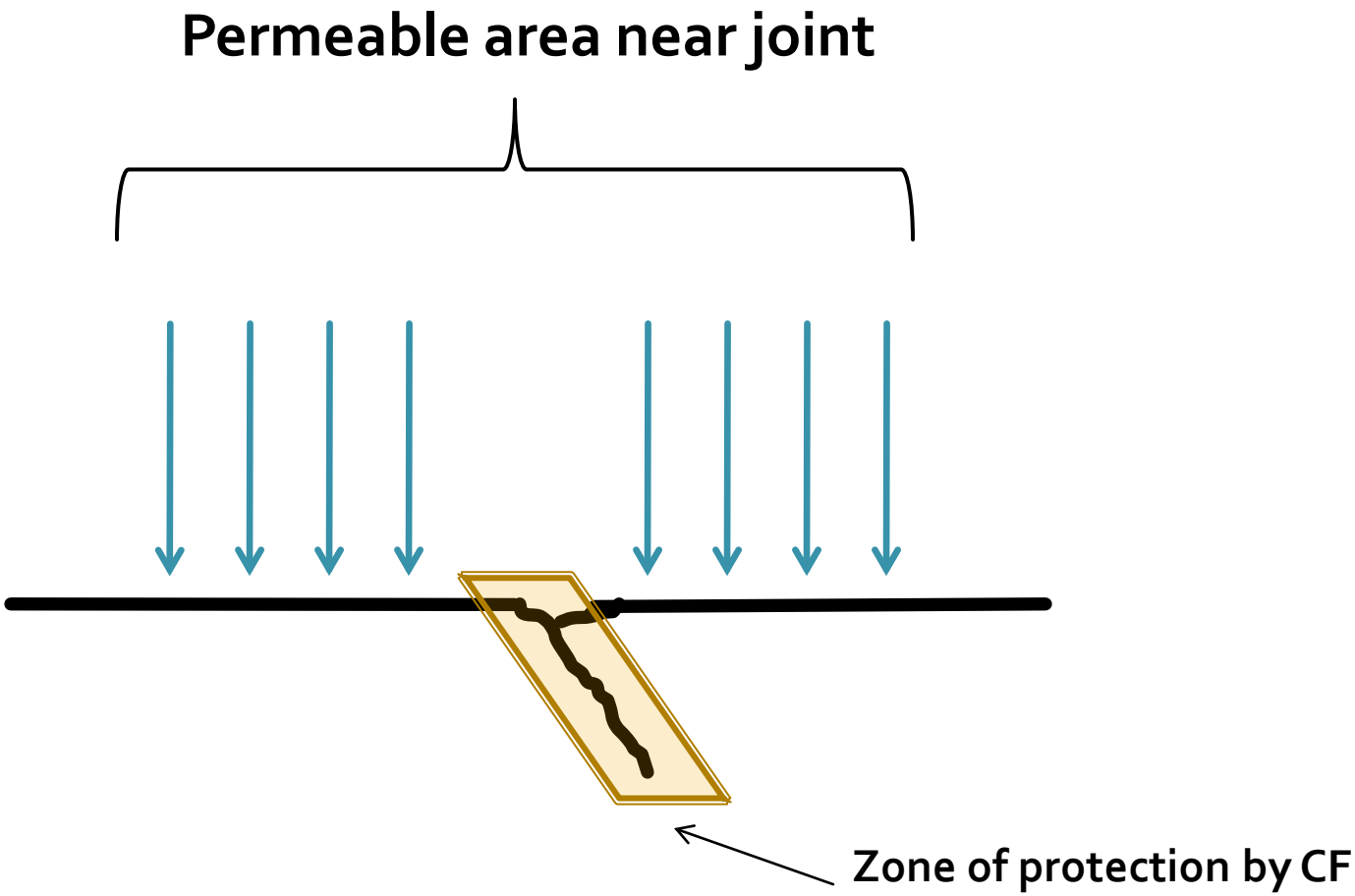
- Rolling Patterns (CR)
- Tack Coat

} Not as successful

- Crafco

} Unsuccessful

Joint Adhesive



Conclusions

- Field measures better able to discriminate quality level than absorption or core density
  - Nuclear gauge dependent upon core correction
    - Gauge seating issues
  - Permeability/infiltration not standard QC tests
- All methods were able distinguish proximity to the joint
  - SSD showed strongest relationship to permeability
    - Ability to measure low density?

Recommendations

- Use Density as measure of quality
  - Already used for QC/QA efforts
- Joint Requirements
  - 89 percent minimum density
  - 4 percent maximum absorption
- Allow contractor to make informed decision regarding specific joint construction method
  - Emphasize the importance of good construction techniques

Acknowledgements

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Thank You