

# Preliminary Results of Simple Durability Tests on Mixes from the FHWA ALF Experiment

# Evaluation of Simple Mix Tests to Assess Cracking Resistance

- Task 37 of FHWA-NCAT Cooperative Agreement
- Original plan was to get materials from WesTrack
- FHWA ALF mix samples obtained by MeadWestvaco
- The objective is to determine if results of selected tests correlate with observed cracking performance using 10 mixtures from the 2013 FHWA ALF experiment.

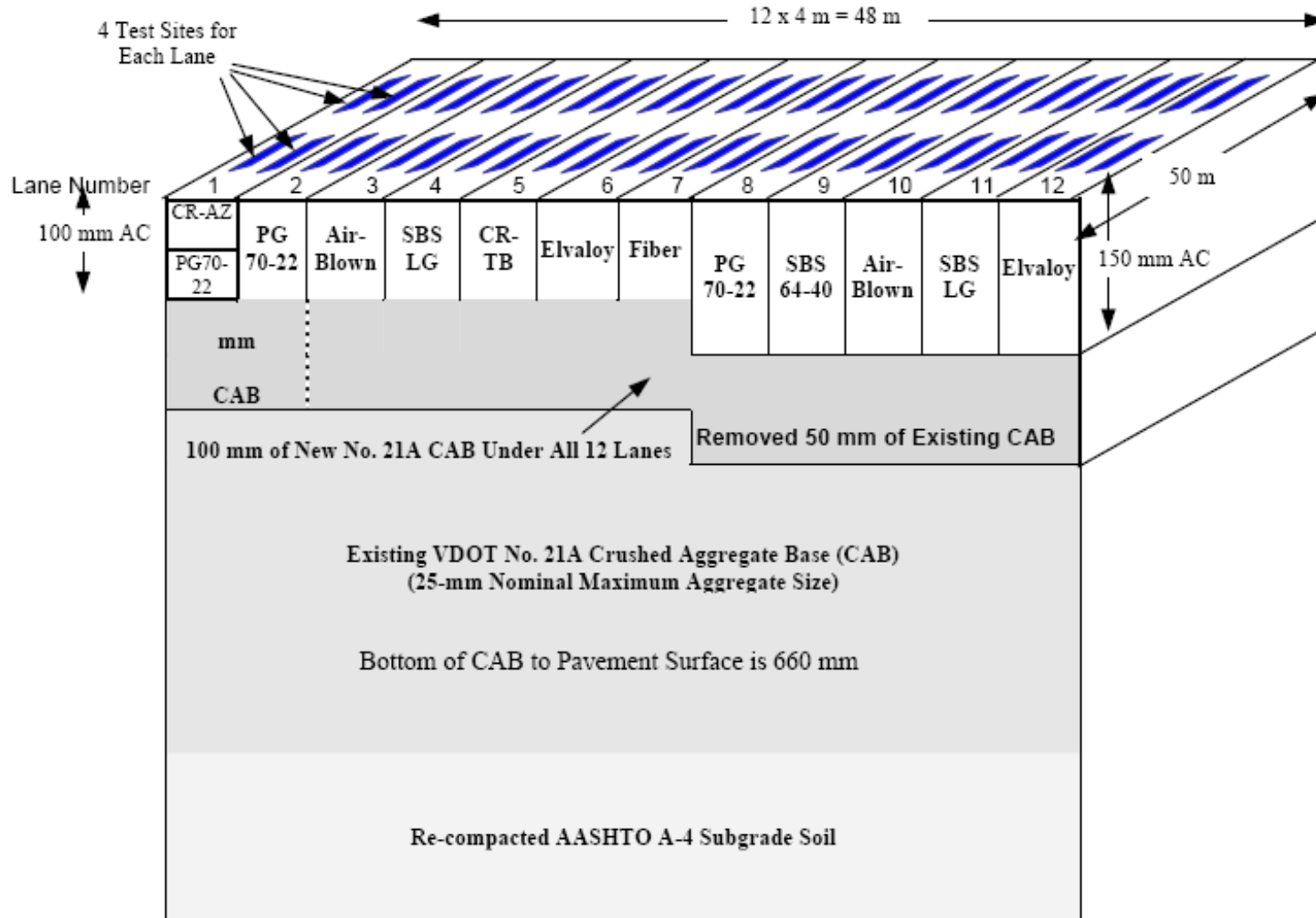


# Facility Overview



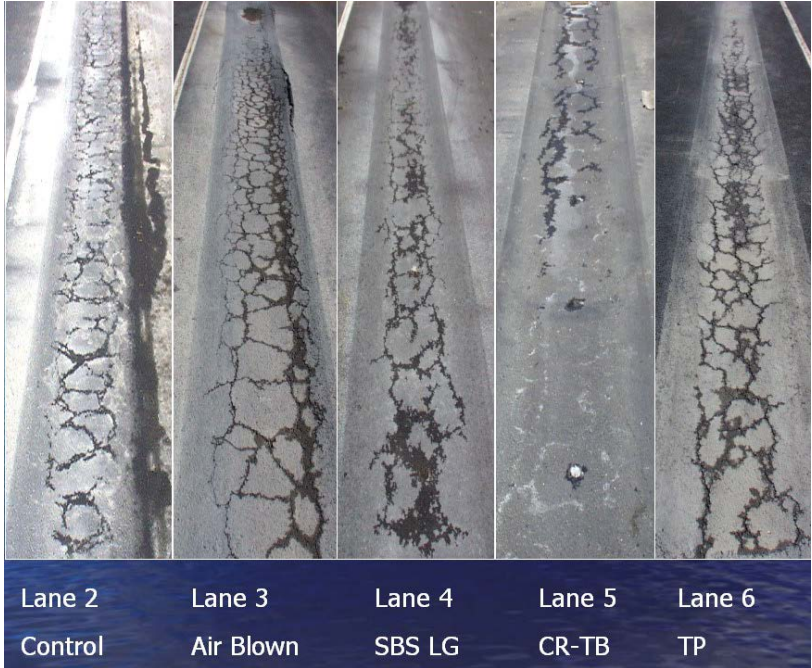


# PG Binder Study



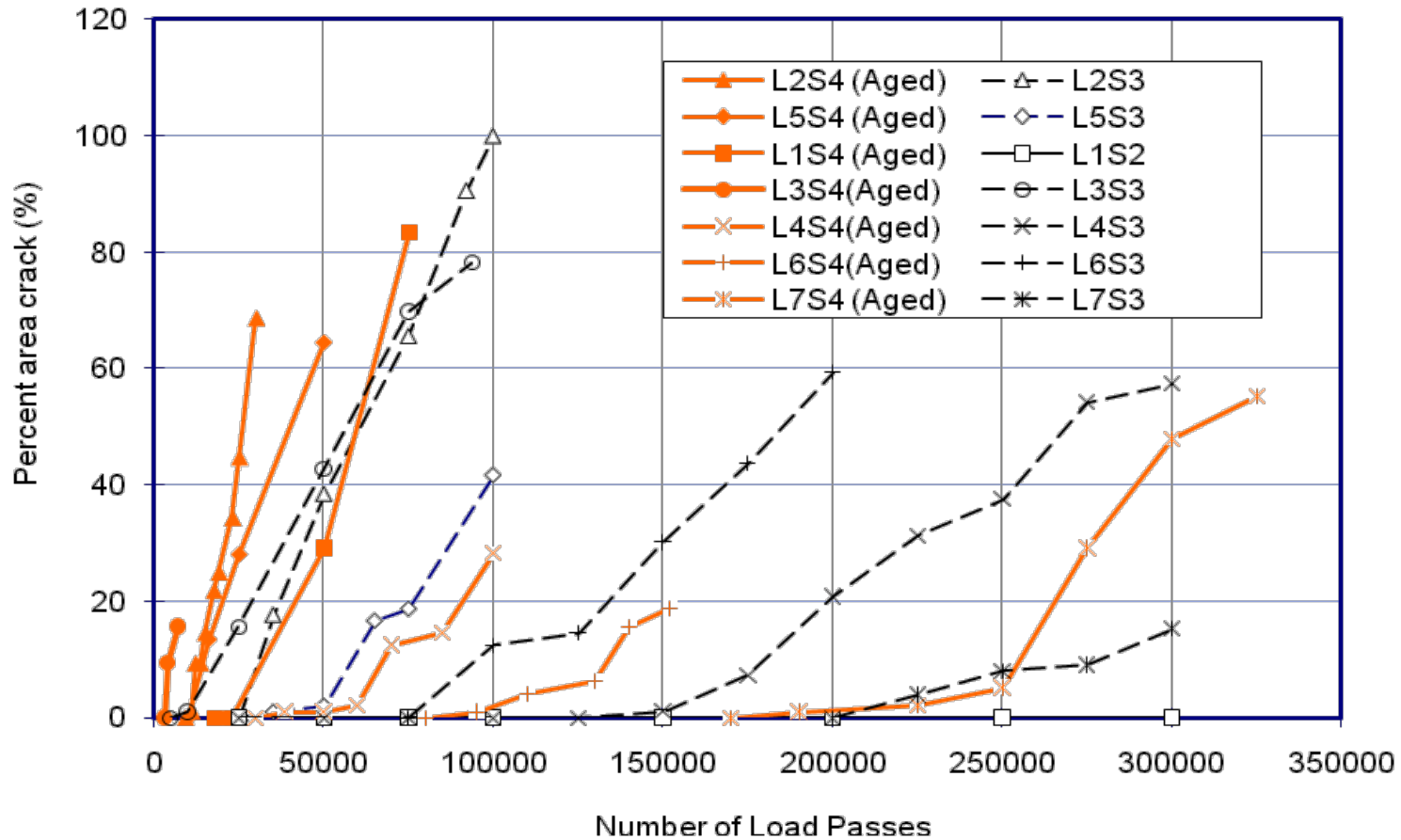


# PG Binder Study





# PG Binder Study





# ALF Experimental Design

| HMA / WMA<br>Production Temperature |  | 300°F - 320°F                         |  | 240°F - 270°F |         |         |
|-------------------------------------|--|---------------------------------------|--|---------------|---------|---------|
|                                     |  | -                                     |  | Foam          | Chem.   |         |
| Warm Mix Technology                 |  | -                                     |  | -             | -       |         |
|                                     |  | -                                     |  | -             | -       |         |
| Recycle Content                     |  | 0%                                    |  | PG64-22       | PG64-22 |         |
|                                     |  | 20% ABR RAP<br>≈ 23% by weight        |  | PG64-22       | PG64-22 | PG64-22 |
|                                     |  | 20% ABR RAS<br>≈ 6% Shingle by weight |  | PG64-22       | PG58-28 |         |
|                                     |  | 40% ABR RAP<br>≈ 44% by weight        |  | PG64-22       | PG58-28 | PG58-28 |

# Mixes from FHWA ALF Experiment

| Lane | WMA Type | RAP BR (%) | RAS BR (%) | Virgin Binder PG | Prod. Temp. (F) |
|------|----------|------------|------------|------------------|-----------------|
| 1    | n/a      | 0          | 0          | 64-22            | 285             |
| 2    | foam     | 40         | 0          | 58-28            | 240             |
| 3    | n/a      | 0          | 5          | 64-22            | 285             |
| 4    | chem.    | 20         | 0          | 64-22            | 240             |
| 5    | n/a      | 40         | 0          | 64-22            | 285             |
| 6    | n/a      | 20         | 0          | 64-22            | 285             |
| 7    | n/a      | 0          | 5          | 64-22            | 240             |
| 8    | n/a      | 40         | 0          | 58-28            | 285             |
| 9    | foam     | 20         | 0          | 64-22            | 240             |
| 11   | chem.    | 40         | 0          | 58-28            | 240             |

- All lanes were built to a total of 4 inches of asphalt mix. Testing of the lanes began in Fall 2013 and is expected to be completed in Fall 2015.



# Tests Conducted

| Test           | Method                   |
|----------------|--------------------------|
| Cantabro       | ASTM D7064-08            |
| SCB            | LTTC modified by Zhou    |
| IDT Work       | NCAT                     |
| Overlay Tester | Tex-248-F modified by Ma |

- Test specimens were made from SGC samples compacted to  $N_{\text{design}}$  (65 gyrations)
- Using  $N_{\text{design}}$  specimens provides the quickest and simplest path to implementation for any of these durability “performance” tests.
- Sealed buckets of mix were reheated for 2 hours for HMA and 4 hours for WMA mixtures, samples for each test were weighed out and brought back to the compaction temperature before SGC compaction.

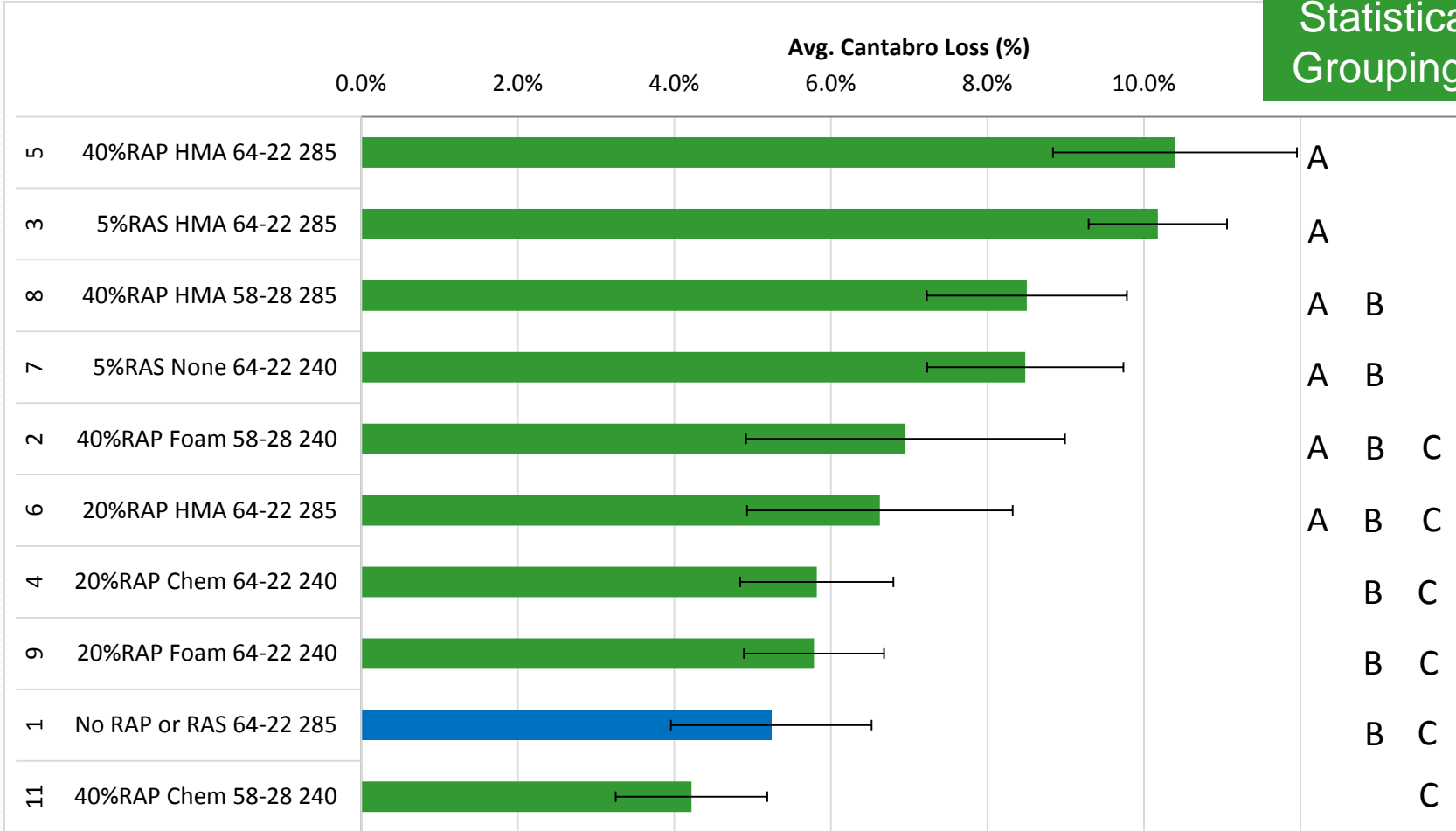
# Cantabro Test

- Primarily used for OGFC mixes
- One compacted specimen placed in LA Abrasion drum at a time
- No Steel Balls
- 300 drum revolutions
- Calculate mass loss
- Studies by Doyle and Howard



# Cantabro Results

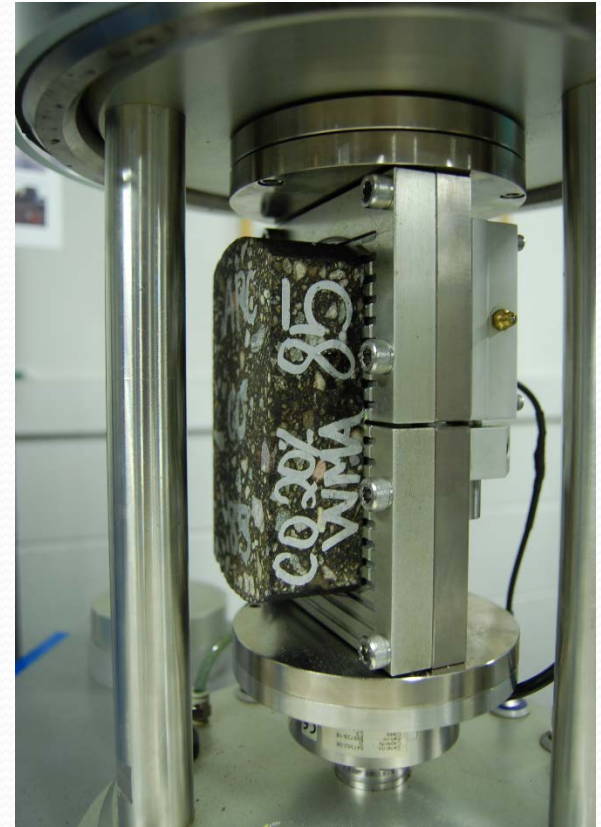
Tukey  
Statistical  
Groupings



Average COV = 19%

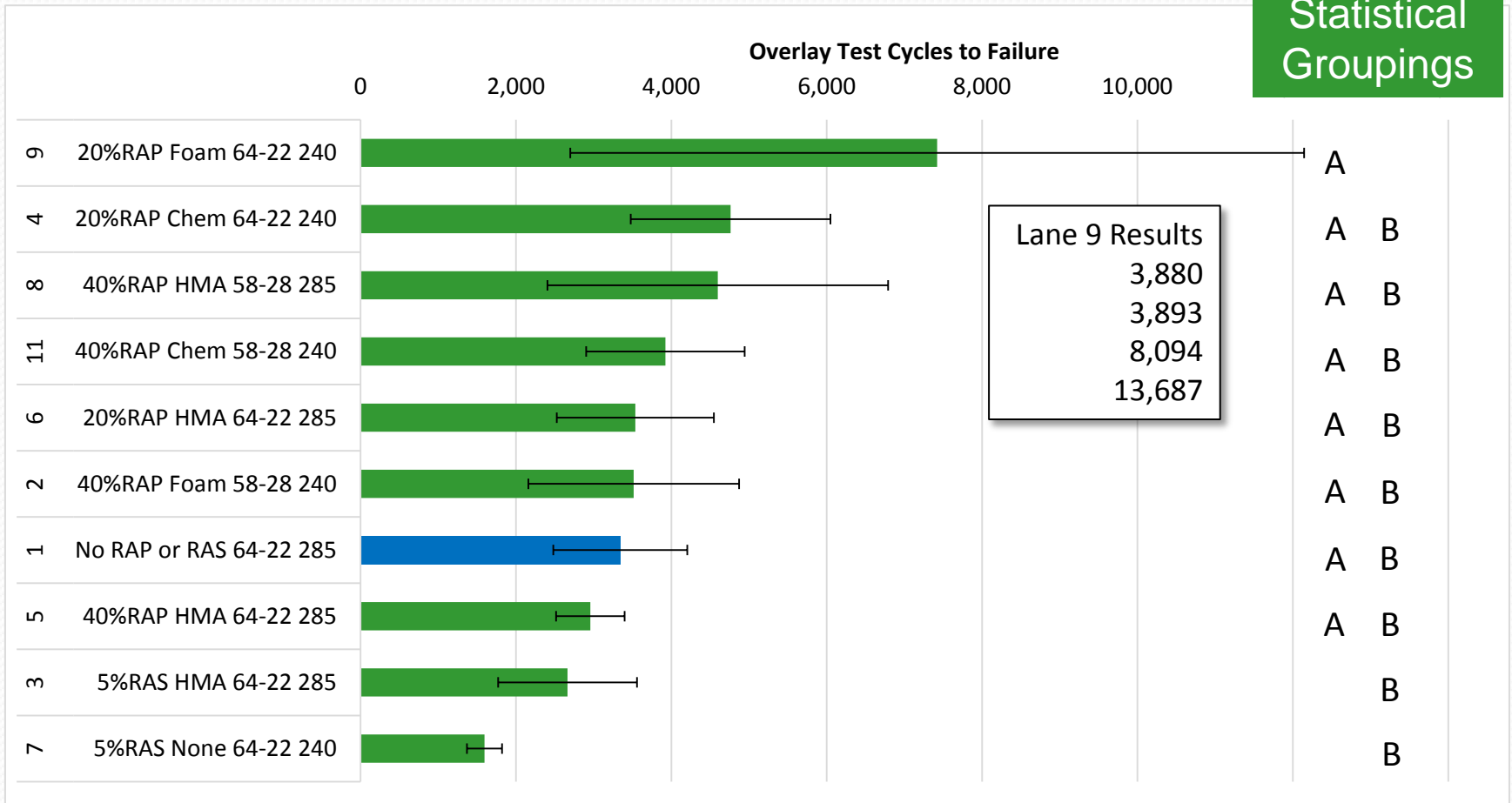
# Modified Overlay Test

- Method modified by NCAT
  - Displacement = 0.381 mm
  - Cycle = 1 Hz
  - Failure = peak of normalized load x cycle
- Conducted in AMPT @ 25°C
- Triplicates



# Overlay Test Results

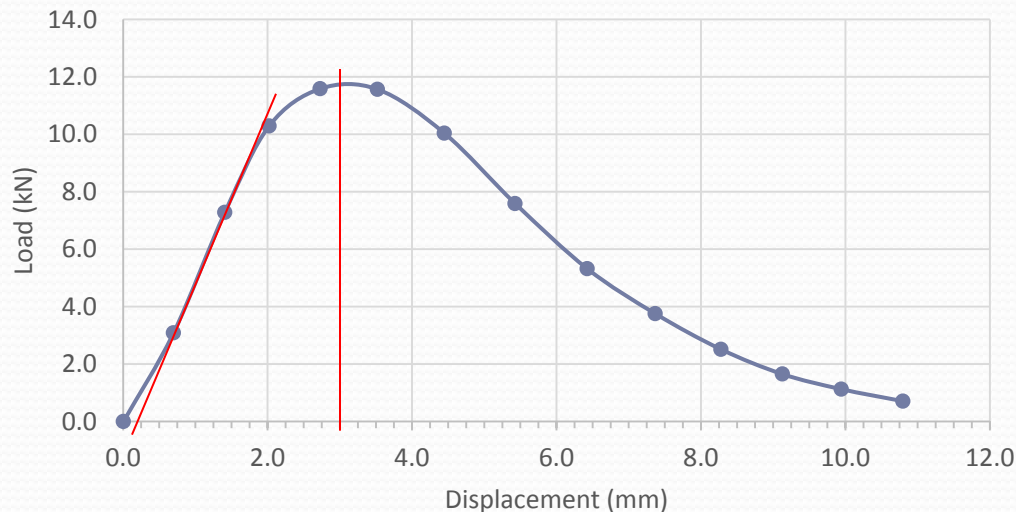
Tukey  
Statistical  
Groupings



Average COV = 32%

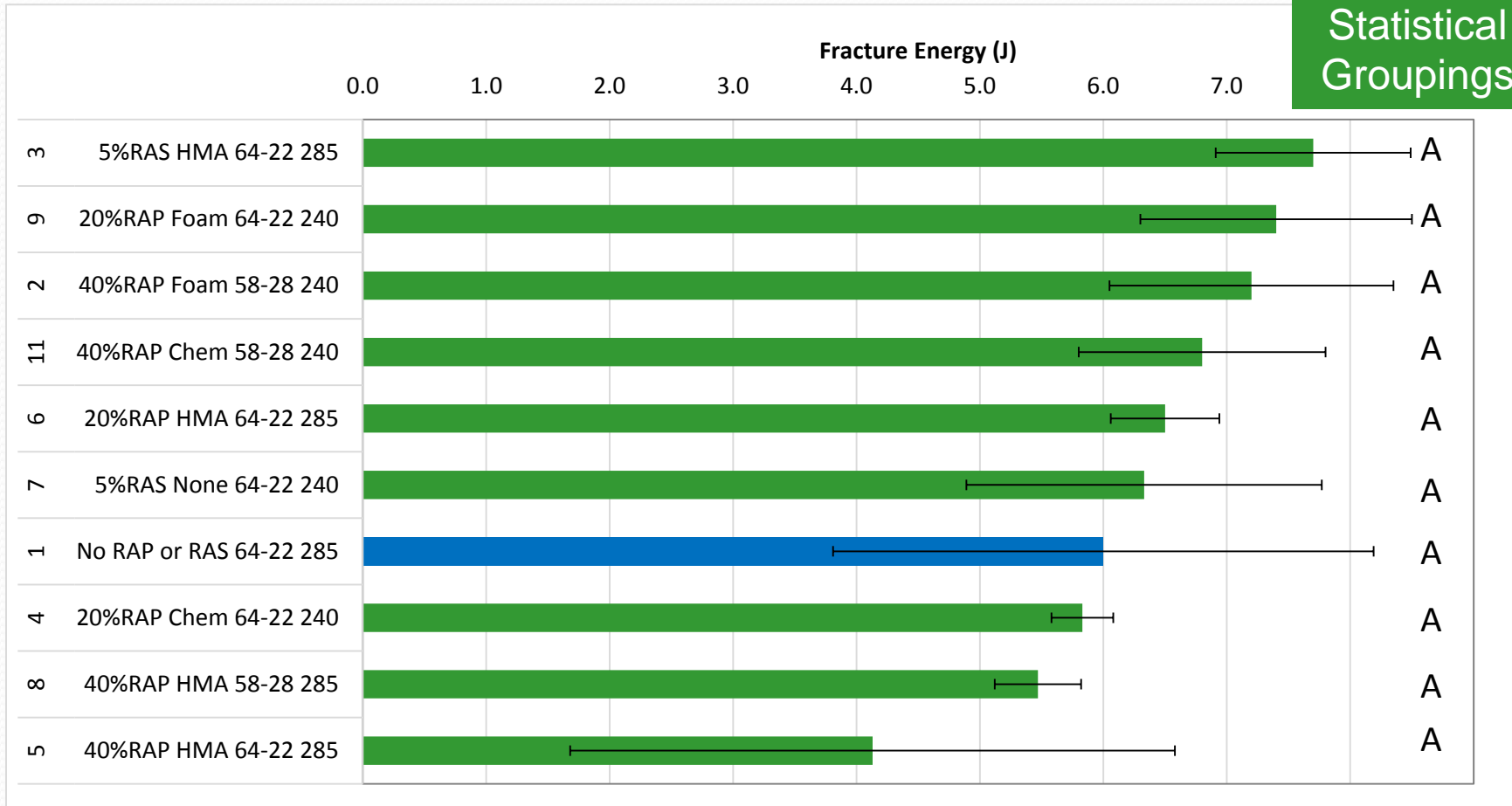
# IDT Fracture Energy

- 50 mm thick specimens
- Ram rate = 50 mm/min.
- Temp. = 25°C
- Triplicates



# IDT Fracture Energy Results

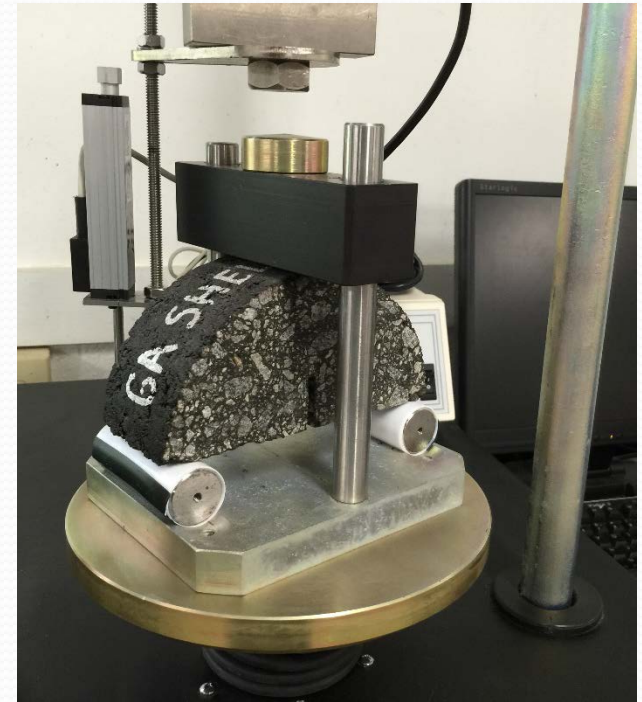
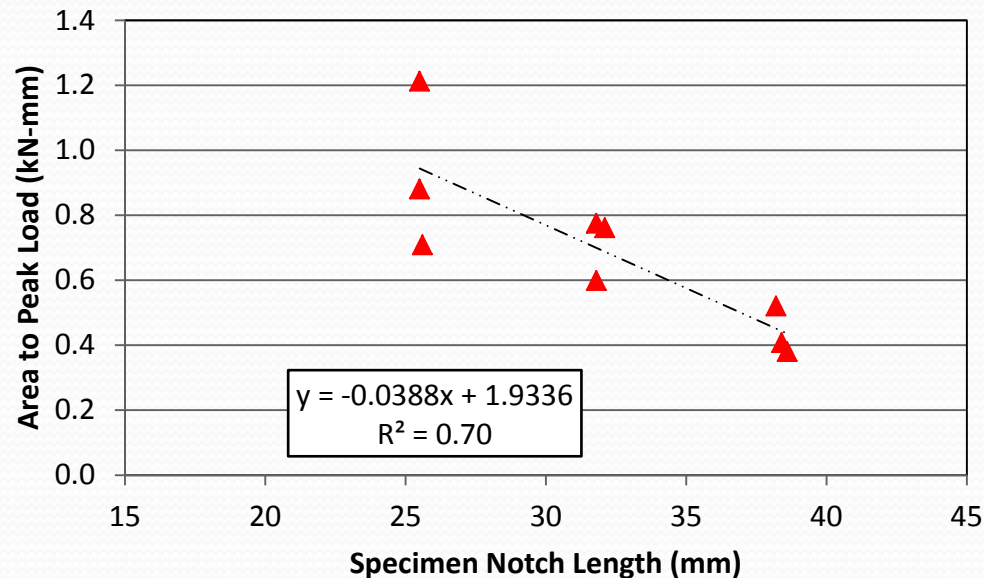
Tukey  
Statistical  
Groupings



Average COV = 19%

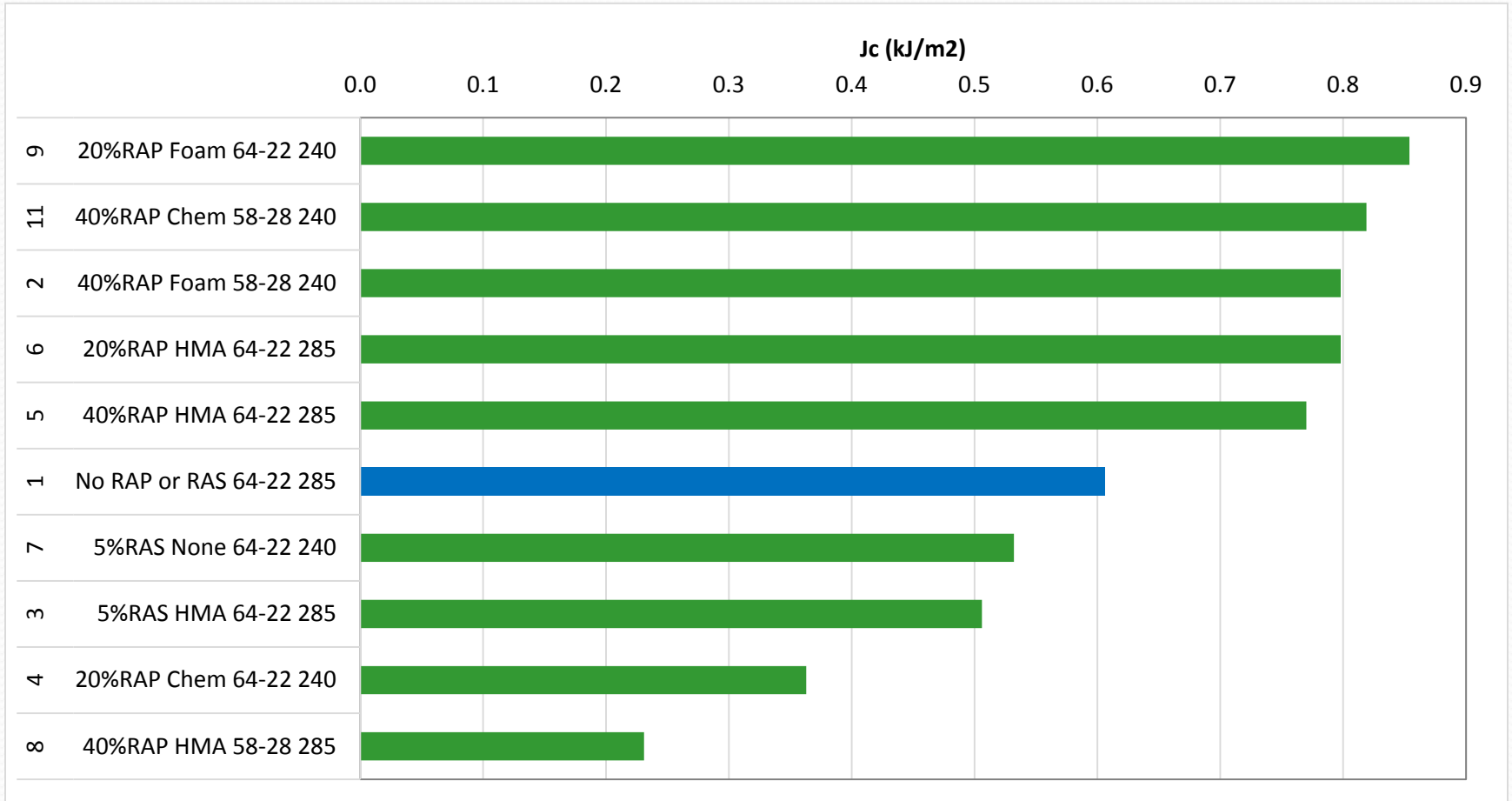
# Semi-Circular Bend Test

- 50 mm thick specimens
- Ram rate = 0.5 mm/min.
- Notch depths of 38.1, 31.8, 25.4 mm
- Triplicates





# SCB Results



Average COV for Area to Peak Load = 27%

# Preliminary Observations

- Only the Cantabro was able to statistically differentiate the virgin mix from any other experimental mix. Statistical analysis of SCB data has not been finalized.

# Remaining Work

- Statistical analysis of SCB work vs notch depth slopes
- Get cracking performance of ALF lanes and conduct correlation analyses between lab and field results
- Explore other parameters from tests conducted
- Prepare final report



Any Questions?