

# Quantifying Laboratory–Field Relationships for Asphalt Pavement Friction and Texture Deterioration

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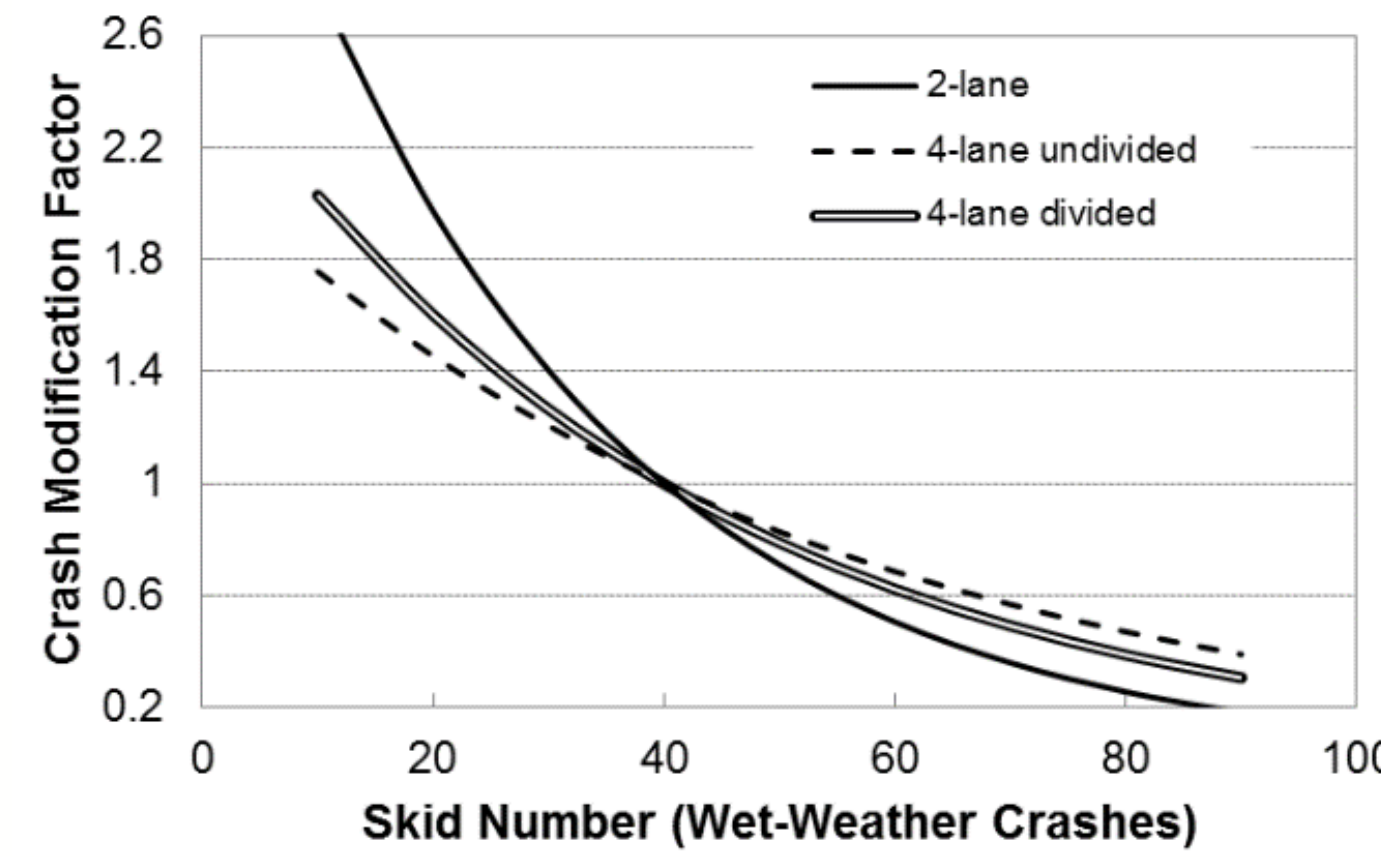


## INTRODUCTION

### Background

Pavement skid resistance is important:

- Wet two-lane crashes double as SN drops from 40 to 20.
- Approximately 860,286 crashes happen annually on wet pavement (21% of all crashes).



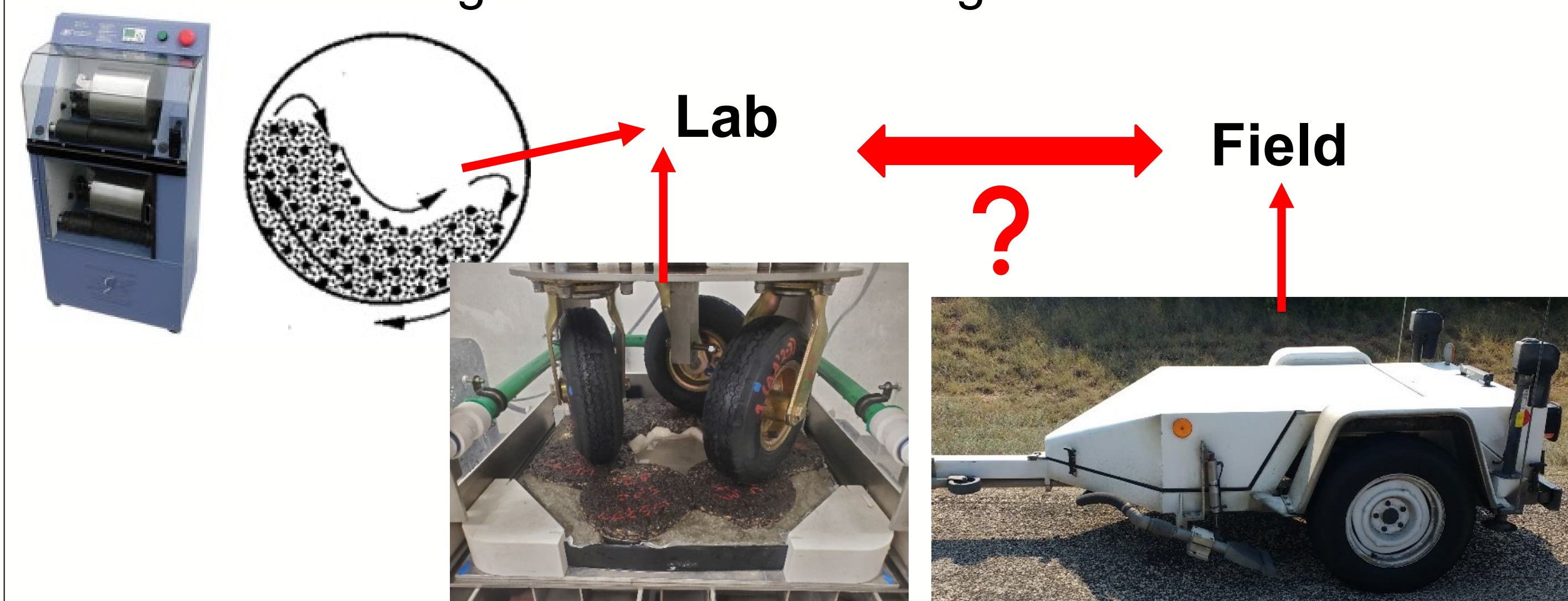
Traditional TxDOT practice: SAC A coarse aggregates are commonly selected for surface layers in high-demand areas to ensure long-term SN.

- Limitation 1:** Selection does not explicitly consider final surface friction and texture.
- Limitation 2:** Changes in skid resistance due to traffic polishing are not accounted for.
- Limitation 3:** SAC A classification is based on the acid insolubility test, rather than direct SN measurements.

### Problem Statement

Understanding long-term pavement SN deterioration:

- Laboratory:** Micro-Deval or three-wheel polisher is used to polish aggregate or mixture specimens.
- Field:** Locked-wheel skid trailer and other devices are used for long-term field monitoring.

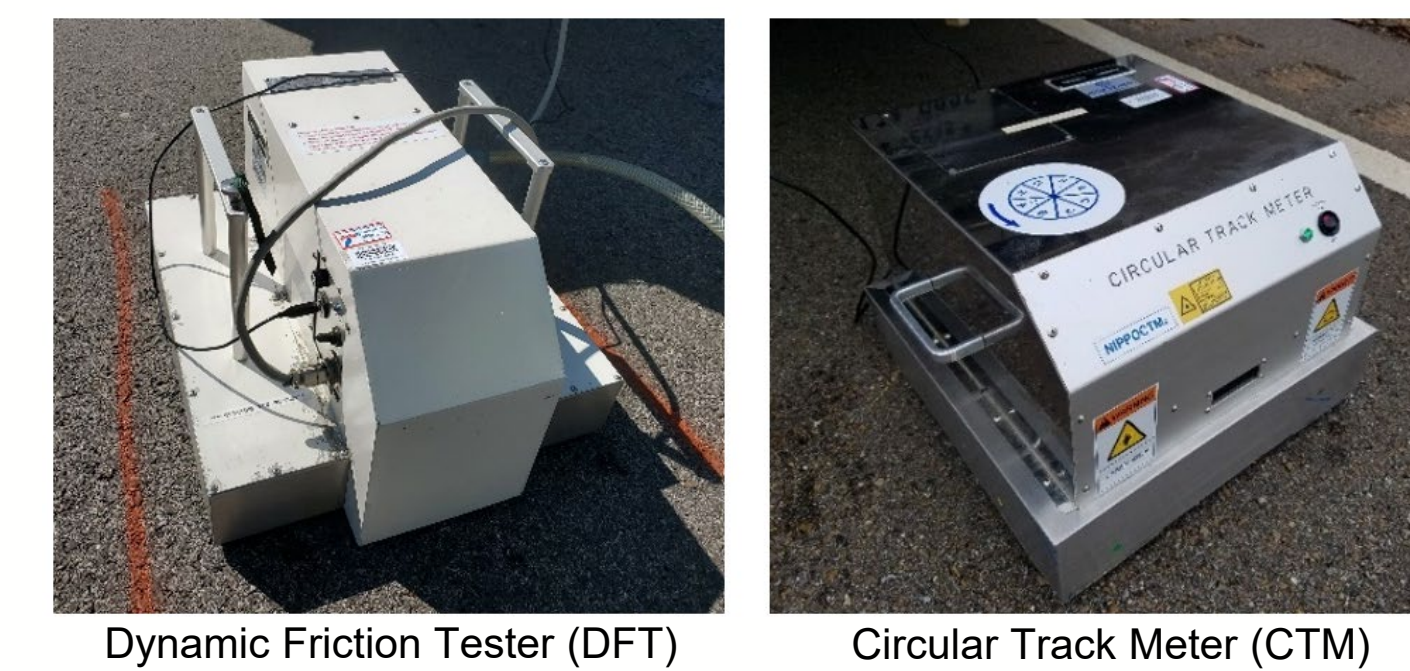
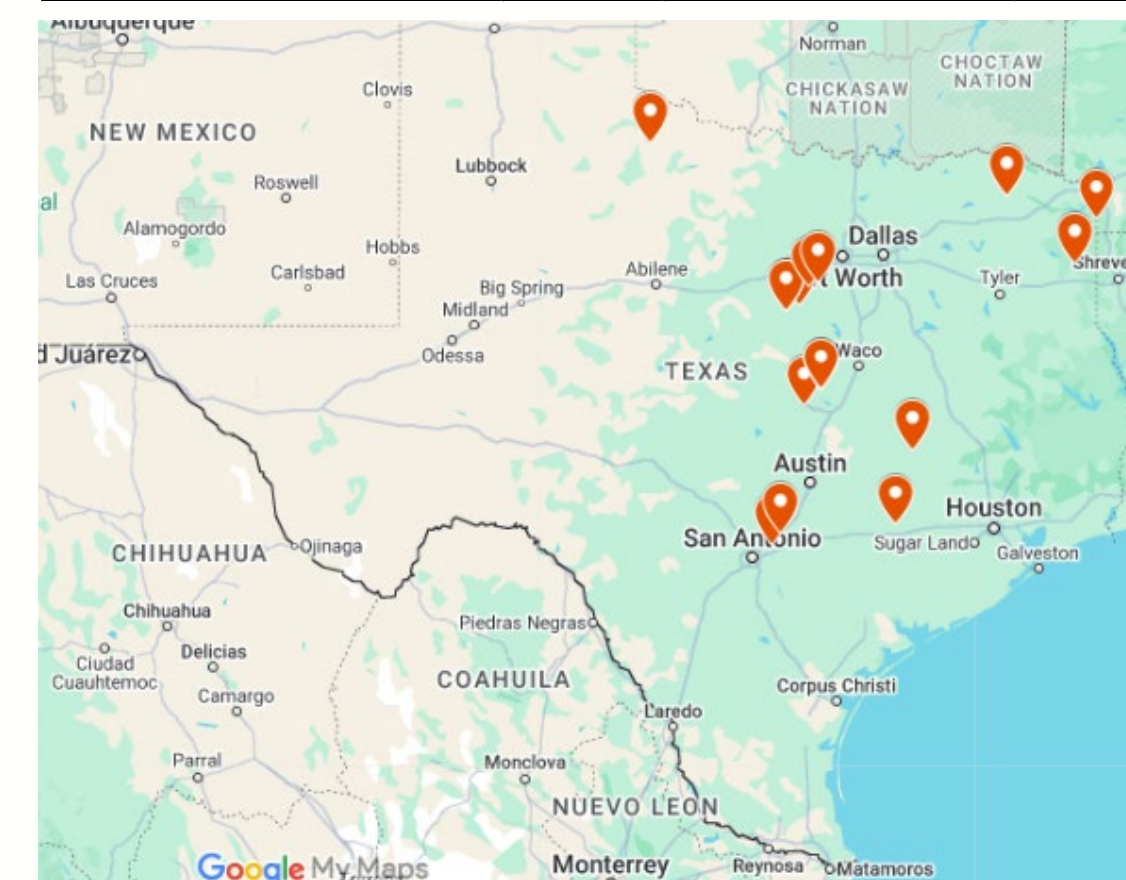


- Research gap:** There is limited understanding of how lab polishing intensity relates to actual traffic loading.

## METHODS

### Field Sites & Testing

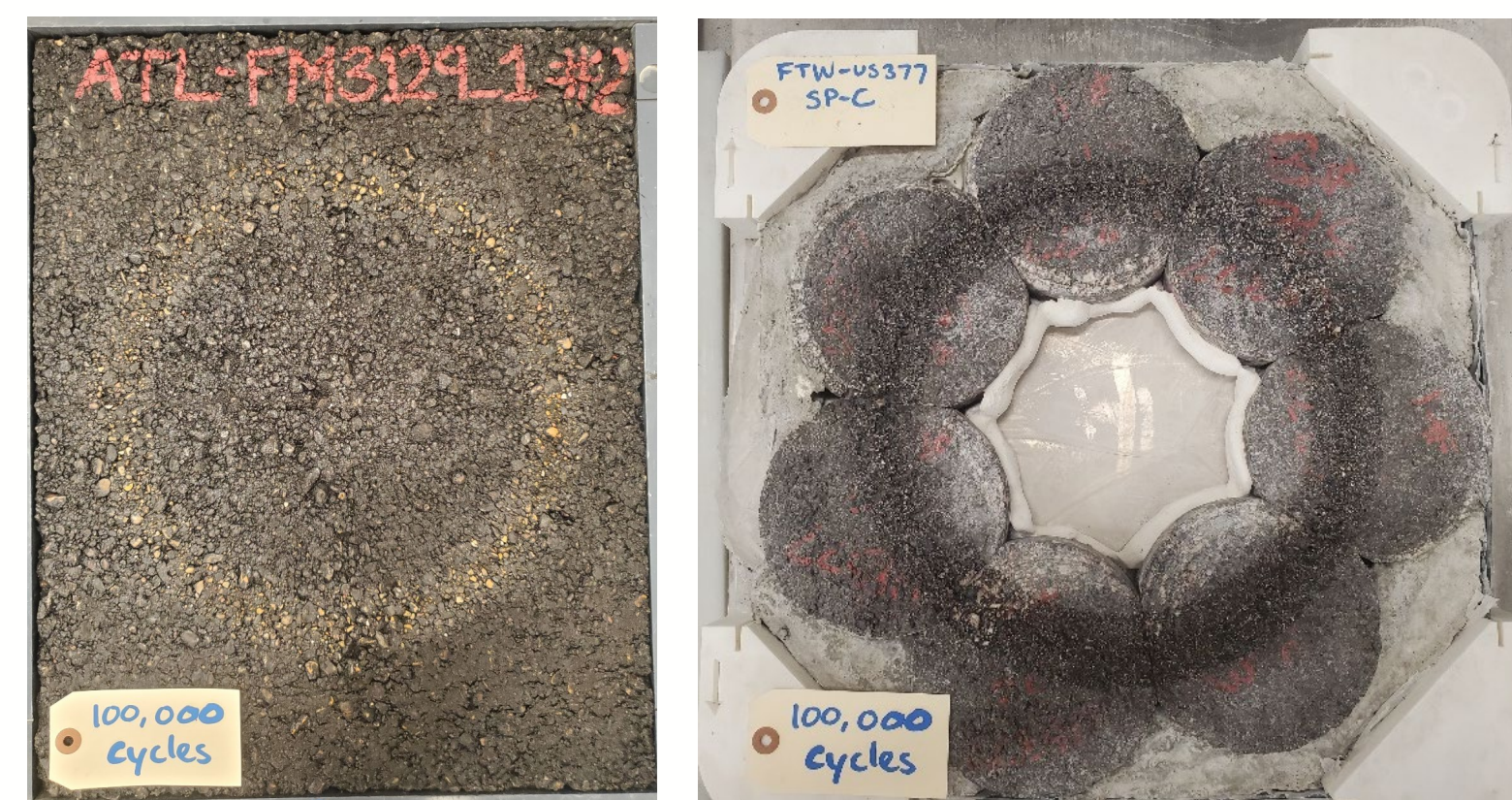
Section Name	Const. Year	Surface			Traffic				
		Type	SAC	AAADT	Truck %	# Lanes One Dir	Urban/ Rural	Divided/ Undiv.	AAADT/ Lane
Site 1-SP D	2019	SP TyD	A	949	38.3	2	Rural	Divided/ U	475
Site 2-SP C	2023	SP TyC	A	39,624	4	4	Urban	D	13,868
Site 3-TOM	2020	TOM-C	A	3,758	12.4	2	Rural	U	1,879
Site 4-TOM	2017	TOM TyC	A/B	24,164	7	4	Rural	D	9,666
Site 5-SP C	2022	SP-C	A	183	24	2	Rural	U	92
Site 7-SP C	2021	SP-C	A/B	3,232	13.4	2	Rural	U	1,616
Site 9-SP C	2020	SP TyC	A/B	28,615	3.8	4	Urban	D	10,015
Site 10-DG D	2021	DG TyD	A	2,197	27.9	2	Rural	U	1,099
Site 11-SP D	2020	SP TyD	B	18,927	3.8	4	Urban	U	5,678
Site 12-SP C, Fine	2021	SP TyC, Fine	A	2,197	27.9	2	Rural	U	1,099
Site 13-TOM	2020	TOM TyC	A	13,740	18.1	4	Rural	D	5,496
Site 14-DG D	2021	DG TyD	A/B	513	39.9	2	Rural	U	257
Site 15-SMA	2023	SMA TyD	A/B	74,917	4.2	6	Urban	D	14,983
Site 16-SMA	2020	SMA TyD	A	11,233	37.7	4	Rural	D	4,493
Site 17-SP C	2020	SP TyC	A	11,233	37.7	4	Rural	D	4,493
Site 18-SC Gr4	2023	SC Gr4	A	8,494	5.7	4	Rural	D	3,398
Site 19-SP C, Coarse	2021	SP TyC, Coarse	A	2,197	27.9	2	Rural	U	1,099
Site 20-SC Gr3	2023	SC Gr3	A	123	21.1	2	Rural	U	62
Site 21-SC Gr4	2023	SC Gr4	A	269	10.4	2	Rural	U	135
Site 22-SP D	2020	SP TyD	B	13,740	18.1	4	Rural	D	5,496



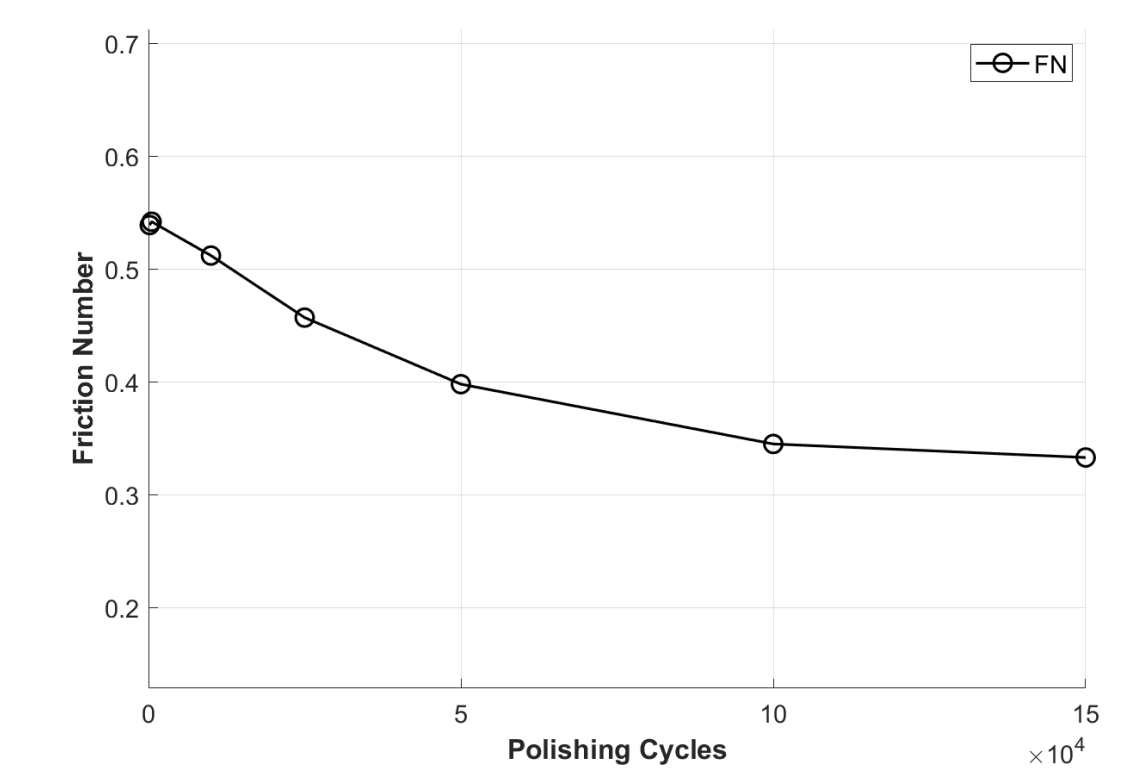
Covered 22 sites with diverse aggregates types and traffic levels via performing multiple DFT and CTM tests to monitor changes in friction/texture throughout the project.

### Laboratory Testing

- Mixture level:** Slabs or core-ring samples were polished via three-wheel polisher for DFT and CTM testing.

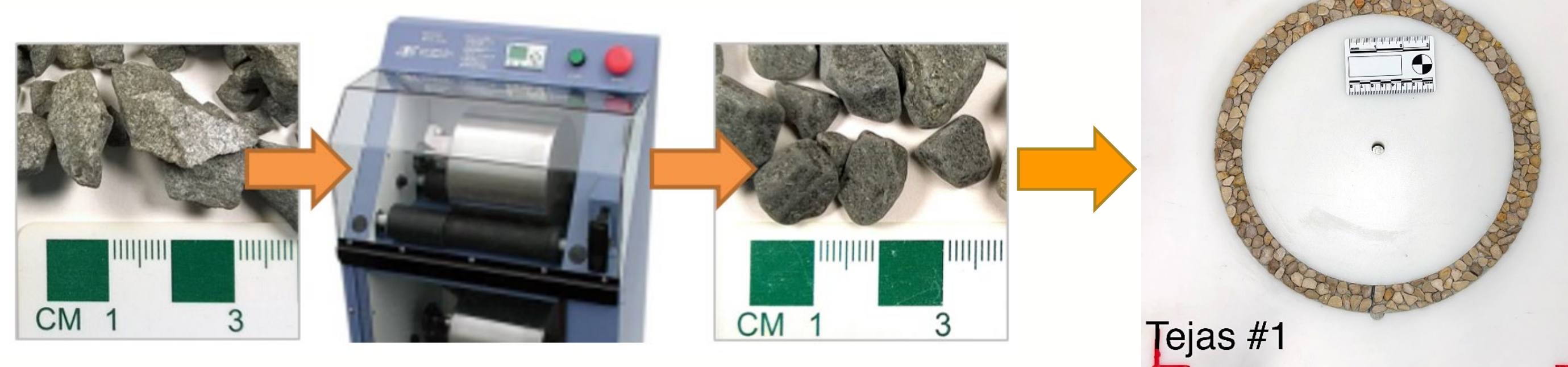


Example of Polished Slab and Core-Ring Sample



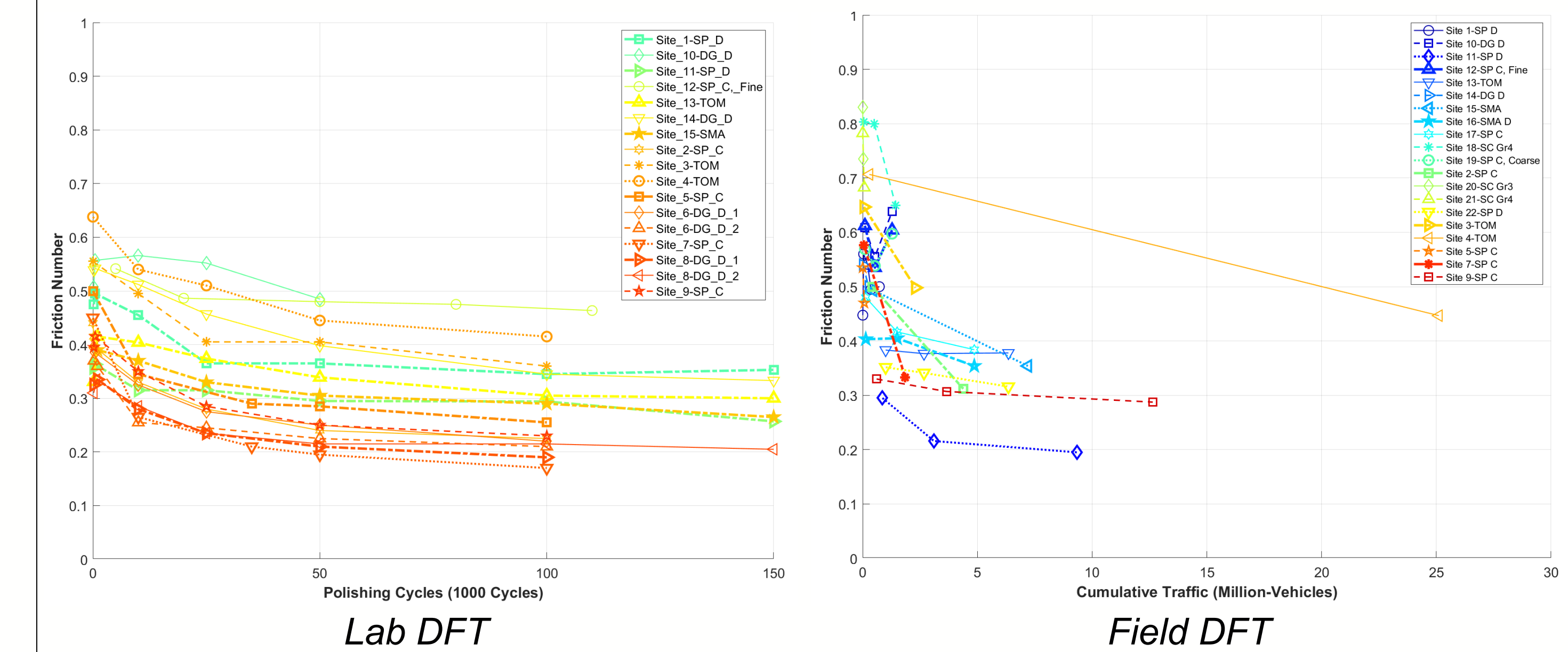
Example Lab DFT Data

- Aggregate level:** Dynamic friction value (DFV) was tested from aggregate ring via aggregates before and after micro-Deval polishing.

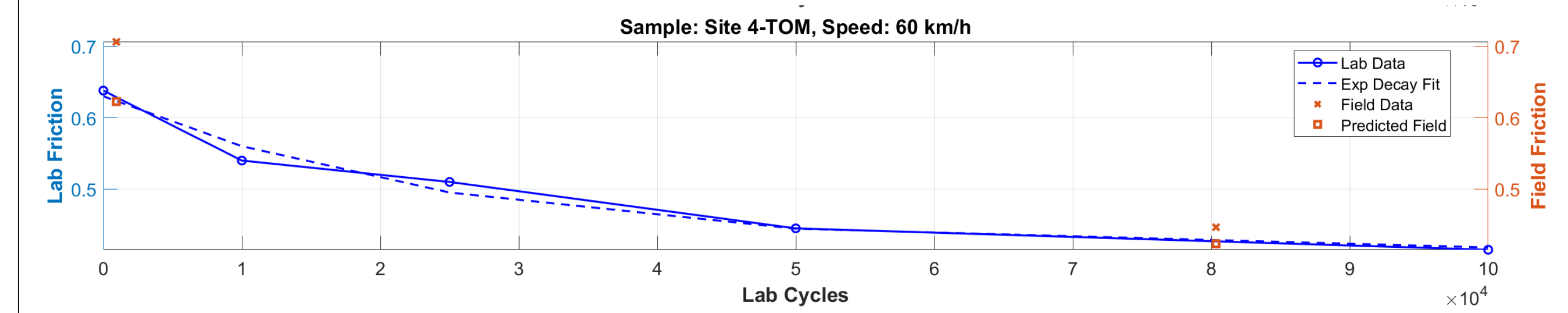


## RESULTS & CONCLUSIONS

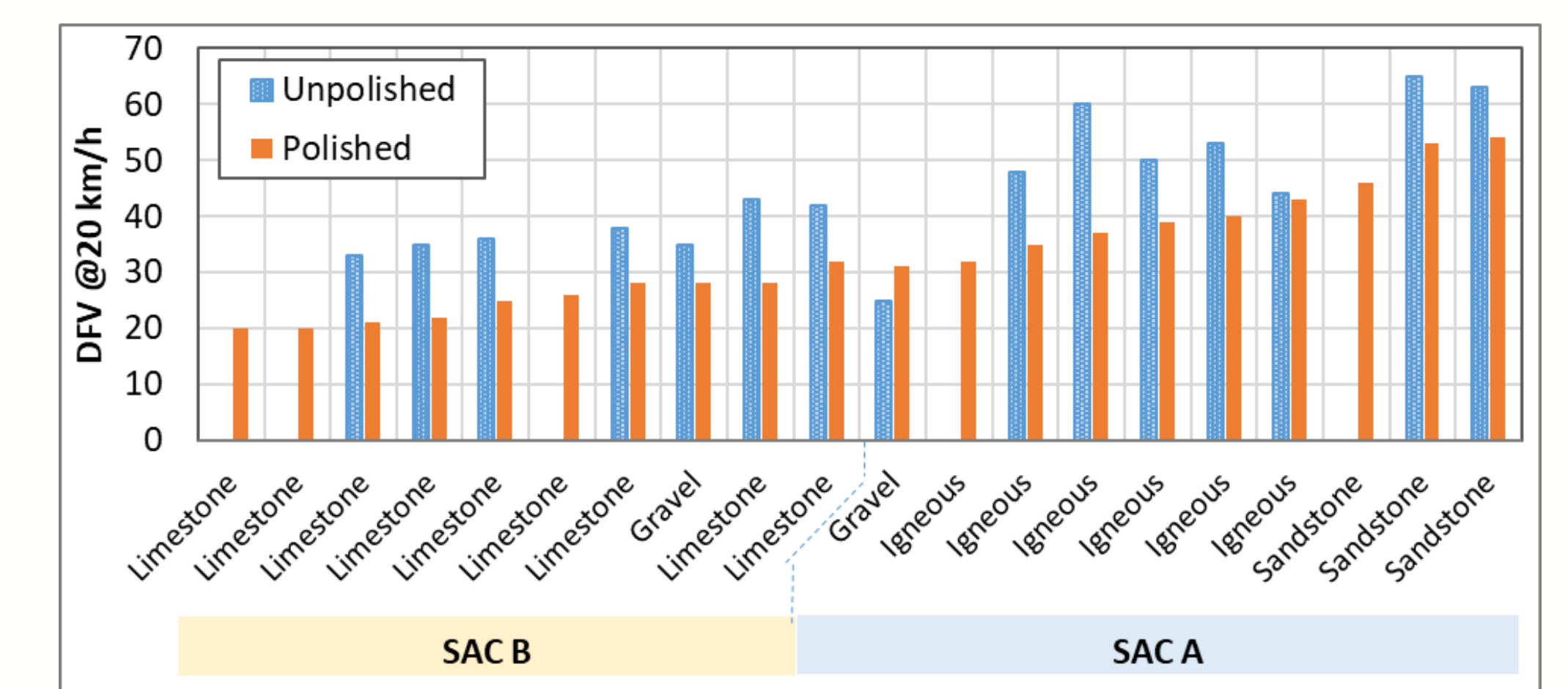
Noticeable difference between lab and field friction and texture data



- Assuming  $T_{DL} = 312.5 \times N$  showed good fit when relating lab to field friction data on some sites.



- A strong field–lab correlation ( $R^2 = 0.74$ ) was achieved using three-wheel polisher results adjusted for equivalent cumulative traffic.
- Linking lab and field MPD remains challenging.
- SAC classification does not fully capture differences in friction performance across aggregate sources.



- Aggregate ring DFV (No. 8 retained) showed stronger correlations with field ( $R^2 = 0.70$ ) and lab friction ( $R^2 = 0.56$ ) than SAC A percentage criteria ( $R^2 < 0.40$ ).

Explanatory Variable	Ret. No.	Field Friction, $\mu$ @ 60 km/h			Lab Friction, $\mu$ @ 60 km/h		
		N	R2	RMSE	N	R2	RMSE
Mixture DFV, Before and After Polishing	Ret. No. 4	15	0.67	40.0	22	0.49	40.4
	Ret. No. 8	15	0.70	38.0	22	0.56	38.6
% SAC A	Ret. No. 4	9	0.28	57.1	15	0.10	69.5
	Ret. No. 8	9	0.39	49.9	15	0.18	63.9