Alaska Department of Transportation & Public Facilities

Research & Technology Transfer

High Friction Surface Treatment Experimental Feature

Final Report and 3rd Year Monitoring Results

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Date

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SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	645.2	square millimeters	mm^2
ft^2	square feet	0.093	square meters	m^2
yd^2	square yard	0.836	square meters	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	square kilometers	km^2
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
	NOTE: volumes greater than 1000 L shall be shown in m^3			
		MASS		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
		TEMPERATURE (exact degrees)		
°F	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	°C
		ILLUMINATION		
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	$candela/m^2$	cd/m^2
		FORCE and PRESSURE or STRESS		
lbf	poundforce	4.45	newtons	N
lbf/in^2	poundforce per square inch	6.89	kilopascals	kPa

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	square millimeters	0.0016	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	square kilometers	0.386	square miles	mi^2
		VOLUME		
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	cubic meters	35.314	cubic feet	ft^3 m^3
	cubic meters	1.307	cubic yards	yd^3
		MASS		
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000 lb)	T
		TEMPERATURE (exact degrees)		
°C	Celsius	1.8C+32	Fahrenheit	°F
		ILLUMINATION		
lx	lux	0.0929	foot-candles	fc
cd/m^2	$candela/m^2$	0.2919	foot-Lamberts	fl
		FORCE and PRESSURE or STRESS		
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in^2

*SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380.
(Revised March 2003)

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This project monitored high friction surface treatment (HFST) at 30 locations throughout Central Alaska between 2016 and 2019. Monitoring indicates a loss of friction at all locations. There is a greater loss of friction associated with higher annual average daily traffic (AADT) per lane, high speeds and in curves. Overall, the friction loss in the wheel paths is more than anticipated for 4 years of installation. Published data on HFST installed in other parts of the country indicates 5-7 years of presence before significant friction loss. The DOT&PF was trusting a minimum of 3 years of presence when factoring for studded tire wear and plowing. It is recommended that HFST be removed in Anchorage and not used in the future in urban centers while studded tire use is allowed. If HFST is applied in the future it is recommended that method 1 be used, where machine mixing, measuring and automated, continuous application and thickness measurements are required.

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December 2019

Table of Contents

Appendix

Introduction

Central Region DOT&PF received approximately $10M to design and construct High Friction Surface Treatments (HFST) throughout Central Alaska in a Highway Safety Improvement Project (HSIP) as a safety countermeasure. This project applied HFST consisting of calcined bauxite and methyl methacrylate (MMA) resin to 28 different locations throughout the summer of 2016. Applications of the high friction surface treatment (HFST) were in a variety of locations where: geometric constraints limit reconstruction, shady/icy curves are located on high speed roadways, crash history shows clusters of single-vehicle-run-off-the-road and motorcycle crashes occurring, and skidding/road conditions were recorded as a contributing factor for a crash.

Although this treatment has been widely used in the lower 48 states, it was relatively new to Alaska during the design and construction. With such a large investment in the product, DOT&PF wanted to study the material wear properties over time to determine its capability to withstand arctic conditions. This led to the Department seeking and receiving FHWA Experimental Feature approval for the project. This report will outline the evaluation process and results from three years of post-construction testing.

Project Scope

HFST was applied at 28 sites throughout Anchorage, Kenai Peninsula, and Wasilla/Palmer based on criteria reviewed and approved through the Highway Safety Improvement Program (HSIP). There were initially more locations planned, but after review these were subsequently cut due to funding constraints, future planning conflicts, and pavement conditions. Figure 1 shows a Vicinity Map for the 28 sites.

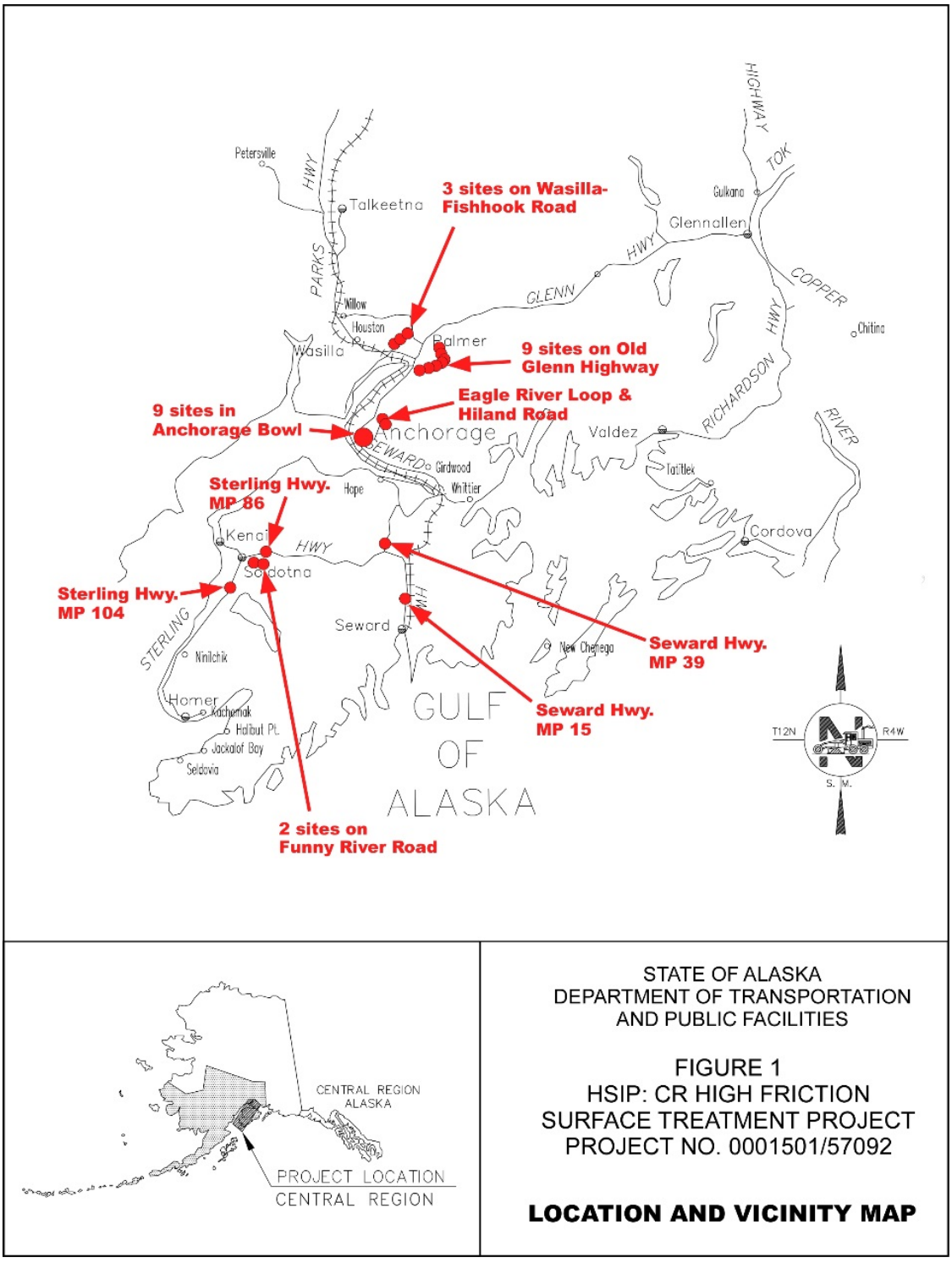
Locations where existing pavement was damaged or had rutting in excess of 0.25” depth were milled 0.75” and repaved with 1” of Type IV, Class A PG 58-34 HMA prior to the application of HFST. Specifications and manufacturer recommendations included a required minimum of 30 days between placing new pavement and applying HFST. Sites were treated in one or multiple lanes, depending on a number of factors such as curve and crash severities. In some locations, surfaces were milled and not resurfaced due to environmental permitting restrictions.

This monitoring project does not include crash analysis. The analysis will be completed separately by the HSIP staff when 3 years or more of post-construction crash data are available.

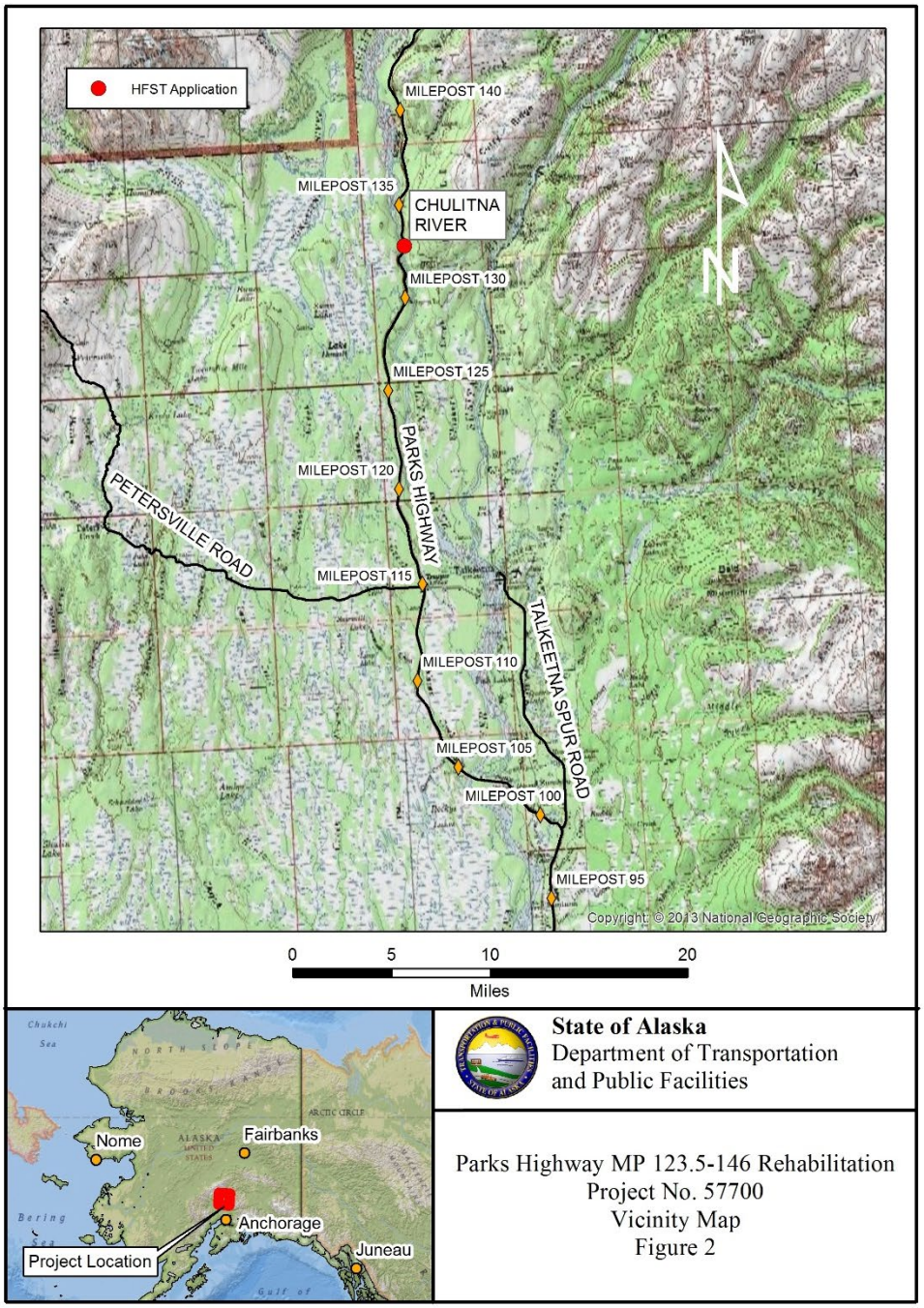
HSIP Disclaimer

The information in these reports is compiled for highway safety planning purposes. Federal law prohibits its discovery or admissibility in litigation against state, tribal or local government that involves a location or locations mentioned in collision data. 23 U.S.C. § 409; 23 U.S.C. § 148(g); Walden v. DOT, 27 P.3d 297, 304-305 (Alaska 2001).

HSIP Central Region High Friction Surface Treatment #Z570920000

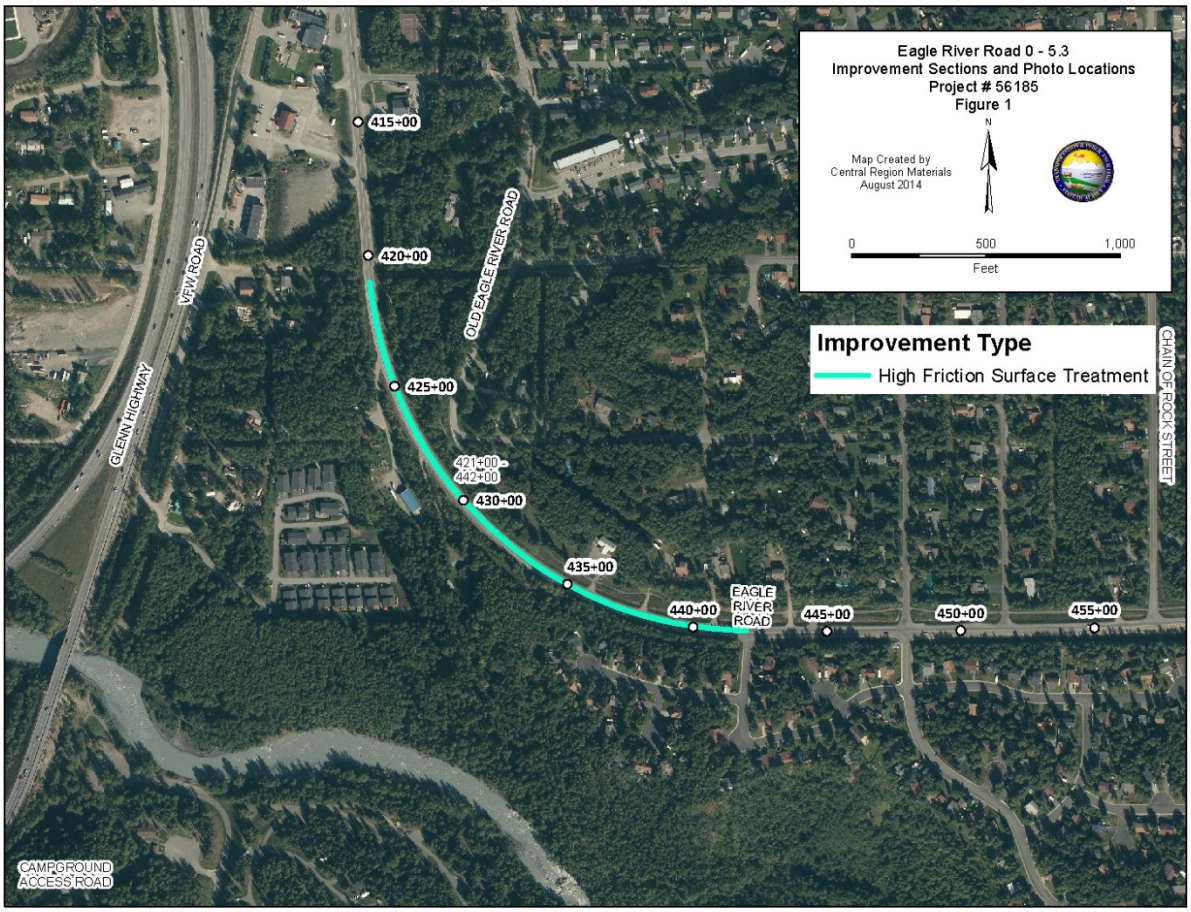


Parks Highway MP 123.5-146 Rehabilitation #57700



Prior to the HSIP project installation, there was a DOT&PF rehabilitation project that included 1 installation of HFST to treat a curve with a steep grade. This project applied HFST in the summer of 2015 on the curve to the north of Chulitna River Bridge as shown in Figure 2. This application used machine control to regulate resin and calcined bauxite application and used epoxy as the resin in place of MMA. Friction testing was included in the monitoring plan to compare friction testing results from machine controlled

application to the manual application used in the HSIP project's 28 sites. The Chulitna site is referred to as Site 29. A second site was installed that summer in Eagle River on a separate project using the same automated method. The Eagle River Site is referred to as Site 30. General comparisons of the performance of these two additional sites is included in this report.



Experimental Feature

High Friction Surface Treatment was a safety countermeasure introduced nationally during the FHWA Everyday Counts Round 2 Initiative in 2010. At that time, DOT&PF was interested in treating both rural and urban sites for a range of crash characteristics where traditional engineering countermeasures were not available. The Highway Safety Improvement Program decided to propose HFST for these sites however the product was new to Alaska and the DOT&PF was uncertain about its material performance in our harsh conditions. Specifically, the Department wanted to study the impacts of:

- Studded tire wear
  - Studded tire wear is the primary cause of rutting on Alaskan roads. Samples of calcined bauxite were Prall tested (EN 12697-16) to simulate the rutting effects of studded tire wear. These samples performed well in the Prall test; however, the test does not take into account the freeze-thaw cycles the surface may go through, the plucking action of studded tires, or the long term effect studded tires wear has on HFST friction.

- Winter plowing operations
    - Plow trucks will run their blades as close to the pavement surface as possible to ensure clean, safe roads during the winter season. This may cause damage to the treatment.
- Anti-icing and de-icing applications
- Freeze-thaw cycle (i.e. cracking, spalling, delamination)
- Application methods (Method 1 vs. Method 2)

The primary objectives of the Experimental Feature Monitoring Plan are:

1. Assess existing asphalt surface preparation and material application during construction.
2. Monitor High Friction Surface Treatment Performance
3. Long-term performance monitoring under Alaska Conditions
4. Make recommendations on future HFST consideration in Alaska

Details of this plan can be found in Appendix C: Work plan for HFST Monitoring Project

Construction

DOT&PF staff collected data at each site during the summer 2016 construction season. Data included Dynamic Friction Tester (DFT) readings, weather data, and pavement condition. Photos and videos were collected at some sites as well. The post-construction DFT readings are summarized in Table 1 in Observations and Results Section

The application areas were swept no less than 6 times in an attempt to remove shed aggregate. The aggregate does not vacuum up well due to its high density, resulting in repeated passes. Traffic warning signage ("Loose Gravel", "Motorcycles Use Caution", etc) was increased to help motorists.

The application method used was less automated than originally suggested, but did meet specifications for the project after addenda were released. Some observations from the application include:

- Uneven/varying lane widths (i.e. turn pockets)
- Areas where the epoxy did not bond or set
- The application thickness of the resin being controlled by the serrations on the squeegees
- All installations met the minimum specified value of 0.75+ for Friction. Most of the DFT results were much higher at 1.0+
- Application temperatures differed between sites (pre-heated vs. cooled)
- Recycled aggregate was used, although there were concerns of dust particles contaminating the application
- Hose dragging through epoxy application was noted in a video for one site on the Old Glenn Highway. This may have occurred at other sites.

DeArmoun was paved instead of MLK Drive due to DeArmoun's failing pavement. MLK Drive showed minimal signs of rutting and the HFST was applied to existing pavement.

The final construction cost came to $6,335,076.

Design Recommendations from Construction

1. The contract required the contractor to sweep the HFST sites prior to opening to traffic, and again between 48 and 72 hours after HFST placement. During construction, it was found that as the HFST encountered traffic it would continue to shed aggregate for several weeks after application. Recommend including weekly sweeping for 4 weeks after placement as part of the item.

2. Some sites were scheduled to receive HFST on top of a milled surface. After HFST wears, traffic could eventually be driving on a milled surface. Also, application rates can be variable on milled surfaces, and some portions of the milling reflect through the HFST application. It would not substantially add to the cost of the project and maintain pavement thickness if milled surfaces were paved prior to HFST. Recommend either placing HFST on existing pavement or new pavement.

3. Recommend adding specifics to temporary striping / lane delineation requirements during the specified 30 day cure period for new HMA.

4. Striping on HFST was either surface applied or inlaid MMA. It was found during construction that the texture of HFST caused surface applied MMA to not cover HFST completely. When thickness and pressure was increased, it caused the edges of the stripes to wash out and to be elevated increasing chances of damage. Recommend inlay MMA striping as much as possible.

5. Provide a Contingent Sum item for Rumble Strips to be used at the discretion of the Engineer.

6. Striping items on a Linear Foot and per/each basis was helpful to tie-in striping between new HFST patches and existing striping.

7. Recommend extending placement limits past all fog lines in plans. This keeps all joints well outside the traveled way and cleans up new striping.

8. When specifying a method specification for HFST, recommend being mindful of specifying an application method that could be proprietary. Resin/MMA was too thin in many locations and didn't provide enough embedding for HFST aggregate. A minimum thickness requirement for binder over application rate would be better for maintaining consistent embedded HFST when the roadway absorbs more resin/MMA or is wider in some locations.

Application Methods

Photo 1: 2016 Application using Method 2 on Old Glenn Highway

Prior to application, surfaces were cleaned, dried, and freed of all dust, oil, debris and any other material that might have interfered with the bond between the polymer resin binder material and existing surfaces. Adequate cleaning of all surfaces were determined by the Engineer. The treatment was applied in one of two ways: Method 1 - automated continuous application, or Method 2 - mechanical and hand mixing and aggregate broadcast. Method 1 (see Appendix) required the contractor to continuously mix, meter, monitor, and apply the resin binder and high friction aggregate in one continuous pass by automated machinery. Method 2 required the polymer resin binder be mechanically mixed, metered, monitored, and distributed while maintaining the designed, proper stoichiometric ratio. According to the HFST specifications, the minimum spread rate of retained aggregate was 13-20 lb/sq yd. The minimum spread rate for polymer resin binder was 0.28-0.32 gal/sq yd. After mixing, the resin binder was uniformly spread onto the surface using a serrated edged squeegee followed closely by mechanically applied high friction surface aggregate, as shown in Photo 1. Exposed areas of wet resin were hand covered with aggregate immediately prior to the gelling of the resin binder. Method 1 was used for Sites 29 and 30, Method 2 was used for Sites 1-28.

Site 30 (Eagle River Road Mile Point 0-5.3 Pavement Preservation) revealed there may have been an error with the resin application which resulted in strips of bare pavement a consistent distance from the fog line prior to the first winter (See Photo 2). This result, however, was noticeable in other areas as well with Method 2 though it has a distinctly different wear pattern (see Photo 3).

Photo 2: June 2016, Eagle River Road one year after Method 1 application.

Photo 3: July 2017, Minnesota Drive one year after Method 2 application.

Monitoring Plan

Photo 4: Dynamic Friction Tester with Case and Water Source

Friction testing was performed by the Central Region Materials Lab (CRML) both during construction for product acceptance and for the monitoring portion of the project. The Dynamic Friction Tester (DFT) is made by Nippo Sangyo Co. out of Japan and is ASTM E-1911 compliant. The CRML is the only DFT owner in Alaska.

> "Three rubber sliders are mounted on the lower surface of a disk that rotates with its plane parallel to the test surface. Once the operator set and software controlled circumferential speed is reached by the spinning disc, the control system initiates water delivery and lowers the spinning disc to the test surface. The rubber sliders thus will be pressed to the surface by the weight of the device; the torque, generated by the friction between the rubber sliders and the test surface as the spinning disc is slowed down, is measured. The calculated force is divided by the weight of the disk and motor assembly to calculate coefficient of friction.
>
> The disk rotational velocity reduces gradually due to the friction between the sliders and the test surface. The velocity is also measured to indicate the relationship between coefficient of friction and speed."
>
> -**Nippo Sangyo Co.**

The DFT requires a flat, even surface to operate. After running a friction test a screen appears (see next page).

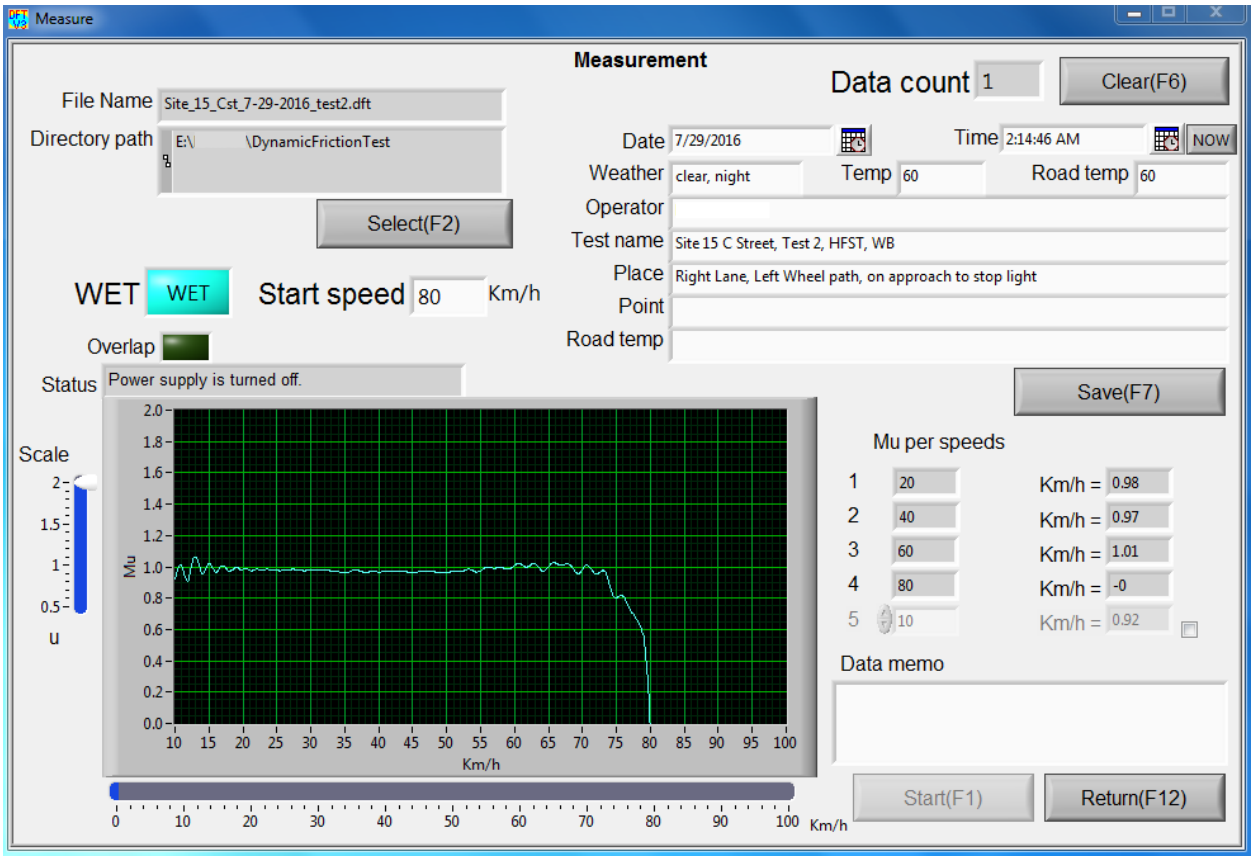


Photo 5: Example of DFT data output as measured in the field

This provides the speeds vs. coefficient of friction, and a graph of the test. The specification for the coefficient of friction on the HFST project was 0.75 or greater. A typical road surface measures, on average, a 0.45 - 0.6 (or 0.3 – 0.35 for striping), with a higher value indicating higher friction.

The CRML tested in wheel-paths, anticipating them to experience the most severe wear-and-tear. Unfortunately, uneven surfaces prevent the DFT from operating; therefore if wheel-paths contained an uneven surface such as severe ruts, friction measurements were collected adjacent to the wheel-path.

Control points were measured during construction on pavement to understand the increase in friction from the HFST. Some sites recorded multiple DFT tests in order to capture different locations of the travel lanes (i.e. wheel path, turn pockets, inside/outside lanes) and are labeled as such. All recorded construction values, including control points, are provided in a table in Appendix B.

The HFST locations were tested annually for three years post-construction (Summer 2017, 2018, 2019) to determine performance and changes in the friction values from wear. This monitoring plan was updated annually with the measured friction values. Sites within Anchorage were dropped from the 3rd year of testing, as they were considered to be failed (friction values recorded in the 2nd year of testing were significantly below the control point values).

7 locations (sites 8c, 27c, 12a&b, 14c, 20a, 22a) tested during construction were not able to be tested under the 1st year's monitoring plan but were included in the 2nd year of testing. These were included in

the 3rd year of DFT testing at locations outside of Anchorage. Additional sites were included in the second year of testing and these were tested in the 3rd year as well outside of Anchorage.

Observations and Results

Results from the construction year (2016), year-1 (2017), year-2 (2018) and year-3 (2019) of the monitoring plan are summarized in Table 1. Analysis indicates a loss of friction at all test locations. A greater loss of friction is associated with a higher annual average daily traffic (AADT) per lane, higher speeds and in curves. Overall, the friction loss in the wheel paths is more than anticipated for 4 years of installation. Published data on HFST installed in other parts of the country indicates 5-7 years of presence before significant friction loss. The DOT&PF was trusting a minimum of 3 years of presence when factoring for studded tire wear and plowing. The complete set of friction data is located in Appendix B as well as a graphs of AADT vs. DFT value. While outliers exist, data shows a clear trend of higher traffic volumes having lower friction values sooner after installation. See Appendix A for observations by site, maps of testing locations and photos.

Visual observations of the application areas indicate a loss of material concentrated in the wheel paths associated with high AADT values. All sites tested in through lanes in Anchorage have visible loss of material in wheel paths. In Anchorage 2018 testing all sites (with the exception of turn lanes) had at least one test *with lower* friction recorded than the control point measured in 2016, while most sites had multiple readings below the control points. This could indicate exposed epoxy resin without aggregate and was reported in the 2017 and 2018 annual reports. A project was initiated to repair these sites and is expected to enter construction in 2020.

In Anchorage, roads with higher AADT had higher friction loss than those with lower AADT, but all sites have lost a significant amount of friction in the wheel paths. The application process may be contributing to friction loss as well due to the hoses used for application of aggregate dragging through applied material prior to hardening. Photo 6, on page 13, has a unique pattern of material loss in the right lane wheel paths that may have been caused by this.

All sites outside of Anchorage show visible signs of wear. A significant portion of the wear on the low AADT routes, such as Chulitna (Site 29) and Funny River Road (Sites 3 and 4), comes from snowplowing operations. Two tests on the shoulder of the road at the Seward Y (Site 6) indicate a loss of 0.21 since application, compared to an average loss of 0.51 from the testing performed in the wheelpaths.

Sites with higher AADT's outside of Anchorage, such as Sterling Highway MP 86 and 104 (Sites 1 and 2), Eagle River Loop Road (Site 16), Old Glenn MP 12 (Site 25) and Wasilla-Fishhook (Sites 26 and 27) did have visible material loss in the wheelpaths and substantial loss of friction resulting in an average friction value of 0.38, being lower than typical control site values. Rural sites with moderate AADT, being the Old Glenn Highway (Sites 17-24) and Wasilla-Fishhook (Site 28) had moderate friction loss overall, and some sites had visible material loss in wheelpaths. See Appendixes A and B for detailed friction values by site and photographs.

Hoses dragging during the application process, and less than optimal resin thickness at the time of construction likely contributed to a diminished embedment of aggregate. Snowplowing likely contributed to material loss on lower AADT routes outside of Anchorage. On the Old Glenn while the material loss is

evident at isolated locations it is not widespread across all sites with similar AADTs and speeds on that road.

Areas that experience lower speeds and AADT values, such as turn pockets, had noticeably less material loss (see Photo 7) and retained higher friction values than through lanes, but still had a significant loss in friction. Appendix A includes photos collected from multiple years of monitoring at each site.

Testing was performed in 2019 on the Old Glenn Highway and Wasilla/Fishhook Road to compare the change in friction on normal pavement compared to the HFST. In 2016 the pavement had an average friction value of 0.56 on those roads, while in 2019 it had an average friction value of 0.51.

Table 1: Summary of Friction Values

Location	Year Constructed	Average					Min-Max
		Constructed Value	2017 Value	2018 Value	2019 Value	Friction Loss	AADT
Anchorage (7-16)	2016	0.996	0.614	0.362	N/A	-0.634	1,996 - 34,938
Anchorage Turn Pockets (8,12,13,16)	2016	0.992	0.982	0.547	N/A	-0.445	No Data
Chulitna (29)	2015	1.080	0.790	0.664	0.662	-0.418	1,320
Old Glenn Highway (17-25)	2016	0.996	0.864	0.608	0.572	-0.424	1,654 - 3680
Seward/Soldotna (1-6)	2016	1.083	0.956	0.551	0.490	-0.593	1,277 – 8,846
Wasilla/Fishhook Road (26-28)	2016	0.993	0.782	0.584	0.540	-0.453	3354

Unique Pattern of Material Loss In Wheelpaths

Photo 6: Old Glenn Highway at Milepost 2 – Site 17 (2018)

Example of Regular Wear of HFST in Alaska

Photo 7 (Left) 2018 & 8 (Right) 2019: Eagle River Loop Road – Site 16

In these images, you can see the turn pocket (right side of Photo 7) has significantly less obvious wear than the high AADT through lane. In 2018 (Photo 7) significant wear is evident on the through lane while minimal in the turn pocket, and in 2019 (Photo 8) a significant amount of pavement is visible in the wheelpaths of the through lane.

Recommendations

Three years of post-construction monitoring of HFST in Central Region of Alaska has been completed. Based on results from testing in 2016, 2017 and 2018 in Anchorage it is recommended HFST not be placed on urban, high volume roads. After two winter seasons HFST had visible material loss at all Anchorage sites in the wheel paths, and all locations in Anchorage have at least one friction value recorded in 2018 that is lower than the control points taken on pavement in 2016.

It is recommended that HFST be removed in Anchorage and not used in the future in urban centers while studded tire use is still allowed.

Testing at rural locations in 2016, 2017, 2018 and 2019 indicates a significant loss of friction at all locations over the three years of post-construction monitoring, with most sites having one or more 2019 friction values coming in less than the original pavement control, and higher AADT rural sites having one or more points being well under the original pavement value. It is recommend HFST be removed on all rural sites and not applied to any roads with greater than 750 AADT per lane in the future while studded tire use is allowed.

If HFST is applied in the future it is recommended that method 1 be used, where machine mixing, measuring and automated, continuous application and thickness measurements are required. This would remove the possibility for squeegees to be used for resin distribution, which can provide varying levels, and no hoses would be present that can drag through the aggregate prior to hardening.

This report is only reviewing the material performance in an arctic environment as compared to anticipated performance from other locations around the country. The HSIP program will evaluated the safety results of these locations through their required benefit/cost analysis once 3-years of post-construction crash data is available.

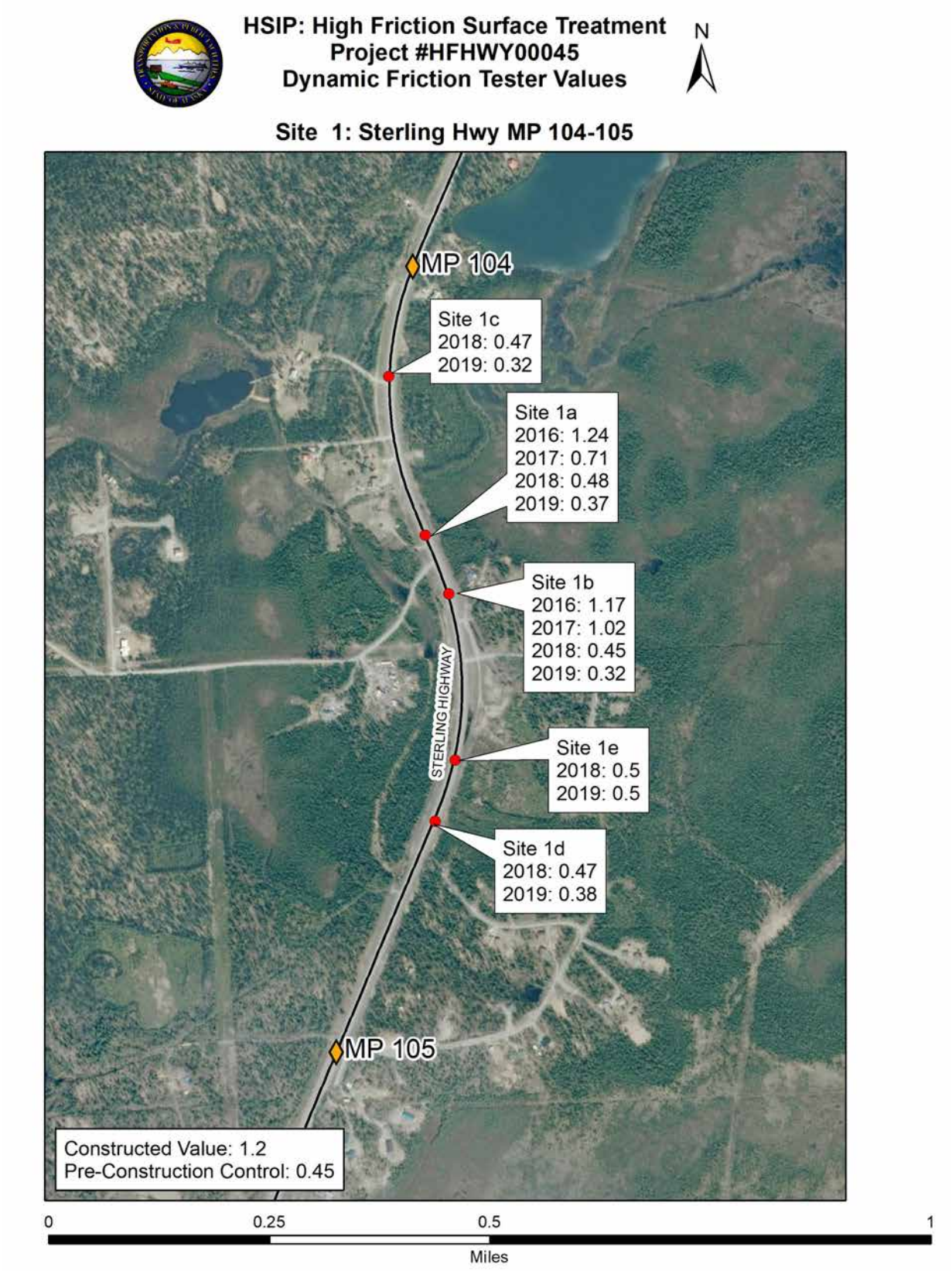
APPENDIX A
Photolog and Friction Summaries

SUMMARY

This document is the culmination of 4 years of **High Friction Surface Treatment (HFST)** research in Central Alaska. All 29 sites are summarized individually, with a site/test map, photos from each year of testing and graphs/tables summarizing site conditions. Tables with all field testing results are given at the end of this appendix.

Please note that data and photo collection for this project was performed by multiple technicians. In 2019, not all pk nails driven to locate previous testing locations were able to be located, possibly being removed during winter plowing operations. Between 2018 and 2019 collection the DFT unit was shipped to the manufacturer for recalibration. Slight variations in testing results between 2018 and 2019 may be attributed to this, or due to new personnel performing the testing.

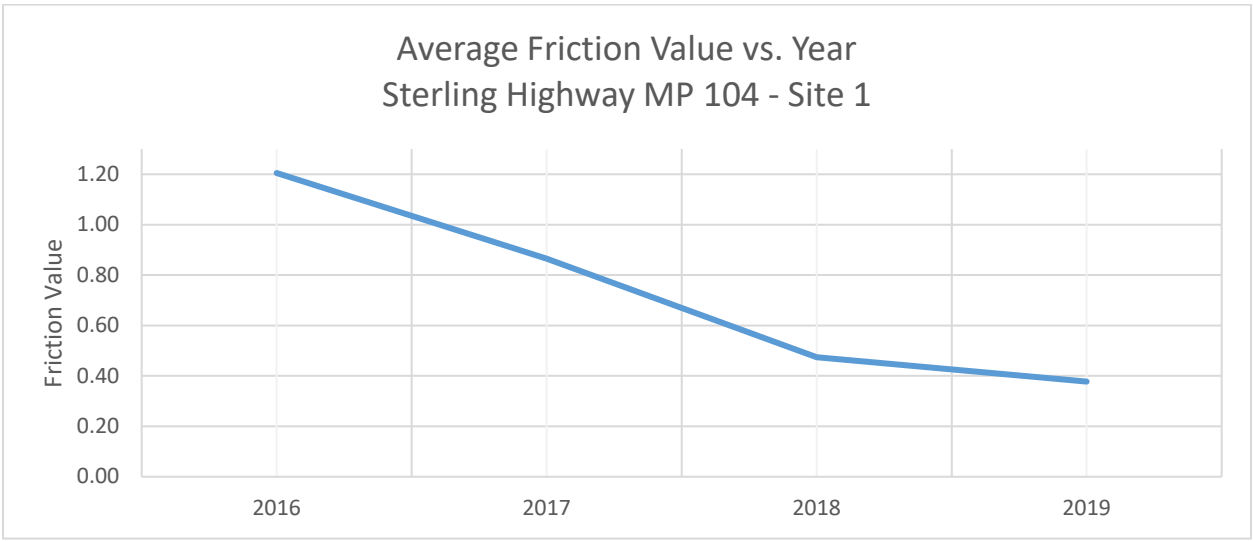
The accuracy of said data/photos is reliant on their field and office records. If you have any questions or concerns, please pass them along to appropriate Central Region Materials personnel.


HSIP: High Friction Surface Treatment
Project #HFHWY00045
Dynamic Friction Tester Values
N
Site 1: Sterling Hwy MP 104-105
MP 104
Site 1c
2018: 0.47
2019: 0.32
Site 1a
2016: 1.24
2017: 0.71
2018: 0.48
2019: 0.37
Site 1b
2016: 1.17
2017: 1.02
2018: 0.45
2019: 0.32
STERLING HIGHWAY
Site 1e
2018: 0.5
2019: 0.5
Site 1d
2018: 0.47
2019: 0.38
MP 105
Constructed Value: 1.2
Pre-Construction Control: 0.45
0
0.25
0.5
1
Miles

Site 1 – Sterling Highway MP 104 - Friction Overview

The site has lost significant friction. Four out of the five tests in 2019 were less than typical pavement value of 0.45, with an average value of 0.38. A zoomed in look at the surface texture in 2019 (below) shows visible pavement under the remaining HFST, and the HFST left in the wheelpaths shows signs of polish.

Average Friction Values				Values by Site 2019	
2016	2017	2018	2019	Sites Less Control Value	Total Sites
1.21	0.87	0.47	0.38	4	5



Site 1 – Photo Log

2016, Test 1

2016, Test 1

2016, Test 2

2017

2017

2017

2018

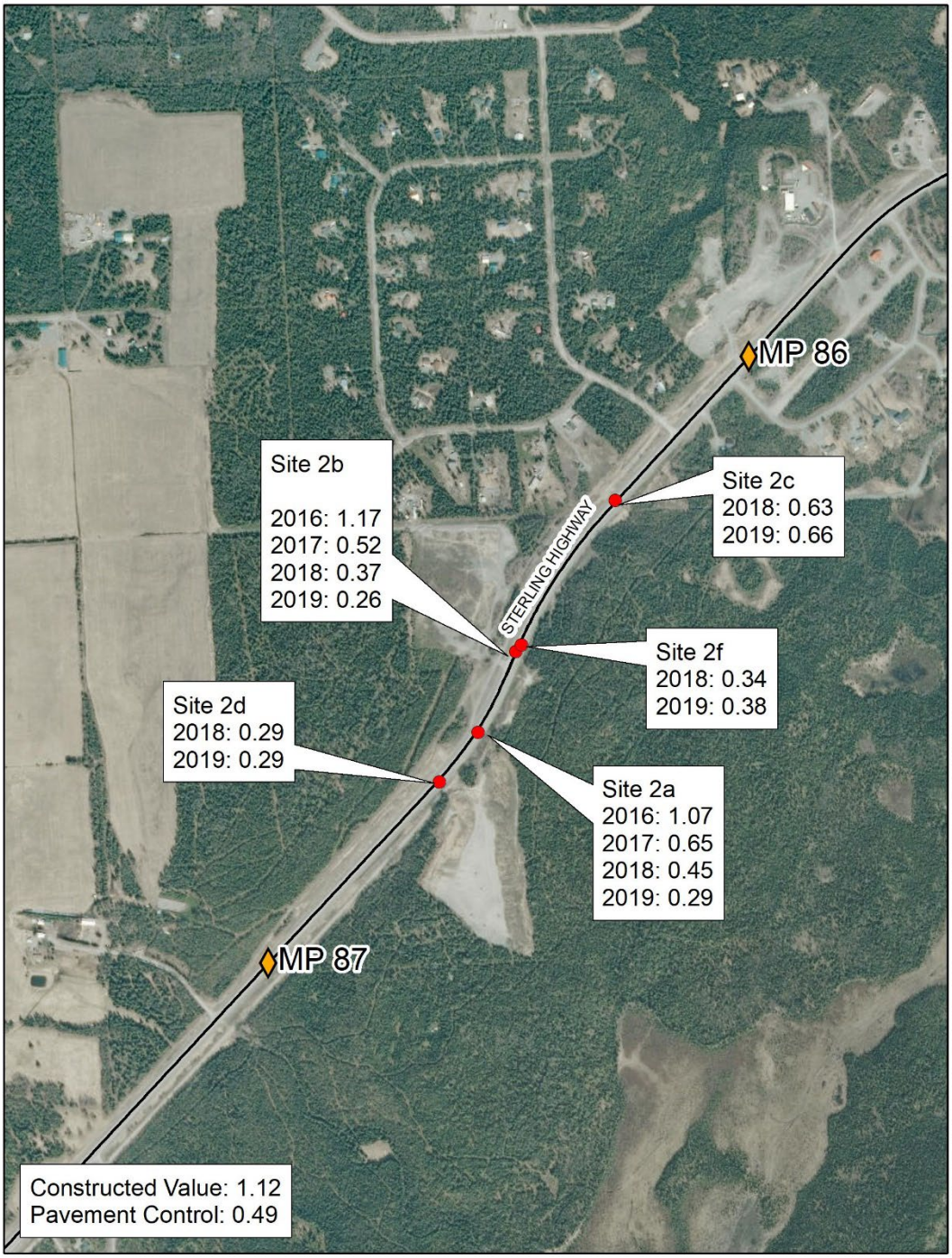
`

2018

HSIP: High Friction Surface Treatment
Project #HFHWY00045
Dynamic Friction Tester Values

N

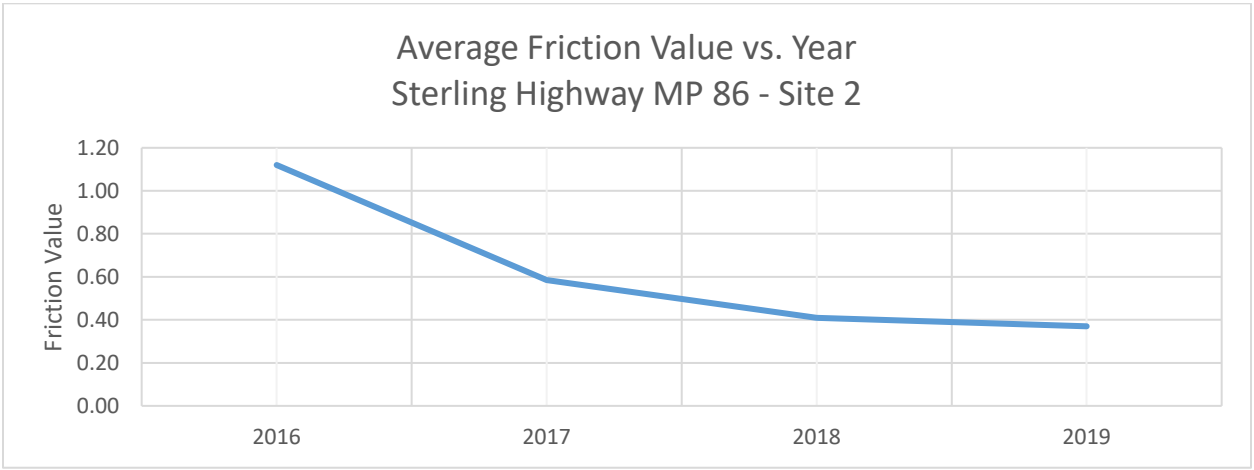
Site 2: Sterling Hwy MP 86.4



Site 2 – Sterling Highway MP 86.4 - Friction Overview

The site has lost significant friction. Five out of the six tests in 2019 were less than typical pavement value of 0.49, with an average value of 0.37. The picture below from 2019 shows bare patches of pavement, and the surface texture within the wheelpaths show significant signs of polish.

Average Friction Values				Values by Site 2019	
2016	2017	2018	2019	Sites Less Control Value 0.49	Total Sites
1.12	0.59	0.41	0.37	5	6



Site 2 – Photo Log

2016, Test 1

2016, Test 1

2016, Test 1

2017

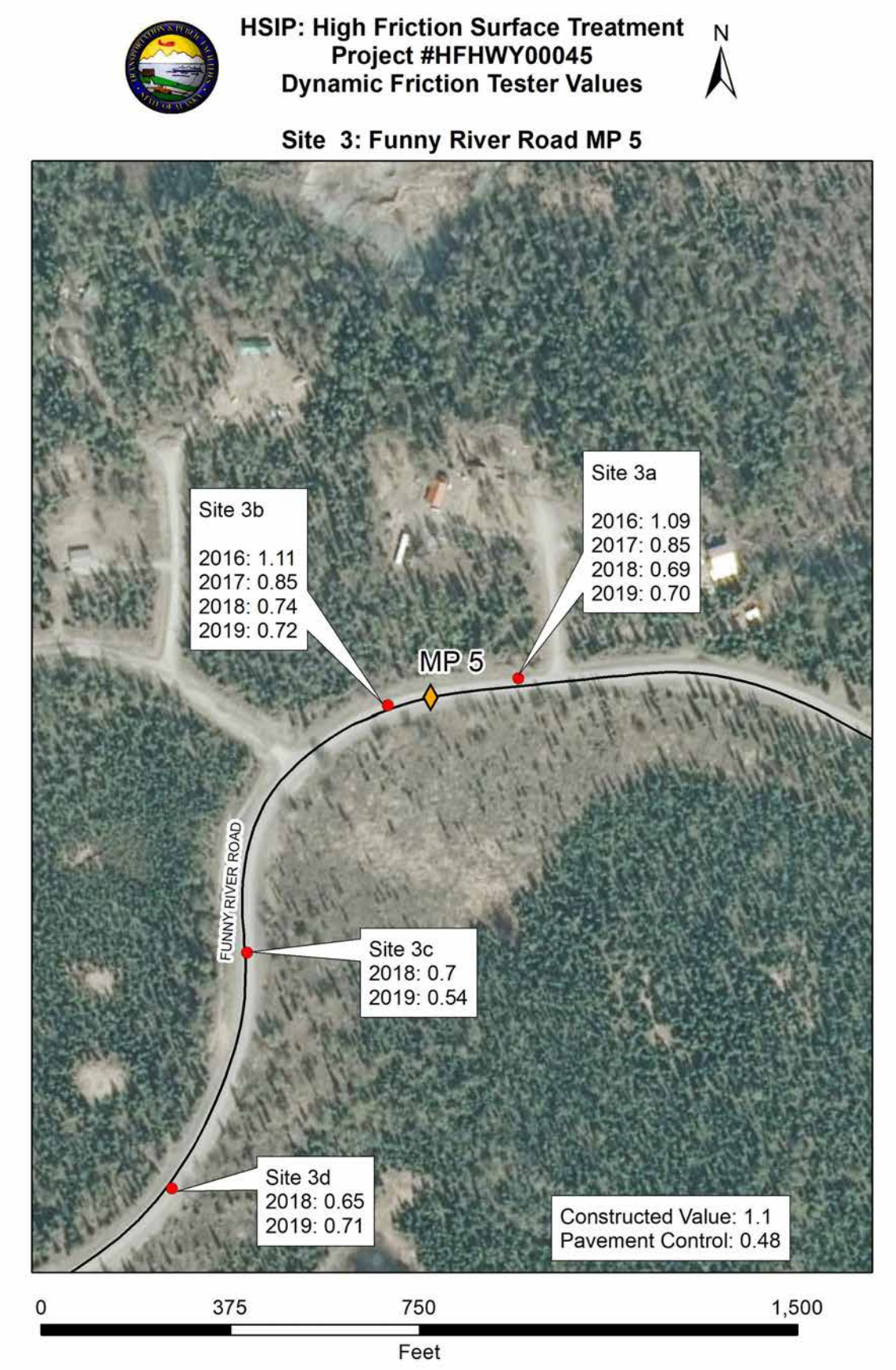
2017

2017

2018

2018

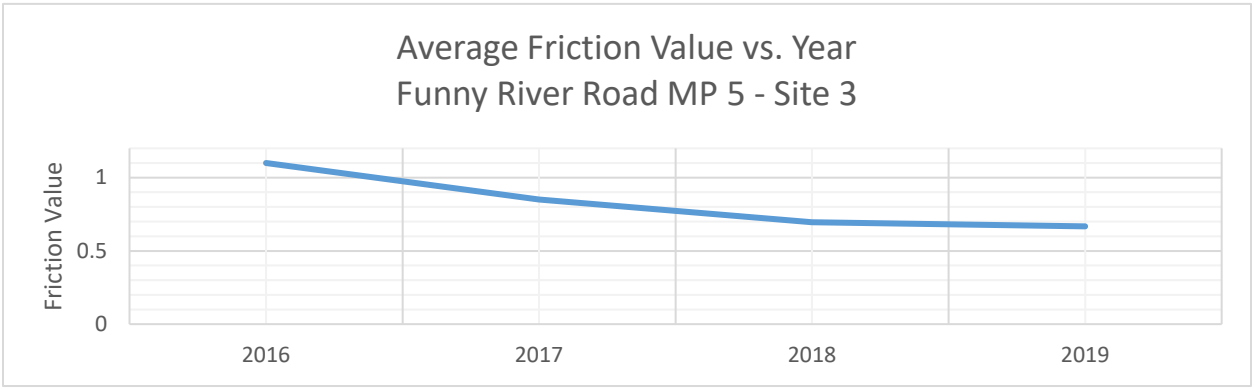
2018


HSIP: High Friction Surface Treatment
Project #HFHWY00045
Dynamic Friction Tester Values
N
Site 3: Funny River Road MP 5
Site 3b
2016: 1.11
2017: 0.85
2018: 0.74
2019: 0.72
Site 3a
2016: 1.09
2017: 0.85
2018: 0.69
2019: 0.70
MP 5
FUNNY RIVER ROAD
Site 3c
2018: 0.7
2019: 0.54
Site 3d
2018: 0.65
2019: 0.71
Constructed Value: 1.1
Pavement Control: 0.48
0
375
750
1,500
Feet

Site 3 – Funny River Road MP 5 - Friction Overview

Funny River Road has lost moderate friction, but did not lose a large amount between testing in 2018 and 2019. None of the four tests in 2019 were less than typical pavement value of 0.48, with an average value of 0.67. The first picture below from 2019 does show visible wear in the wheelpaths into and out of curves. Areas in straightaways seemed to show less signs of visible wear, as shown in the second picture taken in 2019.

Average Friction Values				Values by Site	
2016	2017	2018	2019	Sites Less Control Value	Total Sites
1.1	0.85	0.695	0.67	0	4



Site 3 – Photo Log

2016, Test 1

2016, Test 1

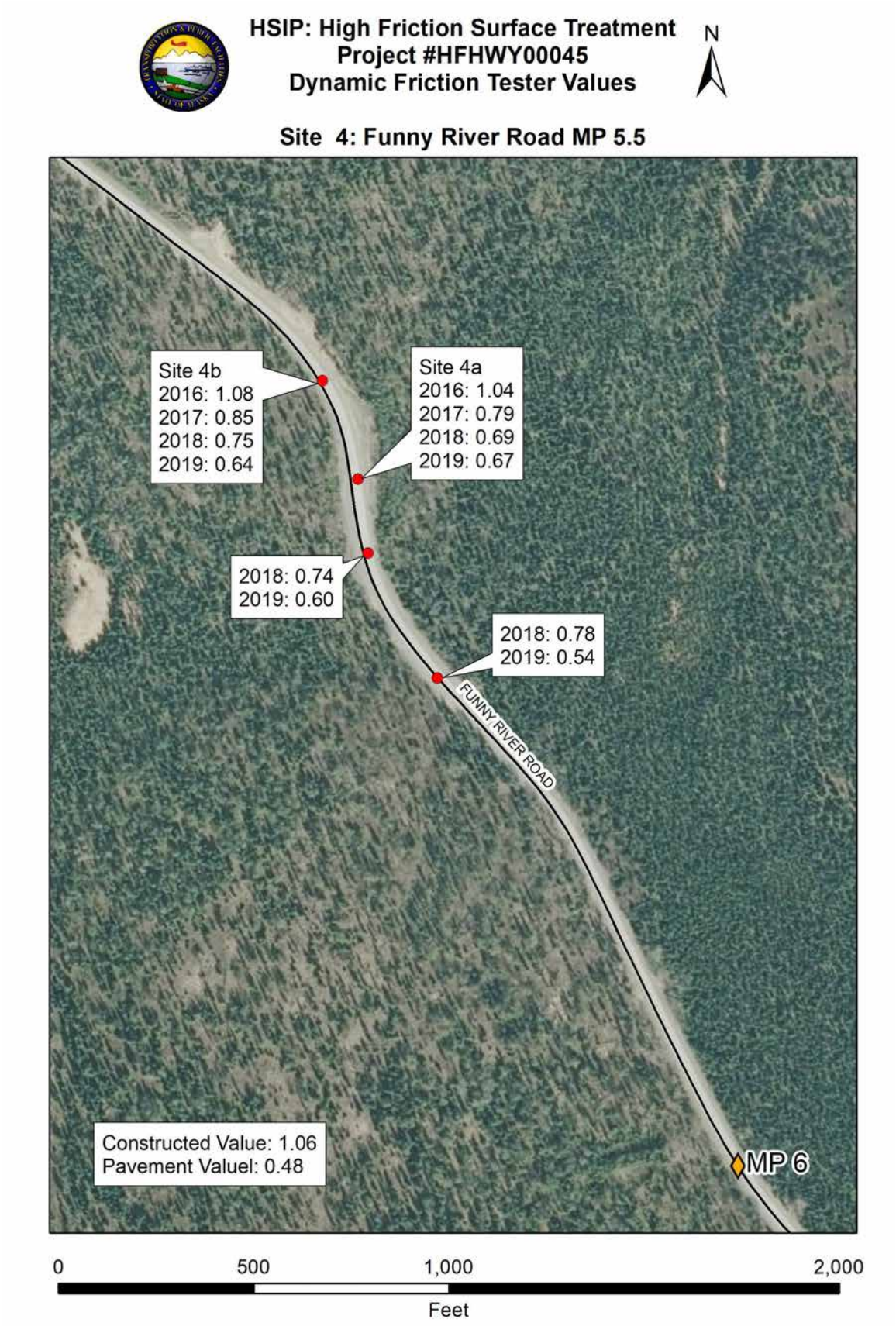
2017

2017

2018

2018

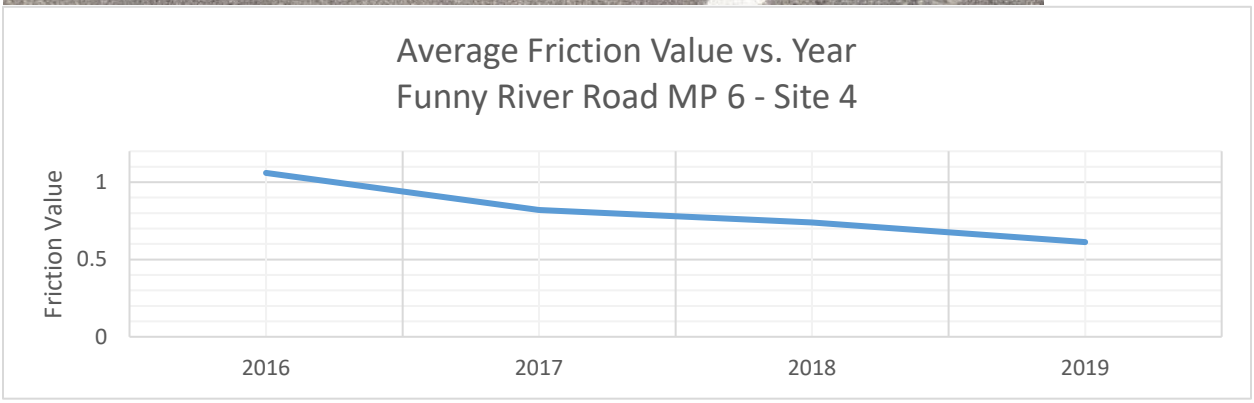
2018


HSIP: High Friction Surface Treatment
Project #HFHWY00045
Dynamic Friction Tester Values
N
Site 4: Funny River Road MP 5.5
Site 4b
2016: 1.08
2017: 0.85
2018: 0.75
2019: 0.64
Site 4a
2016: 1.04
2017: 0.79
2018: 0.69
2019: 0.67
2018: 0.74
2019: 0.60
2018: 0.78
2019: 0.54
FUNNY RIVER ROAD
Constructed Value: 1.06
Pavement Valuel: 0.48
MP 6
0
500
1,000
2,000
Feet

Site 4 – Funny River Road MP 5.5 - Friction Overview

Funny River Road has lost moderate friction, but did not lose a large amount between testing in 2018 and 2019. None of the four tests in 2019 were less than typical pavement value of 0.48, with an average value of 0.61. The picture below shows slight wear in the wheelpaths, and as at Site 3 on Funny River more wear was evident into and out of curves.

Average Friction Values				Values by Site	
2016	2017	2018	2019	Sites Less Control Value	Total Sites
1.06	0.82	0.74	0.61	0	4



Site 4 – Photo Log

2017

2017

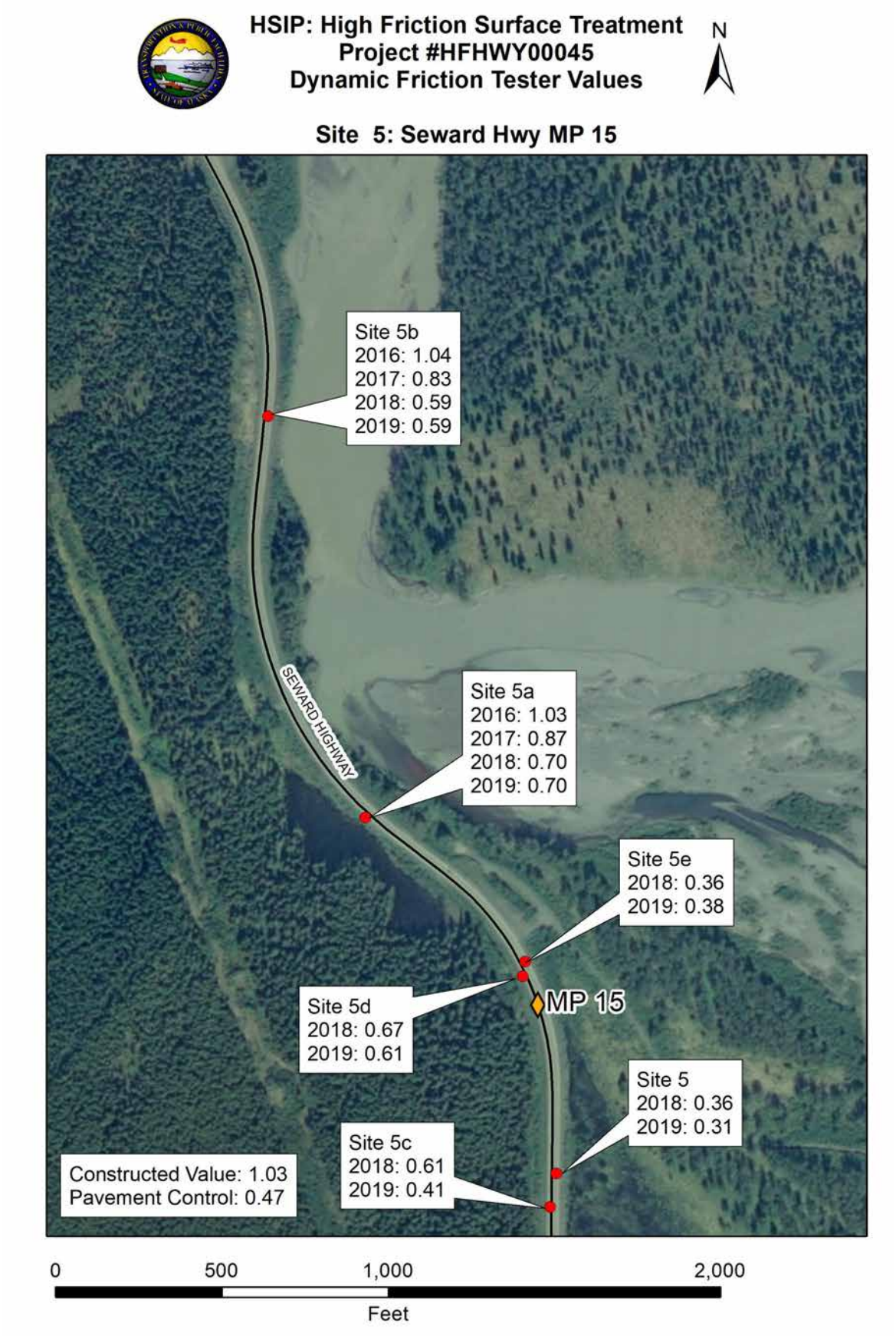
2017

2018

2018

2018

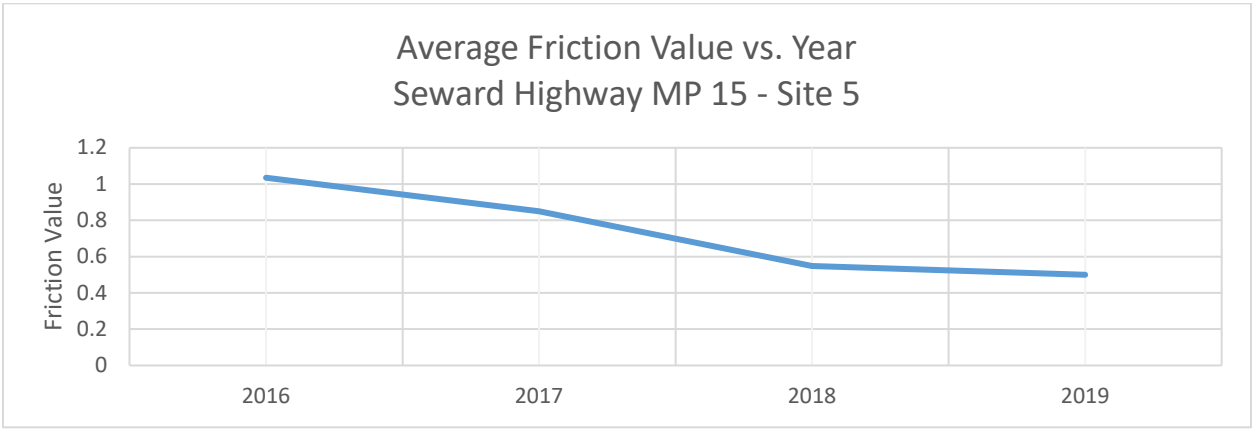
2019


HSIP: High Friction Surface Treatment
Project #HFHWY00045
Dynamic Friction Tester Values
N
Site 5: Seward Hwy MP 15
Site 5b
2016: 1.04
2017: 0.83
2018: 0.59
2019: 0.59
SEWARD HIGHWAY
Site 5a
2016: 1.03
2017: 0.87
2018: 0.70
2019: 0.70
Site 5e
2018: 0.36
2019: 0.38
MP 15
Site 5d
2018: 0.67
2019: 0.61
Site 5
2018: 0.36
2019: 0.31
Site 5c
2018: 0.61
2019: 0.41
Constructed Value: 1.03
Pavement Control: 0.47
0
500
1,000
2,000
Feet

Site 5 – Seward Highway MP 15 - Friction Overview

Seward Highway at milepost 15 has lost moderate friction overall, but significant friction at specific locations. Three of the six tests in 2019 were less than typical pavement value of 0.48, with an average value of 0.50. The picture from 2019 below shows wearin the wheelpaths going into and out of a curve.

Average Friction Values				Values by Site	
2016	2017	2018	2019	Sites Less Control Value	Total Sites
1.03	0.85	0.55	0.5	3	6



Site 5 – Photo Log

2017

2017

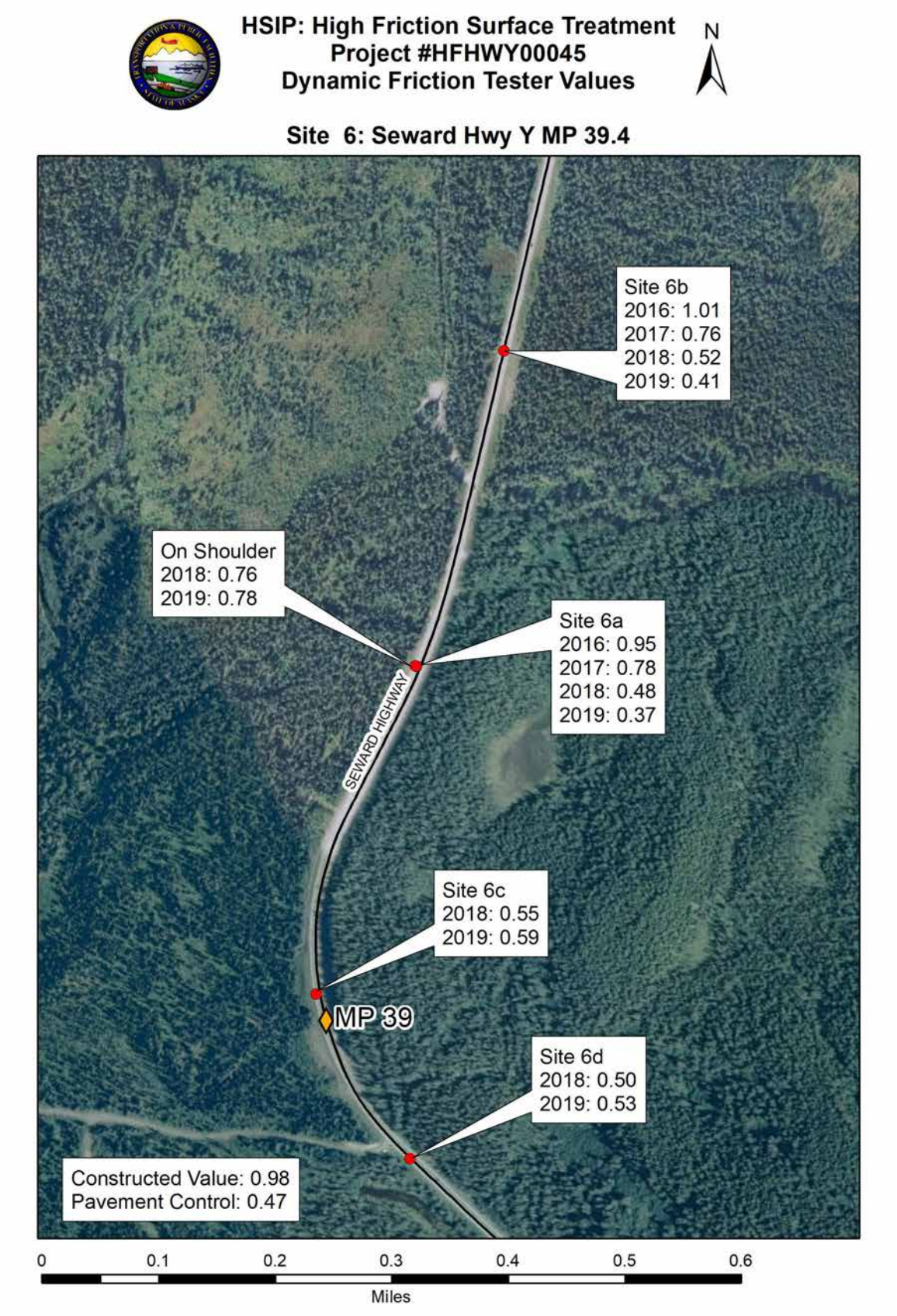
2017

2018

2018

2018

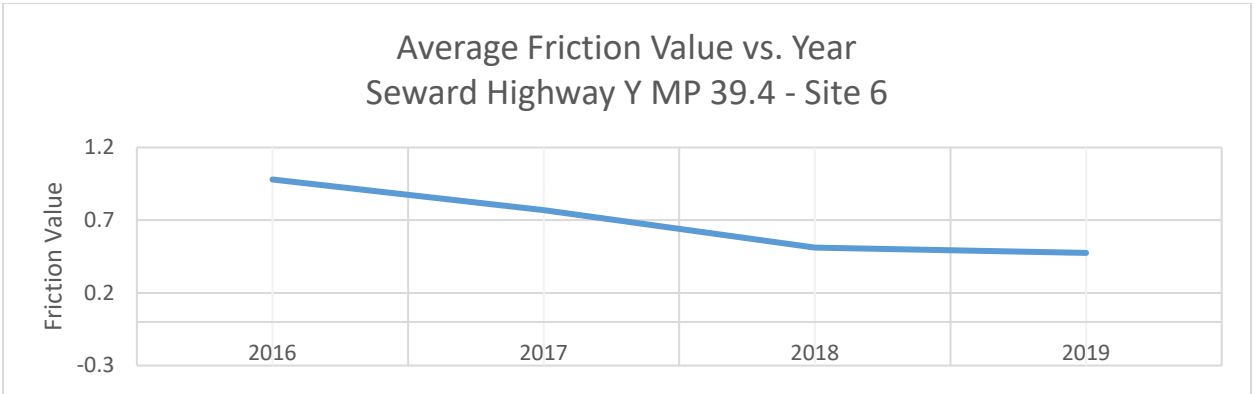
2019


HSIP: High Friction Surface Treatment
Project #HFHWY00045
Dynamic Friction Tester Values
N
Site 6: Seward Hwy Y MP 39.4
Site 6b
2016: 1.01
2017: 0.76
2018: 0.52
2019: 0.41
On Shoulder
2018: 0.76
2019: 0.78
Site 6a
2016: 0.95
2017: 0.78
2018: 0.48
2019: 0.37
SEWARD HIGHWAY
Site 6c
2018: 0.55
2019: 0.59
MP 39
Site 6d
2018: 0.50
2019: 0.53
Constructed Value: 0.98
Pavement Control: 0.47
0
0.1
0.2
0.3
0.4
0.5
0.6
Miles

Site 6 – Friction Overview

Seward Highway at milepost 39.4 has lost moderate friction overall, but significant friction at specific locations. The tests on the shoulder indicate that substantial friction is lost from snowplowing operations. Two of the five tests in 2019 were less than typical pavement value of 0.47, with an average value of 0.48. The picture from 2019 below shows areas of bare pavement in the wheelpaths.

Average Friction Values				Values by Site	
2016	2017	2018	2019	Sites Less Control Value	Total Sites
0.98	0.77	0.51	0.48	2	5



Site 6 – Photo Log

2017

2017

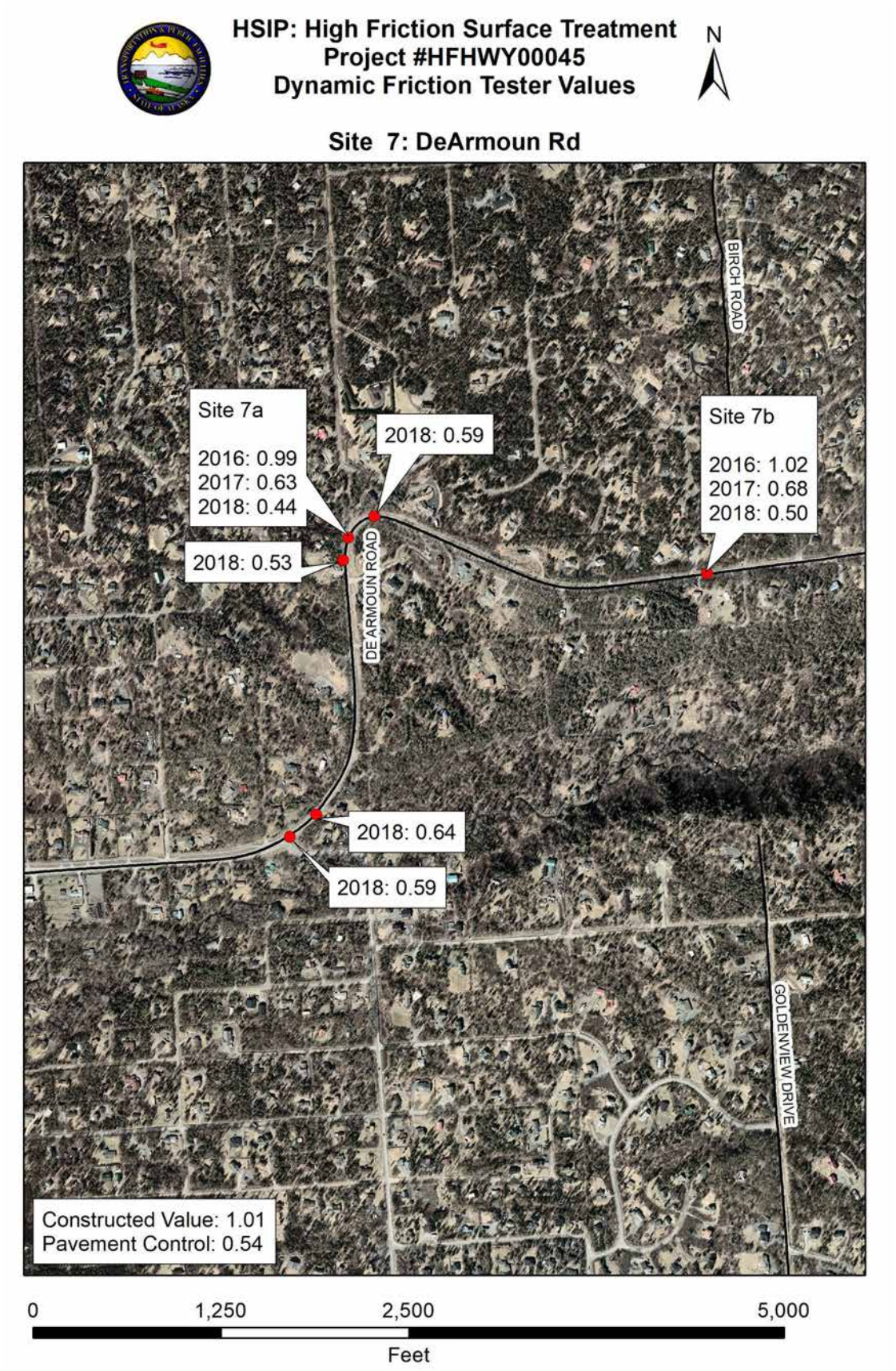
2017

2018

2018

2018

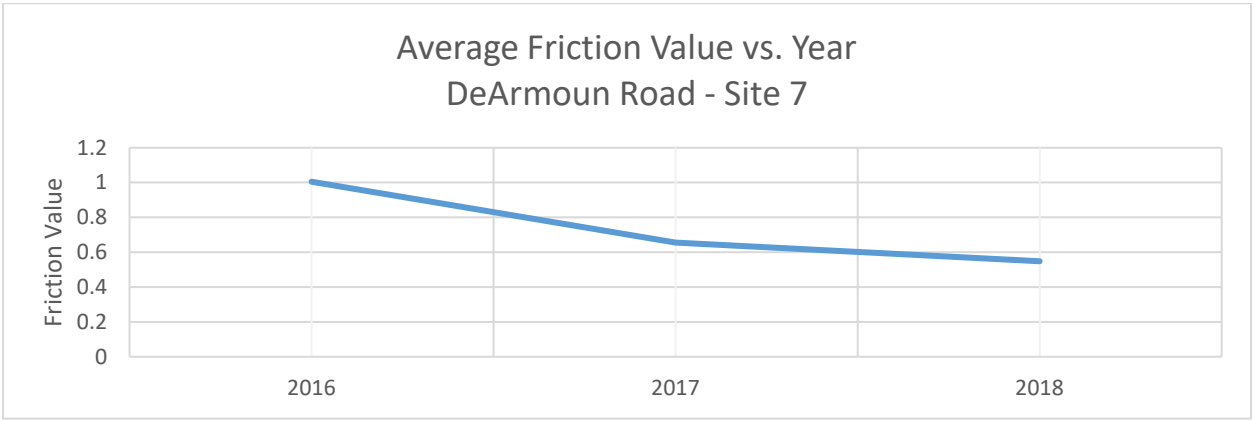
2019


HSIP: High Friction Surface Treatment
Project #HFHWY00045
Dynamic Friction Tester Values
N
Site 7: DeArmoun Rd
BIRCH ROAD
Site 7a
2016: 0.99
2017: 0.63
2018: 0.44
2018: 0.59
Site 7b
2016: 1.02
2017: 0.68
2018: 0.50
2018: 0.53
DE ARMOUN ROAD
2018: 0.64
2018: 0.59
GOLDENVIEW DRIVE
Constructed Value: 1.01
Pavement Control: 0.54
0
1,250
2,500
5,000
Feet

Site 7 – DeArmoun Road - Friction Overview

DeArmoun Road lost moderate friction overall. While the friction drop between 2017 and 2018 was not major three of the six tests in 2018 were less than typical pavement value of 0.54, with an average value of 0.55. Bare pavement was visible at locations as can be seen in the 2018 photo, below.

Average Friction Values				Values by Site	
2016	2017	2018	2019	Sites Less Control Value	Total Sites
1.005	0.655	0.55	N/A	3	6



Site 7 – Photo Log

2017

2017

2017

2018

2018

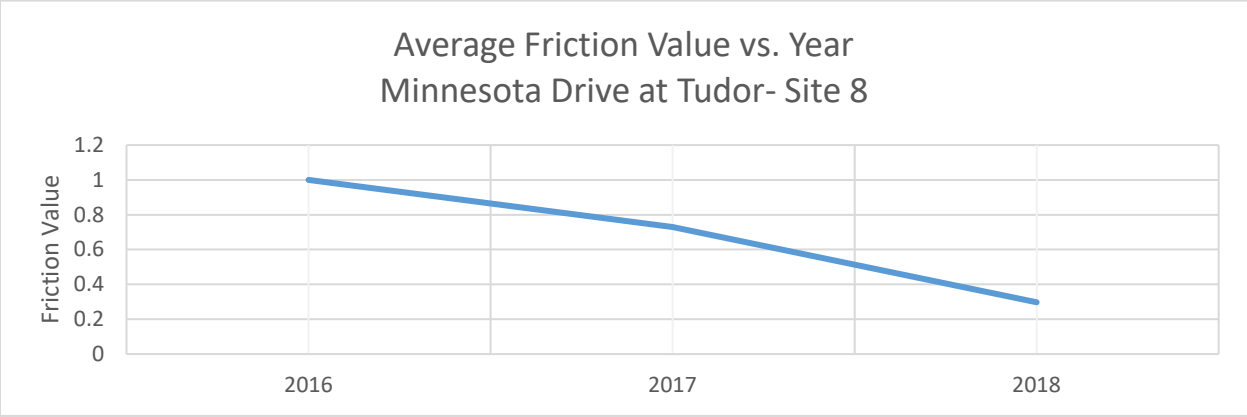
2018


HSIP: High Friction Surface Treatment
Project #HFHWY00045
Dynamic Friction Tester Values
N
Site 8: Minnesota Dr @ Tudor Rd
TUDOR ROAD
LOIS DRIVE
MINNESOTA DRIVE SB
MINNESOTA DRIVE
2018: 0.34
Site 8d
2016: 1.02
2017: 0.85
2018: 0.38
2018: 0.23
Site 8b
2016: 0.99
2017: 0.73
2018: 0.33
2018: 0.29
Constructed Value: 1.0
Pavement Control: 0.60
0
0.2
0.4
Miles

Site 8 – Minnesota Drive at Tudor - Friction Overview

Minnesota Drive at Tudor lost significant friction. The friction drop between 2017 and 2018 was major and all four tests in 2018 were less than typical pavement value of 0.60, with an average value of 0.30. As can be seen in the 2018 photo, below, all wheelpaths show wear and show large amounts of bare pavement.

Average Friction Values				Values by Site	
2016	2017	2018	2019	Sites Less Control Value	Total Sites
1	0.73	0.30	N/A	4	4



Site 8 – Photo Log

2016, Control

2016, Test 3

2016, Test 3

2017

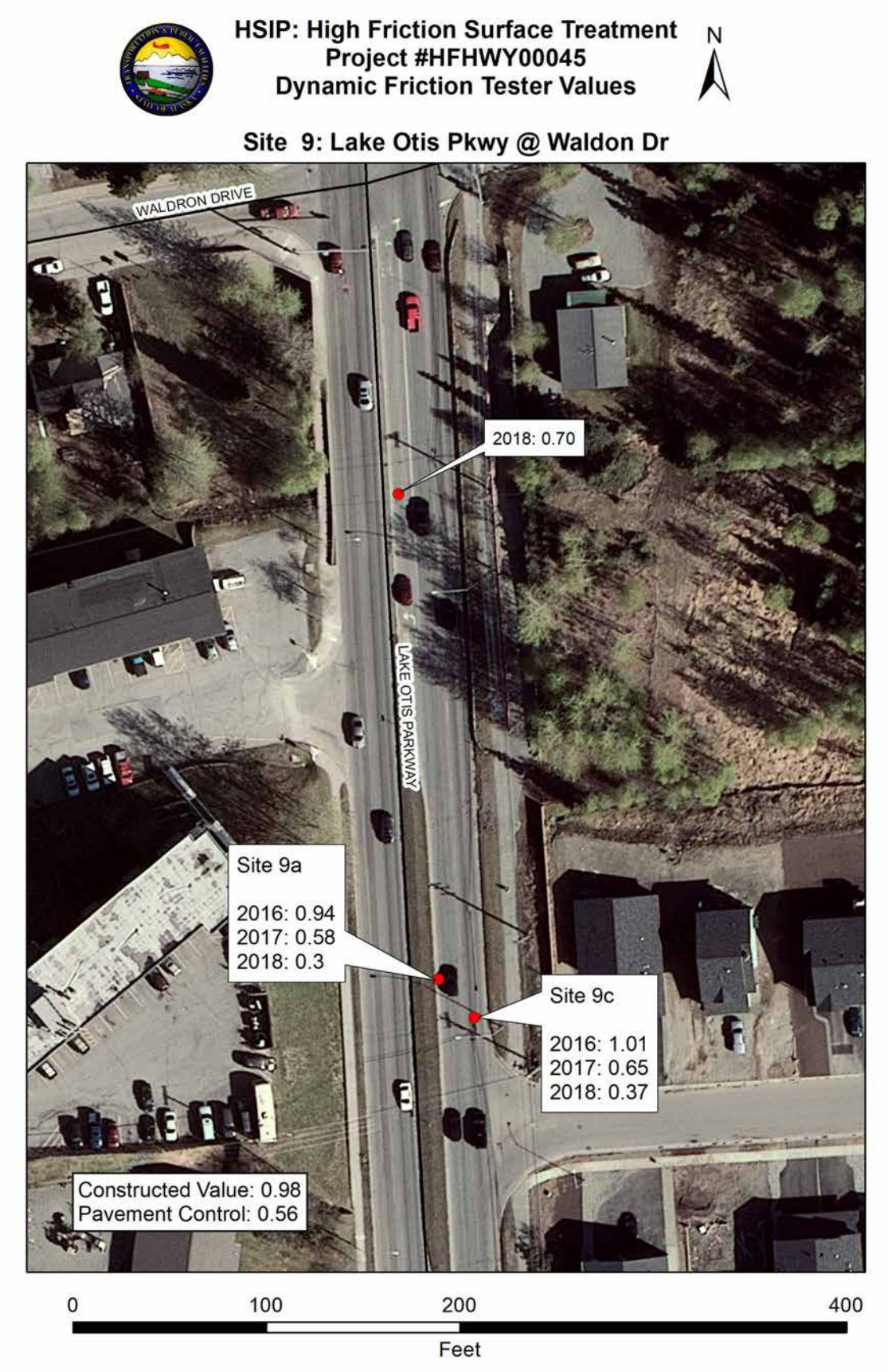
2017

2017

2018

2018

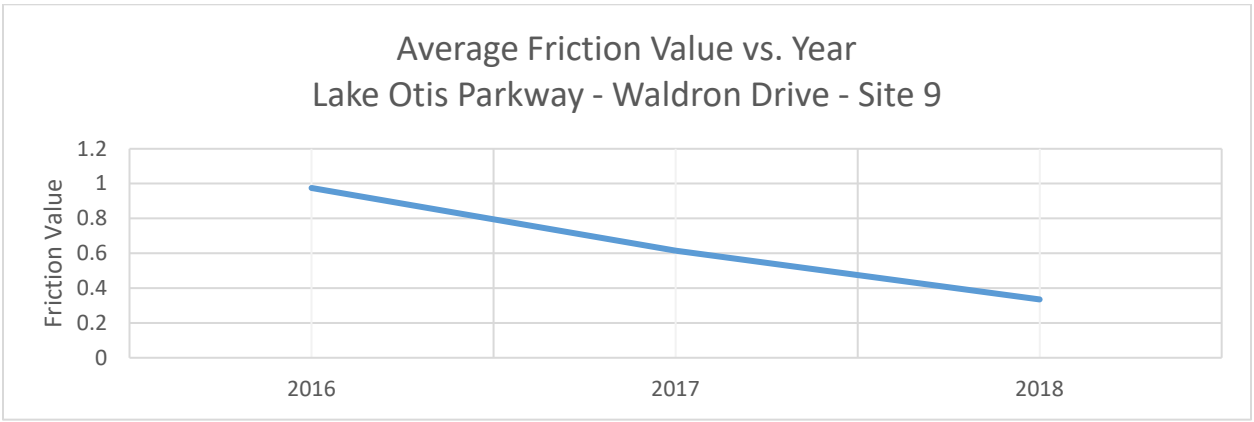
2018


HSIP: High Friction Surface Treatment
Project #HFHWY00045
Dynamic Friction Tester Values
N
Site 9: Lake Otis Pkwy @ Waldon Dr
WALDRON DRIVE
LAKE OTIS PARKWAY
2018: 0.70
Site 9a
2016: 0.94
2017: 0.58
2018: 0.3
Site 9c
2016: 1.01
2017: 0.65
2018: 0.37
Constructed Value: 0.98
Pavement Control: 0.56
0
100
200
400
Feet

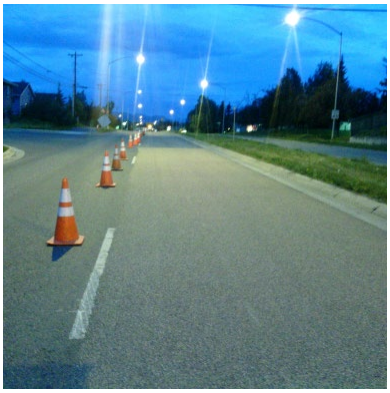
Site 9 – Lake Otis Parkway at Waldron Drive - Friction Overview

Lake Otis at Waldron lost significant friction. The friction drop between 2017 and 2018 was major and the two tests in the through lanes in 2018 were less than typical pavement value of 0.56, with an average value of 0.34. As can be seen in the 2018 photo, below, all wheelpaths show significant wear. The third test performed in 2018 was in the turn pocket, and that data can be seen at the end of the appendix summarized with other turn pocket data.

Average Friction Values				Values by Site	
2016	2017	2018	2019	Sites Less Control Value	Total Sites
0.98	0.62	0.34	N/A	2	2



Site 9 – Photo Log



2016, Test 1

2016, Test 1

2016, Test 1

2017

2017

2018

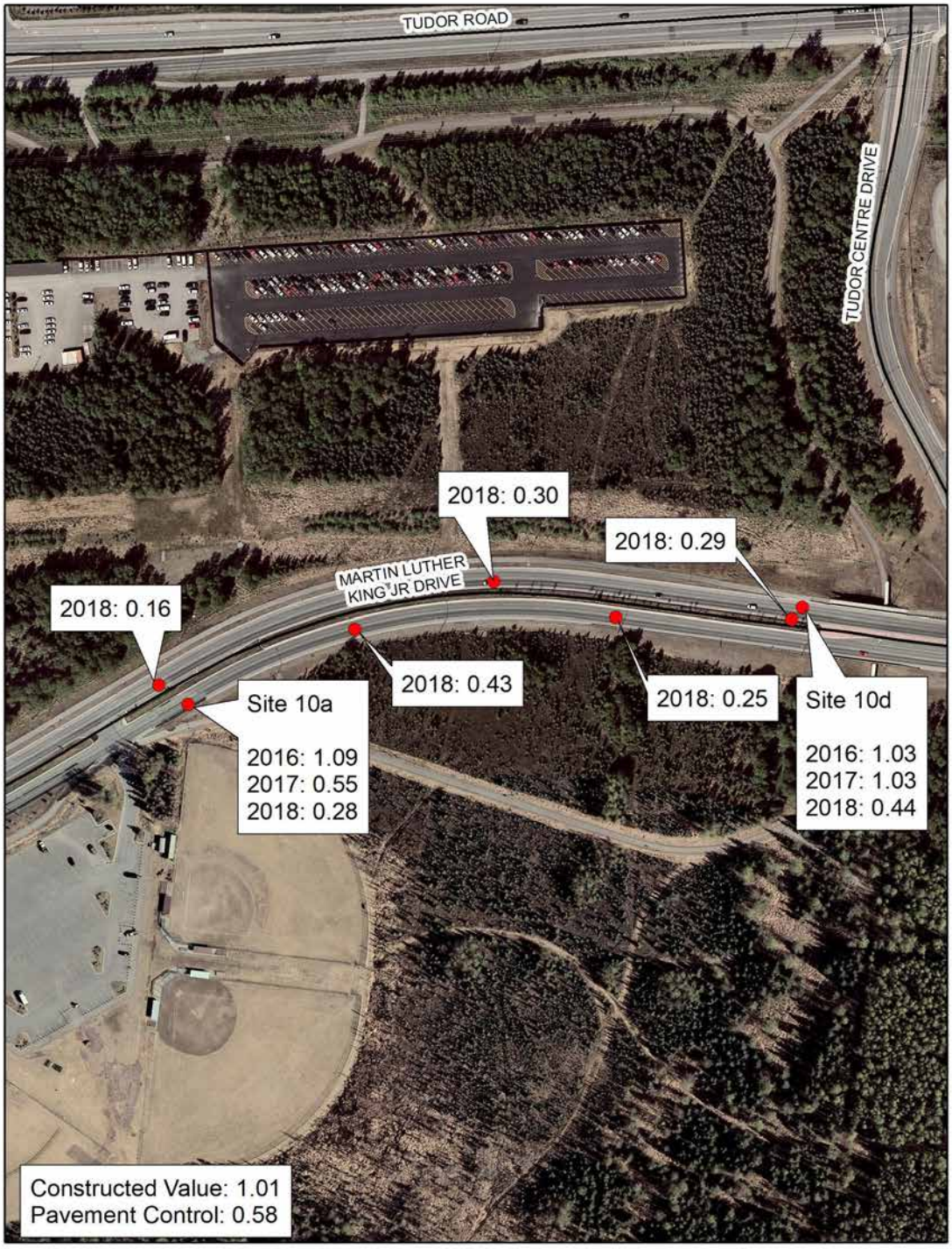
2018

2018

HSIP: High Friction Surface Treatment
Project #HFHWY00045
Dynamic Friction Tester Values

N

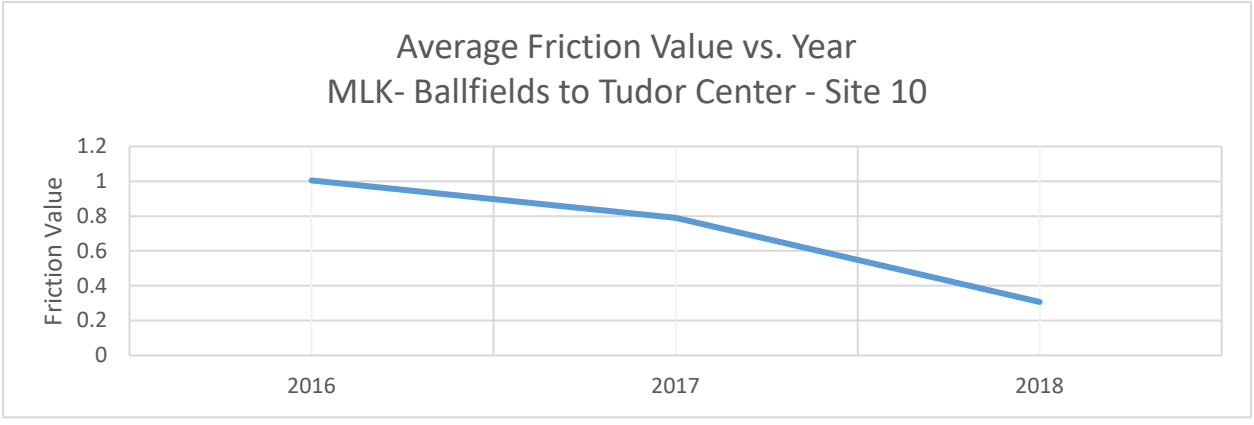
Site 10: MLK Ballfields to Tudor Ctr Dr



Site 10 – Martin Luther King Ballfields to Tudor Center - Friction Overview

Martin Luther King showed major friction loss in all tests. The friction drop between 2017 and 2018 was significant and all seven tests were less than typical pavement value of 0.58, with an average value of 0.31. As can be seen in the 2018 photo, below, the wheelpaths in the left hand lane show significant wear, while less wear is evident in the right hand lane. The majority of traffic travels in the left lane on this road.

Average Friction Values				Values by Site	
2016	2017	2018	2019	Sites Less Control Value	Total Sites
1.005	0.79	0.31	N/A	7	7



Site 10 – Photo Log

2016, Test 2

2016, Test 2

2016, Test 2

2017

2017

2017

2018

2018

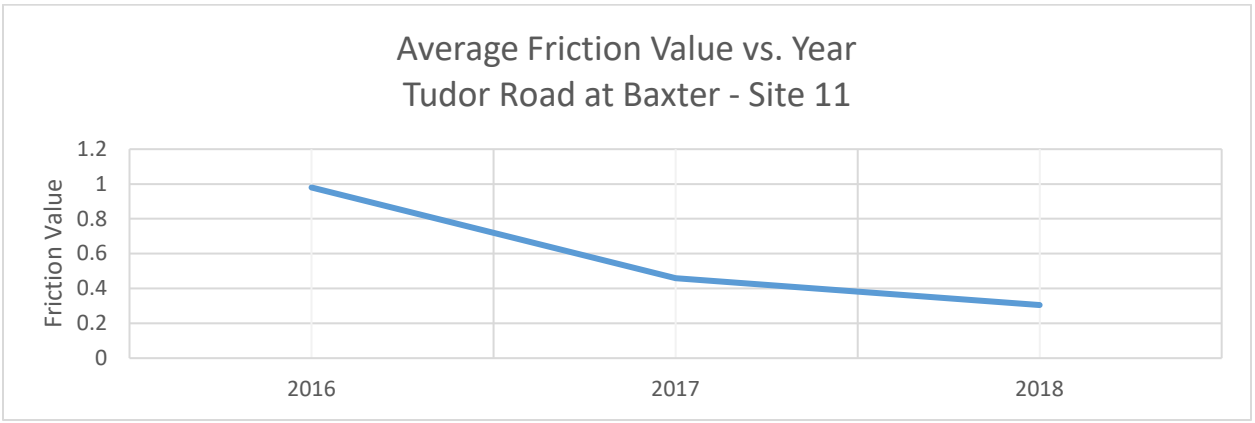
2018


HSIP: High Friction Surface Treatment
Project #HFHWY00045
Dynamic Friction Tester Values
N
Site 11: Tudor Rd @ Baxter Rd
BAXTER ROAD
TUDOR ROAD
CAMPBELL AIRSTRIP ROAD
Site 11a
2016: 0.99
2017: 0.42
2018: 0.32
2018: 0.65
Site 11c
2016: 0.97
2017: 0.5
2018: 0.29
Constructed Value: 0.98
Pavement Control: 0.58
0
200
400
800
Feet

Site 11 – Tudor Road at Baxter - Friction Overview

Tudor Road showed major friction loss in all tests. The friction drop between 2017 and 2018 was significant and both tests were less than typical pavement value of 0.58, with an average value of 0.31. As can be seen in the 2018 photo, below, the turn pocket shows minimal wear while the wheelpaths in the the through lanes show visible pavement and substantial wear. The third test performed in 2018 was in the turn pocket, and that data can be seen at the end of the appendix summarized with other turn pocket data.

Average Friction Values				Values by Site	
2016	2017	2018	2019	Sites Less Control Value	Total Sites
0.98	0.46	0.305	N/A	2	2



Site 11 – Photo Log

2016, Control

2016, Test 2

2017

2017

2017

2018

HSIP: High Friction Surface Treatment
Project #HFHWY00045
Dynamic Friction Tester Values

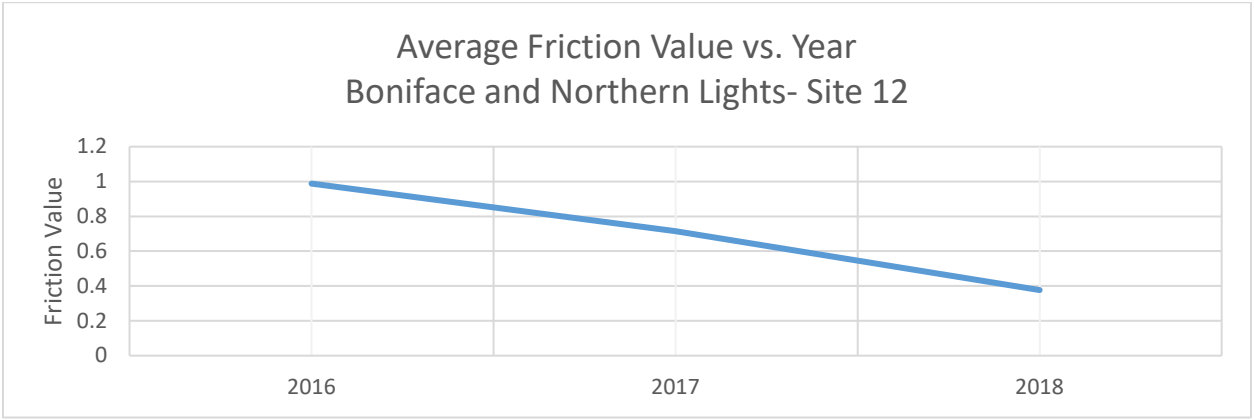
N

Site 12: Boniface Pkwy and Northern Lights Blvd

Site 12 – Boniface and Northern Lights - Friction Overview

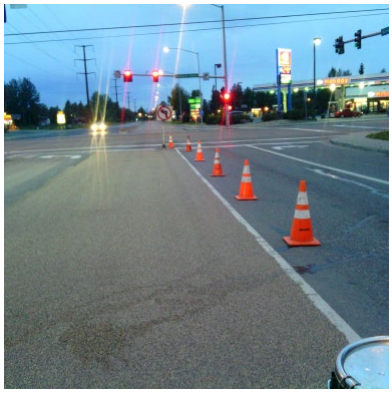
Boniface and Northern Lights showed major friction loss in all tests. The friction drop between 2017 and 2018 was significant and all six tests were less than typical pavement value of 0.60, with an average value of 0.38. Through lanes showed wear with visible pavement in areas. Turn pocket testing can be found at the end of the appendix summarized with other turn pocket data.

Average Friction Values				Values by Site	
2016	2017	2018	2019	Sites Less Control Value	Total Sites
0.99	0.72	0.38	N/A	6	6



Site 12 – Photo Log

2016, Test 1



2016, Test 1

2016, Test 4

2017

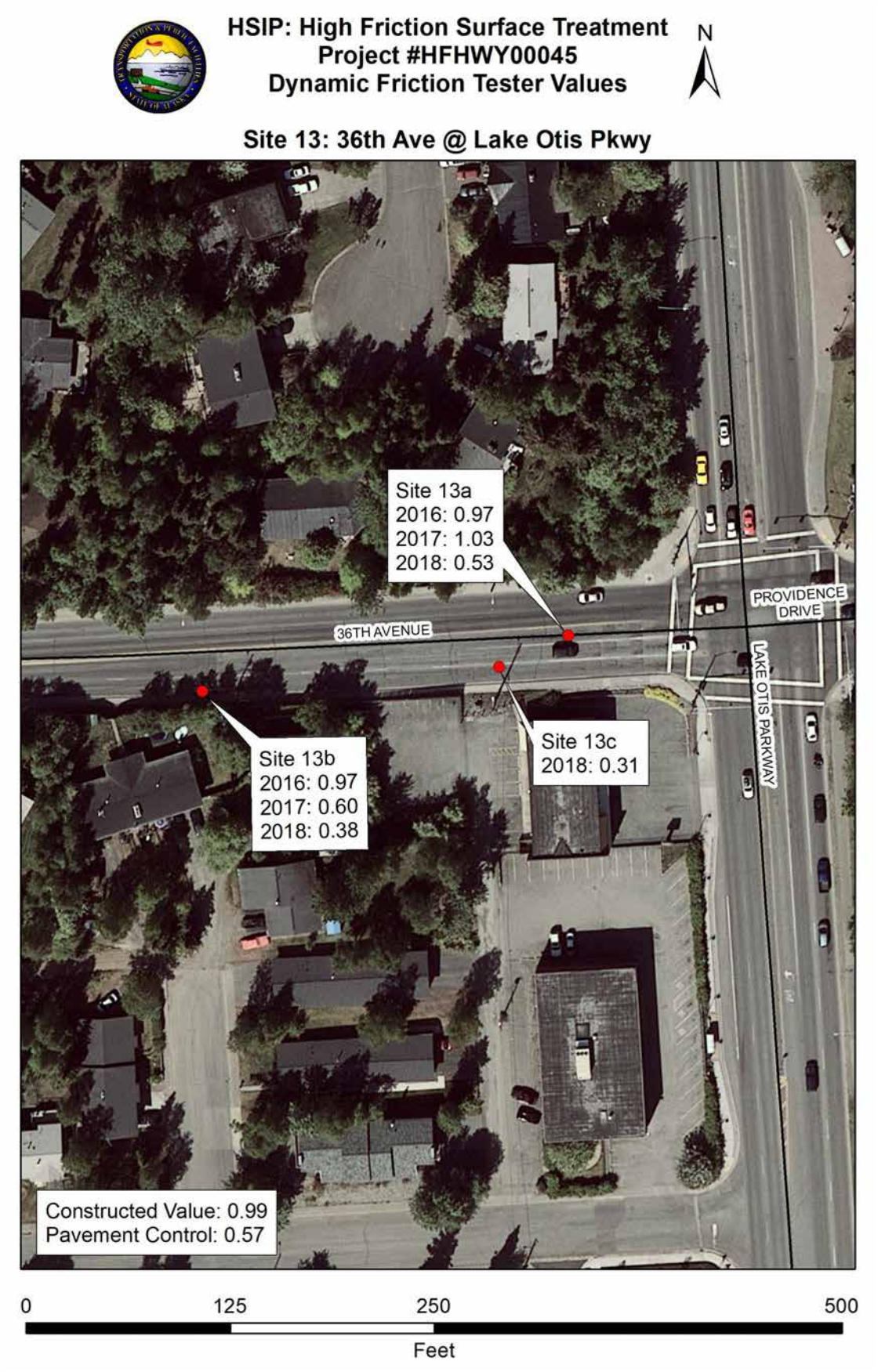
2017

2017

2018

2018

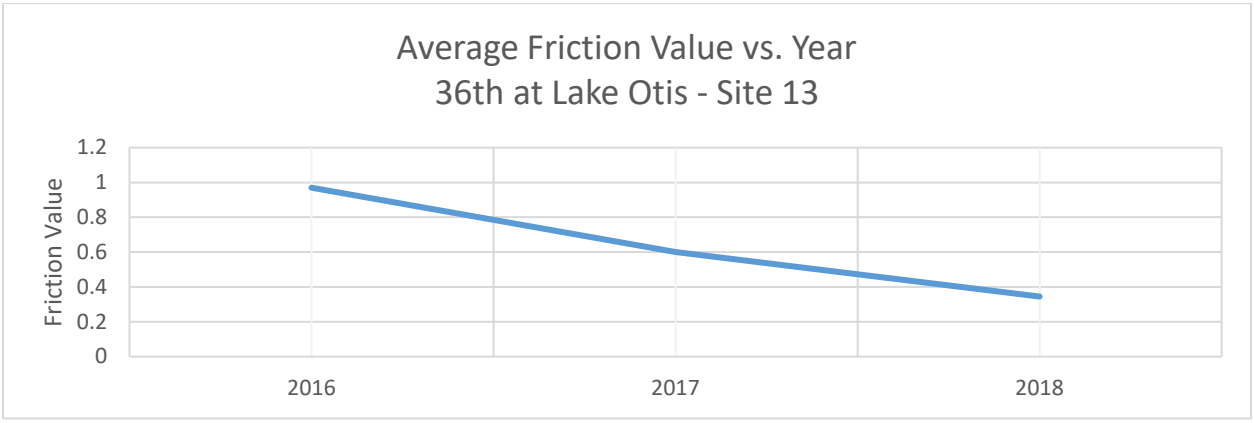
2018


HSIP: High Friction Surface Treatment
Project #HFHWY00045
Dynamic Friction Tester Values
N
Site 13: 36th Ave @ Lake Otis Pkwy
Site 13a
2016: 0.97
2017: 1.03
2018: 0.53
Site 13b
2016: 0.97
2017: 0.60
2018: 0.38
Site 13c
2018: 0.31
36TH AVENUE
PROVIDENCE DRIVE
LAKE OTIS PARKWAY
Constructed Value: 0.99
Pavement Control: 0.57
0
125
250
500
Feet

Site 13 – 36th Avenue at Lake Otis - Friction Overview

36th at Lake Otis showed major friction loss in all tests. The friction drop between 2017 and 2018 was significant and both tests in through lanes were less than the pavement control value of 0.57, with an average value of 0.35. Through lanes showed wear with visible pavement in areas. While the turn pocket showed major wear no pavement was visible. Turn pocket testing can be found at the end of the appendix summarized with other turn pocket data.

Average Friction Values				Values by Site	
2016	2017	2018	2019	Sites Less Control Value	Total Sites
0.97	0.6	0.35	N/A	2	2



Site 13 – Photo Log

2016, Test 1

2016, Test 1

2016, Test 2

2017

2017

2017

2018

2018

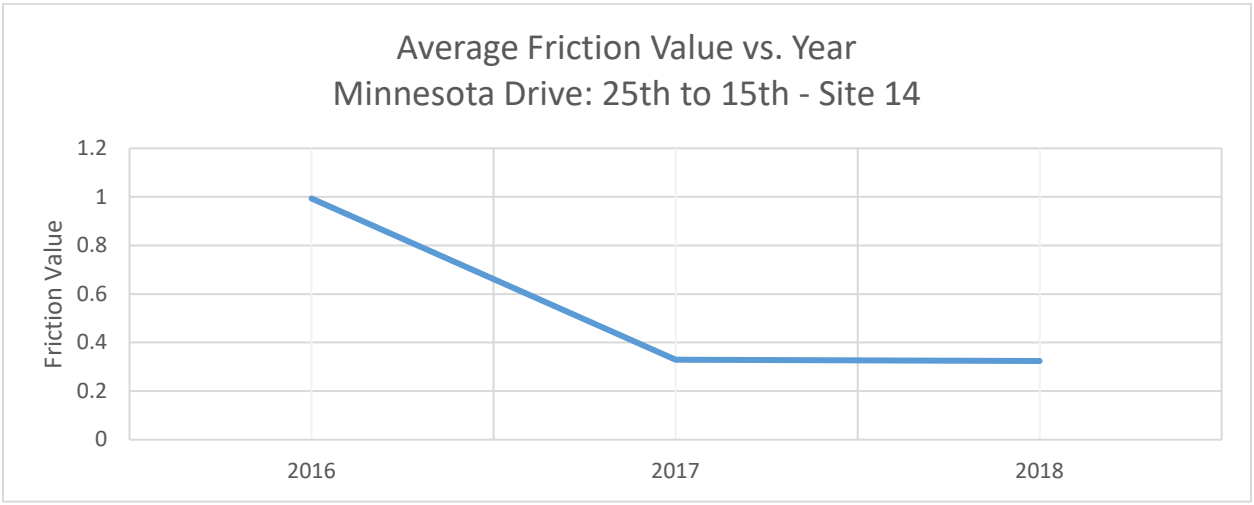
2018


HSIP: High Friction Surface Treatment
Project #HFHWY00045
Dynamic Friction Tester Values
N
Site 14: Minnesota Dr: 25th to 15th
13TH AVENUE
L STREET
I STREET
W 15TH AVENUE
15TH - MINNESOTA SB CONNECTOR
15TH AVENUE
Site 14c
2018: 0.44
17TH AVENUE
Site 14b
2016: 1.02
2017: 0.26
2018: 0.36
Site 14e
2018: 0.29
MINNESOTA SB - HILLCREST RD RAMP
MINNESOTA DRIVE
MINNESOTA DRIVE SB
Site 14d
2016: 1.03
2017: 0.40
2018: 0.30
HILLCREST DRIVE
Site 14a
2018: 0.23
SPENARD ROAD
ARCTIC BOULEVARD
FIREWEED LANE
Constructed Value: 0.99
Pavement Control: 0.58
0
1,000
2,000
4,000
Feet

Site 14 – Minnesota Drive 25th to 15th - Friction Overview

Minnesota Drive showed major friction loss in all tests. All five tests had less friction than the pavement control value of 0.58, with an average value of 0.32. Through lanes showed bare pavement as can be seen in the 2018 photo, below.

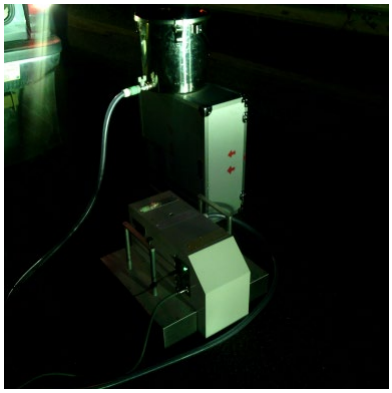
Average Friction Values				Values by Site	
2016	2017	2018	2019	Sites Less Control Value	Total Sites
0.99	0.33	0.32	N/A	5	5



Site 14 – Photo Log

2016, Test 2

2016, Test 3



2016, Test 3

2017

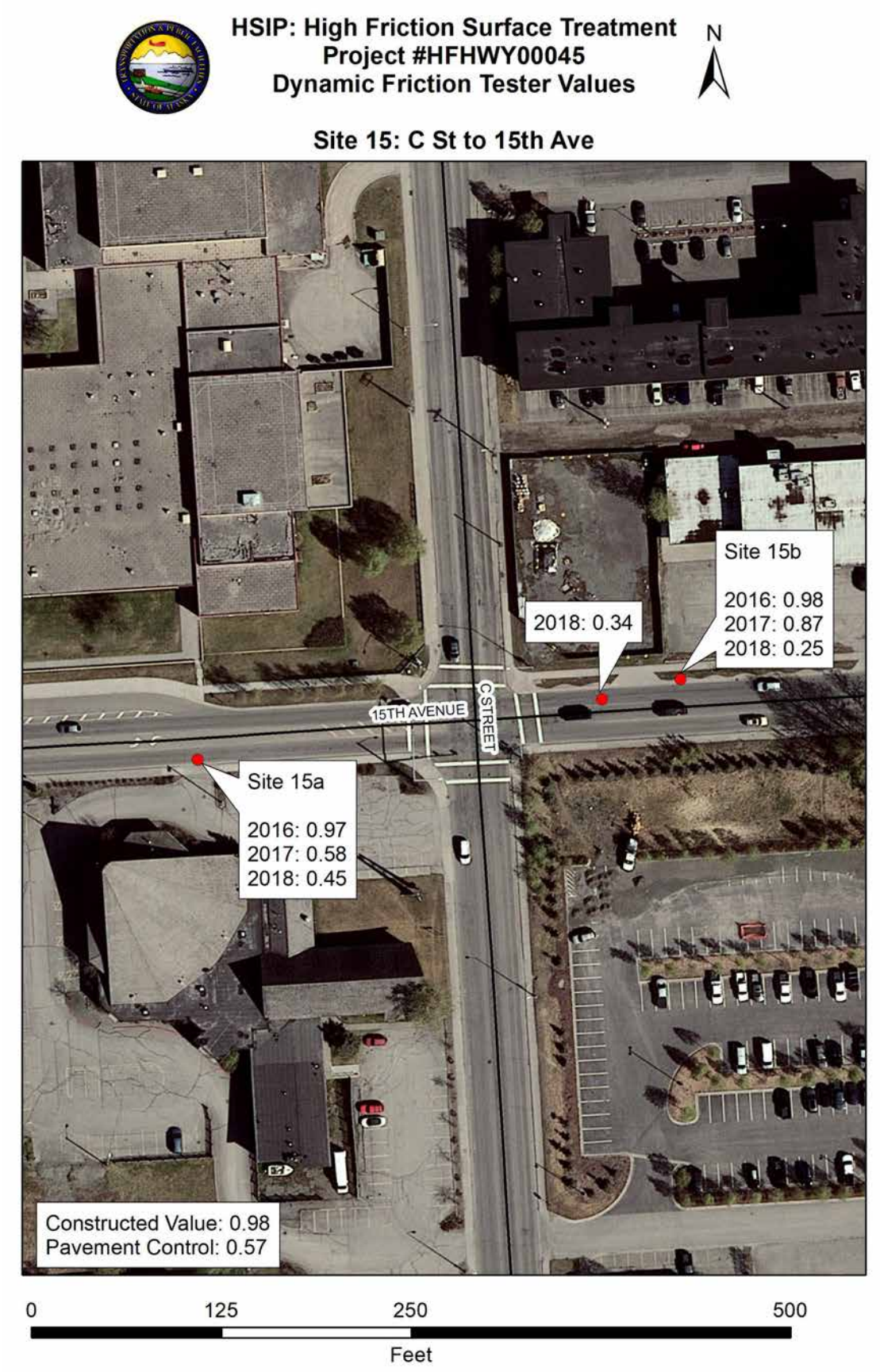
2017

2017

2018

2018

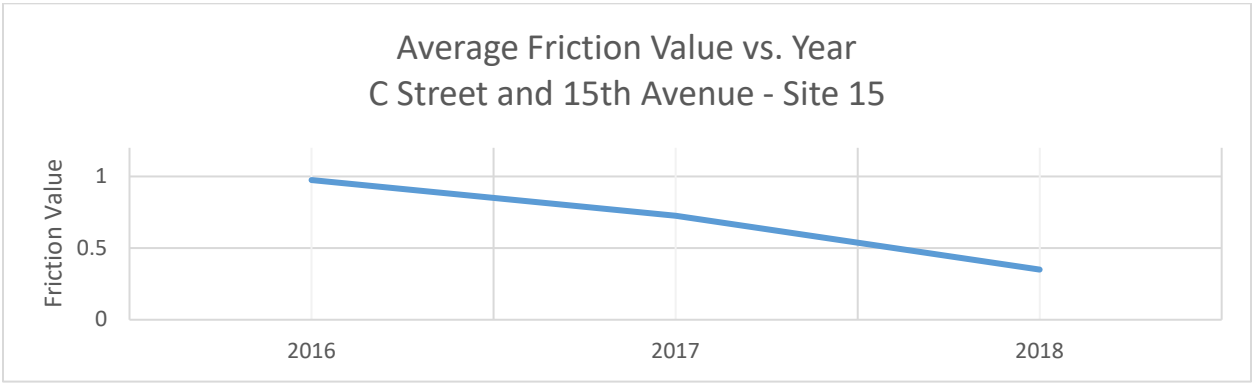
2018


HSIP: High Friction Surface Treatment
Project #HFHWY00045
Dynamic Friction Tester Values
N
Site 15: C St to 15th Ave
Site 15b
2016: 0.98
2017: 0.87
2018: 0.25
2018: 0.34
15TH AVENUE
C STREET
Site 15a
2016: 0.97
2017: 0.58
2018: 0.45
Constructed Value: 0.98
Pavement Control: 0.57
0
125
250
500
Feet

Site 15 – C Street and 15th Avenue - Friction Overview

C Street at 15th showed major friction loss in all tests. The friction drop between 2017 and 2018 was significant and both tests in through lanes had less friction than the pavement control value of 0.57, with an average value of 0.35. Through lanes showed bare pavement as can be seen in the 2018 photo, below. Turn pocket testing can be found at the end of the appendix.

Average Friction Values				Values by Site	
2016	2017	2018	2019	Sites Less Control Value	Total Sites
0.98	0.73	0.35	N/A	2	2

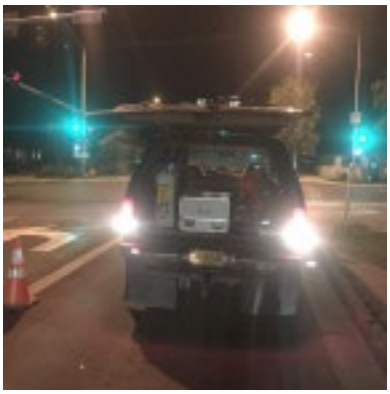


Section 15 – Photo Log

2016, Test 1

2016, Test 2

2016, Test 2



2017

2017

2017

2018

2018

2018

HSIP: High Friction Surface Treatment
Project #HFHWY00045
Dynamic Friction Tester Values

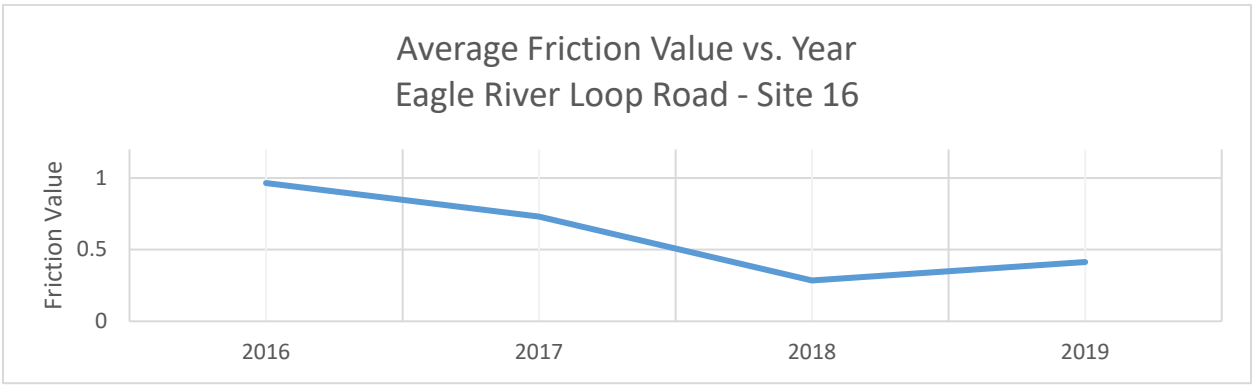
N

Site 16: Eagle River Lp Rd @ Baranof/Citation

Site 16 – Eagle River Loop - Friction Overview

Eagle River Loop Road showed significant friction loss. A third test was performed in through lanes in 2019 with a value of 0.73. This value remained higer than the other two performed in the through lanes closer to the intersection with 2019 values of 0.31 and 0.20. This higher value raised the average value in 2019. Major polishing of the HFST and bare pavement can be seen in the 2019 photo, below. Turn pocket testing can be found at the end of the appendix.

Average Friction Values				Values by Site	
2016	2017	2018	2019	Sites Less Control Value	Total Sites
0.97	0.73	0.29	0.41	2	3



Site 16 – Photo Log

2016

2016, Test 2

2017

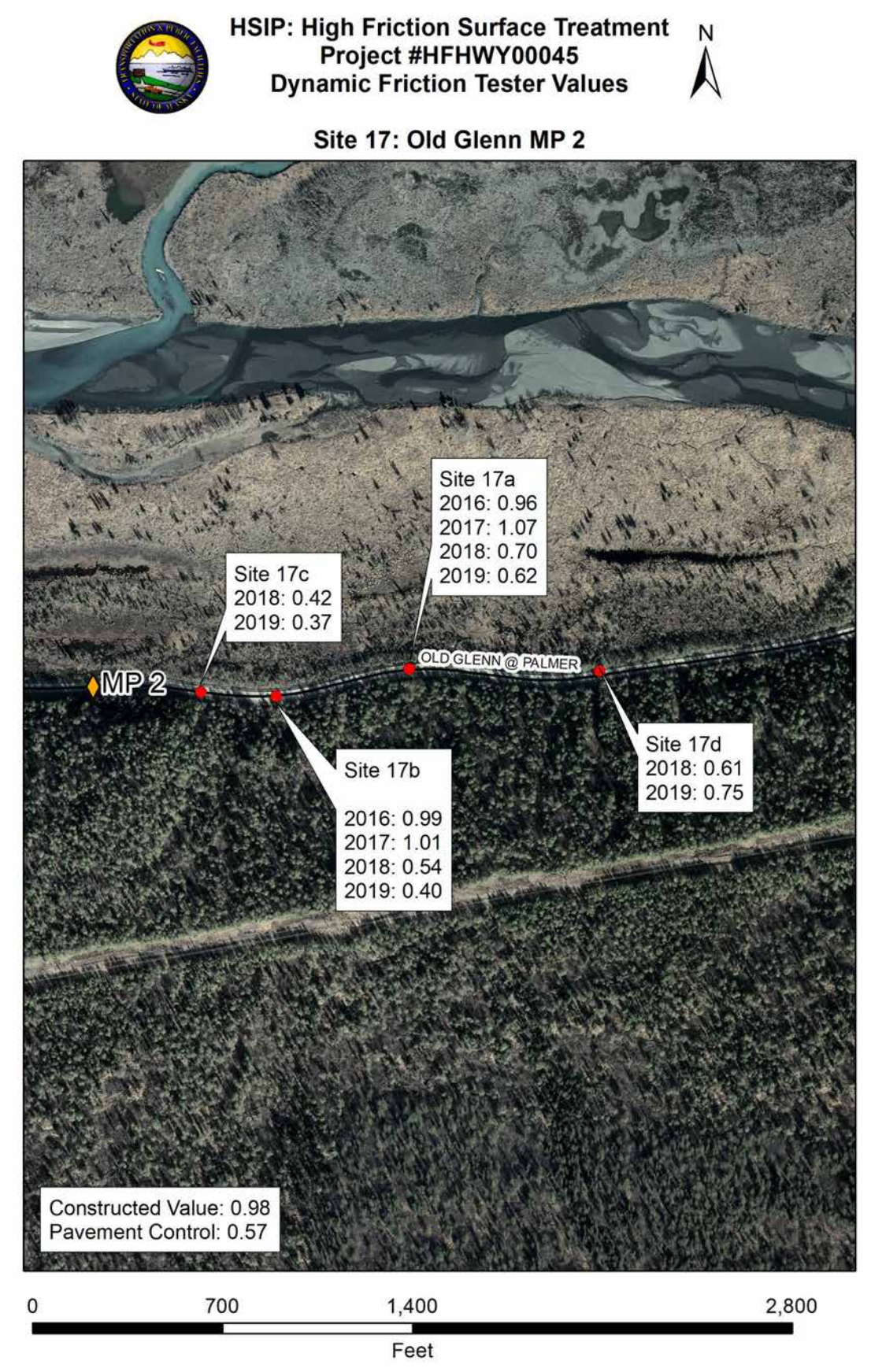
2017

2017

2018

2018

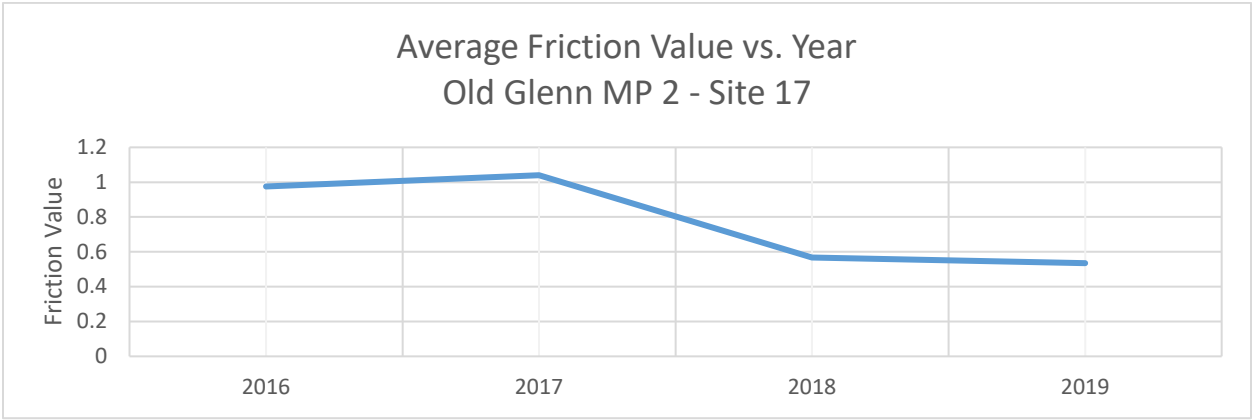
2018


HSIP: High Friction Surface Treatment
Project #HFHWY00045
Dynamic Friction Tester Values
N
Site 17: Old Glenn MP 2
Site 17a
2016: 0.96
2017: 1.07
2018: 0.70
2019: 0.62
Site 17c
2018: 0.42
2019: 0.37
OLD GLENN @ PALMER
MP 2
Site 17b
2016: 0.99
2017: 1.01
2018: 0.54
2019: 0.40
Site 17d
2018: 0.61
2019: 0.75
Constructed Value: 0.98
Pavement Control: 0.57
0
700
1,400
2,800
Feet

Site 17 – Old Glenn at Milepost 2 - Friction Overview

Old Glenn at MP 2 showed moderate friction loss, although not a major loss on average between 2018 and 2019. Two of the four tests had less friction than the original pavement control of 0.57, with an average of 0.54. Areas of bare pavement were visible from both studded tire wear in wheelpaths and areas where the pavement heaved in the winter and the HFST was bladed through, as can be seen in the 2019 photos, below.

Average Friction Values				Values by Site	
2016	2017	2018	2019	Sites Less Control Value	Total Sites
0.975	1.04	0.57	0.54	2	4



Site 17 – Photo Log

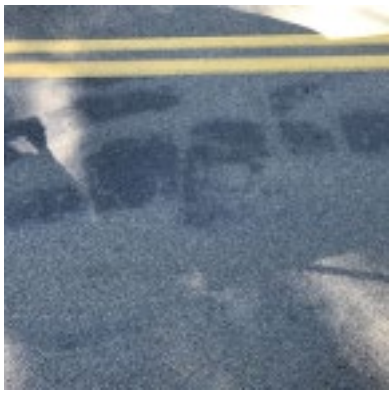
2016, Patch Test

2016, Patch Test

2016, Patch Test

2017

2017

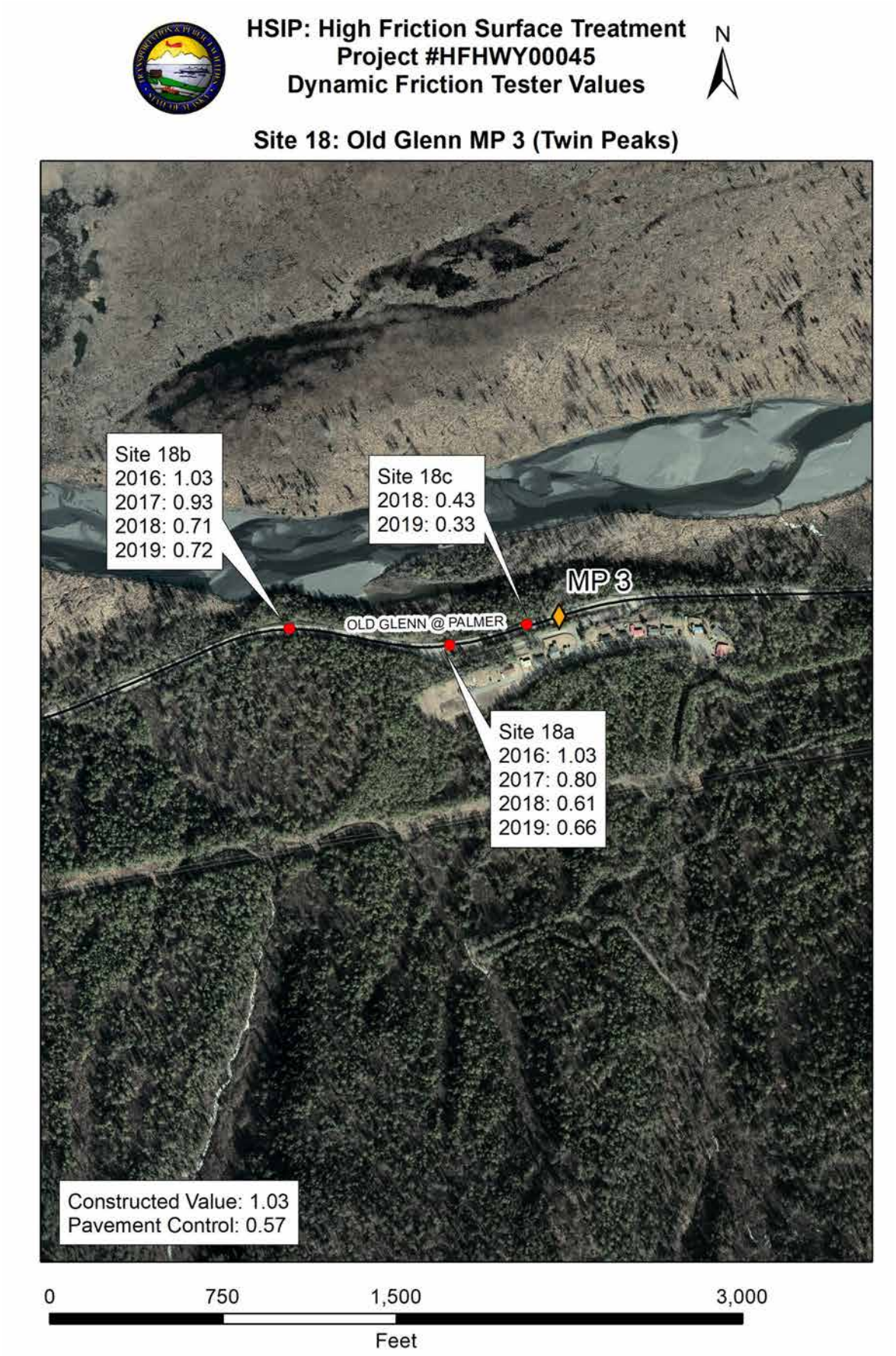


2017

2018

2018

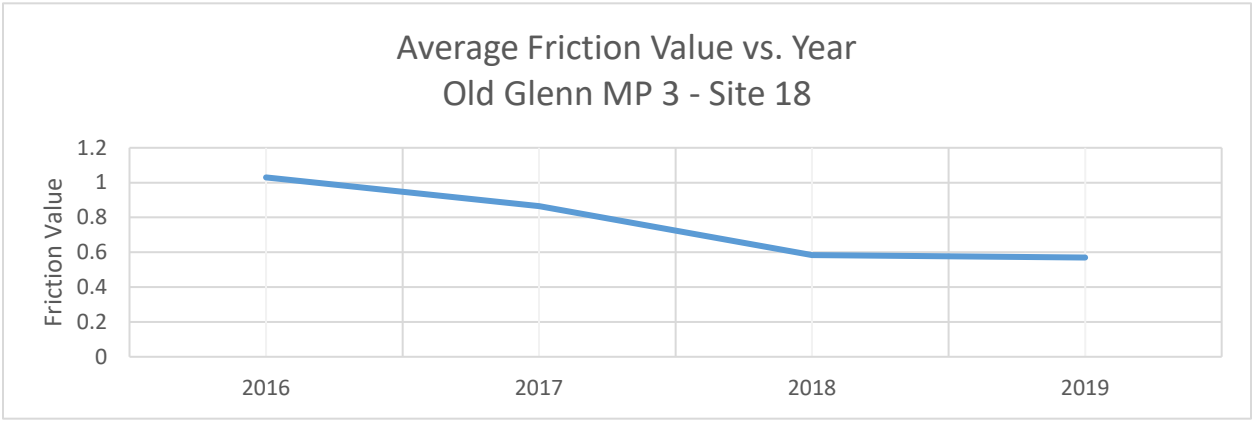
2018


HSIP: High Friction Surface Treatment
Project #HFHWY00045
Dynamic Friction Tester Values
N
Site 18: Old Glenn MP 3 (Twin Peaks)
Site 18b
2016: 1.03
2017: 0.93
2018: 0.71
2019: 0.72
Site 18c
2018: 0.43
2019: 0.33
MP 3
OLD GLENN @ PALMER
Site 18a
2016: 1.03
2017: 0.80
2018: 0.61
2019: 0.66
Constructed Value: 1.03
Pavement Control: 0.57
0
750
1,500
3,000
Feet

Site 18 – Old Glenn at Milepost 3 - Friction Overview

Old Glenn at MP 3 showed moderate friction loss, although minimal loss on average between 2018 and 2019. One of the three tests had less friction than the original pavement control of 0.57, with an average of 0.57. Areas of bare pavement were visible in wheelpaths as can be seen in the 2019 photo below.

Average Friction Values				Values by Site	
2016	2017	2018	2019	Sites Less Control Value	Total Sites
1.03	0.87	0.58	0.57	1	3



Site 18 – Photo Log

2016, Test 1

2016, Test 2

2016, Test 2

2017

2017

2017

2018

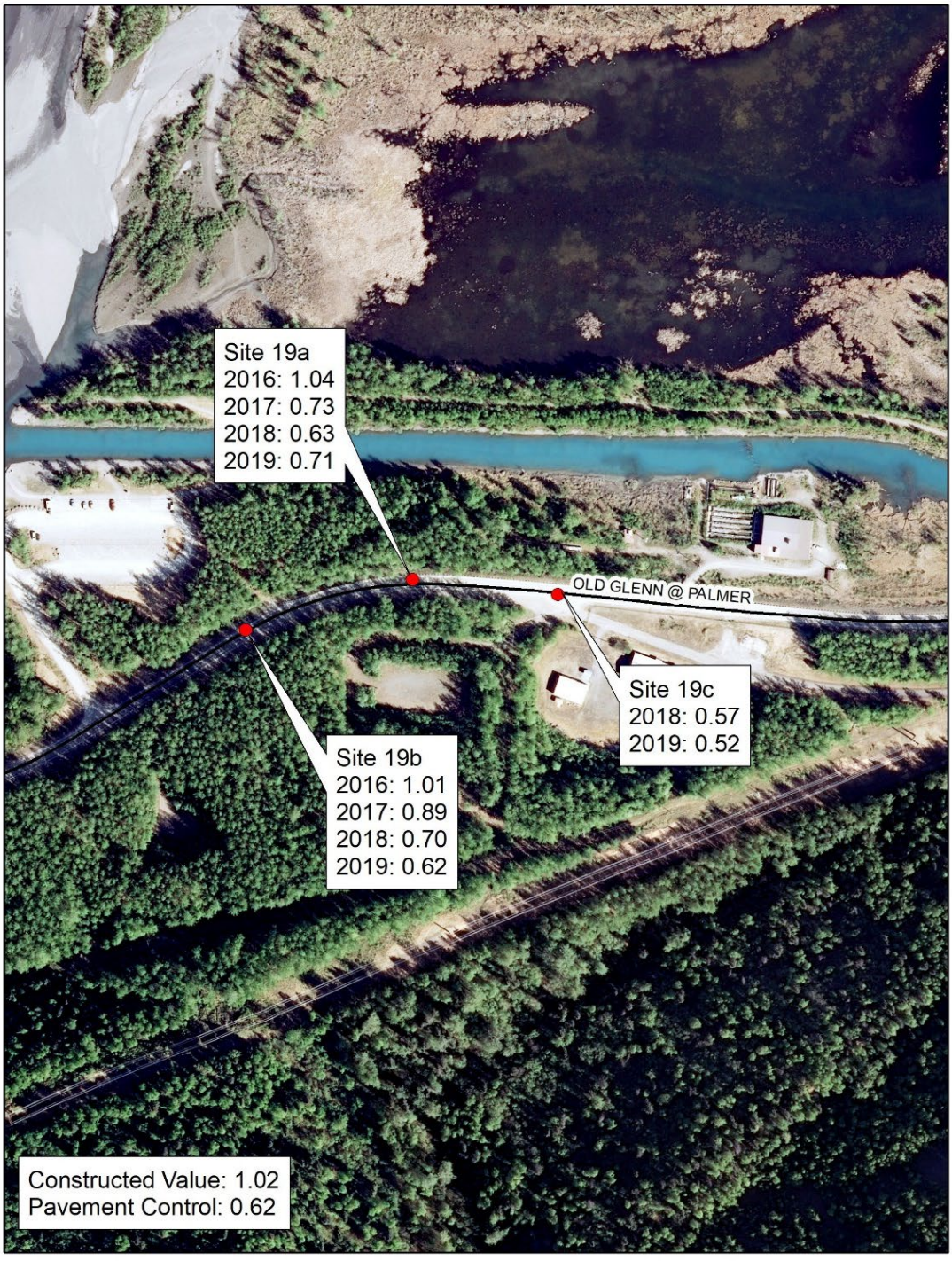
2018

2018

HSIP: High Friction Surface Treatment
Project #HFHWY00045
Dynamic Friction Tester Values

N

Site 19: Old Glenn: Power Plant



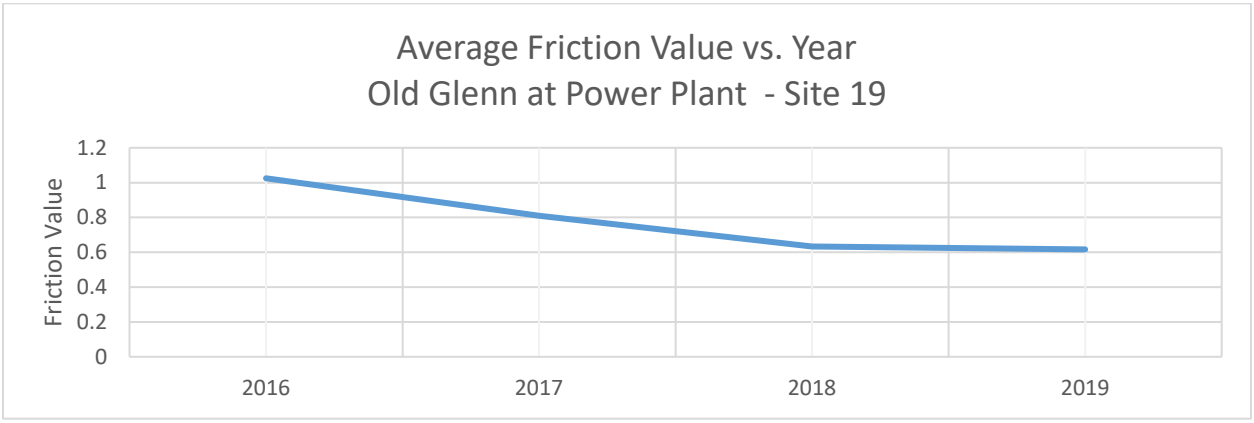
0 450 900 1,800

Feet

Site 19 – Old Glenn Highway at Powerplant -Friction Overview

Old Glenn at at the powerplant showed moderate friction loss, although minimal loss on average between 2018 and 2019. One of the three tests had less friction than the original pavement control of 0.62, with an average of 0.52. The aggregate at this site appeared to have retained more of its angularity than other locations.

Average Friction Values				Values by Site	
2016	2017	2018	2019	Sites Less Control Value	Total Sites
1.02	0.81	0.63	0.62	1	3



Site 19 – Photo Log

2016, Control

2016, Control

2016, Test 2

2017

2017

2017

2018

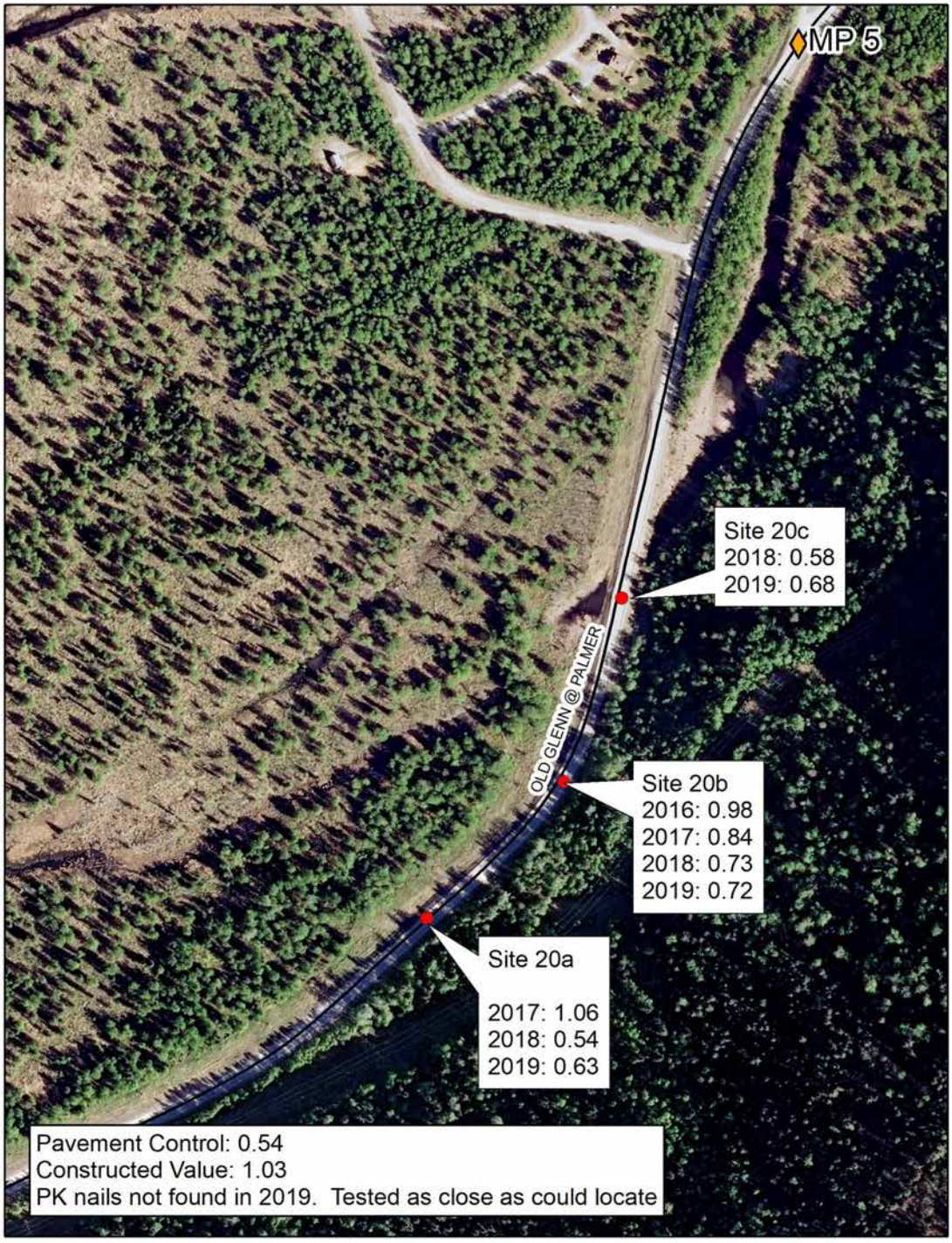
2018

2018

HSIP: High Friction Surface Treatment
Project #HFHWY00045
Dynamic Friction Tester Values

N

Site 20: Old Glenn MP 5



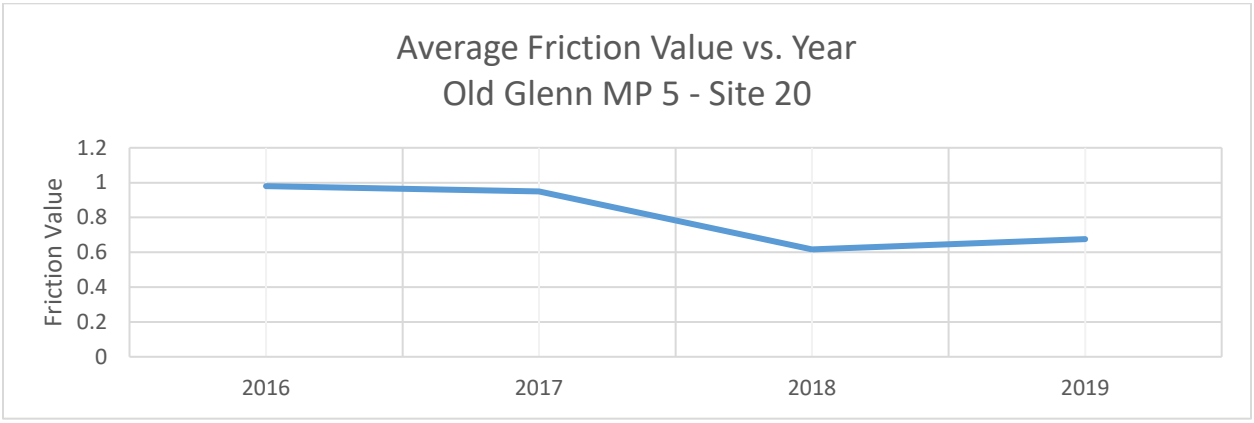
0 500 1,000 2,000

Feet

Site 20 – Old Glenn at Milepost 5 - Friction Overview

Old Glenn at at milepost 5 showed moderate friction loss. None of the three tests had less friction than the original pavement control of 0.54, with an average of 0.68. The PK nails could not be located in 2019 so the testing was performed as close as the crew could manage to the original lcoations. This is likely the cause of the discrepancy of friction values between 2018 and 2019.

Average Friction Values				Values by Site	
2016	2017	2018	2019	Sites Less Control Value	Total Sites
0.98	0.95	0.62	0.68	0	3

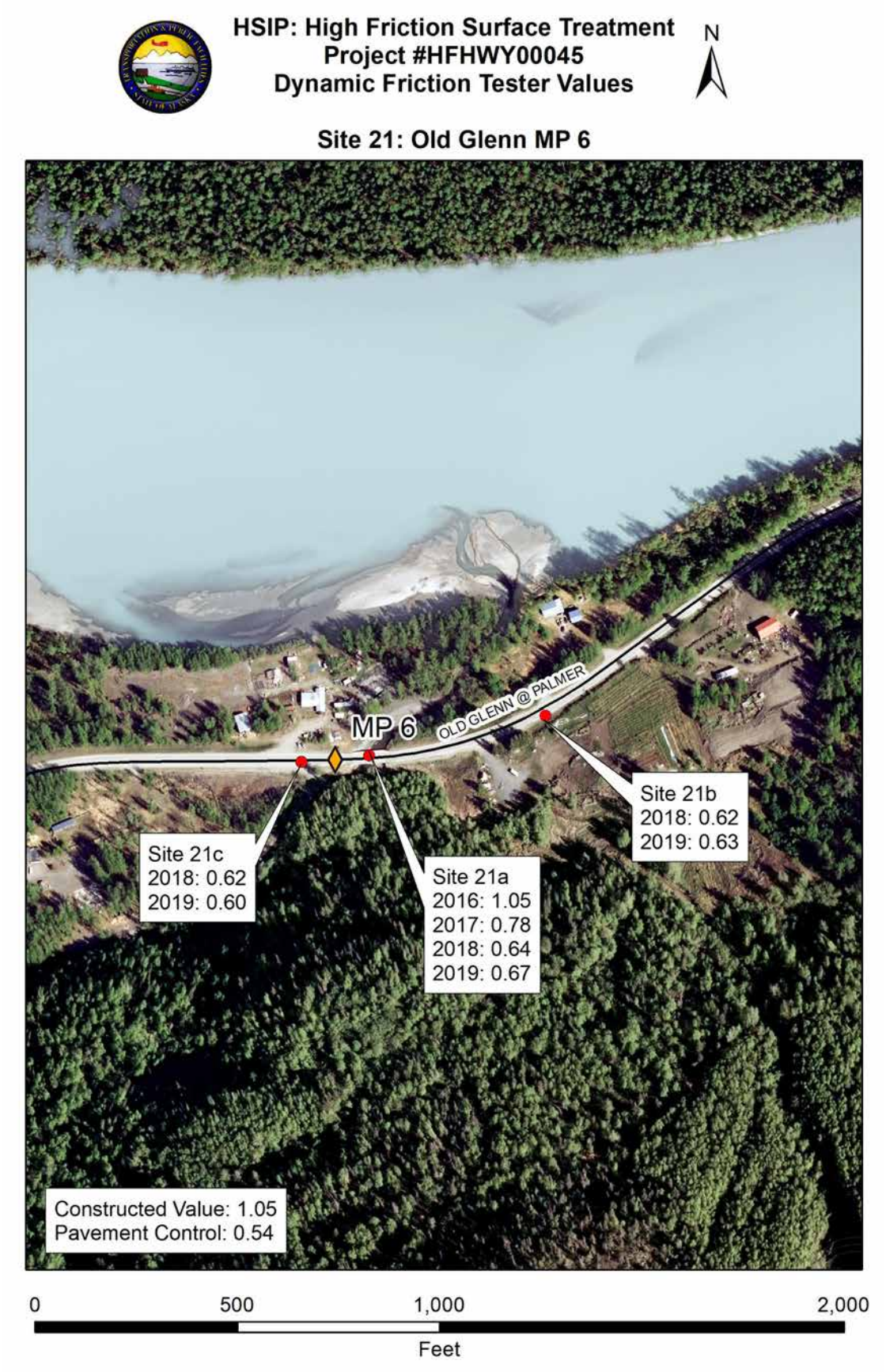


Site 20 – Photo Log

2017

2018

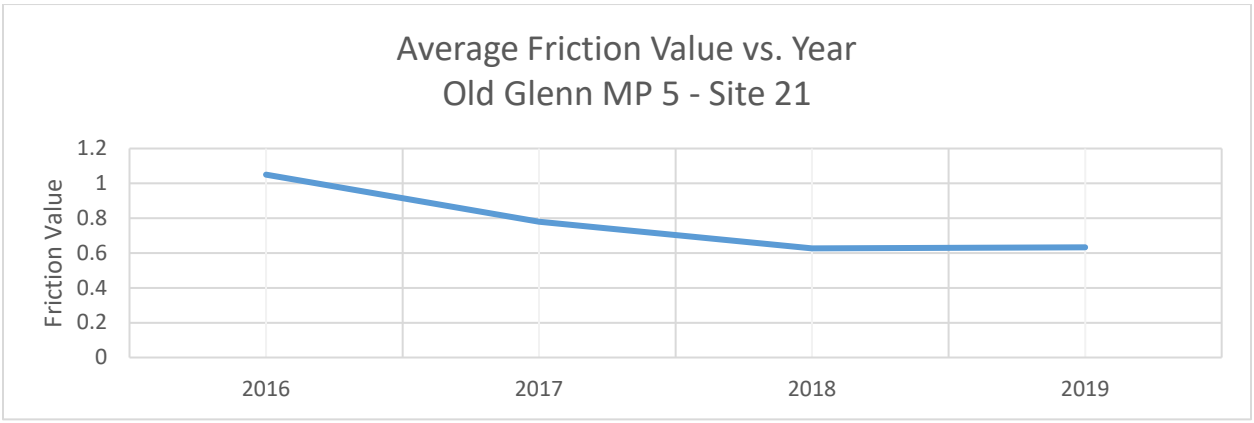
2019


HSIP: High Friction Surface Treatment
Project #HFHWY00045
Dynamic Friction Tester Values
N
Site 21: Old Glenn MP 6
MP 6
OLD GLENN @ PALMER
Site 21b
2018: 0.62
2019: 0.63
Site 21c
2018: 0.62
2019: 0.60
Site 21a
2016: 1.05
2017: 0.78
2018: 0.64
2019: 0.67
Constructed Value: 1.05
Pavement Control: 0.54
0
500
1,000
2,000
Feet

Site 21 – Old Glenn Highway at Milepost 6 - Friction Overview

Old Glenn at at milepost 6 showed moderate friction loss, although no loss on average between 2018 and 2019. None of the three tests had less friction than the original pavement control of 0.54, with an average of 0.63. Small amounts of bare pavement was visible under the HFST, although this did not affect testing at this location. Typical wear of the HFST can be seen in the second 2019 picture adjacent to the PK nail, below.

Average Friction Values				Values by Site	
2016	2017	2018	2019	Sites Less Control Value	Total Sites
1.05	0.78	0.63	0.63	0	3



Site 21 – Photo Log

2016, Test 1

2016, Test 1

2017

2017

2017

2018

2018

2018

HSIP: High Friction Surface Treatment
Project #HFHWY00045
Dynamic Friction Tester Values

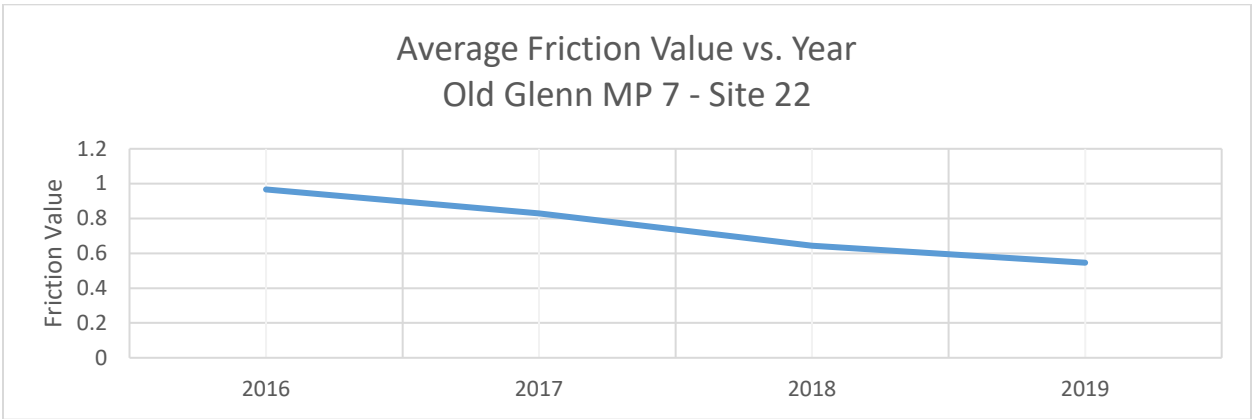
N

Site 22: Old Glenn MP 7

Site 22 – Old Glenn Milepost 7 - Friction Overview

Old Glenn at at milepost 7 showed moderate friction loss. One of the five tests had less friction than the original pavement control of 0.49, while the average was 0.55. Small amounts of bare pavement was visible under the HFST, likely due to snowplowing as there typically wasn't major wear evident in the wheelpaths. See the 2019 picture, below.

Average Friction Values				Values by Site	
2016	2017	2018	2019	Sites Less Control Value	Total Sites
0.97	0.83	0.64	0.55	1	5



Site 22 – Photo Log

2016

2016

2016

2017

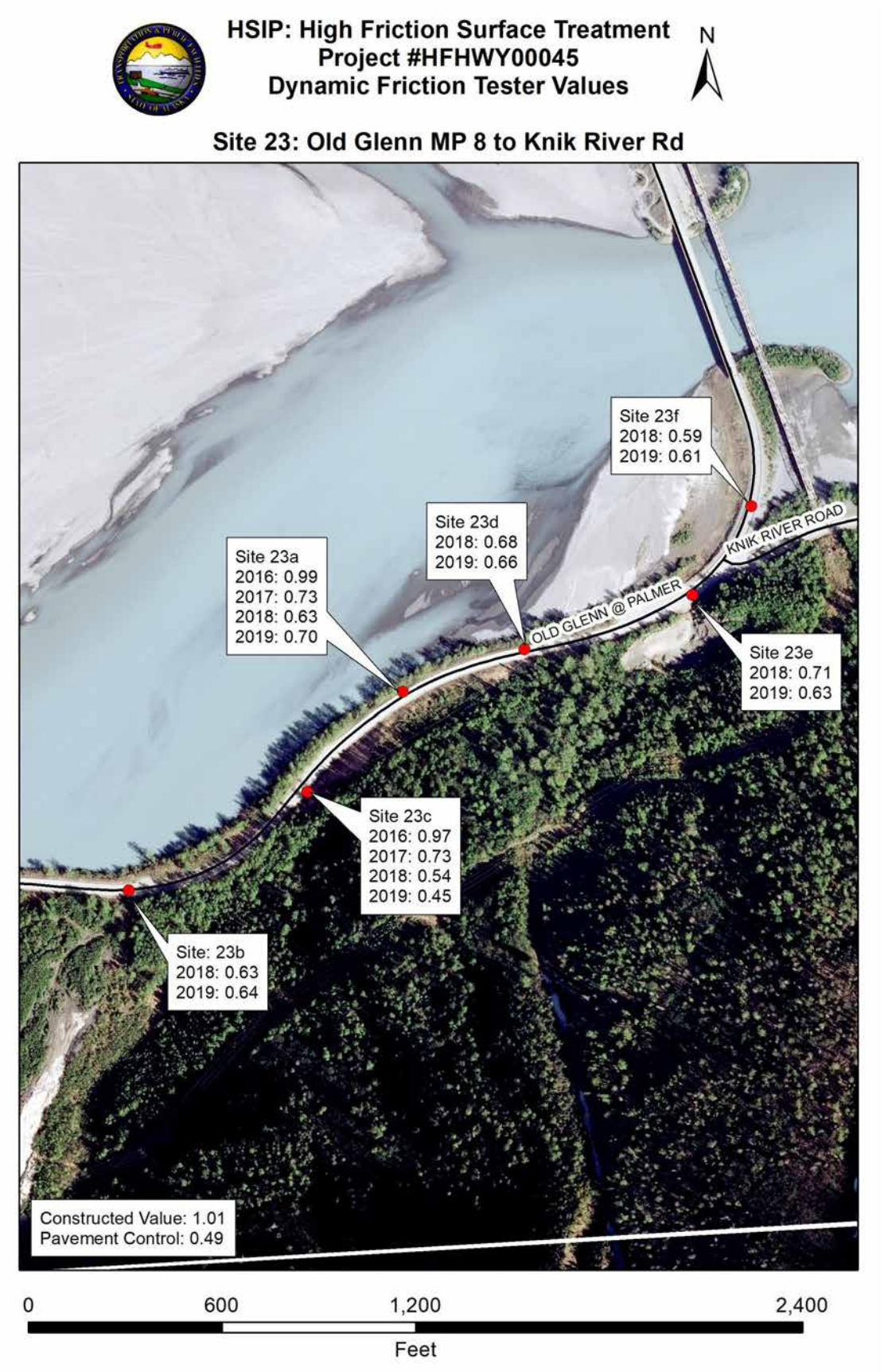
2017

2017

2018

2018

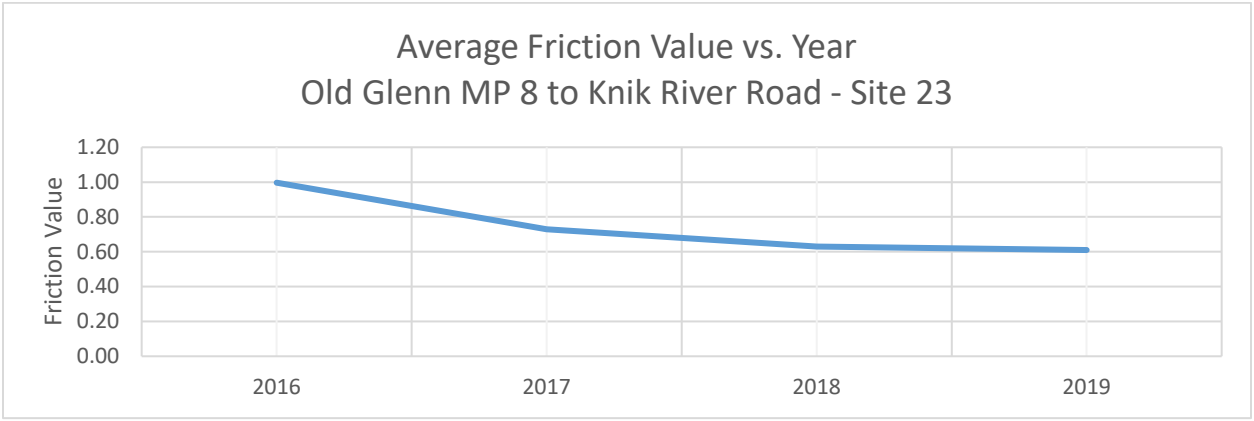
2018


HSIP: High Friction Surface Treatment
Project #HFHWY00045
Dynamic Friction Tester Values
N
Site 23: Old Glenn MP 8 to Knik River Rd
Site 23f
2018: 0.59
2019: 0.61
Site 23d
2018: 0.68
2019: 0.66
Site 23a
2016: 0.99
2017: 0.73
2018: 0.63
2019: 0.70
KNIK RIVER ROAD
OLD GLENN @ PALMER
Site 23e
2018: 0.71
2019: 0.63
Site 23c
2016: 0.97
2017: 0.73
2018: 0.54
2019: 0.45
Site: 23b
2018: 0.63
2019: 0.64
Constructed Value: 1.01
Pavement Control: 0.49
0
600
1,200
2,400
Feet

Site 23 – Old Glenn at Milepost 8 Friction Overview

Old Glenn at milepost 8 showed moderate friction loss, although minimal loss on average between 2018 and 2019. One of the five tests had less friction than the original pavement control of 0.49, while the average was 0.61. Small amounts of bare pavement was visible under the HFST, likely due to snowplowing and studded tire wear. See the 2019 picture, below and on the next page.

Average Friction Values				Values by Site	
2016	2017	2018	2019	Sites Less Control Value	Total Sites
1.00	0.73	0.63	0.61	1	5



Site 23 – Photo Log

2017

2018

2018

2018

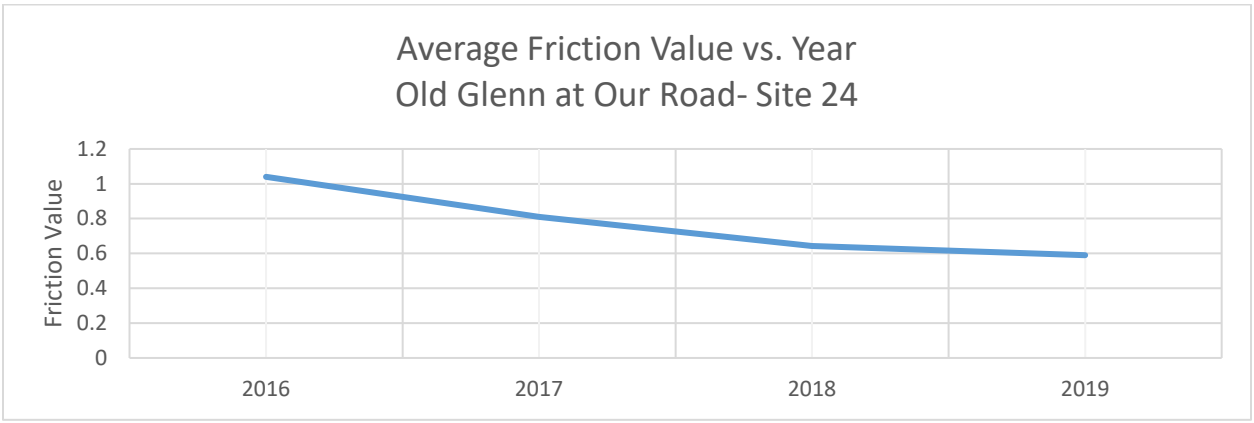
2019 – Bare Pavement and Significant Wear


HSIP: High Friction Surface Treatment
Project #HFHWY00045
Dynamic Friction Tester Values
N
Site 24: Old Glenn: Our Road
Site 24b
2018: 0.59
2019: 0.58
Site 24c
2018: 0.68
2019: 0.53
OLD GLENN @ PALMER
Site 24a
2016: 1.04
2017: 0.81
2018: 0.66
2019: 0.66
Constructed Value: 1.04
Pavement Control: 0.55
0
300
600
1,200
Feet

Site 24 – Old Glenn at Our Road - Friction Overview

Old Glenn at Our Road showed moderate friction loss, although minimal loss on average between 2018 and 2019. One of the three tests had less friction than the original pavement control of 0.55, while the average was 0.59. Small amounts of bare pavement was visible under the HFST, likely due to snowplowing as some of the observed pavement is outside of wheelpaths. The surface texture observed in the 2019 photo, below, is due to the HFST application being located in the floodplain and the surface required milling to maintain elevation.

Average Friction Values				Values by Site	
2016	2017	2018	2019	Sites Less Control Value	Total Sites
1.04	0.81	0.64	0.59	1	3



Site 24 – Photo Log

2016, Control

2016, Test 1

2016, Test 1

2017

2017

2017

2018

2018

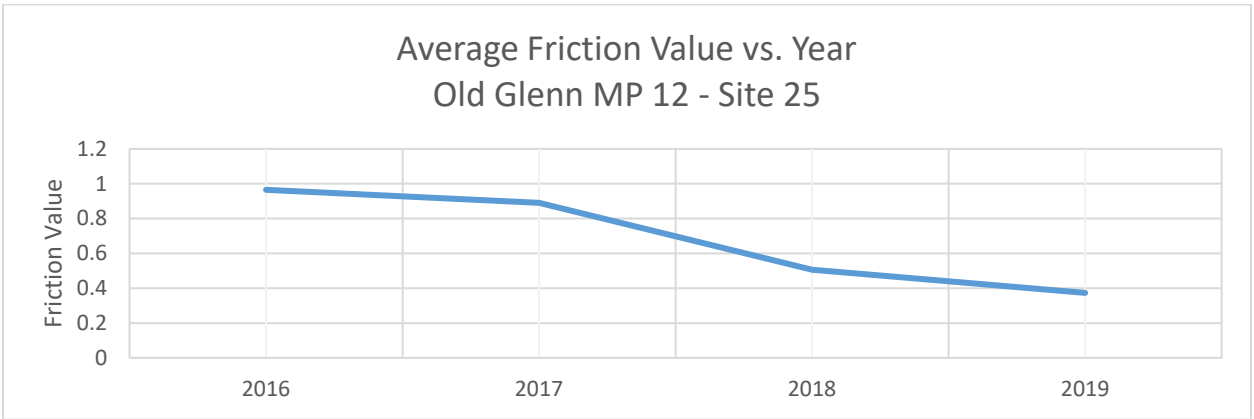
2018


HSIP: High Friction Surface Treatment
Project #HFHWY00045
Dynamic Friction Tester Values
N
Site 25: Old Glenn MP 12
MP 12
MARTH ROAD
Site 25a
2016: 0.95
2017: 0.80
2018: 0.52
2019: 0.36
Site 25b
2016: 0.98
2017: 0.98
2018: 0.49
2019: 0.41
OLD GLENN @ PALMER
Site 25c
2018: 0.51
2019: 0.35
Constructed Value: 0.97
Pavement Control: 0.56
0
300
600
1,200
Feet

Site 25 – Old Glenn at Milepost 12 - Friction Overview

Old Glenn at milepost 12 lost significant friction. All three of the tests had less friction than the pavement control of 0.56. The average 2019 friction value was 0.37. Bare pavement was common at this site and in the 2019 photo, below, bare pavement can be observed in the wheelpath where the friction test is being pefromed. This site is closer to Palmer and contains higher traffic volumes than the rest of the sites on the Old Glenn Highway which is contributing to the wear compared to other Old Glenn Highway sites.

Average Friction Values				Values by Site	
2016	2017	2018	2019	Sites Less Control Value	Total Sites
0.97	0.89	0.51	0.37	3	3



Site 25 – Photo Log

2016, Control

2016, Control

2016, Test 2

2017

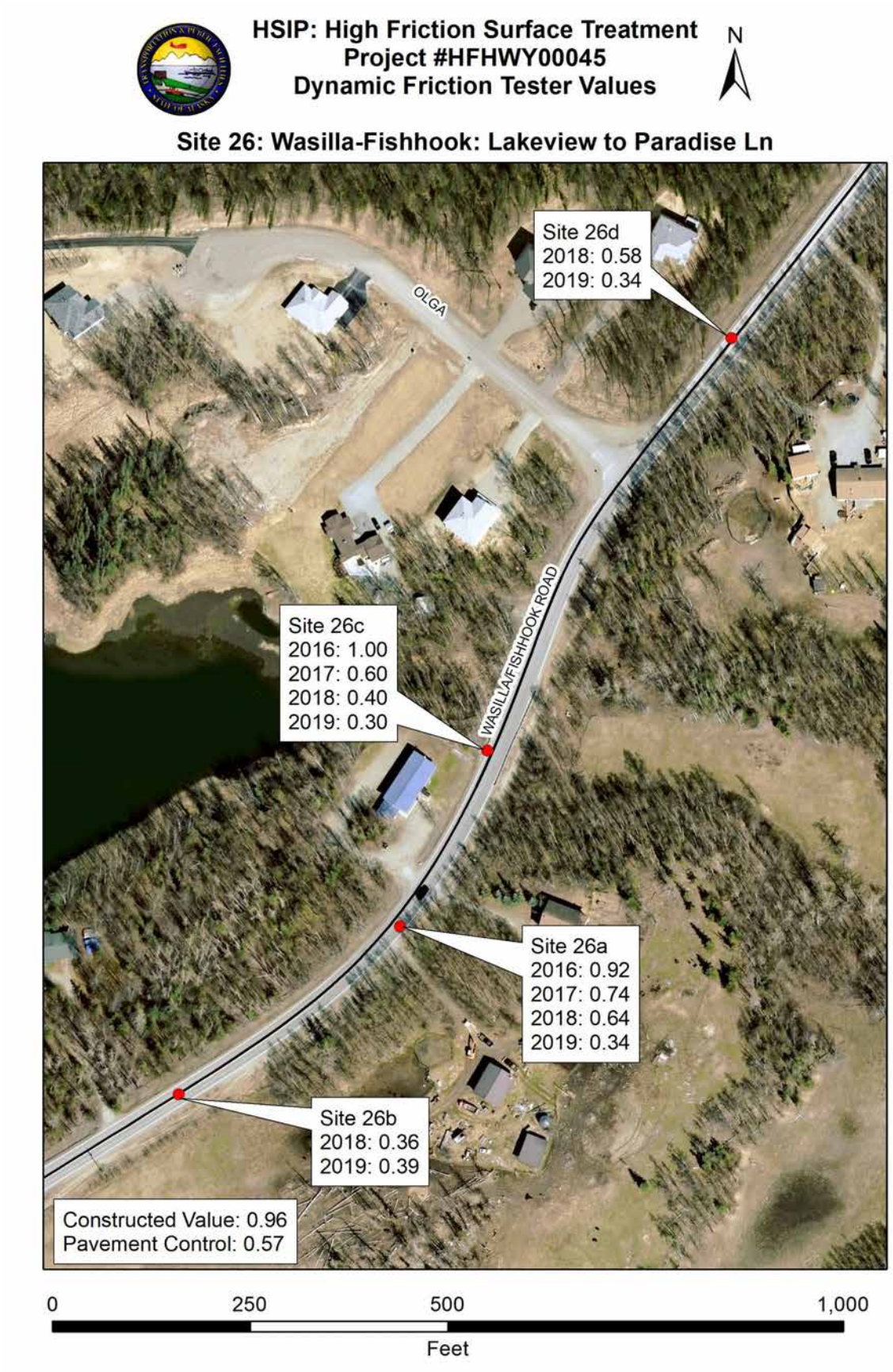
2017

2017

2018

2018

2018

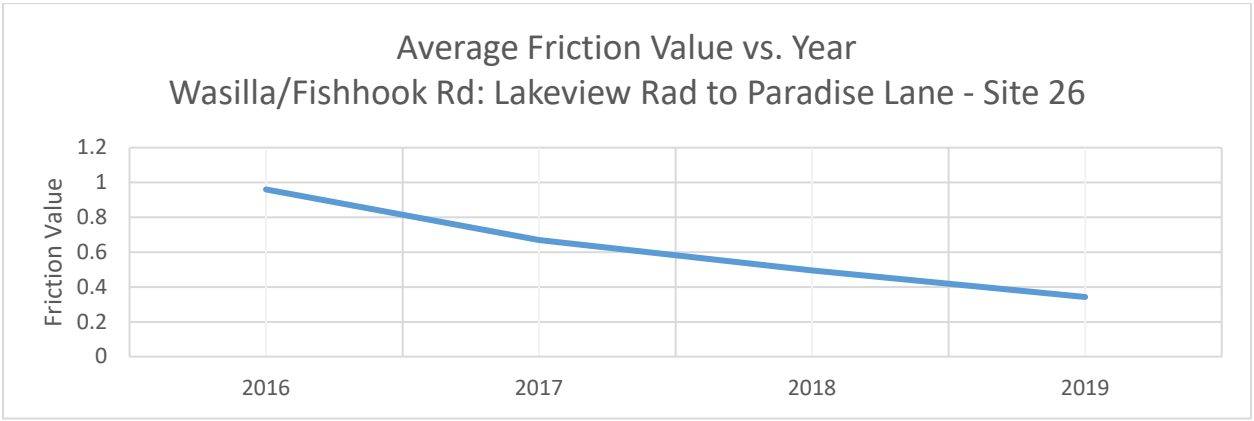

HSIP: High Friction Surface Treatment
Project #HFHWY00045
Dynamic Friction Tester Values
N
Site 26: Wasilla-Fishhook: Lakeview to Paradise Ln
Site 26d
2018: 0.58
2019: 0.34
OLGA
WASILLA/FISHHOOK ROAD
Site 26c
2016: 1.00
2017: 0.60
2018: 0.40
2019: 0.30
Site 26a
2016: 0.92
2017: 0.74
2018: 0.64
2019: 0.34
Site 26b
2018: 0.36
2019: 0.39
Constructed Value: 0.96
Pavement Control: 0.57
0
250
500
1,000
Feet

Site 26 – Wasilla/Fishhook Rd: Lakeview Rad to Paradise Lane

Friction Overview

Site 26 lost significant friction. All four of the tests performed had less friction than the pavement control of 0.57. The average 2019 friction value was 0.34. Bare pavement was common at this site and in the 2019 photo, below, bare pavement can be observed in both wheelpaths, although primarily in the right. This site is close to East Seldon and Bogard and has the highest traffic volume on Wasilla/Fishhook at almost 5,000 AADT.

Average Friction Values				Values by Site	
2016	2017	2018	2019	Sites Less Control Value	Total Sites
0.96	0.67	0.50	0.34	4	4



Site 26 – Photo Log

2016, Control

2016, Test 1

2016, Test 2

2017

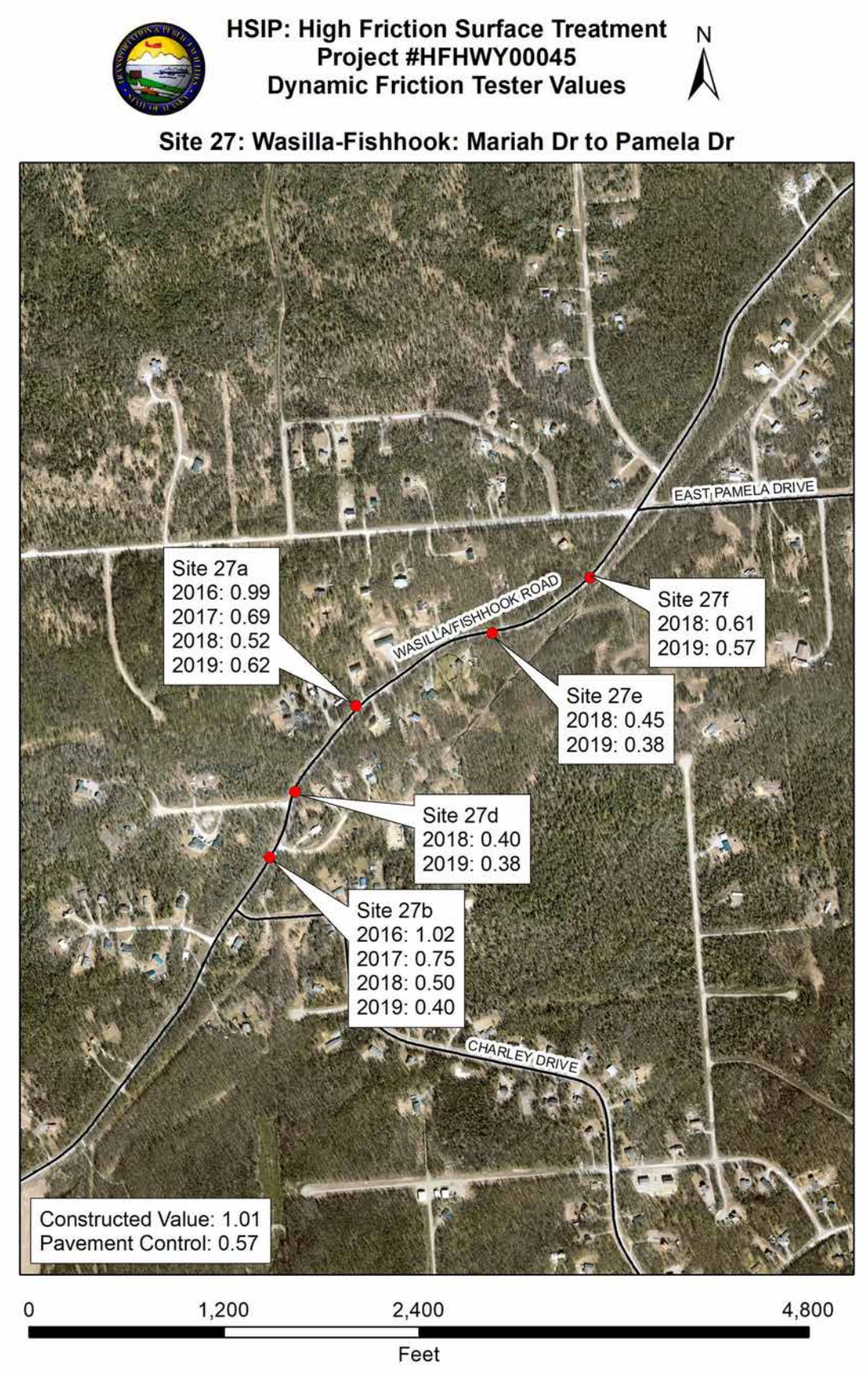
2017

2017

2018

2018

2018

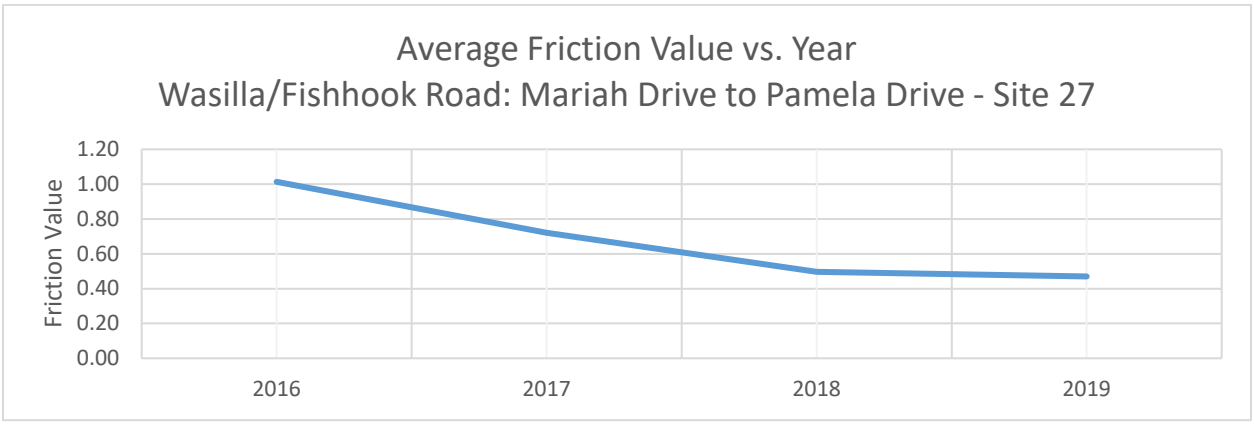

HSIP: High Friction Surface Treatment
Project #HFHWY00045
Dynamic Friction Tester Values
N
Site 27: Wasilla-Fishhook: Mariah Dr to Pamela Dr
EAST PAMELA DRIVE
WASILLA/FISHHOOK ROAD
CHARLEY DRIVE
Site 27a
2016: 0.99
2017: 0.69
2018: 0.52
2019: 0.62
Site 27f
2018: 0.61
2019: 0.57
Site 27e
2018: 0.45
2019: 0.38
Site 27d
2018: 0.40
2019: 0.38
Site 27b
2016: 1.02
2017: 0.75
2018: 0.50
2019: 0.40
Constructed Value: 1.01
Pavement Control: 0.57
0
1,200
2,400
4,800
Feet

Site 27 – Wasilla/Fishhook Road: Mariah Drive to Pamela Drive

Friction Overview

Site 27 lost significant friction, although the average drop in friction between 2018 and 2019 was minimal. Three of the five tests performed had less friction than the pavement control of 0.57. The average 2019 friction value was 0.47. Bare pavement was visible at this site and in the 2019 photo, below, bare pavement can be observed in the left wheelpath. As with site 26 this location has a relatively high AADT at over 4,000, or twice that of the Old Glenn sites.

Average Friction Values				Values by Site	
2016	2017	2018	2019	Sites Less Control Value	Total Sites
1.01	0.72	0.50	0.47	3	5



Site 27 – Photo Log

2016, Test 2

2017

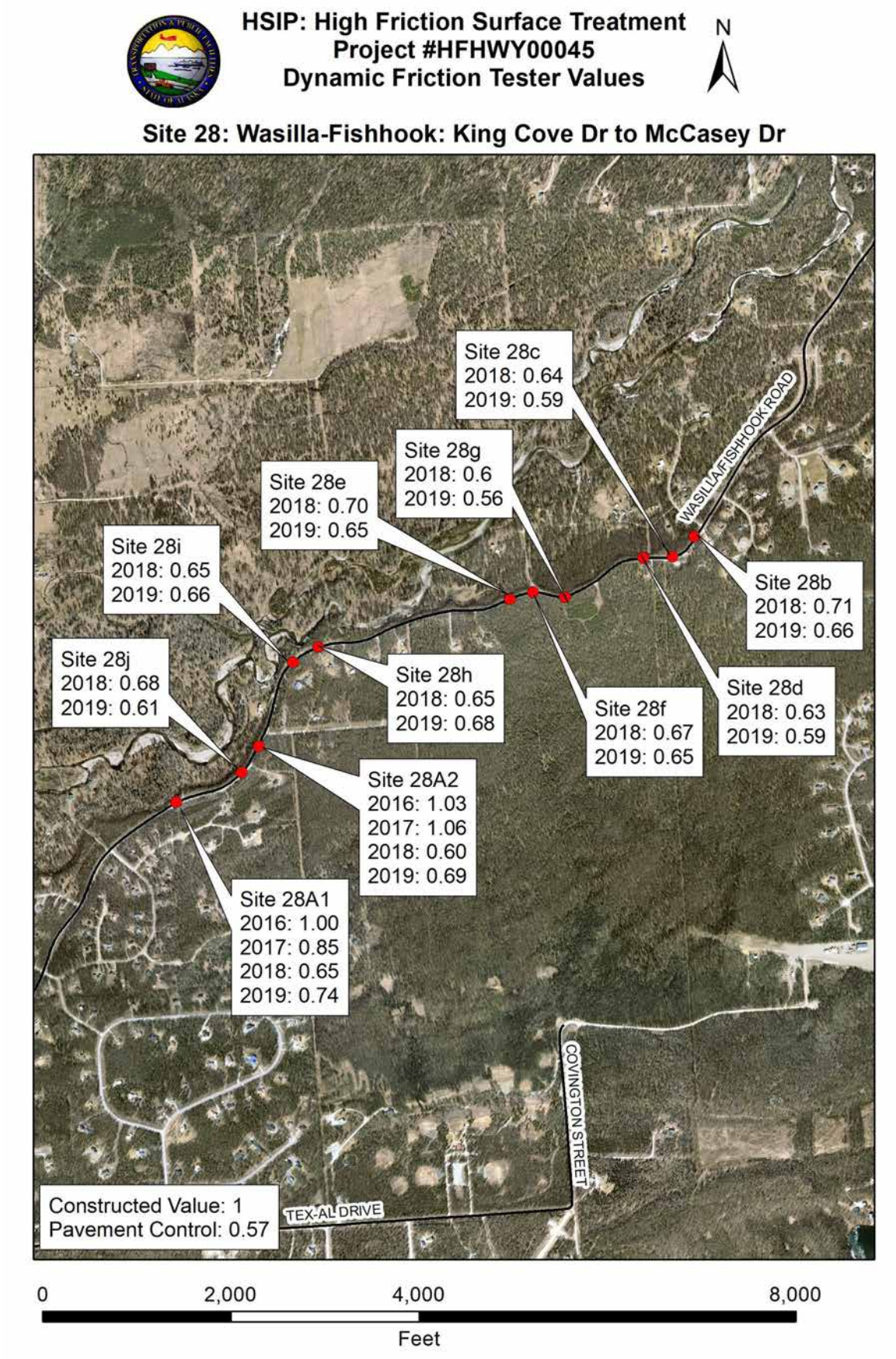
2017

2017

2018

2018

2018

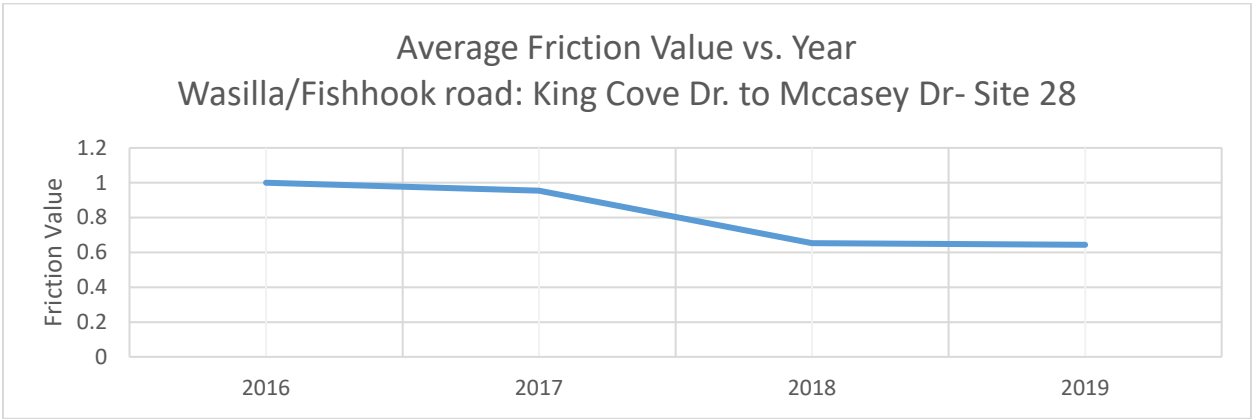

HSIP: High Friction Surface Treatment
Project #HFHWY00045
Dynamic Friction Tester Values
N
Site 28: Wasilla-Fishhook: King Cove Dr to McCasey Dr
Site 28c
2018: 0.64
2019: 0.59
Site 28g
2018: 0.6
2019: 0.56
Site 28e
2018: 0.70
2019: 0.65
Site 28i
2018: 0.65
2019: 0.66
Site 28j
2018: 0.68
2019: 0.61
Site 28h
2018: 0.65
2019: 0.68
Site 28f
2018: 0.67
2019: 0.65
Site 28b
2018: 0.71
2019: 0.66
Site 28d
2018: 0.63
2019: 0.59
Site 28A2
2016: 1.03
2017: 1.06
2018: 0.60
2019: 0.69
Site 28A1
2016: 1.00
2017: 0.85
2018: 0.65
2019: 0.74
WASILLA/FISHHOOK ROAD
COVINGTON STREET
TEX-AL DRIVE
Constructed Value: 1
Pavement Control: 0.57
0
2,000
4,000
8,000
Feet

Site 28 – Wasilla/Fishhook Road: King Cove Dr to McCasey Dr

Friction Overview

Site 28 lost moderate friction, although the average drop in friction between 2018 and 2019 was minimal. Only one of the eleven tests performed had less friction than the pavement control of 0.57. The average 2019 friction value was 0.64 The slight deviations in friction values between 2018 and 2019 is likely due to the original PK nails not being located during 2019 testing at those locations. While this location had less friction loss it also has less than half the traffic of the other two Wasilla/Fishhook sites.

Average Friction Values				Values by Site	
2016	2017	2018	2019	Sites Less Control Value	Total Sites
1	0.96	0.65	0.64	1	11



Site 28 – Photo Log

2016, Control

2016, Test 2

2016, Test 1

2017

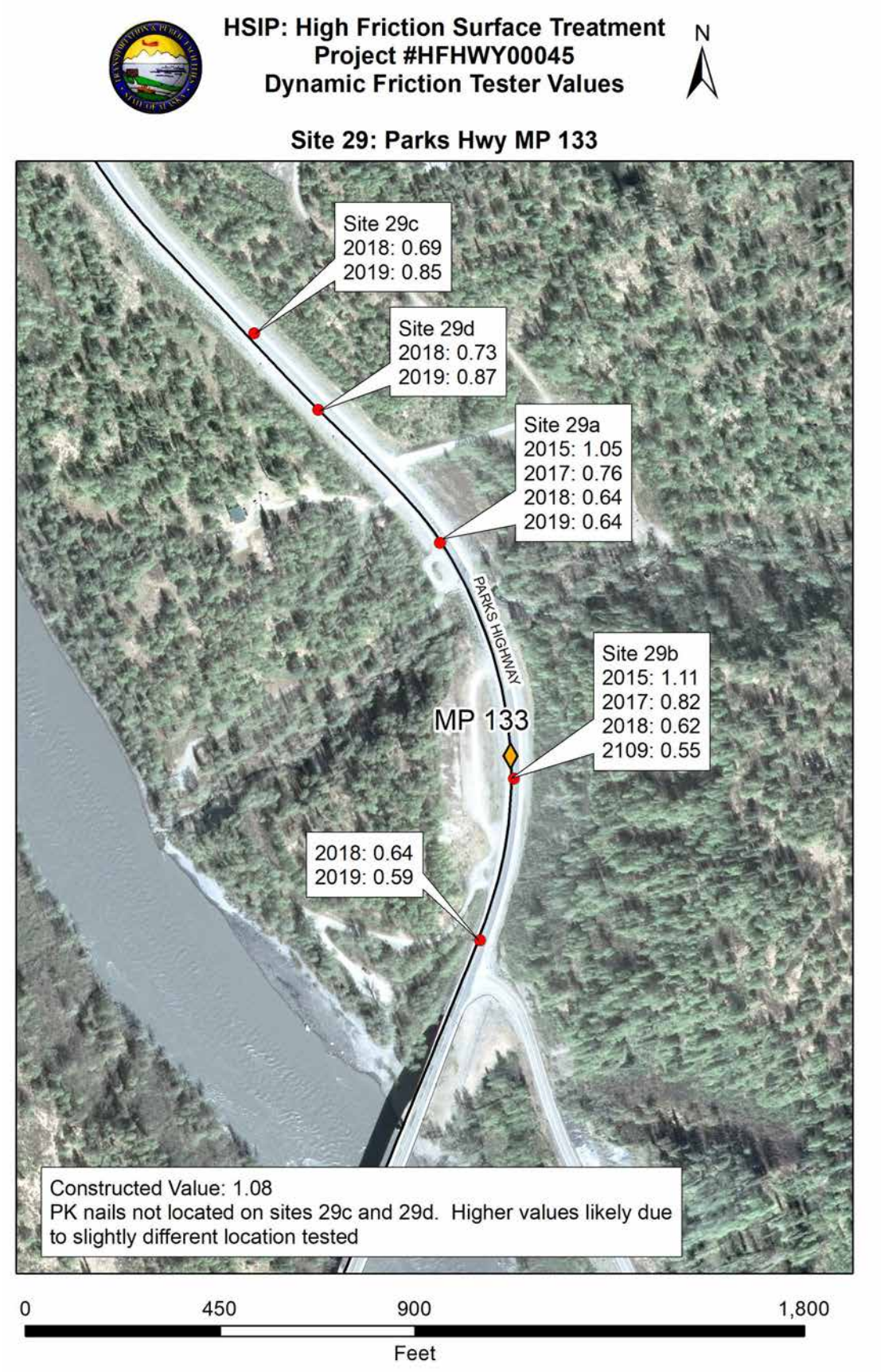
2017

2017

2018

2018

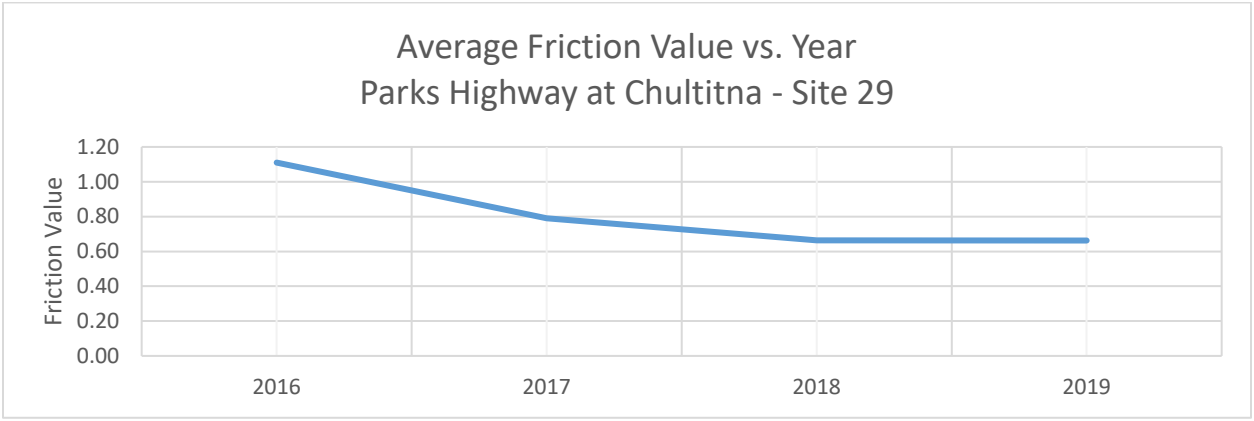
2018


HSIP: High Friction Surface Treatment
Project #HFHWY00045
Dynamic Friction Tester Values
N
Site 29: Parks Hwy MP 133
Site 29c
2018: 0.69
2019: 0.85
Site 29d
2018: 0.73
2019: 0.87
Site 29a
2015: 1.05
2017: 0.76
2018: 0.64
2019: 0.64
PARKS HIGHWAY
MP 133
Site 29b
2015: 1.11
2017: 0.82
2018: 0.62
2109: 0.55
2018: 0.64
2019: 0.59
Constructed Value: 1.08
PK nails not located on sites 29c and 29d. Higher values likely due to slightly different location tested
0
450
900
1,800
Feet

Site 29 – Friction Overview

While the Parks Highway at Chutlina lost moderate friction, it still retains higher friction than most other locations. All tests retain the friction of pavement or higher after 4 winters. The average 2019 friction value was 0.66. This was the only location tested that used fully automated application and used expoxy resin. A cracking pattern can be seen in the 2019 photo, below, that may be due to the contraction of the epoxy during the winter seasons.

Average Friction Values				Values by Site	
2015	2017	2018	2019	Sites Less Control Value	Total Sites
1.11	0.79	0.66	0.66	0	4

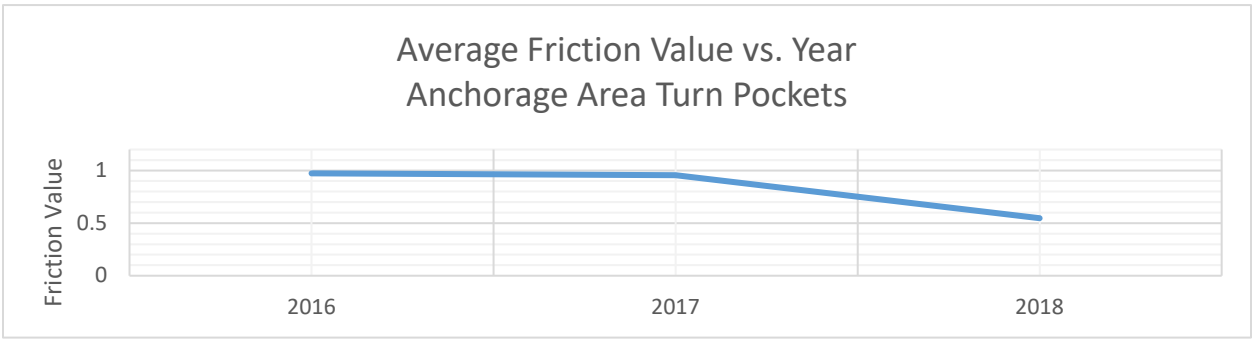


2018 Photo – osbserved cracking pattern

Turn Pockets

While the turn pockets in Anchorage did lose moderate friction they did retain significantly higher friction than the tests performed in the through lanes. This is likely from traffic running at slower speeds in turn pockets, and also reduced traffic volumes compared to the traffic that runs in the through lanes. These points were removed from the summaries in the through lanes as the data would have increased the friction values being reported in the most heavily trafficked lanes.

Average Friction Values				Values by Site	
2016	2017	2018	2019	Sites Less Control Value	Total Sites
0.97	0.96	0.55		6	10



In the picture on the previous page, taken in 2018 just south of the intersection of Waldron and Lake Otis, extensive wheelpath wear is apparent in the through lanes while the turn pocket looks to have minimal wear. At this site the turn pocket retained a friction value of 0.70, while the two tests in the through lanes had values of 0.30 and 0.37.

The wear across the lanes can be observed at the 2018 photo taken at the intersection of Boniface and Northern Lights. The most wear is on the outside lane (right) while the turn pocket has noticeable wear, but not nearly t othe extent the right hand lane does.

APPENDIX B
Friction Tests 2016-2019 Table and Graph

Site	Location	Town	Friction	AADT	Year	Lat	Long	Location
1c	Sterling Highway MP 104	Soldotna	0.47	3573	2018	60.377029	-151.193598	SB, Right Wheel
1c	Sterling Highway MP 104	Soldotna	0.32	3573	2019	60.377029	-151.193598	SB, Right Wheel
1d	Sterling Highway MP 104	Soldotna	0.47	3573	2018	60.369681	-151.192684	NB, Right Wheel
1d	Sterling Highway MP 104	Soldotna	0.38	3573	2019	60.369681	-151.192684	NB, Right Wheel
1e	Sterling Highway MP 104	Soldotna	0.5	3573	2018	60.370668	-151.191926	NB, Right Wheel
1e	Sterling Highway MP 104	Soldotna	0.5	3573	2019	60.370668	-151.191926	NB, Right Wheel
1a	Sterling Highway MP 104	Soldotna	1.24	3573	2016	60.374480	-151.192583	
1a	Sterling Highway MP 104	Soldotna	0.71	3573	2017	60.374491	-151.192738	SB, Right Wheel
1a	Sterling Highway MP 104	Soldotna	0.48	3573	2018	60.374390	-151.192612	SB, Left Wheel
1a	Sterling Highway MP 104	Soldotna	0.37	3573	2019	60.374390	-151.192612	SB, Left Wheel
1b	Sterling Highway MP 104	Soldotna	1.17	3573	2016	60.373346	-151.191852	
1b	Sterling Highway MP 104	Soldotna	1.02	3573	2017	60.373324	-151.191856	NB, Left Wheel
1b	Sterling Highway MP 104	Soldotna	0.45	3573	2018	60.373409	-151.191912	NB, Left Wheel
1b	Sterling Highway MP 104	Soldotna	0.32	3573	2019	60.373409	-151.191912	NB, Left Wheel
2c	Sterling Highway MP 86	Soldotna	0.63	8846	2018	60.531300	-150.864391	SB, Right Wheel
2c	Sterling Highway MP 86	Soldotna	0.66	8846	2019	60.531300	-150.864391	SB, Right Wheel
2d	Sterling Highway MP 86	Soldotna	0.29	8846	2018	60.526876	-150.870672	NB, Right Wheel
2d	Sterling Highway MP 86	Soldotna	0.29	8846	2019	60.526876	-150.870672	NB, Right Wheel
2e	Sterling Highway MP 86	Soldotna	0.42	8846	2018	60.527648	-150.869307	NB, Right Wheel
2e	Sterling Highway MP 86	Soldotna	0.38	8846	2019	60.527648	-150.869307	NB, Right Wheel
2f	Sterling Highway MP 86	Soldotna	0.34	8846	2018	60.529030	-150.867730	NB, Right Wheel
2f	Sterling Highway MP 86	Soldotna	0.38	8846	2019	60.529030	-150.867730	NB, Right Wheel
2g	Sterling Highway MP 86	Soldotna	0.37	8846	2018	60.529054	-150.867717	NB, Right Wheel
2g	Sterling Highway MP 86	Soldotna	0.34	8846	2019	60.529054	-150.867717	NB, Right Wheel
2a	Sterling Highway MP 86	Soldotna	1.07	8846	2016	60.528456	-150.868416	
2a	Sterling Highway MP 86	Soldotna	0.65	8846	2017	60.528383	-150.868438	NB, Left Wheel
2a	Sterling Highway MP 86	Soldotna	0.45	8846	2018	60.528347	-150.868526	SB, Right Wheel
2a	Sterling Highway MP 86	Soldotna	0.29	8846	2019	60.528347	-150.868526	SB, Right Wheel
2b	Sterling Highway MP 86	Soldotna	1.17	8846	2016	60.529026	-150.867838	
2b	Sterling Highway MP 86	Soldotna	0.52	8846	2017	60.529033	-150.867839	SB, Right Wheel
2b	Sterling Highway MP 86	Soldotna	0.37	8846	2018	60.528932	-150.867925	SB, Left Wheel
2b	Sterling Highway MP 86	Soldotna	0.26	8846	2019	60.528932	-150.867925	SB, Left Wheel
2 Control	Sterling Highway MP 86	Soldotna	0.49	8846	2018			SB, Right, Control
2 Control	Sterling Highway MP 86	Soldotna	0.42	8846	2019			SB, Right, Control
3c	FUNNY RIVER ROAD - MP 5	Soldotna	0.7	1277	2018	60.458306	-150.972966	EB, Left Wheel
3c	FUNNY RIVER ROAD - MP 5	Soldotna	0.54	1277	2019	60.458306	-150.972966	EB, Left Wheel
3d	FUNNY RIVER ROAD - MP 5	Soldotna	0.65	1277	2018	60.457052	-150.973913	EB, Right Wheel
3d	FUNNY RIVER ROAD - MP 5	Soldotna	0.71	1277	2019	60.457052	-150.973913	EB, Right Wheel
3a	FUNNY RIVER ROAD - MP 5	Soldotna	1.09	1277	2016	60.459710	-150.969626	

Site	Location	Town	Friction	AADT	Year	Lat	Long	Location
3a	FUNNY RIVER ROAD - MP 5	Soldotna	0.85	1277	2017	60.459692	-150.969585	WB, Right Wheel
3a	FUNNY RIVER ROAD - MP 5	Soldotna	0.69	1277	2018	60.459716	-150.969836	WB, Right Wheel
3a	FUNNY RIVER ROAD - MP 5	Soldotna	0.7	1277	2019	60.459716	-150.969836	WB, Right Wheel
3b	FUNNY RIVER ROAD - MP 5	Soldotna	1.11	1277	2016	60.459588	-150.971297	
3b	FUNNY RIVER ROAD - MP 5	Soldotna	0.85	1277	2017	60.459612	-150.971319	WB, Left Wheel
3b	FUNNY RIVER ROAD - MP 5	Soldotna	0.74	1277	2018	60.459604	-150.971292	WB, Left Wheel
3b	FUNNY RIVER ROAD - MP 5	Soldotna	0.72	1277	2019	60.459604	-150.971292	WB, Left Wheel
4c	FUNNY RIVER ROAD - MP 6	Soldotna	0.78	1277	2018	60.453687	-150.956090	EB, Left Wheel
4c	FUNNY RIVER ROAD - MP 6	Soldotna	0.54	1277	2019	60.453687	-150.956090	EB, Left Wheel
4d	FUNNY RIVER ROAD - MP 6	Soldotna	0.74	1277	2018	60.454572	-150.956993	EB, Left Wheel
4d	FUNNY RIVER ROAD - MP 6	Soldotna	0.6	1277	2019	60.454572	-150.956993	EB, Left Wheel
4a	FUNNY RIVER ROAD - MP 6	Soldotna	1.04	1277	2016	60.455019	-150.957084	
4a	FUNNY RIVER ROAD - MP 6	Soldotna	0.79	1277	2017	60.455014	-150.957096	WB, Right Wheel
4a	FUNNY RIVER ROAD - MP 6	Soldotna	0.69	1277	2018	60.455088	-150.957091	WB, Left Wheel
4a	FUNNY RIVER ROAD - MP 6	Soldotna	0.67	1277	2019	60.455088	-150.957091	WB, Left Wheel
4b	FUNNY RIVER ROAD - MP 6	Soldotna	1.08	1277	2016	60.455717	-150.957500	
4b	FUNNY RIVER ROAD - MP 6	Soldotna	0.85	1277	2017	60.455720	-150.957451	WB, Left Wheel
4b	FUNNY RIVER ROAD - MP 6	Soldotna	0.75	1277	2018	60.455780	-150.957530	WB, Left Wheel
4b	FUNNY RIVER ROAD - MP 6	Soldotna	0.64	1277	2019	60.455780	-150.957530	WB, Left Wheel
5d	Seward Hwy - MP 14 to 16	Seward	0.67	2303	2018	60.300224	-149.352711	WB, Right Wheel
5d	Seward Hwy - MP 14 to 16	Seward	0.61	2303	2019	60.300224	-149.352711	WB, Right Wheel
5c	Seward Hwy - MP 14 to 16	Seward	0.61	2303	2018	60.298316	-149.352524	SB, Right Wheel
5c	Seward Hwy - MP 14 to 16	Seward	0.41	2303	2019	60.298316	-149.352524	SB, Right Wheel
5e	Seward Hwy - MP 14 to 16	Seward	0.36	2303	2018	60.298588	-149.352377	NB, Right Wheel
5e	Seward Hwy - MP 14 to 16	Seward	0.38	2303	2019	60.298588	-149.352377	NB, Right Wheel
5	Seward Hwy - MP 14 to 16	Seward	0.36	2303	2018	60.300342	-149.352652	NB, Right Wheel
5	Seward Hwy - MP 14 to 16	Seward	0.31	2303	2019	60.300342	-149.352652	NB, Right Wheel
5a	Seward Hwy - MP 14 to 16	Seward	1.03	2303	2016	60.301668	-149.355139	NB, Right Wheel
5a	Seward Hwy - MP 14 to 16	Seward	0.87	2303	2017	60.301649	-149.355159	SB, Right Wheel
5a	Seward Hwy - MP 14 to 16	Seward	0.7	2303	2018	60.301615	-149.355137	SB, Left Wheel
5a	Seward Hwy - MP 14 to 16	Seward	0.7	2303	2019	60.301615	-149.355137	SB, Left Wheel
5b	Seward Hwy - MP 14 to 16	Seward	1.04	2303	2016	60.307303	-149.357157	
5b	Seward Hwy - MP 14 to 16	Seward	0.83	2303	2017	60.307319	-149.357196	SB, Left Wheel
5b	Seward Hwy - MP 14 to 16	Seward	0.59	2303	2018	60.304958	-149.356280	NB, Right Wheel
5b	Seward Hwy - MP 14 to 16	Seward	0.59	2303	2019	60.304958	-149.356280	NB, Right Wheel
6 control	Seward Hwy Y	Seward	0.47	4407	2018	60.561724	-149.579265	SB, Control, Right Wheel
6	Seward Hwy Y	Seward	0.76	4407	2018	60.556667	-149.582731	SB, Shoulder
6	Seward Hwy Y	Seward	0.8	4407	2019	60.556667	-149.582731	SB, Shoulder
6c	Seward Hwy Y	Seward	0.55	4407	2018	60.552695	-149.585777	SB, Right Wheel

Site	Location	Town	Friction	AADT	Year	Lat	Long	Location
6c	Seward Hwy Y	Seward	0.59	4407	2019	60.552695	-149.585777	SB, Right Wheel
6d	Seward Hwy Y	Seward	0.5	4407	2018	60.550583	-149.583695	SB, Left Wheel
6d	Seward Hwy Y	Seward	0.53	4407	2019	60.550583	-149.583695	SB, Left Wheel
6a	Seward Hwy Y	Seward	0.95	4407	2016	60.556674	-149.582722	
6a	Seward Hwy Y	Seward	0.78	4407	2017	60.556710	-149.582638	SB, Right Wheel
6a	Seward Hwy Y	Seward	0.48	4407	2018	60.556660	-149.582699	SB, Right Wheel
6a	Seward Hwy Y	Seward	0.37	4407	2019	60.556660	-149.582699	SB, Right Wheel
6b	Seward Hwy Y	Seward	1.01	4407	2016	60.560526	-149.579987	
6b	Seward Hwy Y	Seward	0.76	4407	2017	60.560511	-149.579965	SB, Left Wheel
6b	Seward Hwy Y	Seward	0.52	4407	2018	60.560486	-149.579960	SB, Left Wheel
6b	Seward Hwy Y	Seward	0.41	4407	2019	60.560486	-149.579960	SB, Left Wheel
7	De Armoun Road	Anchorage	0.59	1996	2018	61.100177	-149.788078	WB, Left Wheel
7	De Armoun Road	Anchorage	0.53	1996	2018	61.099417	-149.789343	WB, Right Wheel
7	De Armoun Road	Anchorage	0.59	1996	2018	61.094479	-149.792027	EB, Right Wheel
7	De Armoun Road	Anchorage	0.64	1996	2018	61.094857	-149.790978	EB, Right Wheel
7 control	De Armoun Road	Anchorage	0.54	1996	2016	61.099103	-149.783269	
7a	De Armoun Road	Anchorage	0.99	1996	2016	61.099371	-149.784633	
7a	De Armoun Road	Anchorage	0.63	1996	2017	61.099406	-149.784666	EB, Right Wheel
7a	De Armoun Road	Anchorage	0.44	1996	2018	61.099821	-149.789107	EB, Left Wheel
7b	De Armoun Road	Anchorage	1.02	1996	2016	61.098763	-149.775541	
7b	De Armoun Road	Anchorage	0.68	1996	2017	61.098761	-149.775645	WB, Left Wheel
7b	De Armoun Road	Anchorage	0.5	1996	2018	61.098762	-149.775674	WB, Left Wheel
8	Minnesota Dr.	Anchorage	0.29	45708	2018	61.177558	-149.913158	NB, Outside Lane, Right Wheel
8	Minnesota Dr.	Anchorage	0.34	45708	2018	61.180258	-149.913021	NB Outside Lane, Right Wheel
8	Minnesota Dr.	Anchorage	0.23	45708	2018	61.178387	-149.913170	NB, Inside Lane, Right Wheel
8 control	Minnesota Dr.	Anchorage	0.6	45708	2016	61.177296	-149.913427	
8b	Minnesota Dr.	Anchorage	0.99	45708	2016	61.177694	-149.913278	
8b	Minnesota Dr.	Anchorage	0.73	45708	2017	61.177308	-149.913407	NB, Inside Lane, Left Wheel
8b	Minnesota Dr.	Anchorage	0.33	45708	2018	61.177303	-149.913405	NB, Inside Lane, Left Wheel
8c	Minnesota Dr.	Anchorage	0.99	45708	2016	61.179721	-149.913182	
8d	Minnesota Dr.	Anchorage	1.02	45708	2016	61.179228	-149.912943	
8d	Minnesota Dr.	Anchorage	0.85	45708	2017	61.179211	-149.912969	NB, Right Turn Pocket, Right Wheel
8d	Minnesota Dr.	Anchorage	0.38	45708	2018	61.179230	-149.912960	NB, Right Turn Pocket, Right Wheel
9	Lake Otis Parkway - Waldon Dr.	Anchorage	0.7	18350	2018	61.174519	-149.838165	NB, Turn Pocket, Right Wheel
9 control	Lake Otis Parkway - Waldon Dr.	Anchorage	0.56	18350	2016	61.173674	-149.838047	
9a	Lake Otis Parkway - Waldon Dr.	Anchorage	0.94	18350	2016	61.173914	-149.838107	
9a	Lake Otis Parkway - Waldon Dr.	Anchorage	0.58	18350	2017	61.173829	-149.838153	NB, Inside Lane, Left Wheel
9a	Lake Otis Parkway - Waldon Dr.	Anchorage	0.3	18350	2018	61.173834	-149.838136	NB, Inside Lane, Left Wheel
9c	Lake Otis Parkway - Waldon Dr.	Anchorage	1.01	18350	2016	61.173702	-149.838010	

Site	Location	Town	Friction	AADT	Year	Lat	Long	Location
9c	Lake Otis Parkway - Waldon Dr.	Anchorage	0.65	18350	2017	61.173793	-149.838032	NB, Outside Lane, Right Wheel
9c	Lake Otis Parkway - Waldon Dr.	Anchorage	0.37	18350	2018	61.173777	-149.838038	NB, Outside Lane, Right Wheel
10	MLK: Ballfields to Tudor Ctr Dr.	Anchorage	0.43	17033	2018	61.178139	-149.800953	EB, Outside Lane, Left Wheel
10	MLK: Ballfields to Tudor Ctr Dr.	Anchorage	0.25	17033	2018	61.178117	-149.798516	EB, Outside Lane, Left Wheel
10	MLK: Ballfields to Tudor Ctr Dr.	Anchorage	0.29	17033	2018	61.178060	-149.796882	WB, Inside Lane, Left Wheel
10	MLK: Ballfields to Tudor Ctr Dr.	Anchorage	0.3	17033	2018	61.178312	-149.799632	WB, Inside Lane, Right Wheel
10	MLK: Ballfields to Tudor Ctr Dr.	Anchorage	0.16	17033	2018	61.177945	-149.802806	WB, Inside Lane, Left Wheel
10a	MLK: Ballfields to Tudor Ctr Dr.	Anchorage	1.09	17033	2016	61.177764	-149.802789	
10a	MLK: Ballfields to Tudor Ctr Dr.	Anchorage	0.55	17033	2017	61.177847	-149.802540	EB, Outside Lane, Right Wheel
10a	MLK: Ballfields to Tudor Ctr Dr.	Anchorage	0.28	17033	2018	61.177849	-149.802546	EB, Outside Lane, Right Wheel
10b	MLK: Ballfields to Tudor Ctr Dr.	Anchorage	0.95	17033	2016	61.178081	-149.796743	
10c	MLK: Ballfields to Tudor Ctr Dr.	Anchorage	0.95	17033	2016	61.177977	-149.796700	
10d	MLK: Ballfields to Tudor Ctr Dr.	Anchorage	1.03	17033	2016	61.178118	-149.796765	
10d	MLK: Ballfields to Tudor Ctr Dr.	Anchorage	1.03	17033	2017	61.178108	-149.796776	WB, Outside Lane, Right Wheel
10d	MLK: Ballfields to Tudor Ctr Dr.	Anchorage	0.44	17033	2018	61.178108	-149.796774	WB, Outside Lane, Right Wheel
11	Tudor Rd. @ Baxter Road	Anchorage	0.65	27988	2018	61.180804	-149.762736	WB, Turn Pocket, Right Wheel
11 control	Tudor Rd. @ Baxter Road	Anchorage	0.58	27988	2016	61.180851	-149.758317	
11a	Tudor Rd. @ Baxter Road	Anchorage	0.99	27988	2016	61.180794	-149.762114	
11a	Tudor Rd. @ Baxter Road	Anchorage	0.42	27988	2017	61.180807	-149.761887	WB, Inside Lane, Left Wheel
11a	Tudor Rd. @ Baxter Road	Anchorage	0.32	27988	2018	61.180790	-149.761911	WB, Inside Lane, Left Wheel
11c	Tudor Rd. @ Baxter Road	Anchorage	0.97	27988	2016	61.180859	-149.761636	
11c	Tudor Rd. @ Baxter Road	Anchorage	0.5	27988	2017	61.180857	-149.761675	WB, Outside Lane, Right Wheel
11c	Tudor Rd. @ Baxter Road	Anchorage	0.29	27988	2018	61.180838	-149.761691	WB, Outside Lane, Right Wheel
12	Boniface Parkway and Northern Lights Blvd	Anchorage	0.47	19291	2018	61.195253	-149.779268	EB, Left Turn Pocket, Left Wheel
12	Boniface Parkway and Northern Lights Blvd	Anchorage	0.37	22377	2018	61.194562	-149.778276	NB, Inside Lane, Left Wheel
12	Boniface Parkway and Northern Lights Blvd	Anchorage	0.37	16616	2018	61.195288	-149.776778	WB, Inside Lane, Left Wheel
12	Boniface Parkway and Northern Lights Blvd	Anchorage	0.55	16616	2018	61.195272	-149.776771	WB, Turn Pocket, Right Wheel
12	Boniface Parkway and Northern Lights Blvd	Anchorage	0.34	22377	2018	61.194923	-149.778244	NB, Outside Lane, Left Wheel
12	Boniface Parkway and Northern Lights Blvd	Anchorage	0.45	16616	2018	61.195300	-149.777183	WB, Outside Lane, Left Wheel
12	Boniface Parkway and Northern Lights Blvd	Anchorage	0.38	24556	2018	61.195631	-149.778465	SB, Inside Lane, Right Wheel
12	Boniface Parkway and Northern Lights Blvd	Anchorage	0.35	19291	2018	61.195192	-149.778962	EB, Inside Lane, Right Wheel
12 control	Boniface Parkway and Northern Lights Blvd	Anchorage	0.63	16616	2016	61.195319	-149.778072	
12 control	Boniface Parkway and Northern Lights Blvd	Anchorage	0.57	19291	2016	61.195175	-149.779943	
12a	Boniface Parkway and Northern Lights Blvd	Anchorage	0.98	19291	2016	61.195281	-149.777662	
12b	Boniface Parkway and Northern Lights Blvd	Anchorage	0.98	16616	2016	61.195316	-149.778045	
12e	Boniface Parkway and Northern Lights Blvd	Anchorage	0.99	19291	2016	61.195162	-149.779947	
12e	Boniface Parkway and Northern Lights Blvd	Anchorage	1.06	19291	2017	61.195131	-149.779925	EB, Turn Pocket, Right Wheel
12e	Boniface Parkway and Northern Lights Blvd	Anchorage	0.51	22377	2018	61.194899	-149.778365	NB, Turn Pocket, Left Wheel
12f	Boniface Parkway and Northern Lights Blvd	Anchorage	1	24556	2016	61.196288	-149.778374	

Site	Location	Town	Friction	AADT	Year	Lat	Long	Location
12f	Boniface Parkway and Northern Lights Blvd	Anchorage	1.04	24556	2017	61.196257	-149.778363	WB, Turn Pocket, Left Wheel
12f	Boniface Parkway and Northern Lights Blvd	Anchorage	0.64	24556	2018	61.196256	-149.778368	SB, Turn Pocket, Left Wheel
12g	Boniface Parkway and Northern Lights Blvd	Anchorage	0.99	22377	2016	61.194909	-149.778333	
13c	36th Ave. @ Lake Otis Parkway	Anchorage	0.31	11292	2018	61.188004	-149.839151	EB, Outside Lane, Left Wheel
13a	36th Ave. @ Lake Otis Parkway	Anchorage	0.97	11292	2016	61.188038	-149.838947	
13a	36th Ave. @ Lake Otis Parkway	Anchorage	1.03	11292	2017	61.188061	-149.838880	EB, Turn Pocket, Left Wheel
13a	36th Ave. @ Lake Otis Parkway	Anchorage	0.53	11292	2018	61.188049	-149.838903	EB, Turn Pocket, Left Wheel
13b	36th Ave. @ Lake Otis Parkway	Anchorage	0.97	11292	2016	61.187982	-149.840136	
13b	36th Ave. @ Lake Otis Parkway	Anchorage	0.6	11292	2017	61.188012	-149.840252	EB, Outside Lane, Right Wheel
13b	36th Ave. @ Lake Otis Parkway	Anchorage	0.38	11292	2018	61.187995	-149.840189	EB, Outside Lane, Right Wheel
14a	Minnesota Dr. - 25th to 15th	Anchorage	0.23	18891	2018	61.201324	-149.913019	NB, Inside Lane, Left Wheel
14c	Minnesota Dr. - 25th to 15th	Anchorage	0.44	18891	2018	61.205566	-149.904719	NB, Inside Lane, Left Wheel
14e	Minnesota Dr. - 25th to 15th	Anchorage	0.29	18891	2018	61.205314	-149.902156	NB, Inside Lane, Left Wheel
14 control	Minnesota Dr. - 25th to 15th	Anchorage	0.58	18891	2016	61.206928	-149.899676	
14b	Minnesota Dr. - 25th to 15th	Anchorage	1.02	34938	2016	61.205460	-149.908451	
14b	Minnesota Dr. - 25th to 15th	Anchorage	0.26	34938	2017	61.205443	-149.908532	NB, Outside Lane, Left Wheel
14b	Minnesota Dr. - 25th to 15th	Anchorage	0.36	34938	2018	61.205464	-149.908534	NB, Outside Lane, Left Wheel
14	Minnesota Dr. - 25th to 15th	Anchorage	0.93	34938	2016	61.205236	-149.902751	
14d	Minnesota Dr. - 25th to 15th	Anchorage	1.03	34938	2016	61.202319	-149.912962	
14d	Minnesota Dr. - 25th to 15th	Anchorage	0.4	34938	2017	61.203152	-149.912612	NB, Inside Lane, Left Wheel
14d	Minnesota Dr. - 25th to 15th	Anchorage	0.3	34938	2018	61.203160	-149.912610	NB, Inside Lane, Left Wheel
15	C st. and 15th Ave.	Anchorage	0.34	9480	2018	61.207726	-149.886877	WB, Turn Pocket, Right Wheel
15a	C st. and 15th Ave.	Anchorage	0.97	9480	2016	61.207675	-149.888090	
15a	C st. and 15th Ave.	Anchorage	0.58	9480	2017	61.207656	-149.888105	EB, Right Wheel
15a	C st. and 15th Ave.	Anchorage	0.45	11754	2018	61.207663	-149.888404	EB, Through Lane, Right Wheel
15b	C st. and 15th Ave.	Anchorage	0.98	11754	2016	61.207714	-149.887094	
15b	C st. and 15th Ave.	Anchorage	0.87	11754	2017	61.207739	-149.887021	WB, Left Wheel
15b	C st. and 15th Ave.	Anchorage	0.25	11754	2018	61.207754	-149.886579	WB, Through Lane, Right Wheel
16c	Eagle River Lp Road @ Baranof/Citation	Eagle River	0.26	10630	2018	61.314736	-149.539091	SB, Outside Lane, Left Wheel
16c	Eagle River Lp Road @ Baranof/Citation	Eagle River	0.2	10630	2019	61.314736	-149.539091	SB, Outside Lane, Left Wheel
16a	Eagle River Lp Road @ Baranof/Citation	Eagle River	0.98	10630	2016	61.314492	-149.539013	
16a	Eagle River Lp Road @ Baranof/Citation	Eagle River	0.93	10630	2017	61.314510	-149.539087	SB, Turn Pocket, Right Wheel
16a	Eagle River Lp Road @ Baranof/Citation	Eagle River	0.7	10630	2018	61.314493	-149.539065	SB, Turn Pocket, Right Wheel
16a	Eagle River Lp Road @ Baranof/Citation	Eagle River	0.66	10630	2019	61.314493	-149.539065	SB, Turn Pocket, Right Wheel
16b	Eagle River Lp Road @ Baranof/Citation	Eagle River	0.95	10630	2016	61.315227	-149.539074	
16b	Eagle River Lp Road @ Baranof/Citation	Eagle River	0.73	10630	2017	61.315198	-149.539169	SB, Outside Lane, Right Wheel
16b	Eagle River Lp Road @ Baranof/Citation	Eagle River	0.31	10630	2018	61.315111	-149.539145	SB, Outside Lane, Right Wheel
16d	Eagle River Lp Road @ Baranof/Citation	Eagle River	0.73	10630	2019			SB, Outside Lane, Right Wheel
17c	Old Glenn Mp 2	Palmer	0.42	1854	2018	61.472933	-149.207622	EB, Left Wheel

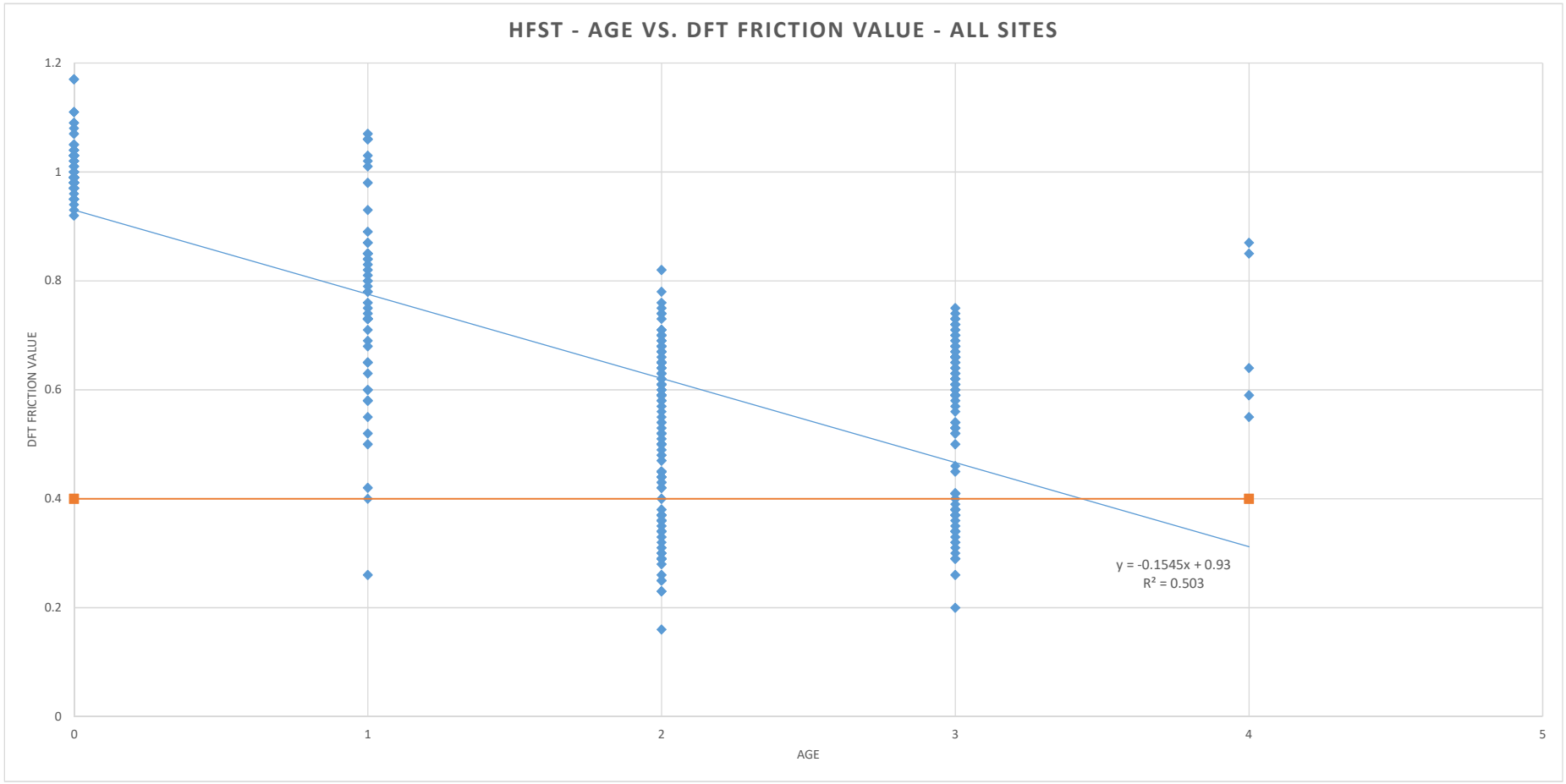
Site	Location	Town	Friction	AADT	Year	Lat	Long	Location
17c	Old Glenn Mp 2	Palmer	0.37	1854	2019	61.472933	-149.207622	EB, Left Wheel
17d	Old Glenn Mp 2	Palmer	0.61	1854	2018	61.472852	-149.199170	WB, Right Wheel
17d	Old Glenn Mp 2	Palmer	0.75	1854	2019	61.472852	-149.199170	WB, Right Wheel
17 control	Old Glenn Mp 2	Palmer	0.57	1854	2016	61.472922	-149.198564	
17a	Old Glenn Mp 2	Palmer	0.96	1854	2016	61.472880	-149.205610	
17a	Old Glenn Mp 2	Palmer	1.07	1854	2017	61.473024	-149.203375	WB, Left Wheel
17a	Old Glenn Mp 2	Palmer	0.7	1854	2018	61.473010	-149.203188	WB, Left Wheel
17a	Old Glenn Mp 2	Palmer	0.62	1854	2019	61.473010	-149.203188	WB, Left Wheel
17b	Old Glenn Mp 2	Palmer	0.99	1854	2016	61.472836	-149.206353	
17b	Old Glenn Mp 2	Palmer	1.01	1854	2017	61.472820	-149.206105	EB, Left Wheel
17b	Old Glenn Mp 2	Palmer	0.54	1854	2018	61.472836	-149.206037	EB, Left Wheel
17b	Old Glenn Mp 2	Palmer	0.4	1854	2019	61.472836	-149.206037	EB, Left Wheel
18c	Old Glenn Mp 3 (Twin Peaks)	Palmer	0.43	1854	2018	61.473803	-149.181044	EB, Left Wheel
18c	Old Glenn Mp 3 (Twin Peaks)	Palmer	0.33	1854	2019	61.473803	-149.181044	EB, Left Wheel
18a	Old Glenn Mp 3 (Twin Peaks)	Palmer	1.03	1854	2016	61.473339	-149.182861	
18a	Old Glenn Mp 3 (Twin Peaks)	Palmer	0.8	1854	2017	61.473581	-149.183117	EB, Right Wheel
18a	Old Glenn Mp 3 (Twin Peaks)	Palmer	0.61	1854	2018	61.473625	-149.182993	EB, Right Wheel
18a	Old Glenn Mp 3 (Twin Peaks)	Palmer	0.66	1854	2019	61.473625	-149.182993	EB, Right Wheel
18b	Old Glenn Mp 3 (Twin Peaks)	Palmer	1.03	1854	2016	61.473478	-149.189981	
18b	Old Glenn Mp 3 (Twin Peaks)	Palmer	0.93	1854	2017	61.473997	-149.187155	WB, Right Wheel
18b	Old Glenn Mp 3 (Twin Peaks)	Palmer	0.71	1854	2018	61.473957	-149.186941	WB, Right Wheel
18b	Old Glenn Mp 3 (Twin Peaks)	Palmer	0.72	1854	2019	61.473957	-149.186941	WB, Right Wheel
19c	Old Glenn - Power Plant	Palmer	0.57	1854	2018	61.475816	-149.156344	WB, Left Wheel
19c	Old Glenn - Power Plant	Palmer	0.52	1854	2019	61.475816	-149.156344	WB, Left Wheel
19 control	Old Glenn - Power Plant	Palmer	0.62	1854	2016	61.475771	-149.155443	
19a	Old Glenn - Power Plant	Palmer	1.04	1854	2016	61.475789	-149.155559	
19a	Old Glenn - Power Plant	Palmer	0.73	1854	2017	61.475920	-149.157990	WB, Right Wheel
19a	Old Glenn - Power Plant	Palmer	0.63	1854	2018	61.475959	-149.158038	WB, Right Wheel
19a	Old Glenn - Power Plant	Palmer	0.71	1854	2019	61.475959	-149.158038	WB, Right Wheel
19b	Old Glenn - Power Plant	Palmer	1.01	1854	2016	61.475650	-149.160532	
19b	Old Glenn - Power Plant	Palmer	0.89	1854	2017	61.475831	-149.159803	WB, Right Wheel
19b	Old Glenn - Power Plant	Palmer	0.7	1854	2018	61.475746	-149.160041	WB, Right Wheel
19b	Old Glenn - Power Plant	Palmer	0.62	1854	2019	61.475746	-149.160041	WB, Right Wheel
20c	Old Glenn - Mp 5	Palmer	0.58	1854	2018	61.480253	-149.131500	EB, Right Wheel
20c	Old Glenn - Mp 5	Palmer	0.68	1854	2019	61.480253	-149.131500	EB, Right Wheel
20a Contro	Old Glenn - Mp 5	Palmer	0.54	1854	2016	61.478272	-149.134361	
20a	Old Glenn - Mp 5	Palmer	1.06	1854	2017	61.478361	-149.134369	EB, Left Wheel
20a	Old Glenn - Mp 5	Palmer	0.54	1854	2018	61.478409	-149.134252	EB, Right Wheel
20a	Old Glenn - Mp 5	Palmer	0.63	1854	2019	61.478409	-149.134252	EB, Right Wheel

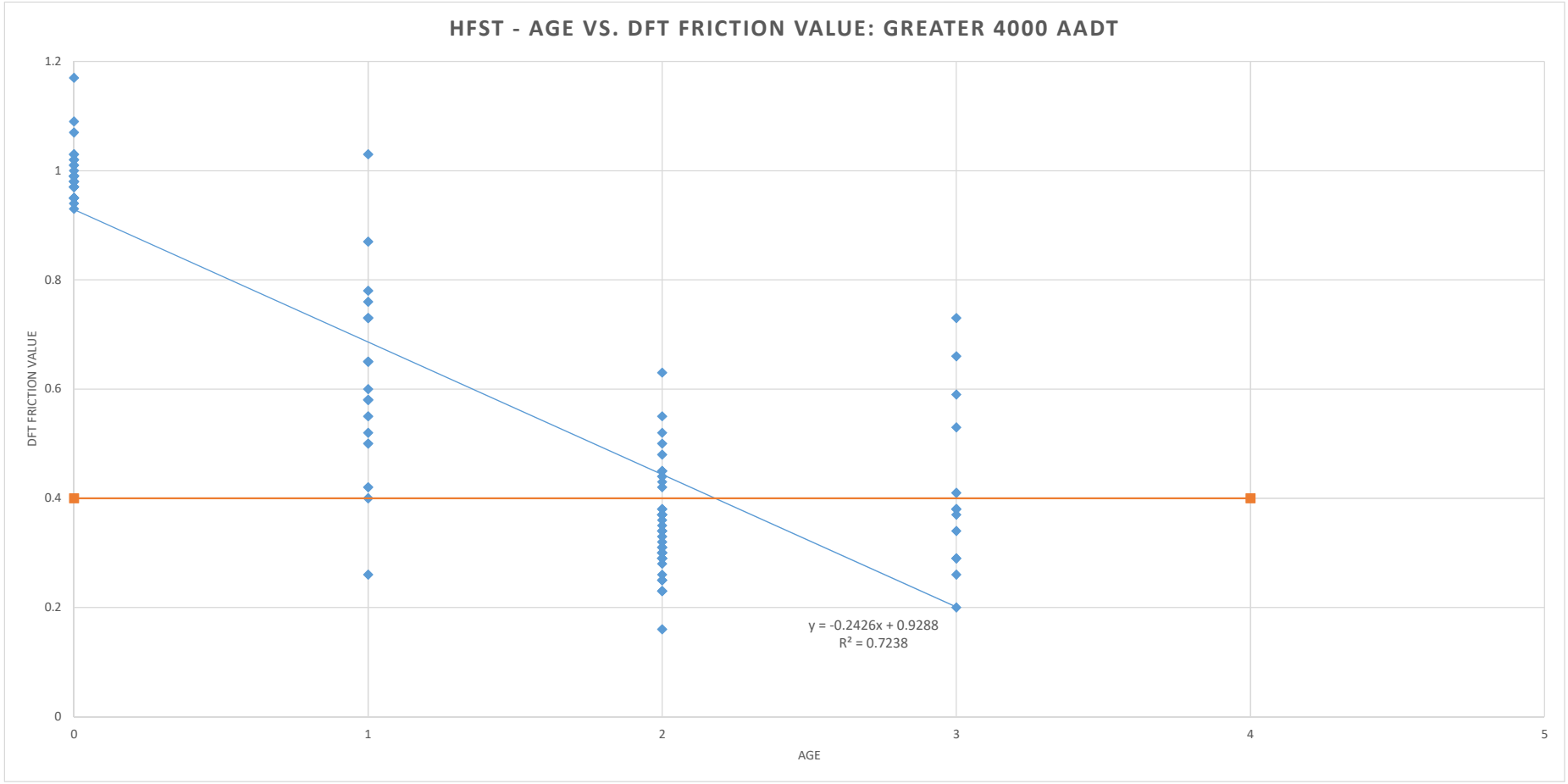
Site	Location	Town	Friction	AADT	Year	Lat	Long	Location
20b	Old Glenn - Mp 5	Palmer	0.98	1854	2016	61.479162	-149.132398	
20b	Old Glenn - Mp 5	Palmer	0.84	1854	2017	61.479177	-149.132418	EB, Right Wheel
20b	Old Glenn - Mp 5	Palmer	0.73	1854	2018	61.479172	-149.132401	EB. Right Wheel
20b	Old Glenn - Mp 5	Palmer	0.72	1854	2019	61.479172	-149.132401	EB. Right Wheel
21c	Old Glenn - Mp 6	Palmer	0.62	1854	2018	61.488414	-149.099741	EB, Right Wheel
21c	Old Glenn - Mp 6	Palmer	0.6	1854	2019	61.488414	-149.099741	EB, Right Wheel
21b	Old Glenn - Mp 6	Palmer	0.62	1854	2018	61.488602	-149.096238	EB, Right Wheel
21b	Old Glenn - Mp 6	Palmer	0.63	1854	2019	61.488602	-149.096238	EB, Right Wheel
21a	Old Glenn - Mp 6	Palmer	1.05	1854	2016	61.488405	-149.098807	
21a	Old Glenn - Mp 6	Palmer	0.78	1854	2017	61.488405	-149.098784	WB, Right Wheel, Bridge Deck
21a	Old Glenn - Mp 6	Palmer	0.64	1854	2018	61.488422	-149.098778	WB
21a	Old Glenn - Mp 6	Palmer	0.67	1854	2019	61.488422	-149.098778	WB
22d	OLD GLENN HIGHWAY - MP 7	Palmer	0.69	1854	2018	61.495650	-149.064891	WB, Right Wheel
22d	OLD GLENN HIGHWAY - MP 7	Palmer	0.54	1854	2019	61.495650	-149.064891	WB, Right Wheel
22a	OLD GLENN HIGHWAY - MP 7	Palmer	0.67	1854	2018	61.493145	-149.071681	EB, Left Wheel
22a	OLD GLENN HIGHWAY - MP 7	Palmer	0.53	1854	2019	61.493145	-149.071681	EB, Left Wheel
22e	OLD GLENN HIGHWAY - MP 7	Palmer	0.65	1854	2018	61.494947	-149.066352	EB, Right Wheel
22e	OLD GLENN HIGHWAY - MP 7	Palmer	0.68	1854	2019	61.494947	-149.066352	EB, Right Wheel
22	OLD GLENN HIGHWAY - MP 7	Palmer	0.98	1854	2016	61.495084	-149.066204	
22b	OLD GLENN HIGHWAY - MP 7	Palmer	0.95	1854	2016	61.493071	-149.071878	
22b	OLD GLENN HIGHWAY - MP 7	Palmer	0.82	1854	2017	61.493199	-149.071639	SB, Left Wheel
22b	OLD GLENN HIGHWAY - MP 7	Palmer	0.56	1854	2018	61.493101	-149.071833	WB, Right Wheel
22b	OLD GLENN HIGHWAY - MP 7	Palmer	0.46	1854	2019	61.493101	-149.071833	WB, Right Wheel
22c	OLD GLENN HIGHWAY - MP 7	Palmer	0.97	1854	2016	61.492284	-149.073903	
22c	OLD GLENN HIGHWAY - MP 7	Palmer	0.84	1854	2017	61.492294	-149.073672	NB, Right Wheel
22c	OLD GLENN HIGHWAY - MP 7	Palmer	0.65	1854	2018	61.492536	-149.073051	NB, Left Wheel
22c	OLD GLENN HIGHWAY - MP 7	Palmer	0.52	1854	2019	61.492536	-149.073051	NB, Left Wheel
23d	Old Glenn Mp 8 to Knik River Road	Palmer	0.68	1854	2018	61.501075	-149.036701	SB, Right Wheel
23d	Old Glenn Mp 8 to Knik River Road	Palmer	0.66	1854	2019	61.501075	-149.036701	SB, Right Wheel
23e	Old Glenn Mp 8 to Knik River Road	Palmer	0.71	1854	2018	61.501429	-149.033653	NB, Right Wheel
23e	Old Glenn Mp 8 to Knik River Road	Palmer	0.63	1854	2019	61.501429	-149.033653	NB, Right Wheel
23f	Old Glenn Mp 8 to Knik River Road	Palmer	0.59	1854	2018	61.502141	-149.032484	NB, Right Wheel
23f	Old Glenn Mp 8 to Knik River Road	Palmer	0.61	1854	2019	61.502141	-149.032484	NB, Right Wheel
23 control	Old Glenn Mp 8 to Knik River Road	Palmer	0.49	1854	2016	61.500846	-149.038351	
23a	Old Glenn Mp 8 to Knik River Road	Palmer	0.99	1854	2016	61.501017	-149.037347	
23a	Old Glenn Mp 8 to Knik River Road	Palmer	0.73	1854	2017	61.500785	-149.038987	SB, Right Wheel
23a	Old Glenn Mp 8 to Knik River Road	Palmer	0.63	1854	2018	61.500797	-149.038919	SB, Right Wheel
23a	Old Glenn Mp 8 to Knik River Road	Palmer	0.7	1854	2019	61.500797	-149.038919	SB, Right Wheel
23	Old Glenn Mp 8 to Knik River Road	Palmer	1.03	1854	2016	61.500878	-149.038370	

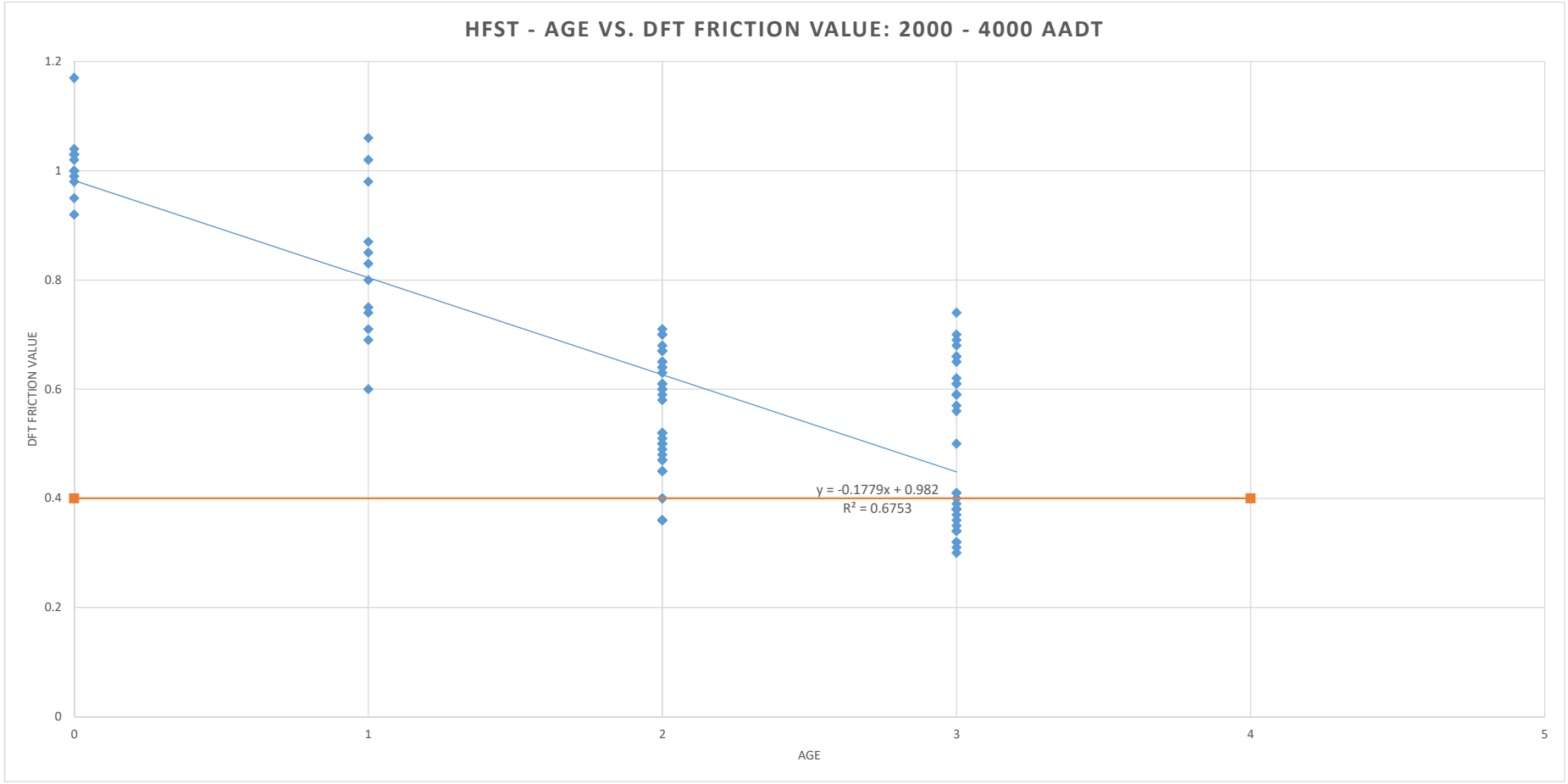
Site	Location	Town	Friction	AADT	Year	Lat	Long	Location
23c	Old Glenn Mp 8 to Knik River Road	Palmer	0.97	1854	2016	61.501152	-149.034825	
23c	Old Glenn Mp 8 to Knik River Road	Palmer	0.73	1854	2017	61.500114	-149.040804	NB, Left Wheel
23c	Old Glenn Mp 8 to Knik River Road	Palmer	0.54	1854	2018	61.500016	-149.040751	NB, Left Wheel
23c	Old Glenn Mp 8 to Knik River Road	Palmer	0.45	1854	2019	61.500016	-149.040751	NB, Left Wheel
23b	Old Glenn Mp 8 to Knik River Road	Palmer	0.63	1854	2018	61.499296	-149.044052	NB, Right Wheel
23b	Old Glenn Mp 8 to Knik River Road	Palmer	0.64	1854	2019	61.499296	-149.044052	NB, Right Wheel
24b	Old Glenn - Our Road	Palmer	0.59	1730	2018	61.518185	-149.047273	SB, Right Wheel
24b	Old Glenn - Our Road	Palmer	0.58	1730	2019	61.518185	-149.047273	SB, Right Wheel
24c	Old Glenn - Our Road	Palmer	0.68	1730	2018	61.517002	-149.047094	SB, Right Wheel
24c	Old Glenn - Our Road	Palmer	0.53	1730	2019	61.517002	-149.047094	SB, Right Wheel
24 control	Old Glenn - Our Road	Palmer	0.55	1730	2016	61.515774	-149.045138	
24a	Old Glenn - Our Road	Palmer	1.04	1730	2016	61.515864	-149.045308	
24a	Old Glenn - Our Road	Palmer	0.81	1730	2017	61.515981	-149.045553	SB, Right Wheel
24a	Old Glenn - Our Road	Palmer	0.66	1730	2018	61.515969	-149.045548	SB, Right Wheel
24a	Old Glenn - Our Road	Palmer	0.66	1730	2019	61.515969	-149.045548	SB, Right Wheel
25c	Old Glenn Mp 12	Palmer	0.51	3680	2018	61.545829	-149.033434	NB, Right Wheel
25c	Old Glenn Mp 12	Palmer	0.35	3680	2019	61.545829	-149.033434	NB, Right Wheel
25 control	Old Glenn Mp 12	Palmer	0.56	3680	2016	61.549189	-149.033985	
25a	Old Glenn Mp 12	Palmer	0.95	3680	2016	61.549178	-149.033949	
25a	Old Glenn Mp 12	Palmer	0.8	3680	2017	61.549116	-149.033997	NB, Left Wheel
25a	Old Glenn Mp 12	Palmer	0.52	3680	2018	61.548360	-149.033254	NB, Right Wheel
25a	Old Glenn Mp 12	Palmer	0.36	3680	2019	61.548360	-149.033254	NB, Right Wheel
25b	Old Glenn Mp 12	Palmer	0.98	3680	2016	61.548193	-149.033151	
25b	Old Glenn Mp 12	Palmer	0.98	3680	2017	61.548257	-149.033188	NB, Right Wheel
25b	Old Glenn Mp 12	Palmer	0.49	3680	2018	61.547938	-149.033106	NB, Left Wheel
25b	Old Glenn Mp 12	Palmer	0.41	3680	2019	61.547938	-149.033106	NB, Left Wheel
26b	Wasilla/Fishhook Rd: Lakeview Rad to Paradise Lane	Wasilla	0.36	3354	2018	61.623524	-149.373054	NB, Left Wheel
26b	Wasilla/Fishhook Rd: Lakeview Rad to Paradise Lane	Wasilla	0.39	3354	2019	61.623524	-149.373054	NB, Left Wheel
26d	Wasilla/Fishhook Rd: Lakeview Rad to Paradise Lane	Wasilla	0.58	3354	2018	61.626010	-149.368644	SB, Left Wheel
26d	Wasilla/Fishhook Rd: Lakeview Rad to Paradise Lane	Wasilla	0.34	3354	2019	61.626010	-149.368644	SB, Left Wheel
26 control	Wasilla/Fishhook Rd: Lakeview Rad to Paradise Lane	Wasilla	0.57	3354	2016	61.624588	-149.370644	
26a	Wasilla/Fishhook Rd: Lakeview Rad to Paradise Lane	Wasilla	0.92	3354	2016	61.624057	-149.371400	
26a	Wasilla/Fishhook Rd: Lakeview Rad to Paradise Lane	Wasilla	0.74	3354	2017	61.624041	-149.371347	NB, Right Wheel
26a	Wasilla/Fishhook Rd: Lakeview Rad to Paradise Lane	Wasilla	0.64	3354	2018	61.624052	-149.371358	EB, Right Wheel
26a	Wasilla/Fishhook Rd: Lakeview Rad to Paradise Lane	Wasilla	0.34	3354	2019	61.624052	-149.371358	EB, Right Wheel
26c	Wasilla/Fishhook Rd: Lakeview Rad to Paradise Lane	Wasilla	1	3354	2016	61.624615	-149.370603	
26c	Wasilla/Fishhook Rd: Lakeview Rad to Paradise Lane	Wasilla	0.6	3354	2017	61.624605	-149.370664	SB, Right Wheel
26c	Wasilla/Fishhook Rd: Lakeview Rad to Paradise Lane	Wasilla	0.4	3354	2018	61.624641	-149.370633	SB, Right Wheel
26c	Wasilla/Fishhook Rd: Lakeview Rad to Paradise Lane	Wasilla	0.3	3354	2019	61.624641	-149.370633	SB, Right Wheel

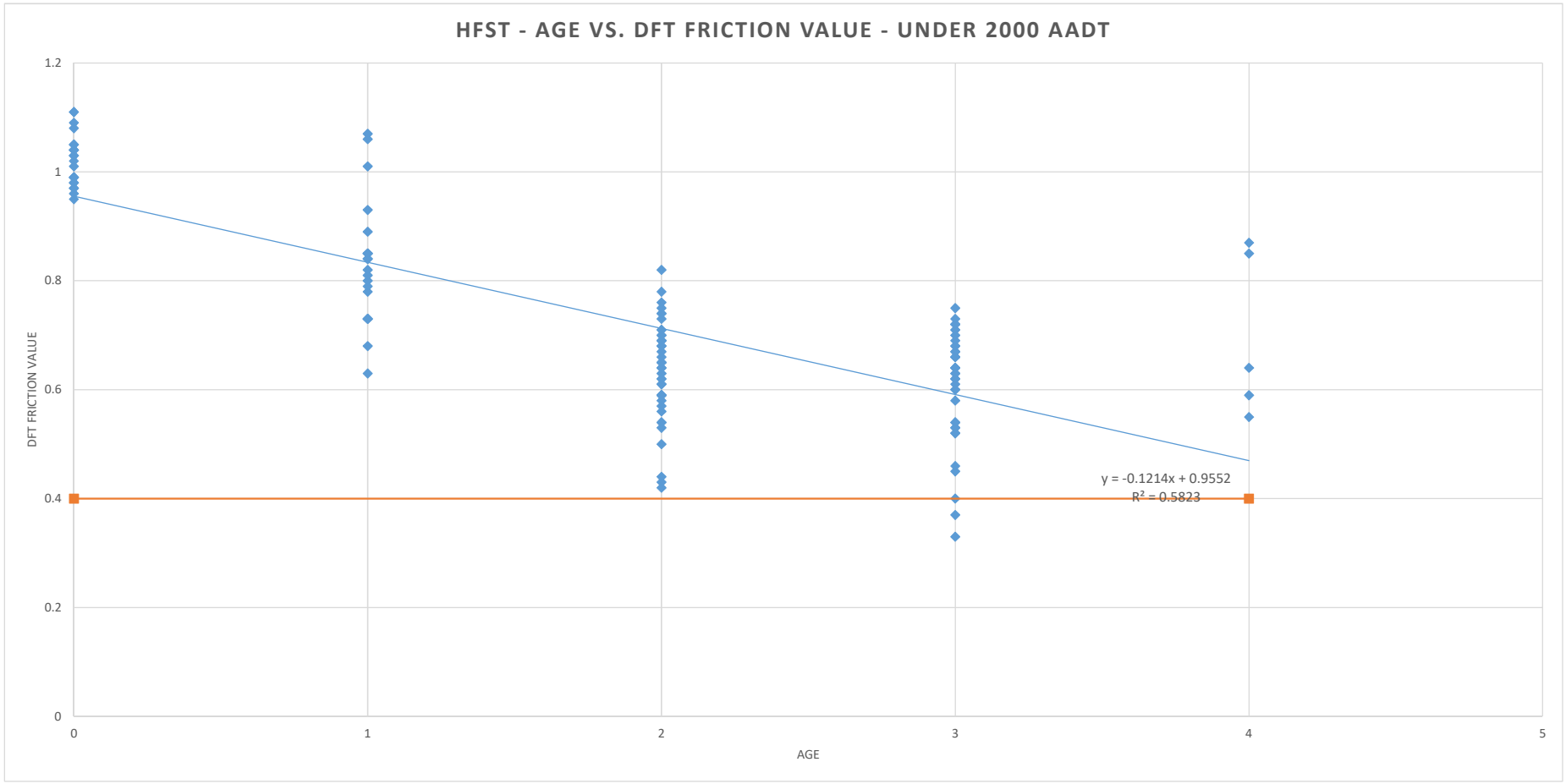
Site	Location	Town	Friction	AADT	Year	Lat	Long	Location
27d	Wasilla/Fishhook Road: Mariah Drive to Pamela Drive	Wasilla	0.4	3354	2018	61.638544	-149.343957	NB, Right Wheel
27d	Wasilla/Fishhook Road: Mariah Drive to Pamela Drive	Wasilla	0.38	3354	2019	61.638544	-149.343957	NB, Right Wheel
27e	Wasilla/Fishhook Road: Mariah Drive to Pamela Drive	Wasilla	0.45	3354	2018	61.640934	-149.336584	NB, Right Wheel
27e	Wasilla/Fishhook Road: Mariah Drive to Pamela Drive	Wasilla	0.38	3354	2019	61.640934	-149.336584	NB, Right Wheel
27f	Wasilla/Fishhook Road: Mariah Drive to Pamela Drive	Wasilla	0.61	3354	2018	61.641743	-149.332970	NB, Right Wheel
27f	Wasilla/Fishhook Road: Mariah Drive to Pamela Drive	Wasilla	0.57	3354	2019	61.641743	-149.332970	NB, Right Wheel
27a	Wasilla/Fishhook Road: Mariah Drive to Pamela Drive	Wasilla	0.99	3354	2016	61.641063	-149.335237	
27a	Wasilla/Fishhook Road: Mariah Drive to Pamela Drive	Wasilla	0.69	3354	2017	61.640736	-149.338795	SB, Right Wheel
27a	Wasilla/Fishhook Road: Mariah Drive to Pamela Drive	Wasilla	0.52	3354	2018	61.639889	-149.341587	SB, Right Wheel
27a	Wasilla/Fishhook Road: Mariah Drive to Pamela Drive	Wasilla	0.62	3354	2019	61.639889	-149.341587	SB, Right Wheel
27b	Wasilla/Fishhook Road: Mariah Drive to Pamela Drive	Wasilla	1.02	3354	2016	61.640758	-149.338850	
27b	Wasilla/Fishhook Road: Mariah Drive to Pamela Drive	Wasilla	0.75	3354	2017	61.637433	-149.345092	NB, Right Wheel
27b	Wasilla/Fishhook Road: Mariah Drive to Pamela Drive	Wasilla	0.5	3354	2018	61.637480	-149.345016	NB, Left Wheel
27b	Wasilla/Fishhook Road: Mariah Drive to Pamela Drive	Wasilla	0.4	3354	2019	61.637480	-149.345016	NB, Left Wheel
27c	Wasilla/Fishhook Road: Mariah Drive to Pamela Drive	Wasilla	1.03	3354	2016	61.636718	-149.346194	
28b	Wasilla/Fishhook road: King Cove dr. to Mccasey Dr	Wasilla	0.71	3354	2018	61.676463	-149.259112	SB, Right Wheel
28b	Wasilla/Fishhook road: King Cove dr. to Mccasey Dr	Wasilla	0.66	3354	2019	61.676463	-149.259112	SB, Right Wheel
28c	Wasilla/Fishhook road: King Cove dr. to Mccasey Dr	Wasilla	0.64	3354	2018	61.675935	-149.260545	SB, Right Wheel
28c	Wasilla/Fishhook road: King Cove dr. to Mccasey Dr	Wasilla	0.59	3354	2019	61.675935	-149.260545	SB, Right Wheel
28d	Wasilla/Fishhook road: King Cove dr. to Mccasey Dr	Wasilla	0.63	3354	2018	61.675956	-149.262347	SB, Right Wheel
28d	Wasilla/Fishhook road: King Cove dr. to Mccasey Dr	Wasilla	0.59	3354	2019	61.675956	-149.262347	SB, Right Wheel
28e	Wasilla/Fishhook road: King Cove dr. to Mccasey Dr	Wasilla	0.7	3354	2018	61.675029	-149.270692	SB, Right Wheel
28e	Wasilla/Fishhook road: King Cove dr. to Mccasey Dr	Wasilla	0.65	3354	2019	61.675029	-149.270692	SB, Right Wheel
28f	Wasilla/Fishhook road: King Cove dr. to Mccasey Dr	Wasilla	0.67	3354	2018	61.675185	-149.269249	NB, Left Wheel
28f	Wasilla/Fishhook road: King Cove dr. to Mccasey Dr	Wasilla	0.65	3354	2019	61.675185	-149.269249	NB, Left Wheel
28g	Wasilla/Fishhook road: King Cove dr. to Mccasey Dr	Wasilla	0.6	3354	2018	61.674973	-149.267325	NB, Right Wheel
28g	Wasilla/Fishhook road: King Cove dr. to Mccasey Dr	Wasilla	0.56	3354	2019	61.674973	-149.267325	NB, Right Wheel
28h	Wasilla/Fishhook road: King Cove dr. to Mccasey Dr	Wasilla	0.65	3354	2018	61.674043	-149.282635	SB, Right Wheel
28h	Wasilla/Fishhook road: King Cove dr. to Mccasey Dr	Wasilla	0.68	3354	2019	61.674043	-149.282635	SB, Right Wheel
28i	Wasilla/Fishhook road: King Cove dr. to Mccasey Dr	Wasilla	0.65	3354	2018	61.673637	-149.284256	SB, Left Wheel
28i	Wasilla/Fishhook road: King Cove dr. to Mccasey Dr	Wasilla	0.66	3354	2019	61.673637	-149.284256	SB, Left Wheel
28j	Wasilla/Fishhook road: King Cove dr. to Mccasey Dr	Wasilla	0.68	3354	2018	61.670568	-149.287882	NB, Left Wheel
28j	Wasilla/Fishhook road: King Cove dr. to Mccasey Dr	Wasilla	0.61	3354	2019	61.670568	-149.287882	NB, Left Wheel
28 control	Wasilla/Fishhook road: King Cove dr. to Mccasey Dr	Wasilla	0.62	3354	2016	61.676883	-149.258544	
28 control	Wasilla/Fishhook road: King Cove dr. to Mccasey Dr	Wasilla	0.61	3354	2016	61.676842	-149.258407	
28 control	Wasilla/Fishhook road: King Cove dr. to Mccasey Dr	Wasilla	0.49	3354	2016	61.674072	-149.282446	
28A1	Wasilla/Fishhook road: King Cove dr. to Mccasey Dr	Wasilla	1	3354	2016	61.669248	-149.294232	
28a1	Wasilla/Fishhook road: King Cove dr. to Mccasey Dr	Wasilla	0.85	3354	2017	61.669861	-149.291978	SB, Right Wheel
28a1	Wasilla/Fishhook road: King Cove dr. to Mccasey Dr	Wasilla	0.65	3354	2018	61.669834	-149.292010	SB, Right Wheel

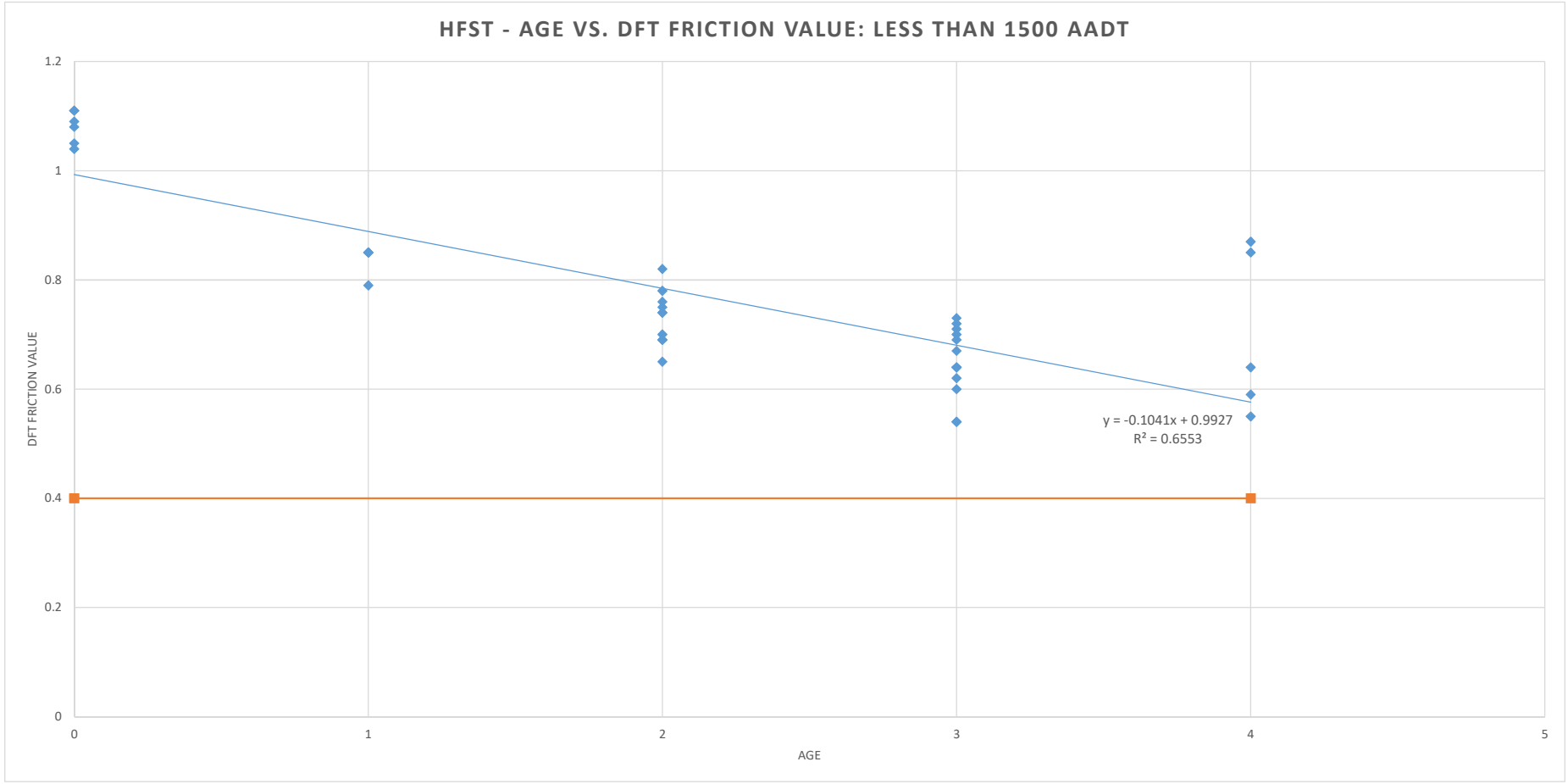
Site	Location	Town	Friction	AADT	Year	Lat	Long	Location
28a1	Wasilla/Fishhook road: King Cove dr. to Mccasey Dr	Wasilla	0.74	3354	2019	61.669834	-149.292010	SB, Right Wheel
28A2	Wasilla/Fishhook road: King Cove dr. to Mccasey Dr	Wasilla	1.03	3354	2016	61.671411	-149.286561	
28a2	Wasilla/Fishhook road: King Cove dr. to Mccasey Dr	Wasilla	1.06	3354	2017	61.671286	-149.286702	NB, Right Wheel
28a2	Wasilla/Fishhook road: King Cove dr. to Mccasey Dr	Wasilla	0.6	3354	2018	61.671287	-149.286695	NB, Right Wheel
28a2	Wasilla/Fishhook road: King Cove dr. to Mccasey Dr	Wasilla	0.69	3354	2019	61.671287	-149.286695	NB, Right Wheel
28	Wasilla/Fishhook road: King Cove dr. to Mccasey Dr	Wasilla	0.98	3354	2016	61.674126	-149.281559	
28	Wasilla/Fishhook road: King Cove dr. to Mccasey Dr	Wasilla	0.99	3354	2016	61.676738	-149.258618	
28	Wasilla/Fishhook road: King Cove dr. to Mccasey Dr	Wasilla	1	3354	2016	61.676761	-149.258463	
29c	Parks Hwy MP 133	Chulitna	0.69	1320	2018	62.570584	-150.234301	NB, Right Wheel
29c	Parks Hwy MP 133	Chulitna	0.85	1320	2018	62.570584	-150.234301	NB, Right Wheel
29d	Parks Hwy MP 133	Chulitna	0.73	1320	2018	62.570082	-150.233480	SB, Left Wheel
29d	Parks Hwy MP 133	Chulitna	0.87	1320	2019	62.570082	-150.233480	SB, Left Wheel
29e	Parks Hwy MP 133	Chulitna	0.64	1320	2018	62.566709	-150.231672	SB, Left Wheel
29e	Parks Hwy MP 133	Chulitna	0.59	1320	2019	62.566709	-150.231672	SB, Left Wheel
29a	Parks Hwy MP 133	Chulitna	1.05	1320	2015			SB, Left Wheel
29a	Parks Hwy MP 133	Chulitna	0.76	1320	2017	62.569271	-150.232001	SB, Left Wheel
29a	Parks Hwy MP 133	Chulitna	0.64	1320	2018	62.569207	-150.231917	SB, Left Wheel
29a	Parks Hwy MP 133	Chulitna	0.64	1320	2019	62.569207	-150.231917	SB, Left Wheel
29b	Parks Hwy MP 133	Chulitna	1.11	1320	2015			NB, Right Wheel
29b	Parks Hwy MP 133	Chulitna	0.82	1320	2017	62.567713	-150.231080	NB, Left Wheel
29b	Parks Hwy MP 133	Chulitna	0.62	1320	2018	62.567707	-150.231080	NB, Right Wheel
29b	Parks Hwy MP 133	Chulitna	0.55	1320	2019	62.567707	-150.231080	NB, Right Wheel


HFST - AGE VS. DFT FRICTION VALUE - ALL SITES
DFT FRICTION VALUE
AGE
1.2
1
0.8
0.6
0.4
0.2
0
0
1
2
3
4
5
y = -0.1545x + 0.93
R² = 0.503


HFST - AGE VS. DFT FRICTION VALUE: GREATER 4000 AADT
DFT FRICTION VALUE
AGE
1.2
1
0.8
0.6
0.4
0.2
0
0
1
2
3
4
5
y = -0.2426x + 0.9288
R² = 0.7238


HFST - AGE VS. DFT FRICTION VALUE: 2000 - 4000 AADT
DFT FRICTION VALUE
AGE
y = -0.1779x + 0.982
R² = 0.6753
1.2
1
0.8
0.6
0.4
0.2
0
0
1
2
3
4
5


HFST - AGE VS. DFT FRICTION VALUE - UNDER 2000 AADT
DFT FRICTION VALUE
AGE
y = -0.1214x + 0.9552
R² = 0.5823
1.2
1
0.8
0.6
0.4
0.2
0
0
1
2
3
4
5


HFST - AGE VS. DFT FRICTION VALUE: LESS THAN 1500 AADT
DFT FRICTION VALUE
AGE
1.2
1
0.8
0.6
0.4
0.2
0
0
1
2
3
4
5
y = -0.1041x + 0.9927
R² = 0.6553

APPENDIX C
Experimental Feature Work Plan

Work Plan For

High Friction Surface Treatment Material Monitoring Project

Alaska Department of Transportation & Public Facilities

Anna Bosin, P.E.
Research Engineer

December 2015

Introduction

Central Region Alaska Department of Transportation and Public Facilities (DOT&PF) will be installing the first highway applications of High Friction Surface Treatment (HFST) in Alaska starting spring 2016. HFST is a pavement surfacing system with exceptional skid-resistant properties that are not typically acquired by conventional pavement materials. The treatment system is composed of a hard aggregate and binder. The aggregate is a thin layer of specially engineered Calcined Bauxite aggregate, a durable high friction topping. Binders vary by manufacturer and are generally proprietary products consisting of bitumen-extended epoxy resins, epoxy-resin, polyester-resin, polyurethane-resin, acrylic-resin, or Methyl Methacrylate (MMA) epoxy.

Although this treatment has been widely used in the lower 48 states, it is not currently in wide use in Alaska.

Background / History

HFST is a crash mitigation measure that has been researched and proven by Federal Highway Administration (FHWA) in other parts of the country to reduce single-vehicle-run-off-the-road (SVROR) crashes due in part to adverse geometric and environmental conditions. In addition, it has also been shown to reduce rear-end type crashes at intersections with steep grades. Ideal crash reduction sites for HFST within Central Region were selected where; geometric constraints limit reconstruction, shady/icy curves are located on high speed roadways, crash history shows clusters of SVROR and motorcycle crashes occurring, and skidding/road condition were recorded as a contributing factor for a crash.

Objectives and Scope

HFST will be applied at 28 sites within the DOT&PF Central Region based on criteria reviewed and approved through the Highway Safety Improvement Program (HSIP).

Existing pavement which is damaged or has rutting in excess of 0.25” depth will be milled 0.75” and repaved with 1” of Type IV, Class A PG 58-34 HMA prior to the application of HFST. DOT&PF Materials is recommending a minimum of 30 days between placing new pavement and applying HFST. Because of this delay, DOT&PF anticipates areas where pavement replacement is performed will have paving completed in year 1 and the HFST would follow in year 2.

For areas with pavement ruts less than 0.25”, the HFST will be applied to the existing paved surface.

The primary objectives of the HFST Monitoring project are the following:

1. **Assess existing asphalt surface preparation and material application during construction.**

For this project, DOT&PF is proposing to monitor the required surface preparation and material application including but not limited to:

- Minimum pavement conditions required for HFST application;
- Minimum amount of time that new pavement must be allowed to cure prior to HFST application. (DOT&PF Materials is requesting a 30 day period. Varying times of between 30 and 90 days are cited by different polymer resin binder material manufacturers.);
- Weather and minimum temperature conditions required for successful application;
- Ability to apply polymer resin binder material in a neat line within a specified distance from existing adjacent features to remain such as striping;
- Production rates utilizing automated equipment, and;
- Amount of time before roadway can be opened to traffic.

2. Monitor High Friction Surface Treatment Performance

Performance will be monitored by the following methods.

- Pavement friction will be measured before and after construction and then annually using a Dynamic Friction Tester (DFT) capable of dynamic friction testing in accordance with, ASTM E1911. The specific work plan is outlined herein.

3. Long-term performance monitoring under Alaska Conditions

For the long-term we are proposing that these HFST sites be monitored for a period of three years. Within the three-year period from construction DOT&PF anticipates all testing and analysis be completed for inclusion in a final report.

This project's 28 data driven locations are located in both urban and rural areas of Central Region (Kenai Peninsula Borough, Matanuska-Susitna Borough, Anchorage, and Eagle River) and are subject to the following cold climate conditions:

- Seasonal studded tire wear between September and May;
- Winter plowing operations;
- Anti-icing and de-icing applications, and;
- A freeze-thaw pavement cycle.

Work Plan

1. HFST Site Description and Construction Procedure

Location maps, a summary table, and as-advertised plans showing the proposed HFST locations are included in Appendix A. The project title is: HSIP: CR High Friction Surface Treatment Project No. 0001501/Z570920000.

Construction, materials, and methods used will conform to Section 405 of the "Special Provisions" of the project "Contract Documents and Specifications". The project calls for the placement of approximately 147,500 square yards of HFST at the 28 sites.

2. Method of Evaluation

A) During construction, DOT&PF staff will monitor and document the required surface preparation and material application including:

- The pavement condition at the time of HFST application including ruts, cracks, etc. and whether the application was on existing older pavement or surfaces milled and repaved prior to application;
- The amount of time for new pavement to cure before application of the binder (minimum 30 days required);
- Weather and temperature conditions at the time of polymer resin binder material application;
- The application of the polymer resin binder material to insure adjacent features are not affected;
- The production rates for the automated lay down equipment and equipment model information, and;
- Amount of time before roadway is opened to traffic.

B) Post-construction evaluation will consist of monitoring the condition and friction of the HFST treated areas over a three-year period. Monitoring will include summer evaluation of:

- Overall pavement condition;
- Pavement rut depths, cracking, IRI (from annual Pavement Management System survey);
- Pavement raveling, binder exposure, etc.;
- Pavement friction compared to time of application per friction testing plan; and,
- Condition of pavement markings placed over the HSFT material (both surface applied and grooved-in MMA).

C) Friction Testing Plan

- As previously mentioned, friction testing will follow the Dynamic Friction Tester, test method ASTM E1911 and will be administered by DOT&PF staff each summer post construction for three consecutive years.
- Testing will require traffic control per MUTCD requirements and a traffic control plan will need to be submitted to the CR Traffic Section for review and approval annually. The traffic control contract will be administered by DOT&PF CR Materials Section.
- Locations for administering the test for each site shall follow the below work plan:

Number of Tests per Site	Tangent	Curve
3	Wheel path, non-wheel path, plus control	PC/PT, MC, plus control

Where "control" means pavement adjacent to test site without HFST but is representative of the overall pavement condition for the lane. Test locations within each HFST Site should have GPS coordinates taken for repeatability and reporting. Photos are encouraged.

Reporting

Paving will be completed prior to placing HFST and the HFST will be completed by September 1, 2016. A construction report will be submitted by the end of November 2016.

Interim reports will be submitted at the end of summer of each of the three evaluation years. A final report, summarizing previous reports will be submitted by the end of 2019. At the end of the evaluation period, a synopsis will be provided that will provide a recommendation whether the use of HFST should continue in Alaska. It also will contain information concerning what pitfalls or construction/maintenance issues could have been avoided through improved specifications, construction plans and practices.

Schedule

- Construction completion of all HFST sites: Fall 2016
- Post-construction report: Winter 2016
- First year survey and report: Fall 2017
- Second year survey and report: Fall 2018
- Third year survey and report: Fall 2019
- Final report: December 2019.

Budget

No additional cost will be incurred for pavement rutting, cracking, or IRI data collection, as the annual Pavement Management System (PMS) survey will document pavement performance after initial construction testing is complete.

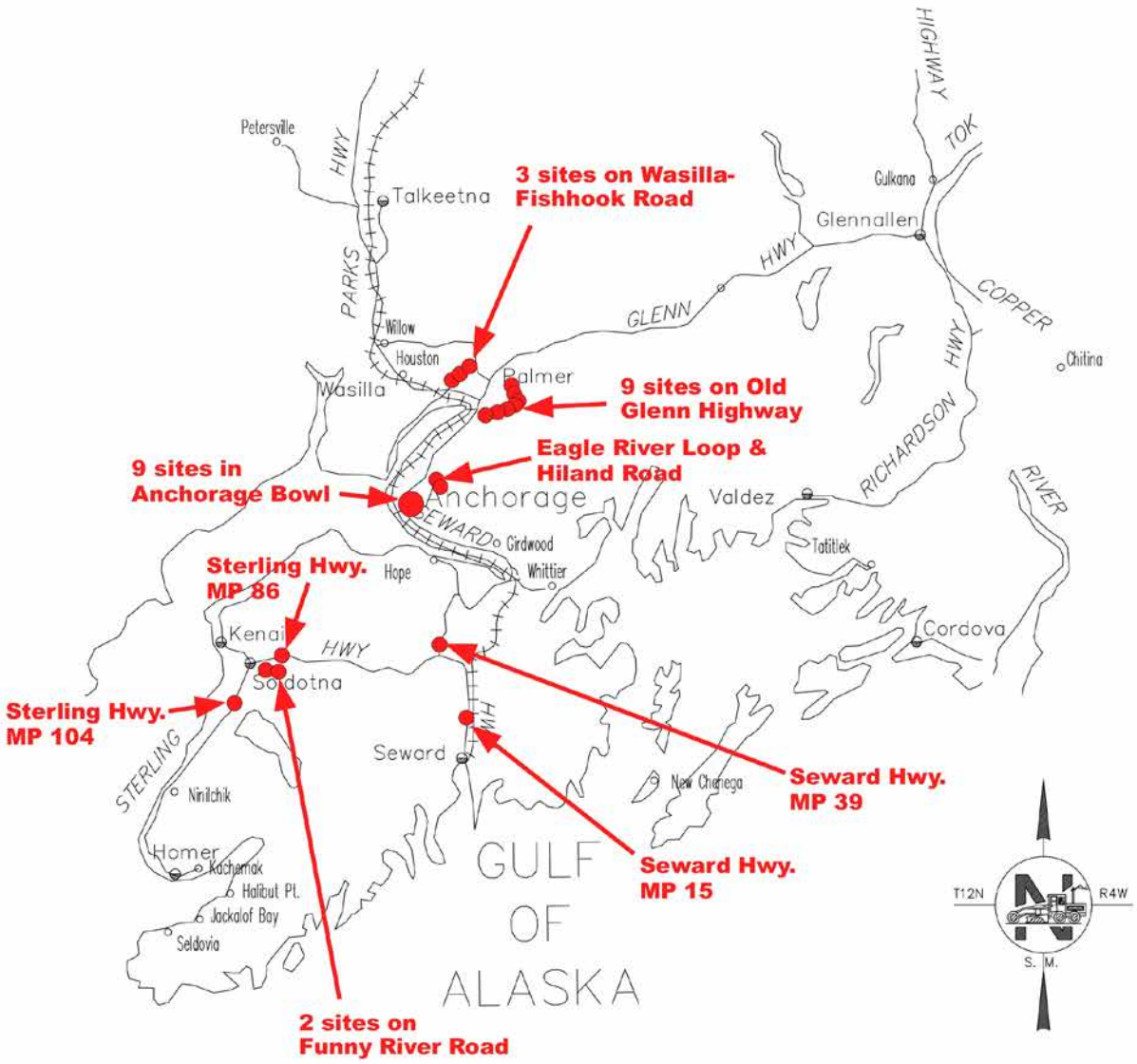
There will be a cost associated with the initial pavement friction measurements (prior to construction) and post-construction pavement evaluation. DOT&PF Materials staff will perform the above planned tasks for a total of $138,500 which includes traffic control operations, ICAP, equipment use, reporting, and staff time. See Appendix B for detailed cost estimate.

Appendix A

HFST Location Maps

HFST Candidate Locations Summary Spreadsheet

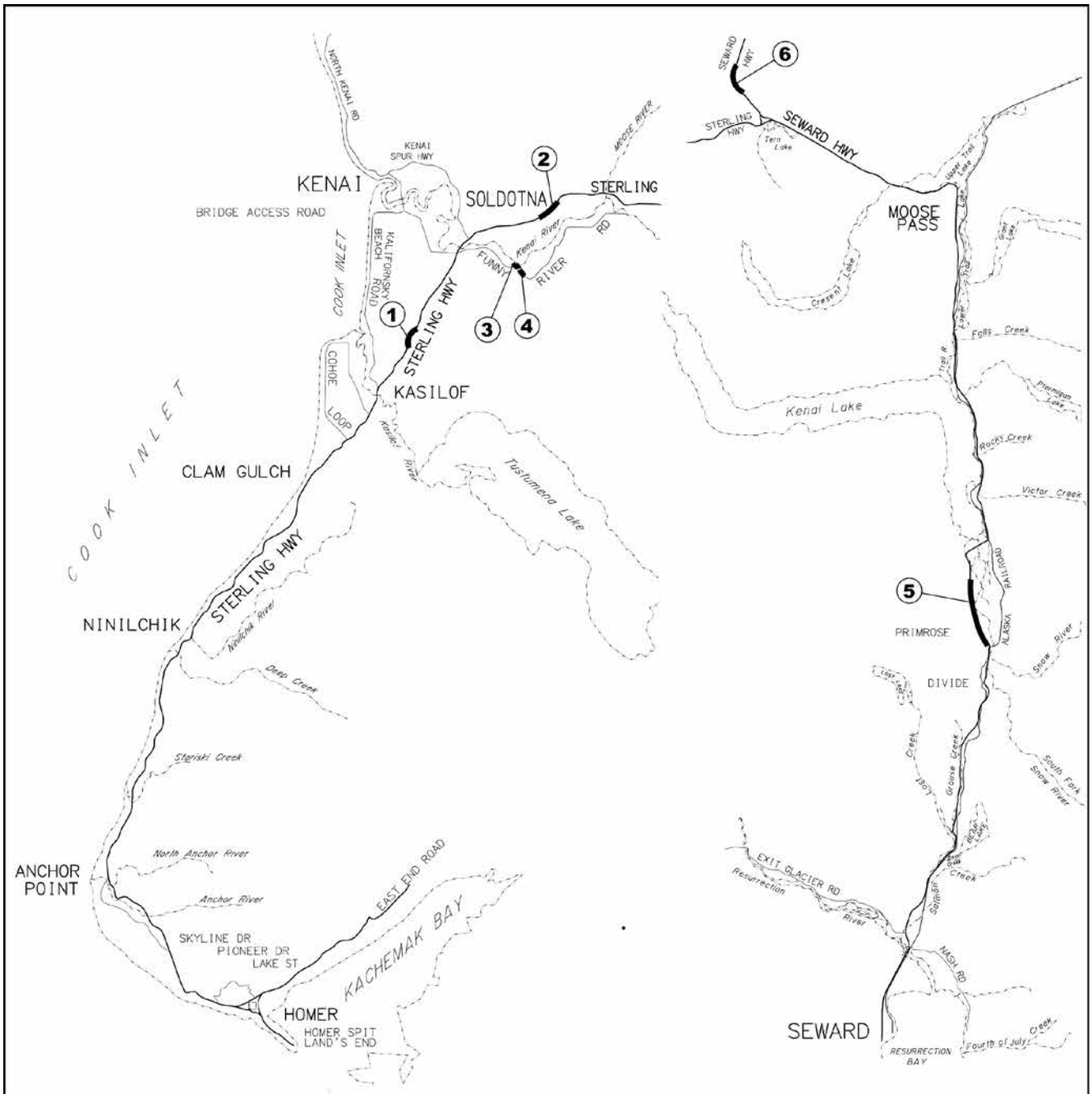
Conformed Planset



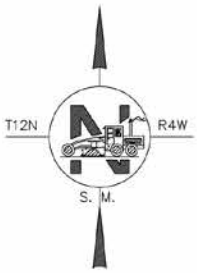
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES

FIGURE 1
HSIP: CR HIGH FRICTION SURFACE TREATMENT PROJECT
PROJECT NO. 0001501/57092

LOCATION AND VICINITY MAP



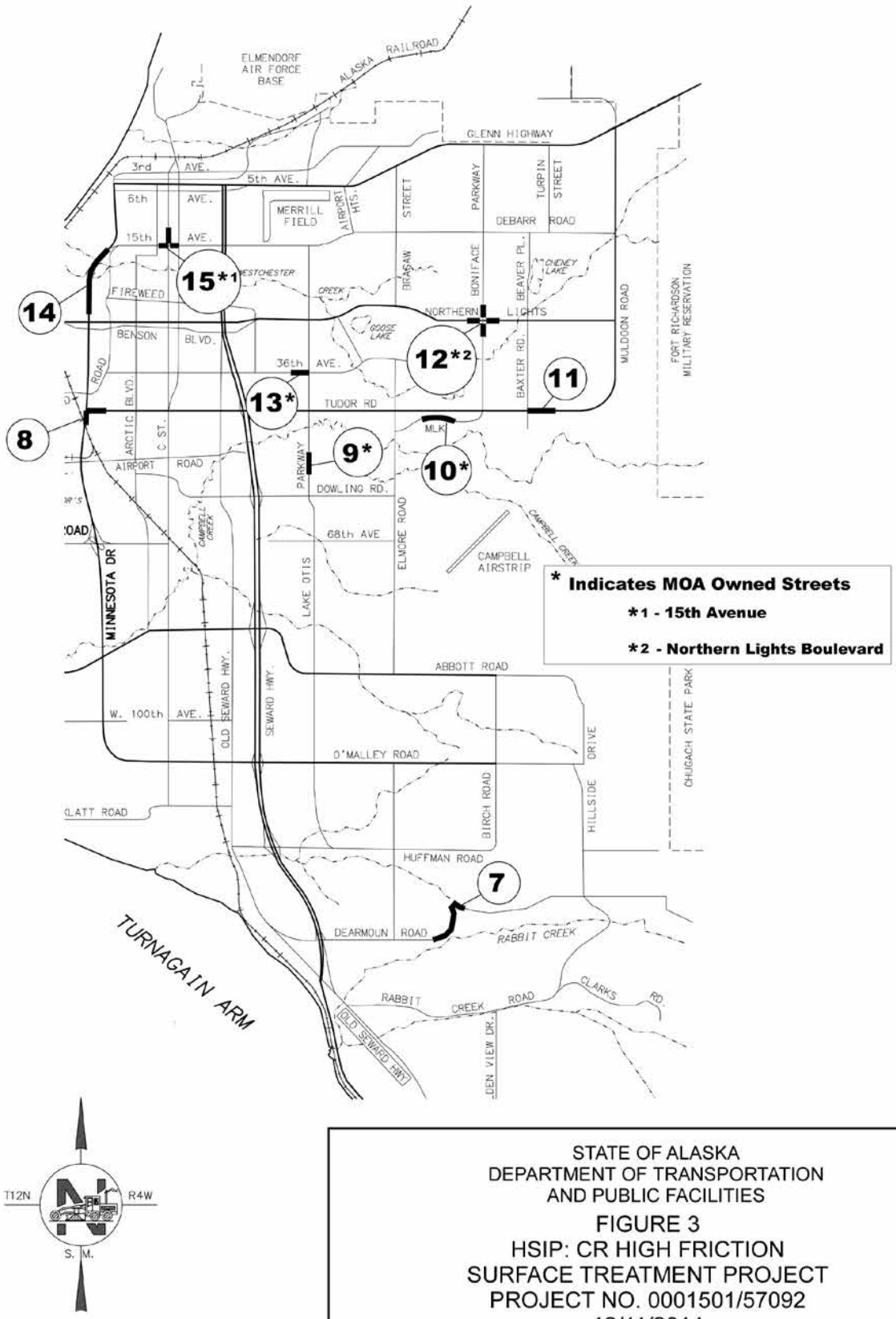
Soldotna-Homer **Seward Highway**



STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
AND PUBLIC FACILITIES

FIGURE 2
HSIP: CR HIGH FRICTION
SURFACE TREATMENT PROJECT
PROJECT NO. 0001501/57092
12/11/2014

KENAI PENINSULA HFST LOCATIONS



STATE OF ALASKA
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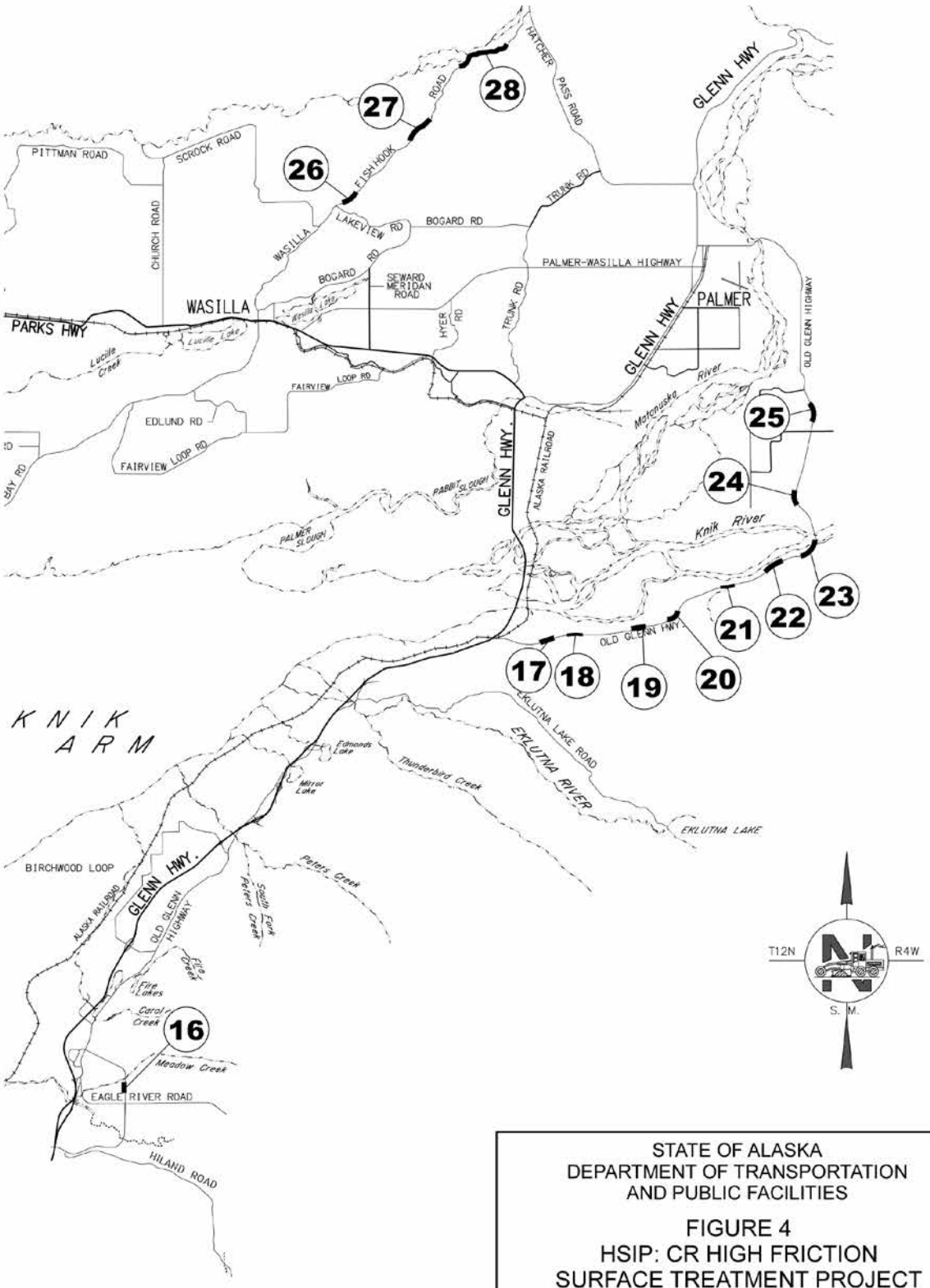
AND PUBLIC FACILITIES

FIGURE 3
HSIP: CR HIGH FRICTION
SURFACE TREATMENT PROJECT
PROJECT NO. 0001501/57092
12/11/2014

ANCHORAGE AREA HFST LOCATIONS



STATE OF ALASKA
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AND PUBLIC FACILITIES

FIGURE 4
HSIP: CR HIGH FRICTION
SURFACE TREATMENT PROJECT
PROJECT NO. 0001501/57092
12/11/2014

EAGLE RIVER AND MAT-SU VALLEY
HFST LOCATIONS

Location Number	Road Segment/Intersection	Begin	End	Roadway Functional Classification	NHS, AHS or HRRR*
1	Sterling Hwy. MP 104	1200' south of Wolverine	260' north of MP 104	Principal Arterial-Other	NHS
2	Sterling Highway MP 86 (Evergreen)	2880' south of Evergreen Street	220' south of Evergreen Street	Interstate	NHS
3	Funny River Rd. (Bayberry to Wik)	700' east of Bayberry Street	Wik Circle	Minor Collector	HRRR. Not NHS or AHS
4	Funny River Rd. MP 6	2275' east of Wik Circle	1340' west of MP 6	Minor Collector	HRRR. Not NHS or AHS
5	Seward Highway MP 14-16	625- south of MP 15	1030' south of Greyling Creek Crossing	Principal Arterial-Other	NHS
6	Seward Highway MP 38-40	1050' north of Devils Pass Trailhead Access Road (55/65 MPH speed transition)	850' south of west side driveway access north of Jerome Lake.	Interstate	NHS
7	De Armoun Rd.	300' east of Mulligan Street	600' west of Crestview	Major Collector	Not NHS or AHS
8	Minnesota Drive @ Tudor Road	North Abutment north Railroad Overcrossing	South Crosswalk Line, Tudor Road	Principal Arterial-Other	NHS
9	Lake Otis Pkwy.	20' north of 52nd Avenue centerline	STOP bar line at Waldron Drive	Principal Arterial-Other	NHS
10	MLK Dr. Ballfields Access to Tudor Centre Drive	25' east of Ballfield Access	End of median island 280' west of Tudor Centre Drive	Minor Arterial	Not NHS or AHS
11	Tudor Rd. at Baxter Road	150' west of Baxter Road.	1050' east of Baxter Road.	Principal Arterial-Other	NHS
12	Northern Lights Blvd. at Boniface Parkway	350' west of near X-Walk Line at Boniface Parkway	415' east of near X-Walk Line at Boniface Parkway	Principal Arterial-Other	NHS
	Boniface Parkway @ Northern Lights Blvd.	260' south of near X-Walk line at Northern Lights Boulevard	330' north of near X-Walk line at Northern Lights Boulevard		
13	36th Ave. at Lake Otis Parkway	150' east of Randolph Street	Near X-Walk line at Lake Otis Parkway	Principal Arterial-Other	NHS
14	Minnesota Dr. 25th to 15th	25th Avenue	15th Avenue	Principal Arterial-Other	NHS
15	15th Avenue @ C Street	215' west of near X-Walk line at C Street	120' east of near X-Walk line at C Street	Minor Arterial	Not NHS or AHS
	C Street @ 15th Avenue	310' north of near X-Walk line at 15th Avenue.	Near X-Walk line at 15th Avenue.	Principal Arterial-Other	NHS
16	Eagle River Loop Road @ Baranof/Citation	950' north of Baranof/Citation centerline	Near X-Walk line at Baranof/Citation	Minor Arterial	Not NHS or AHS
17	Old Glenn -MP 2	200' east of MP 2	Winding Road sign 2000' east of MP 2	Major Collector	HRRR and AHS
18	Old Glenn-MP 3 Twin Peaks	1740' west of MP 3. (Twin Peaks)	990' west of MP 3	Major Collector	HRRR and AHS

Location Number	Road Segment/Intersection	Begin	End	Roadway Functional Classification	NHS, AHS or HRRR*
19	Old Glenn-Power Plant	Curve to left sign 715' west of MP 4.	1930' west of MP 4 (100'+/- west of Eklutna Tailrace entrance)	Major Collector	HRRR and AHS
20	Old Glenn-MP 5	3160' east of MP 4. (at Curve to Left with 45 MPH plate)	Curve to right sign 1160' west of MP 5.	Major Collector	HRRR and AHS
21	Old Glenn-MP 6	400' west of western Goat Creek Bridge abutment. (AT EB curve to left sign Near MP 6)	840' east of east end of Goat creek bridge. (940' east of MP 6)	Major Collector	HRRR and AHS
22	Old Glenn-MP 7	400' west of mP 7 (winding road sign near MP 7)	2400' east of MP 7.	Major Collector	HRRR and AHS
23	Old Glenn-MP 8 to Knik River	Curve to left sign with 40 MPH plate 425' east of MP 8.	South Knik River Bridge abutment.	Major Collector	HRRR and AHS
24	Old Glenn-Our Road	At curve warning sign 825' north of Our Road.	Curve warning sign 275' south of Our Road.	Major Collector	HRRR and AHS
25	Old Glenn-MP 12	Curve to left sign 1330' south of Marilyn Drive.	At cross culvert 120' north of Marilyn Drive.	Major Collector	HRRR and AHS
26	Wasilla/Fishhook Rd. Lakeview to Paradise	1800' northeast of Lakeview Drive	900' south of Paradise (400' north of Olga Cir.)	Major Collector	HRRR. Not NHS or AHS
27	Wasilla/Fishhook Rd., Mariah to Pamela	E. Mariah Drive intersection	Pamela Drive intersection	Major Collector	HRRR. Not NHS or AHS
28	Wasilla/Fishhook Rd. King Cove to McCasey	420' northeast of N King Cove Drive	N McCasey Drive intersection	Major Collector	HRRR. Not NHS or AHS

*NHS: National Highway System, AHS: Alaska Highway System, HRRR: HSIP High Risk Rural Road

HSIP: CR High Friction Surface Treatment Candidate Locations