

CC6 Update

Presented to: Airport Pavement Working Group
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Federal Aviation
Administration



CC6 Objectives

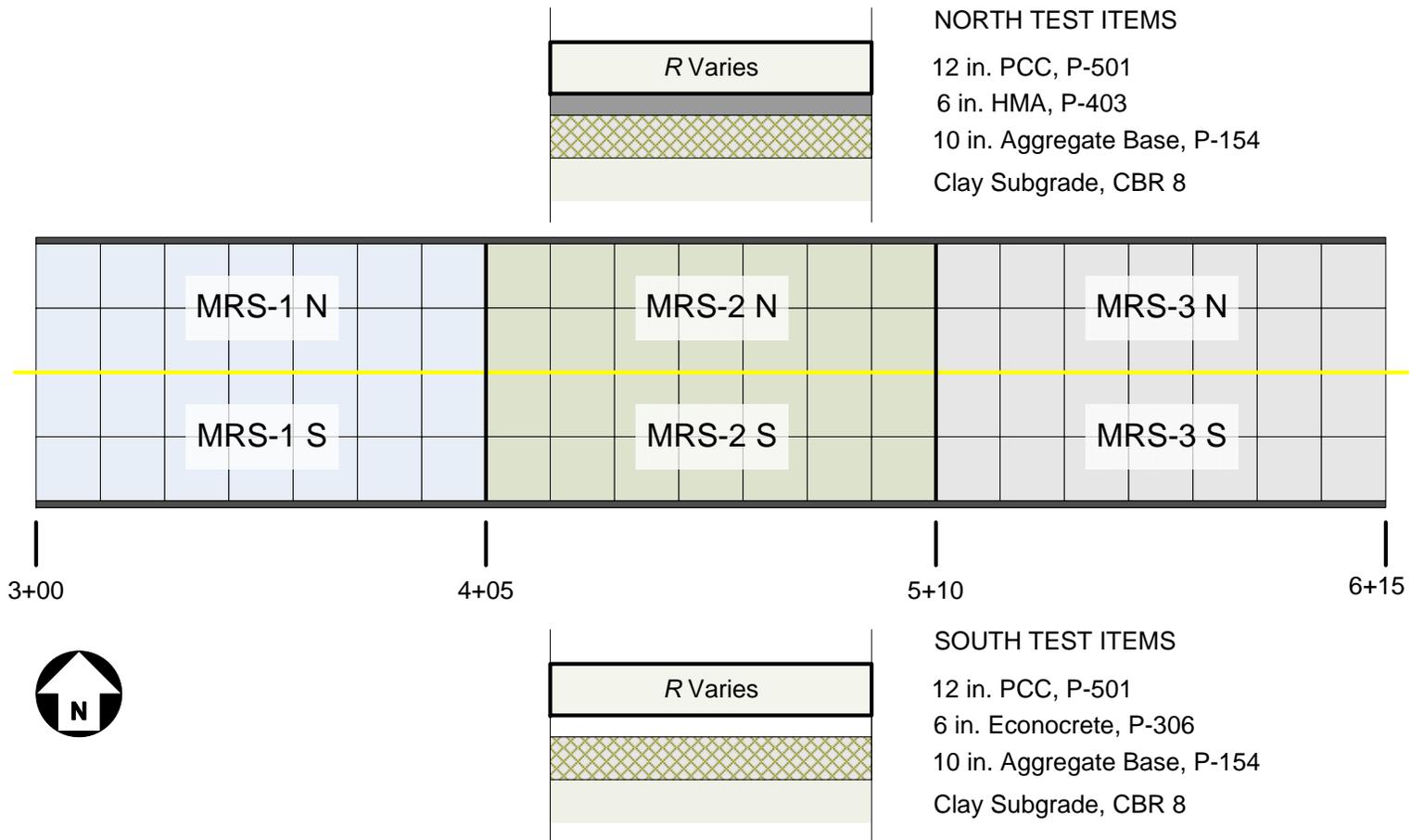
- **Investigate the relative effect of concrete strength on test item performance.**
 - Will concrete that is “too strong” perform poorly?
 - Is the current flexural strength limitation in AC 150/5320-6E justified by objective full-scale test data?
- **Investigate the effect of subbase material (cement stabilized vs. asphalt stabilized) on performance.**

CC6 Test Item Structure Summary

“Low Strength”
Target 500 psi

“Medium Strength”
Target 750 psi

“High Strength”
Target 1000 psi



CC6 Test Items – Concrete Strength

Test Item	Target Concrete Strength, psi	Average 28-day Concrete Strength (C78), psi	Average Strength of Field-Cut Beams (C78), psi
MRS-1	500	662 ($\sigma = 48$ psi)	660 ($\sigma = 51$ psi)
MRS-2	750	763 ($\sigma = 113$ psi)	749 ($\sigma = 30$ psi)
MRS-3	1000	1007 ($\sigma = 150$ psi)	932 ($\sigma = 66$ psi)

CC6 Trafficking History

Dates	Wander Pattern	Wheel Load, lbs.	Passes		
			MRS-1	MRS-2	MRS-3
7/8/11 – 8/15/11	*	44,000	6,790	0	0
8/30/11 – 12/20/11	1-238	45,000	15,708	15,708	15,708
12/27/11 – 2/29/12	239-405	52,000	0	11,022	11,022
2/29/12 – 3/30/12	406-508	52,000	0	6,798	0
		70,000	0	0	6,798
3/30/12 – 4/25/12	509-595	70,000	0	5,742	5,742
Total Passes:			22,498	39,270	39,270

* Preliminary traffic tests (zero wander) on MRS-1 North only

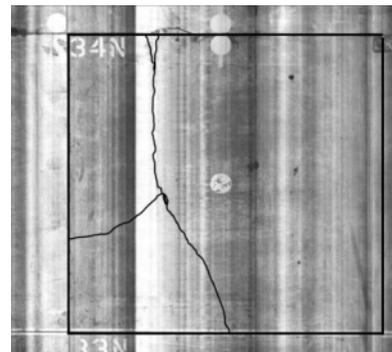
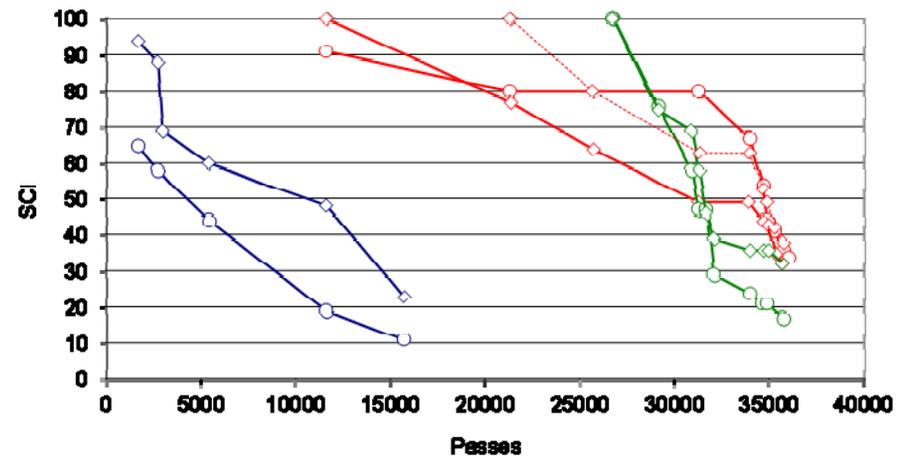
CC6 Current Status



- **Traffic ended 4/25/2012. All test items were trafficked to full failure.**
- **Total of 39,270 passes of the test vehicle.**
- **Post-traffic testing is in progress.**
- **Parallel laboratory effort (beam fatigue & fracture testing) is in progress.**

Major Results from CC6

- Rigid pavement life is strongly correlated to concrete flexural strength.
- Higher strength test items required more passes at higher loads to fail.
- No significant difference in performance for base types. However, some differences in crack patterns observed.
- Thickened edge joint performed better than reinforced isolation joint.



Use of Laser Imaging to Document CC6 Distresses



Equivalent Passes to Failure

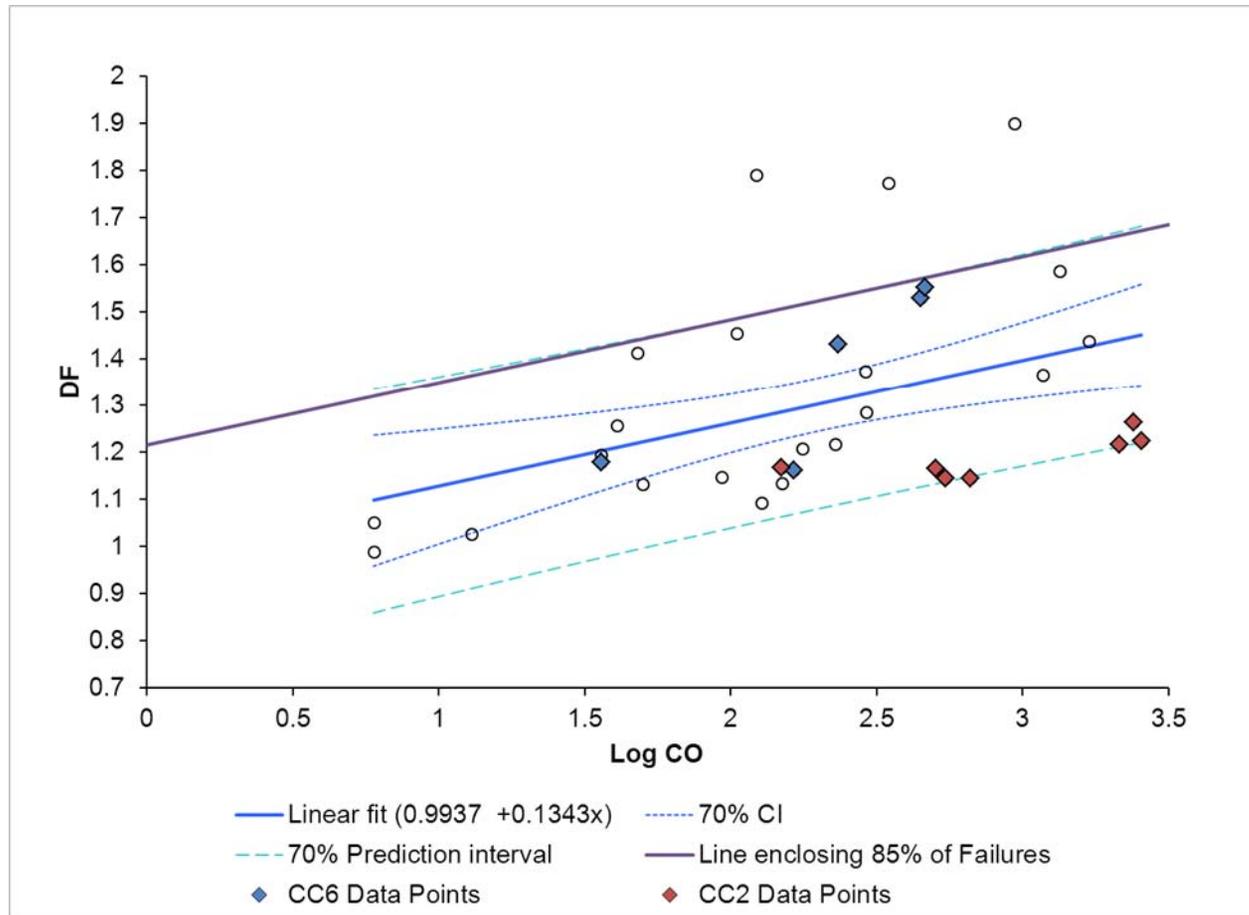
(Vehicle passes adjusted for wheel load)

Test Item	Equivalent Passes @ 45 kips	Equivalent Passes @ 70 kips
MRS-1 North	9,108	63
MRS-1 South	7,834	54
MRS-2 North	577,393	1,855
MRS-2 South	572,096	1,838
MRS-3 North	9,909,051	4,696
MRS-3 South	11,175,129	5,296

High Strength > Medium Strength > Low Strength

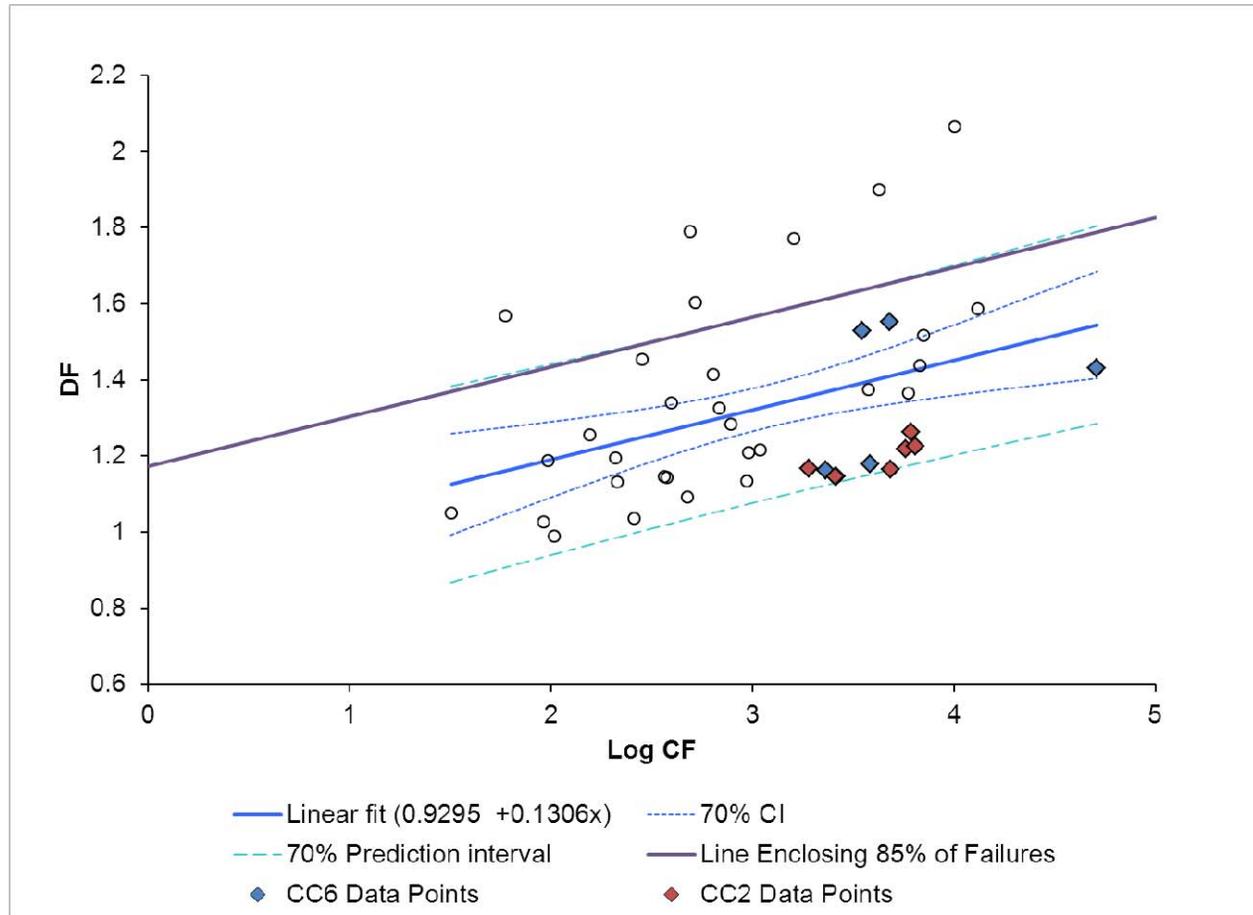
Rigid Failure Data Reanalysis (1)

Design Factor vs. Adjusted Coverages to 1st Crack



Rigid Failure Data Reanalysis (2)

Design Factor vs. Adjusted Coverages to Full Failure

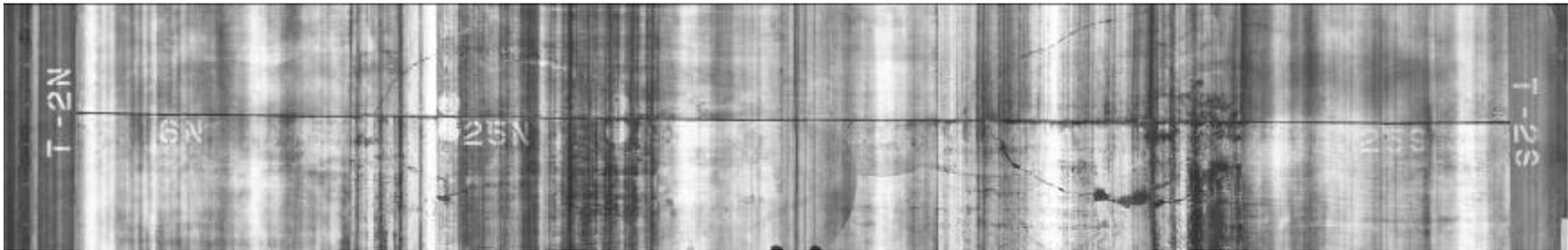


Updated Parametric Values

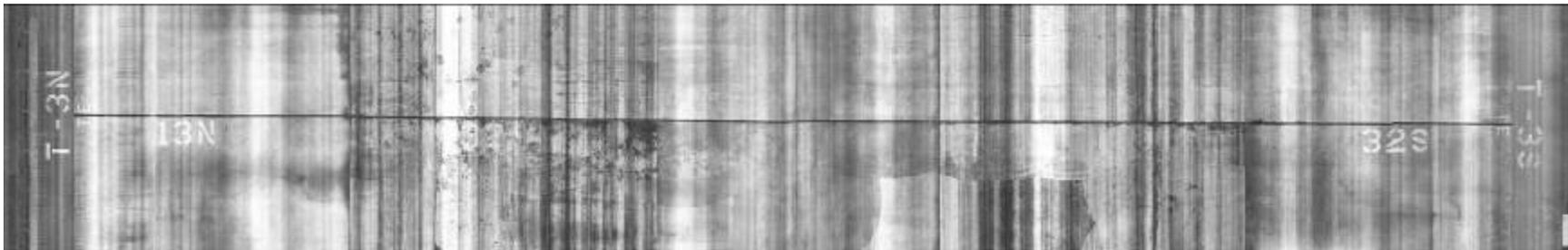
	a	b	c	d
85%ile Values	1.173	0.1306	1.215	0.1343
50%ile Values	0.9295	0.1306	0.9937	0.1343
Current Values	0.5878	0.2523	0.7409	0.2465



Isolation Joint Damage



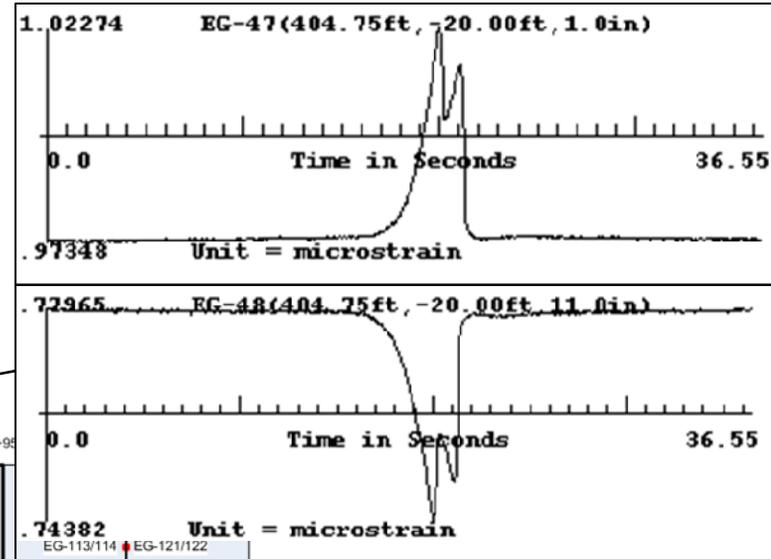
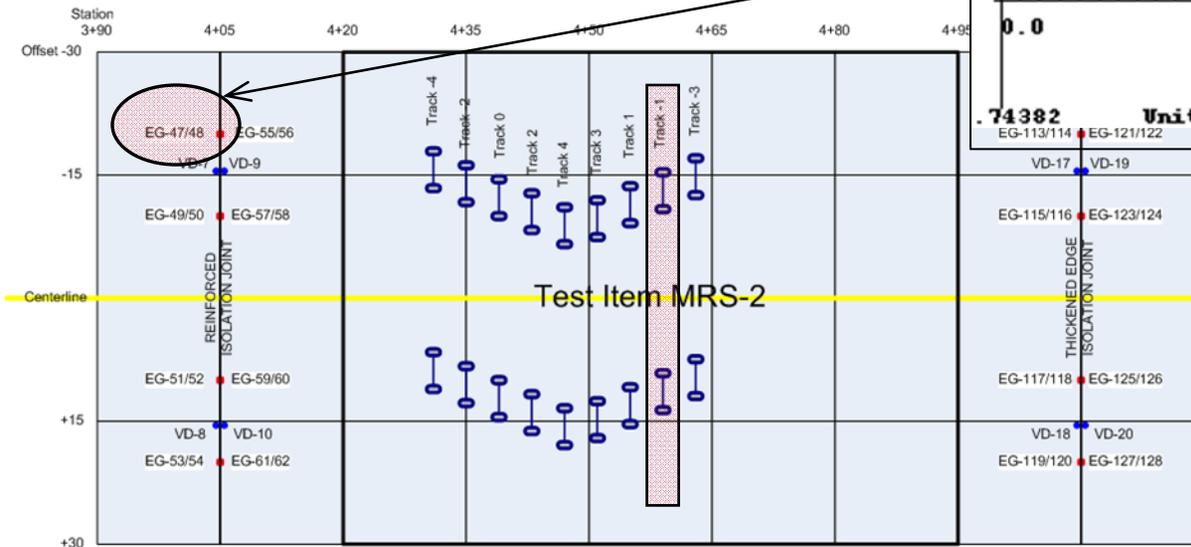
Reinforced Isolation Joint



Thickened Edge Isolation Joint

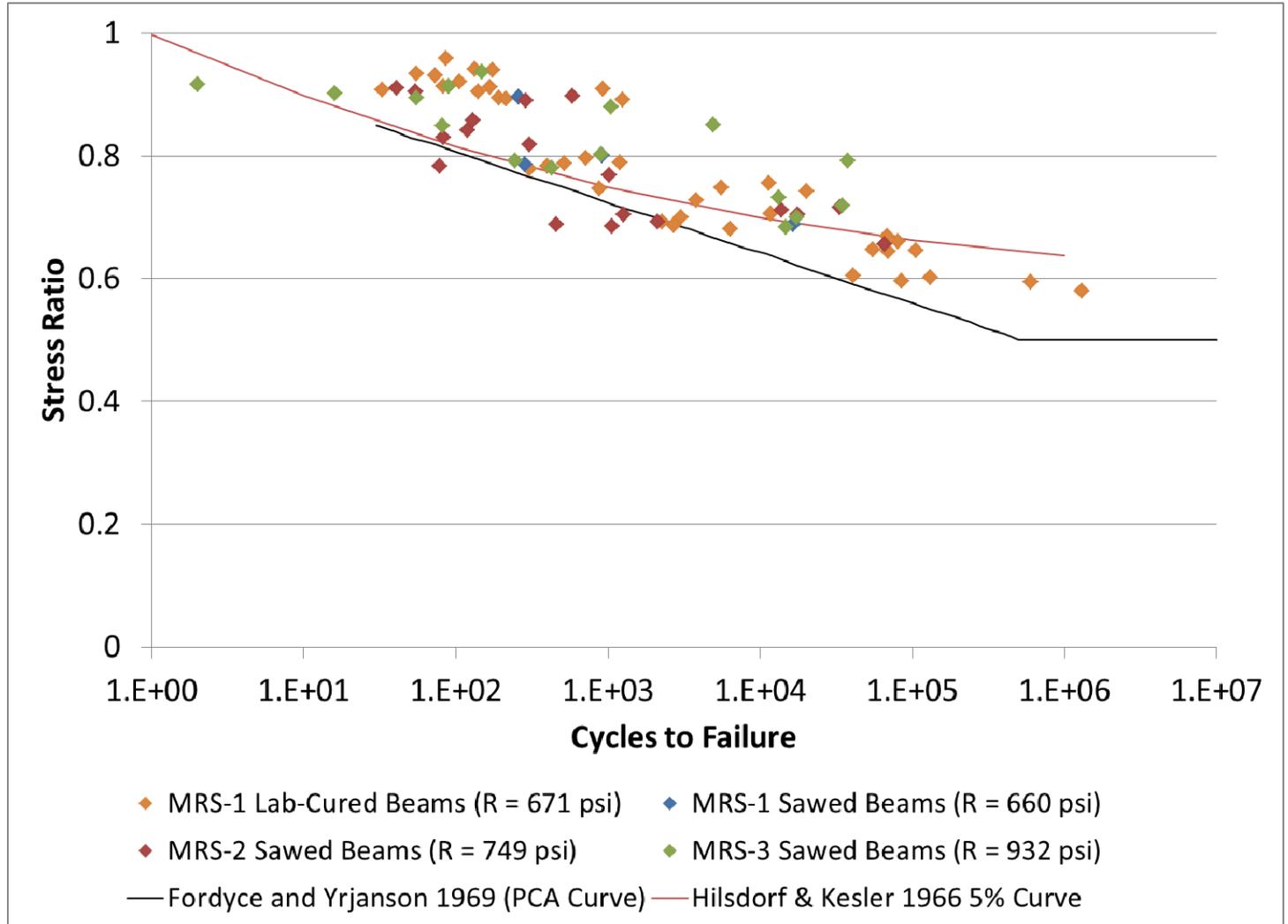
Isolation Joint Analysis

The load-induced tensile peak strain at the top of the slab for the reinforced joint (EG-47) was approximately 29% higher than the corresponding bottom strain.



Pass 15 – 8/30/2011
Wheel Load = 45 kip

Concrete Beam Fatigue Results



Post-Traffic Testing Summary

- **Tests performed since 5/12:**
 - Flexural strength and fatigue tests on field-cut beams.
 - Split tensile tests on lab-cured and field-cut cylinders.
 - Residual stress tests (MRS-2 and MRS-3) .
 - Slab strength tests (MRS-2 and MRS-3).
 - HWD and vehicle load tests (MRS-2).
 - Ultrasonic tomography tests on slabs and beams.
 - Transverse profiles.
 - PSPA.
- **Planned tests:**
 - Plate load tests.
 - CBR and post-traffic density.



CC6 Summary Results

- **CC6 performance data indicates that the current AC limitation on concrete strength (600 – 700 psi) can reasonably be relaxed.**
- **Concrete fatigue study so far has not found evidence of improved fatigue performance with lower strength. We are continuing to investigate this.**
- **Fracture tests on field cut beams @ PSU suggest a strong correlation between flexural strength and fracture energy.**
- **Based on test performance, a modification of A-1 reinforced isolation joint detail may be warranted. (i.e., add top steel.)**
- **CC6 failure data used to update FAARFIELD design model for rigid pavements.**



Questions?

