

**ALASKA DEPARTMENT OF TRANSPORTATION &
PUBLIC FACILITIES - CENTRAL REGION**

HSIP SIGN INVENTORY

FINAL PROJECT REPORT



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ACRONYMS

- ASDS.....Alaska Sign Design Specification
- DOT&PFAlaska Department of Transportation & Public Facilities
- FHAFederal Highway Administration
- HSIP.....Highway Safety Improvement Program
- M&OMaintenance and Operations
- MUTCDManual of Uniform Traffic Control Devices
- PLSProfessional Licensed Surveyor
- QA/QC.....Quality Assurance/Quality Control
- USKHUSKH Inc.



1 PROJECT SUMMARY

1.1 Abstract

The goal of this project was to provide mapping services to inventory existing and current road and highway signs along all State of Alaska-owned roadways for the Alaska Department of Transportation & Public Facilities (DOT&PF) Central Region. The sign inventory database is designed to enable DOT&PF to track and monitor the number, location, and condition of signs that fall under their maintenance and operations (M&O) responsibility. It allows users to easily query where the oldest signs are still being used, to determine where additional signs may be needed, and to monitor field maintenance and replacement programs. This database includes an engineering assessment of sign post assemblies and sign types. It also includes an assessment of sign retro-reflectivity, which is mandated by the recent *Manual on Uniform Traffic Control Devices* (MUTCD), on approximately 5 percent of the total signs. This database deliverable includes a total of 12,915 post locations and 25,265 panel locations, which represents an average of 18 signs per mile outside of the Municipality of Anchorage (MOA) Metropolitan Planning Organization (MPO).

The deliverables include the following:

- .mdb format geodatabase for the sign inventory and a Microsoft Excel copy.
- Copies of full-resolution photographs of each sign asset.
- Google Earth KMZ files for the signs and photographs. In order to optimize performance, the KMZ files have been broken up into geographic regions.
- An engineering assessment of signs inventoried. The assessment is intended to facilitate the evaluation of sign life, failure rates, and sign budgets.

This report is intended to provide a detailed account of the sign inventory project and conclusions. It also describes USKH field and office procedures in detail in order to streamline future updates and data collection efforts.

1.2 Key Metadata Overview

- Time Period of Content: The data was collected primarily over a six month period between June and November 2012. The temporal relevance of each asset is identified through an 'Inspection Date' field in the deliverable database. In addition, each sign photograph was time/date stamped in the lower left hand corner. At this time, USKH Inc. (USKH) is not aware of any specific maintenance and update frequency planned by DOT&PF Central Region.
- Spatial Domain: This dataset contains signs along roads maintained by the DOT&PF Central Region. The minimum bounding WGS 1984 latitude/longitude rectangle enclosing this dataset is West -152.668495 / East -147.185035 / North 62.940493 / South 57.311459. The project area includes the Homer Area, the Kenai/Soldotna Area, Seward, the Palmer/Wasilla Area, Big Lake/Talkeetna, the Sutton/Matanuska Area, and parts of Kodiak Island. It excludes the Municipality of Anchorage (MOA).
- Spatial Reference Information:



- The geodatabase employs the 'NAD_1983_Alaska_Albers' Projection, which is the projection standard adopted by many federal and state agencies in Alaska. This projection is a conic equal-area representation. Linear Units are Meters. Please note that the latitude and longitude attributes included in the database are WGS 1984 values.
 - The Google Earth KMZ files use the WGS 1984 coordinate system.
 - It should be noted that the difference between the above mentioned 'NAD_1983_Alaska_Albers' and 'WGS_1984' coordinate systems corresponds to approximately 1.25 meters in the project area.
 - If ArcGIS is to be used to transform between the above mentioned 'NAD_1983_Alaska_Albers' and 'WGS_1984' coordinate systems, it is recommended that the 'WGS_1984_(ITRF00)_To_NAD_1983' transformation be applied.
- Data Quality:
 - Horizontal Positional Accuracy: While the project scope required a horizontal positional accuracy of within 3 meters, data quality reports generated during the GPS differential correction process indicate that the majority of sign assets are sub-meter accuracy.
 - Logical Consistency: The product has been thoroughly checked for errors in values, conditional, and geometry as described in more detail in this report.
 - Completeness: Dutch Harbor, Dillingham, and King Salmon are not included in this deliverable, although these areas fall under the jurisdiction of DOT&PF Central Region. In addition, the Port Lions area of Kodiak was not inventoried. It was felt that the small quantities of signs in these areas combined with the difficult logistics made a sign inventory in these areas better targets for future routine M&O work than part of the current database effort.
 - Entity and Attribute Information: This project required reconciliation with the specific needs of the DOT&PF Central Region and the existing sign inventory database schema developed by the statewide DOT&PF. At the outset of this project, the schema was not defined. A lengthy process was commenced to define and clarify attributes that both existed in the photolog database and which were developed for this project. Please see Appendix A in this report for a further explanation of each attribute in the deliverable.



2 REDUCTION NARRATIVE

The field and office procedures described below were designed to ensure that the end product would be consistent with existing DOT&PF schema. Although DOT&PF provided USKH with tablets preloaded with the schema, the decision was made not to employ the tablets due to the substantial increase in field data collection time and resultant costs that their utilization would have caused. The steps outlined below thus demonstrate a practical and efficient alternative to the preloaded tablets; other adaptations may be possible.

2.1 Field Survey Data Collection Narrative

The most time-consuming and safety-critical aspect of this project was the on-site data collection. All field survey data collection was supervised by a Professional Land Surveyor (PLS) registered in Alaska. Safety of field personnel was paramount.

Before field work commenced, USKH traffic engineers worked with surveyors on critical sign identification procedures and retro-reflectivity readings. Field methodology was designed to optimize efficiency. With a project scope as large as this one, a time savings of even a couple of minutes per sign translates into hours and weeks saved in the ultimate labor cost. To this end, a detailed feature code library (data dictionary) with extensive domain values was developed to assist the field surveyors with on-site data collection and to eliminate the opportunities for typographical errors in data entry that arise with free-form data fields.

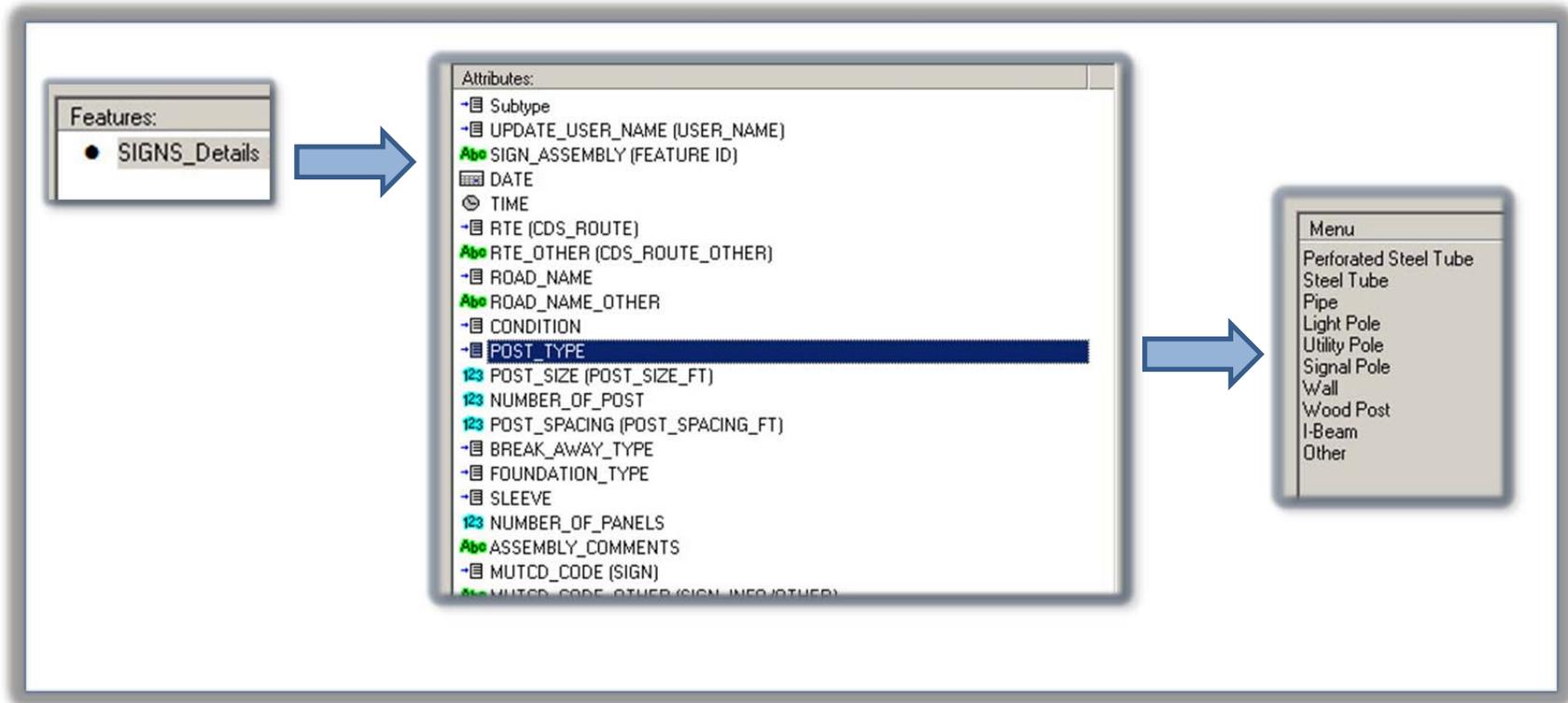


Figure 1 – USKH Data Dictionary Field Prompt Example: Attributes and Domains

The overwhelming majority of the ground survey was completed between June and November 2012. Each sign is logged in the geodatabase with the time of inventory and all photographs are time/date stamped in the lower left hand corner. The Trimble GeoXH handheld GPS collector was utilized to log GPS data for sign locations, record observational attribute fields, and record geotagged sign photos. In addition, conventional surveying and other methods were necessary to capture the locations of signs where GPS satellites were unavailable or of inadequate quality. DOT&PF Central Region staff participated in on-site observations of the field surveyors collecting data.



Figure 2 – Primary Field Data Collection Equipment Used

2.2 Office Processing Steps

2.2.1 Sign Position

Raw GPS data was differentially corrected using Trimble Pathfinder Office. Processing of field data was performed every day in order to capture any potential errors made in the field as quickly as possible. Corrected coordinates along with field-collected attribute information were then exported as a .mdb format geodatabase using Trimble Pathfinder Office. In most cases, all sign panels were snapped to the appropriate sign post; however, in the rare event that a sign post was unable to be differentially corrected, the post was snapped to the nearest sign panel. Signs collected encompassed a broad area throughout Alaska, as shown on the following figure.

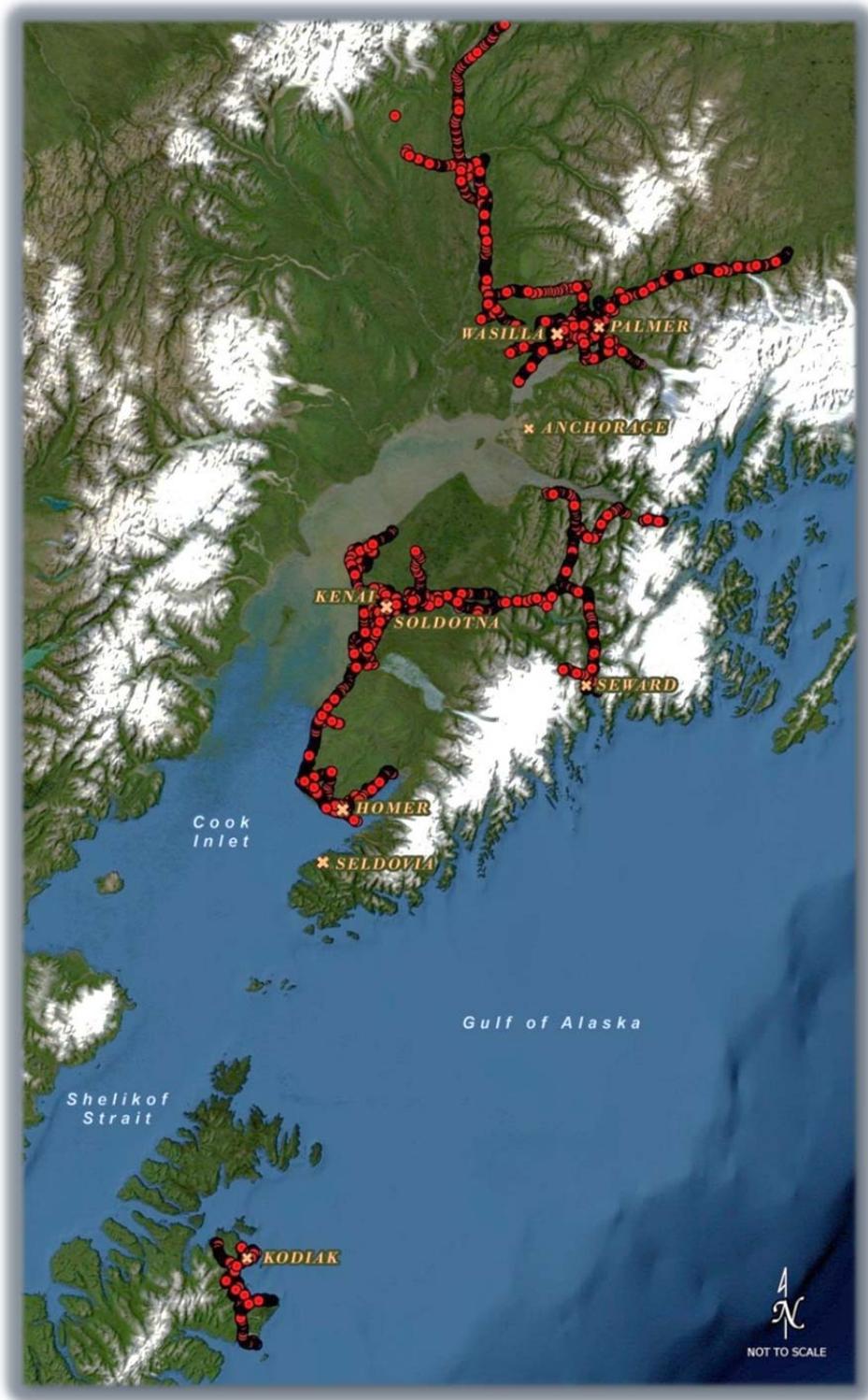


Figure 3 – Location of USKH Field Collected Signs



2.2.2 Geodatabase Modification

Sign Attributes

Trimble Pathfinder Office presented numerous restrictions on the exported .mdb. Several of the limitations on field lengths and types did not match the required DOT&PF schema. Microsoft Access was used to address those issues after export from Trimble Pathfinder Office.

The meticulous design of the USKH feature code library ensured that most of the required attributes for each sign feature were populated in the field with domain-bound values and already included in the .mdb generated in the process described above. However, some sign attributes were entered in the office processing stage to expedite overall editing time. The routes and road names were populated visually from the road feature class provided by DOT&PF Central Region. Sign panels were snapped to post locations and the x, y coordinates of each sign were recalculated. The distance from roadway and height from road surface calculations were populated using formulas, with different formulas used for signs with different numbers of posts. The date of inspection was calculated with a query combining date and time fields. Minor formatting edits were also made to the 'legend' field to ensure a consistent methodology of data entry. In addition, the automated photo name that was assigned during the field data collection process required manual editing in order to be compatible with the length constraints already present in the DOT&PF sign geodatabase. The post and sign feature classes were also run through an ArcGIS tool, which added and calculated other required attributes that were not collected in the field but were required to be in the final deliverable.

After these edits were complete, data was passed in tabular format to Engineering for the engineering analysis attributes to be calculated and populated. After the engineering analysis was complete, the tables were joined to the sign and post data by assembly number. Engineering comments were added as needed to the sign panel comments and post comments fields. In addition, legend information was populated from a joined spreadsheet and field collected attributes.

Final Processing Steps

All databases were then imported in DOT&PF schema using ArcGIS Toolbox. KMZ files were created using ArcGIS and Google Earth.

Photographs

The photographs taken of each sign were essential in USKH's internal procedures for both engineering analysis and quality assurance/quality control (QA/QC). Photographic documentation of each sign helped confirm that the physical attributes of each sign were logged correctly in the field. For example, because signs marked as 'unacceptable' have special significance to DOT&PF Central Region, they were cross-checked with the sign photograph to avoid signs being unnecessarily tagged for replacement.



Figure 4 – Sign photograph documenting ‘unacceptable’ condition

The precise geotagging of sign photographs provided a special challenge. Although the photographs taken with the Trimble GeoXH units were geotagged with coordinates, these coordinates represented unprocessed GPS locations and did not incorporate the differentially corrected sign positions. A third party software program called RoboGeo was used to apply differentially corrected coordinates to each photograph and to generate a raw shapefile of the photo locations. Using ArcGIS, the raw photo locations were then snapped to the appropriate post and new x, y coordinate locations generated. A .dbf file was then exported from this shapefile and edited in order to meet the required input format used by RoboGeo. At this time, images could be regeocoded within RoboGeo and a new EXIF header written to each .jpg. RoboGeo also generated KMZ files of each sign photograph in the differentially corrected sign location. Because of file size constraints, these KMZ files were split up into regions as shown on the following figures:

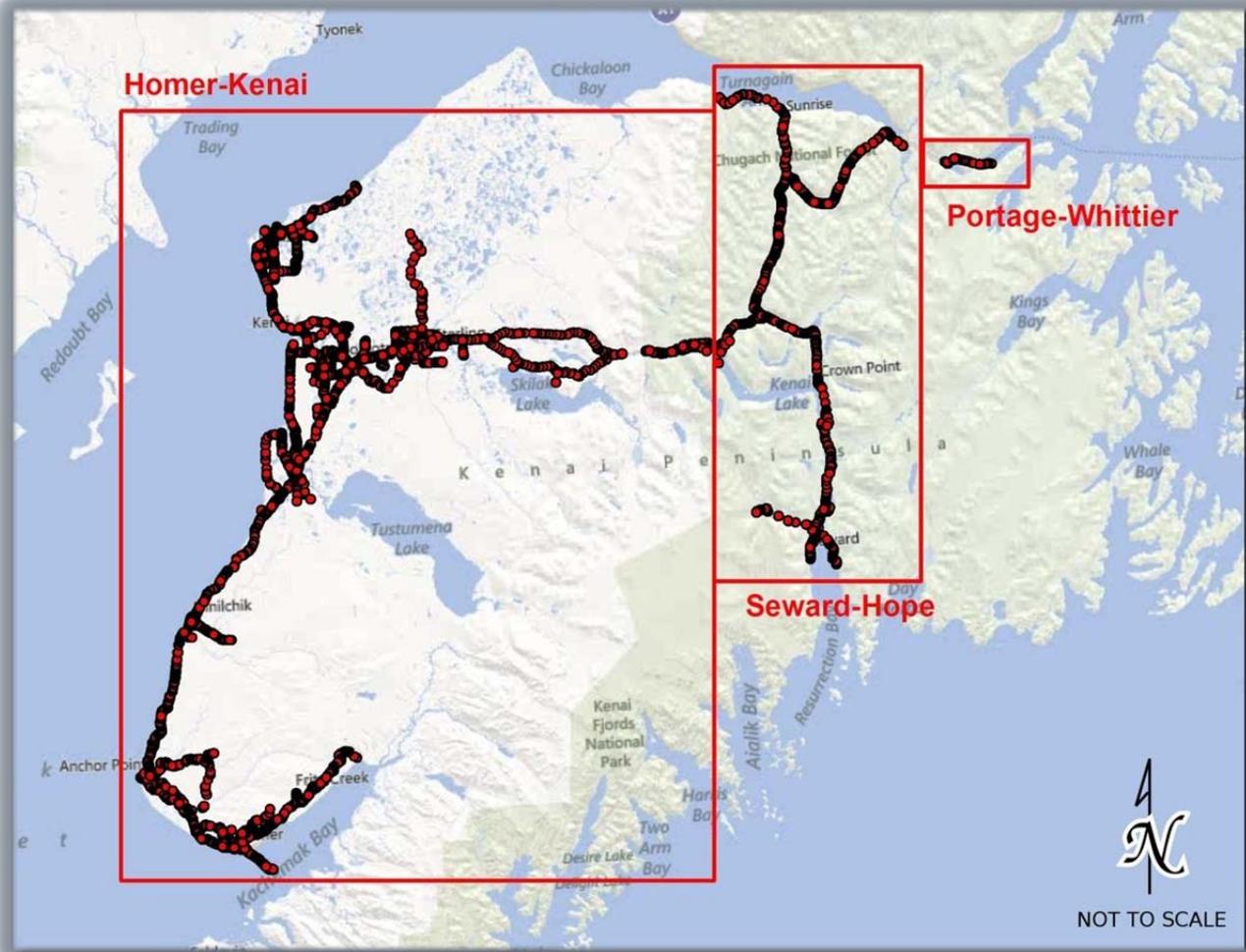


Figure 5 – Homer-Kenai, Seward-Hope, and Portage-Whittier KMZ limits



Figure 6 - Kodiak KMZ limits

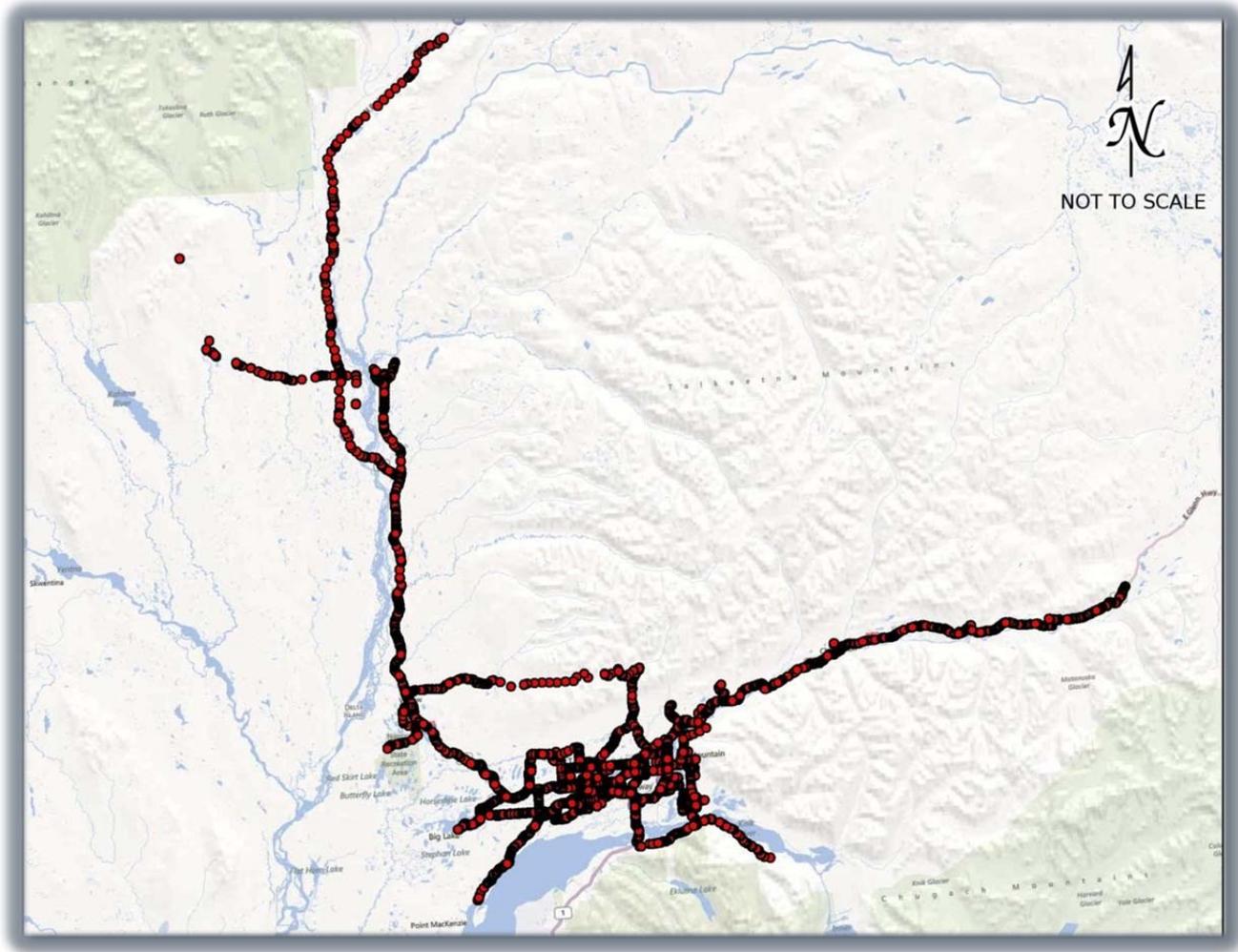


Figure 7 – Mat-Su KMZ limits

2.3 Quality Assurance / Quality Control Procedures

2.3.1 USKH Procedures

USKH’s internal QA/QC processes consisted of both spatial and attribute checks. As described above, field procedures were designed to eliminate the introduction of many errors, and all fieldwork was overseen by a Professional Land Surveyor registered in Alaska. Reports were generated in Trimble Pathfinder Office on the positional quality of differentially corrected sign positions, and review of these reports ensured that each set of signs met the minimum requirements of the project. In addition, office processing procedures involved manual checks to ensure that street names were tagged correctly in the field. Unusual situations, such as densely-marked sign interchanges, were individually inspected to ensure that signs were coded with the appropriate attributes in this location. In addition, the engineering analysis process identified sign dimensions that were transcribed or off, and sign codes that were inaccurate.



As described above, the USKH internal data processing and analysis procedures provided a great degree of redundancy in review of data and potential spatial and attribute data errors were able to be flagged at several different points in the process. When the combined geodatabase files were assembled, summary query checks were then performed on the deliverable geodatabase files to identify attribute fields that were blank or had inconsistent values. Any identified issues were addressed in order to provide as clean a product as possible to Marshall GIS for the next stage in the QA/QC process.

As an additional QC measure, USKH compared the location of 69 signs in the Whittier area that were redundantly collected in both this Highway Safety Improvement Program (HSIP) Sign Inventory project and an earlier survey effort for the Whittier Ferry Access project. This assessment, which analyzed the WGS 84 positions of each sign, found very good results as summarized in the following figure:

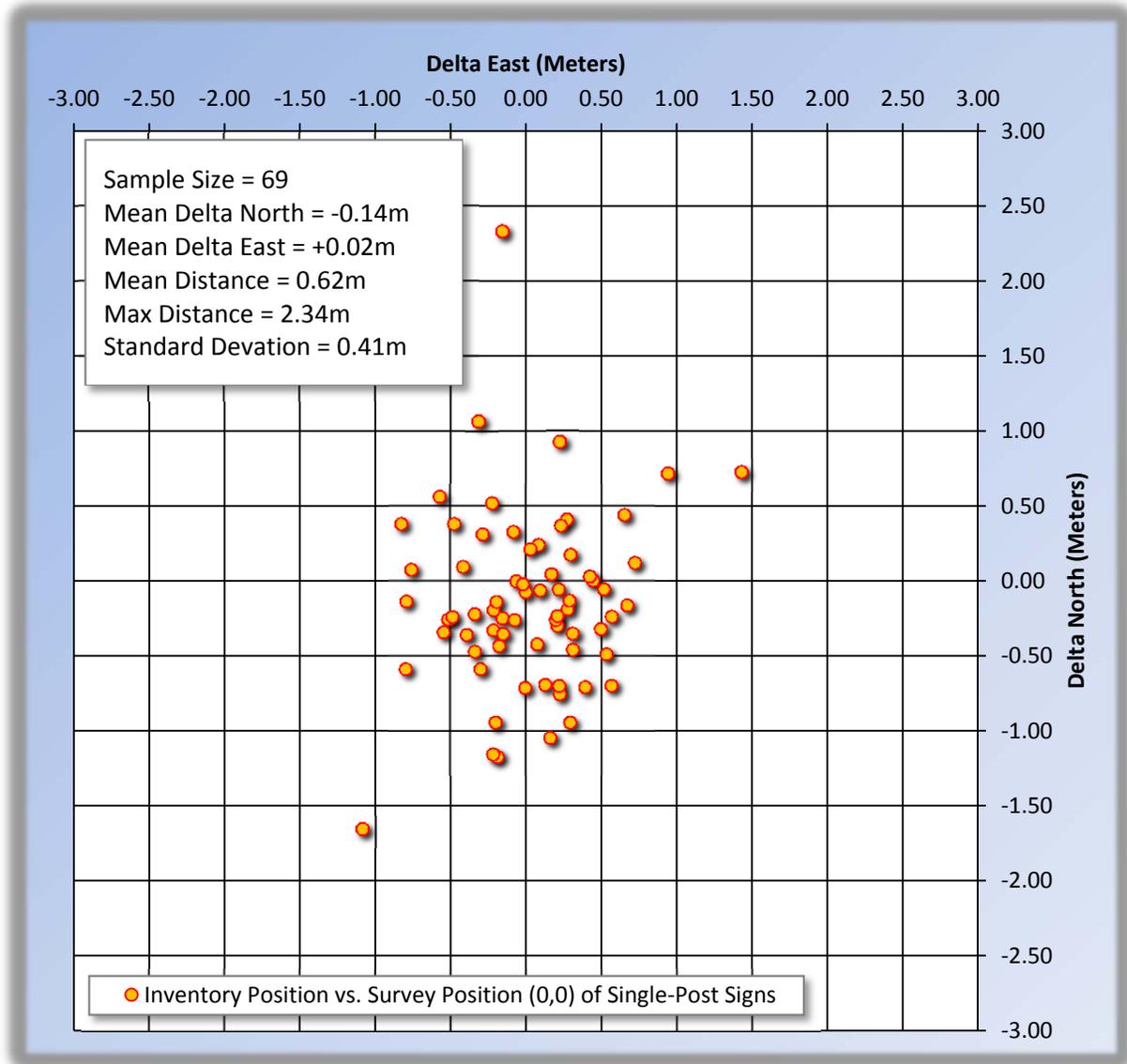


Figure 8 - USKH Sign Sample Check Scatter Plot

2.3.2 Marshall GIS Procedures

Marshall GIS then performed their own series of spatial and attribute-based automated checking procedures on the USKH product, as detailed in the below table. Any errors identified in this checking process were addressed by USKH staff in the final deliverable product, which was re-checked before being uploaded into the DOT&PF master geodatabase.



Check Name	Description
<i>Domain Check</i>	For every domain bound field for every feature: compares the value in the domain in the USKH deliverable to the list of valid values in the existing DOT&PF geodatabase.
<i>Text Field Length Check</i>	For every non-domain bound text (string) field: checks the length of the value in the USKH deliverable to ensure the text is not too long to fit in the target field in the DOT&PF geodatabase.
<i>Assembly ID Value Checks</i>	<p>Ensures that the Assembly ID value matches the required DOT&PF pattern (An upper case U followed by exactly five digits followed by an underscore, followed by exactly two digits)</p> <p>Ensures that the Assembly ID value for each feature is unique in the USKH deliverable.</p> <p>Ensures that the Assembly ID value does not exist in the DOT&PF geodatabase.</p> <p>Ensures that the Assembly ID value for the post ends with “00”</p> <p>Ensures that the sequence for a particular Assembly prefix (the part before the underscore) is correct and complete and does not have any gaps.</p> <p>Ensures that the sequence for a particular Assembly prefix matches the sign count for the prefix.</p>
<i>Field Name Check</i>	Ensures that the field names in the USKH deliverable match the field name in the DOT&PF geodatabase.
<i>Field Type Check</i>	Ensures that the field types in the USKH deliverable match the field types in the DOT&PF geodatabase.
<i>Field Length Check</i>	Ensures that the field lengths in the USKH deliverable match the field lengths in the DOT&PF geodatabase.
<i>Post and Panel Location Check</i>	For each post feature: ensures that the X and Y values for each panel attached to post match the X and Y of the post, within 0.1 meter. (X and Y values are rounded before the comparison is made.)
<i>Location Attribute to Location Check</i>	For each feature: ensures that the X and Y values of the point, when projected into latitude and longitude, match the values in the LATITUDE_DEG and LONGITUDE_DEG fields when both values are rounded to 6 significant digits
<i>Organization ID Field Check</i>	Ensures that every feature has an ORG_ID value of 900002



Check Name	Description
<i>User Name Field Check</i>	Ensures that the value in the UPDATE_USER_NAME field starts with “USKH” for every feature.

Table 1 – Marshall GIS QA/QC Tool Check Summary
 (Created from information provided by Jay Florey at Marshall GIS)

2.3.3 DOT&PF Procedures:

DOT&PF Central Region also ran a spatial comparison of USKH sign inventory data with existing survey data previously collected by the agency as part of previous highway design projects. The results indicated varying levels of continuity between the two datasets throughout the three comparison regions. In the Parks Highway region, the 100 features compared yielded a maximum distance between features of 8.7 feet, with 100 percent of features being within 10 feet, 98 percent being within 7.5 feet and 76 percent being within 5 feet. In the Knik-Goose Bay Road Region, the 7 features compared yielded a maximum distance between features of 10.3 feet, with 85.7 percent of features being within 10 feet, and 14.3 percent being within 7.5 feet, and 0 percent of features being within 5 feet. In the Sterling Highway Region, the 3 features compared yielded a maximum distance between features of 5.93 percent, with 100 percent of features being within 10 feet, 100 percent of features being within 7.5 feet, and 66.7 percent of features being within 5 feet.

Region	Number of Features Compared	Percentage of Features Within 10'	Percentage of Features Within 7.5'	Percentage of Features Within 5'
Parks Highway	100	100	98	76
Knik-Goose Bay Road	7	85.7	14.3	0
Sterling Highway	3	100	100	66.7

Table 2 – DOT&PF Central Region Sign Feature Spatial Comparison Summary
 (Created from information provided by Joshua Zellmer at DOT&PF Central Region)

There are many factors which could have affected the results of this comparison. Because the individual signs being compared could be either single –or–multi-post, discrepancies could have arisen on the perceived ‘center’ of the signs. In addition, depending on how the custom projection systems used by DOT&PF Central Region for the Knik-Goose Bay and Sterling Highway area comparisons were developed, known alignment and accuracy problems between different coordinate systems due to the choice of transformation parameters within ESRI software could have affected the coordinates of the re-projected data.

2.4 Engineering Analysis

2.4.1 Engineering Analysis Overview

The engineering analysis performed by USKH drew upon the physical attributes of each sign that were either observed on-site by the field crews or generated through office data processing efforts. In addition to the observations collected in the field, additional analyses were conducted to determine if each sign met minimum criteria for sign size, crashworthiness, retro-reflectivity, or appropriate use.

Figure 9 and Figure 10 show breakdowns by sign color and post type. On average, each panel is about 6 square feet and each post has about two panels accounting for 11.7 square feet. To illustrate the costs of replacing signs, recent sign bids were researched in DOT&PF's Bid Tab program. Recent bids for signs have been about \$100 per square foot. This value does not include costs such as project design, administration, traffic control, mobilization, or storm water pollution prevention requirements, but it does include both panel and post materials and installation.

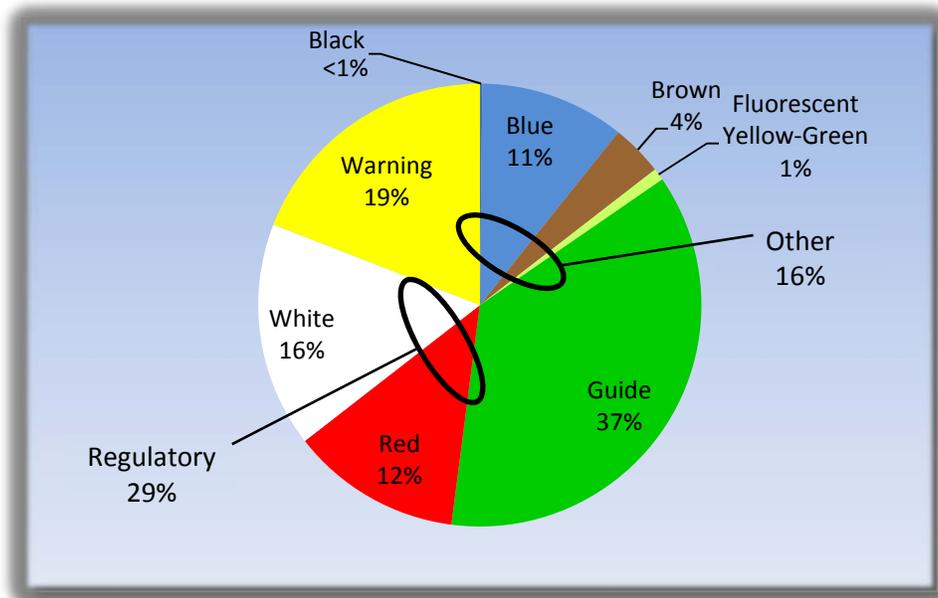


Figure 9 – Signs by Color

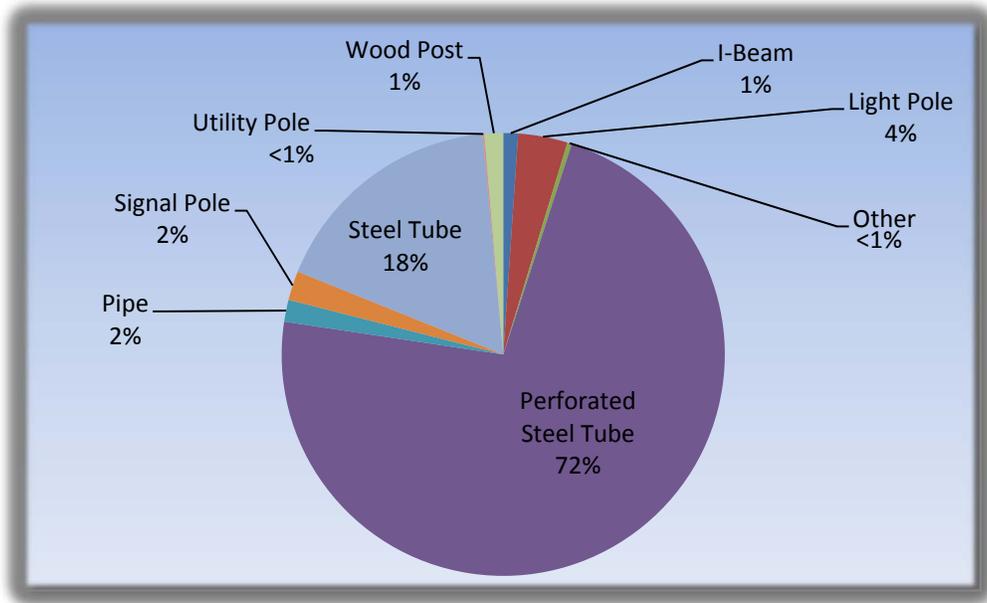


Figure 10 – Posts by Type

2.4.2 Preparation for Analysis

The first step to the engineering analysis effort was to create databases of standards to use in determining whether signs met standards or not. Tables of retro-reflectivity standards based on the current *Alaska Traffic Manual* and sign sizes based on the *Alaska Sign Design Specifications* were created. USKH then created logic statements to compare each sign's characteristics to the standards tables.

Each day's data collection was output into an Excel file for use in the engineering analysis. Ten columns were added to each sheet – one for comments, four for the engineering attributes requested in the RFP, two used to create hyperlinks to the photos for the signs and posts, one for road designation, and two for listing the required sign dimensions.

Each sign was inspected to double check the code and condition. In addition, each sign base was evaluated to verify crashworthiness. When problems were identified with the data reported, a note was added to the comments sheet for the data to be verified or adjusted by our GIS personnel. Data problems were rare, but various sign dimension and code errors were also flagged during this process.

2.4.3 Sign Size Assessment

In order to determine if the signs met the size criteria, USKH first had to identify the designation of the road the sign is on. Virtually all of the roads in the project area are "conventional" roads, except the sections of the Glenn and Parks highway that are freeways and new Trunk Road and Palmer Wasilla Highway Extension, which fit the Alaska Sign Design Specifications (ASDS) definitions of expressways. There were also several roads not listed on the DOT&PF functional classification maps, so they fit the ASDS definition of "minimum" roads. With the road



classification and sign code, it was possible to create lookups that referenced the ASDS sign size table to determine the minimum dimensions for most signs. These could then be compared to the measured dimensions to determine if the sign was properly sized or not. Special signs (signs without codes) could not be analyzed for meeting size criteria. Additionally, many guide signs have variable size requirements depending on how much text is on the sign or whether a larger letter height has been used on higher speed roads. These signs were marked as not meeting size standards if they were obviously too small, but were otherwise marked as meeting size standards.

Table 3 lists the results of the sign size assessment. The signs listed as N/A are non-standard signs that do not have required dimensions. The green (guide) signs have a large percent failing the sign size assessment. These failures are primarily the D3-1 signs at stop signs. Many were measured to be only 6 inches tall. The ASDS requires all of them to be at least 8 inches tall, and 12 inches tall when facing non-stop controlled roads with speed limits over 25 mph. Since the current list of MUTCD compliance dates (MUTCD Table I-2) does not include D3-1 sign sizing, these signs are not required to be replaced immediately and can be upgraded to current standards as they are replaced for other reasons.

Table 3 also lists the square footage of each sign type that does not meet size requirements. The total square footage of all the signs mounted with an undersized sign is also listed, since common practice is to replace all of the signs when any of them are replaced. Breakdown of the assessment by area is included in Appendix C.

Sign Type	Background Color	N/A	Fails to Meet Standard	Meets Standard	Total Signs	Percent Fail	SF Failing
Regulatory	Red	10	129	3,001	3,140	4.1%	819
	White	592	633	2,925	4,150	15.3%	2,854
Warning	Yellow	205	359	4,257	4,821	7.4%	1,319
Guide	Green	276	4,364	4,620	9,260	47.1%	7,895
Other	Black	5	21	20	46	45.7%	101
	Blue	292	188	2,194	2,674	7.0%	715
	Brown	477	111	364	952	11.7%	438
	Fluorescent Yellow-Green	1	8	213	222	3.6%	406
	Total	1,858	5,813	17,594	25,265	23.0%	14,546
Square Footage of Attached Signs							57,637

Table 3 – Sign Size Assessment

Assuming the properly sized signs are 50 percent larger than the existing signs, the cost to replace the undersized signs would be approximately \$2.2 million. Replacing the undersized signs and the attached signs would cost approximately \$6.5 million.

2.4.4 Crashworthiness Assessment

This assessment made use of a complex formula that determined if the sign post was breakaway or frangible, if it was behind a curb or guardrail, and what the post size and spacing were. Three responses were coded – ‘Yes’, ‘No’, and ‘No – Ok’. Signs were either crashworthy (yes); not crashworthy (no); or not crashworthy, but not in the clear zone or behind curbs or guardrails (no – ok). Some signs were not crashworthy even though they had breakaway or frangible bases. Specific signs falling into this category were some signs with multiple perforated steel tubes greater than 2 inches within 7 feet of each other. Since there was no information on road side slopes, we reported non-breakaway posts as non-crashworthy if they were within 30 feet of the road side and not behind a guardrail or curb. As a result, it is possible that some signs identified as not crashworthy could meet standards, but this was deemed preferable to improperly identifying signs as crashworthy.

Table 4 lists the results of the crashworthiness assessment by post type. Breakdown of the crashworthiness assessment by region is included in Appendix C.

Post Type	Not Crashworthy	No - Ok	Crashworthy	Total Posts	Percent No	SF of Attached Signs
I-Beam	3	1	131	135	2.2%	135
Light Pole	19	55	391	465	4.1%	159
Other	13	17	12	42	31.0%	84
Perforated Steel Tube	201	208	8,943	9,352	2.1%	3,245
Pipe	44	23	140	207	21.3%	393
Signal Pole	71	68	135	274	25.9%	129
Steel Tube	34	89	2,124	2,247	1.5%	514
Utility Pole	10	6	2	18	55.6%	27
Wood Post	62	18	95	175	35.4%	900
Total	457	485	11,973	12,915	3.5%	5,586

Table 4 – Crashworthiness Assessment

Since standard practice is to bid signs posts as subsidiary to sign panels, post pricing is not available. If we assume that posts generally make up half the cost of sign installation, then replacing just the non-crashworthy posts would cost about \$280,000. However, it is likely that the wood posts could be made crashworthy by simply drilling holes in the posts to match the requirements of the DOT&PF Standard Drawings. Many of the wood posts are most likely permitted signs that may require notifying the permit holders once identified. Also, utility poles and signal poles will not be made crashworthy, which would further reduce the cost of these improvements.

2.4.5 Retro-reflectivity Assessment

The measured values were compared to the minimum values listed in the MUTCD. These values vary based on sign color and sign size. The MUTCD only specifies retroreflectivity requirements for signs with white, red, yellow



and green backgrounds. Other colored signs, and signs intended for pedestrians and cyclists, are not required to meet retroreflectivity standards. There are also less stringent requirements for signs with Type I beaded sheeting than other types of sheeting, but since current regional standards call for the use of prismatic sheeting, the more stringent standards were applied to all measured signs. If either the background sheeting or the legend sheeting failed to meet standards, the sign was reported to not meet retro-reflectivity requirements. There are additional criteria for black on yellow signs depending on the specific sign in question, so a manual check was conducted on these criteria, resulting in a dozen or so signs being changed from fail to pass.

Table 5 lists the results of the retro-reflectivity assessment. Overall, 5.5 percent of signs were measured for retro-reflectivity, which meets the project requirement of 5 percent. The green (guide) signs were underrepresented in the sample measured. This is likely due to the fact that most green (guide) signs are mounted on top of stop sign assemblies, making it difficult to reach them with the retroreflectometer. The overall rate of failure for signs to meet the retro-reflectivity requirement was 15.6 percent. The particulars of these results are discussed in more detail later in the report. Breakdown of the retro-reflectivity assessment by region is included in Appendix C.

Background Color	Does not Meet	Does Meet	Total Measured	Total Signs	Percent Measured	Percent Failing	SF Failing	Total SF
Green	83	83	166	9,260	1.8%	50.0%	188	36,257
Red	30	284	314	3,140	10.0%	9.6%	181	19,482
White	17	254	271	4,150	6.5%	6.3%	67	22,984
Yellow	52	365	417	4,821	8.6%	12.5%	320	49,997
Grand Total	182	986	1,168	21,371	5.5%	21.5%	757	128,719

Table 5 – Retro-reflectivity Assessment

The cost to replace the signs observed as failing to meet the retroreflectivity requirements would be approximately \$76,000. If the failure rate for each colored sign is applicable to all of the signs in the region, the total replacement cost would be approximately \$2.8 million.

2.4.6 “Appropriate Use’ Assessment

This attribute is much more subjective than the other attributes and required manual review of each sign installation. There were many non-standard signs in use that could have been replaced with standard signs, but in general these were not recorded as inappropriate signs. In general, signs identified as inappropriate were confusing to users, were the wrong color or shape for the intended use, or did not apply to the situation at hand (i.e., a left curve warning at a right curve).

Table 6 lists the results of the appropriate use assessment. No square footage calculations have been given because many of the issues that lead to identifying the sign as inappropriate would be best corrected by either removing the sign or adding additional signage. Comments on each sign tagged as not appropriate use are included in Appendix C.



Sign Type	Background Color	No	Yes	Total Signs	Percent No
Regulatory	Red	28	3,112	3140	0.9%
	White	46	4,104	4150	1.1%
Warning	Yellow	72	4,749	4821	1.5%
Guide	Green	20	9,240	9260	0.2%
Other	Black	0	46	46	0.0%
	Blue	15	2,659	2674	0.6%
	Brown	12	940	952	1.3%
	Fluorescent Yellow-Green	0	222	222	0.0%
	Total	193	25,072	25,265	0.8%

Table 6 – Appropriate Use Assessment

There were a variety of issues identified in the Appropriate Use assessment. Several issues were responsible for a number of signs being on this list.

- Pathway Stop Signs – There are several pathway stop signs in short succession at driveways along the Kenai Spur Highway across from Home Depot. The sight distance available to motorists and path users appears adequate to use yield signs or no signs on the path. There may also be enough off-street queuing space to remove the pathway control all together. Since it is a pathway of regional significance, it does not seem appropriate at first glance to stop pathway traffic for driveway traffic.
- Many signs were the wrong color or wrong shape for their use.
- Misuse of object markers

Other areas that could use attention are the end of Crooked Creek Road and Deep Creek Farm Road. Both roads dead end and lack appropriate signage. In addition, 48 school signs (S1-1, S4-2, S4-3) were observed that were yellow and should be fluorescent yellow-green, according to the MUTCD. These were not tagged as not appropriate use, but care should be taken to correct the colors when they are ultimately replaced. The incorrect color usage likely is a result of the fact that these signs were yellow in previous versions of the ATM and ASDS.

2.4.7 Condition Assessment

The sign and post condition assessments were done in the field by the survey personnel. While not strictly an engineering assessment, it is appropriate to discuss here since it relates to signs needing replacement. The field assessment was verified during the office data reduction. In general, signs that could not clearly and effectively convey the desired message were labeled as Unacceptable, signs with few to no defects were labeled as Acceptable, and signs falling between the two extremes were labeled Marginal. Posts were tagged in a similar fashion, but the cut-off between tags was a little more subjective.



Figure 11 – Sign Condition Summary by Age

Sign Type	Background Color	Acceptable	Marginal	Unacceptable	Total Signs	Percent Fail	SF Failing
Regulatory	Red	2,607	389	144	3,140	4.6%	844
	White	3,379	538	233	4,150	5.6%	1,232
Warning	Yellow	3,141	1,054	626	4,821	13.0%	6,588
Guide	Green	8,248	686	326	9,260	3.5%	1,589
Other	Black	41	1	4	46	8.7%	12
	Blue	1,924	523	227	2,674	8.5%	685
	Brown	762	143	47	952	4.9%	346
	Fluorescent Yellow-Green	210	10	2	222	0.9%	10
	Total	20,312	3,344	1,609	25,265	6.4%	11,306
	Square Footage of Attached Signs						19,852

Table 7 – Sign Condition Summary by Type

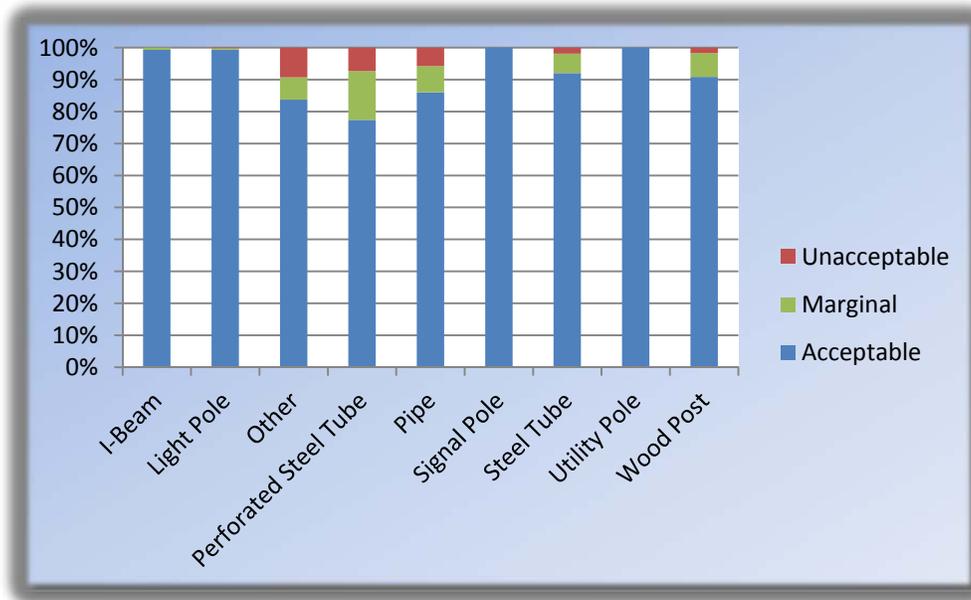


Figure 12 - Post Condition by Type

Post Type	Acceptable	Marginal	Unacceptable	Total Posts	Percent Fail	SF of Attached Signs
I-Beam	134	1	-	135	0.0%	-
Light Pole	462	2	1	465	0.2%	8
Other	35	3	4	42	9.5%	20
Perforated Steel Tube	7,240	1,426	686	9,352	7.3%	6,971
Pipe	178	17	12	207	5.8%	119
Signal Pole	274	-	-	274	0.0%	-
Steel Tube	2,068	136	43	2,247	1.9%	536
Utility Pole	18	-	-	18	0.0%	-
Wood Post	159	13	3	175	1.7%	28
Total	10,568	1,598	749	12,915	5.8%	7,682

Table 8 - Post Condition by Type

Assuming posts cost 50-percent of the assembly replacement cost, the overall cost of replacing the unacceptable signs and posts would be about \$1.5 million.

2.4.8 Sign Life Cycle

One of the purposes behind this project was to develop a plan for on-going sign maintenance. Specifically, how long can a sign be expected to last in the field? The answer will be function of sign condition and maintenance of retro-reflectivity. Sign post condition could be a factor; however, it is much more likely that the sign face will degrade to an unacceptable state before a post would. Unless the post is hit or otherwise broken, in which case the sign would need to be repaired immediately.

2.4.9 Sign Condition

The earliest installation date we observed on a sign was 1990, and that sign was in Marginal condition. The earliest year with more than a few observations was 1995, and 40 percent of those signs were in Acceptable condition, 45 percent were in Marginal condition, and 15 percent were in Unacceptable condition. To determine what role age plays in sign condition, Figure 13 below contains a plot of sign condition versus sign age. The data reflect a linear relationship between age and condition, but the sign conditions are not consistent throughout the range of observed sign ages. The R-square value for the regression line is 0.533, which tells us that only about half of the variation in sign condition is explained by sign age.

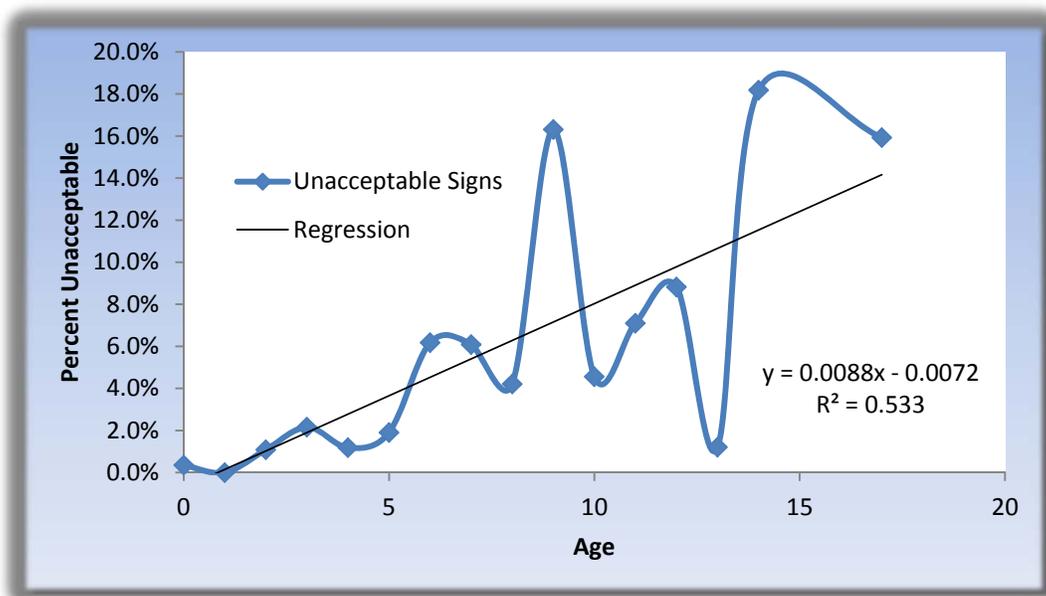


Figure 13 – Sign Condition by Age

In fact, these data likely understate the effect of age on signs. This is because the longer a sign is in service, the more likely it is to be replaced due to knockdown or resident complaints. This probably has the effect of weeding out some of the worse-condition signs as time goes by. However, based on the observations, there does not appear to be a distinct age of failure for signs.



2.4.10 Retro-reflectivity

Retro-reflectivity measurements were taken throughout the project. The MUTCD lists minimum required retro-reflectivity values for white, yellow, red, and green signs. Overall, 15.6 percent of signs failed the retro-reflectivity test. This varied depending on sign color, with green signs failing to meet retro-reflectivity 50 percent of the time. This is likely a result of the fact that 83 percent of the green signs tested were un-dated, meaning they are potentially older signs. This cannot be stated for certain, since two-sided green signs are common and do not have date stickers. Overall, 68 percent of the tested signs were undated, compared to 63 percent of the observed signs.

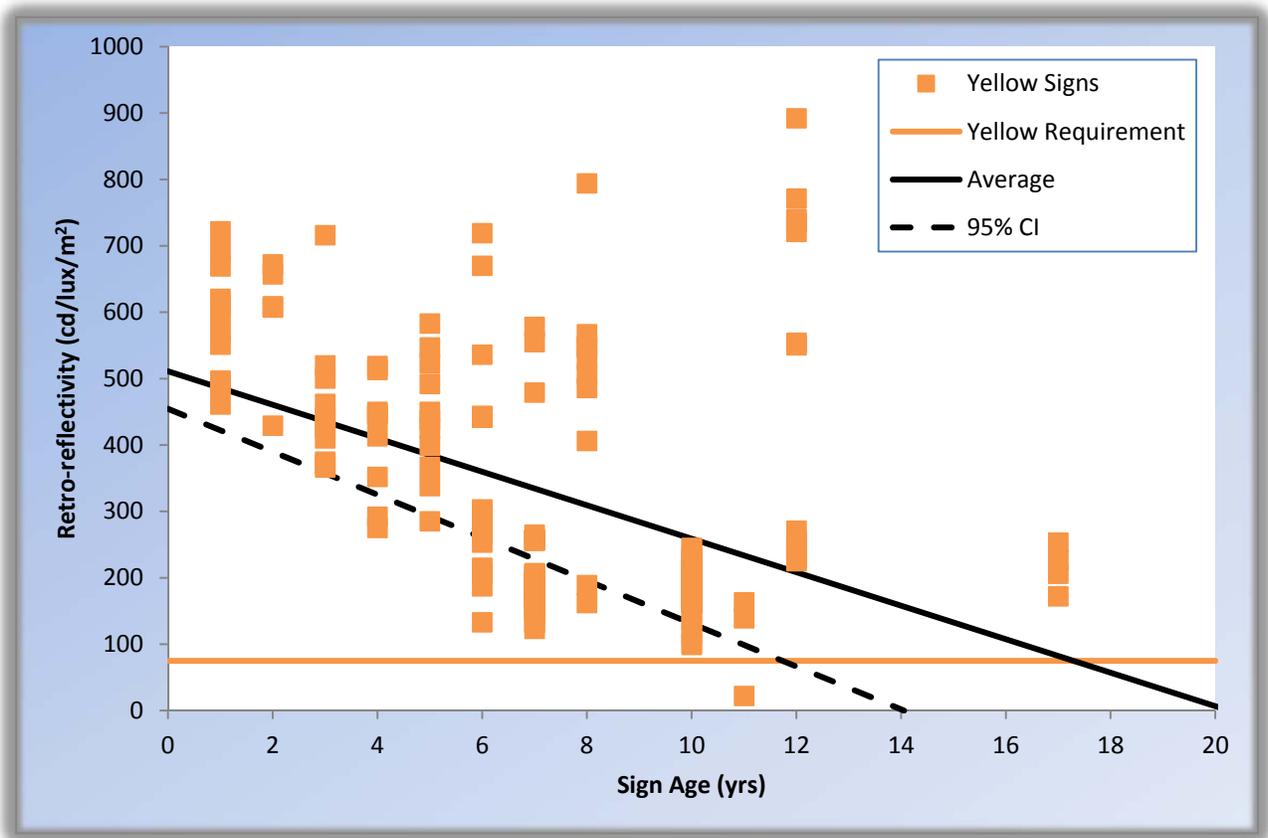


Figure 14 – Retro-reflectivity versus Age for Yellow Signs

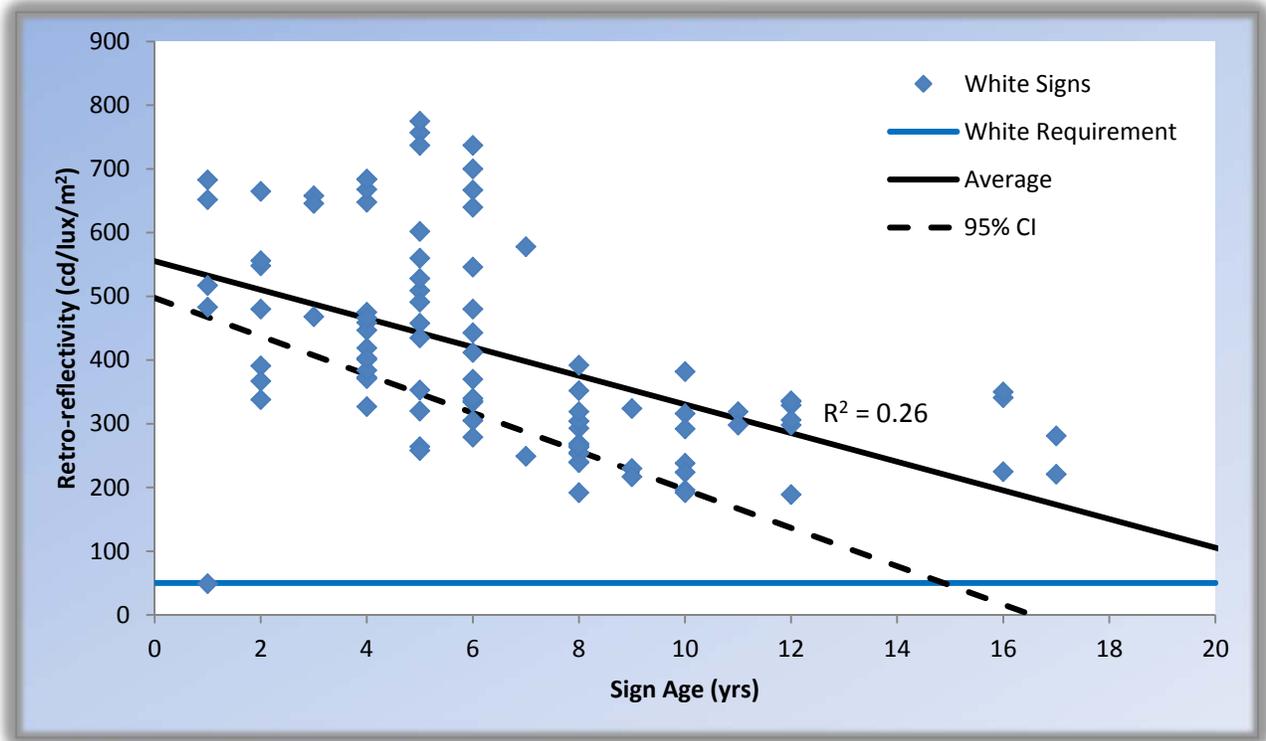


Figure 15 - Retro-reflectivity versus Age for White Signs

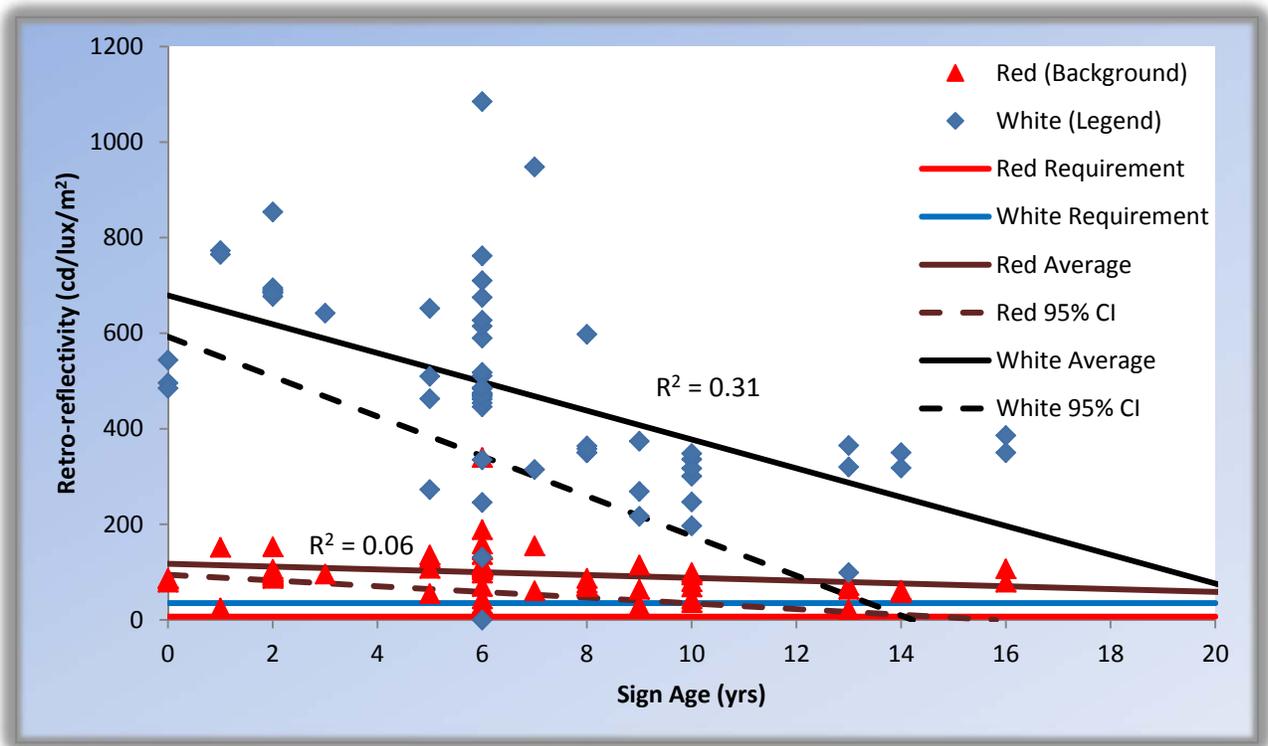


Figure 16 - Retro-reflectivity versus Age for Red Signs

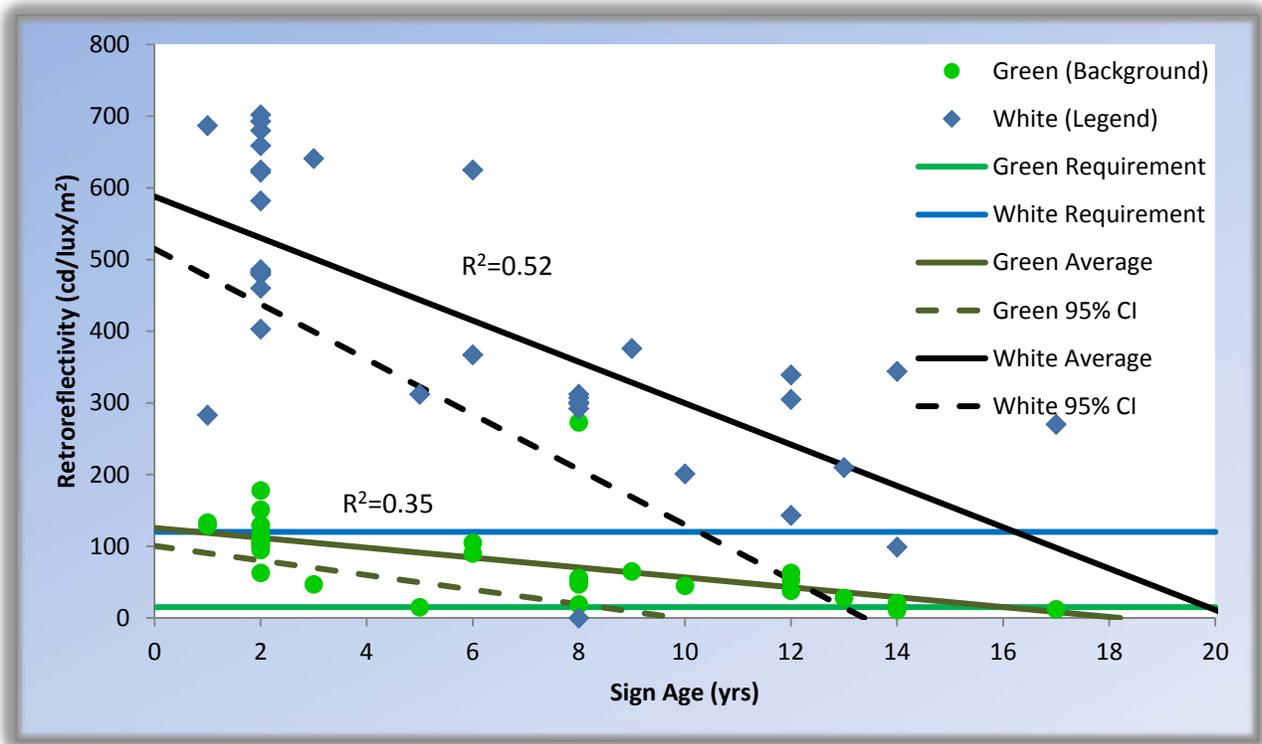


Figure 17 – Retro-reflectivity versus Age for Green Signs

Figure 14 through Figure 17 shows plots of retro-reflectivity versus sign age for the various colored signs. The MUTCD minimum retro-reflectivity values are displayed as horizontal lines near the bottom of the figures. The R-squared values for the regression line vary across the colors and range from 0.06 to 0.52. Overall this indicates a fairly poor correlation between age and retroreflectivity. Additionally, the actual values of retro-reflectivity vary depending on the color of the sign. This may be a result of the colorant both blocking some of the retro-reflectivity of the underlying material and protecting it from degradation.

Applying regression analyses to the data collected for the various sign types results in an anticipated timeframe when the average sign is expected to no longer meet the retro-reflectivity requirements. While this data may assist in considering a sign replacement schedule and budget, methods of directly assessing retroreflectivity should be considered in the ultimate decision to replace a sign. By the time the estimated lifetime of a sign has passed, fully half of the signs are expected to not meet standards. That would be an unacceptable number of failing signs. On the other hand, it would be unreasonable to plan a replacement schedule around the premise of ensuring no signs fall below the retro-reflectivity requirements, since even signs a couple of years old were observed at failing retro-reflectivity levels. As a compromise, we analyzed the data to determine the regression line at the lower end of a 95 percent confidence interval. Essentially, we are saying that there is 95 percent confidence that the average retro-reflectivity value for any given year is higher than the value predicted by the line. The 95 percent confidence interval lines are included in the retroreflectivity figures.



Color	Retro-reflectivity (cd/lux/m ²)			Projected Age (yrs) for Average to Approach Minimum Req.	Projected Age (yrs) for lower 95% Confidence Interval to Approach Minimum Req.
	Minimum Required	Average Initial	Average Annual Decline		
Red Signs					
White Legend	35	679	30	21.4	13.4
Red Background	7	117	3	37.6	14.6
Green Signs					
White Legend	120	588	29	16.2	10.3
Green Background	15	125	7	16.0	8.4
Yellow Signs	75	511	25	17.3	11.7
White Signs	50	555	22	22.5	14.9

Table 9 – Retro-reflectivity Regression Results

The red and green colors exhibit nearly a 50 percent decline in expected life when comparing the average and the 95 percent confidence interval retro-reflectivity lifespans. This reflects relatively large variability in the observed retro-reflectivity values across the signs sampled. It is surprising that the green signs have such low life spans, since the current regional sign specification requires a 10-year manufacturer warranty on sign sheeting.

A common assumption regarding signs is that south- and west-facing signs tend to be in worse condition due to their exposure to the sun. To validate this assumption, we conducted an analysis of variance of the various colored signs with respect to their facing direction. While south-facing signs as a group did tend to have lower retro-reflectivity values, the differences in retro-reflectivity were not found to be statistically significant with respect to the sign facing direction. The one exception was the white portion of green signs, which exhibited higher retroreflectivity values on north facing signs than signs facing other directions. Red legends on white backgrounds (such as those used on parking and turn prohibition signs) were not included in this analysis due to the small sample size.

2.4.11 Life Cycle Discussion

The MUTCD (Section 2A.08) identifies four sign management methods to be used for maintaining retroreflectivity: Visual Nighttime Inspection, Measured Retroreflectivity, Expected Sign Life, and Blanket replacement. While the MUTCD identifies these as methods for maintaining retroreflectivity, they can also be applied to signs that need to be replaced due to unacceptable condition. We understand that the DOT&PF has tentatively selected the visual inspection method for maintaining its inventory, but this is not official policy yet.

These methods are discussed in detail below, but the visual nighttime inspection and measured retroreflectivity have been grouped together since they are both a variant of assessment-based replacement.

Assessment-Based Replacement

The first two methods of retroreflectivity maintenance identified in the MUTCD (visual nighttime inspection and measured sign retroreflectivity) involve inspecting signs to verify they meet standards. One method involves

measuring retroreflectivity at each sign, similar to the measurements taken on a sample of signs for this project. This would be a very labor-intensive exercise. Alternatively, the Federal Highway Administration (FHWA) has developed methods of visually inspecting signs for compliance with retro-reflectivity standards. These methods generally involve training inspection personnel using reference signs that are at or just above the retro-reflectivity requirements. This enables an inspector to identify non-compliant signs by driving a corridor at night.

By inspecting signs, only the signs that are in unacceptable condition or that fail to meet retro-reflectivity standards would be targeted for replacement. This scheme would enable the use of signs throughout their full life, since no sign would be replaced until it was no longer meeting standards. This scheme would also maintain the maximum number of signs to the published standards. For budgeting purposes, this means using the average retro-reflectivity life. That would result in an average annual replacement quantity of about 1,600 panels, for an annual replacement cost of about \$1 million.

The benefits of this replacement method are that it is the most likely to maintain signs to the published standards and it would take advantage of all of each sign’s useful life. Since this method is not directly driven by sign age, it would also be the most compatible in the case of a large quantity of signs being replaced at once as a result of this inventory project. It also means that replacement would not rely on statistical assumptions, although these could be used for budgeting purposes. The disadvantages are that it requires actively monitoring the condition of the signs and will result in a mix of new and old signs along a corridor. Since DOT&PF has expressed interest in this method, further discussion is included in Appendix D.

Expected Sign Life

The second method of sign replacement would be to plan to replace signs as they reach the expected end of their retroreflectivity life, based on sign color. Replacements would be needed based on the retro-reflectivity lives listed in Table 9. The actual sign life used will depend on DOT&PF’s tolerance for non-compliant signs. Anticipated replacement quantities and costs are listed in Table 10 below for two scenarios, one using the average retroreflectivity life and one using the 95 percent confidence interval life. Both scenarios assume that signs without retroreflectivity requirements are replaced on 22 year intervals, which is equal to the longest sign life based on retroreflectivity,

			Average Retroreflectivity Life			95 percent CI Retroreflectivity Life		
	Panels	SF/Panel	Life	SF/Yr	\$/Yr	Life	SF/Yr	\$/Yr
Red	3,140	6.2	21	928	\$ 92,769	13	1,499	\$ 149,858
White	4,150	5.5	22	1,045	\$ 104,472	15	1,532	\$ 153,225
Yellow	4,821	10.4	17	2,941	\$ 294,103	12	4,166	\$ 416,646
Green	9,260	3.9	16	2,266	\$ 226,604	8	4,532	\$ 362,567
Other	3,894	5.6	22	992	\$ 99,169	22	992	\$ 99,169
Total	25,265	6.0	18.4	8,171	\$ 817,117	12.7	11,815	\$ 1,181,465

Table 10 – Sign Replacement Schedule – Expected Sign Life

The benefits of the second replacement method are that no on-going monitoring is required. The sign database would be queried each year and signs that have reached their projected end of life age would be scheduled for



replacement. The disadvantages are that some signs would be replaced before they fail to meet standards, which means the replacement costs might be higher than the first method, depending on how aggressive DOT&PF is in meeting the publish standards. In addition, some signs degrade to an unacceptable condition each year, and this is not accounted for in this method. Presumably the worst signs would be reported by maintenance personnel or the public, but there is a likelihood that signs in unacceptable condition will remain in service until their scheduled replacement.

Blanket Replacement

The blanket replacement method involves replacing all of the signs in a given area or corridor on a regular schedule. Based on the analyses of the data collected, a 10-year replacement cycle would be the most frequent schedule for replacements. This life is essentially based on the shortest retro-reflectivity life of the various colored signs and coincides with the length of the sign sheeting warranty currently required by the Central Region special provisions to the Standard Specifications for Highway Construction. More green signs may fail to meet retro-reflectivity requirements by the end of their life cycle than other sign types, but the white legend should remain visible to motorists. By planning the life cycle of signs around the worst performing signs, the other sign types will be that much less likely to fall below the performance criteria before they are replaced. Longer replacement periods could be used, with the understanding that it would lead to a higher number of signs failing to meet standards.

Using the sign condition analysis, even the 10-year-old signs (i.e., those due for replacement) will have approximately 8.8 percent of signs in unacceptable condition. The average portion of unacceptable signs across all of the signs would drop to approximately half that number under the blanket replacement scheme.

Replacing one-tenth of the region’s signs every year would cost approximately \$1.5 million. If the replacement period were extended to 15 years, the annual replacement cost would be approximately \$1 million. The benefits of this method are that it is simple to administer and lends itself to replacing all of the signs on a given post at the same time, which could reduce the per-square-foot sign cost. However, this has the potential of being most expensive option and will lead to many signs being salvaged that have lots of potential life remaining. In addition, as with the previously mentioned age-based replacement scheme, any signs that degrade to unacceptable condition before their scheduled replacement would remain in service unless reported by maintenance personnel or the public.

3 CONCLUSIONS

3.1 Initial Estimate versus Actual Results

A project such as this, covering a vast number of assets over an enormous geographic area, proved difficult to estimate. The below table compares the initial project estimates to actual totals encountered in the sign inventory project.



Factor	Estimated	Actual	Difference	Percent Change
Number of Signs	21,170	25,265	4,095	119%
Minutes of Fieldwork Required Per Sign	6.3	7.5	1.2	119%
Project Cost	\$807,500	\$1,287,000	\$479,500	159%

Table 11 – Initial Project Estimates versus Actual Results Encountered

The discrepancies shown above illustrate the complexities of the sign inventory estimation task. Changes in the expected number of signs or processing time per sign very quickly multiplied into cost increases due to the very large number of signs. DOT&PF should be aware that future policy-level decisions affecting the sign inventory geodatabase will likely involve the same unpredictability.

3.2 Overall Project Conclusions and Recommendations

Analysis of the data collected during the sign inventory indicate that, while age of the majority of the Central Region signs is undocumented, most of the signs are still in serviceable condition. However, federal retro-reflectivity requirements may mean that signs will have to be replaced on a regular basis or with capital projects to ensure compliance.

Of the 38,180 posts and sign panels in service, 8,366 were observed as substandard for a variety of reasons. This works out to 1,176 (or 9.1-percent) posts and 7,190 (or 28.5-percent) sign panels. Assuming that the retroreflectivity trends in the tested sample are accurate for all of the signs, we expect 3,205 additional signs fail to meet retroreflectivity requirements. This is in addition to the signs that are known to be substandard with respect to condition, size, and retroreflectivity. This would bring the total percentage of substandard panels to 41.1-percent. Table 12 breaks down the substandard panels and posts. Note that the rows do not add up because some signs may be substandard for more than one reason. For example, some signs in unacceptable condition may also not meet current size requirements.



	Total	Panels Not Meeting:				Total Substandard		
		Size	Retro - Actual	Retro - Projected	Condition	Panels	Percent Panels	SF
Panels								
Regulatory	7,290	762	47	489	377	1,606	22.0%	8,505
Warning	4,821	359	52	473	626	1,440	29.9%	12,935
Guide	9,260	4,364	83	2,243	326	6,771	73.1%	18,161
Other	3,894	328			280	578	14.8%	2,225
Total	25,265	5,813	182	3,205	1,609	10,395	41.1%	41,825
	Total			Crashworthy	Condition	Total Posts	Percent Posts	
Posts	12,915			457	749	1,176	9.1%	

Table 12 – Substandard Sign and Post Summary

It is unlikely that it will be feasible to immediately replace all of the substandard signs in the region. Cost breakdowns are included in Table 13. Costs reflect the previously stated assumption that new signs installed to meet new size standards will be 50-percent larger than the signs they replace. As with the previous table, the total column is not necessarily equal to the sum of the preceding columns due to the fact that some signs are substandard in multiple ways.

	Cost to Meet Standard:				Total
	Size	Retro – Actual	Retro – Projected	Condition	
Panels					
Regulatory	\$551,000	\$24,900	\$284,800	\$207,600	\$1,035,000
Warning	\$206,000	\$32,000	\$490,500	\$658,800	\$1,363,000
Guide	\$1,226,000	\$18,800	\$878,200	\$158,900	\$2,225,000
Other	\$193,000	\$0	\$0	\$105,300	\$287,000
Total	\$2,176,000	\$75,700	\$1,653,600	\$1,130,600	\$4,908,000
			Crashworthy	Condition	
Posts			\$280,000	\$384,100	\$643,000

Table 13 – Substandard Sign and Post Replacement Cost

Unit costs for post replacement are not available, so the post replacement costs were estimated to be one half of the attached sign panel replacement costs. There are 12,860 square feet of signs attached to substandard posts, so at \$50 per square foot, the post replacement costs are estimated to be \$643,000. It should be noted that 3,257 square feet of the signs attached to substandard posts were observed to be substandard as well, so if the panels and posts were replaced, the cost to fix the substandard posts would increase to \$1.29 million and the overall substandard panel replacement cost could be reduced by \$325,700.

The replacement projects should focus first on signs and posts that are in unacceptable condition. Non crashworthy posts should also be a priority. As these safety issues are addressed, the replacement effort should refocus on signs that are known to not meet retro-reflectivity requirements, then moving on to signs that are smaller than current standards. Replacement projects could be developed either region-wide or by corridor to address priorities based on safety, funding, traffic volume, or other metrics.

Going forward, there are several inventory management methods that would help ensure the deployed signs continue to meet the needs of the road users and meet federal standards. Of those methods, the most cost effective would be to visually inspect all of the signs on a regular basis and replace signs as they degrade to an unacceptable condition or fail to meet retro-reflectivity standards. Even with the expense of drive-by inspections (assuming a few weeks using a two-person team), this is still the most cost effective method considered. Overall, we anticipate about \$1 million worth of signs needing to be replaced annually. This would vary significantly. Over the next 5 years we anticipate nearly \$10 million worth of sign replacement as over-aged signs are replaced. Going forward, the sign replacement needs would be less since so many of the signs would be new. Sign replacement breakdowns are included in Appendix D.

After documenting all of the signs in the region, it became apparent that some signs should be considered for inclusion in the ASDS. Specific recommendations include a generic 6-inch-tall destination plate, similar to a D9-308; waste transfer center barrel signs, similar to D9-103; arrows for parking signs, potentially smaller sized D9-301 signs; pathway milemarkers; and a variety of Alaska State Parks signs (i.e. Lake Stocked, Lake Access, etc.).

3.3 Data Maintenance and Updates are Necessary to the Continuing Relevance of this Project

This study represents a static or ‘snapshot’ inventory of sign assets. The physical attributes recorded for each sign and vital engineering assessments are only valid for the time of the analysis. With the passage of time, attributes such as sign condition, retro-reflectivity reading, and all engineering assessments are subject to change. These attributes should be considered dynamic in nature and users of the sign inventory geodatabase should be aware of the potential problems that may arise if outdated data is relied upon for safety-critical purposes. In order to protect the validity of this investment and invaluable tool, it should be recognized that maintenance of the component dataset and periodic updates of the engineering analysis are essential for relevant results.

The task of keeping the geodatabase current can take many different forms. The Marshall tablets which were purchased by DOT&PF for use as in-house updating tools and regular maintenance sign work can be used to ensure compliance with DOT&PF schema for those contractors who are unprepared to accommodate less cumbersome equipment to the task. Alternatively, sign as-built contractors who are capable with GIS data collection can use the field and office methods described above or other adaptations in order to ensure that data is formatted and delivered appropriately. Another option would be to utilize a term contractor to update signs on a regular basis in order to ensure that all signs are collected and delivered with a consistent methodology. Finally, DOT&PF could decide that ongoing updates are impractical and that further ‘snapshot’ updates, capturing the entire region at some defined interval, may be the best solution.

It should also be noted that this project did not incorporate the MOA sign geodatabase. The schema differences between that geodatabase and the existing DOT&PF sign inventory were so different that reconciliation requires policy-level decisions on the best way to proceed. Options include allowing the MOA to maintain the entire



geodatabase, as they are currently doing. It could also be decided that DOT&PF should pursue and maintain a separate geodatabase which covers the same geographic region as the MOA geodatabase. An effort could also be undertaken to convert the MOA database to the DOT&PF schema, although this option would be complicated and necessarily result in many DOT&PF standard schema fields remaining empty. In addition, any decision involving DOT&PF collection or maintenance of the MOA geodatabase also necessitates consideration of updating issues similar to the ones listed in the above paragraph.

It is hoped that this document along with the .xml file that accompanies the deliverable, will provide valuable insight that will help DOT&PF assess the quality and relevance of the collected data.



APPENDIX A – MAPPING ATLAS

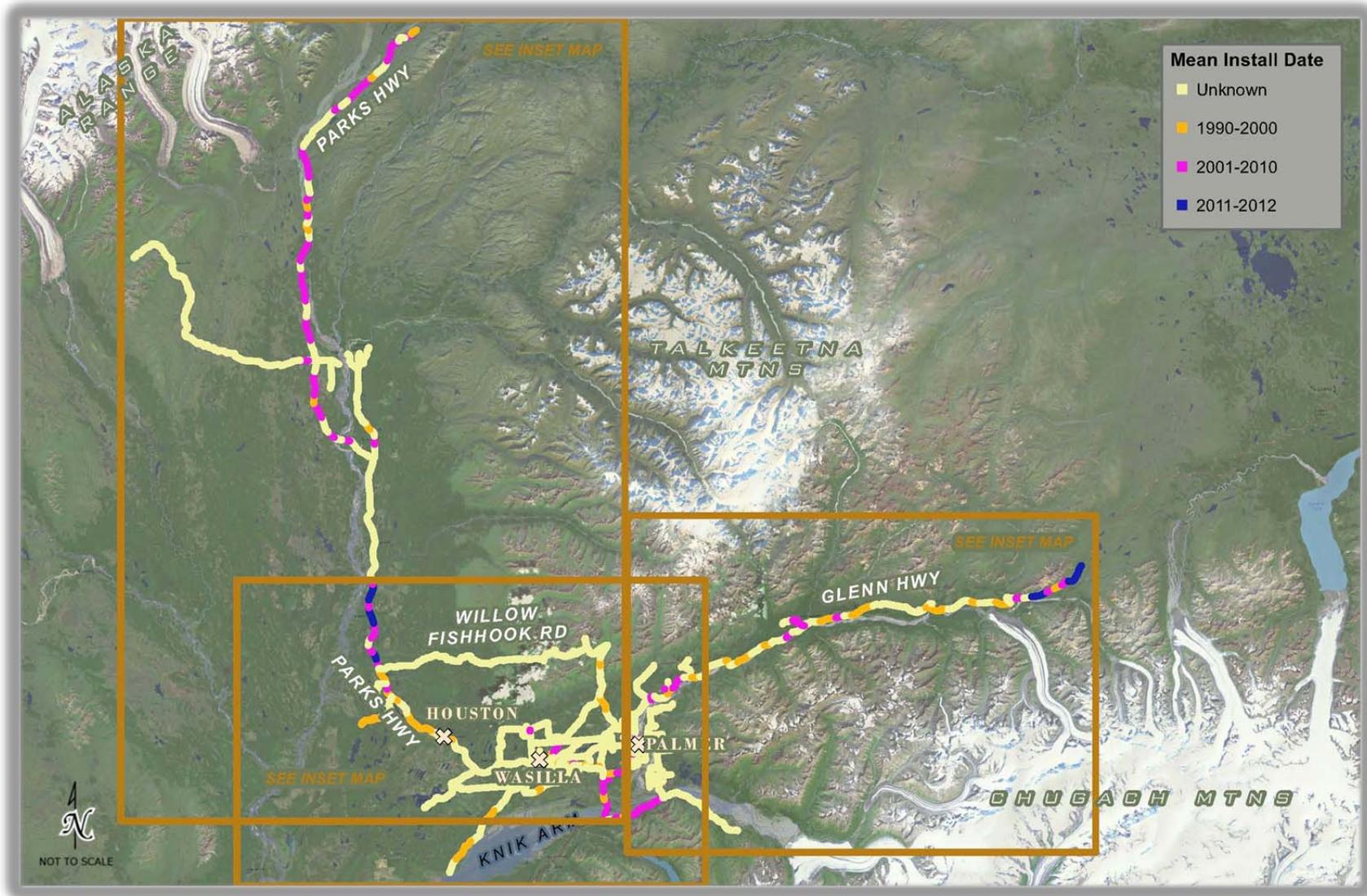
Note: The following pages display reduced-size copies of summary mapping relating to this project. Full-size hard copy maps are provided with this report.

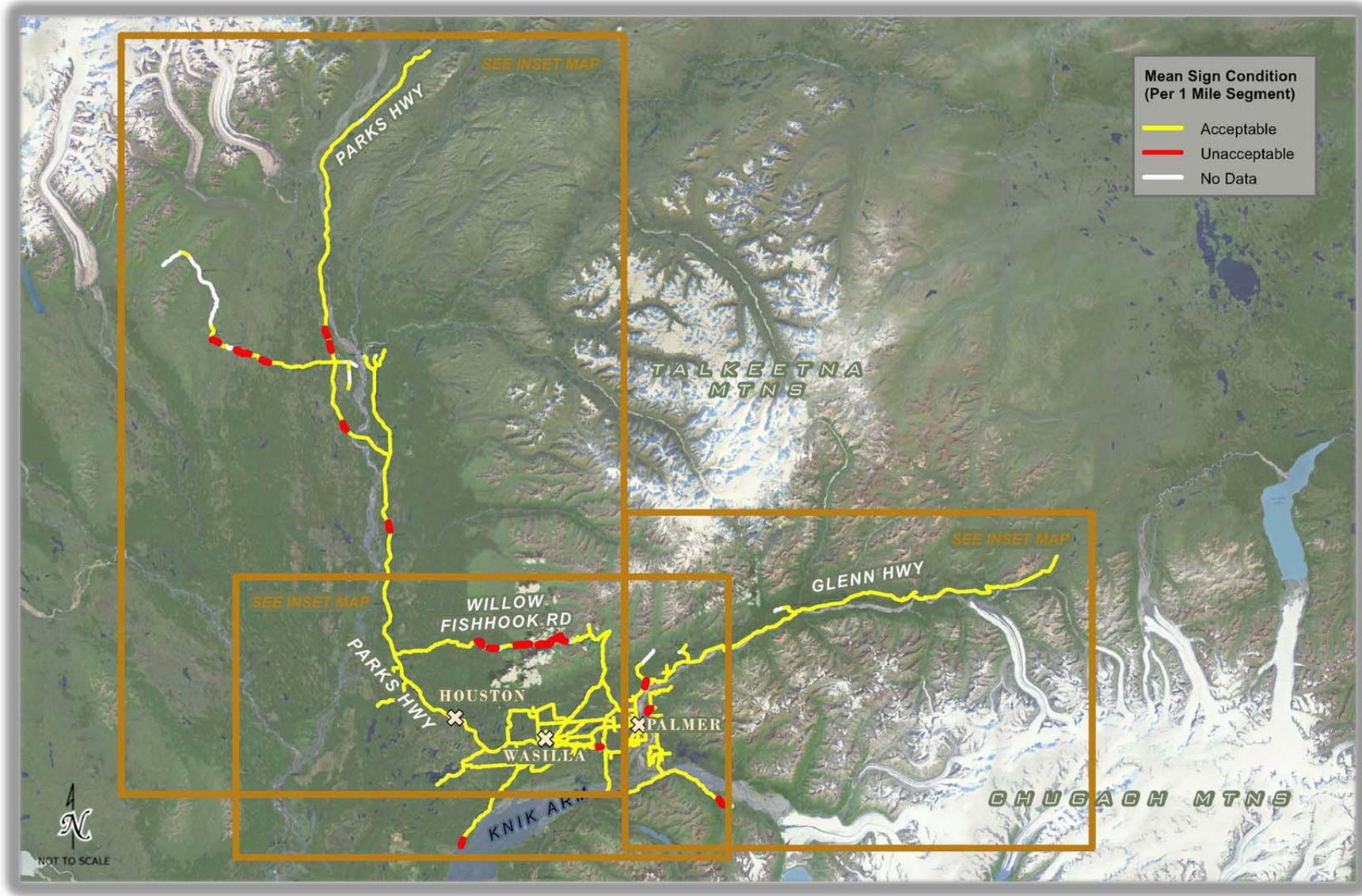
All maps reference aerial imagery provided by ESRI. Original sources may include ESRI, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, ESRI Japan, ESRI China (Hong Kong), ESRI (Thailand), TomTom, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community.

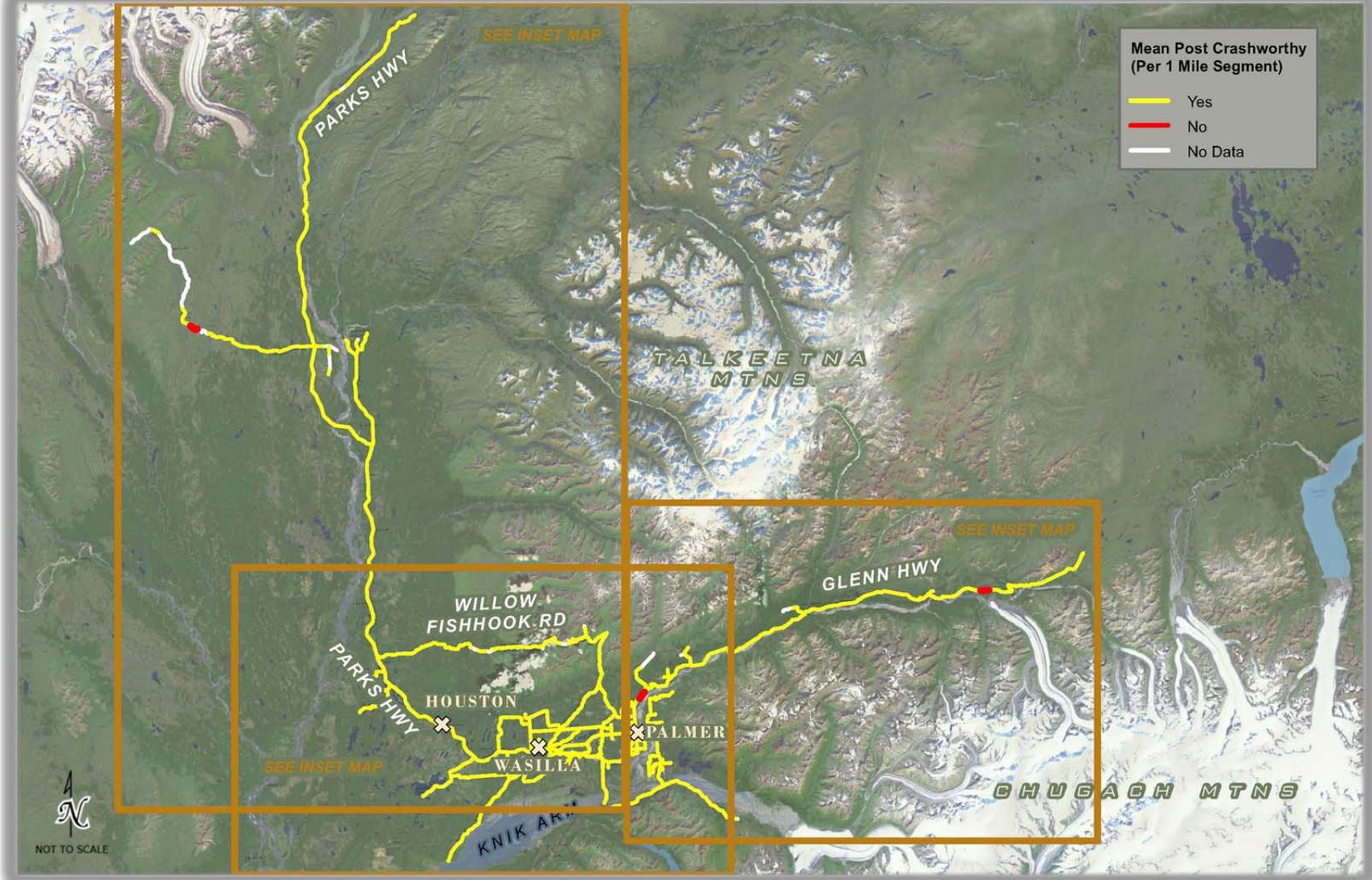


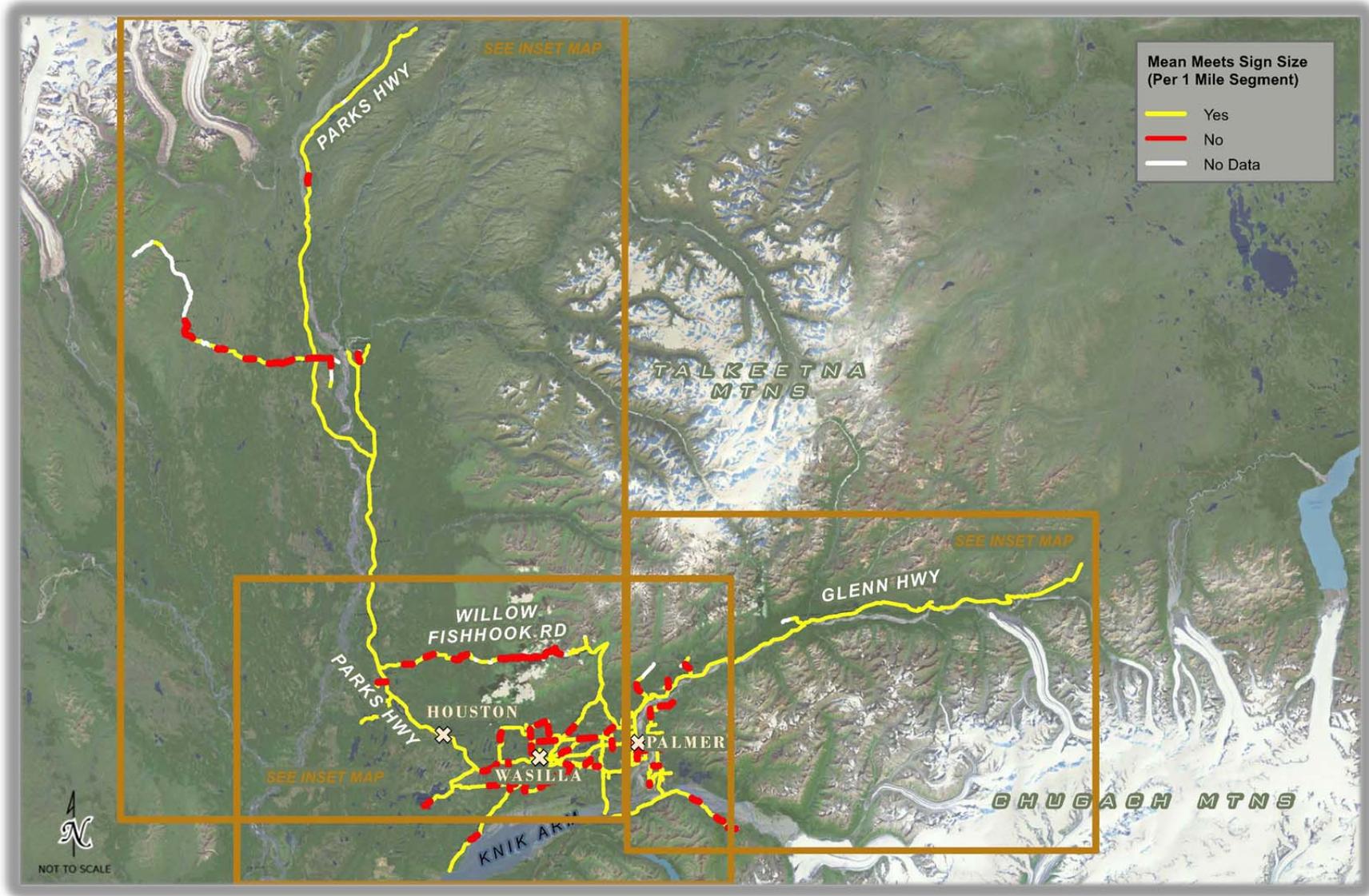
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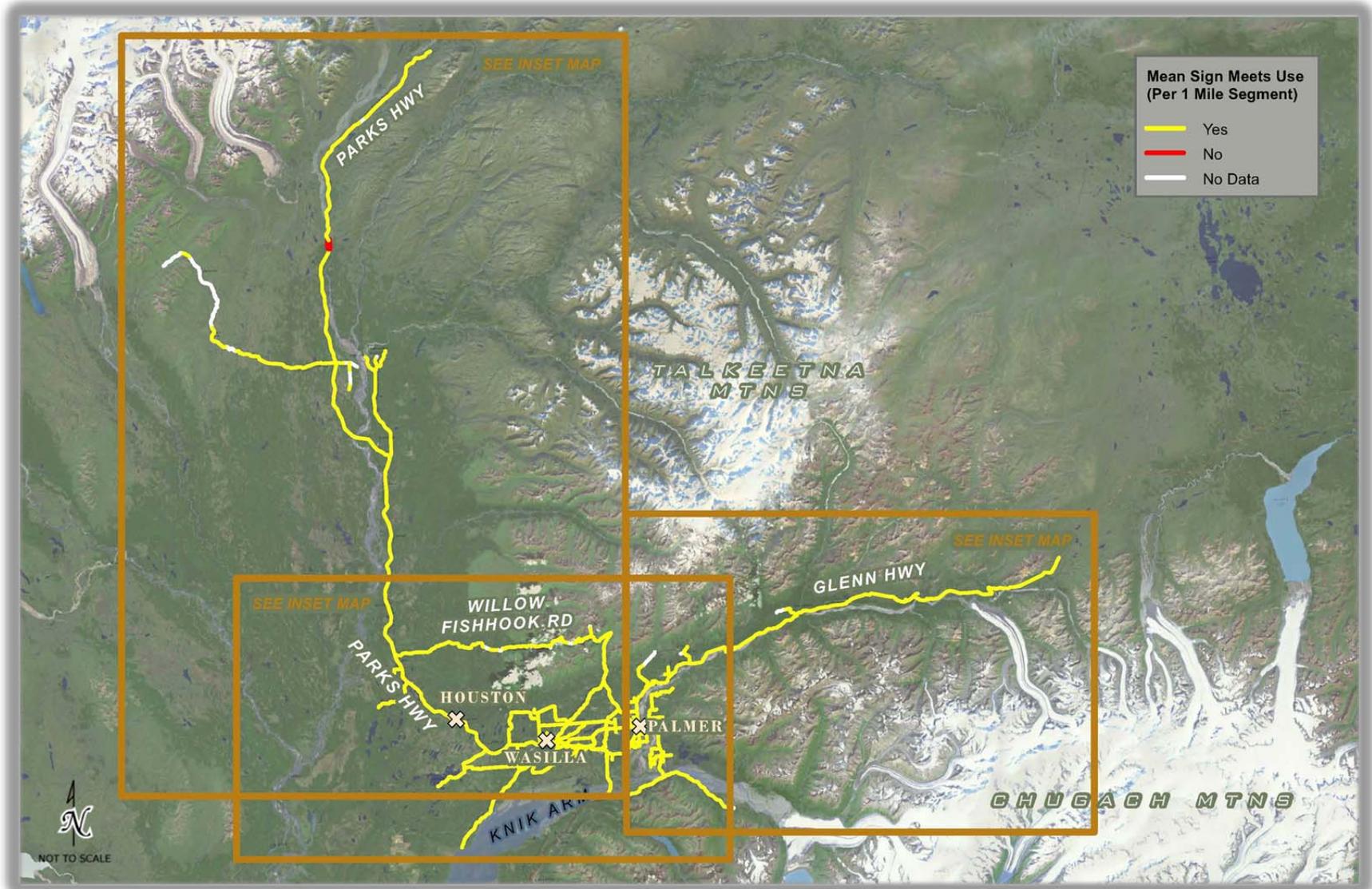
Mat-Su Overview Maps

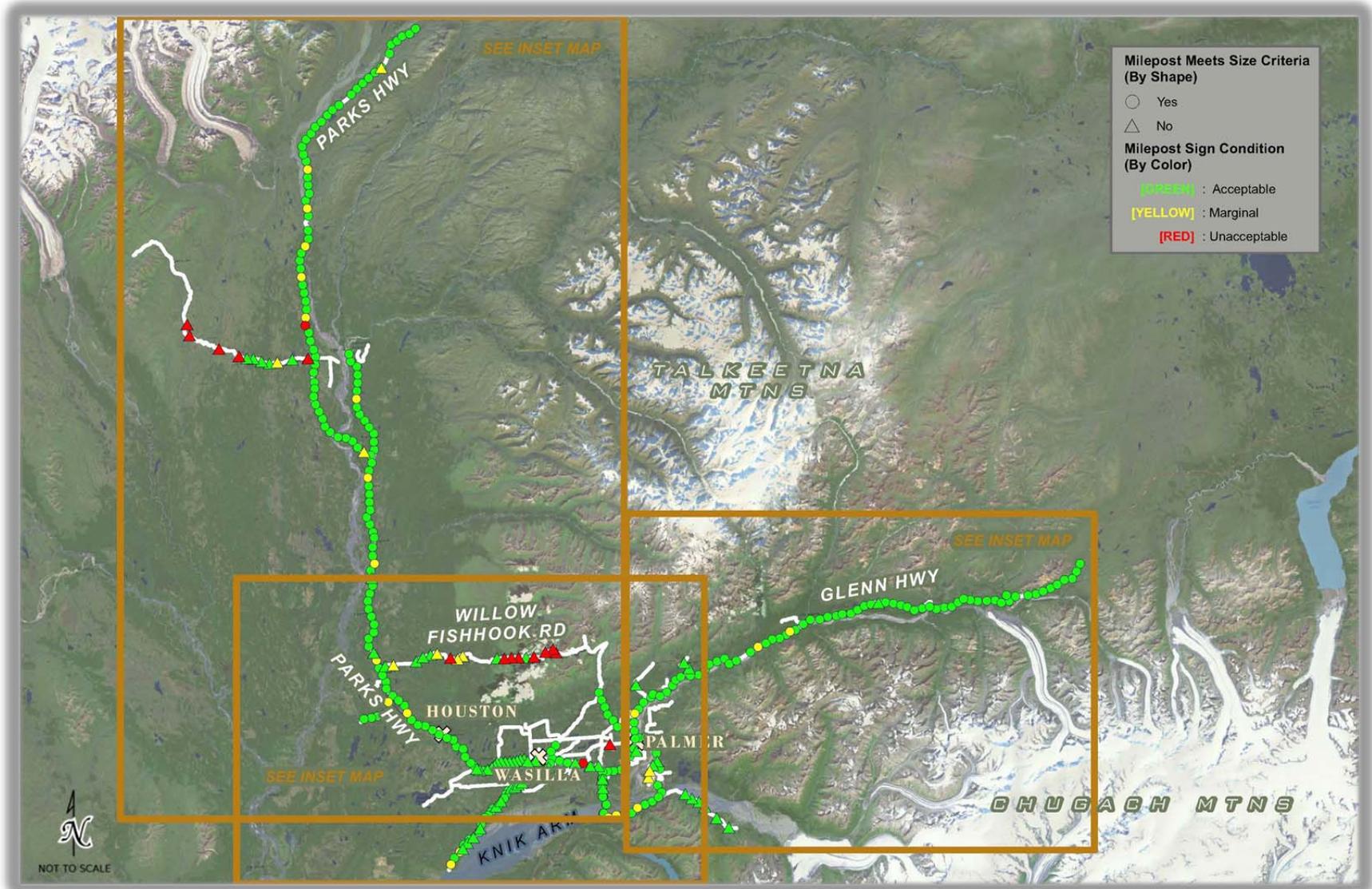


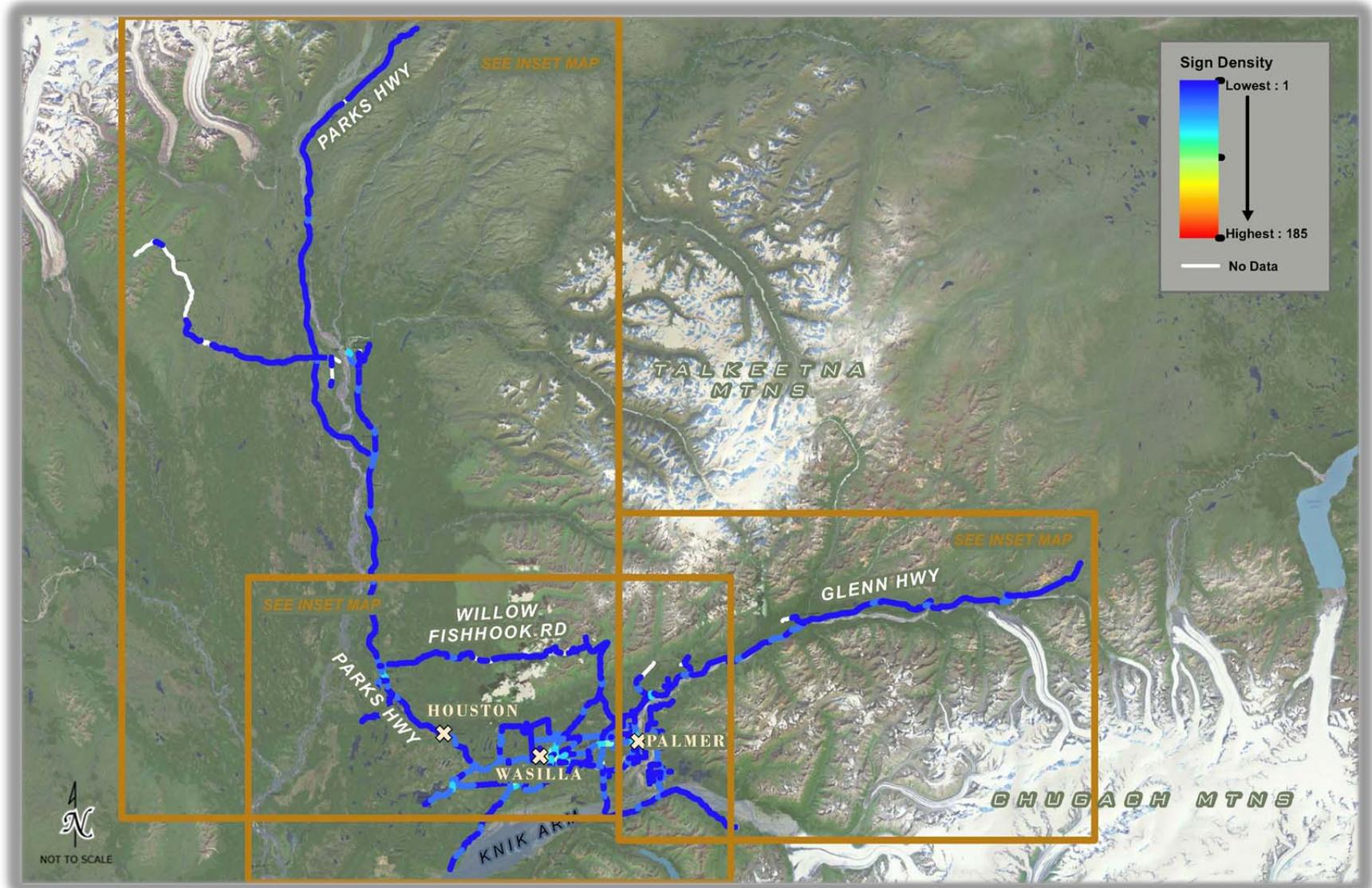




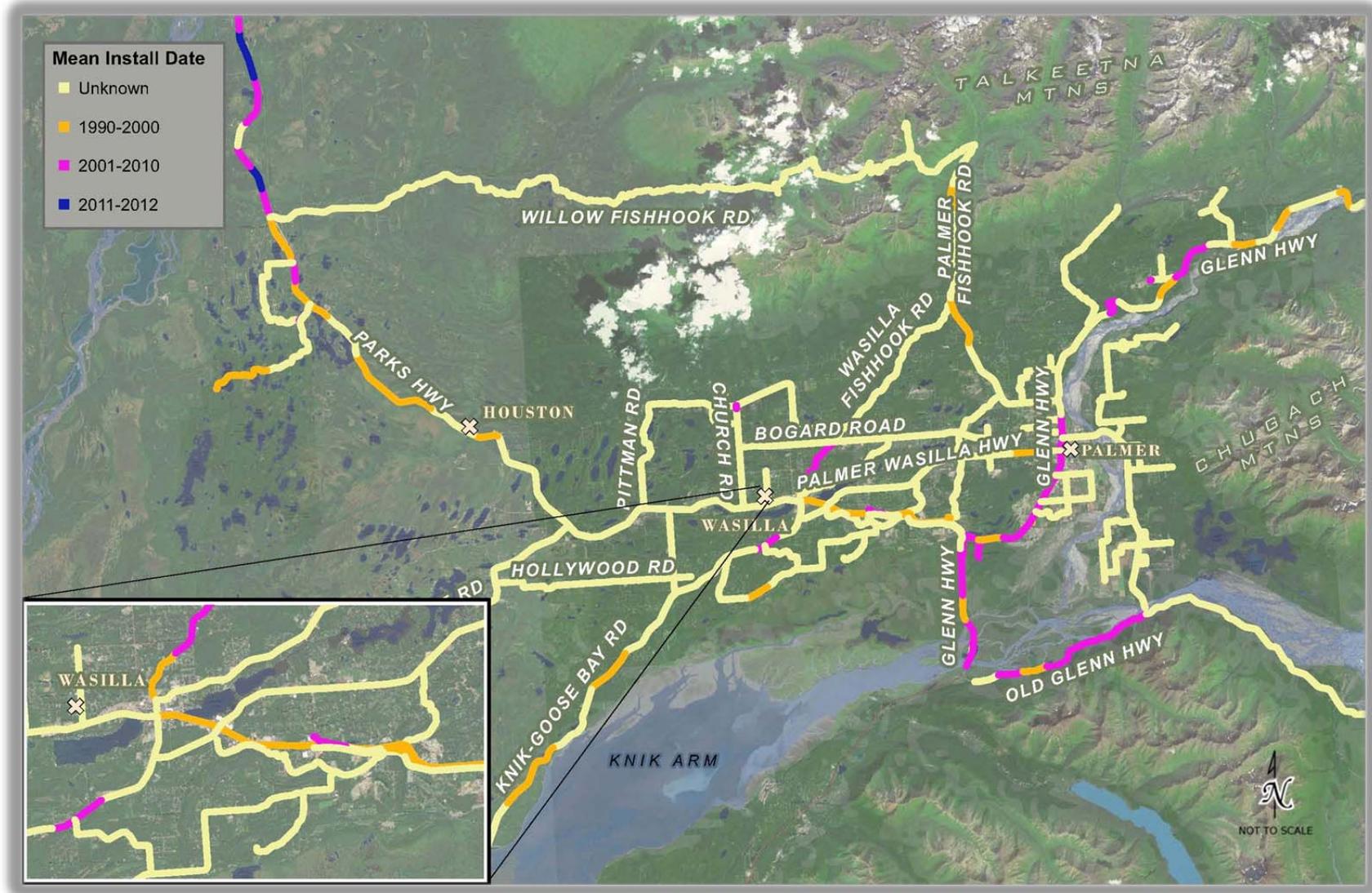


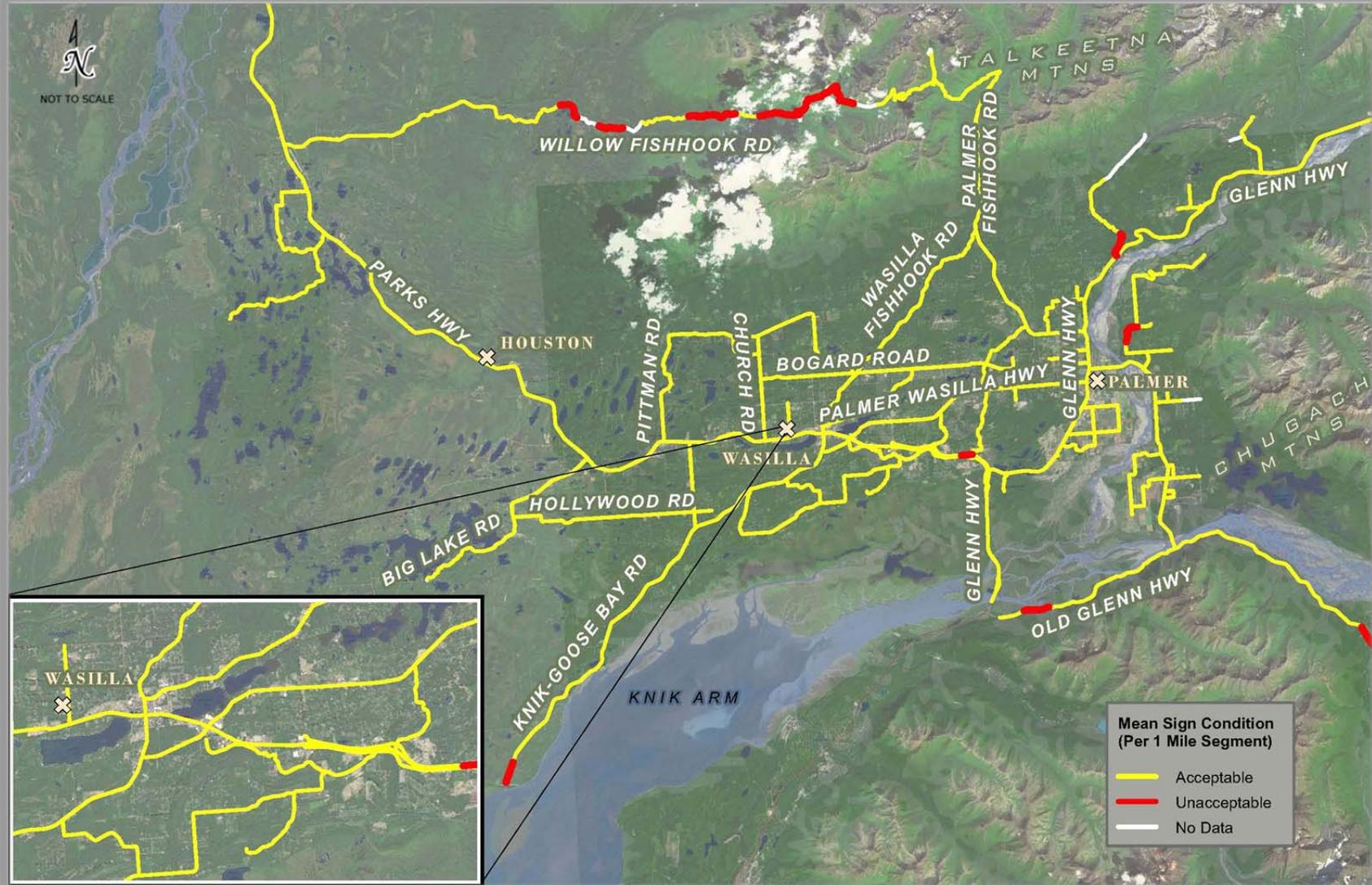


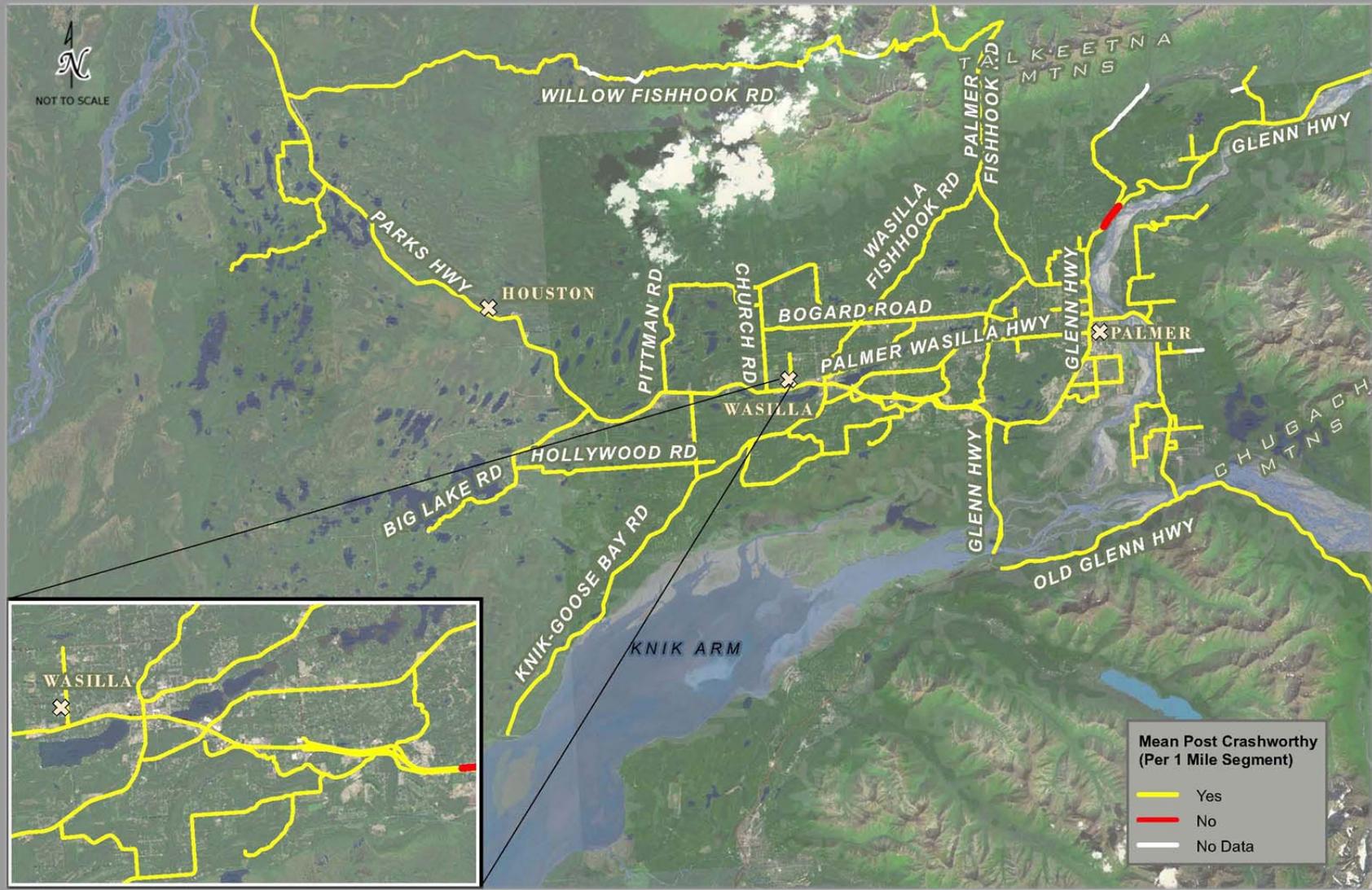


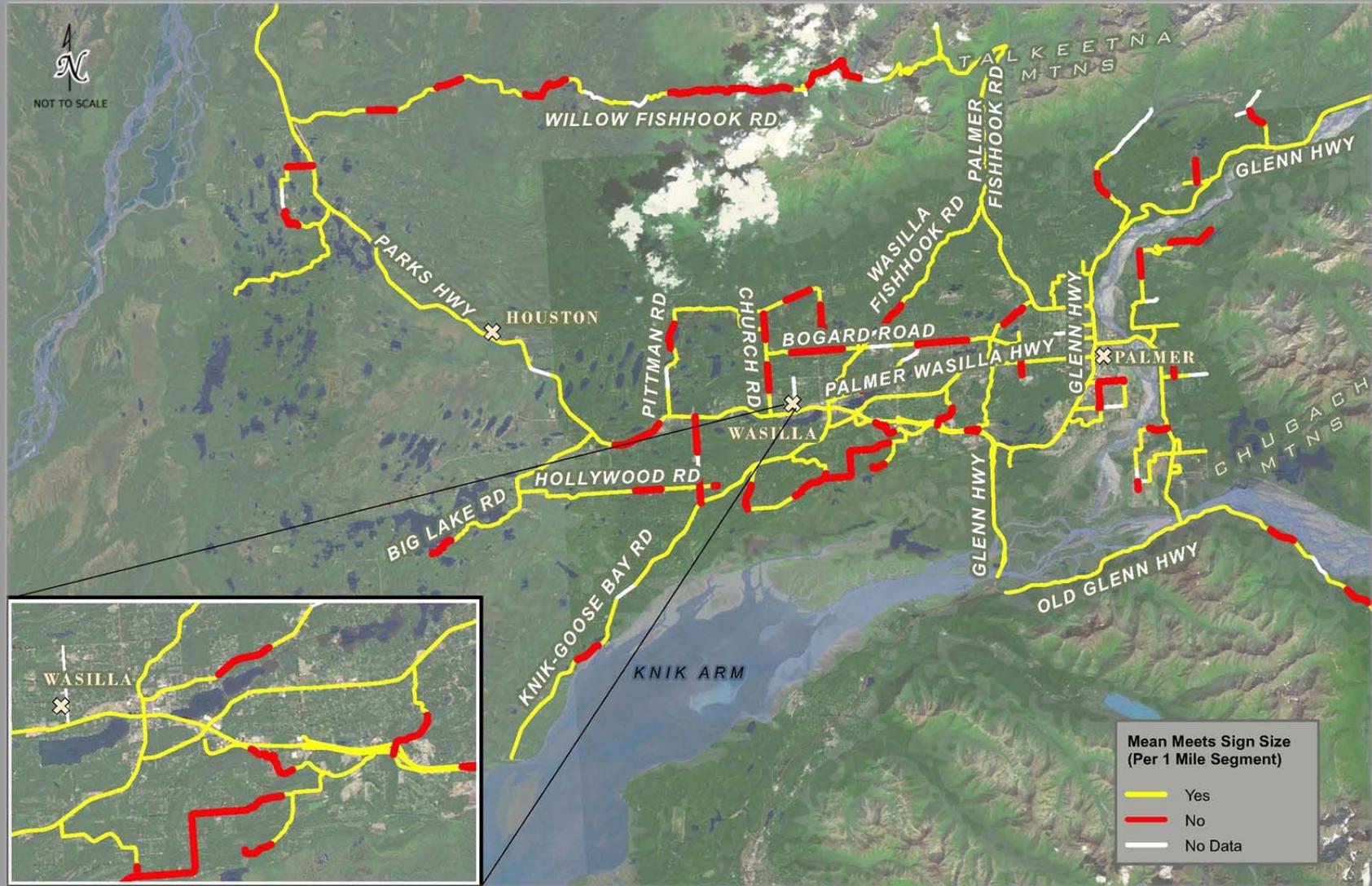


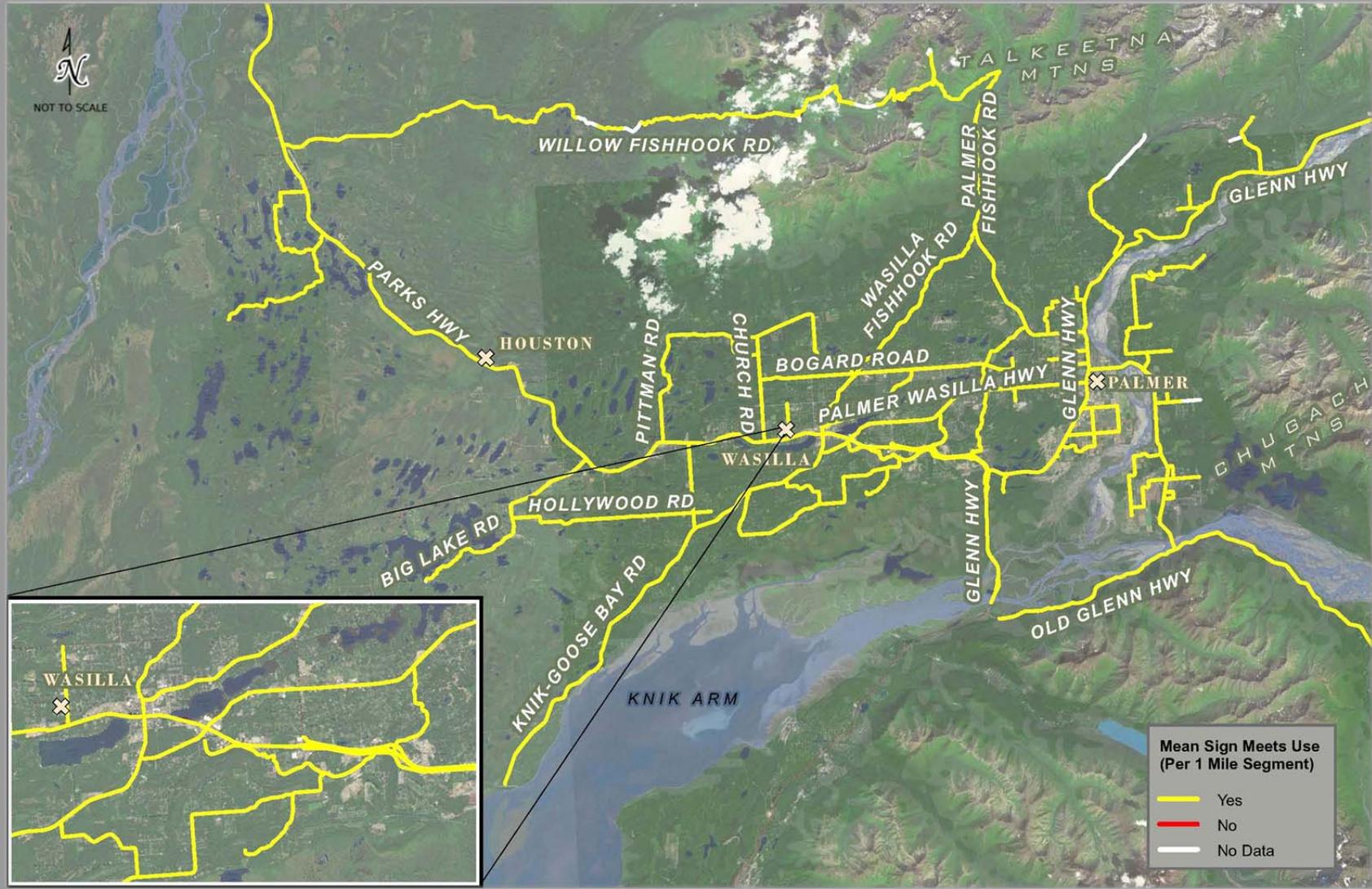
Palmer-Wasilla Area Maps

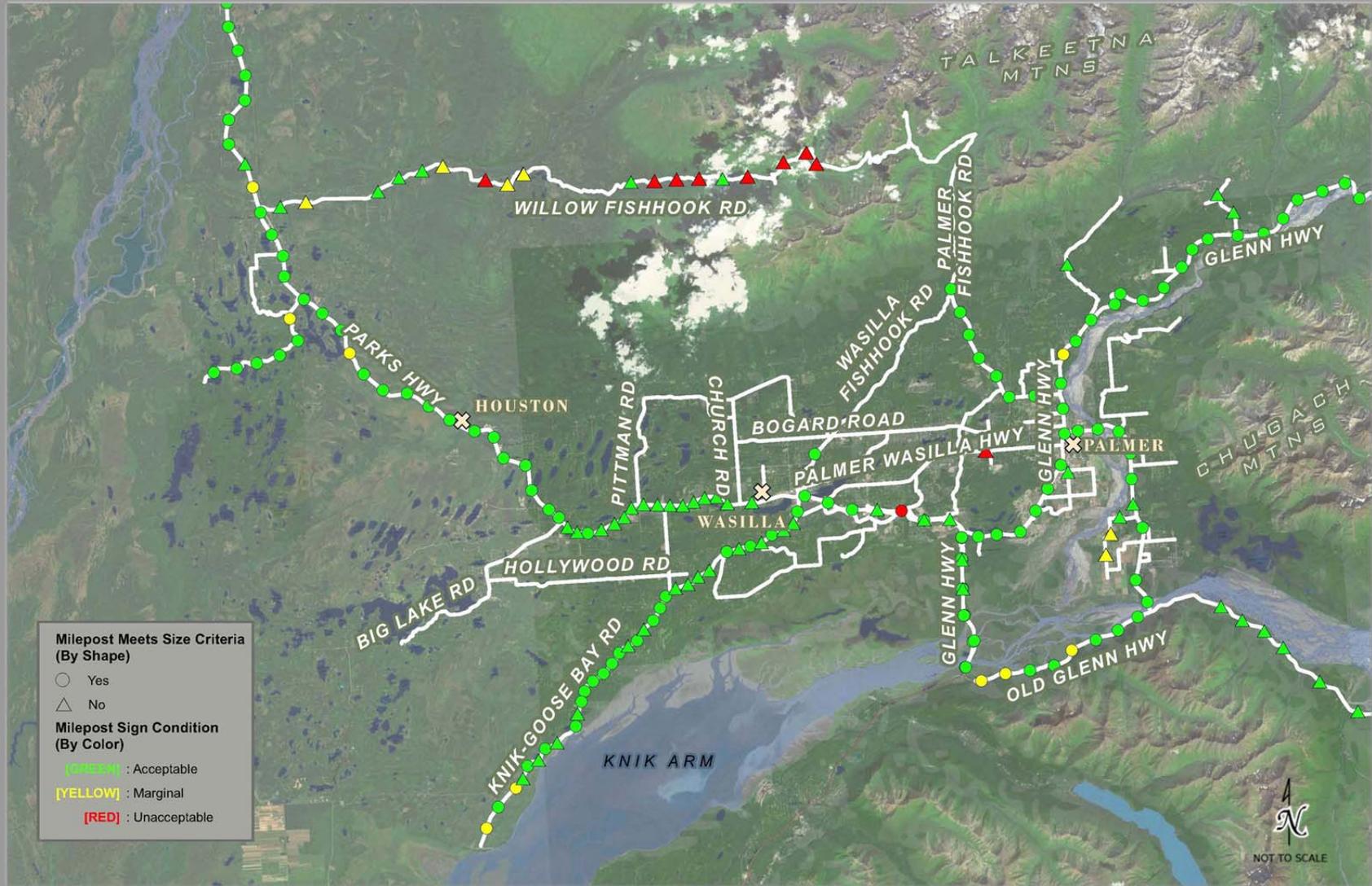


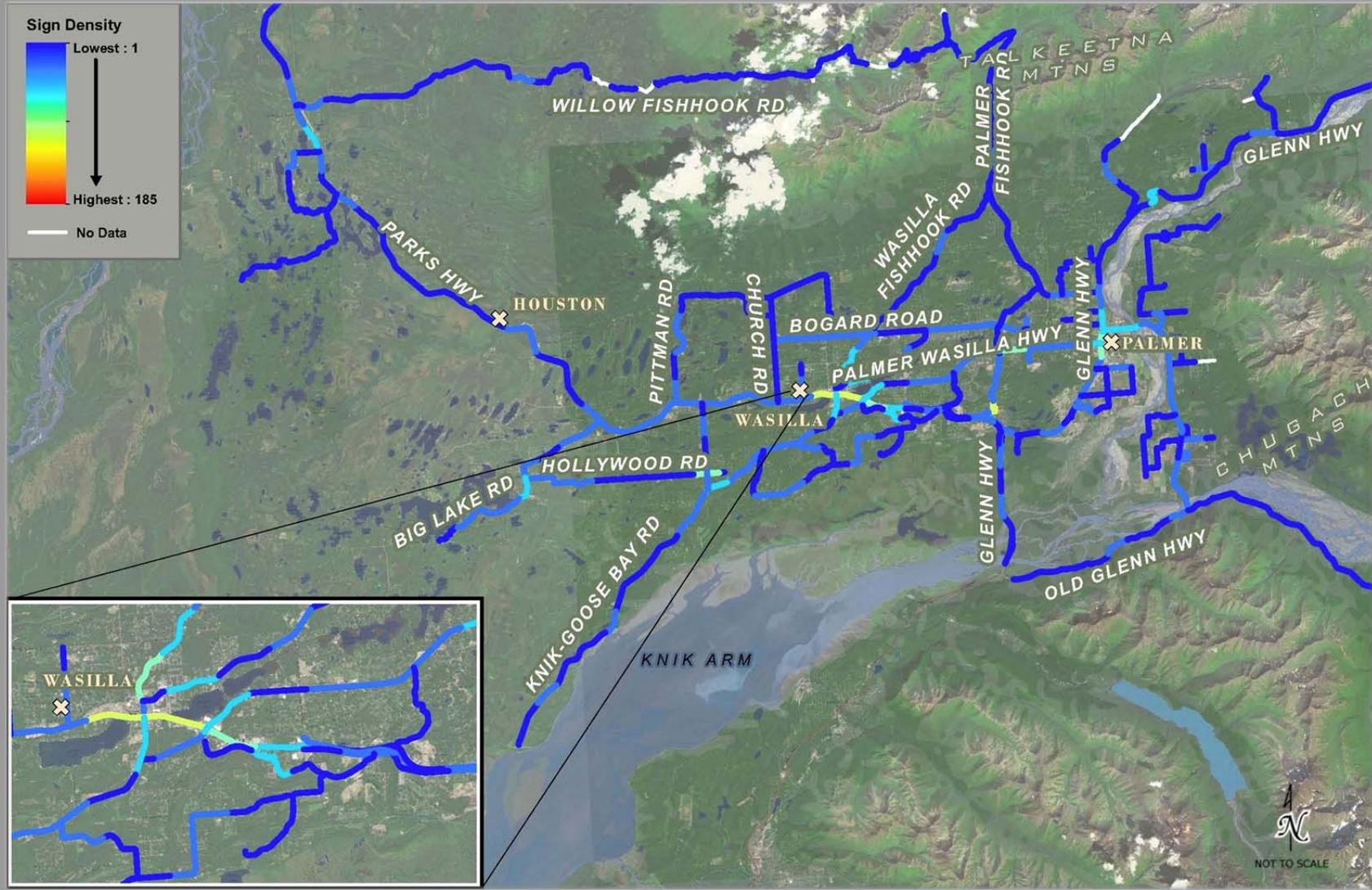






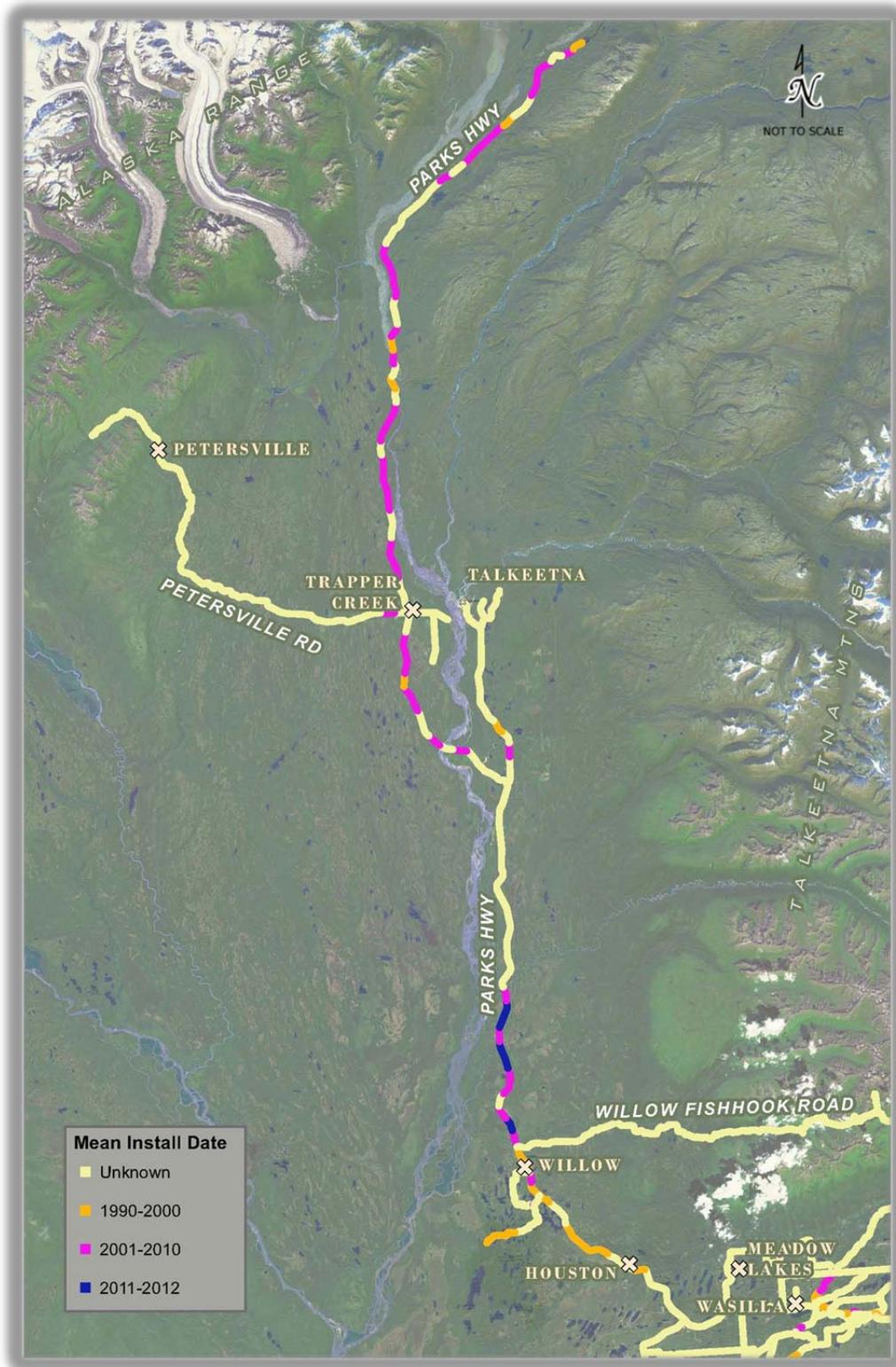


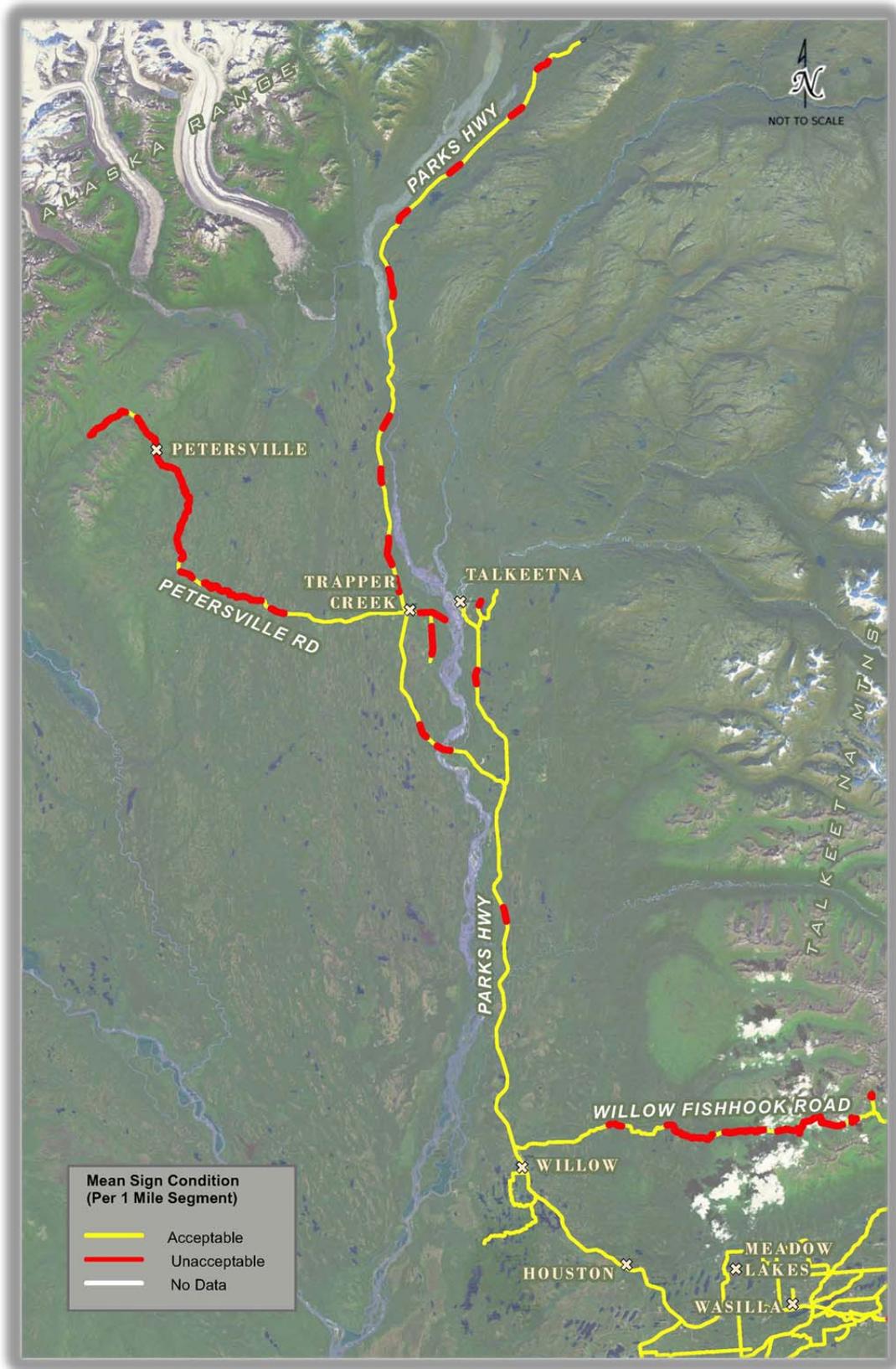


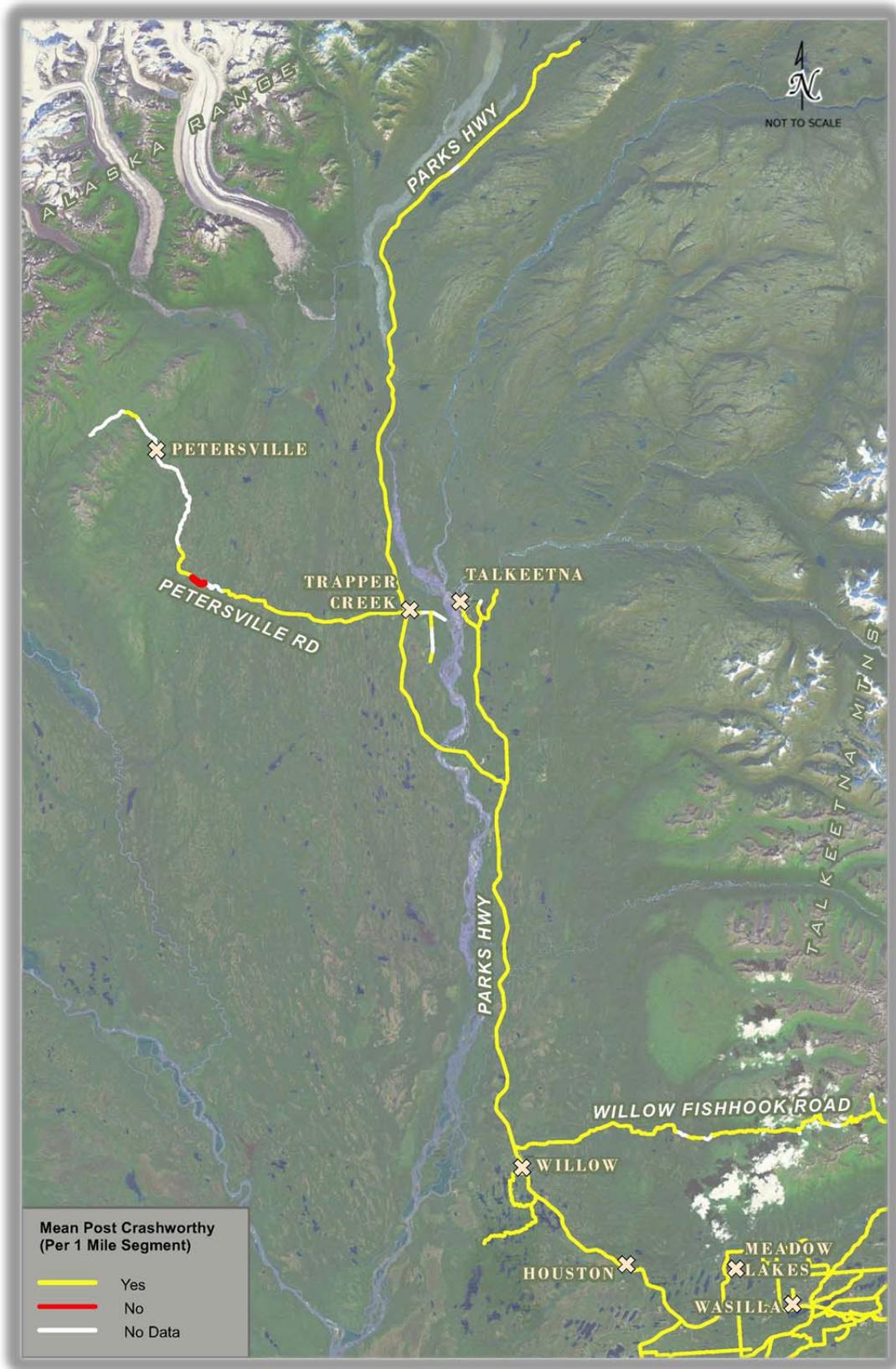


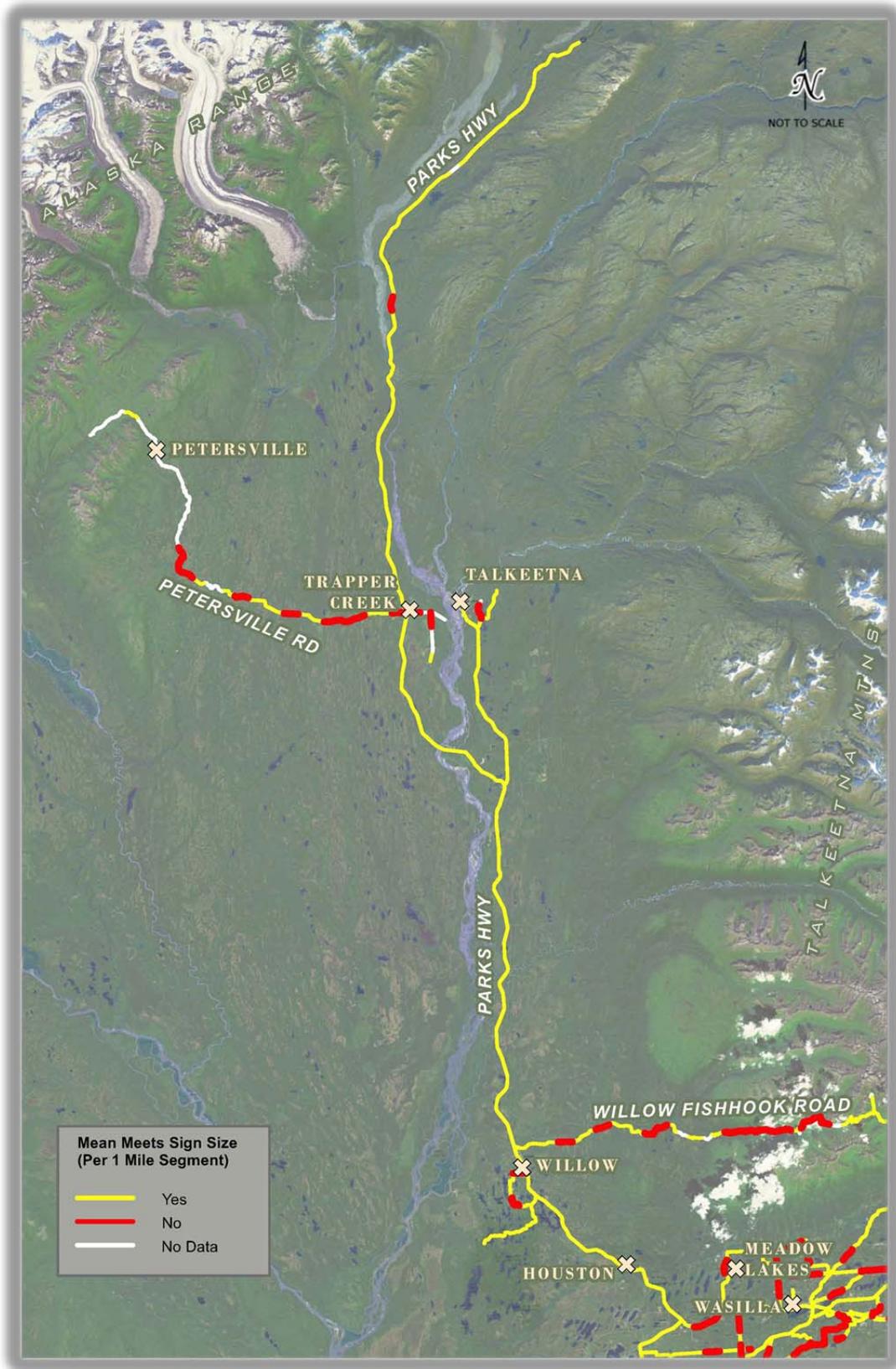


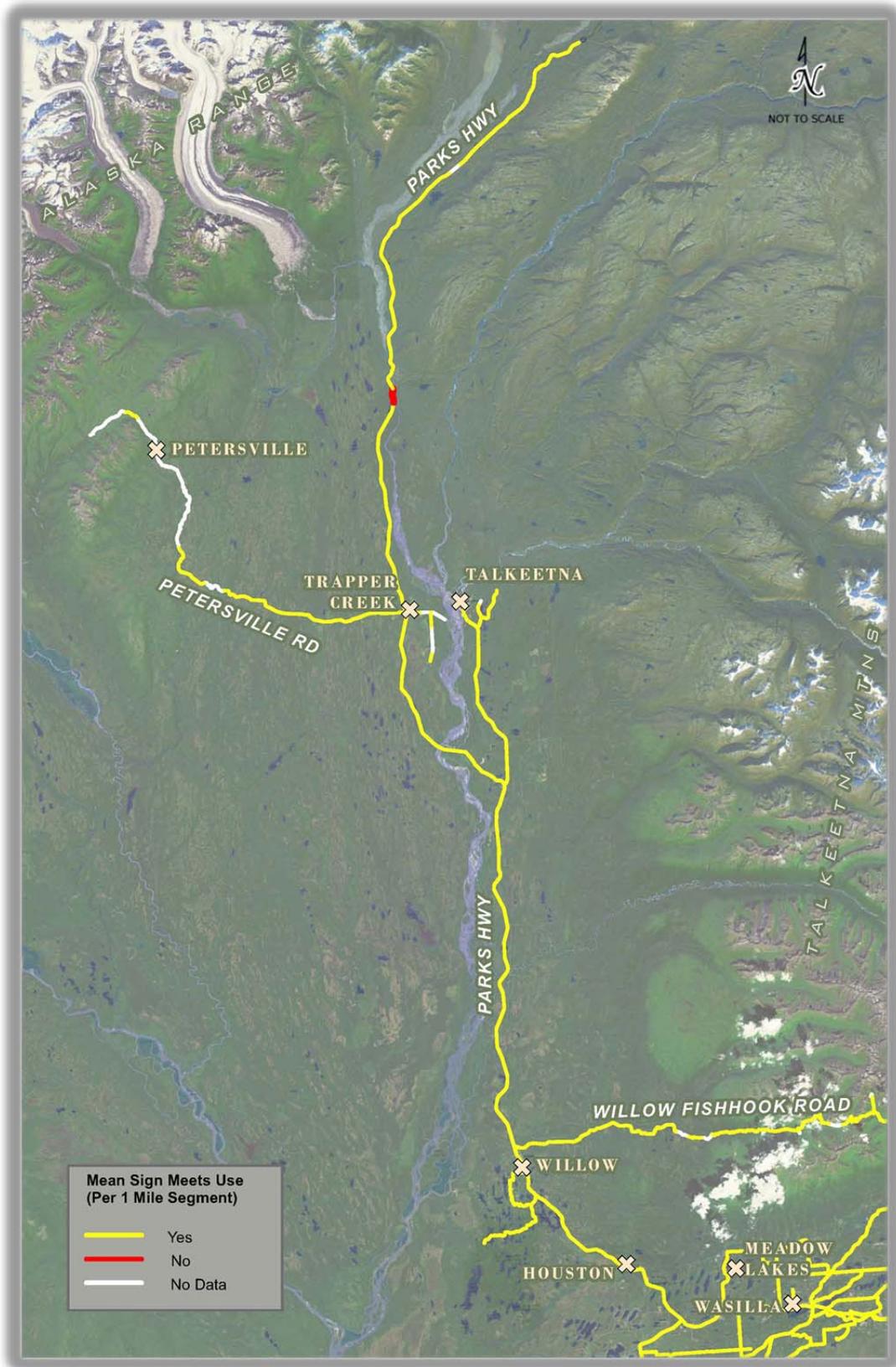
Parks Highway North Area Maps

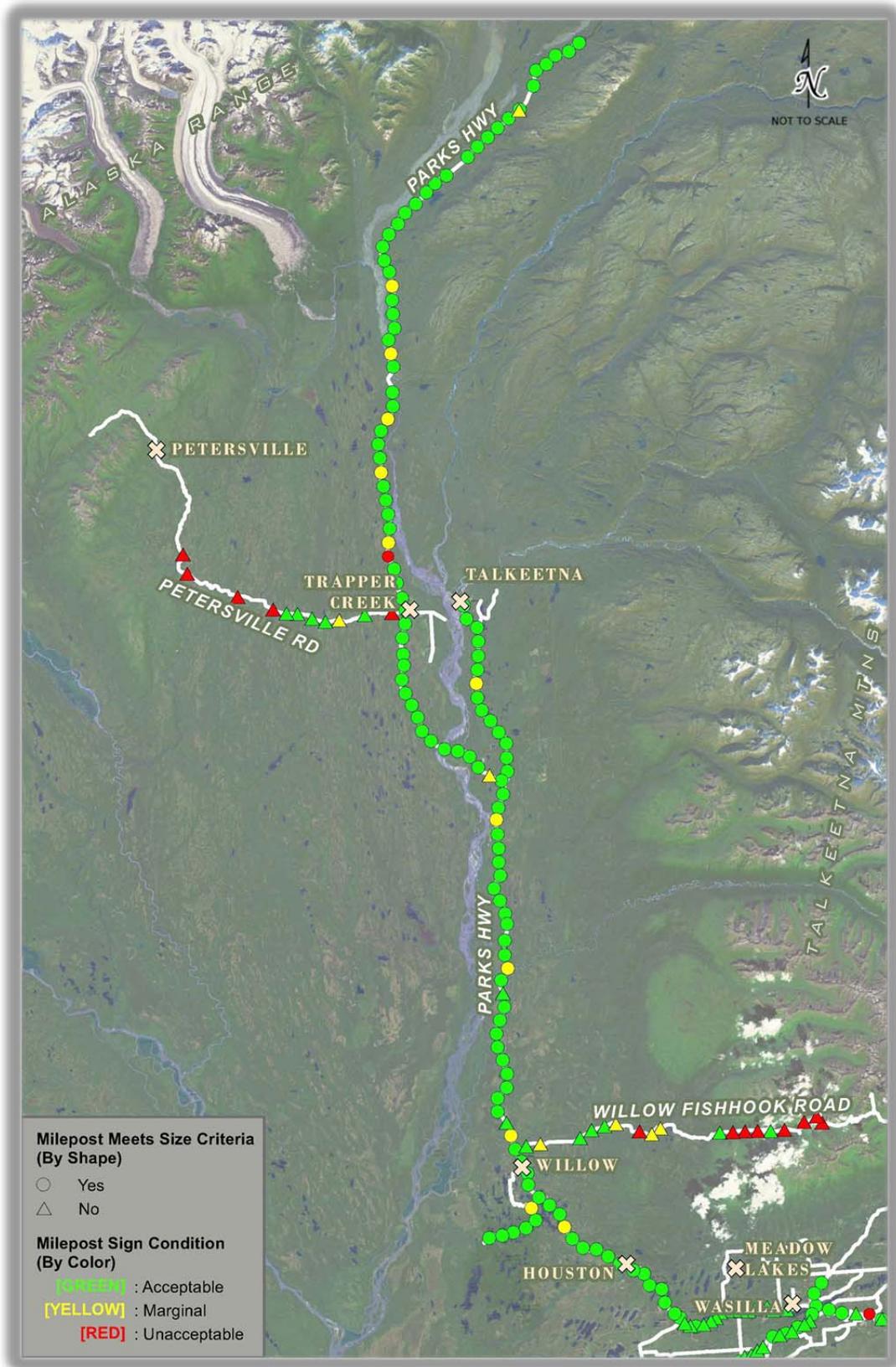


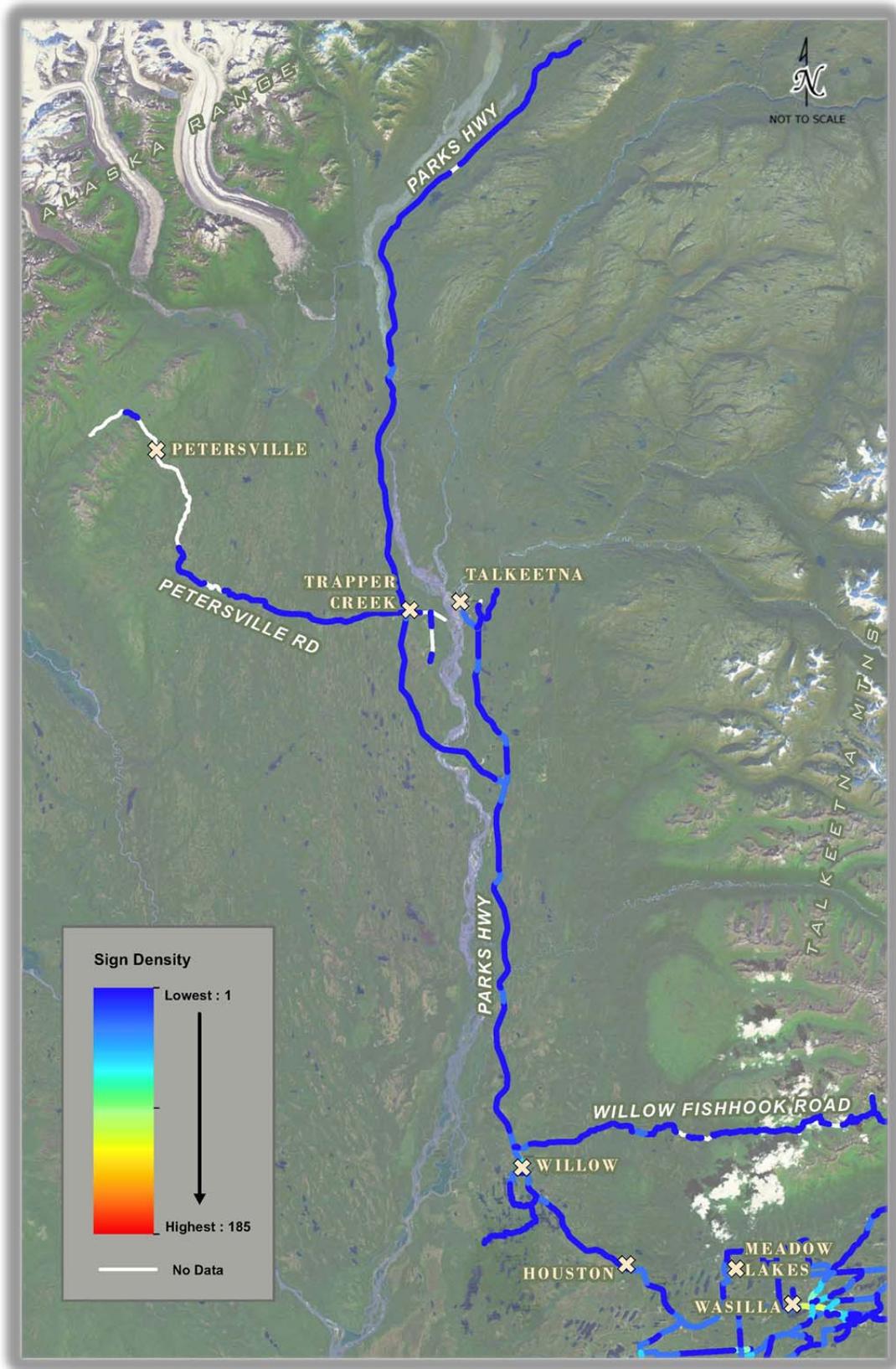














Glenn Highway Area Maps









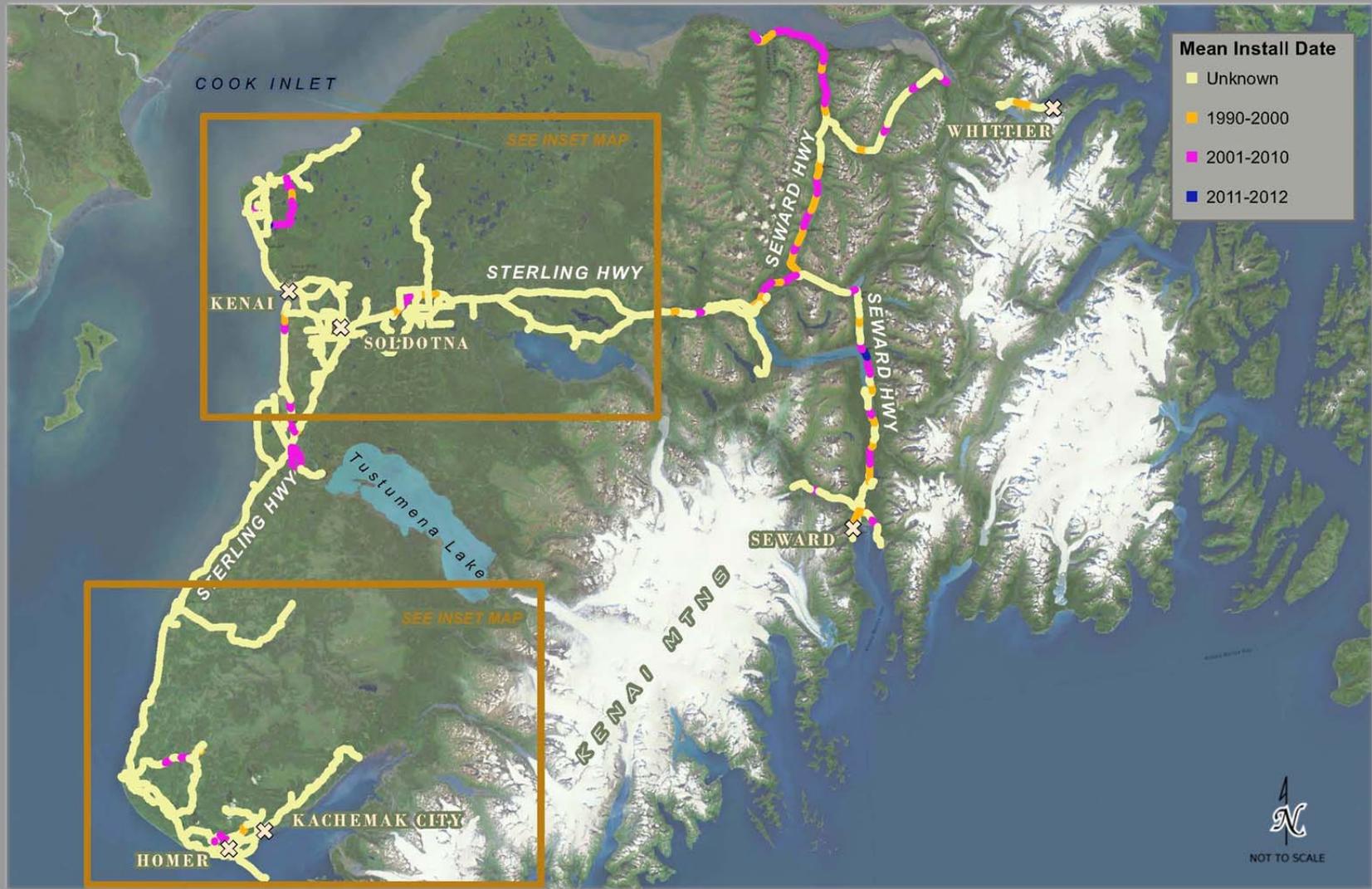


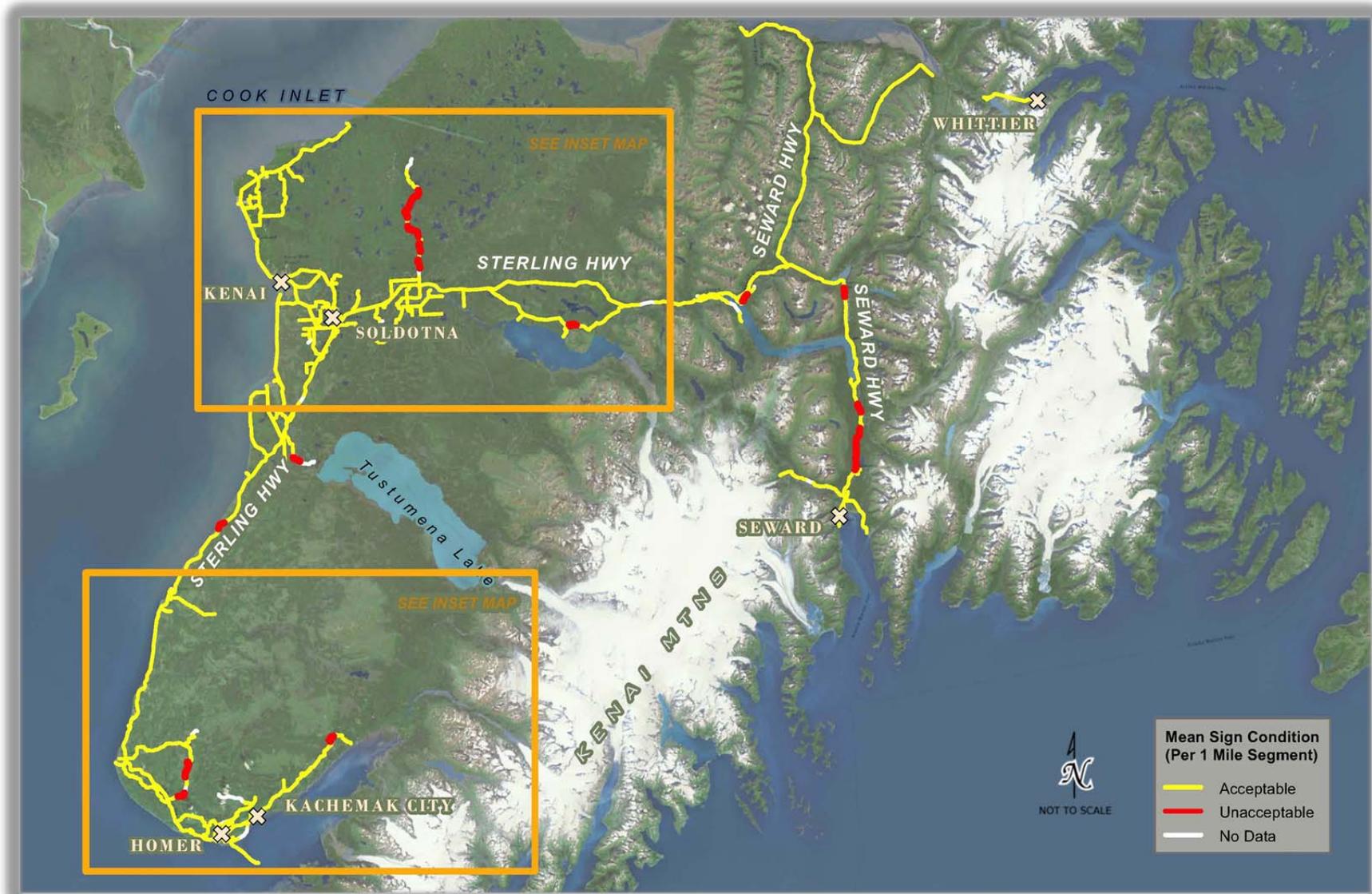


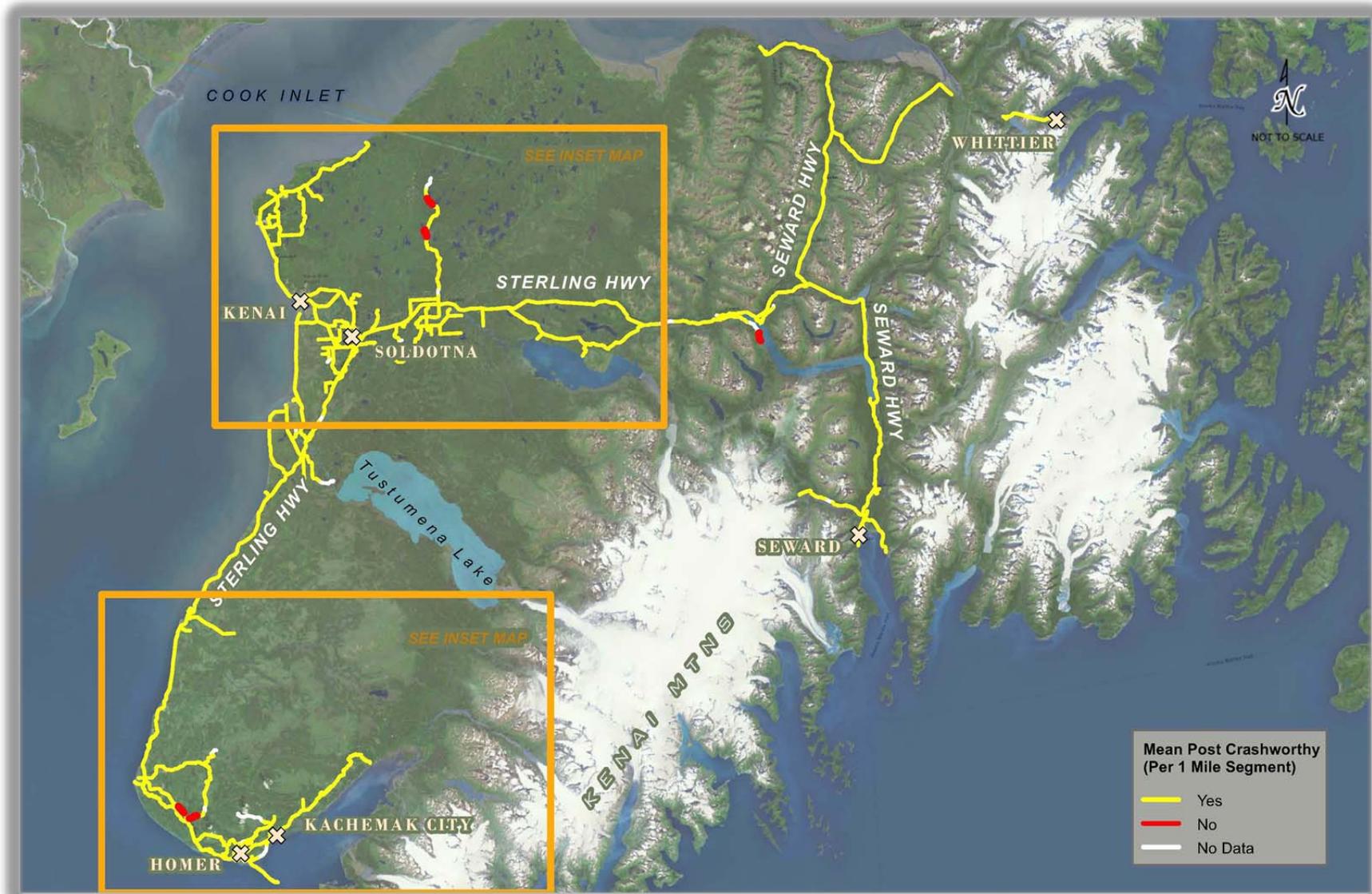


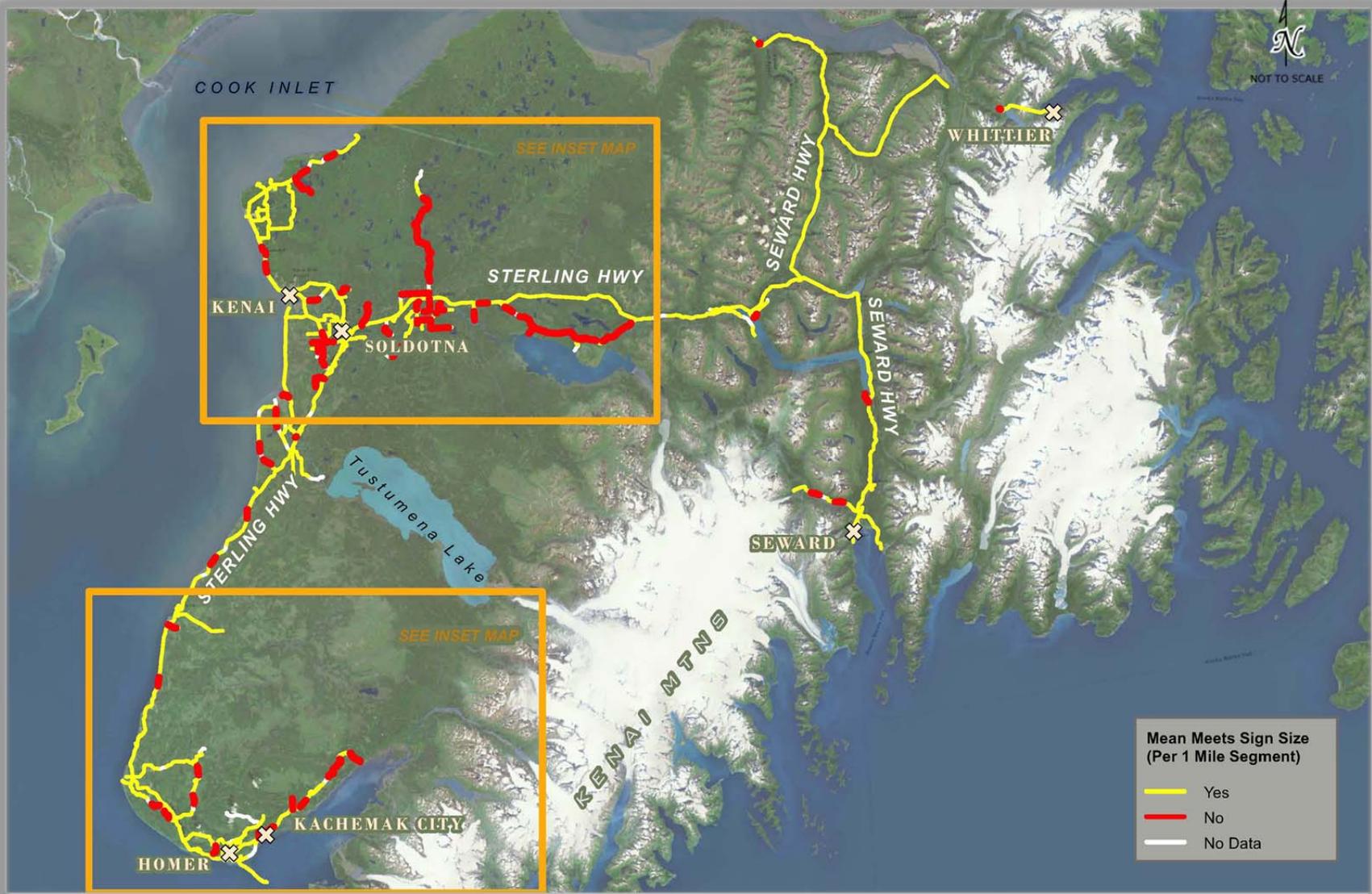


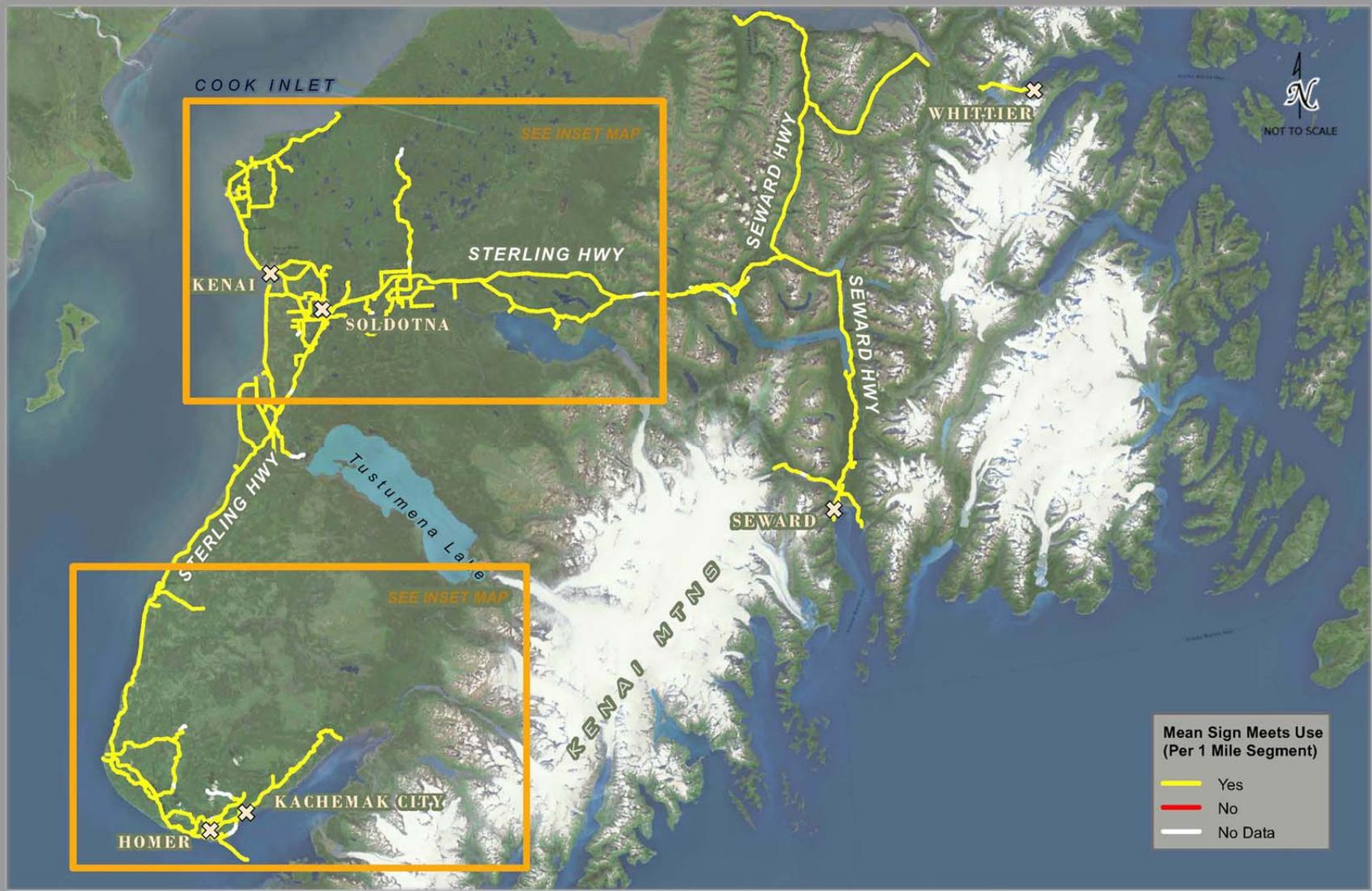
Kenai Peninsula Overview Maps

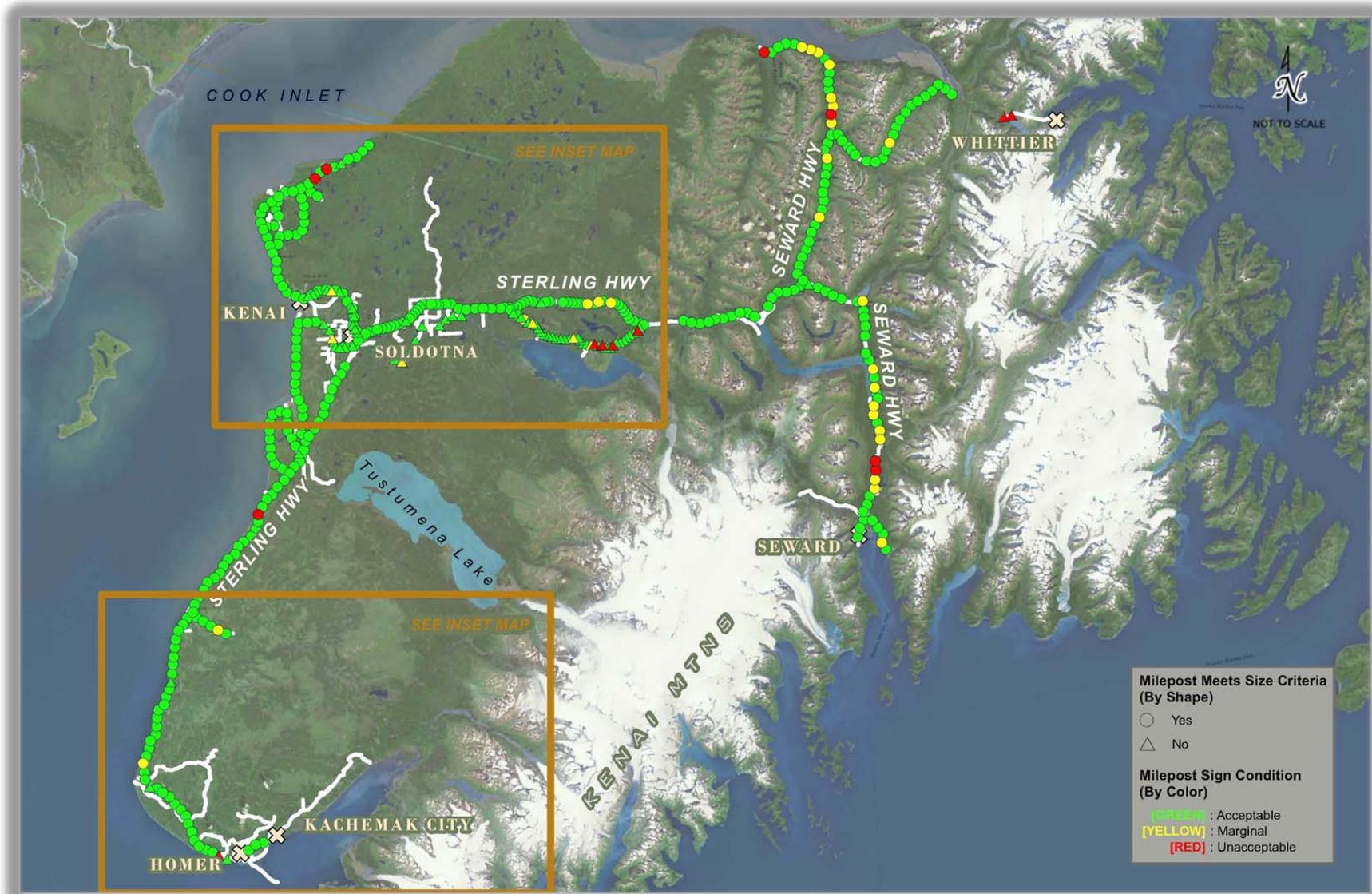


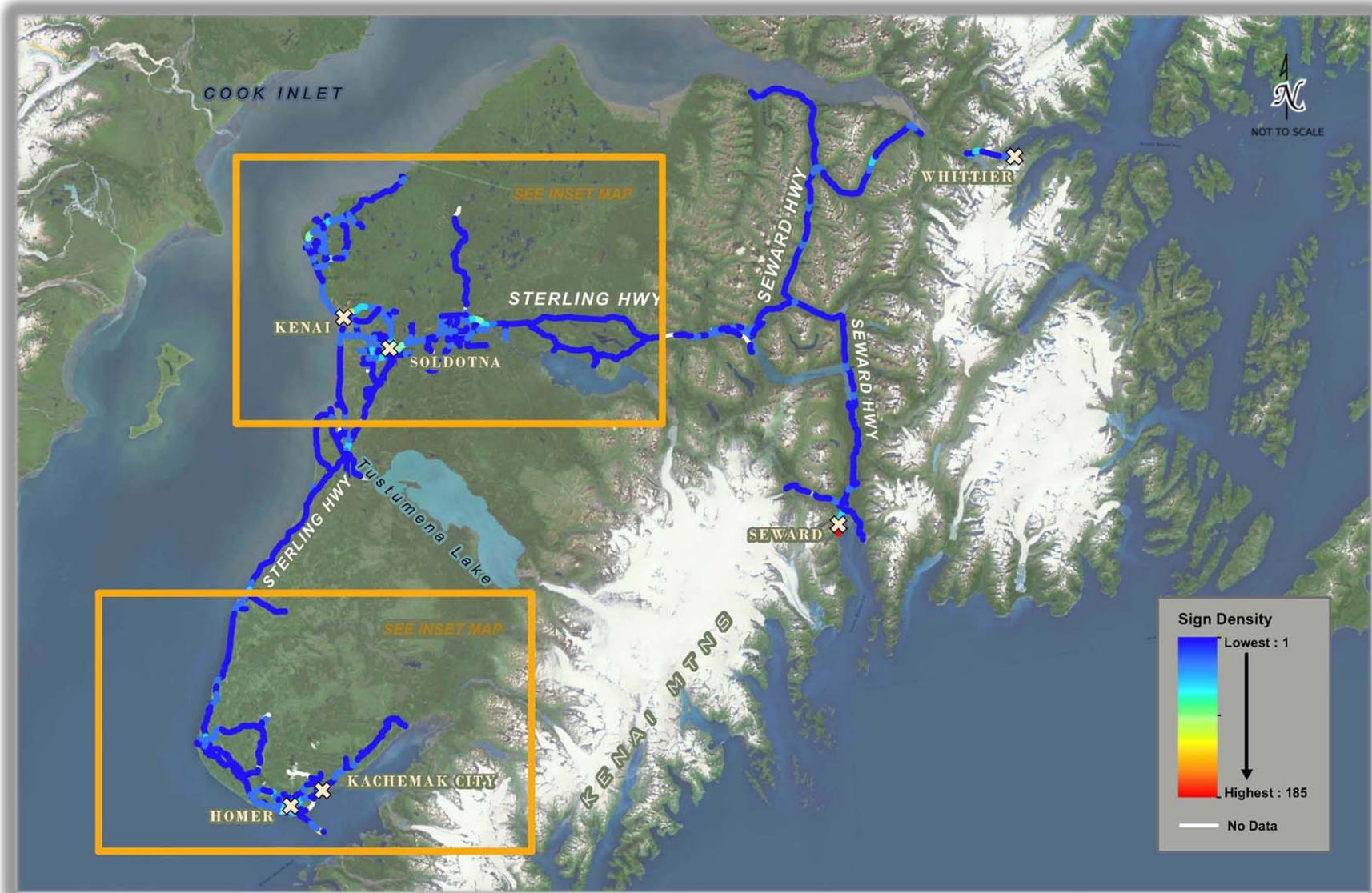






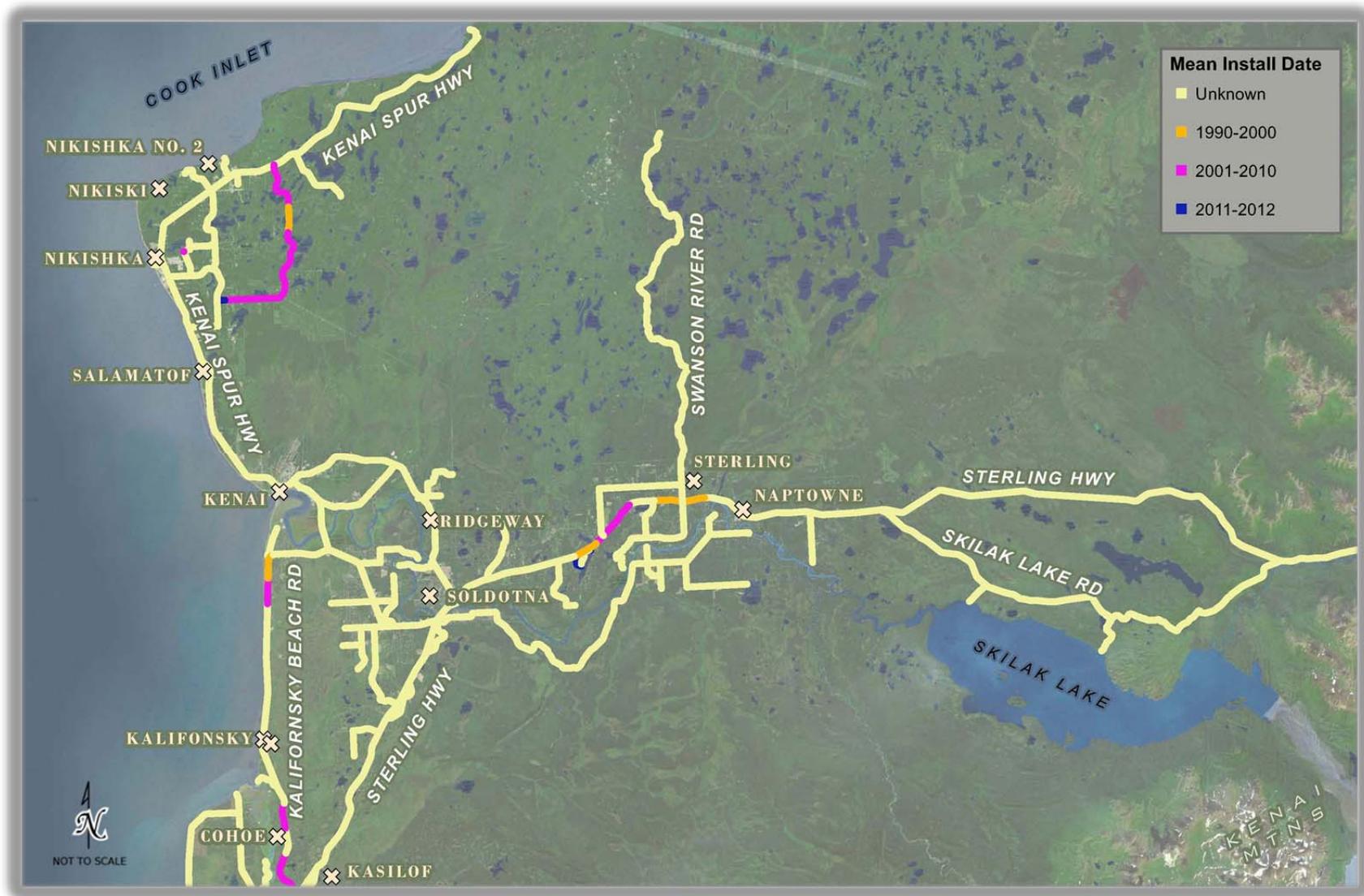


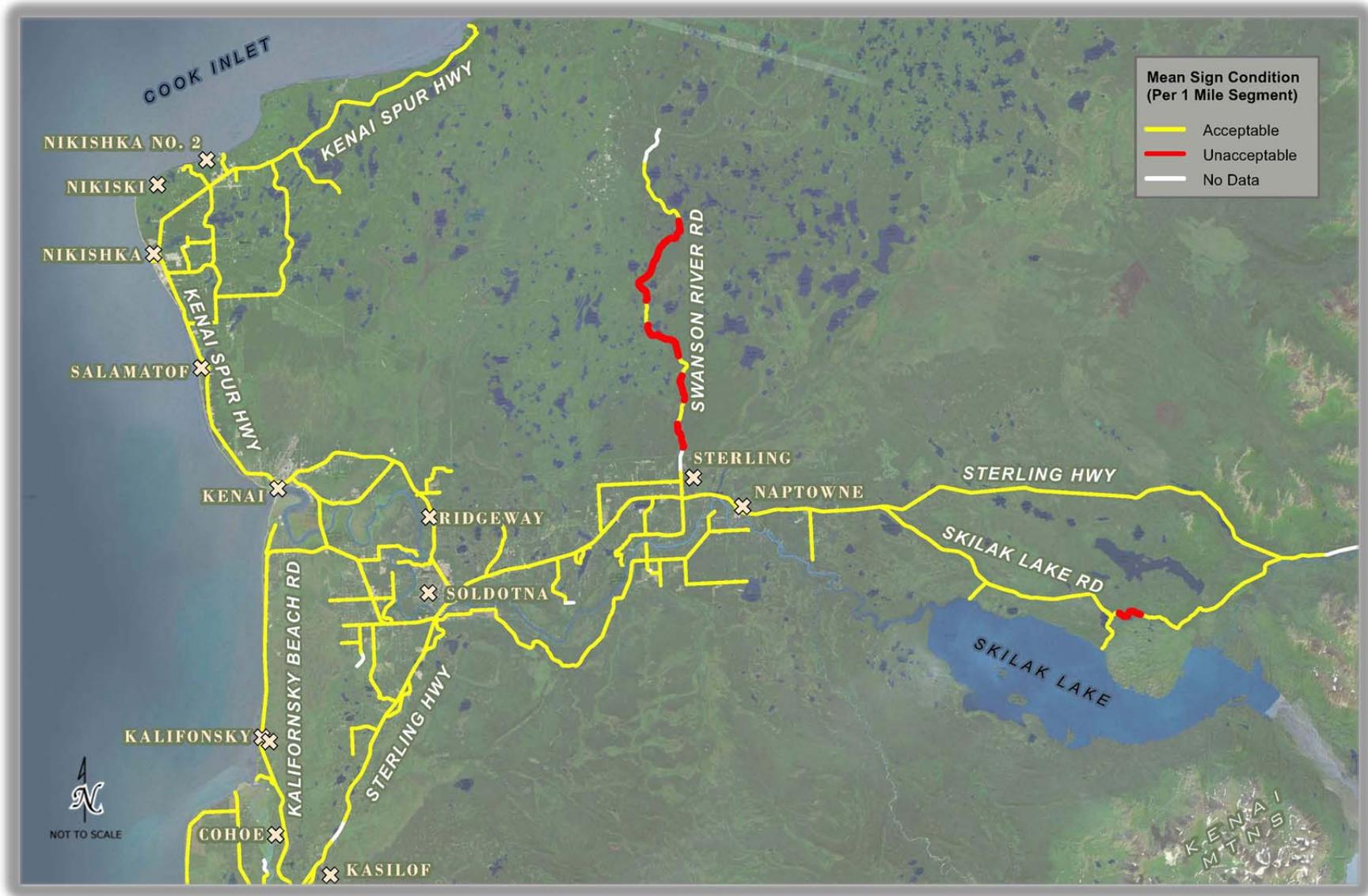


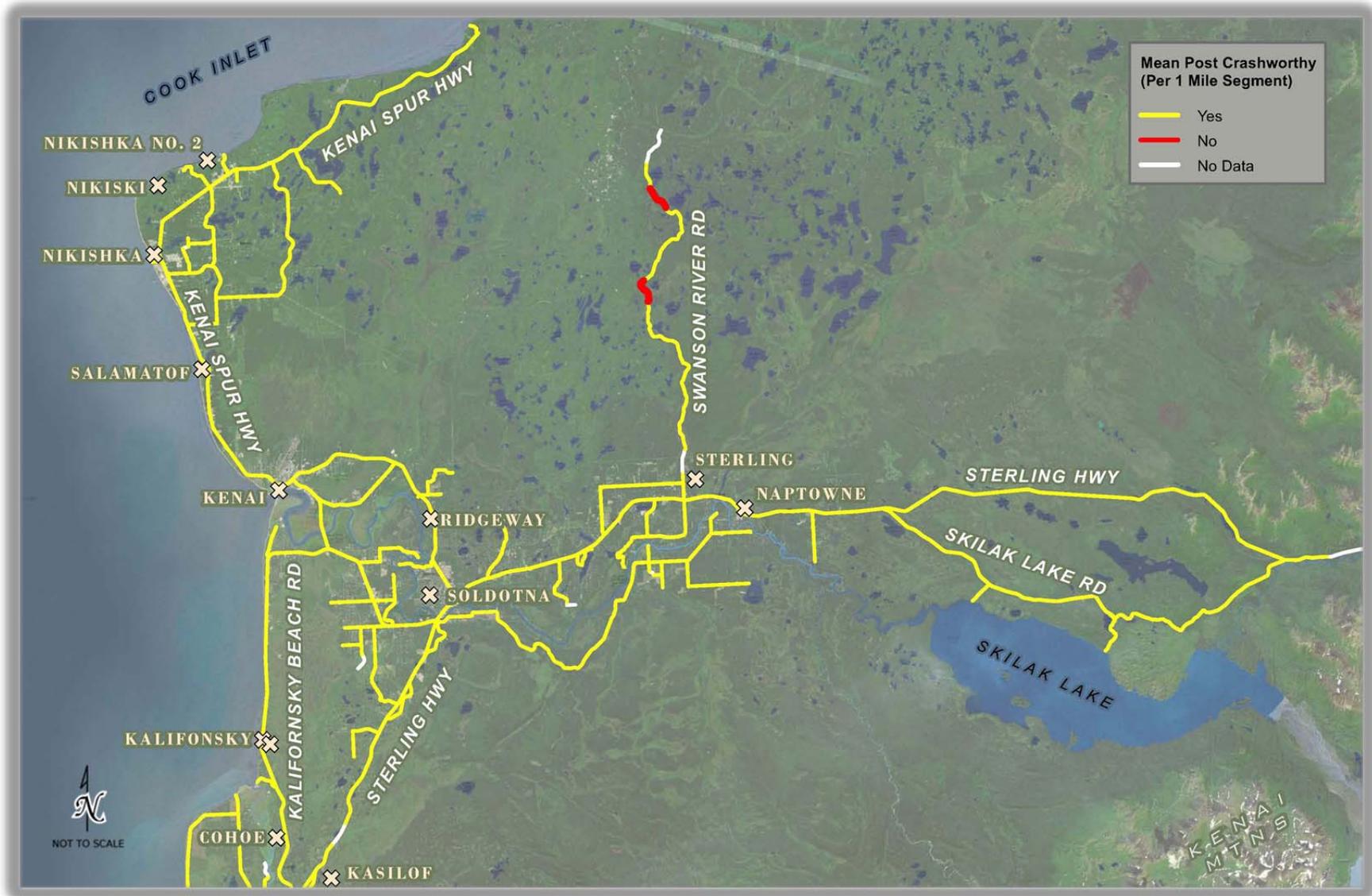


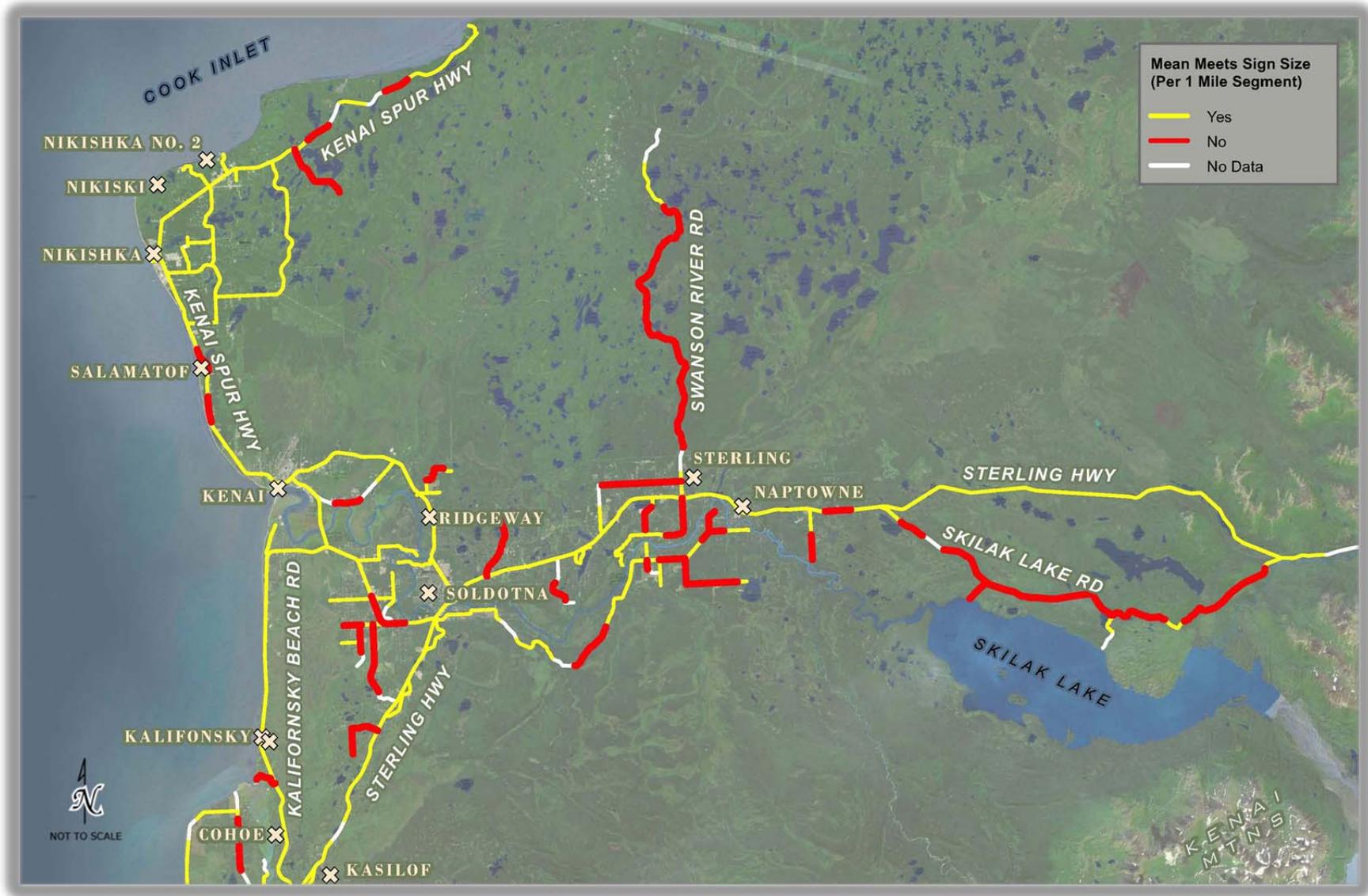


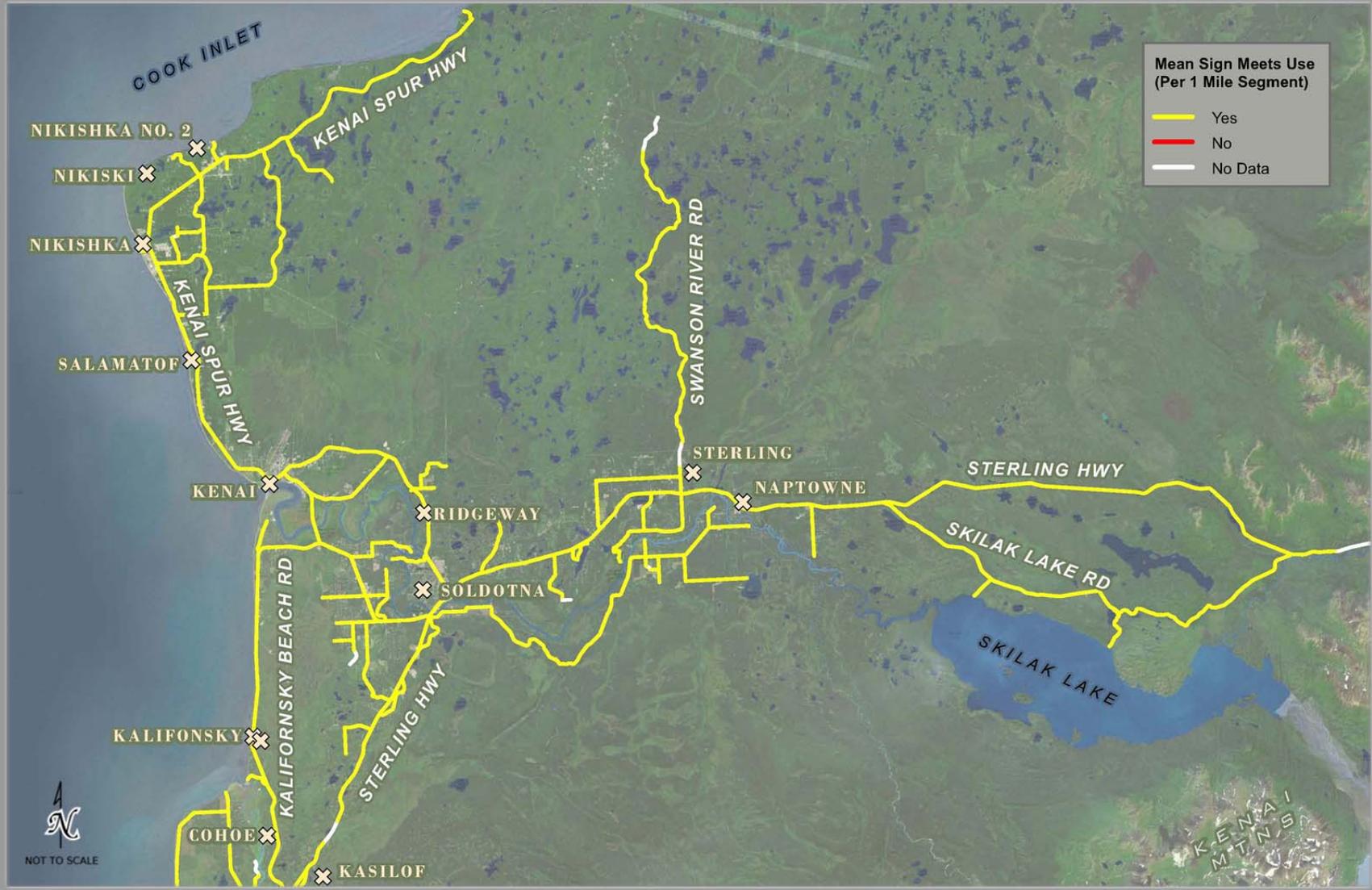
Kenai / Soldotna / Sterling Area Maps

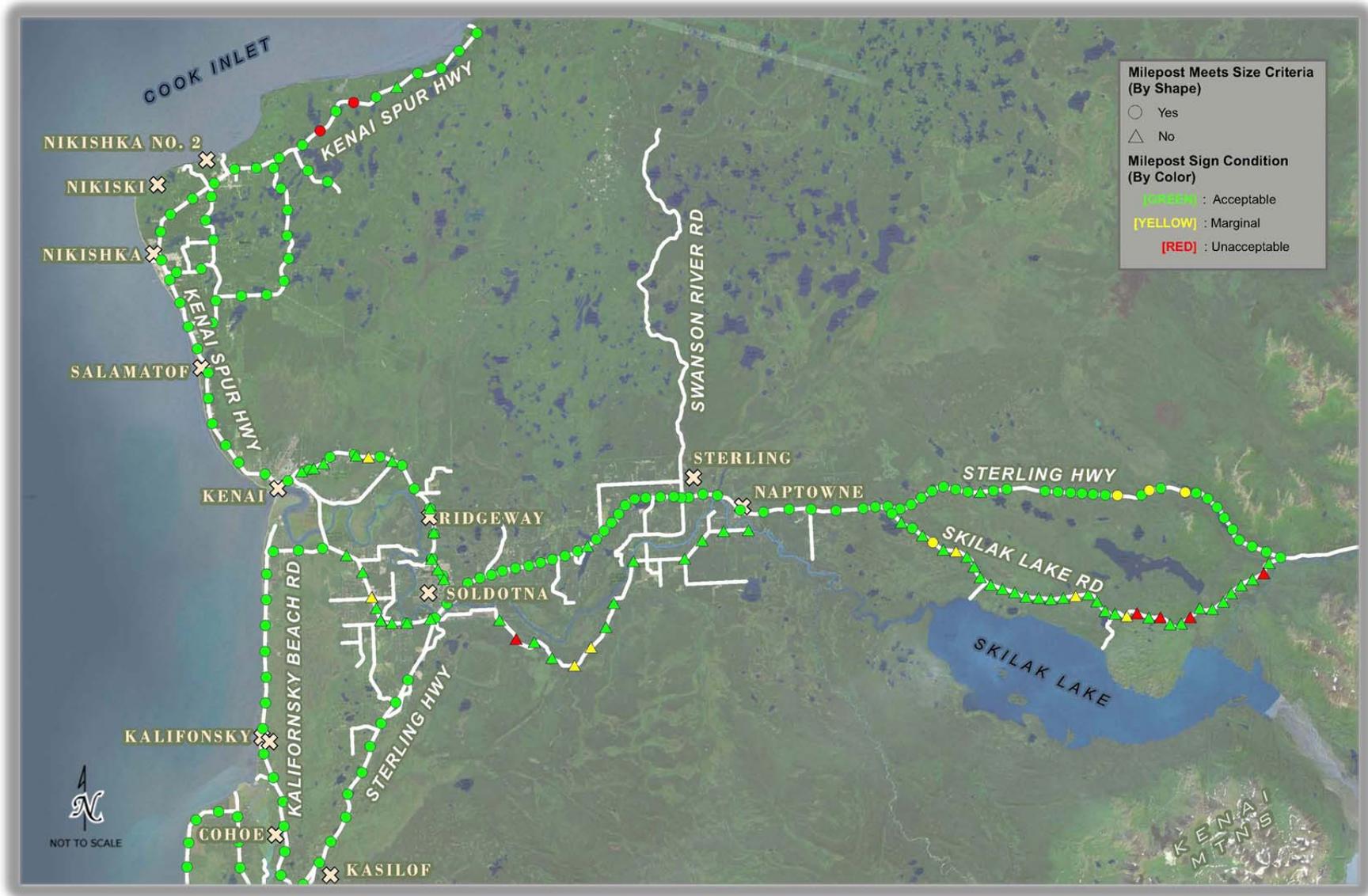


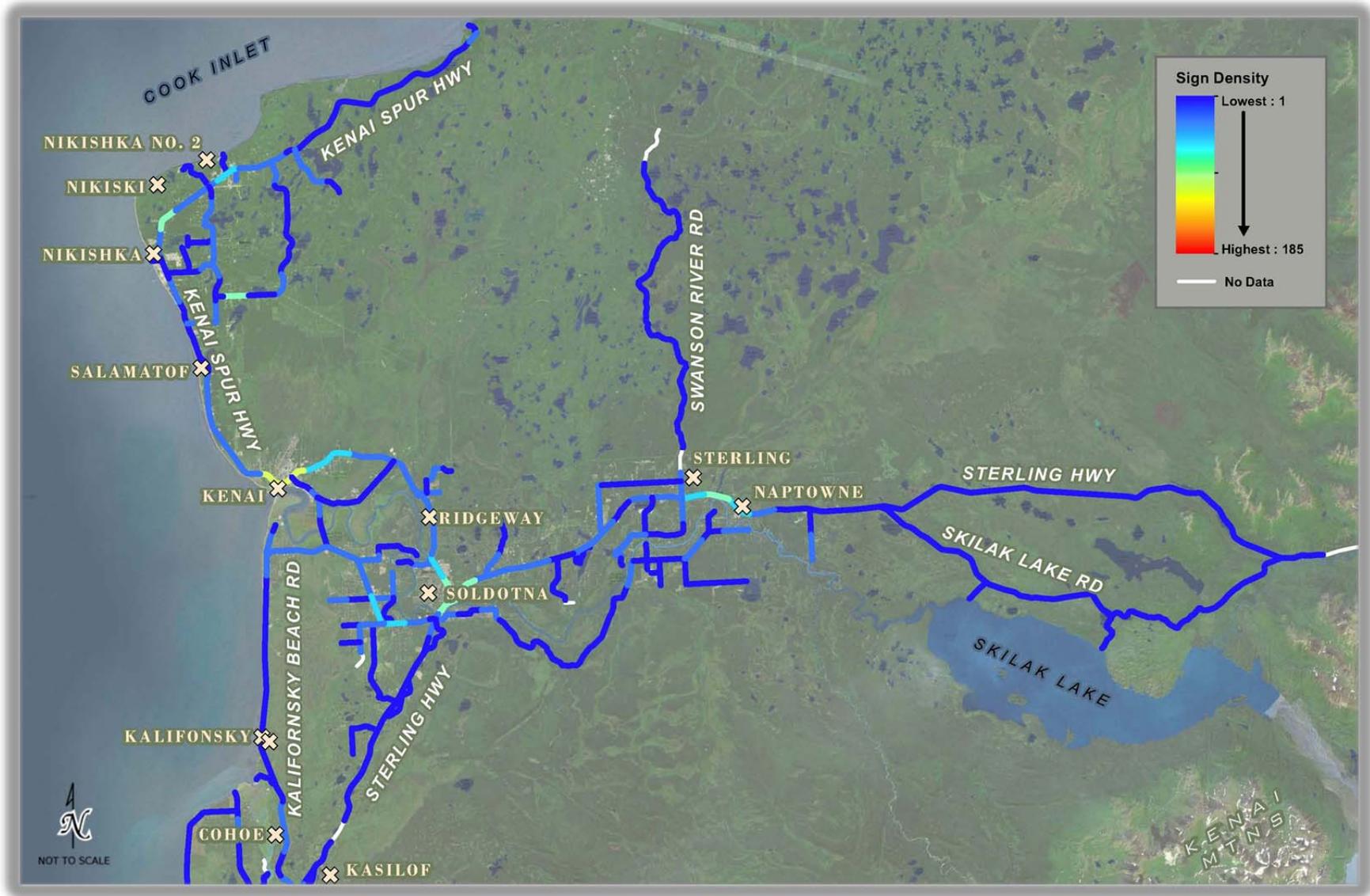






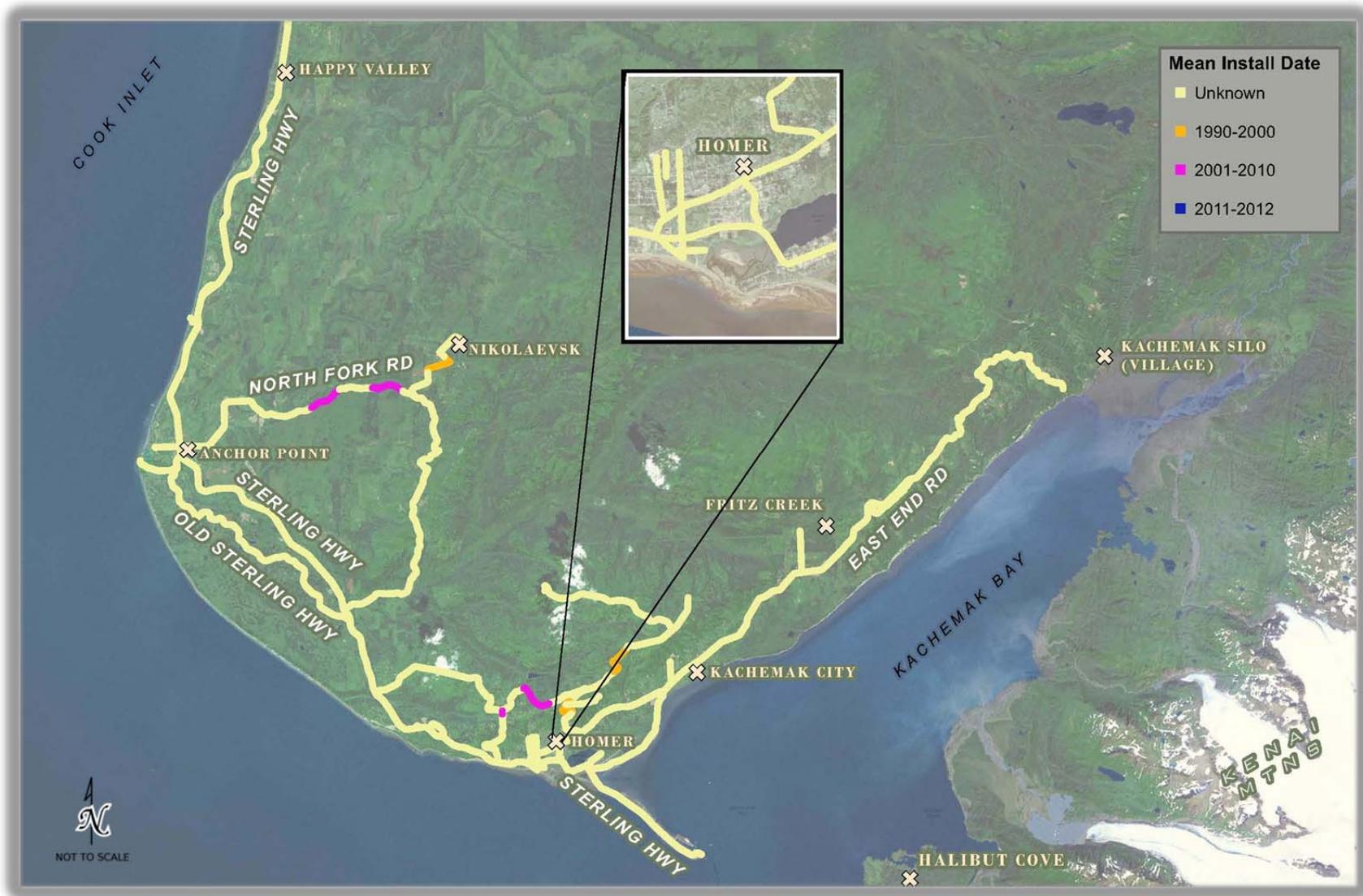








Homer / Anchor Point Area Maps









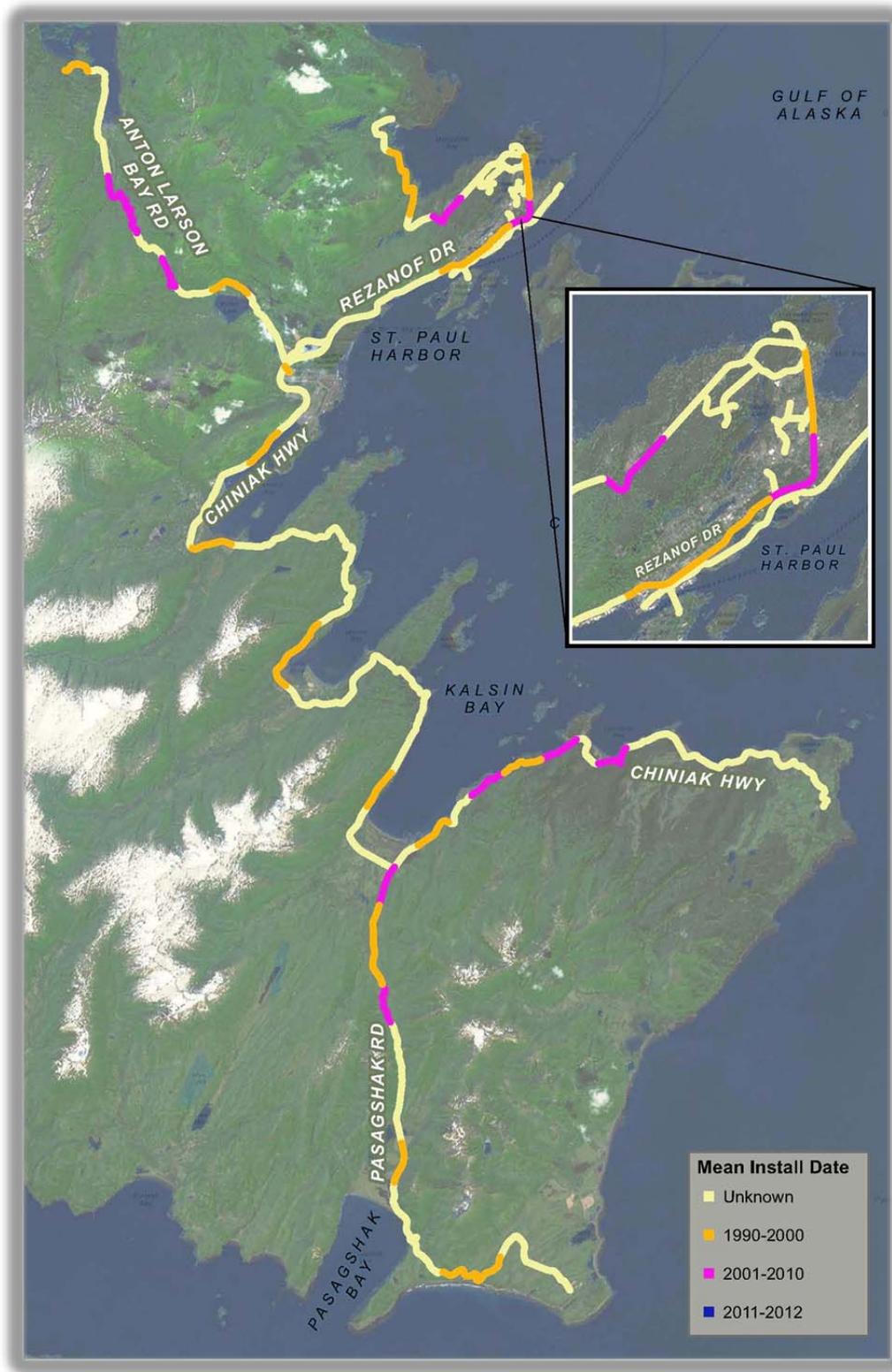


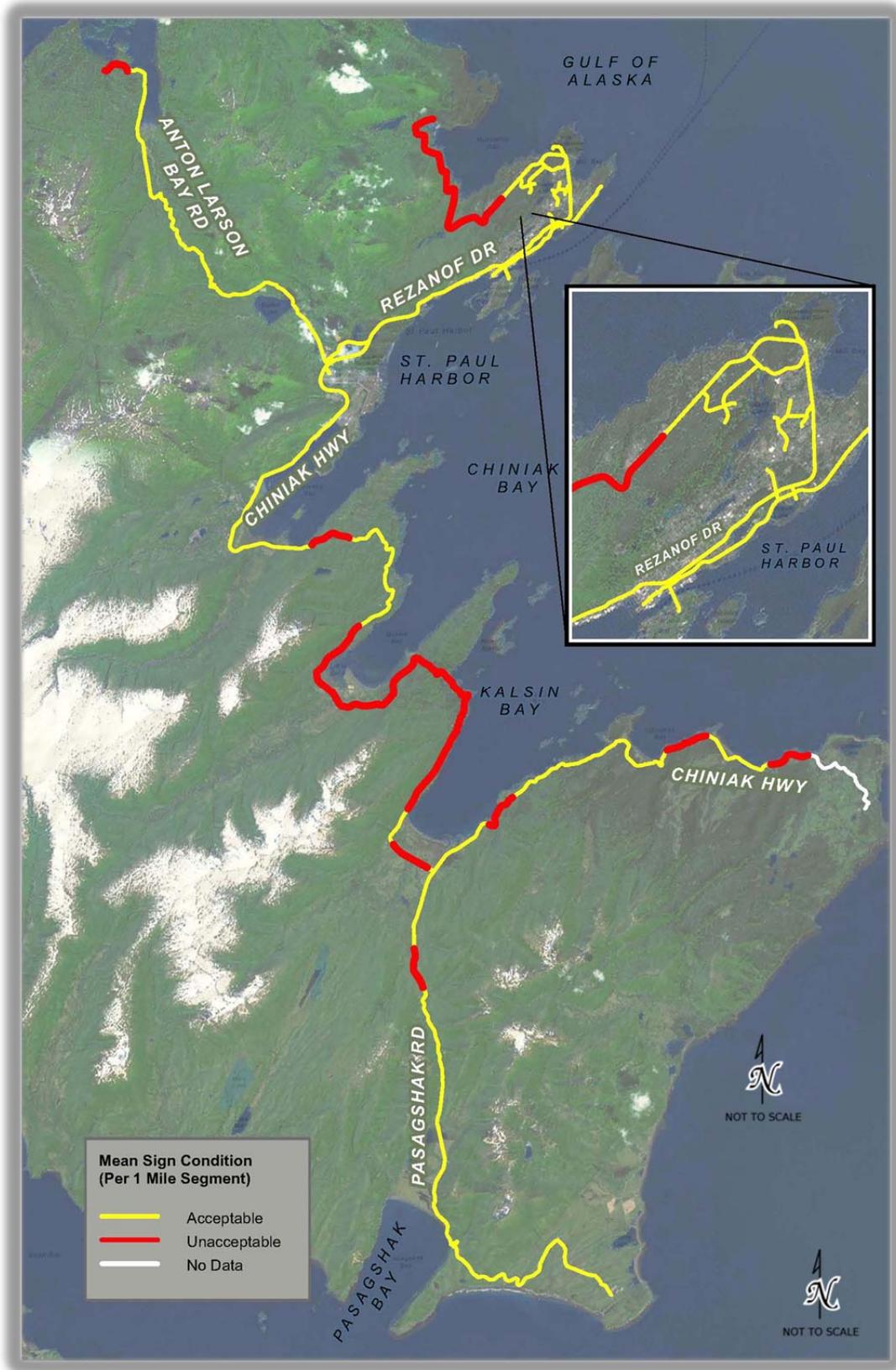


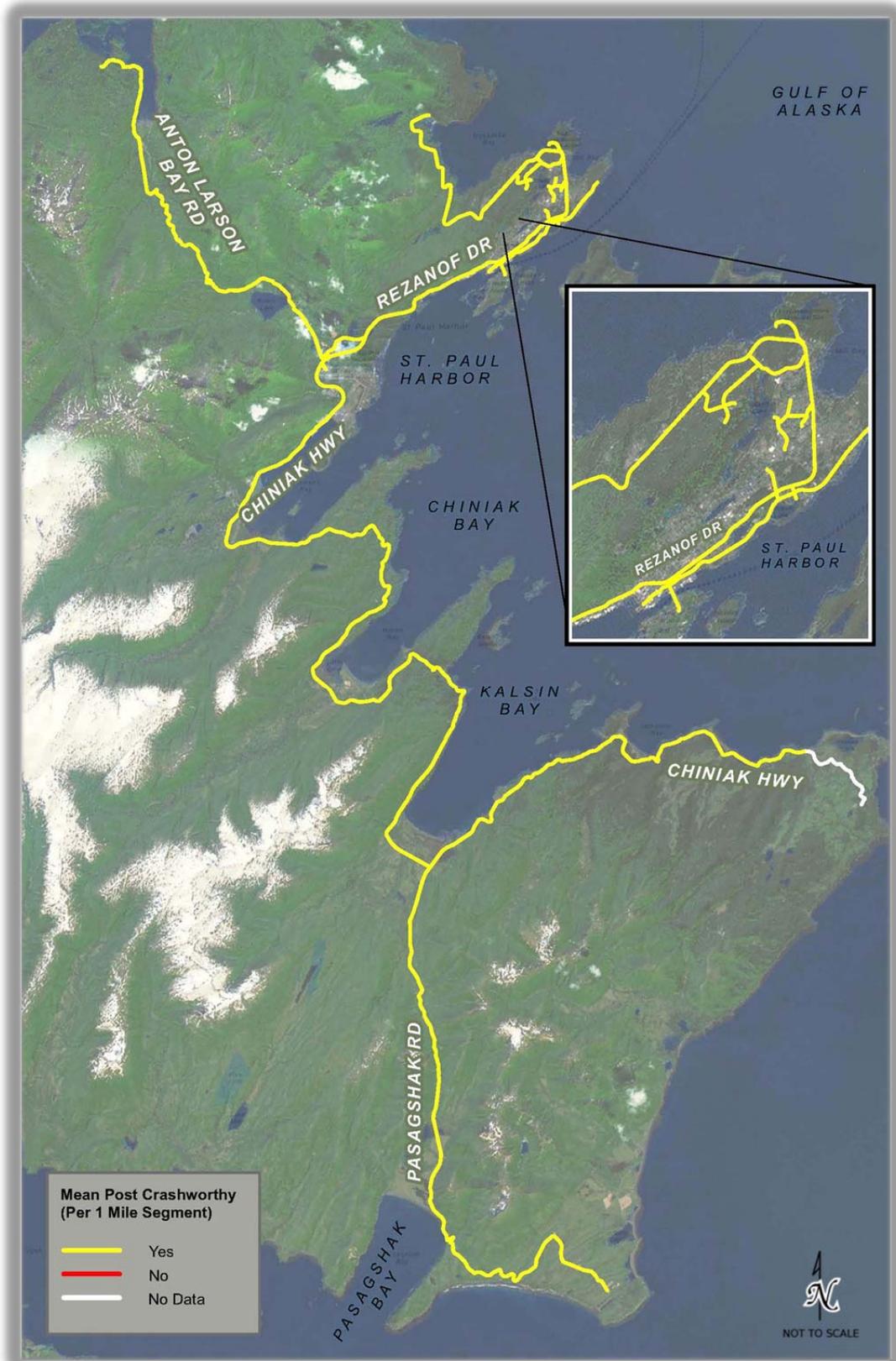


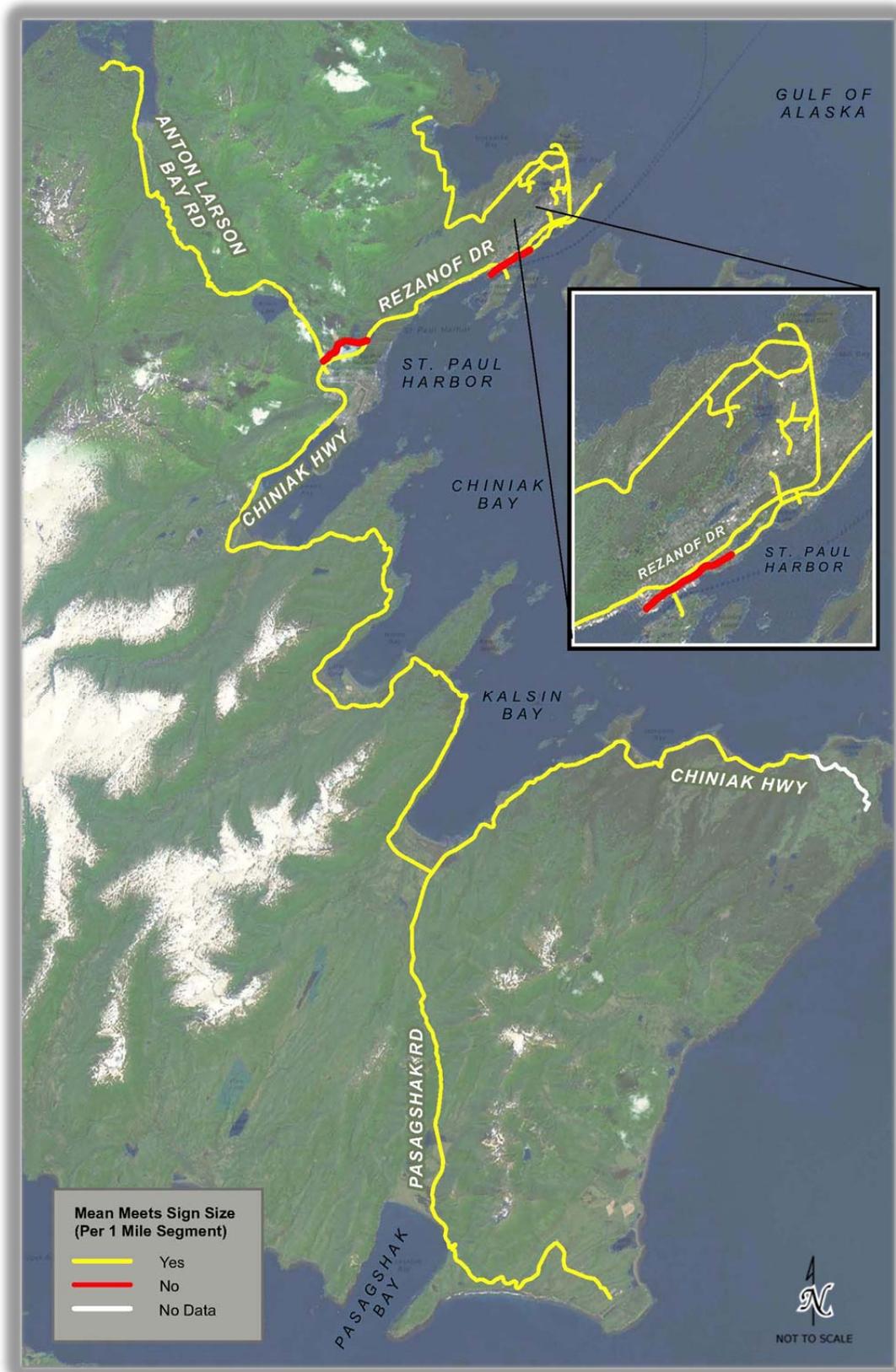


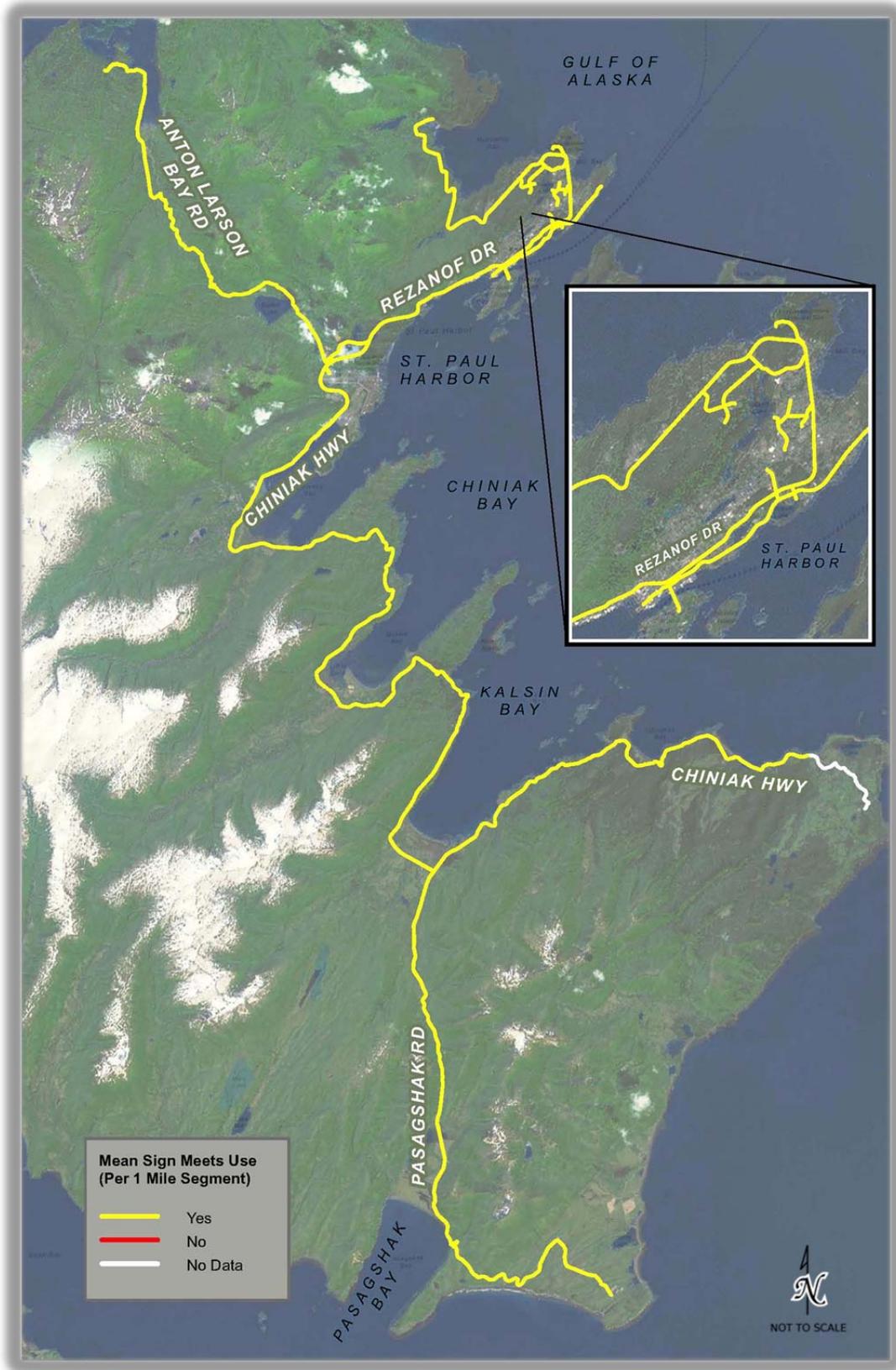
Kodiak Island Maps

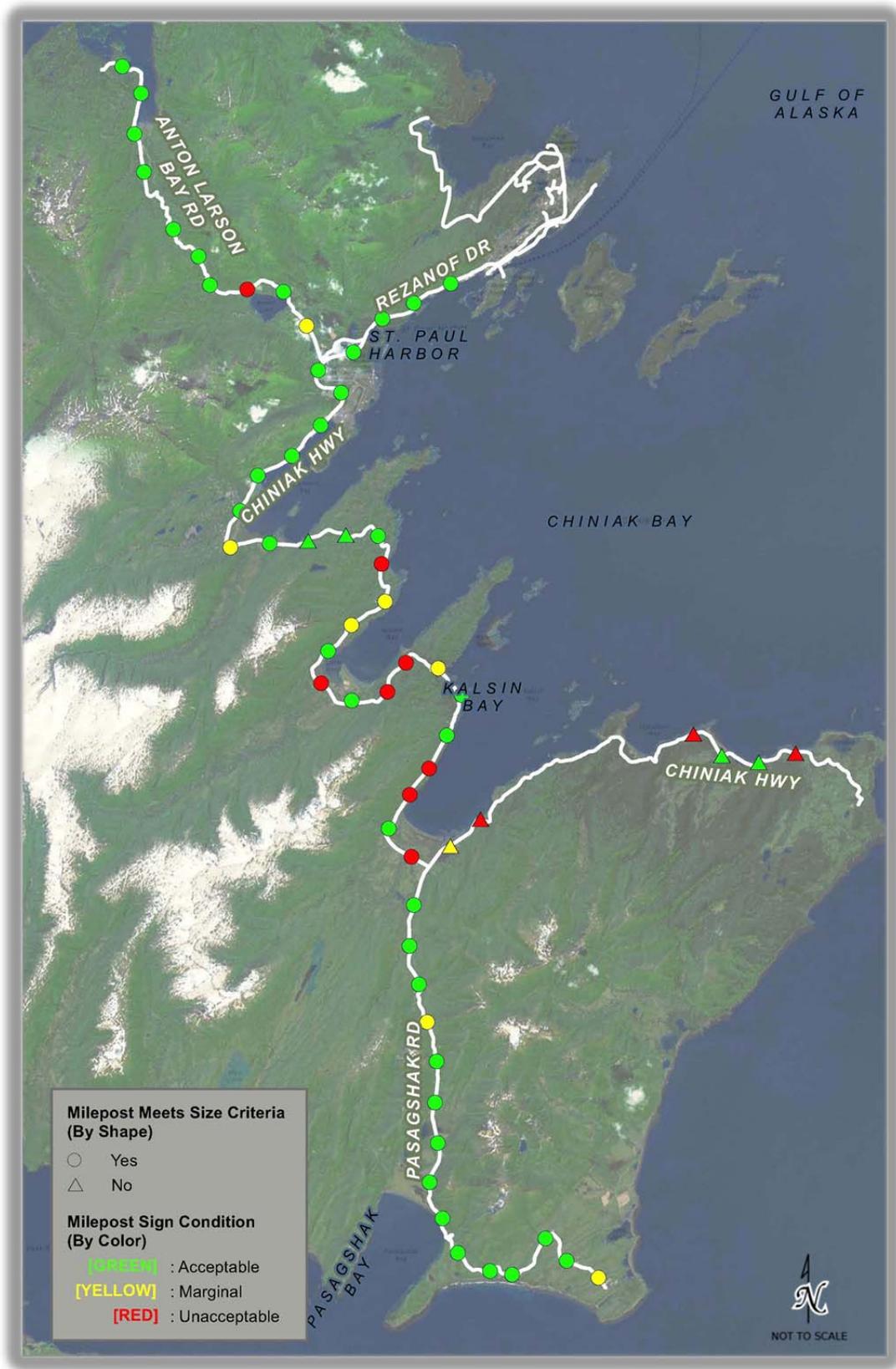


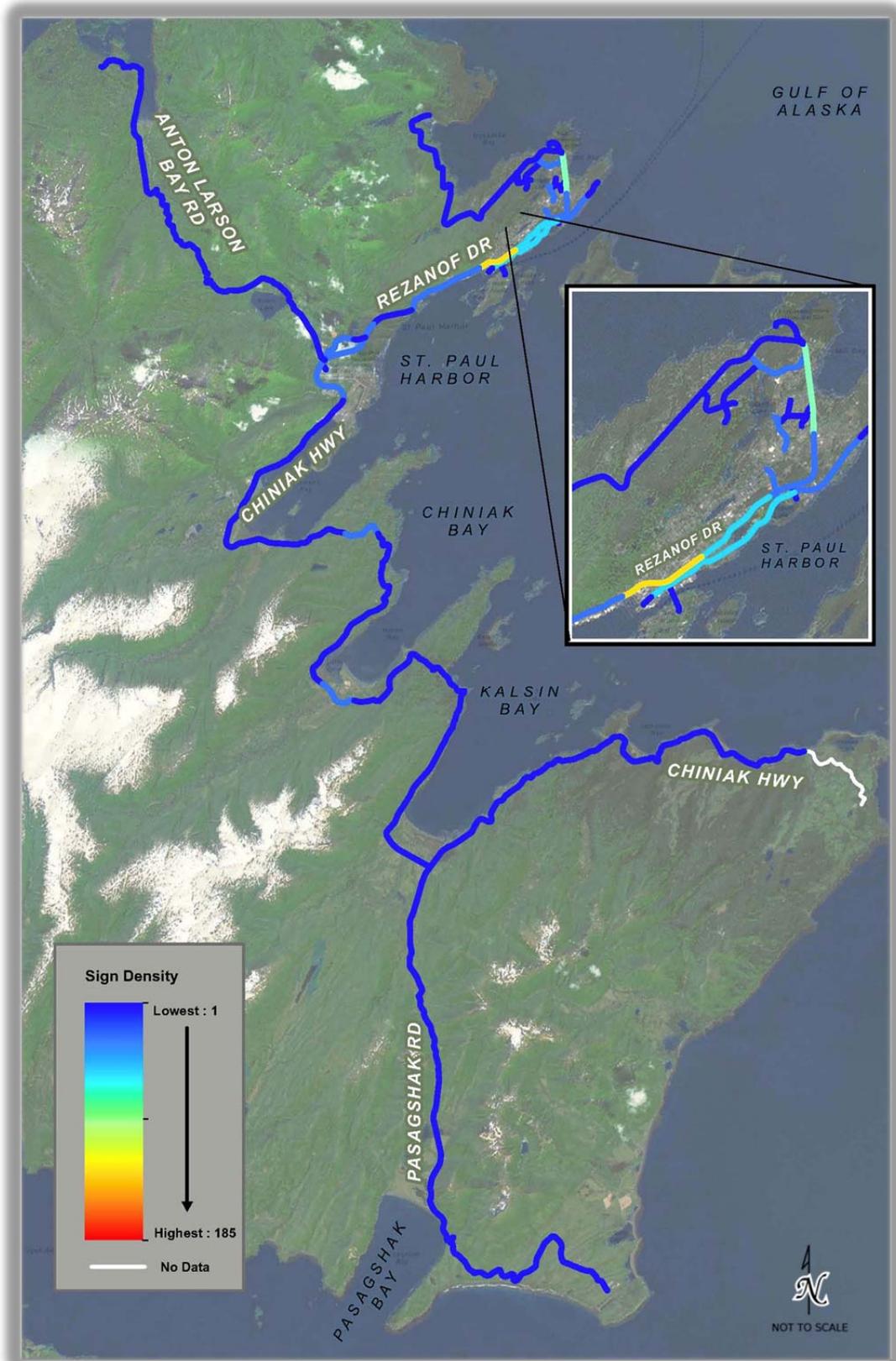














APPENDIX B – DETAILED ATTRIBUTE LIST



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The following is based on information provided by Angela Parsons at DOT&PF:

Geodatabase Field	Comments/Descriptions
<p>FIELD OBJECTID * ALIAS OBJECTID * DATA TYPE OID * WIDTH 4 * FIELD DESCRIPTION Internal feature number.</p> <p>* DESCRIPTION SOURCE ESRI</p> <p>* DESCRIPTION OF VALUES Sequential unique whole numbers that are automatically generated.</p>	<p>This is an internal Geodatabase field</p>
<p>FIELD Shape * ALIAS Shape * DATA TYPE Geometry * FIELD DESCRIPTION Feature geometry.</p> <p>* DESCRIPTION SOURCE ESRI</p> <p>* DESCRIPTION OF VALUES Coordinates defining the features.</p>	<p>This is an internal Geodatabase field</p>
<p>FIELD Session_Na * ALIAS Session_Na * DATA TYPE String * WIDTH 254</p>	<p>Not used for Master Sign Inventory Database – legacy from Photolog based inventory</p>
<p>FIELD Sign_Id * ALIAS Sign_Id * DATA TYPE String * WIDTH 254</p>	<p>Not used for Master Sign Inventory Database – legacy from Photolog based inventory</p>
<p>FIELD Frame * ALIAS Frame * DATA TYPE Integer * WIDTH 4</p>	<p>Not used for Master Sign Inventory Database – legacy from Photolog based inventory</p>



Geodatabase Field	Comments/Descriptions
FIELD Lat * ALIAS Lat * DATA TYPE Double * WIDTH 8	Not used for Master Sign Inventory Database – legacy from Photolog based inventory
FIELD Lon * ALIAS Lon * DATA TYPE Double * WIDTH 8	Not used for Master Sign Inventory Database – legacy from Photolog based inventory
FIELD Z * ALIAS Z * DATA TYPE Double * WIDTH 8	Not used for Master Sign Inventory Database – legacy from Photolog based inventory
FIELD Mileage * ALIAS Mileage * DATA TYPE Double * WIDTH 8	Not used for Master Sign Inventory Database – legacy from Photolog based inventory
FIELD Mpt * ALIAS Mpt * DATA TYPE Double * WIDTH 8	Not used for Master Sign Inventory Database – legacy from Photolog based inventory
FIELD CDS_Num * ALIAS CDS_Num * DATA TYPE String * WIDTH 30	Not used for Master Sign Inventory Database – legacy from Photolog based inventory
FIELD Side * ALIAS Side * DATA TYPE String * WIDTH 10	Not used for Master Sign Inventory Database – legacy from Photolog based inventory
FIELD Run_Dir * ALIAS Run_Dir * DATA TYPE String * WIDTH 10	Not used for Master Sign Inventory Database – legacy from Photolog based inventory



Geodatabase Field	Comments/Descriptions
FIELD Coll_Date * ALIAS Coll_Date * DATA TYPE String * WIDTH 15	Not used for Master Sign Inventory Database – legacy from Photolog based inventory
FIELD Num_Posts * ALIAS Num_Posts * DATA TYPE Integer * WIDTH 4	Not used for Master Sign Inventory Database – legacy from Photolog based inventory
FIELD Num_Sign * ALIAS Num_Sign * DATA TYPE String * WIDTH 4	Not used for Master Sign Inventory Database – legacy from Photolog based inventory
FIELD SignDesc * ALIAS SignDesc * DATA TYPE String * WIDTH 254	Not used for Master Sign Inventory Database – legacy from Photolog based inventory
FIELD Snap_To * ALIAS Snap_To * DATA TYPE String * WIDTH 10	Not used for Master Sign Inventory Database – legacy from Photolog based inventory
FIELD No_RF * ALIAS No_RF * DATA TYPE SmallInteger * WIDTH 2	Not used for Master Sign Inventory Database – legacy from Photolog based inventory
FIELD DataFlag * ALIAS DataFlag * DATA TYPE Integer * WIDTH 4	Not used for Master Sign Inventory Database – legacy from Photolog based inventory
FIELD Remarks * ALIAS Remarks * DATA TYPE String * WIDTH 255	Not used for Master Sign Inventory Database – legacy from Photolog based inventory
FIELD Distance * ALIAS Distance * DATA TYPE Double * WIDTH 8	Not used for Master Sign Inventory Database – legacy from Photolog based inventory



Geodatabase Field	Comments/Descriptions
FIELD MValue * ALIAS MValue * DATA TYPE Double * WIDTH 8	Not used for Master Sign Inventory Database – legacy from Photolog based inventory
FIELD DIFF * ALIAS DIFF * DATA TYPE Double * WIDTH 8	Not used for Master Sign Inventory Database – legacy from Photolog based inventory
FIELD SIGN_ASSEMBLY * ALIAS SIGN_ASSEMBLY * DATA TYPE String * WIDTH 20	<ul style="list-style-type: none"> • Unique identifier for entire sign entity. Includes post(s), and one or more sign panels • Formatted example: C06141_00 <ul style="list-style-type: none"> ○ First character is alpha with “N” equal Northern Region, “S” equal Southeast Region, “C” equal Central Region <ul style="list-style-type: none"> ▪ NOTE: due to potential problems with NR using “C”, CR will use “U” to denote “USKH” until data is cleaned up on the master copy. ○ Positions 2-6 are sequential numbers. <ul style="list-style-type: none"> ▪ These should be assigned valid ranges per field data collection device or collector to avoid duplication. ▪ CR scheme has not yet been developed. ○ Position 7 is an underscore ○ Position 8 and 9 are numbers <ul style="list-style-type: none"> ▪ If the feature is a sign assembly, the value will be “00” ▪ The bottom most sign panel on the assembly will be “01”, the next will be “02” etc. ▪ Question: what happens if a panel is replaced? Answer: it retain the original panel’s number
FIELD INSPECT_DATE * ALIAS INSPECT_DATE * DATA TYPE Date * WIDTH 8	Date the sign assembly or panel was inspected.
FIELD PHOTO_ID * ALIAS PHOTO_ID * DATA TYPE String * WIDTH 16	<ul style="list-style-type: none"> • USKH took more than just 1 photo per assembly and panel, but will limit the submission of photos to 1 per assembly and panel for this DB.



Geodatabase Field	Comments/Descriptions
FIELD ROAD_NAME * ALIAS ROAD_NAME * DATA TYPE String * WIDTH 100	<ul style="list-style-type: none"> This should be the official CDS/HAS Road name
FIELD RTE * ALIAS RTE * DATA TYPE String * WIDTH 8	<ul style="list-style-type: none"> This should be the official CDS/HAS route ID.
FIELD MILE_POINT * ALIAS MILE_POINT * DATA TYPE Double * WIDTH 8	<ul style="list-style-type: none"> This is the CDS roadlog centerline milepoint that corresponds to a perpendicular “snap” of the location
FIELD SIDE_OF_ROAD * ALIAS SIDE_OF_ROAD * DATA TYPE String * WIDTH 6 SUBTYPE INFORMATION * SUBTYPE NAME (SUBTYPE CODE) * DEFAULT VALUE Sign Post Assembly (0) no default value Sign Panel (1) no default value DOMAIN NAME dRoadSide * TYPE Coded Value * DESCRIPTION MMS side of road values * MERGE RULE Default value * SPLIT RULE Default value	<ul style="list-style-type: none"> Where the sign assembly/panel is based on the CDS roadlog direction. Is a coded domain with valid entries of “Right” “Left” “Median”
FIELD LATITUDE_DEG * ALIAS LATITUDE_DEG * DATA TYPE Double * WIDTH 8	<ul style="list-style-type: none"> Latitude of sign assembly or panel in decimal degrees. Use NAD83 datum (not NAD27).
FIELD LONGITUDE_DEG * ALIAS LONGITUDE_DEG * DATA TYPE Double * WIDTH 8	<ul style="list-style-type: none"> Latitude of sign assembly or panel in decimal degrees. Use NAD83 datum (not NAD27).



Geodatabase Field	Comments/Descriptions
<p>FIELD POST_TYPE * ALIAS POST_TYPE * DATA TYPE String * WIDTH 22</p> <p>SUBTYPE INFORMATION * SUBTYPE NAME (SUBTYPE CODE) * DEFAULT VALUE</p> <hr/> <p>Sign Post Assembly (0) Perforated Steel Tube Sign Panel (1) no default value</p> <p>DOMAIN NAME dPostType * TYPE Coded Value * DESCRIPTION MMS post type values * MERGE RULE Default value * SPLIT RULE Default value</p>	<p>Type of Post based on coded domain list</p>
<p>FIELD POST_SIZE * ALIAS POST_SIZE * DATA TYPE Double * WIDTH 8</p> <p>SUBTYPE INFORMATION * SUBTYPE NAME (SUBTYPE CODE) * DEFAULT VALUE</p> <hr/> <p>Sign Post Assembly (0) 2.5</p>	<p>Post size in units of “inches”. Geodatabase enforces a default value of “2.5”</p>
<p>FIELD NUMBER_OF_POST * ALIAS NUMBER_OF_POST * DATA TYPE SmallInteger * WIDTH 2</p> <p>SUBTYPE INFORMATION * SUBTYPE NAME (SUBTYPE CODE) * DEFAULT VALUE</p> <hr/> <p>Sign Post Assembly (0) 1</p>	<p>Number of posts. Geodatabase enforces a default value of “1”</p>



Geodatabase Field	Comments/Descriptions
<p>FIELD POST_SPACING * ALIAS POST_SPACING * DATA TYPE SmallInteger * WIDTH 2</p> <p>SUBTYPE INFORMATION * SUBTYPE NAME (SUBTYPE CODE) * DEFAULT VALUE</p> <hr/> <p>Sign Post Assembly (0) 0</p>	<p>Spacing between the posts in units of “inches” . Geodatabase enforces a default value of “0” – Yes, if only one post.</p>
<p>FIELD BENT_POST * ALIAS BENT_POST * DATA TYPE String * WIDTH 7</p> <p>SUBTYPE INFORMATION * SUBTYPE NAME (SUBTYPE CODE) * DEFAULT VALUE</p> <hr/> <p>Sign Post Assembly (0) No Sign Panel (1) no default value</p> <p>DOMAIN NAME dBentPost * TYPE Coded Value * DESCRIPTION MMS Bent post values * MERGE RULE Default value * SPLIT RULE Default value</p>	<p>Is the post bent? Geodatabase enforces a default value of “No” for the Post Assembly, but no default value for the panel.</p>



Geodatabase Field	Comments/Descriptions
<p>FIELD BREAK_AWAY_TYPE * ALIAS BREAK_AWAY_TYPE * DATA TYPE String * WIDTH 19</p> <p>SUBTYPE INFORMATION * SUBTYPE NAME (SUBTYPE CODE) * DEFAULT VALUE</p> <hr/> <p>Sign Post Assembly (0) None - Not Required Sign Panel (1) no default value</p> <p>DOMAIN NAME dBreakAwayType * TYPE Coded Value * DESCRIPTION MMS Breakaway type values * MERGE RULE Default value * SPLIT RULE Default value</p>	<p>Type of post breakaway. Geodatabase enforces default value of "None – Not Required" for an Assembly.</p>
<p>FIELD FOUNDATION_TYPE * ALIAS FOUNDATION_TYPE * DATA TYPE String * WIDTH 16</p> <p>SUBTYPE INFORMATION * SUBTYPE NAME (SUBTYPE CODE) * DEFAULT VALUE</p> <hr/> <p>Sign Post Assembly (0) no default value Sign Panel (1) no default value</p> <p>DOMAIN NAME dFoundationType * TYPE Coded Value * DESCRIPTION MMS foundation type values * MERGE RULE Default value * SPLIT RULE Default value</p>	<p>Type of foundation for the Assembly and panel? Coded value from domain (see below) and geodatabase does not enforce defaults.</p>



Geodatabase Field	Comments/Descriptions
<p>FIELD SLEEVE * ALIAS SLEEVE * DATA TYPE String * WIDTH 3</p> <p>SUBTYPE INFORMATION * SUBTYPE NAME (SUBTYPE CODE) * DEFAULT VALUE</p> <hr/> <p>Sign Post Assembly (0) no default value Sign Panel (1) no default value</p> <p>DOMAIN NAME dYesNo * TYPE Coded Value * DESCRIPTION MMS Yes No values * MERGE RULE Default value * SPLIT RULE Default value</p>	<p>Type of sleeve for the assembly.</p>
<p>FIELD NUMBER_OF_PANELS * ALIAS NUMBER_OF_PANELS * DATA TYPE SmallInteger * WIDTH 2</p>	<p>Number of panels on the sign assembly.</p>
<p>FIELD ASSEMBLY_COMMENTS * ALIAS ASSEMBLY_COMMENTS * DATA TYPE String * WIDTH 144</p>	<p>Comments about the assembly.</p>
<p>FIELD BACKGROUND_COLOR * ALIAS BACKGROUND_COLOR * DATA TYPE String * WIDTH 24</p> <p>SUBTYPE INFORMATION * SUBTYPE NAME (SUBTYPE CODE) * DEFAULT VALUE</p> <hr/> <p>Sign Post Assembly (0) no default value Sign Panel (1) no default value</p> <p>DOMAIN NAME dBackgroundColor * TYPE Coded Value * DESCRIPTION MMS color values * MERGE RULE Default value * SPLIT RULE Default value</p>	<p>Background color of the sign panel. Coded value from domain (see below) with no default values.</p>



Geodatabase Field	Comments/Descriptions
FIELD MUTCD_CODE * ALIAS MUTCD_CODE * DATA TYPE String * WIDTH 16	The MUTCD code for the panel based on the ASDS. Is a coded value in the domain of the “sign.mdb” geodatabase (not a domain) with hundreds of potential codes.
FIELD LEGEND * ALIAS LEGEND * DATA TYPE String * WIDTH 100	The legend of the panel.
FIELD PANEL_ORIENT * ALIAS PANEL_ORIENT * DATA TYPE String * WIDTH 3 SUBTYPE INFORMATION * SUBTYPE NAME (SUBTYPE CODE) * DEFAULT VALUE <hr/> Sign Post Assembly (0) no default value Sign Panel (1) no default value DOMAIN NAME dPanelOrient * TYPE Coded Value * DESCRIPTION MMS panel orientation values * MERGE RULE Default value * SPLIT RULE Default value	Compass orientation of the sign panel, domain coded value (see below) with no defaults.



Geodatabase Field	Comments/Descriptions
<p>FIELD CONDITION * ALIAS CONDITION * DATA TYPE String * WIDTH 14</p> <p>SUBTYPE INFORMATION * SUBTYPE NAME (SUBTYPE CODE) * DEFAULT VALUE</p> <hr/> <p>Sign Post Assembly (0) no default value Sign Panel (1) no default value</p> <p>DOMAIN NAME dCondition * TYPE Coded Value * DESCRIPTION MMS condition values * MERGE RULE Default value * SPLIT RULE Default value</p>	<p>Condition of the Assembly and/or the Panel. Coded value based on domain (see below) with no default values enforced.</p>
<p>FIELD VERTICAL_SIZE * ALIAS VERTICAL_SIZE * DATA TYPE SmallInteger * WIDTH 2</p>	<p>Vertical size of the panel, in units of inches. Largest dimension, in Inches, applies to panels only</p>
<p>FIELD HORIZONTAL_SIZE * ALIAS HORIZONTAL_SIZE * DATA TYPE SmallInteger * WIDTH 2</p>	<p>Horizontal size of the panel, in units of inches.</p>
<p>FIELD HGHT_FRM_ROAD_SURF * ALIAS HGHT_FRM_ROAD_SURF * DATA TYPE SmallInteger * WIDTH 2</p>	<p>.</p>
<p>FIELD HGHT_FRM_GRND * ALIAS HGHT_FRM_GRND * DATA TYPE SmallInteger * WIDTH 2</p>	
<p>FIELD DIST_FROM_ROAD_EDG * ALIAS DIST_FROM_ROAD_EDG * DATA TYPE SmallInteger * WIDTH 2</p>	



Geodatabase Field	Comments/Descriptions
<p>FIELD SHEETING_TYPE * ALIAS SHEETING_TYPE * DATA TYPE String * WIDTH 25</p> <p>SUBTYPE INFORMATION * SUBTYPE NAME (SUBTYPE CODE) * DEFAULT VALUE</p> <hr/> <p>Sign Post Assembly (0) no default value Sign Panel (1) no default value</p> <p>DOMAIN NAME dSheetingType * TYPE Coded Value * DESCRIPTION MMS sheeting type values * MERGE RULE Default value * SPLIT RULE Default value</p>	<p>Type of the sheeting of the panel, coded from domain.</p>
<p>FIELD RETRO_REFLEC_BACK * ALIAS RETRO_REFLEC_BACK * DATA TYPE SmallInteger * WIDTH 2</p>	<p>Retro-reflectivity value of the background of the sign.</p>
<p>FIELD RETRO_REFLEC_LEGE * ALIAS RETRO_REFLEC_LEGE * DATA TYPE SmallInteger * WIDTH 2</p>	<p>Retro-reflectivity value of the legend of the sign.</p>
<p>FIELD YEAR_INSTALLED * ALIAS YEAR_INSTALLED * DATA TYPE SmallInteger * WIDTH 2</p> <p>SUBTYPE INFORMATION * SUBTYPE NAME (SUBTYPE CODE) * DEFAULT VALUE</p> <hr/> <p>Sign Panel (1) 1959</p>	<p>Year that the panel was installed. Default value is 1959 – indicates that the year is unknown.</p>



Geodatabase Field	Comments/Descriptions
<p>FIELD OUTDATED_PANEL * ALIAS OUTDATED_PANEL * DATA TYPE String * WIDTH 7</p> <p>SUBTYPE INFORMATION * SUBTYPE NAME (SUBTYPE CODE) * DEFAULT VALUE</p> <hr/> <p>Sign Post Assembly (0) no default value Sign Panel (1) no default value</p> <p>DOMAIN NAME dOutdatedPanel * TYPE Coded Value * DESCRIPTION MMS outdated panel values * MERGE RULE Default value * SPLIT RULE Default value</p>	<p>Indicates if the panel is out of standard or needs to be replaced.</p>
<p>FIELD PHOTO_NUMBER * ALIAS PHOTO_NUMBER * DATA TYPE String * WIDTH 16</p>	<p>Unique identifier of a photo of a panel.</p>
<p>FIELD PANEL_COMMENTS * ALIAS PANEL_COMMENTS * DATA TYPE String * WIDTH 144</p>	<p>Comments on the panel</p>
<p>FIELD ASSET_GROUP_ID * ALIAS ASSET_GROUP_ID * DATA TYPE SmallInteger * WIDTH 2</p>	<p>Based on the MMS standard asset group codes and that all sign assemblies and panels will be coded "26" for "Signs".</p>
<p>FIELD ORG_ID * ALIAS ORG_ID * DATA TYPE Integer * WIDTH 4</p>	<p>Unique identifier of creating organization; USKH's ORG_ID value is 9000002.</p>



Geodatabase Field	Comments/Descriptions
FIELD USER_ID * ALIAS USER_ID * DATA TYPE Integer * WIDTH 4	
FIELD UPDATE_USER_NAME * ALIAS UPDATE_USER_NAME * DATA TYPE String * WIDTH 30	
FIELD UPDATE_DATE * ALIAS UPDATE_DATE * DATA TYPE Date * WIDTH 8	Field to show when the sign assembly and/or panel DB entry was changed.
FIELD PREV_UPDATE_USER_NAME * ALIAS PREV_UPDATE_USER_NAME * DATA TYPE String * WIDTH 30	
FIELD PREV_UPDATE_DATE * ALIAS PREV_UPDATE_DATE * DATA TYPE Date * WIDTH 8	
FIELD SIGN_NO * ALIAS SIGN_NO * DATA TYPE Integer * WIDTH 4	
FIELD GDB_EVENT_ID * ALIAS GDB_EVENT_ID * DATA TYPE Integer * WIDTH 4	
FIELD TRANSFER_DATE * ALIAS TRANSFER_DATE * DATA TYPE Date * WIDTH 8	



Geodatabase Field	Comments/Descriptions
<p>FIELD DIR_OF_TRAVEL * ALIAS DIR_OF_TRAVEL * DATA TYPE String * WIDTH 12</p> <p>SUBTYPE INFORMATION * SUBTYPE NAME (SUBTYPE CODE) * DEFAULT VALUE</p> <hr/> <p>Sign Post Assembly (0) no default value Sign Panel (1) Up Station</p> <p>DOMAIN NAME dDirectionOfTravel * TYPE Coded Value * DESCRIPTION MMS direction of travel values * MERGE RULE Default value * SPLIT RULE Default value</p>	
<p>FIELD Subtype * ALIAS Subtype * DATA TYPE SmallInteger * WIDTH 2</p>	
<p>FIELD MP_AS_TXT * ALIAS MP_AS_TXT * DATA TYPE String * WIDTH 15</p>	
<p>FIELD ID_PREFIX * ALIAS ID_PREFIX * DATA TYPE String * WIDTH 5</p>	



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APPENDIX C – ENGINEERING ANALYSIS TABLES



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Table C 1 – Sign Panels by Color

Sign Color	Kenai		Kodiak		MatSu		Total		Percent of Total	
	Panels	SF	Panels	SF	Panels	SF	Panels	SF	Panels	SF
Black	2	3			44	141	46	143	0.2%	0.1%
Blue	1,566	6,478	70	265	1,038	4,926	2,674	11,668	10.6%	7.8%
Brown	507	4,390	70	455	375	3,335	952	8,180	3.8%	5.4%
Fluorescent Yellow-Green	99	804	43	342	80	680	222	1,826	0.9%	1.2%
Green	4,860	15,300	564	1,478	3,836	19,479	9,260	36,257	36.7%	24.1%
Red	1,663	10,213	160	954	1,317	8,314	3,140	19,482	12.4%	12.9%
White	2,116	10,944	266	1,420	1,768	10,620	4,150	22,984	16.4%	15.3%
Yellow	2,047	21,707	619	6,203	2,155	22,088	4,821	49,997	19.1%	33.2%
Grand Total	12,860	69,838	1,792	11,116	10,613	69,582	25,265	150,537		
Percent of Total	51%	46%	7%	7%	42%	46%				

Table C 2 – Sign Posts by Type

	Kenai	Kodiak	MatSu	Grand Total	Percent of Total
I-Beam	41		94	135	1.0%
Light Pole	292	3	170	465	3.6%
Other	21	6	15	42	0.3%
Perforated Steel Tube	4777	886	3689	9352	72.4%
Pipe	121	12	74	207	1.6%
Signal Pole	96	7	171	274	2.1%
Steel Tube	945	51	1251	2247	17.4%
Utility Pole	6	2	10	18	0.1%
Wood Post	105	7	63	175	1.4%
Grand Total	6404	974	5537	12915	
Percent of Total	49.6%	7.5%	42.9%		



Table C 3 – Sign Size Assessment, Kenai

	N/A	No	Yes	Total Signs	Percent No	SF No
Black	2			2	0.0%	
Blue	170	87	1,309	1,566	5.6%	293
Brown	241	43	223	507	8.5%	190
Fluorescent Yellow-Green		6	93	99	6.1%	29
Green	81	2,261	2,518	4,860	46.5%	4,141
Red	8	50	1,605	1,663	3.0%	233
White	374	347	1,395	2,116	16.4%	1,543
Yellow	110	160	1,777	2,047	7.8%	639
Grand Total	986	2,954	8,920	12,860	23.0%	7,068
				Square Foot of Attached Signs		27,698

Units are Panels, except last column, which is Square Feet

Table C 4 – Sign Size Assessment, Kodiak

	N/A	No	Yes	Total Signs	Percent No	SF No
Black						
Blue	28	21	21	70	30.0%	38
Brown	40	5	25	70	7.1%	50
Fluorescent Yellow-Green			43	43	0.0%	
Green	33	191	340	564	33.9%	373
Red		19	141	160	11.9%	84
White	56	52	158	266	19.5%	238
Yellow	19	20	580	619	3.2%	81
Grand Total	176	308	1,308	1,792	17.2%	863
				Square Foot of Attached Signs		2,596

Units are Panels, except last column, which is Square Feet



Table C 5 – Sign Size Assessment, Mat Su

	N/A	No	Yes	Total Signs	Percent No	SF No
Black	3	21	20	44	47.7%	63
Blue	94	80	864	1,038	7.7%	371
Brown	196	63	116	375	16.8%	247
Fluorescent Yellow-Green	1	2	77	80	2.5%	4
Green	162	1,912	1,762	3,836	49.8%	3,671
Red	2	60	1,255	1,317	4.6%	349
White	162	234	1,372	1,768	13.2%	1,230
Yellow	76	179	1,900	2,155	8.3%	680
Grand Total	696	2,551	7,366	10,613	24.0%	6,616
				Square Foot of Attached Signs		27,343

Units are Panels, except last column, which is Square Feet

Table C 6 – Crashworthy by Post Type. Kenai

	No	No - Ok	Yes	Total Posts	Percent No	SF of Attached Signs
I-Beam	2		39	41	4.9%	84
Light Pole	12	53	227	292	4.1%	98
Other	7	13	1	21	33.3%	42
Perforated Steel Tube	89	97	4,591	4,777	1.9%	1,456
Pipe	30	19	72	121	24.8%	267
Signal Pole	4	49	43	96	4.2%	12
Steel Tube	20	43	882	945	2.1%	263
Utility Pole	3	3		6	50.0%	14
Wood Post	26	9	70	105	24.8%	397
Grand Total	193	286	5,925	6,404	3.0%	2,633



Table C 7 – Crashworthy by Post Type, Kodiak

	No	No - Ok	Yes	Total Posts	Percent No	SF of Attached Signs
I-Beam						
Light Pole	1		2	3	33.3%	6
Other	1	1	4	6	16.7%	7
Perforated Steel Tube	19	37	830	886	2.1%	279
Pipe	9	3		12	75.0%	40
Signal Pole	1	3	3	7	14.3%	2
Steel Tube		2	49	51	0.0%	
Utility Pole		2		2	0.0%	
Wood Post	4	1	2	7	57.1%	57
Grand Total	35	49	890	974	3.6%	391

Table C 8 – Crashworthy by Post Type, Mat Su

	No	No - Ok	Yes	Total Posts	Percent No	SF of Attached Signs
I-Beam	1	1	92	94	1.1%	51
Light Pole	6	2	162	170	3.5%	55
Other	5	3	7	15	33.3%	35
Perforated Steel Tube	93	74	3,522	3,689	2.5%	1,510
Pipe	5	1	68	74	6.8%	86
Signal Pole	66	16	89	171	38.6%	115
Steel Tube	14	44	1,193	1,251	1.1%	251
Utility Pole	7	1	2	10	70.0%	13
Wood Post	32	8	23	63	50.8%	446
Grand Total	229	150	5,158	5,537	4.1%	2,562



Table C 9 – Retro-reflectivity by Color, Kenai

Background Color	No	Yes	Total	Total Signs	Percent Measured	Percent Failing	SF Failing
Green	52	41	93	4,860	1.9%	55.9%	140
Red	24	176	200	1,663	12.0%	12.0%	151
White	8	150	158	2,116	7.5%	5.1%	33
Yellow	26	159	185	2,047	9.0%	14.1%	142
Grand Total	110	526	636	10,686	6.0%	17.3%	466
						Square Foot of Attached Signs	807

Units are panels unless otherwise noted

Table C 10 – Retro-reflectivity by Color, Kodiak

Background Color	No	Yes	Total	Total Signs	Percent Measured	Percent Failing	SF Failing
Green	1	3	4	564	0.7%	25.0%	3
Red		13	13	160	8.1%	0.0%	
White	7	34	41	266	15.4%	17.1%	26
Yellow	7	87	94	619	15.2%	7.4%	61
Grand Total	15	137	152	1,609	9.4%	9.9%	90
						Square Foot of Attached Signs	160

Units are panels unless otherwise noted

Table C 11 – Retro-reflectivity by Color, Mat Su

Background Color	No	Yes	Total	Total Signs	Percent Measured	Percent Failing	SF Failing
Green	30	39	69	3,836	1.8%	43.5%	45
Red	6	95	101	1,317	7.7%	5.9%	31
White	2	70	72	1,768	4.1%	2.8%	8
Yellow	19	119	138	2,155	6.4%	13.8%	117
Grand Total	57	323	380	9,076	4.2%	15.0%	200
						Square Foot of Attached Signs	499

Units are panels unless otherwise noted



Table C 12 – Meets Use by Color, Kenai

	No	Yes	Total Signs	Percent No
Black		2	2	0.0%
Blue	6	1,560	1,566	0.4%
Brown	4	503	507	0.8%
Fluorescent Yellow-Green		99	99	0.0%
Green	3	4,857	4,860	0.1%
Red	24	1,639	1,663	1.4%
White	36	2,080	2,116	1.7%
Yellow	18	2,029	2,047	0.9%
Grand Total	91	12,769	12,860	0.7%

Units are panels unless otherwise noted

Table C 13 – Meets Use by Color, Kodiak

	No	Yes	Total Signs	Percent No
Black				
Blue	1	69	70	1.4%
Brown		70	70	0.0%
Fluorescent Yellow-Green		43	43	0.0%
Green		564	564	0.0%
Red		160	160	0.0%
White	1	265	266	0.4%
Yellow	7	612	619	1.1%
Grand Total	9	1,783	1,792	0.5%

Units are panels unless otherwise noted



Table C 14 – Meets Use by Color, Mat Su

	No	Yes	Total Signs	Percent No
Black		44	44	0.0%
Blue	8	1,030	1,038	0.8%
Brown	8	367	375	2.1%
Fluorescent Yellow-Green		80	80	0.0%
Green	17	3,819	3,836	0.4%
Red	4	1,313	1,317	0.3%
White	9	1,759	1,768	0.5%
Yellow	47	2,108	2,155	2.2%
Grand Total	93	10,520	10,613	0.9%

Units are panels unless otherwise noted



Table C 15 – Signs not Meeting Use

REGION	SIGN ASSEMBLY	ROUTE	CODE	LEGEND	COMMENT
MatSu	U01013_01	135000	D10-2	Single-Faced 2 digit Mile Marker Signs : 34	SECOND MP 34 - SHOULD BE REMOVED
MatSu	U01049_03	170000	SPECIAL	NO ASDS/MUTCD : NORTHSTAR SPEEDWAY VETERANS WALL	NO DIRECTION FOR SIGN
MatSu	U01049_04	170000	SPECIAL	NO ASDS/MUTCD : U OF A MAT-SU COLLEGE	NO DIRECTION FOR SIGN
MatSu	U01063_01	170016	SPECIAL	NO ASDS/MUTCD : STOCKED BY ADF&G	COMPLEMENTARY SIGN IS MISSING
MatSu	U01192_01	170000	OM-3R	Object Marker (Type 3) NO ASDS/MUTCD : Obsolete Picnic Area	SIGN IS COLLAPSED
MatSu	U01269_01	170000	SPECIAL	(Symbol)	NO DIRECTION FOR SIGN
MatSu	U01308_01	170000	R1-1	STOP	APPEARS TO BE ADEQUATE SIGHT DISTANCE FOR STOPPED VEHICLES TO SEE CYCLISTS
MatSu	U01310_01	170000	R1-1	STOP	APPEARS TO BE ADEQUATE SIGHT DISTANCE FOR STOPPED VEHICLES TO SEE CYCLISTS
MatSu	U01352_01	170000	OM-3R	Object Marker (Type 3)	DELINEATOR WOULD BE MORE APPROPRIATE
MatSu	U01353_01	170000	OM-3R	Object Marker (Type 3)	DELINEATOR WOULD BE MORE APPROPRIATE
MatSu	U01354_01	170000	OM-3L	Object Marker (Type 3)	DELINEATOR WOULD BE MORE APPROPRIATE
MatSu	U01355_01	170000	OM-3R	Object Marker (Type 3)	DELINEATOR WOULD BE MORE APPROPRIATE
MatSu	U01356_01	170000	OM-3R	Object Marker (Type 3)	DELINEATOR WOULD BE MORE APPROPRIATE
MatSu	U01692_01	170076	SPECIAL	NO ASDS/MUTCD : HILL Street Name (small sign) : CLEARVIEW	REDUNDANT SIGN
MatSu	U01719_01	170044	D3-1	LOOP	NEEDS AN ACCOMPANYING STOP SIGN
MatSu	U01729_01	170044	SPECIAL	NO ASDS/MUTCD : GOLF COURSE	DUCT TAPE COVERING PART OF SIGN
MatSu	U01760_01	170066	SPECIAL	NO ASDS/MUTCD : FIRE STATION	REDUNDANT SIGN
MatSu	U01767_01	170066	SPECIAL	NO ASDS/MUTCD : FIRE STATION	REDUNDANT SIGN
MatSu	U01873_01	170700	SPECIAL	NO ASDS/MUTCD : EWE FIRST YARN (RIGHT ARROW)	APPEARS TO BE A BUSINESS SIGN
MatSu	U01969_01	136800	SPECIAL	NO ASDS/MUTCD : (BIKE) LANE AHEAD	DIAMOND SYMBOL IS ONLY FOR HOV LANES. SIGN SHOULD BE REPLACED WITH R3-16



REGION	SIGN ASSEMBLY	ROUTE	CODE	LEGEND	COMMENT
				NO ASDS/MUTCD : SLOW CHILDREN	
MatSu	U01999_01	136800	SPECIAL	PLAYING	CONSIDER A W11-2 IF NECESSARY FOR PATH
MatSu	U02299_01	170085	SPECIAL	NO ASDS/MUTCD : SPEED BUMP	WARNING SIGNS SHOULD BE DIAMOND SHAPE
				NO ASDS/MUTCD : CAUTION	IF SIGHT DISTANCE IS AN ISSUE, INTERSECTION
				DANGEROUS INTERSECTION RIGHT TURN	WARNING SIGNS SHOULD BE INSTALLED OR
MatSu	U02380_01	170000	SPECIAL	ONLY	DRIVEWAY REMOVED
Kenai	U02708_02	130000	W6-2	Divided Highway Ends (Arrows) (Symbol)	SIGN IS UPSIDE DOWN - SHOULD BE A W6-1
Kenai	U02763_02	119300	S4-2	WHEN CHILDREN ARE PRESENT (3 Lines)	REPLACE WITH WHITE SIGN
Kenai	U02763_04	119300	S4-3	SCHOOL	REPLACE WITH YELLOW-GREEN SIGN
Kenai	U02767_01	110000	S4-2	WHEN CHILDREN ARE PRESENT (3 Lines)	REPLACE WITH WHITE SIGN
Kenai	U02767_03	110000	S4-3	SCHOOL	REPLACE WITH YELLOW-GREEN SIGN
Kenai	U02769_01	119300	S4-2	WHEN CHILDREN ARE PRESENT (3 Lines)	REPLACE WITH YELLOW-GREEN SIGN
Kenai	U02769_03	119300	S4-3	SCHOOL	REPLACE WITH YELLOW-GREEN SIGN
Kenai	U02800_03	119500	OM-3L	Object Marker (Type 3)	SHOULD BE AN OM4-1
Kenai	U03047_01	119225	SPECIAL	NO ASDS/MUTCD : REDUCE SPEED 15	SHOULD BE A R2-1
					ROAD CONTINUES - DOUBLE ARROW SEEMS
Kenai	U03116_02	118900	W1-7	Two Way (large Arrow) (Symbol)	INAPPROPRIATE
Kenai	U03533_01	110000	SPECIAL	NO ASDS/MUTCD : SIGNAL AHEAD	REDUNDANT SIGN
Kenai	U03573_02	118550	R2-1	SPEED LIMIT 35	SIGN IS ON THE WRONG SIDE OF THE ROAD
Kenai	U03575_01	118550	R2-1	SPEED LIMIT 35	SIGN IS ON THE WRONG SIDE OF THE ROAD
Kenai	U03581_01	118550	R2-1	SPEED LIMIT 35	SIGN IS ON THE WRONG SIDE OF THE ROAD
Kenai	U03583_01	118550	SPECIAL	NO ASDS/MUTCD : MILE 14.5	SHOULD BE A GREEN SIGN (D10-2A)
Kenai	U03728_02	117300	SPECIAL	NO ASDS/MUTCD : HORSE TRAIL	REDUNDANT SIGN
Kenai	U03729_02	117300	SPECIAL	NO ASDS/MUTCD : HORSE TRAIL	REDUNDANT SIGN
Kenai	U03831_01	117400	OM4-1	Object Marker (Type 4)	MOVE SIGNS TO END OF ROAD
Kenai	U03831_02	117400	W14-100	END	ADD W14-101 HERE OR 500' UP THE ROAD
Kenai	U04020_01	115750	SPECIAL	NO ASDS/MUTCD : SLOW CHILDREN	WARNING SIGNS SHOULD BE DIAMOND SHAPE
				NO ASDS/MUTCD : PEDESTRIAN AND	
Kenai	U04217_01	117600	SPECIAL	BIKE LANE ONLY	REMOVE. COULD REPLACE WITH R5-3A/P



REGION	SIGN ASSEMBLY	ROUTE	CODE	LEGEND	COMMENT
Kenai	U04510_01	116400	SPECIAL	NO ASDS/MUTCD : PEDESTRIAN AND BIKE LANE ONLY	SIGN IS ON A PATH, NOT LANE
Kenai	U04519_01	116400	SPECIAL	NO ASDS/MUTCD : PEDESTRIAN AND BIKE LANE ONLY	SIGN IS ON A PATH, NOT LANE
Kenai	U04544_01	116400	SPECIAL	NO ASDS/MUTCD : PEDESTRIAN AND BIKE LANE ONLY	SIGN IS ON A PATH, NOT LANE
Kenai	U04868_01	110000	I-3	[River Name] - 2 Line : NINILCHIK RIVER	SHOULD BE WHITE ON GREEN
Kodiak	U05334_02	067000	W1-5R	Winding Road (Arrow) (Symbol) (Right)	SHOULD BE A W1-5L SINCE FIRST CURVE IS TO THE LEFT
Kodiak	U05391_02	067400	W1-5R	Winding Road (Arrow) (Symbol) (Right)	SHOULD BE A W1-5L SINCE FIRST CURVE IS TO THE LEFT
Kodiak	U05398_02	067400	W1-3R	Reverse Turn (Arrow) (Symbol) (Right)	THERE DOES NOT APPEAR TO BE A JOG AHEAD FOR THIS SIGN. COULD USE W1-4
Kodiak	U05400_02	067400	W1-3R	Reverse Turn (Arrow) (Symbol) (Right) One Line Destination & Arrow : (LEFT)	THERE DOES NOT APPEAR TO BE A JOG AHEAD FOR THIS SIGN. COULD USE W1-4
Kodiak	U05490_01	068000	D1-1	USCG BASE	D1-1 - SHOULD BE GREEN, LIKE OTHER SIGN SHOULD BE REMOVED. IF REPLACED, SHOULD BE YELLOW DIAMOND
Kodiak	U05680_01	068554	SPECIAL	NO ASDS/MUTCD : CHILDREN AT PLAY	SHOULD BE REMOVED. IF REPLACED, SHOULD BE YELLOW DIAMOND
Kodiak	U05692_01	068551	W3-100	NEW TRAFFIC PATTERN	THIS SHOULD BE A TEMPORARY SIGN
MatSu	U10125_05	170016	M3-1	NORTH (Plates)	COMPLEMENTARY SIGN IS MISSING
MatSu	U10530_01	170006	R6-4	ROUNDABOUT DIRECTIONS (2 chevrons)	SHOULD BE 1 EACH R6-4
MatSu	U10531_01	170006	R6-4	ROUNDABOUT DIRECTIONS (2 chevrons)	SHOULD BE 1 EACH R6-4
MatSu	U10532_01	170006	R6-4	ROUNDABOUT DIRECTIONS (2 chevrons)	SHOULD BE 1 EACH R6-4
MatSu	U10533_01	170006	R6-4	ROUNDABOUT DIRECTIONS (2 chevrons)	SHOULD BE 1 EACH R6-4
MatSu	U10650_01	136910	SPECIAL	NO ASDS/MUTCD : STOP AHEAD	SHOULD BE A W3-1A
MatSu	U10720_02	136430	SPECIAL	NO ASDS/MUTCD : EXIT	SHOULD BE R6-1 SIGNS ON TOP OF POST
MatSu	U10721_02	136430	SPECIAL	NO ASDS/MUTCD : EXIT	SHOULD BE R6-1 SIGNS ON TOP OF POST
MatSu	U11030_01	136065	SPECIAL	NO ASDS/MUTCD : MT VIEW RV PARK	SHOULD BE D9-205
MatSu	U20022_01	170000	SPECIAL	NO ASDS/MUTCD : WASILLA AIRPORT	NO DIRECTION FOR SIGN
MatSu	U20037_01	170000	SPECIAL	NO ASDS/MUTCD : WASILLA AIRPORT	NO DIRECTION FOR SIGN



REGION	SIGN ASSEMBLY	ROUTE	CODE	LEGEND	COMMENT
MatSu	U20060_01	170073	SPECIAL	NO ASDS/MUTCD : STOP AHEAD	SIGN NOT NECESSARY - STOP IS VISIBLE
MatSu	U20108_01	170073	SPECIAL	NO ASDS/MUTCD : ONLY	UNCLEAR WHAT THE ONLY SIGN REFERS TO
MatSu	U20294_01	170028	SPECIAL	NO ASDS/MUTCD : FOR ONE MILE NO ASDS/MUTCD : NO MOTORIZED	SHOULD READ "NEXT 1 MILE"
MatSu	U20493_01	170088	SPECIAL	VEHICLES ON THE BIKE PATH NO ASDS/MUTCD : NO MOTORIZED	REPLACE WITH R5-3 (REGULATORY SIGNS)
MatSu	U20501_01	170088	SPECIAL	VEHICLES ON THE BIKE PATH NO ASDS/MUTCD : NO MOTORIZED	REPLACE WITH R5-3 (REGULATORY SIGNS)
MatSu	U20502_01	170088	SPECIAL	VEHICLES ON THE BIKE PATH NO ASDS/MUTCD : NO MOTORIZED	REPLACE WITH R5-3 (REGULATORY SIGNS)
MatSu	U20504_01	170088	SPECIAL	VEHICLES ON THE BIKE PATH NO ASDS/MUTCD : NO MOTORIZED	REPLACE WITH R5-3 (REGULATORY SIGNS)
MatSu	U20507_01	170088	SPECIAL	VEHICLES ON THE BIKE PATH	REPLACE WITH R5-3 (REGULATORY SIGNS)
MatSu	U20533_01	170088	SPECIAL	NO ASDS/MUTCD : STOP AHEAD	UNNECESSARY SIGN
MatSu	U20680_01	170047	SPECIAL	NO ASDS/MUTCD : STOP AHEAD	SHOULD BE A W3-1A
MatSu	U20736_02	137000	D3-1	Street Name (small sign) : N HODSDON RD	DOES THIS ROAD REALLY HAVE TWO NAMES?
MatSu	U20736_03	137000	D3-1	Street Name (small sign) : N HODSDON RD	DOES THIS ROAD REALLY HAVE TWO NAMES?
MatSu	U20736_04	137000	D3-1	Street Name (small sign) : N MOFFIT RD	DOES THIS ROAD REALLY HAVE TWO NAMES?
MatSu	U20736_05	137000	D3-1	Street Name (small sign) : N MOFFIT RD	DOES THIS ROAD REALLY HAVE TWO NAMES?
MatSu	U20755_01	170044	SPECIAL	NO ASDS/MUTCD : RESTRICTED AREA AUTHORIZED PERSONEL ONLY VIOLATORS WILL BE PROSECUTED BY THE*	SIGN SHOULD BE WHITE ON RED
MatSu	U20791_01	136800	R4-7	Keep Right (Arrow and Symbol)	SIGN IS UNNECESSARY
MatSu	U20857_01	137000	SPECIAL	NO ASDS/MUTCD : PED CROSSING	SHOULD BE A W11-2
MatSu	U20858_01	137000	SPECIAL	NO ASDS/MUTCD : PED CROSSING	SHOULD BE A W11-2
MatSu	U20869_01	137000	SPECIAL	NO ASDS/MUTCD : NO STOPPING OR PARKING VEHICLES IN ROADWAY	SIGN SHOULD BE BLACK ON WHITE



REGION	SIGN ASSEMBLY	ROUTE	CODE	LEGEND	COMMENT
MatSu	U20876_01	137000	SPECIAL	NO ASDS/MUTCD : NO STOPPING OR PARKING VEHICLES ON ROADWAY	SIGN SHOULD BE BLACK ON WHITE
MatSu	U20877_01	137000	SPECIAL	NO ASDS/MUTCD : NO STOPPING OR PARKING VEHICLES ON ROADWAY	SIGN SHOULD BE BLACK ON WHITE
MatSu	U20884_01	137000	SPECIAL	NO ASDS/MUTCD : NO STOPPING OR PARKING VEHICLES ON ROADWAY	SIGN SHOULD BE BLACK ON WHITE
MatSu	U20924_07	137700	OM1-1	Object Marker (Type 1) NO ASDS/MUTCD : BLACK AND WHITE	SHOULD BE OM4-1
MatSu	U20924_08	137700	SPECIAL	OBJECT MARKER Single-Faced 2 digit Mile Marker Signs :	SHOULD BE OM4-1
MatSu	U20929_01	137700	D10-2	37	OBSOLETE MILEPOST
MatSu	U20945_01	137700	SPECIAL	NO ASDS/MUTCD : HILL	REDUNDANT SIGN
MatSu	U20958_01	137700	SPECIAL	NO ASDS/MUTCD : HILL	REDUNDANT SIGN
MatSu	U21161_01	170000	D3-1	Street Name (small sign) : HATTIE LN	EITHER THIS NEEDS A STOP SIGN, OR IT'S NOT A REAL ROAD AND SHOULD BE REMOVED
MatSu	U21161_02	170000	D3-1	Street Name (small sign) : HATTIE LN NO ASDS/MUTCD : NOTICE TO BOATERS:USE OF WATERCRAFT ON QUESTION LAKE IS RESTRICTED: 5 HP	EITHER THIS NEEDS A STOP SIGN, OR IT'S NOT A REAL ROAD AND SHOULD BE REMOVED
MatSu	U21279_01	171000	SPECIAL	MOTORS OR*	TEXT IS TOO SMALL FOR DRIVERS
MatSu	U21334_01	171000	SPECIAL	NO ASDS/MUTCD : 500 FT	SIGN POST IS TOO CLOSE TO NEXT SIGN. BETTER TO MOVE UP THE ROAD AND USE A "1000 FT" SIGN
MatSu	U21334_02	171000	D9-102	SCENIC NO ASDS/MUTCD : LIBRARY MEMBER	SIGN POST IS TOO CLOSE TO NEXT SIGN. BETTER TO MOVE UP THE ROAD AND USE A "1000 FT" SIGN
MatSu	U21353_01	171000	SPECIAL	ALASKA LIBRARY NETWORK	SIGN NEEDS A D9-301
MatSu	U21356_01	171000	S5-2A	END SCHOOL ZONE (Plaque)	SIGN SHOULD NOT HAVE YELLOW-GREEN BACKGROUND
MatSu	U21368_01	171000	S5-2A	END SCHOOL ZONE (Plaque)	SIGN SHOULD NOT HAVE YELLOW-GREEN BACKGROUND
MatSu	U21664_01	135000	SPECIAL	NO ASDS/MUTCD : SPEC CALC:GOOD	SHOULD BE REMOVED



REGION	SIGN ASSEMBLY	ROUTE	CODE	LEGEND	COMMENT
				SAM PARK	
MatSu	U21664_02	135000	SPECIAL	NO ASDS/MUTCD : SPEC CALC:HOME STYLE MEALS & ESPRESSO	SHOULD BE REMOVED
MatSu	U21666_01	135000	SPECIAL	NO ASDS/MUTCD : SPEC CALC:GOOD SAM PARK	SHOULD BE REMOVED
MatSu	U21666_02	135000	SPECIAL	NO ASDS/MUTCD : SPEC CALC:HOME STYLE MEALS & ESPRESSO	SHOULD BE REMOVED
MatSu	U21873_01	136035	SPECIAL	NO ASDS/MUTCD : 911	SIGN NEEDS CONTEXT OR REPLACE WITH D12-4
MatSu	U21873_02	136035	SPECIAL	NO ASDS/MUTCD : 911	SIGN NEEDS CONTEXT OR REPLACE WITH D12-4
Kenai	U22541_01	115525	D9-301	Directional Arrow (Symbol)	SHOULD BE WHITE ON BLUE
Kenai	U22706_01	112300	W13-1	20 MPH (Advisory Speed Plate)	PLAQUE NEEDS A WARNING SIGN
Kenai	U22726_01	110000	SPECIAL	NO ASDS/MUTCD : NEXT 4 MILES	SIGN SHOULD BE FLUORESCENT YELLOW-GREEN
Kenai	U22754_01	110000	SPECIAL	NO ASDS/MUTCD : NEXT 4 MILES	SIGN SHOULD BE FLUORESCENT YELLOW-GREEN
Kenai	U22937_02	111740	SPECIAL	NO ASDS/MUTCD : DEAD END ROAD NO TURN AROUND	SHOULD BE BLACK ON YELLOW
Kenai	U23011_01	110000	SPECIAL	NO ASDS/MUTCD : IN CASE OF EMERGENCY DIAL 911	SIGN IS TOO SMALL
Kenai	U23113_01	110000	W16-8P	Advance Street Name (Plate) : WEST HILL RD	MISSING INTERSECTION WARNING SIGN
Kenai	U23224_02	110000	I-5	Airport (Symbol)	AIRPORT SIGN NEEDS TO POINT LEFT
Kenai	U23291_01	110000	D9-301	Directional Arrow (Symbol)	NEEDS AN ACCOMPANYING SIGN
Kenai	U23294_01	110000	D9-301	Directional Arrow (Symbol)	NEEDS AN ACCOMPANYING SIGN
Kenai	U23298_03	110000	SPECIAL	NO ASDS/MUTCD : SELDOVIA BAY FERRY	SHOULD BE REMOVED. MAY BE REPLACED WITH D9-205 OR A FERRY GUIDE SIGN
Kenai	U23298_04	110000	SPECIAL	NO ASDS/MUTCD : SELDOVIA BAY FERRY	SHOULD BE REMOVED. MAY BE REPLACED WITH D9-205 OR A FERRY GUIDE SIGN
Kenai	U23729_01	130650	OM-3L	Object Marker (Type 3)	SHOULD BE OM-4 - ON GATE
Kenai	U23729_02	130650	OM-3L	Object Marker (Type 3)	SHOULD BE OM-4 - ON GATE
Kenai	U23729_04	130650	OM-3L	Object Marker (Type 3)	SHOULD BE OM-4 - ON GATE
Kenai	U23729_05	130650	OM-3L	Object Marker (Type 3)	SHOULD BE OM-4 - ON GATE



REGION	SIGN ASSEMBLY	ROUTE	CODE	LEGEND	COMMENT
Kenai	U23730_01	130650	OM-3L	Object Marker (Type 3)	SHOULD BE OM-4 - ON GATE
Kenai	U23730_02	130650	OM-3L	Object Marker (Type 3)	SHOULD BE OM-4 - ON GATE
Kenai	U23730_04	130650	OM-3L	Object Marker (Type 3)	SHOULD BE OM-4 - ON GATE
Kenai	U23730_05	130650	OM-3L	Object Marker (Type 3)	SHOULD BE OM-4 - ON GATE
Kenai	U23737_03	130650	OM-3L	Object Marker (Type 3)	SHOULD BE OM-4 - ON GATE
Kenai	U23737_04	130650	OM-3R	Object Marker (Type 3)	SHOULD BE OM-4 - ON GATE
Kenai	U23738_03	130650	OM-3R	Object Marker (Type 3)	SHOULD BE OM-4 - ON GATE
Kenai	U23738_04	130650	OM-3R	Object Marker (Type 3) NO ASDS/MUTCD : Red and White	SHOULD BE OM-4 - ON GATE
Kenai	U23845_01	130000	SPECIAL	Directional Marker	SHOULD BE OM-3C
Kenai	U23845_02	130000	OM-3L	Object Marker (Type 3)	SHOULD BE BLACK AND YELLOW
MatSu	U30133_02	170066	D3-1	Street Name (small sign) : CONNER CREEK RANCH	SIGN SHOULD BE PLACED ON A STOP SIGN. COLOCATING WITH W1-6 IS CONFUSING
MatSu	U30133_03	170066	D3-1	Street Name (small sign) : CONNER CREEK RANCH	SIGN SHOULD BE PLACED ON A STOP SIGN. COLOCATING WITH W1-6 IS CONFUSING
MatSu	U30170_02	170047	R1-1	STOP	VERIFY SIGHT DISTANCE - YEILD OR NO CONTROL MAY BE MORE APPROPRIATE
MatSu	U30175_02	170047	R1-1	STOP	VERIFY SIGHT DISTANCE - YEILD OR NO CONTROL MAY BE MORE APPROPRIATE
MatSu	U30228_01	170047	SPECIAL	NO ASDS/MUTCD : NO THRU TRAFFIC	ROAD DOES GO THROUGH. IF NOT, "NO OUTLET" WOULD BE MORE APPROPRIATE
MatSu	U30234_01	170047	W5-1A	SHOULDER NARROWS	SIGN TOO WIDE FOR LOCATION. SHOULD BE INSTALLED ON SHOULDER
MatSu	U30405_01	135000	W7-3A	NEXT 8 MILES NO ASDS/MUTCD : EQUIPMENT IN	SEEMS MORE APPROPRIATE AS A FOLD-UP CONSTRUCTION SIGN.
MatSu	U30405_02	135000	SPECIAL	SLIDE AREAD	SEEMS MORE APPROPRIATE AS A FOLD-UP CONSTRUCTION SIGN.
MatSu	U40066_01	170086	W1-8L	Chevron (Symbol) (Left)	COULD BE REPLACED WITH OM1-1
MatSu	U40066_02	170086	W1-8L	Chevron (Symbol) (Left)	COULD BE REPLACED WITH OM1-1
MatSu	U40197_01	170000	SPECIAL	NO ASDS/MUTCD : MONTANA LAKE	TOO CLOSE TO PREVIOUS SIGN.
MatSu	U40197_02	170000	SPECIAL	NO ASDS/MUTCD : MONTANA LAKE	ON WRONG SIDE OF ROAD.



REGION	SIGN ASSEMBLY	ROUTE	CODE	LEGEND	COMMENT
MatSu	U40292_01	171420	SPECIAL	NO ASDS/MUTCD : WEIGHT LIMIT 3 TONS	REPLACE WITH R12-1
MatSu	U40293_01	171420	SPECIAL	NO ASDS/MUTCD : WEIGHT LIMIT 3 TONS	REPLACE WITH R12-1
MatSu	U40322_01	170000	SPECIAL	NO ASDS/MUTCD : ROAD TEST 29035	PANEL IS OLD - IS TEST STILL IN PLACE?
MatSu	U40335_02	170000	SPECIAL	NO ASDS/MUTCD : \$500 FINE FOR LITTERING	FINE IS \$1000
MatSu	U40342_01	170000	W11-100	Snowmobile Crossing (Symbol)	THIS PANEL IS FACING SIDEWAYS, TO A HILL
MatSu	U40343_01	170000	W11-100	Snowmobile Crossing (Symbol)	THIS PANEL IS FACING SIDEWAYS, TO A HILL
Kenai	U40417_02	132000	SPECIAL	NO ASDS/MUTCD : ONE WAY DO NOT ENTER	SHOULD BE R5-1 AND EITHER R6-1 OR R3-2 SIGNS
Kenai	U40418_02	132000	SPECIAL	NO ASDS/MUTCD : ONE WAY DO NOT ENTER	SHOULD BE R5-1 AND EITHER R6-1 OR R3-2 SIGNS
Kenai	U40656_01	132302	D10-1	Single-Faced 1 digit Mile Marker Signs : 5	SIGN JUST UP THE ROAD
Kenai	U40671_01	132310	SPECIAL	NO ASDS/MUTCD : SHARE THE ROAD	SHOULD BE A WARNING SIGN (W16-1)
Kenai	U40896_01	110000	SPECIAL	NO ASDS/MUTCD : CAUTION SPEED BUMPS	REMOVE OR REPLACE WITH W17-1
Kenai	U50091_01	117500	SPECIAL	NO ASDS/MUTCD : NEIGHBORHOOD CRIME WATCH	REPLACE WITH REAL CRIME WATCH SIGN
Kenai	U50145_01	117600	D9-301	Directional Arrow (Symbol)	NOT NECESSARY, UNLESS A PANEL IS MISSING
Kenai	U50253_01	117703	SPECIAL	NO ASDS/MUTCD : ACCESS GATE CLOSED	NEED BETTER WAY TO SAY IF GATE IS OPEN OR CLOSED
Kenai	U50253_02	117703	SPECIAL	NO ASDS/MUTCD : ACCESS GATE OPEN	NEED BETTER WAY TO SAY IF GATE IS OPEN OR CLOSED
Kenai	U50453_01	117600	SPECIAL	NO ASDS/MUTCD : PRISM TRAINING (LEFT)	REMOVE SIGN
Kenai	U50461_01	117600	R1-1	STOP	YIELD SIGN MAY BE MORE APPROPRIATE
Kenai	U50462_01	117600	R1-1	STOP	YIELD SIGN MAY BE MORE APPROPRIATE
Kenai	U50464_01	117600	R1-1	STOP	YIELD SIGN MAY BE MORE APPROPRIATE
Kenai	U50465_01	117600	R1-1	STOP	YIELD SIGN MAY BE MORE APPROPRIATE



REGION	SIGN ASSEMBLY	ROUTE	CODE	LEGEND	COMMENT
Kenai	U50467_01	117600	R1-1	STOP	YIELD SIGN MAY BE MORE APPROPRIATE
Kenai	U50468_01	117600	R1-1	STOP	YIELD SIGN MAY BE MORE APPROPRIATE
Kenai	U50471_01	117600	R1-1	STOP	YIELD SIGN MAY BE MORE APPROPRIATE
Kenai	U50472_01	117600	R1-1	STOP	YIELD SIGN MAY BE MORE APPROPRIATE
Kenai	U50474_01	117600	R1-1	STOP	YIELD SIGN MAY BE MORE APPROPRIATE
Kenai	U50475_01	117600	R1-1	STOP	YIELD SIGN MAY BE MORE APPROPRIATE
Kenai	U50502_01	117600	R1-1	STOP	YIELD SIGN MAY BE MORE APPROPRIATE
Kenai	U50503_01	117600	R1-1	STOP	YIELD SIGN MAY BE MORE APPROPRIATE
Kenai	U50506_01	117600	R1-1	STOP	YIELD SIGN MAY BE MORE APPROPRIATE
Kenai	U50520_01	117600	D9-301	Directional Arrow (Symbol)	D9-301 NEEDS ACCOMPANYING PANEL
Kodiak	U52094_02	067400	W1-5L	Winding Road (Arrow) (Symbol) (Left)	SHOULD BE W1-5R
Kodiak	U52242_01	068020	SPECIAL	NO ASDS/MUTCD : BLIND CURVE NO ASDS/MUTCD : PRIVATE ROAD NO THRU TRAFFIC	THIS SIGN IS OK - SHOULD HAVE A W7-102 OR W1-10 ON Tom Stiles Rd IS THIS REALLY A PRIVATE ROAD? - ROW APPEARS ON BOROUGH GIS
Kenai	U60161_01	111850	SPECIAL	600 FT	SIGNS OBSCURED BY BUSHES
Kenai	U60233_01	110800	W16-2P	SCHOOL BUS STOP AHEAD	SIGNS OBSCURED BY BUSHES
Kenai	U60233_02	110800	S3-1	NO ASDS/MUTCD : VICTORIAN HEIGHTS & MAJESTIC VIEW B&B	SIGN IS TOO SMALL. ENTIRE ASSEMBLY COULD BE A D9-205
Kenai	U60258_01	110305	SPECIAL	Directional Arrow (Symbol)	REDUNDANT SIGN
Kenai	U60390_01	110625	D9-301	Hospital (Symbol) : HOSPITAL	REDUNDANT SIGN
Kenai	U60390_02	110625	D9-2	Hospital (Symbol)	REDUNDANT SIGN
Kenai	U60390_03	110625	D9-2	Hospital (Symbol)	REDUNDANT SIGN
Kenai	U60398_01	110625	D9-301	Directional Arrow (Symbol)	SHOULD NOT HAVE RED BACKGROUND
Kenai	U60398_02	110625	SPECIAL	NO ASDS/MUTCD : EMERGENCY ROOM	SHOULD NOT HAVE RED BACKGROUND
Kenai	U60402_01	110525	D9-301	Directional Arrow (Symbol)	SHOULD NOT HAVE RED BACKGROUND
Kenai	U60402_02	110525	SPECIAL	NO ASDS/MUTCD : EMERGENCY ROOM	SHOULD NOT HAVE RED BACKGROUND
Kenai	U60426_01	110500	D9-301	Directional Arrow (Symbol)	REDUNDANT SIGN
Kenai	U60426_02	110500	SPECIAL	NO ASDS/MUTCD : EMERGENCY ROOM	SHOULD NOT HAVE RED BACKGROUND
Kenai	U60426_03	110500	D9-2	Hospital (Symbol)	REDUNDANT SIGN



SIGN		ROUTE	CODE	LEGEND	COMMENT
REGION	ASSEMBLY				
Kenai	U60714_01	130000	SPECIAL	NO ASDS/MUTCD : CITY BUSINESS LICENSE REQUIRED	SIGN IS TOO SMALL TO BE LEGIBLE
Kenai	U70022_01	115525	SPECIAL	NO ASDS/MUTCD : BEACH ACCESS (LEFT)	SHOULD BE WHITE ON BROWN OR GREEN



Table C 16 – Sign Condition by Color, Kenai

	Acceptable	Marginal	Unacceptable	Total Signs	Unacceptable	
					Percent	SF
Black	2			2	0.0%	
Blue	1,102	352	112	1,566	7.2%	303
Brown	407	82	18	507	3.6%	89
Fluorescent Yellow-Green	95	4		99	0.0%	
Green	4,310	405	145	4,860	3.0%	493
Red	1,318	247	98	1,663	5.9%	566
White	1,651	333	132	2,116	6.2%	605
Yellow	1,388	478	181	2,047	8.8%	1,715
Grand Total	10,273	1,901	686	12,860	5.3%	3,771
				Square Foot of Attached Signs		6,891

Units are panels unless otherwise noted

Table C 17 – Sign Condition by Color, Kodiak

	Acceptable	Marginal	Unacceptable	Total Signs	Unacceptable	
					Percent	SF
Black						
Blue	56	10	4	70	5.7%	12
Brown	55	10	5	70	7.1%	36
Fluorescent Yellow-Green	42		1	43	2.3%	5
Green	475	39	50	564	8.9%	165
Red	127	19	14	160	8.8%	82
White	214	30	22	266	8.3%	113
Yellow	332	124	163	619	26.3%	1,887
Grand Total	1,301	232	259	1,792	14.5%	2,300
				Square Foot of Attached Signs		3,546

Units are panels unless otherwise noted



Table C 18 – Sign Condition by Color, Mat Su

	Acceptable	Marginal	Unacceptable	Total Signs	Unacceptable	
					Percent	SF
Black	39	1	4	44	9.1%	12
Blue	766	161	111	1,038	10.7%	371
Brown	300	51	24	375	6.4%	221
Fluorescent Yellow-Green	73	6	1	80	1.3%	5
Green	3,463	242	131	3,836	3.4%	931
Red	1,162	123	32	1,317	2.4%	196
White	1,514	175	79	1,768	4.5%	514
Yellow	1,421	452	282	2,155	13.1%	2,985
Grand Total	8,738	1,211	664	10,613	6.3%	5,235
					Square Foot of Attached Signs	9,415

Units are panels unless otherwise noted

Table C 19– Post Condition by Type, Kenai

	Acceptable	Marginal	Unacceptable	Total Posts	Percent Unacceptable	SF of Attached Signs
I-Beam	41			41	0.0%	
Light Pole	291	1		292	0.0%	
Other	19	2		21	0.0%	
Perforated Steel Tube	3,593	831	353	4,777	7.4%	3,431
Pipe	95	16	10	121	8.3%	101
Signal Pole	96			96	0.0%	
Steel Tube	844	79	22	945	2.3%	246
Utility Pole	6			6	0.0%	
Wood Post	93	9	3	105	2.9%	28
Grand Total	5,078	938	388	6,404	6.1%	3,806

Units are panels unless otherwise noted



Table C 20 – Post Condition by Type, Kodiak

	Acceptable	Marginal	Unacceptable	Total Posts	Percent Unacceptable	SF of Attached Signs
I-Beam						
Light Pole	3			3	0.0%	
Other	4		2	6	33.3%	10
Perforated Steel Tube	749	84	53	886	6.0%	555
Pipe	11		1	12	8.3%	3
Signal Pole	7			7	0.0%	
Steel Tube	51			51	0.0%	
Utility Pole	2			2	0.0%	
Wood Post	7			7	0.0%	
Grand Total	834	84	56	974	5.7%	567

Units are panels unless otherwise noted

Table C 21 – Post Condition by Type, Mat Su

	Acceptable	Marginal	Unacceptable	Total Posts	Percent Unacceptable	SF of Attached Signs
I-Beam	93	1		94	0.0%	
Light Pole	168	1	1	170	0.6%	8
Other	12	1	2	15	13.3%	11
Perforated Steel Tube	2,898	511	280	3,689	7.6%	2,985
Pipe	72	1	1	74	1.4%	16
Signal Pole	171			171	0.0%	
Steel Tube	1,173	57	21	1,251	1.7%	290
Utility Pole	10			10	0.0%	
Wood Post	59	4		63	0.0%	
Grand Total	4,656	576	305	5,537	5.5%	3,309

Units are panels unless otherwise noted



Table C 22 – Panels Failing Condition and Retroreflectivity on High Speed Roads by Age, Type, and Region

High Speed Roads (Greater than 45 mph)

	Regulatory								Warning							
	Kenai		Kodiak		MatSu		Total		Kenai		Kodiak		MatSu		Total	
Installed	Fail	OK	Fail	OK	Fail	OK	Fail	OK	Fail	OK	Fail	OK	Fail	OK	Fail	Ok
1959	48	552	3	9	35	584	86	1,145	28	264	16	40	114	326	158	630
1990							0	0							0	0
1994	2						2	0							0	0
1995		6				10	0	16	1	12			6	1	18	
1996		1					0	1		1				0	1	
1997						1	0	1						0	0	
1998		4				13	0	17		2			2	0	4	
1999		1			1	7	1	8		1			1	6	1	7
2000	3	29					3	29	7	34			1	7	35	
2001	6	34			1	10	7	44	3	15			4	3	19	
2002				2	2	56	2	58			58	55	4	24	62	79
2003	1	1			1	40	2	41					12	0	12	
2004	1	28			7	97	8	125	1	38			16	119	17	157
2005	3	70	5	8		10	8	88	1	43	5	19	1	29	7	91
2006	1	52			1	48	2	100	3	12		1	15	3	28	
2007		21				2	0	23		48				0	48	
2008		47			1	19	1	66		14				0	14	
2009	1	38			1	105	2	143		24			45	0	69	
2010		10				58	0	68					42	0	42	
2011	1	54				79	1	133		106			1	218	1	324
2012		78				126	0	204		37			51	0	88	
Grand Total	67	1,026	8	19	50	1,265	125	2,310	44	651	79	115	137	900	260	1,666



	Guide								Other								Total	
	Kenai		Kodiak		MatSu		Total		Kenai		Kodiak		MatSu		Total			
Installed	Fail	OK	Fail	OK	Fail	OK	Fail	Ok	Fail	OK	Fail	OK	Fail	OK	Fail	Ok	Fail	Ok
1959	45	1,028	9	39	47	930	101	1,997	71	728	6	37	83	466	160	1,231	505	5,003
1990							0	0		1					0	1	0	1
1994							0	0							0	0	2	0
1995	1	7				7	1	14	1	8				3	1	11	3	59
1996							0	0							0	0	0	2
1997						2	0	2					6		6	0	6	3
1998		2			2	23	2	25						4	0	4	2	50
1999		2				11	0	13		9			1		1	9	3	37
2000	2	23			5	16	7	39		42					0	42	17	145
2001		60				6	0	66		4				12	0	16	10	145
2002			10	6	3	44	13	50				1	2	36	2	37	79	224
2003					6	70	6	70		2			1	29	1	31	9	154
2004		11			5	181	5	192	3	45			8	59	11	104	41	578
2005		29				7	0	36	4	52			3	46	7	98	22	313
2006	5	158			2	196	7	354	2	34			1	28	3	62	15	544
2007		2				4	0	6		11			2	90	2	101	2	178
2008		129			3	9	3	138		24					0	24	4	242
2009	1	22				23	1	45	1	72			1	27	2	99	5	356
2010		8				44	0	52						36	0	36	0	198
2011		153				72	0	225		19				76	0	95	2	777
2012		118			1	126	1	244		20				32	0	52	1	588
Grand Total	54	1,752	19	45	74	1,771	147	3,568	82	1,071	6	38	108	944	196	2,053	728	9,597



Table C 23 – Panels Failing Condition and Retroreflectivity on Medium Speed Roads by Age, Type, and Region

Medium Speed Roads (40-45 mph)

	Regulatory								Warning							
	Kenai		Kodiak		MatSu		Total		Kenai		Kodiak		MatSu		Total	
Installed	Fail	OK	Fail	OK	Fail	OK	Fail	Ok	Fail	OK	Fail	OK	Fail	OK	Fail	Ok
1959	48	623	7	48	29	773	84	1,444	59	293	9	25	105	324	173	642
1995						2	0	2					6	13	6	13
1996	2	15		1			2	16		3		3		2	0	8
1998		7					12	0	19	5				22	0	27
1999		5					2	0	7	1				2	0	3
2000		2			1	1	1	3		1				1	0	2
2001	2	12				9	2	21							0	0
2002	2	6	2	15	5	56	9	77		35	33	59	11	25	44	119
2003		5					18	0	23	2				17	0	19
2004		4			4	92	4	96	7				1	23	1	30
2005	1	94		13		16	1	123	57	6	50		2	28	8	135
2006		50	1	2	3	59	4	111	8		1			22	0	31
2007	1	40			1	32	2	72	28					15	0	43
2008				6		18	0	24		5	24			35	5	59
2009		12				26	0	38	5		4			1	0	10
2010		7				19	0	26						20	0	20
2011	1	12				7	1	19	3					1	0	4
2012		2		23		47	0	72	1		13			17	0	31
Grand Total	57	896	10	108	43	1,189	110	2,193	59	449	53	179	125	568	237	1,196



	Guide								Other								Total	
	Kenai		Kodiak		MatSu		Total		Kenai		Kodiak		MatSu		Total			
Installed	Fail	OK	Fail	OK	Fail	OK	Fail	Ok	Fail	OK	Fail	OK	Fail	OK	Fail	Ok	Fail	Ok
1959	43	1,088	11	63	19	1,023	73	2,174	19	319	1	38	11	150	31	507	361	4,767
1995					2	3	2	3					1	0	1	8	19	
1996		1					0	1							0	0	2	25
1998		10				11	0	21					7	0	7	0	74	
1999						6	0	6					2	2	2	2	18	
2000		2				1	0	3		8					0	8	1	16
2001		12			2	6	2	18		2				4	0	6	4	45
2002		1		5	6	61	6	67				4	1	12	1	16	60	279
2003						18	0	18		1			1	22	1	23	1	83
2004		10			8	59	8	69	2	3				8	2	11	15	206
2005	2	40		2		5	2	47		7				29	0	36	11	341
2006		27		1	2	87	2	115		14				7	0	21	6	278
2007		3				24	0	27		11				5	0	16	2	158
2008						20	0	20		2				9	0	11	5	114
2009						7	0	7						4	0	4	0	59
2010		11				28	0	39		9				12	0	21	0	106
2011		2				9	0	11		3				5	0	8	1	42
2012		2		70		67	0	139				10		9	0	19	0	261
Grand Total	45	1,209	11	141	39	1,435	95	2,785	21	379	1	52	15	286	37	717	479	6,891



Table C 24 – Panels Failing Condition and Retroreflectivity on Low Speed Roads by Age, Type, and Region

Low Speed Roads (Less than 40 mph)

Installed	Regulatory								Warning							
	Kenai		Kodiak		MatSu		Total		Kenai		Kodiak		MatSu		Total	
	Fail	OK	Fail	OK	Fail	OK	Fail	Ok	Fail	OK	Fail	OK	Fail	OK	Fail	Ok
1959	120	1,114	24	147	21	301	165	1,562	81	395	12	36	22	176	115	607
1995	1	3				2	1	5					6	9	6	9
1996	6	8		1			6	9							0	0
1997		3					0	3							0	0
1998		3				6	0	9	1	14			1	10	2	24
1999	1	5					1	5							0	0
2000	2	44				13	2	57	1	17			1	43	2	60
2001	1	63				2	1	65	2	21				3	2	24
2002	2	63		13		28	2	104	5	78	2	26	5	52	12	156
2003		1			1	21	1	22					2	18	2	18
2004		25				32	0	57		16				8	0	24
2005		65	1	11	1	12	2	88	2	32	20	75	1	28	23	135
2006		82		1	1	44	1	127		128				13	0	141
2007		62					0	62	2	25					2	25
2008				29		2	0	31			3	9			3	9
2009		4				26	0	30				4			0	4
2010		45		3		19	0	67		20				24	0	44
2011		9				4	0	13	1	3				3	1	6
2012		1		51		2	0	54				6			0	6
Grand Total	133	1,600	25	256	24	514	182	2,370	95	749	37	156	38	387	170	1,292



	Guide								Other								Total	
	Kenai		Kodiak		MatSu		Total		Kenai		Kodiak		MatSu		Total			
Installed	Fail	OK	Fail	OK	Fail	OK	Fail	Ok	Fail	OK	Fail	OK	Fail	OK	Fail	Ok	Fail	Ok
1959	94	1,484	21	244	40	390	155	2,118	24	435	3	55	15	120	42	610	477	4,897
1995		2				1	0	3							0	0	7	17
1996							0	0							0	0	6	9
1997							0	0							0	0	0	3
1998						4	0	4					1		0	1	2	38
1999							0	0	2						0	2	1	7
2000		4				4	0	8					2		0	2	4	127
2001		42					0	42	12				1		0	13	3	144
2002		3				1	0	4	12						0	12	14	276
2003						14	0	14					5		0	5	3	59
2004		7				6	0	13	12			2	5		2	17	2	111
2005	1	23			2	8	3	31	1	16			2		1	18	29	272
2006		36				25	0	61	2	16			16		2	32	3	361
2007		28					0	28	50						0	50	2	165
2008				9			0	9							0	0	3	49
2009						5	0	5					1		0	1	0	40
2010		72		8		7	0	87	32		12		8		0	52	0	250
2011						6	0	6	7				6		0	13	1	38
2012		4		66		4	0	74			16				0	16	0	150
Grand Total	95	1,705	21	327	42	475	158	2,507	27	594	3	83	17	167	47	844	557	7,013



APPENDIX D – SIGN REPLACEMENT BREAKDOWNS



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TABLES

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SIGN REPLACEMENT BREAKDOWNS

This appendix outlines the method used to develop a potential sign replacement schedule assuming a regular sign inspection system is put in place. We envision this to consist of a two-person team consisting of a driver/observer and a data recorder. The team would traverse the region during periods of darkness to observe both sign conditions and retro-reflectivity, using the methods identified by the FHWA for estimating retro-reflectivity. The results of these inventories would be used to guide sign replacements in the following year, or some increment of years (2,5, etc.)

We used the Sign Life Cycle discussion in the body of the report as the foundation for estimating sign replacement budgets. This work is based primarily on the data collected on dated signs. Undated signs could not be used in age analyses. Based on Table D 1 below, it appears that age stickers were introduced in 1990, but not used consistently on all signs until around 2000. In general, signs last longer than 13 years. While we were able to develop trend lines for retro-reflectivity and condition degradation from the data collected, we do not know if these trends can be extrapolated beyond the available data. We have assumed that they can be.

As mentioned in the report, there are essentially two reasons signs will fail over time – either their condition degrades, or their retro-reflectivity degrades. The data indicate that for each year a group of signs is in the field, 0.88 percent of them will degrade to an unacceptable condition. For that reason, our sign replacement schedule assumes that every year 0.88 percent of signs will need to be replaced.

The replacements due to retro-reflectivity are less clear cut due to the high variability in the retro-reflectivity data. All of the sign colors exhibited a negative correlation between time and retro-reflectivity. The average age of failure for each sign color could be determined by the year when the retro-reflectivity trend line crossed the MUTCD retro-reflectivity threshold. We assumed the age of all the signs at failure would fall within a normal distribution around this average age, generally within plus or minus 7 years of the average value (this ranged up to plus or minus 10 years according to the data). For example, if there was a group of stop signs installed in a given year, the average age at which they would no longer meet retro-reflectivity requirements would be about 21 years. Using our assumptions, the first signs would start to fail at 14 years, half of them would have failed by 21 years, and a few signs would last 28 years. Given that the projected failure age for most colors was beyond the realm of the available data, the true life of retro-reflectivity could be longer than we are projecting.

Since we do not know anything about the age of the undated signs, we cannot reliably estimate when those signs will fail to meet standards. The assumptions we have made, listed below, likely overestimate the number of signs that will fall below required thresholds in next several years.

The replacement schedule is based on several assumptions:

1. All signs observed in unacceptable condition by this inventory are replaced in 2013.
2. Signs are replaced by panel, not by post (i.e., replacing one sign would not trigger replacing all signs on a post).
3. We made three assumptions about undated signs to help produce a potential sign replacement schedule.
 - a. All signs installed since 2000 have date stickers, except two-sided signs.



- b. Guide signs were 70-percent undated, compared with 50-percent for the warning and regulatory signs. We assumed that guide signs should have a similar undated proportion as the warning and regulatory signs and that the “extra” 20 percent of undated guide signs were due to the fact that many guide signs are double sided and do not have a place for date stickers. To account for this, the “extra” undated guide signs were distributed to the years 2011 through 2000 in the same proportions as observed in the warning and regulatory signs.
 - c. Once the “extra” undated signs were distributed, the remaining undated signs were assigned to installation years prior to 2000. This was done by assuming the median number of signs installed in 2000 through 2011 (about 550 signs per year) was representative to the number of signs in each year prior to 2000. This resulted in the 12,000 undated signs being assigned to the years 1977-1999.
4. Since we do not know how many signs have been installed in recent years without date stickers, these assumptions may overstate the age of signs in place.
5. Square feet given are a reflection of current sign square footage. As undersized signs are replaced, the square footage will increase. The overall increase in sign area will be approximately 5 percent and is included in Table D 3.
6. Based on the observed data, 0.88 percent of signs degrade to unacceptable condition each year and will be replaced.
7. Signs are replaced as they fail to meet retro-reflectivity standards. Based on the observed data, on average signs are anticipated to violate retro-reflectivity standards after 21 years of use for regulatory, 16 years for guide, and 17 years for warning signs. Actual failure was assumed to be normally distributed around these average lifespans over 15 year periods, based on variances in the collected data.



Table D 1 – Signs Currently in Unacceptable Condition by Year Installed

Acceptable Condition?	Guide							Regulatory						
	Kenai		Kodiak		Mat Su		Total	Kenai		Kodiak		Mat Su		Total
	No	Yes	No	Yes	No	Yes		No	Yes	No	Yes			
1959 (a)	133	3,649	40	347	84	2,365	6,618	190	2,315	27	211	80	1,663	4,486
1990														
1994		0		0		0		2	0	0	0	0	0	2
1995	1	9		0	2	11	23	1	9	0	0	0	14	24
1996		1		0		0	1	8	24	0	2	0	0	34
1997		0		0		2	2	0	3	0	0	0	1	4
1998		12		0		40	52	0	14	0	0	0	31	45
1999		2		0		17	19	1	11	0	0	1	9	22
2000	2	29		0	5	21	57	5	75	0	0	1	14	95
2001		114		0	2	12	128	9	109	0	0	1	21	140
2002		4	10	11	9	106	140	4	69	2	30	7	140	252
2003		0		0	6	102	108	1	7	0	0	2	79	89
2004		28		0	13	246	287	1	57	0	0	11	221	290
2005	3	92		2	2	20	119	4	229	6	32	1	38	310
2006	5	221		1	4	308	539	1	184	1	3	4	152	345
2007		33		0		28	61	1	123	0	0	1	34	159
2008		129		9	3	29	170	0	47	0	35	1	39	122
2009	1	22		0		35	58	1	54	0	0	1	157	213
2010		91		8		79	178	0	62	0	3	0	96	161
2011		155		0		87	242	1	76	0	0	0	90	167
2012		124		136	1	197	458	0	81	0	74	0	175	330
Grand Total	145	4,715	50	514	131	3,705	9,260	230	3,549	36	390	111	2,974	7,290



Acceptable Condition?	Warning							Other							Total
	Kenai		Kodiak		Mat Su		Total	Kenai		Kodiak		Mat Su		Total	
	No	Yes	No	Yes	No	Yes		No	Yes	No	Yes	No	Yes		
1959 (a)	153	967	34	104	224	843	2,325	114	1,482	10	130	109	736	2,581	16,010
1990									1		0		0	1	1
1994		0		0		0								0	2
1995	1	12		0	12	28	53	1	8		0		4	13	113
1996		4		3		2	9							0	44
1997		0		0		0			0		0	6	0	6	12
1998	1	21		0	1	34	57		0		0		12	12	166
1999		2		0	1	8	11		11		0	3	2	16	68
2000	8	52		0	1	45	106		50		0		2	52	310
2001	4	37		0		7	48		18		0		17	35	351
2002	5	113	93	140	19	102	472		12		5	3	48	68	932
2003		2		0	2	47	51		3		0	2	56	61	309
2004	1	61		0	17	150	229	5	60		0	10	72	147	953
2005	2	133	31	144	4	85	399	5	75		0	3	77	160	988
2006	3	148		2		50	203	4	64		0	1	51	120	1,207
2007	2	101		0		15	118		72		0	2	95	169	507
2008		14	5	36		35	90		26		0		9	35	417
2009		29		8		46	83	1	72		0	1	32	106	460
2010		20		0		86	106		41		12		56	109	554
2011	1	112		0	1	222	336		29		0		87	116	861
2012		38		19		68	125		20		26		41	87	1,000
Grand Total	181	1,866	163	456	282	1,873	4,821	130	2,044	10	173	140	1,397	3,894	25,265

a. Signs dated “1959” did not have date stickers, so their actual installation date is unknown.



Table D 2 – Sign Panels By Age With Undated Distribution Assumptions

Year Installed	Regulatory			Warning		
	Kenai	MatSu	Kodiak	Kenai	MatSu	Kodiak
1977	58	42	5	24	21	3
1978	103	74	9	43	37	5
1979	103	74	9	43	37	5
1980	103	74	9	43	37	5
1981	103	74	9	43	37	5
1982	103	74	9	43	37	5
1983	103	74	9	43	37	5
1984	103	74	9	43	37	5
1985	103	74	9	43	37	5
1986	103	74	9	43	37	5
1987	103	74	9	43	37	5
1988	103	74	9	43	37	5
1989	103	74	9	43	37	5
1990	103	74	9	43	37	5
1991	103	74	9	43	37	5
1992	103	74	9	43	37	5
1993	103	74	9	43	37	5
1994	103	74	9	43	37	5
1995	112	88	9	55	65	5
1996	127	74	11	47	39	8
1997	106	75	9	43	37	5
1998	117	105	9	64	71	5
1999	114	83	9	45	45	5
2000	75	14	0	52	45	0
2001	109	21	0	37	7	0
2002	69	140	30	113	102	140
2003	7	79	0	2	47	0
2004	57	221	0	61	150	0
2005	229	38	32	133	85	144
2006	184	152	3	148	50	2
2007	123	34	0	101	15	0
2008	47	39	35	14	35	36
2009	54	157	0	29	46	8
2010	62	96	3	20	86	0
2011	76	90	0	112	222	0
2012	81	175	74	38	68	19
2013	230	111	36	181	282	163



Year	Guide - Adjusted			Kenai	MatSu	Kodiak
	Kenai	MatSu	Kodiak			
Installed						
1977	73	47	7	37	18	3
1978	129	84	12	66	33	6
1979	129	84	12	66	33	6
1980	129	84	12	66	33	6
1981	129	84	12	66	33	6
1982	129	84	12	66	33	6
1983	129	84	12	66	33	6
1984	129	84	12	66	33	6
1985	129	84	12	66	33	6
1986	129	84	12	66	33	6
1987	129	84	12	66	33	6
1988	129	84	12	66	33	6
1989	129	84	12	66	33	6
1990	129	84	12	67	33	6
1991	129	84	12	66	33	6
1992	129	84	12	66	33	6
1993	129	84	12	66	33	6
1994	129	84	12	66	33	6
1995	146	100	13	74	37	6
1996	134	87	12	66	33	6
1997	129	86	12	66	33	6
1998	153	132	13	66	45	6
1999	135	103	12	77	35	6
2000	52	36	2	50	2	0
2001	135	26	2	18	17	0
2002	76	153	18	12	48	5
2003	16	113	2	3	56	0
2004	87	284	6	60	72	0
2005	172	72	10	75	77	0
2006	286	350	7	64	51	0
2007	66	49	3	72	95	0
2008	154	45	11	26	9	0
2009	58	58	3	72	32	0
2010	123	100	11	41	56	12
2011	216	126	6	29	87	0
2012	179	233	141	20	41	26
2013(a)	267	210	62	130	140	10

a. Assumed all “unacceptable” signs are replaced in 2013



Table D 3 – Sign Panel Replacement Schedule

Year	Regulatory			Warning		
	Kenai	MatSu	Kodiak	Kenai	MatSu	Kodiak
2014	458	333	40	238	214	32
2015	458	334	40	239	215	35
2016	455	334	40	238	215	38
2017	451	334	40	239	215	43
2018	445	333	39	241	217	50
2019	117	102	11	72	70	37
2020	109	102	11	73	71	37
2021	103	102	11	78	75	38
2022	100	107	12	82	72	38
2023	98	116	13	82	71	33
2024	100	122	13	79	72	28
2025	106	127	13	74	78	25
2026	114	126	14	75	93	25
2027	114	125	15	85	113	26
2028	109	124	15	101	136	31
2029	106	128	18	121	154	37
2030	111	139	20	146	174	44
2031	128	154	23	168	184	45
2032	157	175	28	180	185	44
2033	198	202	34	181	178	43
2034	248	231	36	174	165	42
2035	296	261	38	156	145	39



Guide - Adjusted

Year	Kenai	MatSu	Kodiak	Kenai	MatSu	Kodiak
2014	695	478	63	18	12	2
2015	686	478	62	18	12	2
2016	672	477	60	18	12	2
2017	664	481	60	18	12	2
2018	657	492	59	18	12	2
2019	120	147	9	18	12	2
2020	124	153	8	18	12	2
2021	134	153	9	18	12	2
2022	142	151	10	18	12	2
2023	146	139	12	18	12	2
2024	156	135	17	18	12	2
2025	172	141	24	18	12	2
2026	206	162	32	18	12	2
2027	256	196	41	18	12	2
2028	313	239	52	18	12	2
2029	380	286	56	18	12	2
2030	447	331	57	18	12	2
2031	483	357	56	18	12	2
2032	486	362	52	18	12	2
2033	458	348	45	18	12	2
2034	402	314	37	18	12	2
2035	320	263	29	18	12	2

Table D 4 – Potential Sign Replacement Schedule

Years from 2014	Guide							
	Kenai		Kodiak		Mat Su		Total	
	Panels	SF	Panels	SF	Panels	SF	Panels	SF
0-5	3,374	19,333	2,406	13,786	305	1,748	6,085	34,867
5-10	666	3,816	743	4,257	48	275	1,457	8,349
10-15	1,103	6,320	873	5,002	166	951	2,142	12,274
15-20	2,254	12,915	1,684	9,649	266	1,524	4,204	24,089

Years from 2014	Regulatory							
	Kenai		Kodiak		Mat Su		Total	
	Panels	SF	Panels	SF	Panels	SF	Panels	SF
0-5	2,269	13,478	1,668	9,908	199	1,182	4,136	24,568
5-10	527	3,130	529	3,142	58	345	1,114	6,617



10-15	543	3,225	624	3,707	70	416	1,237	7,348
15-20	700	4,158	798	4,740	123	731	1,621	9,629

Years from 2014	Warning							
	Kenai		Kodiak		Mat Su		Total	
	Panels	SF	Panels	SF	Panels	SF	Panels	SF
0-5	1,195	13,014	1,078	11,739	200	2,178	2,473	26,931
5-10	387	4,214	359	3,910	183	1,993	929	10,117
10-15	414	4,508	492	5,358	135	1,470	1,041	11,336
15-20	796	8,668	875	9,529	213	2,320	1,884	20,517

Years from 2014	Other							
	Kenai		Kodiak		Mat Su		Total	
	Panels	SF	Panels	SF	Panels	SF	Panels	SF
0-5	90	518	60	346	10	58	160	922
5-10	90	518	60	346	10	58	160	922
10-15	90	518	60	346	10	58	160	922
15-20	90	518	60	346	10	58	160	922

Table D 5 – Potential Sign Replacement Schedule Summary

Years from 2014	Total							
	Kenai		Kodiak		Mat Su		Total	
	Panels	SF	Panels	SF	Panels	SF	Panels	SF
0-5	6,928	46,343	5,212	35,779	714	5,165	12,854	87,287
5-10	1,670	11,679	1,691	11,655	299	2,670	3,660	26,004
10-15	2,150	14,572	2,049	14,412	381	2,895	4,580	31,880
15-20	3,840	26,260	3,417	24,264	612	4,632	7,869	55,156



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APPENDIX E – SIGN TYPE ‘CHEAT SHEETS’



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GUIDE

 D1-1 VAR X 24	 D1-1A VAR X 24	 D1-2A-1 VAR X 36	 D1-2A-2 VAR X 24	 D2-1 VAR X 24	 D3-1 VAR X 12	 D3-1B VAR X 18	 D3-1C VAR X 42					
 D3-1D VAR X 12	 D3-2 VAR X 24	 D4-1 30 X 24	 D4-2 30 X 36	 D7-2 VAR X 30	 D7-105 36 X 48	 D7-RW-050* 24 X 24	 D7-RW-070* 24 X 24					
 D7-RW-080* 24 X 24	 D7-RL-100* 24 X 24	 D9-1* 24 X 24	 D9-1A* 24 X 30	 D9-1B* 24 X 30	 D9-1C 30 X 36	 D9-2 24 X 24	 D9-3* 24 X 24	 D9-3X* 24 X 24 24 X 6	 D9-4* 24 X 24	 D9-4X* 24 X 24 24 X 6	 D9-5* 24 X 24	 D9-6* 24 X 24
 D9-7* 24 X 24	 D9-8* 24 X 24	 D9-10* 24 X 24 24 X 6	 D9-11* 24 X 24	 D9-12* 24 X 24	 D9-13 24 X 24	 D9-15* 24 X 24	 D9-102* 24 X 24	 D9-103* 24 X 30	 D9-104 24 X 24 24 X 6	 D9-105* 24 X 24 24 X 6	 D9-106* 24 X 24 24 X 6	
 D9-210 72 X 24	 D9-221 84 X 30	 D9-230 24 X 36	 D9-301* 24 X 6	 D9-302* 24 X 6	 D9-303* 24 X 9	 D9-304* 24 X 6						
 D9-305* 24 X 6	 D9-306* 24 X 6	 D9-308* 24 X 6	 D10-1 10 X 18	 D10-2 10 X 27	 D10-3 10 X 36	 D11-1 30 X 24	 I-3 VAR X 36	 I-5* 30 X 30	 I-8* 24 X 24	 I-8P* 24 X 12		
 I-102 24 X 24 24 X 8	 I-121 72 X 36	 I-150 30 X 24 30 X 12	 I-160 30 X 36	 I-161 30 X 30	 I-162 30 X 12	 I-163 30 X 12	 I-180 30 X 18	 I-181 30 X 18				
 M1-5 36 X 36	 M2-1 21 X 15	 M2-2 72 X 60	 M3-1 30 X 15	 M3-2 30 X 15	 M3-3 30 X 15	 M3-4 30 X 15	 M4-1 30 X 15	 M4-2 30 X 15	 M4-3 30 X 15			
 M5-1 21 X 15	 M5-2 21 X 15	 M6-1 21 X 15	 M6-2 21 X 15	 M6-3 21 X 15	 M6-4 21 X 15	 M6-5 21 X 15	 M6-6 21 X 15	 M6-7 21 X 15				

* MOTORIST SERVICE - BLUE
RECREATIONAL/CULTURAL - BROWN
DESTINATION AND DISTANCE - GREEN

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES

SIGNS ARE BASED UPON THE ALASKA SIGN DESIGN SPECIFICATIONS (ASDS) AVAILABLE AT www.dot.alaska.gov.
SIGN DIMENSIONS SHOWN ARE CONVENTIONAL SIZES FOR TYPICAL STATE HIGHWAYS WITH POSTED SPEED LIMITS OF 35 MPH OR GREATER.
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REVISION DATE 4/6/07



REGULATORY

R1-1 30X30	R1-2 36X36	R1-2A 24X18	R1-8 12X6	R1-4 18 X8	R2-1 30X36	R2-5A 24X30	R2-5C 30X36	R3-1 30X30	R3-2 30X30	R3-3 30X30	R3-4 30X30		
R3-5(L/R) 30X36	R3-5A 30X36	R3-6(L/R) 30X36	R3-7L 36X36	R3-7R 36X36	R3-8(L,R) VPRXVPR	R3-9A 30X36	R3-9B 24X36	R4-1 30X36	R4-2 30X36				
R4-3 36X48	R4-5 36X48	R4-6 36X48	R4-9A 48X36	R4-9B 48X48	R4-7 24X30	R4-7A 24X30	R4-7B 24X30	R4-8 24X30	R4-9 24X30	R4-100 36X48	R5-1 36X36		
R5-1A 36X24	R5-3 24X24	R5-6 30X30	R5-10B 30X18	R5-10C 24X12	R5-1(R/L) 36X12	R5-2(R/L) 24X30	R5-7(R/L) 12X18	R5-10B(R/L) 12X18	R7-202 24X12	R8-1 24X30	R8-1A 24X12		
R8-2 24X30	R8-3 24X30	R8-3AP 24X(NAP)	R8-3A 24X24	R8-4 30X24	R8-5 24X30	R8-6 24X30	R8-7 30X24	R8-8 36X48	R8-100 30X36	R8-1 18X24	R8-2 12X18	R8-3A 18X18	R8-3B1 18X12
R9-5 12X18	R9-6 12X18	R9-9 24X12	R9-10 24X12	R9-11L 36X24	R9-10L 24X12	R10-2A 9X12	R10-2A 9X12	R10-3B 9X12	R10-4A 9X12				
R10-8 6X8	R10-5 24X30	R10-6(L/R) 24X36	R10-7 24X30	R10-8 24X30	R10-11A 24X30	R10-11B 24X24	R10-11C 24X30	R10-11D 24X30	R10-12 30X36	R10-100 30X36			
R11-1 24X30	R11-2 48X30	R11-4 60X30	R12-1 24X30	R12-2 24X30	R12-3 24X36	R12-100 24X36	R12-101 24X42	R12-102 42X48	R13-1 72X48	R13-100 48 X72			
R14-1 24X18	R14-1A(L/R) 30X42	R15-1 9X48	R15-2 27X9	R15-3 24X12	R16-103 84X36	R16-104 48X24							
R16-105 54X30	R16-106 42X42	R16-107 24X30	R16-108 18X24	R16-109 30X14	R16-110 42X42	R16-111 48X36							

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WARNING

W1-1(RL) 36 X 36	W1-2(RL) 36 X 36	W1-3(RL) 36 X 36	W1-4(RL) 36 X 36	W1-5(RL) 36 X 36	W1-6(RL) 48 X 24	W1-7 48 X 24	W1-8(RL) 24 X 20	W1-10(RL) 36 X 36	W1-101(RL) 36 X 36	W1-101(RL) 36 X 36
W2-1 36 X 36	W2-2(RL) 36 X 36	W2-3(RL) 36 X 36	W2-4 36 X 36	W2-5 36 X 36	W2-6 36 X 36	W2-7 36 X 36	W2-8 36 X 36	W2-9 36 X 36	W2-10 36 X 36	W2-11 36 X 36
W4-3(RL) 48 X 48	W4-4P 30 X 15	W5-1 36 X 36	W5-1A 36 X 28	W5-2 36 X 36	W5-3 36 X 36	W5-4 36 X 36	W5-1 36 X 36	W5-2 36 X 36	W5-3 36 X 36	W5-100 36 X 36
W7-1 36 X 36	W7-3 24 X 18	W7-3A 24 X 18	W7-100 36 X 36	W7-101 36 X 36	W7-102 36 X 36	W7-1 36 X 36	W7-1A 36 X 36	W7-2 36 X 36	W7-2A 36 X 36	W7-3 36 X 36
W9-4 36 X 36	W9-4P 24 X 18	W9-5 36 X 36	W9-6 36 X 36	W9-6 36 X 36	W9-6A 36 X 36	W9-1(RL) 36 X 36	W9-2(RL) 36 X 36	W9-1 36 X 36	W9-2 36 X 36	W9-3 36 X 36
W10-5 36 X 36	W10-11A 36 X 36	W10-100 24 X 18	W11-1 36 X 36	W11-2 36 X 36	W11-3 36 X 36	W11-5 36 X 36	W11-7 36 X 36	W11-4 36 X 36	W11-4A 36 X 36	W11-10 36 X 36
W11-100 36 X 36	W11-101 36 X 36	W11-103 36 X 36	W11-104 36 X 36	W11-107 36 X 36	W12-1 36 X 36	W12-2 36 X 36	W12-2P 78 X 24	W12-100 24 X 18	W13-1 24 X 24	W13-1A 18 X 18
W13-2 36 X 48	W13-3 36 X 48	W14-1 30 X 36	W14-2 36 X 36	W14-3 48 X 36	W14-100 30 X 30	W14-101 36 X 36	W14-102 36 X 36	W14-103 36 X 36	W14-104 36 X 36	W14-105 78 X 48
W16-1 24 X 30	W16-2P 36 X 28	W16-7(P/L/P/R) 30 X 18	W16-4P VAR X 12	W16-4P VAR X 12	W16-100 36 X 36	W16-101 36 X 36	W16-102 36 X 36	W16-102 36 X 36	W16-103 36 X 36	W16-104 36 X 36
W16-105 36 X 36	W16-106 36 X 36	W16-107 60 X 60	W16-108 36 X 36	W16-108 36 X 36	W16-110 36 X 36	W16-111 36 X 36	W16-112 60 X 48	W16-113 30 X 36	W16-114 36 X 36	W17-1 36 X 36
S5-1 36 X 36	S4-1 36 X 18	S4-3 36 X 12	S5-1 36 X 72	S5-2 24 X 28	S5-2A 30 X 12	S6-1 18 X 24	DM1-1 18 X 18	DM1-1 18 X 18	DM1-1 18 X 18	DM1-1 18 X 18

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