

# ADOT Roadway Friction Studies

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Pavement Management Section

11/17/2016

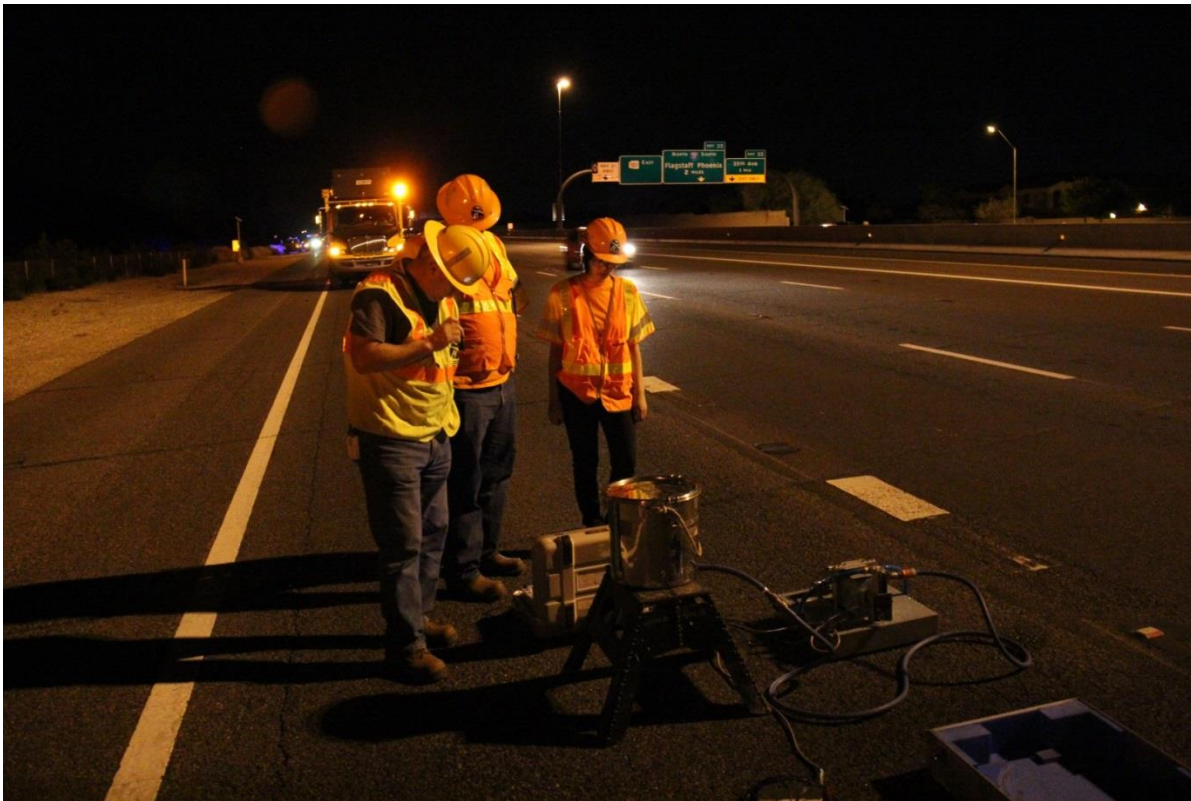


Transportation Systems Management and Operations

# ADOT Roadway Friction Studies 2014 - 2016

- **SR 195 Fog Seal Product Test (15 Products)**
  - MP 9.60 to 23.85 NB & SB
  - Full Width Test Strips
  - Strips Varied in Length from 1.46 Miles to 3.43 Miles
- **FHWA SHRP2 R26 - Preservation of High-Traffic-Volume Roadways**
  - 2 Micro Surface Projects (SR 68 & I-10)
  - 2 Crack Seal Projects (I-8 & I-10)

# Friction Testing The Hard Way – Dynamic Friction Tester (DFT)



Friction Pads

# Friction Testing The Easy Way – Highway Friction Tester (HFT) Dynatest 6875H



ASTM E1151 4.00-8 NHS Smooth  
Friction Test Tire





# Dynatest Highway Friction Tester (HFT)

## SR 195 NB Friction Test Pass



60 mph Continuous Test Mode

# Dynatest Highway Friction Tester (HFT)

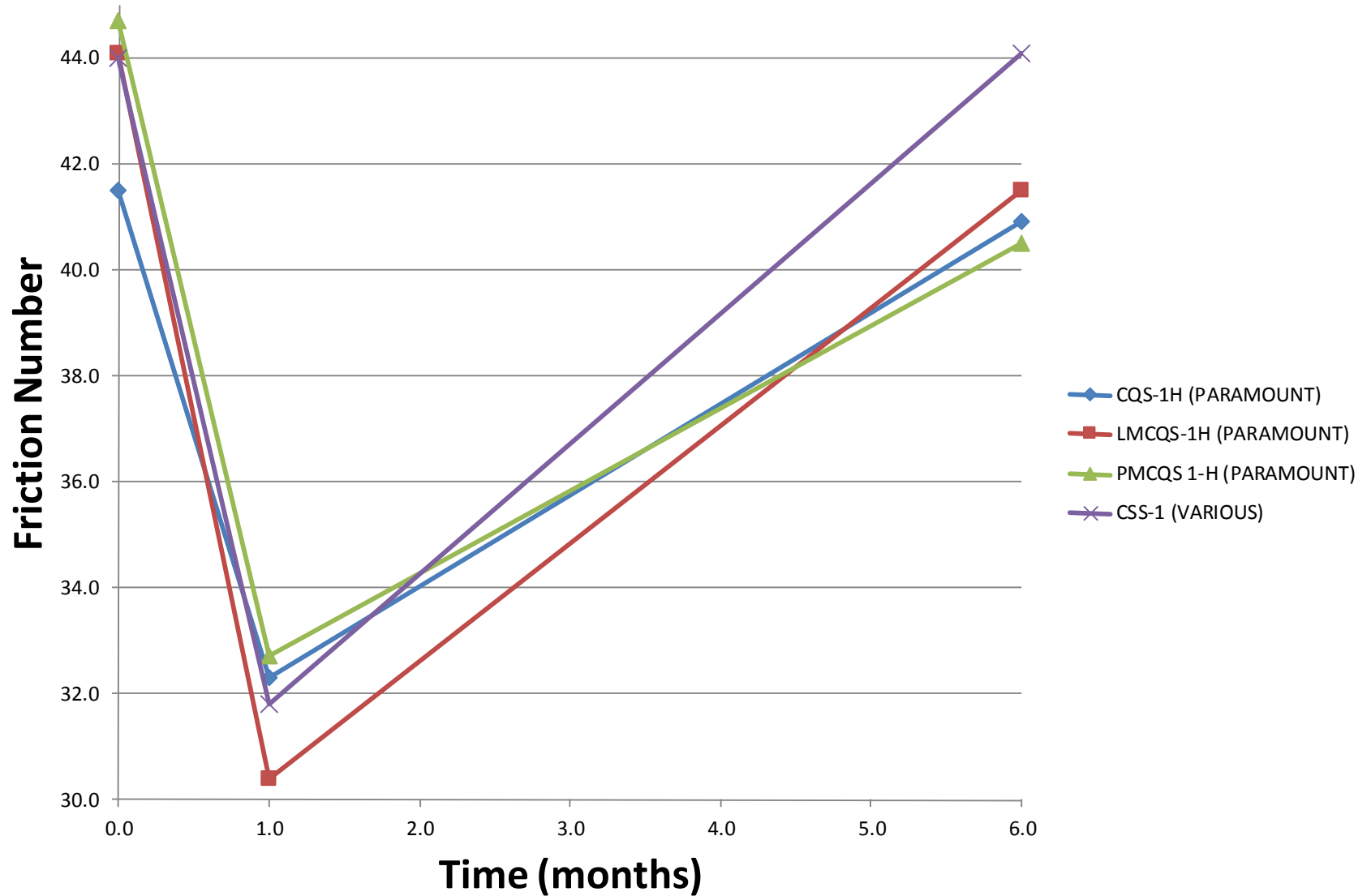
## SR 195 Friction Test Pass Cab View



# SR 195 Friction Numbers

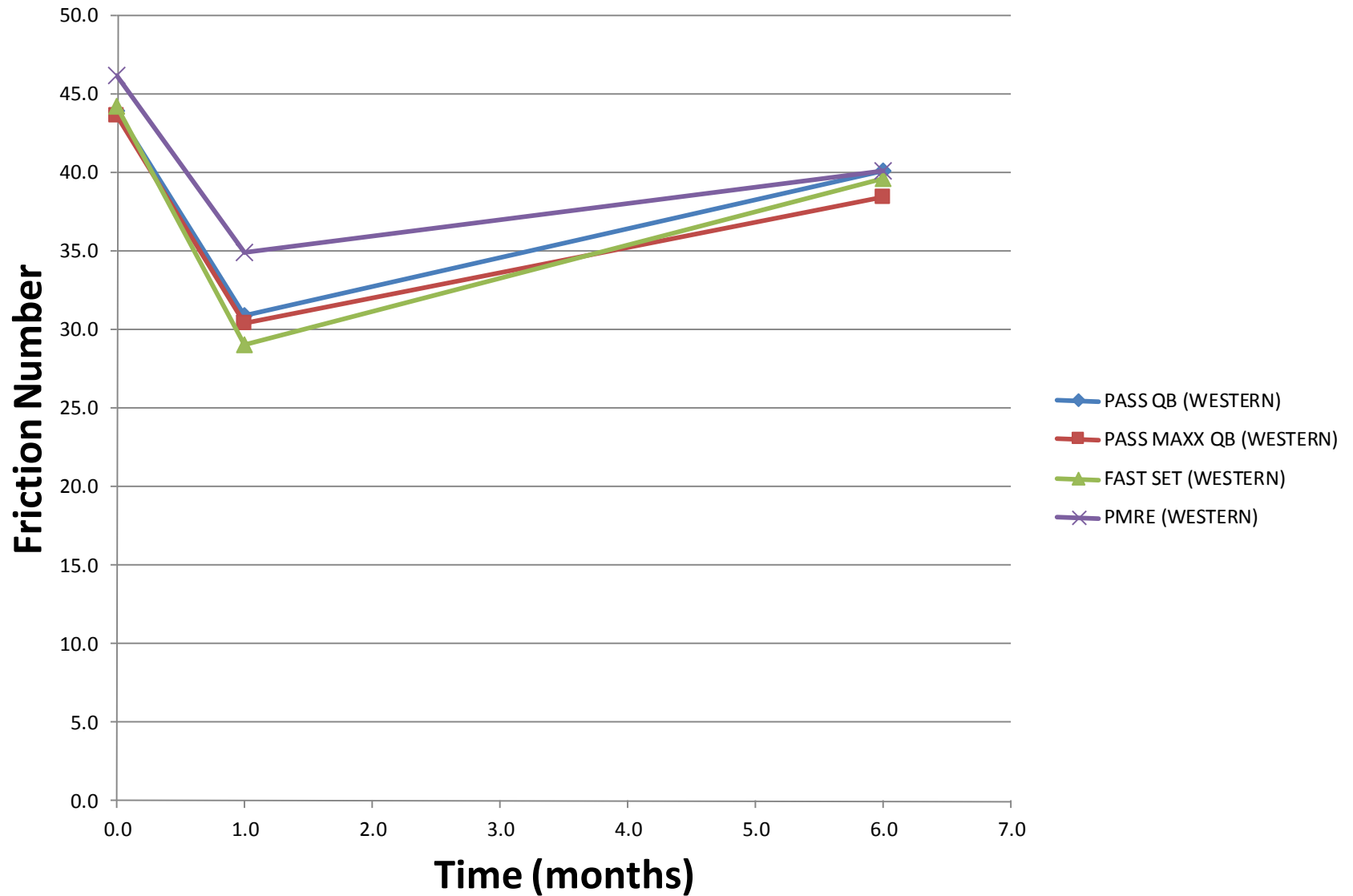
Fog Seal Product	Friction Number				
	Pre-Construction 10/1/2015	Post-Construction 11/16/2015		Post-Construction 4/13/2016	
		1 Month	$\Delta^*$	6 Months	$\Delta^*$
Light Application Rate (0.08 Gal/SY)					
CQS-1H (PARAMOUNT)	41.5	32.3	-9.2	40.9	-0.6
LMCQS-1H (PARAMOUNT)	44.1	30.4	-13.7	41.5	-2.6
PMCQS 1-H (PARAMOUNT)	44.7	32.7	-12.0	40.5	-4.2
CSS-1 (VARIOUS)	44.0	31.8	-12.2	44.1	0.1
Medium/Light Application Rate (0.10 Gal/SY)					
	Pre-Construction 10/1/2015	Post-Construction 11/16/2015		Post-Construction 4/13/2016	
		1 Month	$\Delta^*$	6 Months	$\Delta^*$
PASS QB (WESTERN)	43.9	30.9	-13.0	40.1	-3.8
PASS MAXX QB (WESTERN)	43.6	30.4	-13.2	38.4	-5.2
FAST SET (WESTERN)	44.2	29.0	-15.2	39.6	-4.6
PMRE (WESTERN)	46.2	34.9	-11.3	40.1	-6.1
*Change from Pre-Construction Value					

## Light Application Rate (0.08 Gal/SY)





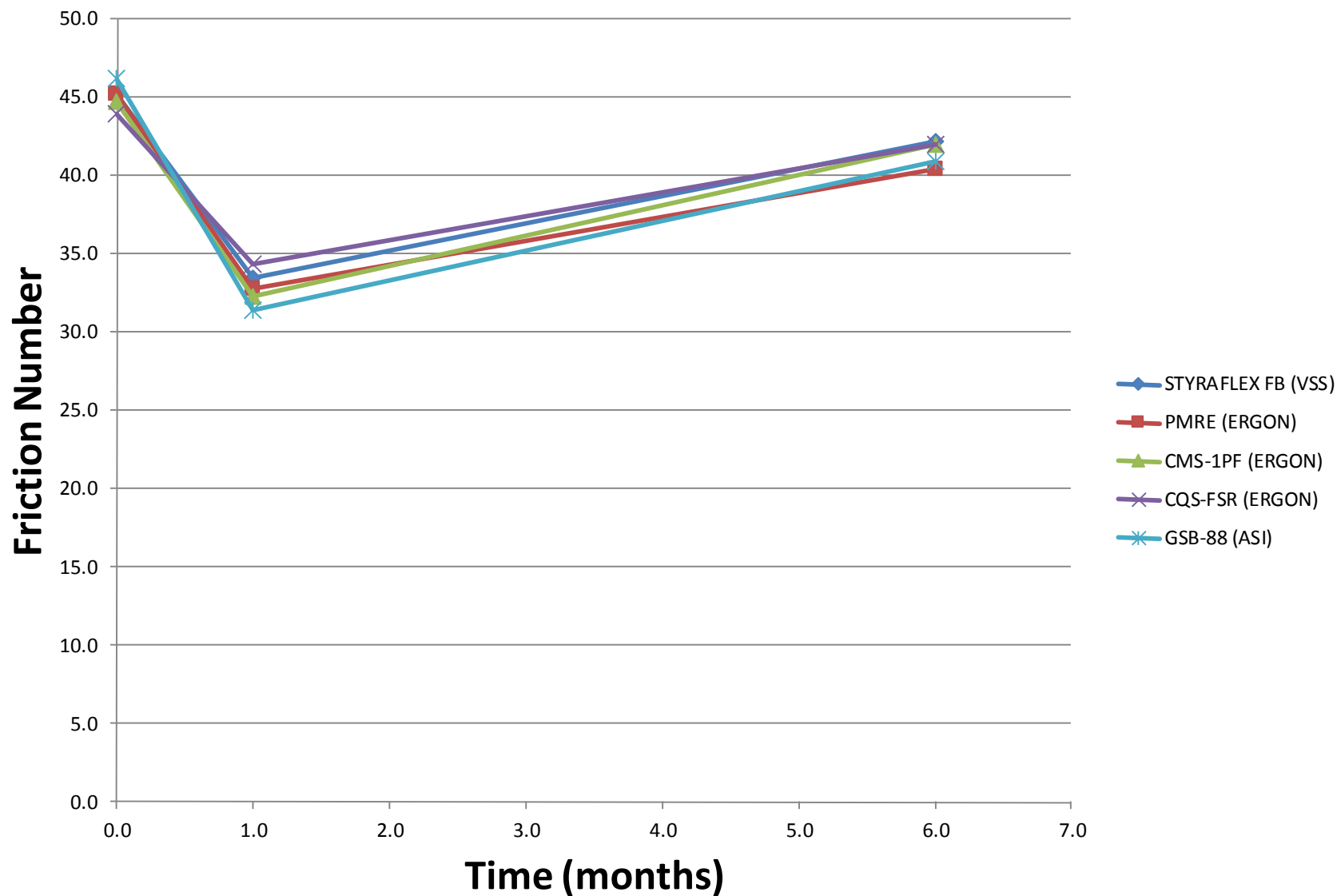
## Medium/Light Application Rate (0.10 Gal/SY)



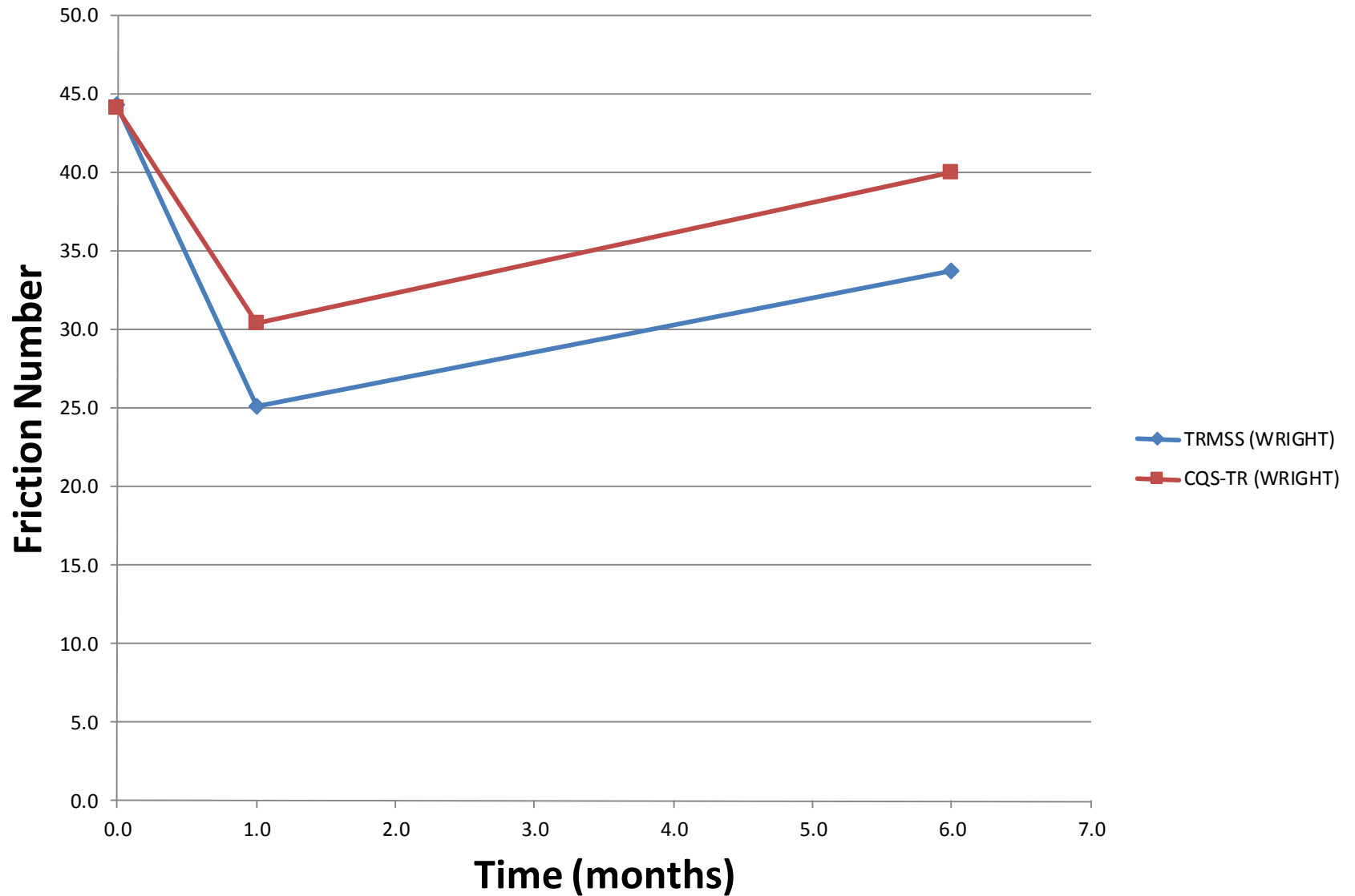
# SR 195 Friction Numbers

Medium/Heavy Application Rate (0.12 Gal/SY)	Pre-Construction 10/1/2015	Post-Construction 11/16/2015		Post-Construction 4/13/2016	
		1 Month	$\Delta^*$	6 Months	$\Delta^*$
STYRAFLEX FB (VSS)	45.2	33.4	-11.8	42.2	-3.0
PMRE (ERGON)	45.2	32.8	-12.4	40.4	-4.8
CMS-1PF (ERGON)	44.7	32.3	-12.4	42.0	-2.7
CQS-FSR (ERGON)	43.9	34.3	-9.6	42.0	-1.9
GSB-88 (ASI)	46.2	31.4	-14.8	40.9	-5.3
Heavy Application Rate (0.15 Gal/SY)	Pre-Construction 10/1/2015	Post-Construction 11/16/2015		Post-Construction 4/13/2016	
		1 Month	$\Delta^*$	6 Months	$\Delta^*$
TRMSS (WRIGHT)	44.3	25.1	-19.2	33.7	-10.6
CQS-TR (WRIGHT)	44.1	30.4	-13.7	40.0	-4.1
*Change from Pre-Construction Value					

## Medium/Heavy Application Rate (0.12 Gal/SY)



## Heavy Application Rate (0.15 Gal/SY)

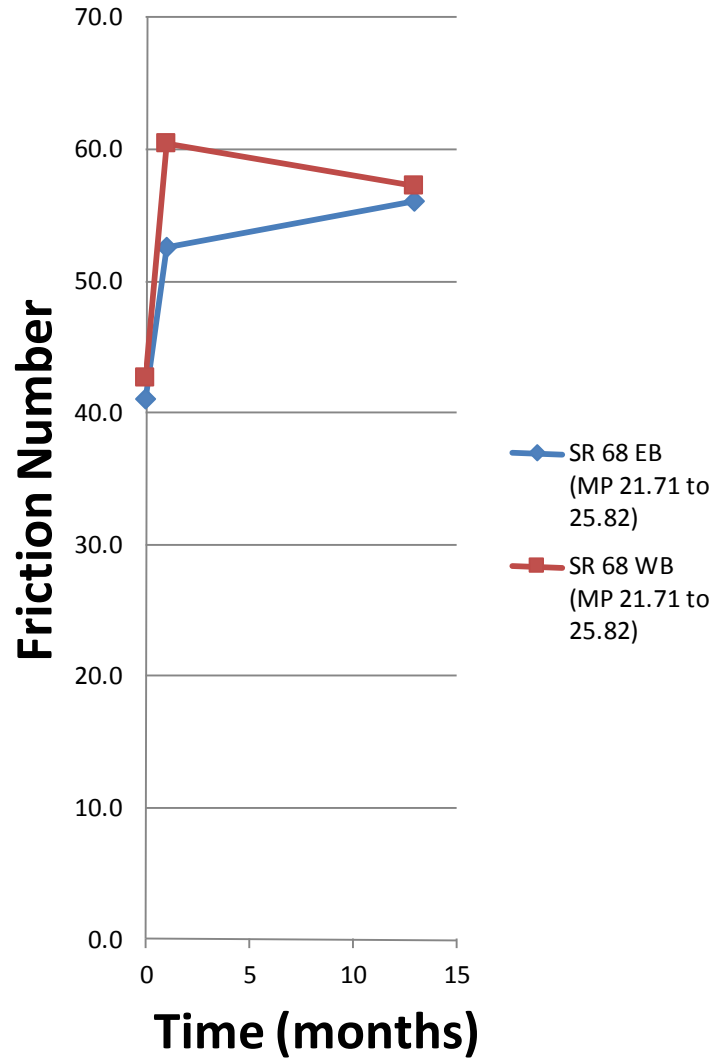


# SHRP2 R26 Projects & Chip Seal Reference Project

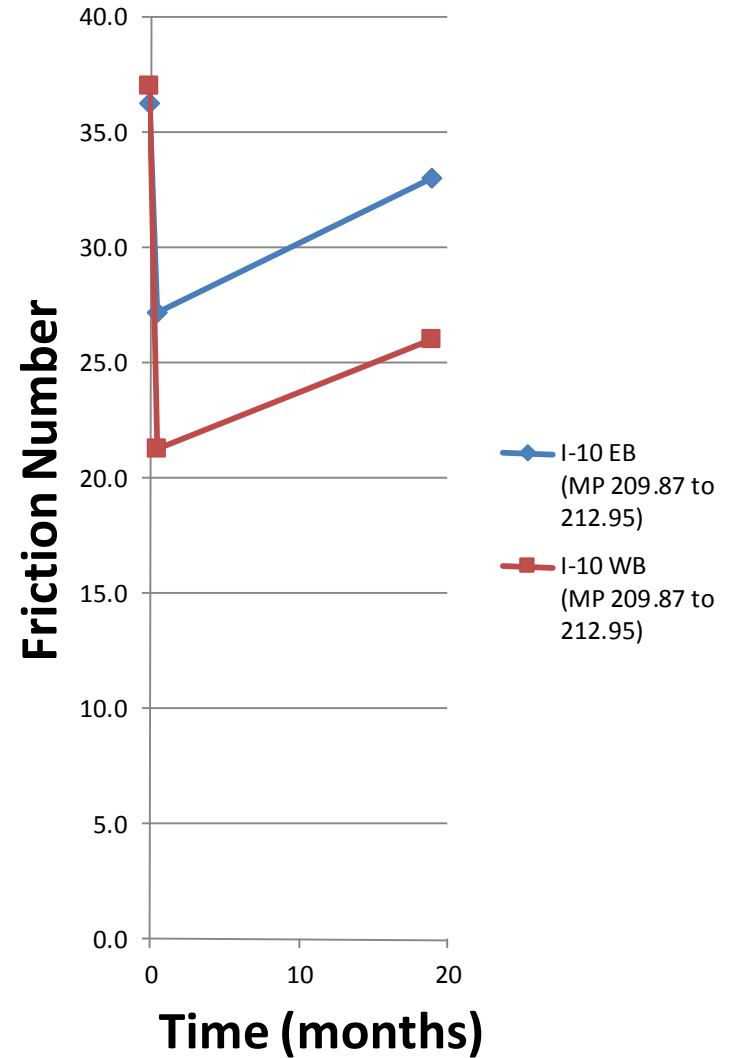
Project	Friction Values					
New Micro Surface SHRP2 R26 Project	Pre-Construction	Post-Construction		Post-Construction		Notes
		1 Month	Δ*	13 Months	Δ*	
SR 68 EB (MP 21.71 to 25.82)	41.1	52.5	11.4	56.0	14.9	N/A
SR 68 WB (MP 21.71 to 25.82)	42.7	60.4	17.7	57.3	14.6	N/A
New Micro Surface SHRP2 R26 Project	Pre-Construction	Post-Construction		Post-Construction		Notes
		2 Weeks	Δ*	19 Months	Δ*	
I-10 EB (MP 209.87 to 212.95)	36.3	27.2	-9.1	33.0	-3.3	Wheel Path Bleeding
I-10 WB (MP 209.87 to 212.95)	37.0	21.3	-15.7	26.0	-11.0	Wheel Path Bleeding
Crack Seal SHRP2 R26 Project	Post-Construction	Post-Construction		Post-Construction Fresh Fog Seal		Notes
	5-Months	8-Months		24-Months		
I-8 (MP 141.10 to 147.60)	44.0	46.0		34.0		ADOT Applied Fog Seal
Chip Seal	Pre-Construction	Post-Construction		Post-Construction		Notes
		1-Month	Δ*	13-Months	Δ*	
SR 68 EB (MP 14.00 to 21.71)	53.5	51.5	-2.0	59.6	6.1	Fog & Blotter
SR 68 WB (MP 14.00 to 21.71)	53.1	49.1	-4.0	57.6	4.5	Fog & Blotter
*Change from Pre-Construction Value						



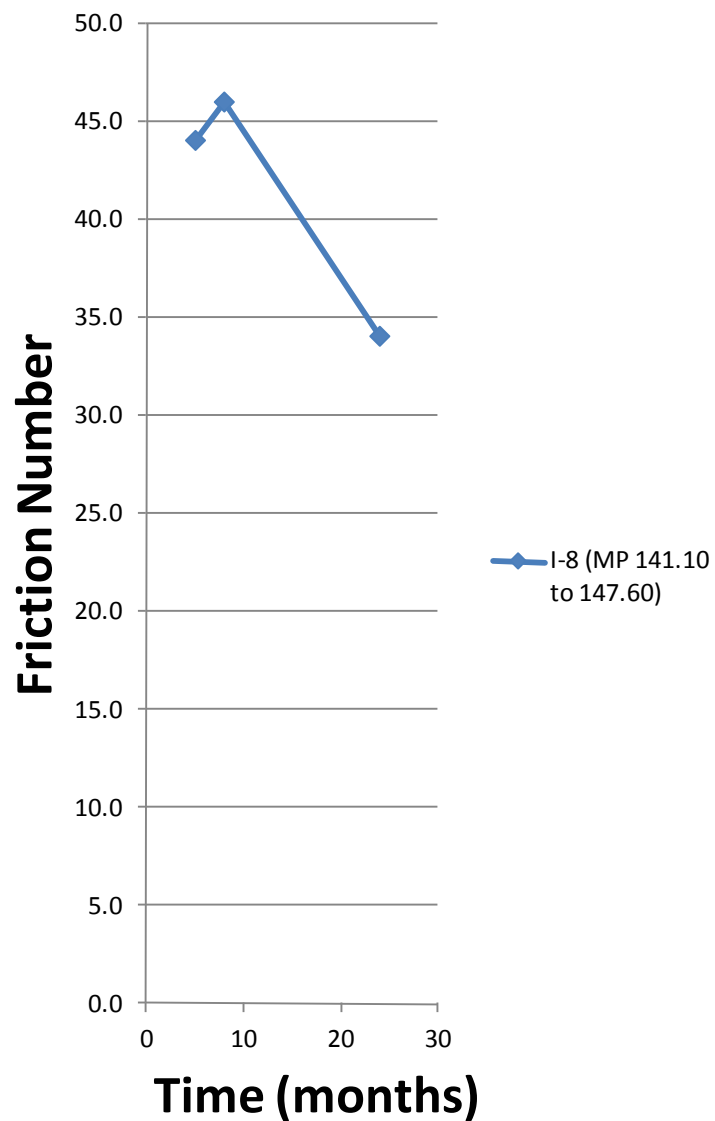
## New Micro Surface SHRP2 R26 Project



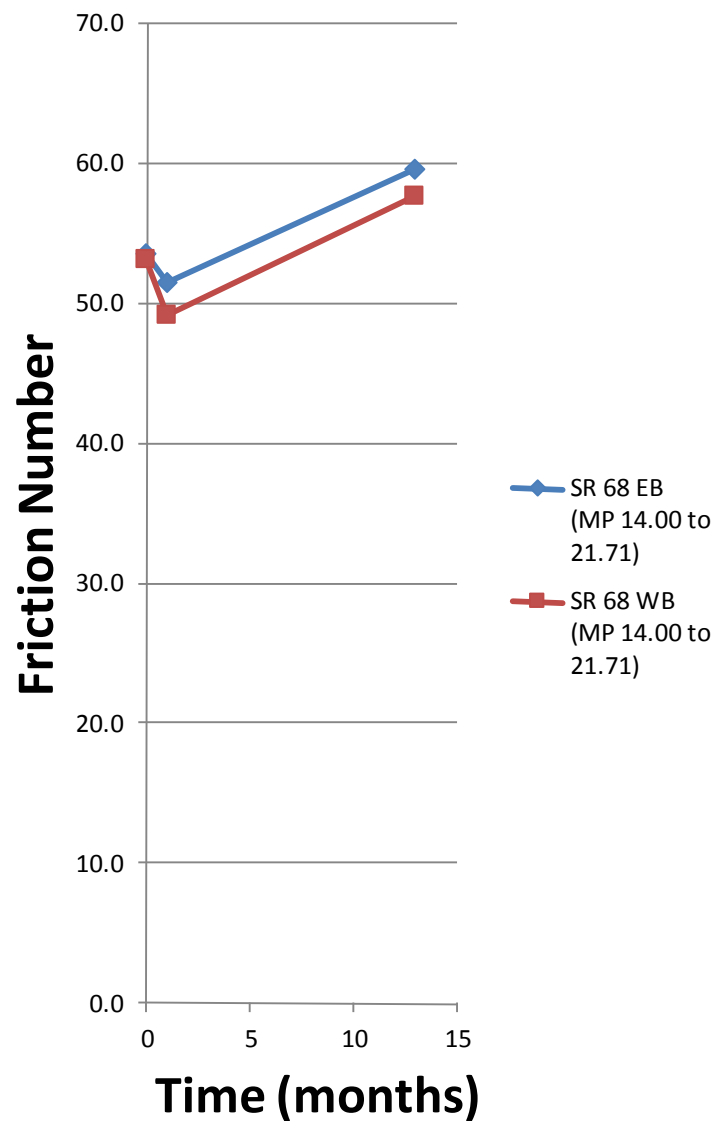
## New Micro Surface SHRP2 R26 Project



## Crack Seal SHRP2 R26 Project



## Chip Seal



# I-10 Micro Surface Wheel Path Bleeding





# I-8 Crack Seal



# Airport Friction Studies

Airport:	Buckeye Municiple Airport (AZ)	
Test Date:	WEDNESDAY 10/5/2016	
Taxiway:	16	
Offset:	None - CL of Taxiway	
Taxiway Length:	5353 ft	
Test Vehicle:	ADOT CE27 Dynatest Model 6875 Highway/Runway Friction Tester (S/N #034)	
Vehicle Test Speed:	40 mph	
Water Application Thickness:	1.00 Millimeter (0.04 inch)	
Vehicle Operator:	Shawn Harvey	
Friction Engineer:	Kevin Robertson (AZ PE 35922)	
	Friction Average (Mu)	Testing Notes: Runway Friction testing was performed in accordance with the requirements of FAA Advisory Circular 150/5320-12C
Runway Length:	0.58	
First 1/3 Segment:	0.61	
Middle 1/3 Segment:	0.58	
End 1/3 Segment:	0.56	



# What Can Decrease Available Friction?

- Cold Weather (Ice & Snow)
- Wet Weather (Rain & Hydroplaning)
- Surface Contamination (Oil, Mud, Loose Rocks, Chemicals)
- Surface Aggregate Polishing
- Fresh Standard Fog Seals, Rejuvenating Fog Seals & Excessive Wheel Path Crack Seal

## *Contributing Factors:*

- Superelevation, Curvature & Excessive Speed
- Vehicle Issues (Hard & Bald Tires, Suspension Systems)

# What Increases Available Friction?

## Surface Treatments

- Micro Surface – Type II & III (Watch for Bleeding)
- Chip Seal – 3/8" & 1/2" (Watch for Bleeding)
- Friction Courses – AC-FC & AR-ACFC
- Ultra-Thin Bonded Wearing Course - aka "NovaChip"
- Calcined Bauxite High Friction Surfacing
  - Spot Improvement
  - Hot and Cold Applied Epoxy-Resin
  - Highly Polish and Abrasion Resistant
- Surface Texturing (Shot blasting)

# Typical Friction Testing Equipment

## Dynamic Friction Tester (DFT)

- Nippo Sangyo Co., Ltd.

## Locked Wheel Skid Trailer

- Dynatest 1295 Pavement Friction Tester
- Wetted Friction Test
- Traffic Control Required

## Fixed Slip Vehicle – 14% Slip Typical

- Dynatest 6875H Highway Friction Tester Self-Contained Continuous Friction Measuring
- Performed at 40mph and 60mph. No traffic control is required.
- Roadway Wetted Friction Test (0.5mm Water Film)
- Airport Wetted Friction Test (1.0mm Water Film)

# Calibration and Maintenance



# Calibration Certification



**CALIBRATION CERTIFICATE  
6875 HIGHWAY/RUNWAY FRICTION TESTER**

**CUSTOMER:** Arizona Dept. of Transportation

**EQUIP:** Dynatest Model 6875 Highway/Runway Friction Tester S/N # 034

**PURCHASE ORDER NO.:** ADO116-131955

**JOB NUMBER:** 004A16

**CALIBRATION DATE:** June 22<sup>nd</sup>, 2016

**CALIBRATION RESULTS:**

Transducer No.	=	027
Wheel Load	=	320
Load Cal	=	350
Trac Cal	=	425p
Distance Cal	=	1.00637

Calibration Certification is performed at a working ambient temperature that is stable within  $\pm 10$  degrees Fahrenheit.

This Calibration Certification was performed in accordance with prescribed Dynatest Consulting standard operating procedures.

  
Paul R. Campbell Calibration Technician

**Issued:** June 29<sup>th</sup>, 2016

**Limitation of Use:** Maximum Traction & Load Force not to exceed 2000 lbs.

**Maintenance /Repairs Required:** Re-Calibration recommended after one (1) year.

This certificate of calibration shall not be reproduced, except in full, without the express written approval of Dynatest Consulting, Inc.



# Friction Testing Support Equipment & Supplies



Support Truck With Variable Message Board  
& 550 Gallon Tank Trailer



Test Tire  
Pressure Gauge



FIG A



FIG B

Spare ASTM Certified Friction Test Tires  
Figure A – Ribbed Test Tire (Optional)  
Figure B – Smooth Test Tire (Used by ADOT)



Test Tire  
Air Pump

Questions?