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May 19th, 2005

Hot Mix Asphalt Research

UNIVERSITY OF NEVADA - RENO

- Impact of Construction Variability on Performance
- Longitudinal Joint Construction Techniques

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Impact of Construction Variability on Performance

Adjusted Mix Components:

- Gradation (Sloan & Lockwood Sources)
- Binder Content (AC-20 & 30, PG 64 & 76)
- Air Void Content

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Impact of Construction Variability on Performance

Gradations - Low, Medium & High

- Percentage Passing the #200 – L= 0%, H=11%
- Percentage Passing # 4 Sieve – L=43%, H=64%
- Medium Matched the Mix Design

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Impact of Construction Variability on Performance

Binder Content

- 6% Below Target
- 6% Above Target
- Mix Design Target

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Impact of Construction Variability on Performance

Air Voids (Low, Medium, High)

- 3% Low
- 7% Medium (JMF)
- 11% High

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Impact of Construction Variability on Performance

#4 Gradation – Low, Medium, High

#200 Gradation – Low, Medium, High

Binder Content – Low, Medium, High

Air Voids – Low, Medium, High

42 Combinations for Each Agg. Source

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Impact of Construction Variability on Performance

Performance Analysis Testing

- Resilient Modulus (M_r)
- Resistance to Rutting
- Resistance to Fatigue Cracking
- Resistance to Thermal Cracking (Northern Mixes)

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Impact of Construction Variability on Performance

Table 35 Performance Analysis of the Lockwood Aggregate Source.

Violations	Mix ID	General Strength MR	Rutting	Beam Fatigue			Thermal Cracking	Compaction Observations
				300 µStrain	500 µStrain	800 µStrain		
Low on # 4-Sieve	LM22	S Lower	NS	S Better	NS	S Worse	NS	
High on # 4-Sieve	HM22	NS	NS	S Better	S Better	S Better	S Better	
High on # 200-Sieve	MH22	NS	S Worse	S Worse	S Worse	S Worse	NS	
Low on Percent AC	MM12	S Higher	NS	S Worse	S Worse	S Worse	NS	
High on Percent AC	MM32	NS	S Worse	NS	S Better	S Better	S Better	
Low on Percent AV	MM21	S Higher	S Better	NS	NS	S Better	S Better	High Compaction Effort – High temp
High on Percent AV	MM23	NS	S Worse	NS	S Worse	S Worse	NS	
Low on # 4 & High on # 200-Sieves	LH22	NS	S Worse	NS	S Worse	S Worse	NS	
High on # 4 & High on # 200-Sieves	HH22	S Higher	S Better	NS	S Worse	NS	S Worse	
Low on # 4 & Low on Percent AC	LM12	NS	NS	S Worse	S Worse	S Worse	S Worse	
Low on # 4 & High on Percent AC	LM32	S Lower	S Worse	NS	S Better	S Better	NS	Minor Compaction
High on # 4 & Low on Percent AC	HM12	S Higher	S Better	NS	S Worse	S Worse	S Worse	High Compaction Effort – High temp
High on # 4 & High on Percent AC	HM32	NS	NS	S Better	S Better	S Better	S Better	
Low on # 4 & Low on Percent AV	LM21	S Higher	S Better	S Better	S Better	NS	NS	
Low on # 4 & High on Percent AV	LM23	S Lower	S Worse	S Better	S Better	NS	NS	Not Compacted – Just Leveled

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Impact of Construction Variability on Performance

Results

- 81% Chance of Lower Performance if placed outside of Specification Limits (6 years reduced service life)
- High % Passing #200 Always Perf. Worse than “MD”
- Low Binder Content Always Perf. Worse than “MD”

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Longitudinal Joint Construction

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Longitudinal Joint Construction

US 395 Washoe Valley

US 95 Las Vegas

- 5 – Joint Construction Techniques
- 2 – Rolling Patterns
- 10 – Test Sections

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Longitudinal Joint Construction

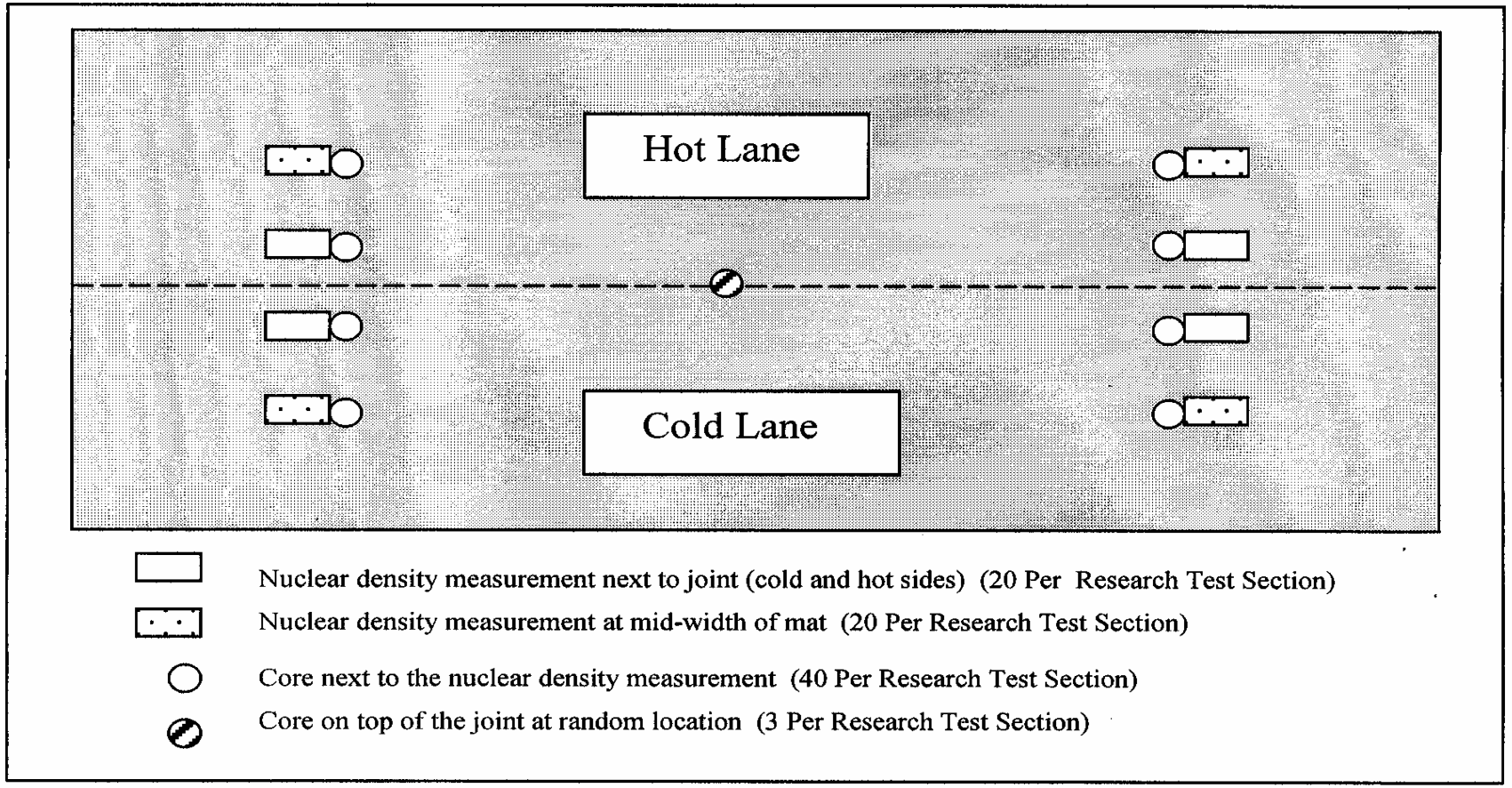

Figure 4. – Core & Nuclear Density Measurement Layout

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Longitudinal Joint Construction

Joint Construction Techniques

1. Natural Slope
2. Edge Restraining Device
3. Cut Edge with Joint Adhesive
4. Cut Edge Without Joint Adhesive
5. 3:1 Paved Slope Edge

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Longitudinal Joint Construction

Joint Construction Techniques

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EDGE RESTRAINING DEVICE

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Longitudinal Joint Construction

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Cut Edge W / Joint Adhesive

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Longitudinal Joint Construction

Joint Construction Techniques

1. Natural Slope
2. Edge Restraining Device
3. Cut Edge with Joint Adhesive
4. Cut Edge Without Joint Adhesive
5. 3:1 Paved Slope Edge

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Cutting Wheel

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Longitudinal Joint Construction

Joint Construction Techniques

1. Natural Slope
2. Edge Restraining Device
3. Cut Edge with Joint Adhesive
4. Cut Edge Without Joint Adhesive
5. 3:1 Paved Slope Edge

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3:1 Slope / Fabricated Plate

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3:1 Slope

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Longitudinal Joint Construction

Joint Rolling Pattern Techniques

1. Overlap Drum 6” onto Cold Mat
2. Roller Drum 6” Away From Joint

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Longitudinal Joint Construction

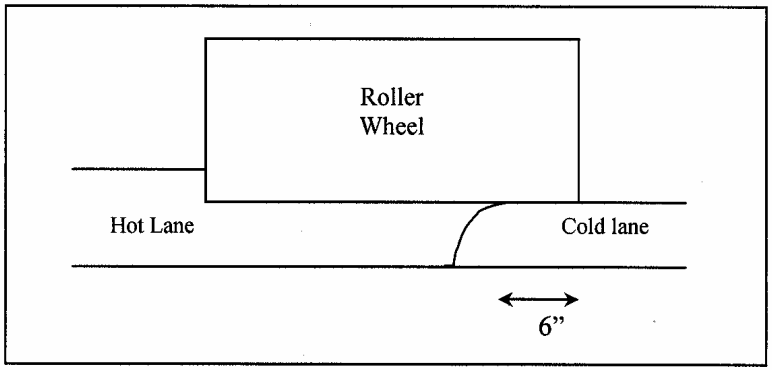

Figure 2. – Joint Rolling Pattern I

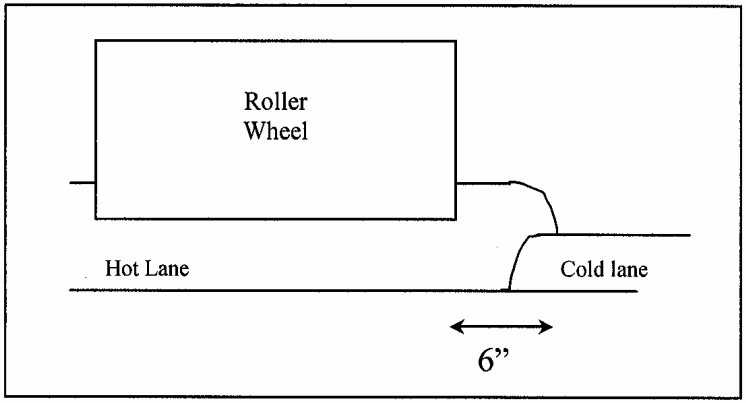

Figure 3. – Joint Rolling Pattern II

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Longitudinal Joint Construction

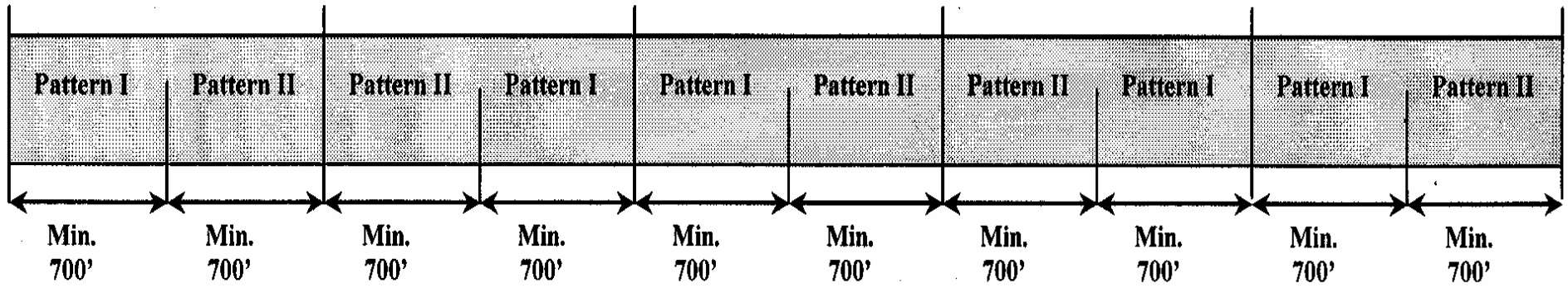

Figure 1: Layout of Test Sections

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Longitudinal Joint Construction

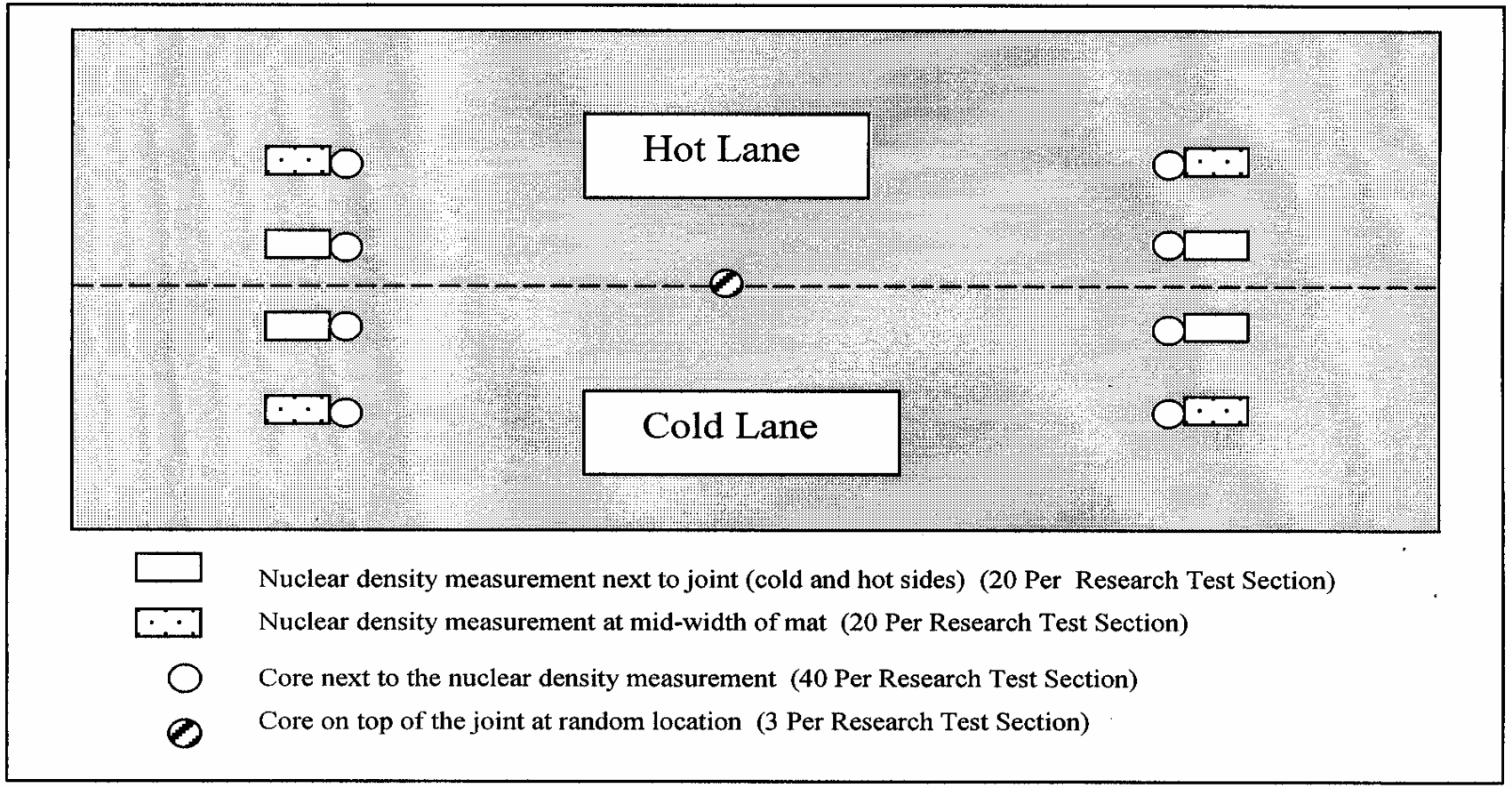

Figure 4. – Core & Nuclear Density Measurement Layout

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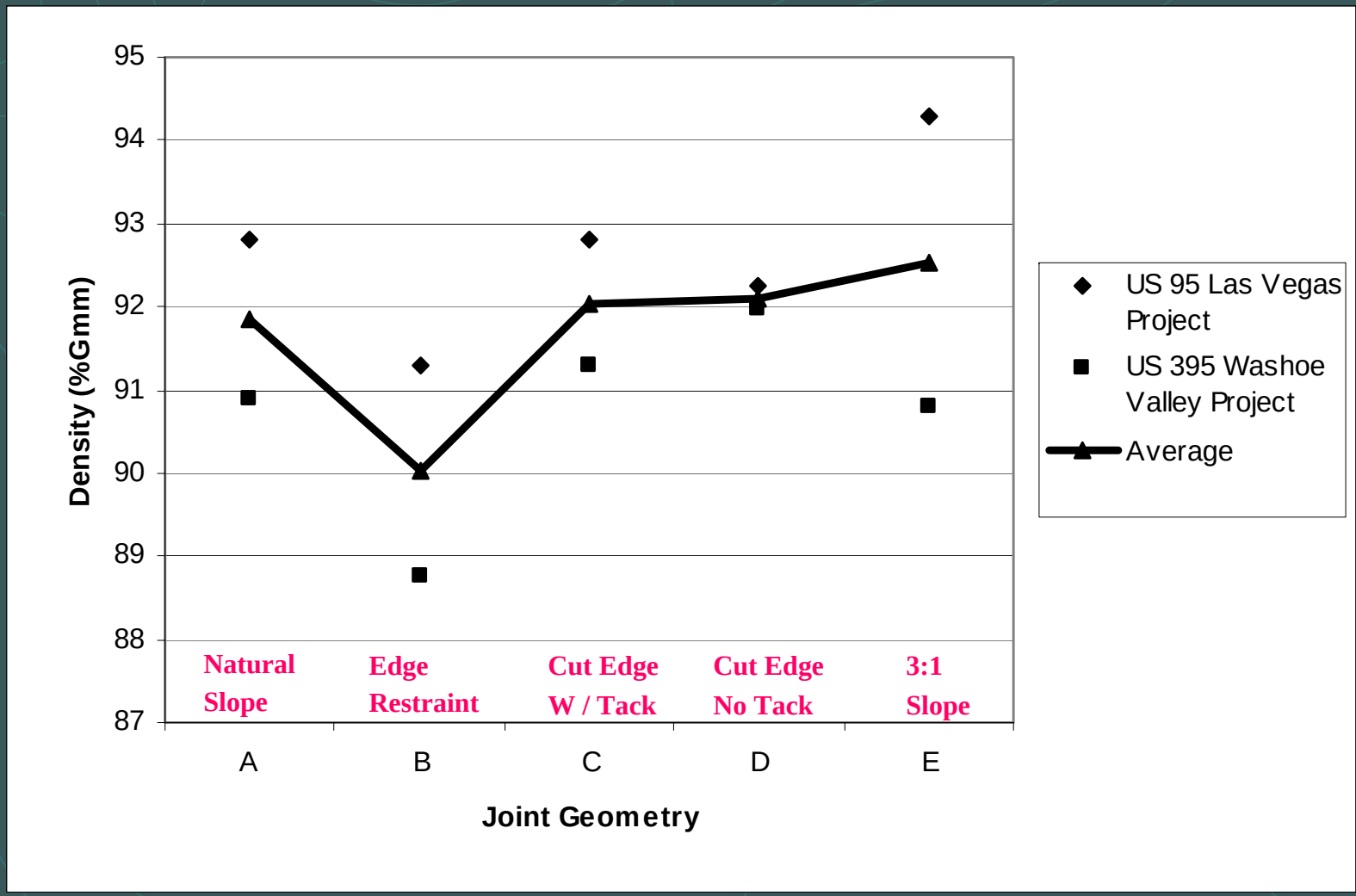
Longitudinal Joint Construction



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Longitudinal Joint Construction

Results

Minimal Difference Between Roller Patterns

1. 3:1 Sloped Edge Showed Greatest Density Results
2. Cut Edge Showed 2nd Highest Densities
3. Natural Slope Had 3rd Highest Density Values

Final Research Project to be Performed This Summer

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QUESTIONS ?