

# Origin-Destination Data Memo

## Introduction

The Alaska Department of Transportation (DOT&PF) has retained Kinney Engineering, LLC (KE) as a subconsultant to DOWL for the *Juneau-Douglas North Channel Crossing Planning & Environmental Linkage (PEL) Study*, which will evaluate alternatives and determine recommended crossing location(s) for a second bridge crossing of the Gastineau channel to and from Douglas Island, north of the existing Juneau-Douglas Bridge. This memo provides a general description of existing Origin-Destination data that was gathered to forecast volumes for each bridge location. Volume forecasts for each bridge will be included in a separate memo.

## Introduction to Location-Based Service (LBS) and Other “Big” Data

There are numerous software services that gather location data from users and use that information to provide location-specific information. Examples of these types of services include navigation software and location-based advertising. Software-as-a-service analytics companies buy this anonymized data and combine it with other purchased data sources (such as connected vehicles and roadway sensors) to provide information such as travel times, travel speeds, and travel paths. These types of services and data sources will be used for the Juneau origin-destination analysis for this project.

Research is underway to determine the accuracy and usefulness of this data for numerous applications. For example, the Eastern Transportation Coalition, a partnership between 17 eastern states and DC, has an initiative to prequalify analytics vendors to provide travel time and speed, origin-destination, freight, waypoint, volume, and conflation data to agencies. To date, three vendors (HERE, INRIX, and TomTom) have been pre-qualified for providing validated travel time and speed data. A current project will pre-qualify twelve vendors for all six datasets (see [TDM Fact Sheet](#) and [Data Validation Reports](#)).

Because LBS analytics is an emerging service, the landscape is changing rapidly (i.e. new data sources are frequently added and new tools for evaluating them are being developed) and not all possible uses of the data have been fully vetted. That being said, the information gathered by analytics companies provides significantly more travel path detail and is less time consuming to gather than information gathered using traditional methods (such as license plate surveys or household travel surveys). As such, the LBS data can be used for a range of planning purposes.

## Data Purchased for the Juneau-Douglas North Channel PEL

The Origin-Destination dataset for this project was provided by INRIX (an analytics vendor supplying LBS data) through IDAX (a distributor of INRIX data) for the months of March, April, May, and June 2022. INRIX gathered the data from 14 providers, including 3 providers monitoring fleet vehicles with embedded GPS, 4 providers monitoring consumer vehicles with embedded GPS, and 7 providers monitoring consumer mobile devices. The data includes trip start and end points, as well as waypoints (indicating the route taken). The frequency of the waypoint data varies from once every second to once every 12 minutes. All of the trips in the data set have at least one waypoint either on the Douglas Bridge, or on Egan Drive/Glacier Highway between the bridge and the Auke Bay roundabout.

A total of 83,973 trips were provided from March through June 2022; about 85% of the trips came from a single mobile device provider that was added to the INRIX dataset at the end of April 2022. As such, this memo focuses on the 76,168 trips that occurred between April 29, 2022 and June 28, 2022.

The INRIX dataset includes only the portion of the total trips traveling in the City and Borough of Juneau that can be tracked by the data providers. As such, this memorandum compares the INRIX volumes with traffic volumes collected at DOT&PF continuous count stations (CCSs) to estimate how much of the total traffic was captured by the INRIX data.

Figure 1 shows the census tract and block group boundaries for the study area, including Douglas Island, Downtown Juneau, Lemon Creek, Mendenhall Valley, and Auke Bay. Figure 2 shows the locations of four DOT&PF CCSs (Auke Bay, Sunny Point, Egan at Mile 3, and South Douglas Highway).

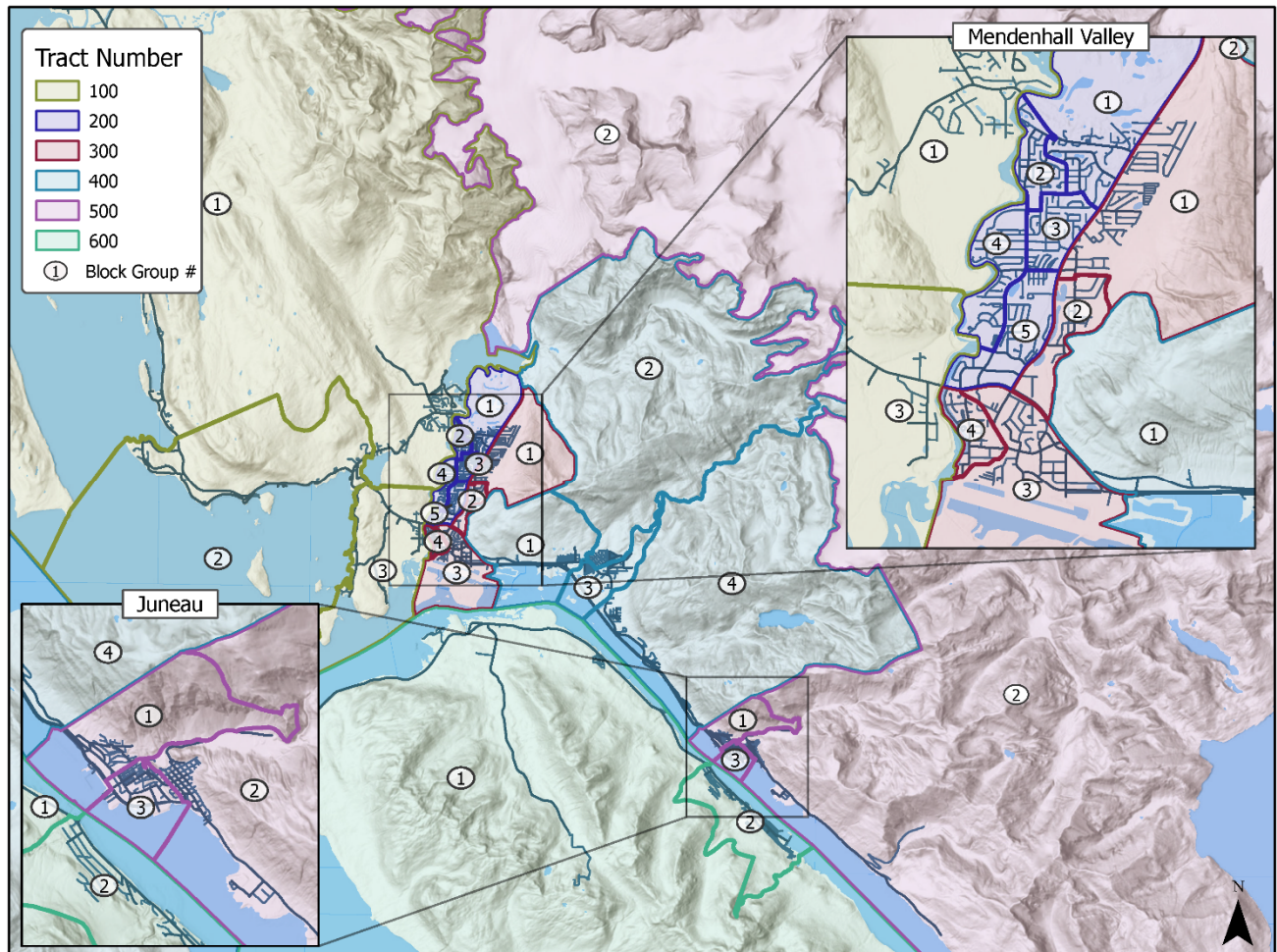
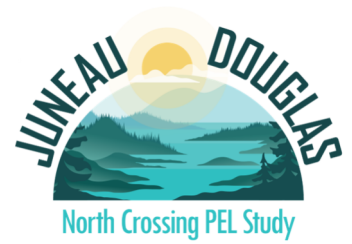


Figure 1: Census Tract and Block Groups in Study Area



Figure 2: DOT&PF Continuous Count Stations Used in the Analysis



## Analysis

### Seasonality

Because the majority of the trips collected from INRIX occurred in May and June, the data set represents spring/summer traffic patterns. The May data includes the period while school is in session, and the June data includes the beginning of the cruise ship season. Because the data was not collected in winter months, it does not include winter recreation trips to Eaglecrest Ski Area. Origin-destination patterns are somewhat different in summer and winter because the ski area is situated on the north side of Douglas Island while most other Douglas Island tourist/recreational destinations are south of the Juneau-Douglas bridge.

Winter trips to Eaglecrest Ski Area were estimated from information provided by Eaglecrest Ski Area, as well as from the 2012 Eaglecrest Ski Area Master Plan and their current website. Average daily trips in winter range from 500 to 800 trips per day, with as many as 1,600 trips on individual days when snow conditions are very good. This estimate corresponds with data collected by DOT&PF on Fish Creek Road at Fish Creek Bridge for one week in February 2006 and one week in March 2012. For both weeks, the average volume was 700 vehicles per day.

### Statistical Analysis of the INRIX Dataset for Origin-Destination Analysis

The INRIX dataset can be organized into an origin-destination table showing the number of trips in the dataset that start in each census block group (corresponding to the rows in the table) and end in each census block group (corresponding to the columns in each table). For the purposes of forecasting volumes on each of the proposed bridges, the data will be converted to percentages of trips. As such, the data becomes a percentage likelihood, with the likelihood that any trip within Juneau starting in one census block group and ending in another being estimated as the percentage of total INRIX trips that were observed traveling between those census block groups.

When performing statistical analysis of percentage likelihood, it is desirable for there to be at least 5 data points in each cell of the table. The standard error of the percentage in each cell can then be determined by the equation:

$$SE = \sqrt{\frac{P(1 - P)}{n}}$$

The 95<sup>th</sup> percentile confidence interval for the percentage likelihood can be calculated using the equation:

$$Confidence\ Interval = P \pm 1.96(SE)$$

The origin-destination table using all of the census tracts and block groups separately has many cells that contain less than 5 data points. As such, the areas were combined to obtain statistically valid results. To obtain statistically valid results for less aggregated data, additional data would be needed; however, the data could be aggregated in other ways to obtain equally valid data sets. Table 1 shows the percentage likelihoods and confidence intervals for the resulting origin-destination table. Figure 3 shows the location of the combined census tract and block group areas.

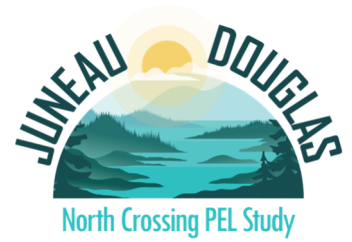


Table 1: Origin Destination Percentage Likelihood and Confidence Interval

		Destination Zone				
		Point Lena / Auke Bay / Mendenhall Valley	Sunny Point / Lemon Creek / Twin Lakes	Downtown Juneau	North Douglas Island	South Douglas Island
Origin Zone	Point Lena / Auke Bay / Mendenhall Valley				3.3% (1.3 to 5.3%)	13.2% (11.4 to 15.1%)
	Sunny Point / Lemon Creek / Twin Lakes				4.5% (2.6 to 6.5%)	13.4% (11.5 to 15.2%)
	Downtown Juneau				3.8% (1.9 to 5.8%)	8.8% (6.9 to 10.6%)
	North Douglas Island	3.7% (1.8 to 5.7%)	4.1% (2.2 to 6.1%)	4.1% (2.2 to 6.1%)	3.9% (2.0 to 5.9%)	
	South Douglas Island	11.6% (9.7 to 13.5%)	10.5% (8.6 to 12.4%)	9.0% (7.1 to 10.9%)		5.9% (4.0 to 7.9%)

Incorporating the trip estimates for Eaglecrest Ski Area, in wintertime about 30% of the bridge traffic heads to North Douglas and 70% to South Douglas, while in the summertime, about 25% of the bridge traffic heads to North Douglas and 75% to South Douglas.

The percentage likelihood and confidence intervals from Table 1 will be used to develop the volume forecasts for each proposed bridge location. Whether or not a proposed bridge will be used will be determined by comparing travel time using the proposed bridge with travel time using the existing bridge. These percentages will inform the amount of the forecasted bridge volume that would switch to the proposed bridge if it were built, for each combination of origin and destinations.

Table 1 presents the average and likely range of the percentage of all trips between each origin and destination pair. By using the 90% confidence interval for the origin destination it can be seen that the largest volume of vehicles at 13.4% are traveling from Sunny Point/Lemon Creek/Twin Lakes to South Douglas.

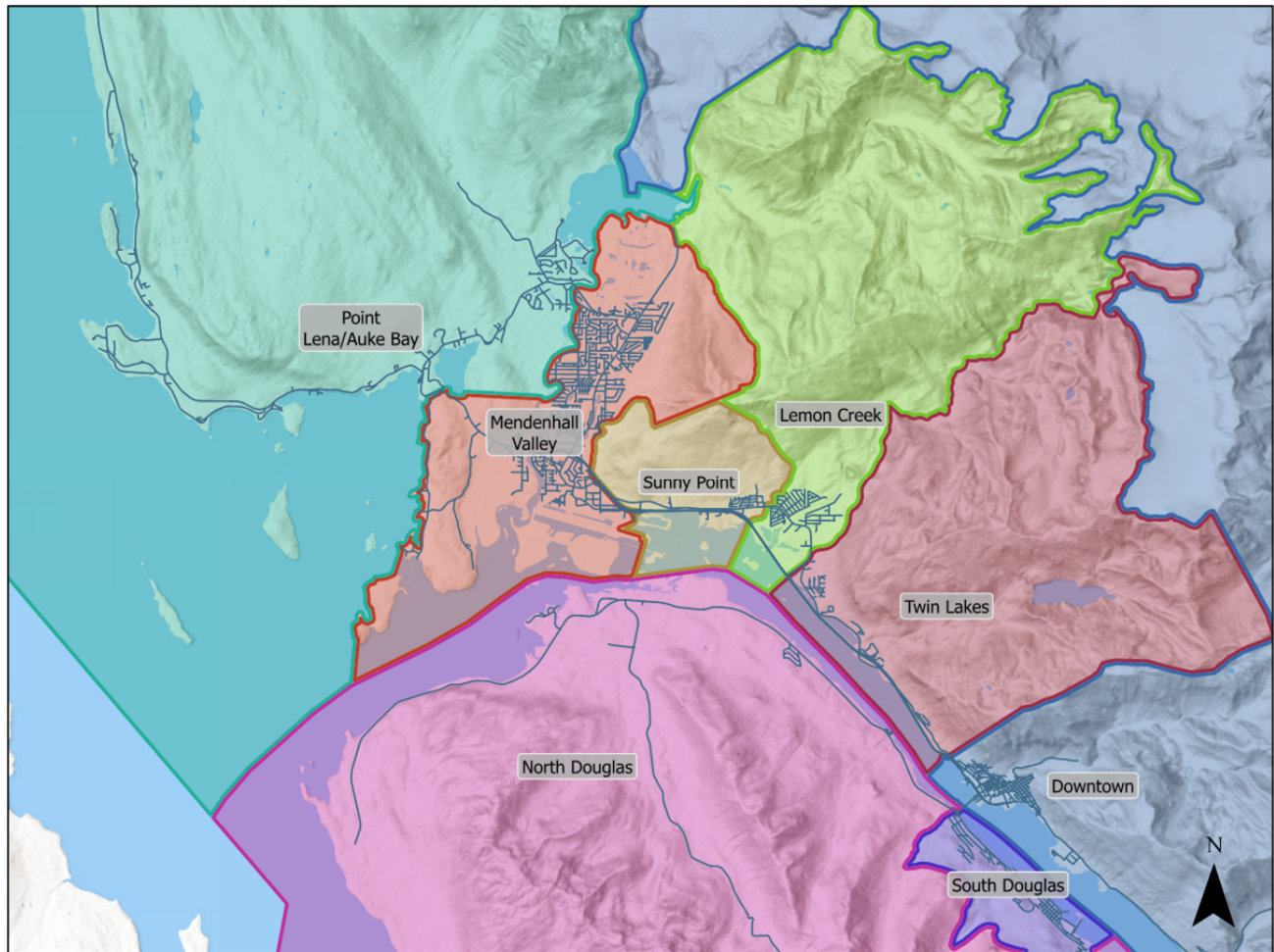


Figure 3: Combined Areas for Statistical Analysis

## Comparison of Origin-Destination Data to Volume Counts

DOT&PF collects traffic volumes at continuous count station (CCS) locations year-round and publishes that data online. As such, traffic volumes at these sites can be collected for the same period as the INRIX data set. The DOT&PF data includes all vehicles that pass a specific location but is limited in that counts are only available at select locations and trip origin and destination locations are unknown. The INRIX data includes trip origin and destination data but is pulled from limited sources and therefore does not include all trips. There are four CCSs in the area covered by the INRIX data. For each CCS, Table 2 provides an estimate of the volume of INRIX trips passing that point (based on the origin and destination census tracts and block groups) and compares it to the DOT&PF traffic volumes at that CCS location. The INRIX trip volumes range from 1.3% to 1.7% of the total DOT&PF volumes (average of 1.5%).

Table 2: DOT&PF Continuous Count Station Volumes compared to INRIX Data (April 29-June 28, 2022)

<u>Location</u>	DOT&PF Continuous Count Station Volume	INRIX Data	INRIX as % of DOT&PF Volume
Auke Bay (TMAS 000805)	167,115	2,570	1.5%
Sunny Point (TMAS 000896)	1,616,584	21,097	1.3%
Egan Drive at mile 3 (TMAS 000806)	1,272,690	21,302	1.7%
South Douglas Highway (TMAS 000918)	459,485	6,671	1.5%

## Exploration of Raw Origin-Destination Data

Table 3 shows the number of INRIX trips traveling from Douglas Island to mainland Juneau and from mainland Juneau to Douglas Island. A further breakdown of INRIX trips in Table 4 and Table 5 shows that most of this traffic (about 75%) is going to and from the southern side of Douglas Island (Tract 6 Block 2).

Table 3: INRIX trips between Douglas Island and Juneau Mainland (April 29-June 28, 2022)

INRIX Data		<u>Destination</u>	
		Douglas Island	Juneau Mainland
<u>Origin Location</u>	Douglas Island	-	4,200
	Juneau Mainland	4,577	-

Table 4: INRIX Trips with Douglas Island (Tract 6) Destinations (April 29-June 28, 2022)

INRIX Data		<u>Destination</u>	
		North Douglas (Tract 6 Block 1 A,B,C)	South Douglas (Tract 6 Block 2)
<u>Origin Location</u>	Juneau Mainland (Tracts 1-5)	1,132	3,445

Table 5: INRIX Trips with Douglas Island (Tract 6) Origins (April 29-June 28, 2022)

INRIX Data		<u>Destination</u>
		Juneau (Tracts 1-5)
<u>Origin Location</u>	North Douglas (Tract 6 Block 1)	1,171
	South Douglas (Tract 6 Block 2)	3,029