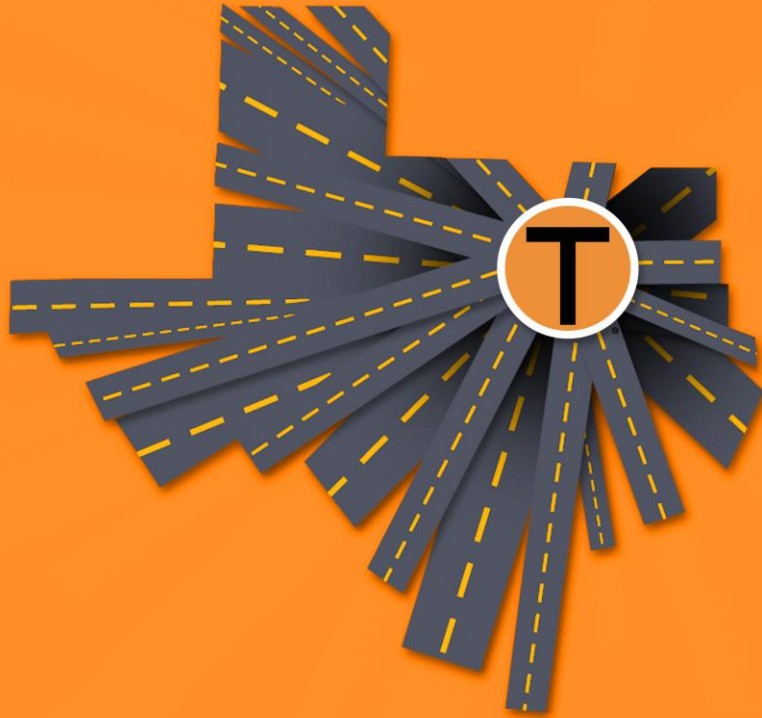




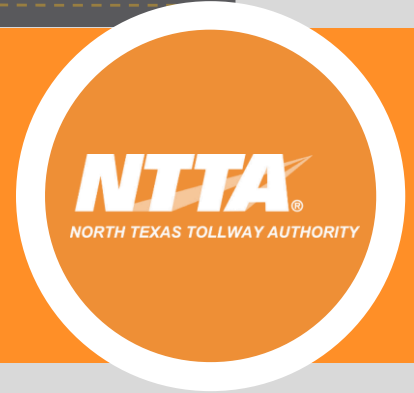
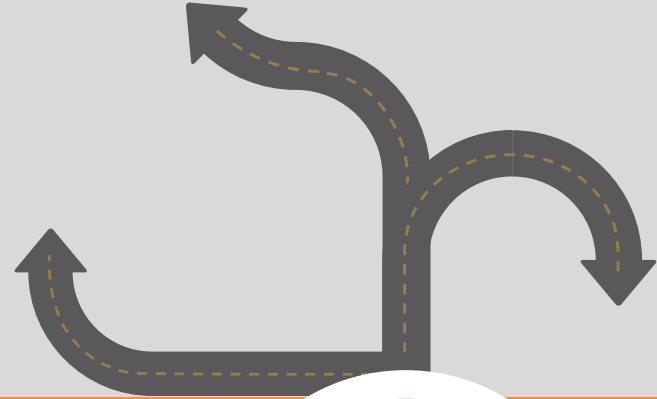
Data Driven Safety Improvement –

A Case Study of Wet Surface Crash Reduction on DNT

Yang Ouyang, P.E., PTOE, RSP2I
Sr Traffic Engineering Manager

October 23, 2026

KEEP TRAFFIC MOVING
SAFELY AND EFFICIENTLY



Introduction

The NTTA Traffic Safety Management Program

- Backgrounds
- Ongoing efforts

Wet Surface Related Crashes on the NTTA System

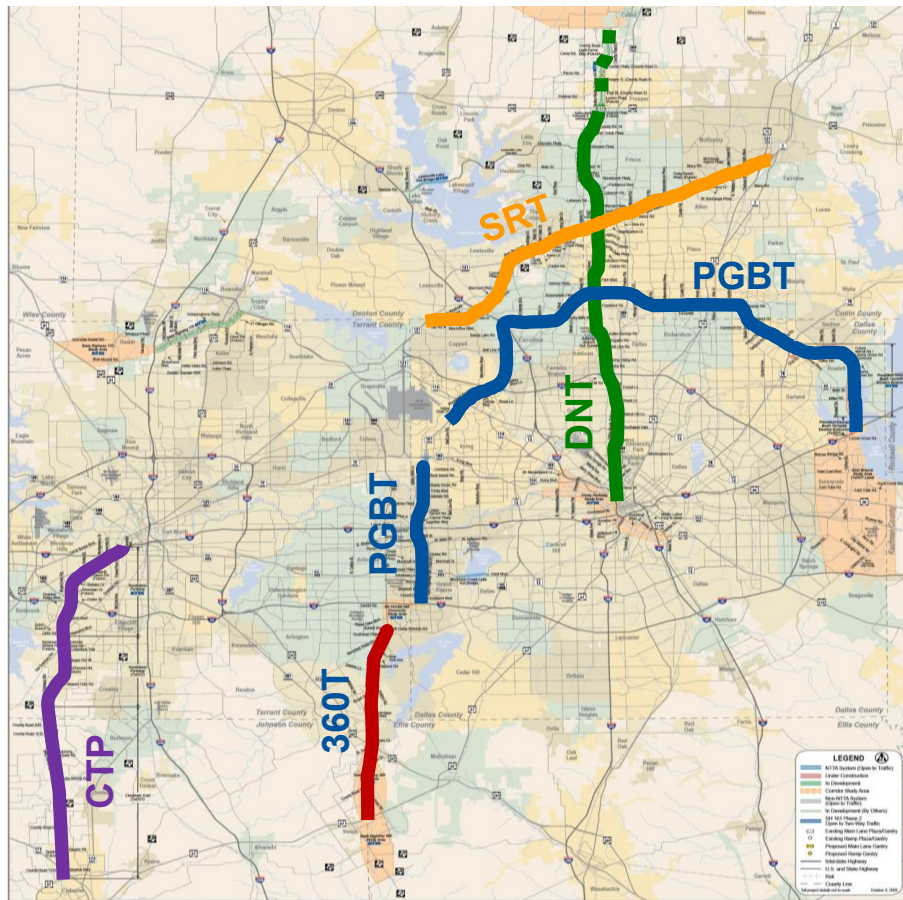
- Patterns and Relevant Factors
- Mitigation Measures

Summary of Findings

NTTA Toll Road System

Key Features:

- High-speed toll roads to major destinations
- Expanding throughout Dallas / Ft Worth metro
- All Electronic Toll Collection (ETC) – cashless operation



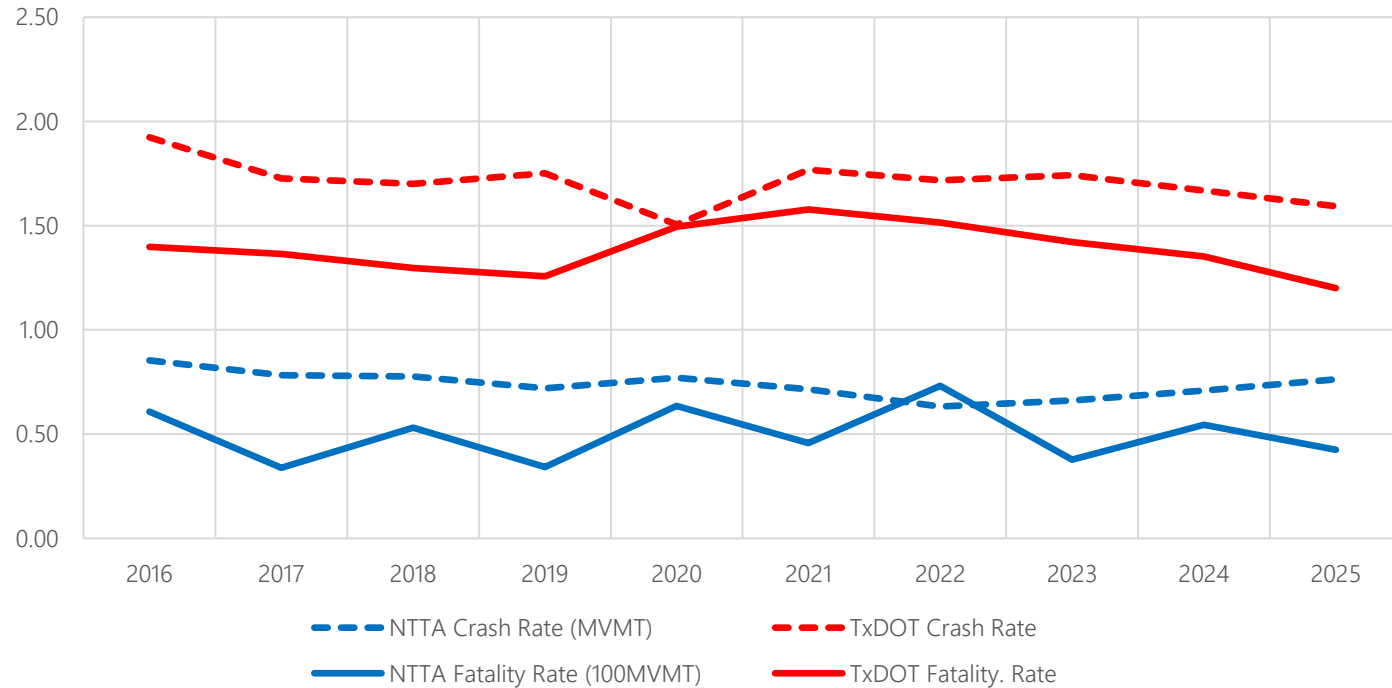
NTTA System Map

NTTA Traffic Safety Management Program

- Data Driven and Proactive
- Three-pronged approach
 - Engineering
 - Enforcement
 - Education
- Technologies and Innovations
 - Infrastructure Readiness
 - Risk Assessment
- Process Adjustment

Crash Rates on NTTA System

NTTA vs TxDOT Crash Rates Comparison



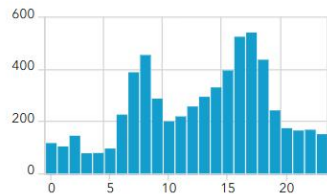
Crash Dashboard on NTTA System

CRIS Crashes

Year
No category selected

Roadway
No category selected

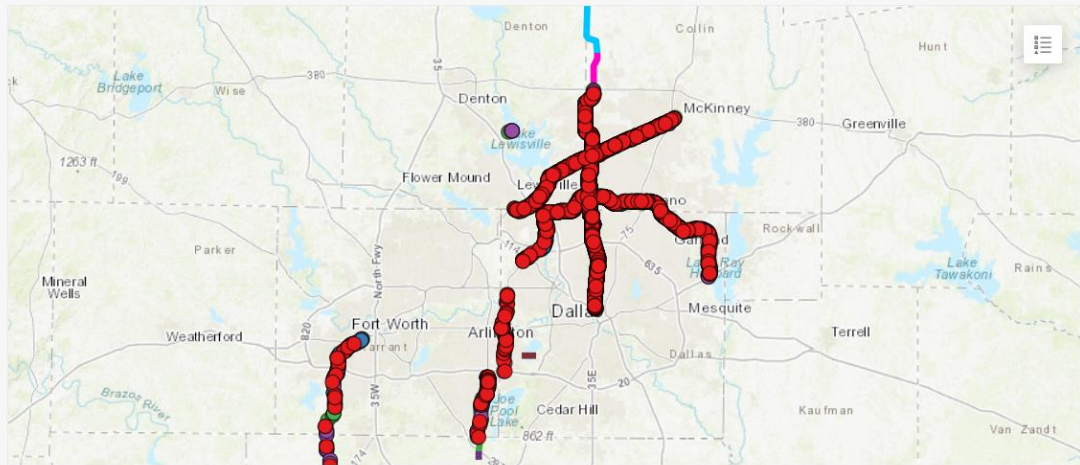
1,139
3,607



Day of Week Time of Day

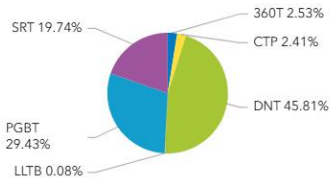
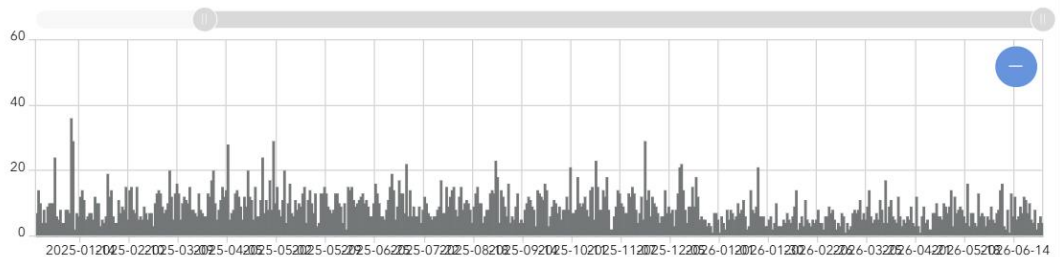


Month Year

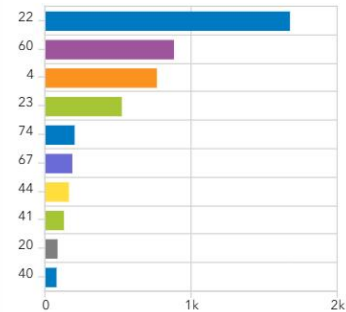


Esri | HERE | Garmin | FAO | USGS | NGA | EPA | NPS

Powered by Esri

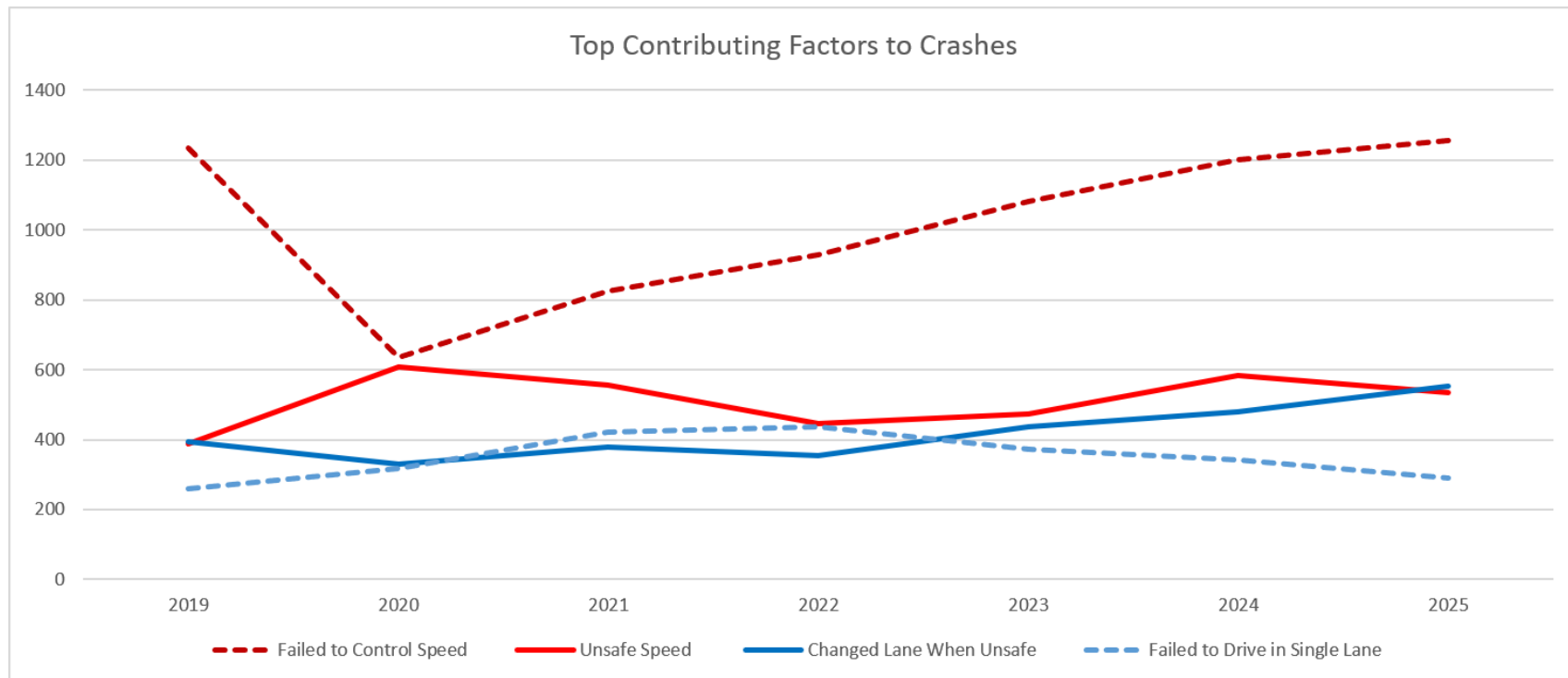


Pie chart Work Zone Severity

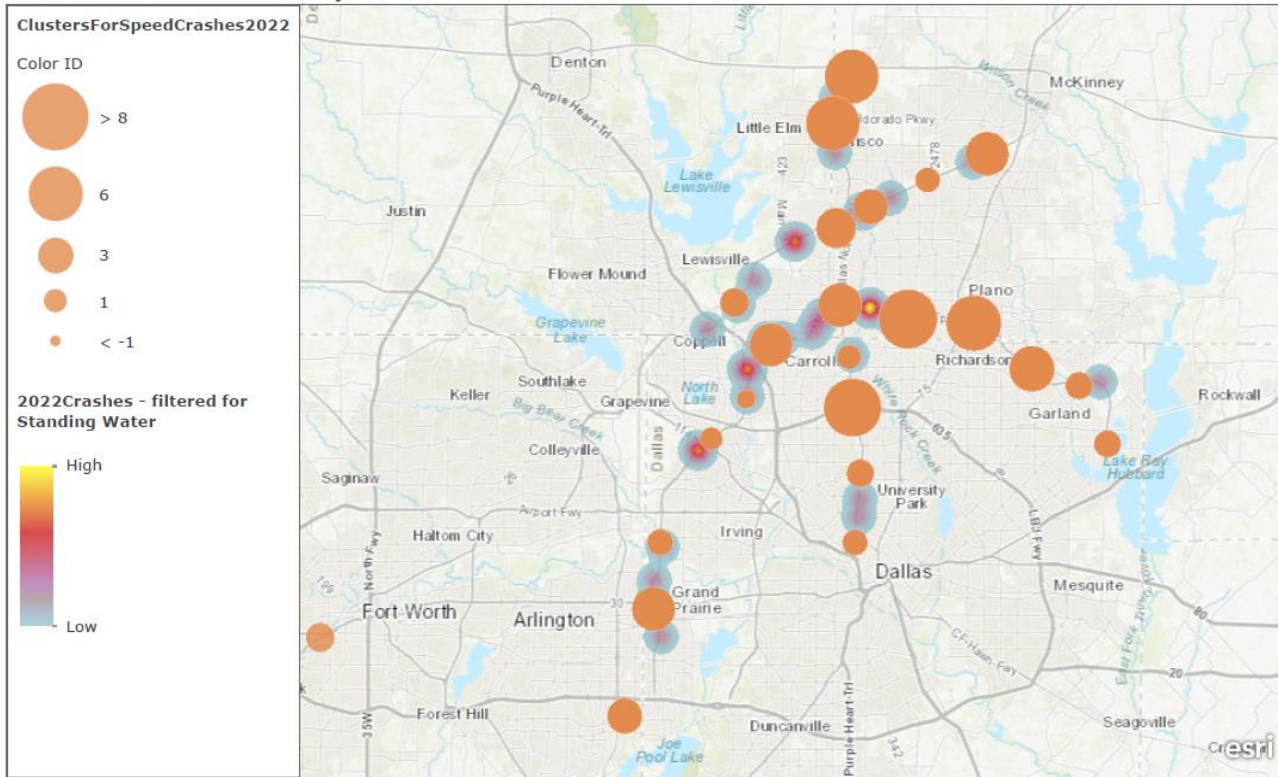


Contributing Factor Weather Cc < >

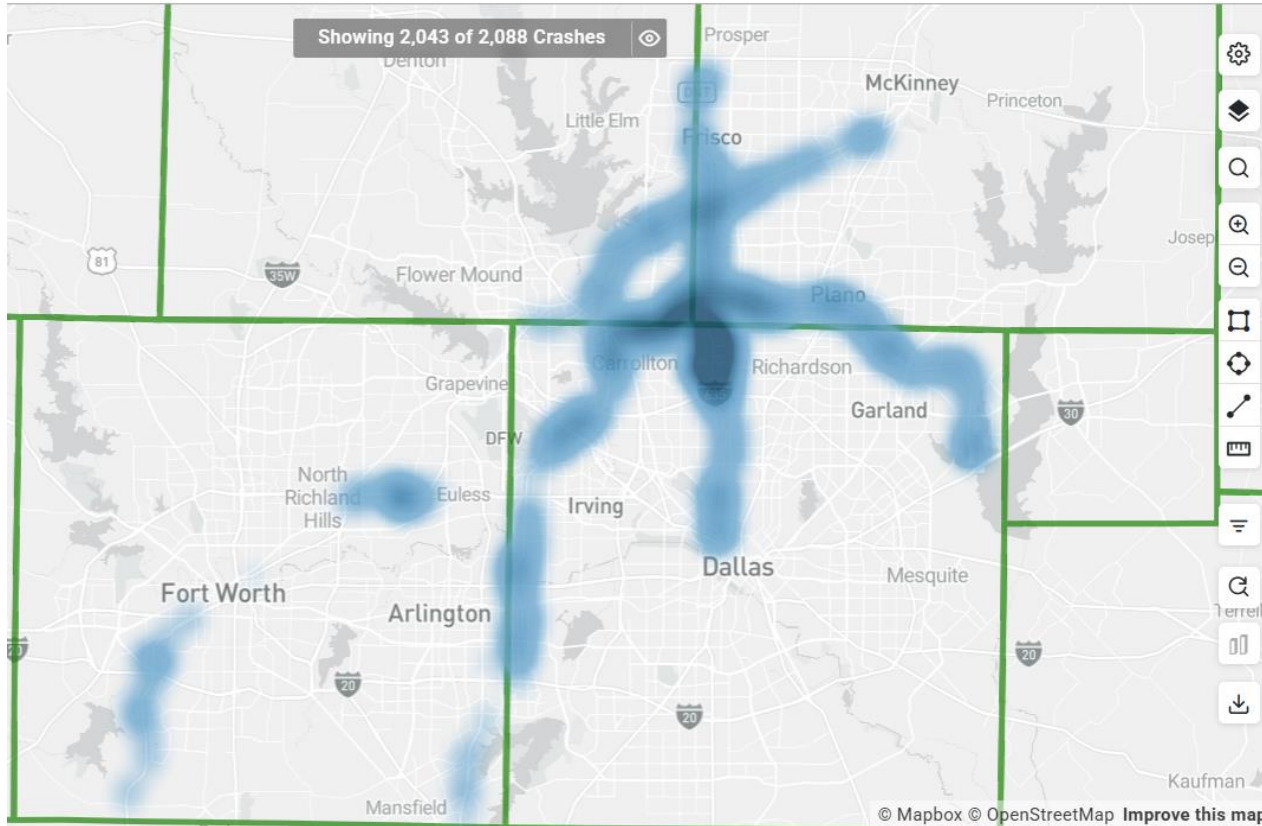
Top Contributing Factors to Crashes



Speed Related Crashes on NTTA System



Wet Surface Related Crashes on NTTA System



Wet Surface Related Crashes on NTTA System

- Crashes have been recorded on all toll roads
- A few “hot spots” account for high percentage of the crashes
- Primary factors as reported :
 - Unsafe Speed
 - Failed to Control Speed
 - Harmful Event: Fixed Object

Crash Distribution by Locations along DNT

	2018	2019	2020	2021	2022	2023	2024	2025	Grand Total
700					1			2	3
695							1		1
690	2		1	2	1			1	7
685			2			3			5
684							1		1
680		2	8	10	4	9	29	6	68
679							1		1
678							1		1
677				1					1
675	1	2	11	8	10	10	15	2	59
670		2	4	2		2	1	1	12
665	3	5	10	10	3	1	4	1	37
664							1		1
663							1		1
656								1	1
655						1	1	1	3
650	1			1		1	4		7
645			2		1	2			5
640				1				1	2
639								1	1
635			1	1		1		1	4
632							1		1
630			1	1				1	3
625		1							1
620				1			1	1	3
612								1	1
610	1	4	7	4		1			17
605	1	3	8	3			1		16
603			1						1
600	9	9	17	4			1		40
595		2	1	1					4
590			5						5
585				1			1		2
580						1			1

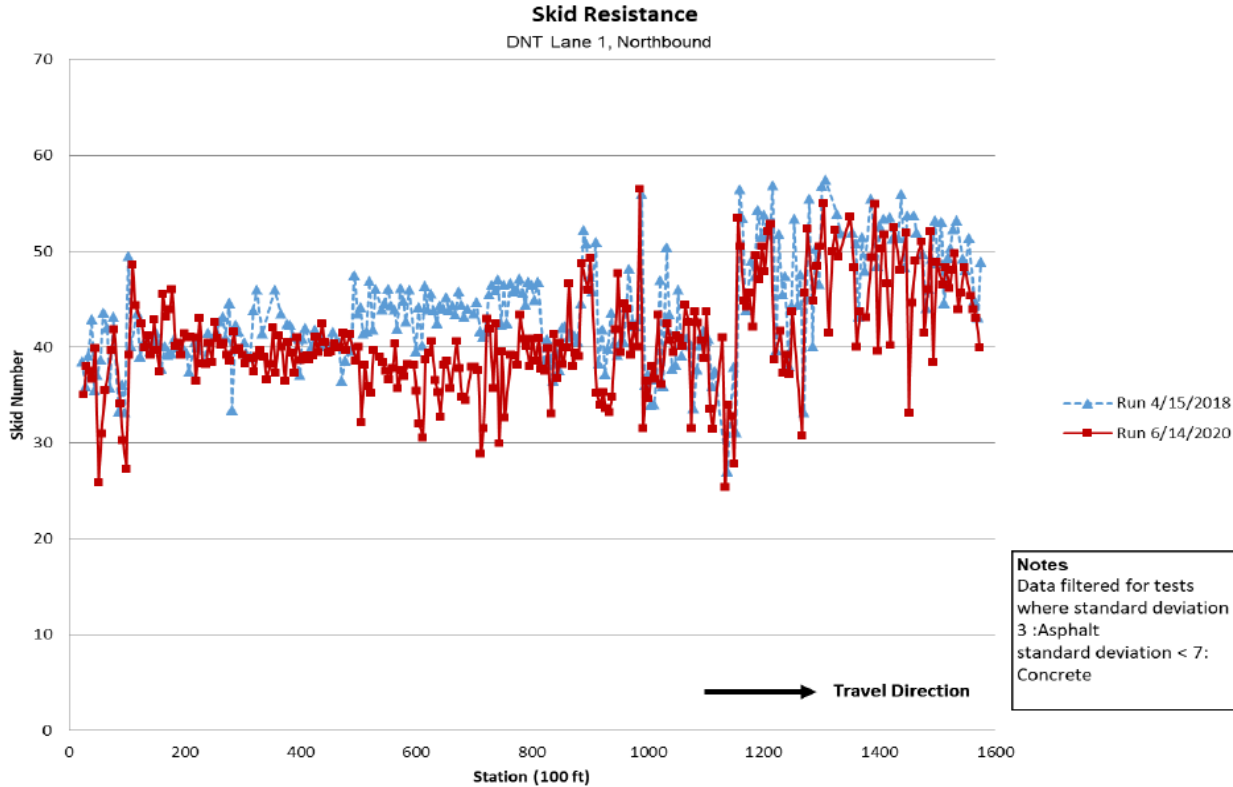
Keller Springs

Belt Line

Typical Speeds along DNT

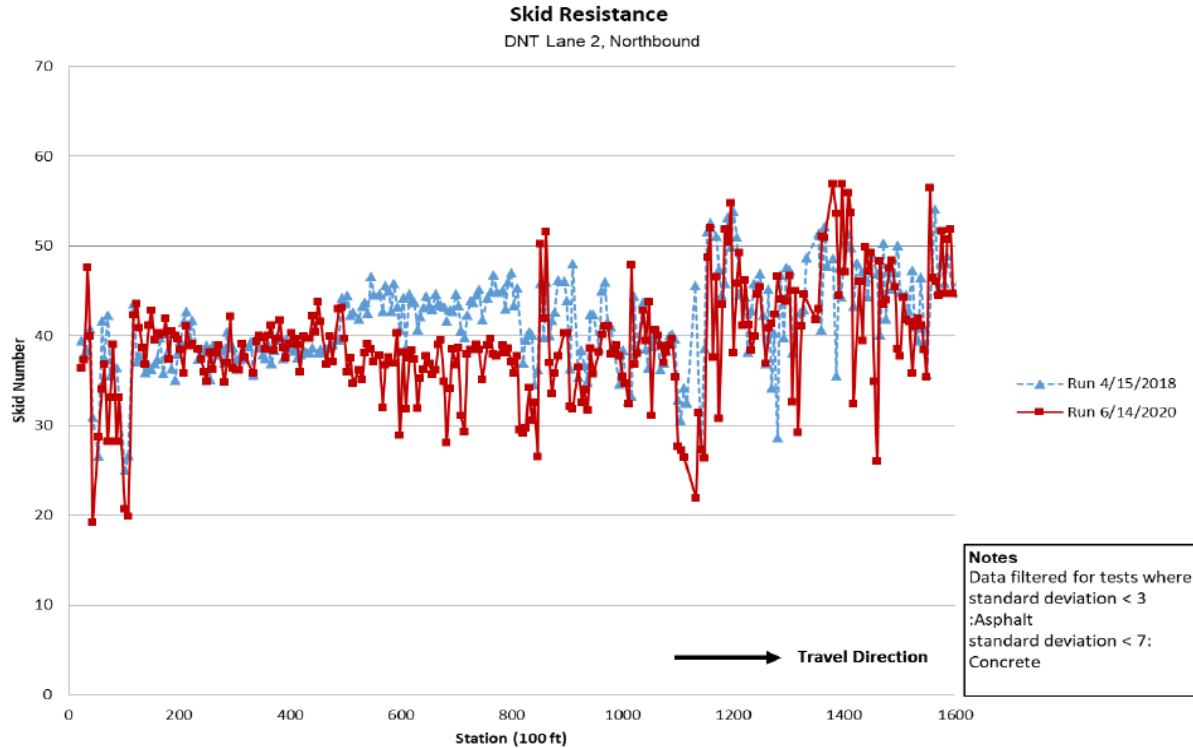


Roadway Data – Surface Friction



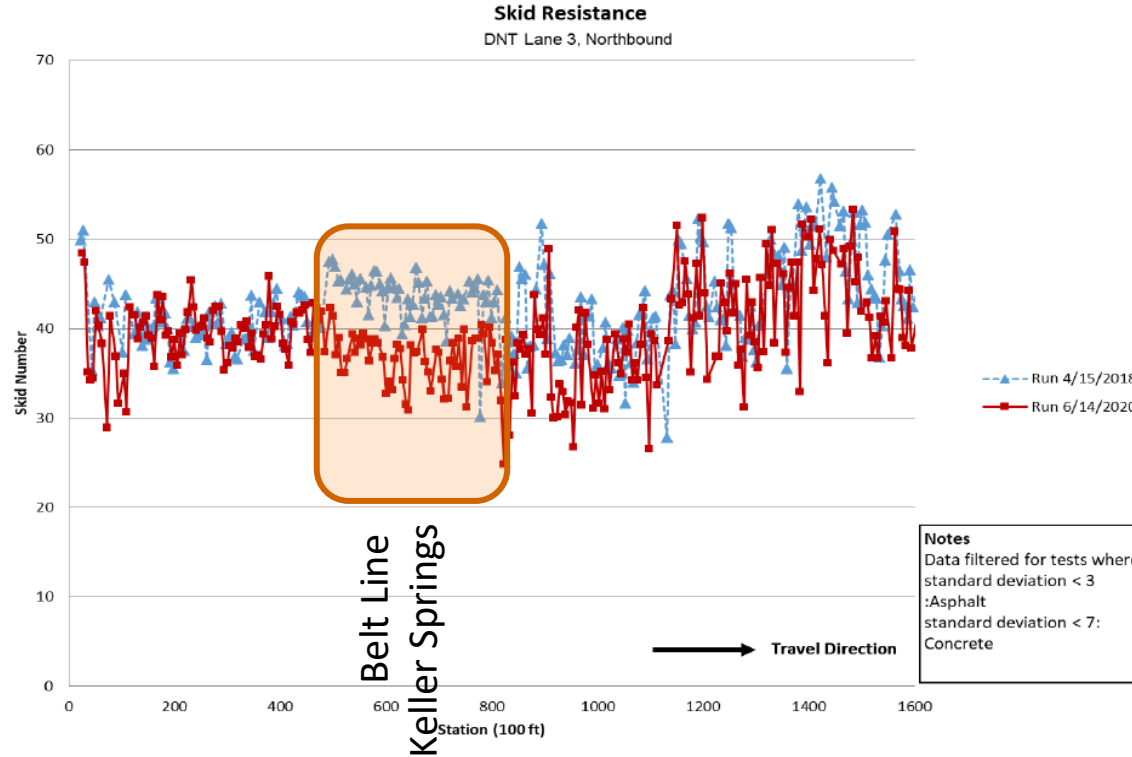
Skid Number	General Friction Condition
Less than 20	Low
20-30	Transitional
30-40	Good
More than 40	Excellent

Roadway Data – Surface Friction



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Roadway Data – Surface Friction

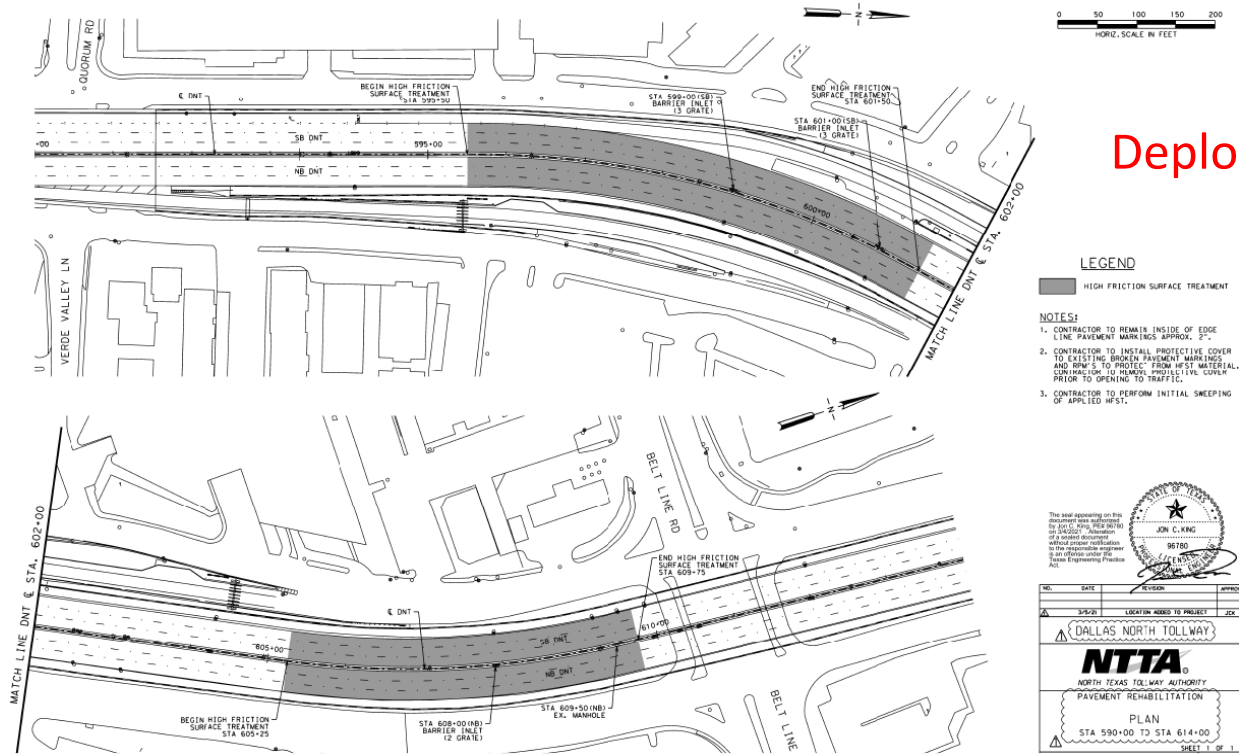


Skid Number	General Friction Condition
Less than 20	Low
20-30	Transitional
30-40	Good
More than 40	Excellent

Countermeasures Selection and Evaluation

- Field Investigation
- Operational and Enforcement Input
- Traditional Engineering Countermeasures
- Innovative Solution
 - Pilot Deployment of High Friction Surface Treatment (HFST)

Countermeasure Deployment



Deployed in May 2021

Before and After the Pilot Deployment of HFST at Belt Line Rd

Phase I - Beltline												
	2018	2019	2020	2021	2022	2023	2024	2025		2018-2021	2022-2025	
Beltline area (600-610)	17	36	89	40	0	1	3	0	✓	182	4	-97.8%
NB	6	20	56	29	0	0	1	0	✓	111	1	-99.1%
SB	11	16	33	11	0	1	2	0		71	3	-95.8%
Keller Springs area (660-670)	10	22	50	63	32	51	79	28	✓	145	190	31.0%
NB	4	11	14	30	14	26	27	17	✓	59	84	42.4%
SB	6	11	36	33	18	25	52	11		86	106	23.3%

Continued Deployment of the Countermeasure

Count of Incident ID	Column Labels							
Row Labels	2019	2020	2021	2022	2023	2024	2025	Grand Total
700	1	1	1	1		1		5
695			3	2		1		6
691		1			1			2
690	10	8	14	5	12	13	5	67
687						1		1
685		4	10	6	4	7	7	39
684						1		1
680			1		4	2	4	11
679							1	1
675			1	1	2	2		6
670			3	1	2	1		7
665		2	1	1	2			6
658			1					1
656							1	1
655				1				1
650	1		2			1	1	5
645						2		2
640	1	2	1	1	1		2	8
635		1		1	2		1	5
633					2	1		3
630		1			2			3
629						1		1
625		1		2		2	1	6
620		1					2	3
615		5	1			2		8
610	5	17	8			1		31
609		3						3
605	8	14	13					35
600	7	22	8					37
595	1	2						3
Grand Total	36	93	74	29	41	48	30	351

Keller Springs

Deployed in
June 2025

Belt Line

Deployed in
May 2021

Before and After the Deployment of HFST at Keller Springs

Phase II - Keller Springs			
	2024-07 to 2025-06	2025-07 to 2026-06	
690	15	1	
685	9	2	
680	24	2	
675	6	0	
670	3	1	
	57	6	-89%

Summary

- High Friction Surface Treatment (HFST) is highly effective in reducing wet surface related traffic crashes
- Supplementing crash data with roadway data provides significant insight in identifying the causes and improvement alternatives
- Qualitative data matters too
- Every small improvement counts

North Texas Tollway Authority

Our Mission

❖ **Provide** a safe and reliable toll road system ❖ **Increase** value and mobility options for customers ❖ **Operate** the Authority in a businesslike manner ❖ **Protect** our bondholders ❖ **Partner** to meet our region's growing need for transportation infrastructure