Wasilla Main Street Traffic Study

IRIS Program No. Z600770000
Federal Project No. 0001408

Traffic Analysis Report

August 2017

Prepared for
HDR-Alaska and
Alaska Department of
Transportation and
Public Facilities

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Abbreviations

AADT	Annual Average Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
AMATS	Anchorage Metropolitan Area Transportation Solutions
DOT&PF	Alaska Department of Transportation and Public Facilities
GIS	Geographic Information System
HCM	Highway Capacity Manual
HSIP	Highway Safety Improvement Program
LOS	Level-of-Service
LRTP	Long Range Transportation Plan
MASCOT	Mat-Su Community Transit
MEV	Million Entering Vehicles
MOA	Municipality of Anchorage
MSB	Matanuska Susitna Borough
KE	Kinney Engineering, LLC
NCHRP	National Cooperative Highway Research Program
PGDHS	A Policy on the Geometric Design of Highways and Streets
PLOS	Pedestrian Level of Service
SRTS	Safe Routes to School
TMV	Turning Movement Volume

Definition of Terms

Access: Ability to enter and exit a given location from a public roadway.

Annual Average Daily Traffic (AADT): A measurement of the number of vehicles traveling on a segment of highway each day, averaged over the year.

Capacity: The maximum number of users able to pass through a point of a given facility during a particular period of time. The number of users able to pass is dependent on roadway geometry, traffic conditions, control type, and environmental conditions.

Flow Rate: Measurement of the number of vehicles passing a given point within a set amount of time, usually an hour.

Level of Service (LOS): Performance measure concept used to quantify the operational performance of a facility and present the information to users and operating agencies. The actual performance measure used varies by the type of facility; however, all use a scale of A (best conditions for individual users) to F (worst conditions). Often, LOS C or D in the most congested hours of the day will provide the optimal societal benefits for the required construction and maintenance costs.

Mobility: Ability of people and goods to move from one place to another. A high level of mobility, such as that on an interstate, means vehicles can move freely with little delay. Within urban centers, the level of mobility will be lower as traffic entering and exiting the traffic stream from driveways and side streets will slow traffic.

Peak Hour: Hour-long period during which traffic volumes are higher than all other hours within a specified time period. Morning, midday, and evening periods are often used for analysis, although peak hours may occur at other times, such as school dismissal.

Peak Hour Factor (PHF): Measure of traffic variability over an hour period calculated by dividing the hourly flowrate by the peak 15-minute flowrate. PHF values can vary from 0.25 (all traffic for the hour arrives in the same 15-minute period) to 1.00 (traffic is spread evenly throughout the hour).

Permanent Traffic Recorder (PTR): Permanently installed device that counts all vehicles on a given roadway. The device may record other information as well, such as vehicle classification.

Functional Area: The area where intersection operation and conflicts significantly influence driver behavior, vehicles operations, or traffic conditions.

Impact Distance: Distance upstream of an access connection at which the brake lights of a through vehicle in the curb lane are activated in response to the interference of a right-turning vehicle.

Perception Reaction Time: The time it takes a driver to detect an object, identify the object, decide on a response, and initiate a response.

Platoon: A group of vehicles or pedestrians traveling together as a group, either voluntarily or involuntarily because of signal control, geometrics, or other factors.

Stopping Sight Distance: The minimum desired length of roadway on which a below-average driver moving at the design speed will be able to recognize a stationary object in the road and bring their vehicle to a stop before colliding with the observed object.

Executive Summary

The Alaska Department of Transportation and Public Facilities (DOT&PF) has retained HDR-Alaska and Kinney Engineering, LLC (KE) to update the traffic analysis report for the Wasilla Main Street Traffic Study to a new design year of 2043. The project addresses existing and future congestion in the downtown urban core of Wasilla. Previous studies (between 2006 and 2012) identified a preferred alternative: the development of a one-way couplet, with southbound traffic traveling along Main Street and Knik-Goose Bay Road and northbound traffic traveling along Yenlo Street and Talkeetna Street. Figure 1 shows a schematic of the preferred alternative analyzed for this study.

Figure 1. Executive Summary: Preferred Alternative Design Map

As shown in the figure, the couplet would span Wasilla between Enter Way on Knik-Goose Bay Road on the south end, and Bogard Road on the north end. Bogard Road will serve as a turnaround point for traffic generated on Yenlo Street desiring to travel south. In addition to addressing congestion, pedestrian connectivity in the downtown area is being addressed. The recommended cross section for the one-way roadways forming the couplet is 2-lanes, with wider sidewalks and some areas of on street parking. In addition to updating the design year volumes, this report revisits recommendations for intersection control, auxiliary lanes and lane lengths, and side street approach design.

The safety analysis was also updated. Previous studies considered the crashes that occurred between 1999 and 2008 to determine the effect of the proposed design on safety. This report updates the safety analysis to look at crashes that occurred during the years 2003 to 2012. General conclusions of the new analysis are similar to the previous analysis. Along the proposed couplet, some intersections will experience increased crash rates due to an increase in traffic volume and a redistribution of trips. However, the installation of a couplet will reduce overall crash rates by approximately 10%. Crash severity, however, is expected to be reduced due to reductions in the speeds and increased platooning.

Traffic volumes for the 2043 design year were estimated using a new 2040 travel demand model for Anchorage and Mat-Su. For this report, the model was updated to improve the accuracy of traffic generation and distribution surrounding the study area, and a screenline analysis further refined the volumes for design. A background growth rate of 1.0% was derived to project 2043 volumes from the adjusted 2040 volumes.

The impacts of the Parks Highway Alternative Corridor on the design were examined by modifying the travel demand model. The effect of the Alternative Corridor was a reduction in traffic on the Parks Highway and Knik-Goose Bay Road. The traffic design recommendations in this report are based on a model without the Alternative Corridor; however, performance of the proposed design was analyzed for both cases.

As shown in Figure 1, four new signals are proposed as part of this project:

1. Main Street and Swanson Avenue
2. Yenlo Street and Parks Highway
3. Yenlo Street and Swanson Avenue
4. Yenlo Street and Bogard Road

Likewise, the existing signals in the study area will need to be reconfigured to work with the new road network. No signals are warranted or recommended south of the Parks Highway; however, it is possible that future development east of Talkeetna Street could generate adequate traffic to warrant a signal, depending on how the road network is developed.

Table 1 presents the recommended lengths for auxiliary lanes that are recommended as part of this project.

Table 1. Executive Summary: Recommended Auxiliary Turn-Lane Lengths

Intersection	Recommended Auxiliary Lane	Recommended Auxiliary Lane Length (ft)
Main St & Bogard Rd/Nelson Rd	Southbound Left-Turn	225
	Southbound Right-Turn	225
	Westbound Right-Turn	275
	Eastbound Left-Turn	175
	Eastbound Right-Turn	175
Main St and Swanson Rd	Westbound Left-Turn	150
Main St and Herning Ave	Westbound Left-Turn	150
Parks Hwy and Main St	Southbound Right-Turn	400
	Dual Westbound Left-Turn	400
	Eastbound Right-Turn	400
Enter Way with Knik-Goose Bay	Southbound Left-Turn	400
	Northbound Left-Turn	400
Parks Hwy and Yenlo St	Northbound Left-Turn	375
	Northbound Right-Turn	350
	Westbound Right-Turn	400
	Dual Eastbound Left-Turn	400
Yenlo St and Herning Ave	Westbound Right-Turn	175
	Eastbound Left-Turn	150
Yenlo St and Swanson Ave	Westbound Right-Turn	250
	Eastbound Left-Turn	150

Traffic operations were reviewed for both the no build alternative and under the proposed alternative, using the updated 2043 design year. DOT&PF has selected a target level-of-service of E or better during the PM peak hour in 2043. LOS E is typically not accepted; however, it has been seen in this and previous studies that the operation of the Parks Highway signals are highly dependent on additional through lanes on the Parks Highway which is outside the scope of this project to address.

Analysis suggest that vehicle and pedestrian operations are currently failing at the Main Street intersections of Parks Highway and Swanson Avenue. Models using Highway Capacity Manual calculation methods show that in a no build scenario (no proposed couplet alternative and no Parks Highway Alternative Corridor) vehicle operations along Main Street will be failing (LOS F) at the intersections of Swanson Avenue, Herning Avenue, and Parks Highway, by the construction year of 2023. By 2043 left turns off the side streets will experience very high delay, with calculations showing only 4 usable gaps during the PM peak hour.

Under the proposed alternative, the traffic signals will all operate at LOS E or better. Only two movements, the dual eastbound left-turn at Parks Highway and Yenlo Street and the southbound right-turn at the intersection of the Parks Highway and Main Street, will operate at LOS F (about two minutes of delay per vehicle for those movements in the PM peak).

Under the proposed alternative, forecasted 2043 pedestrian delay is projected be similar to current conditions at unsignalized crossings; however, given the nature of one-way streets with adjacent signals, more crossing gaps will be available more frequently.

Analysis of the westbound approach of Herning Avenue to Yenlo Street indicates that the approach is projected to have high enough volumes to warrant an auxiliary right-turn lane. However, due to geometry constraints, it is likely that there will not be adequate space to fit an additional lane at this approach. Even with the additional turn lane, queues of approximately 75 feet are expected. The current configuration of the parking lot will make it difficult to accommodate queues even of this length within the parking lot adjacent to the intersection. As a result, consideration was given to converting the westbound approach at Yenlo Street and Herning Avenue to a restricted right-in right-out driveway. The results show that this option would increase delay for critical movements within the network (including the eastbound dual left turn from the Parks Highway onto Yenlo Street) without reducing queues in the Carrs parking lot.

An additional concern is the driveways into the Carrs parking lot along the Parks Highway, on the westbound approach to the proposed Yenlo Street signal. These driveways provide access to a major generator, and are unlikely to be removed without reconfiguration of the street system, and extensive coordination with area property owners and the City of Wasilla. With a new signal being installed at the Parks Highway and Yenlo Street, the driveways will fall within influence areas for several signalized intersections. Intersection functional area was calculated for the proposed signals at Parks Highway and Main Street and Parks Highway and Yenlo Street. The functional area includes the roadway directly before and after a traffic signal where the through traffic is influenced by the signal and within which restriction to side street movements should be considered. Under the proposed alternative, the functional area along the Parks Highway for all of the signals between Crusey Street and Lucille Street overlap. This means that traffic using Parks Highway driveways between these signals will be entering and exiting the roadway where through traffic needs to be making decisions based on the traffic signal. It is recommended that the Carrs driveway onto the Parks Highway nearest to the Yenlo signal should be restricted to Right-in-right-out movements only, which will be accomplished through continuous raised median and left-turn lane channelization on the Parks Highway. Other driveways onto the Parks Highway between Crusey and Lucille are not recommended for restriction at this time, since the conditions at these driveways are not changing as a result of this project.

1 Introduction

The Alaska Department of Transportation and Public Facilities (DOT&PF) has retained HDR-Alaska and Kinney Engineering, LLC (KE) to update the traffic analysis report for the Wasilla Main Street Traffic Study. Figure 2 shows the location of the project, which is in downtown Wasilla and crosses the Parks Highway.

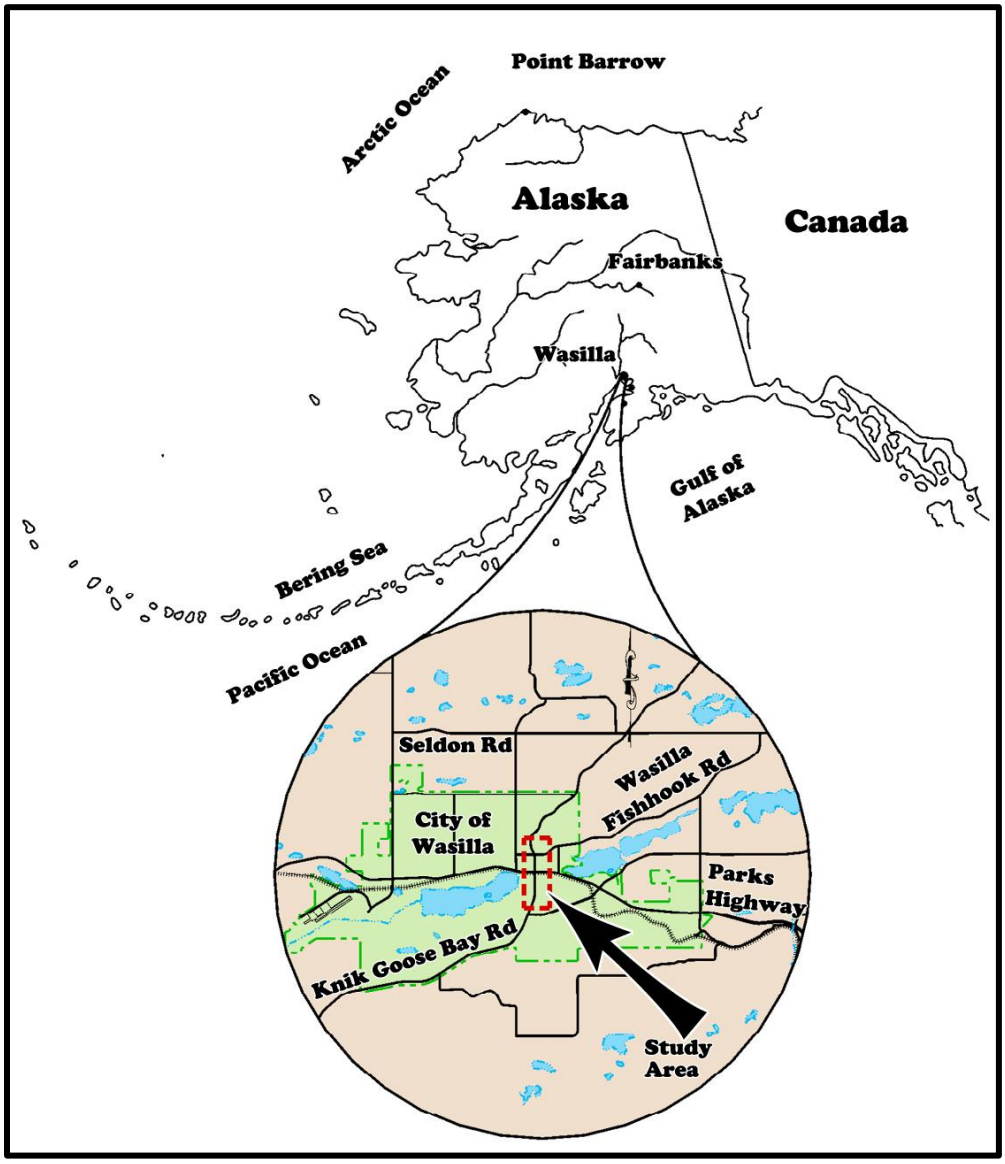


Figure 2. Project Location Map

1.1 Project Background

The Wasilla Main Street Project has been ongoing since preliminary studies began in 1983. A Knik-Goose Bay Road and Wasilla Main Street couplet was first proposed and selected as the preferred alternative in 1992. However, concerns about impacts of a couplet were raised in the early 2000's. Between 2004 and 2006 a new traffic study found a Main Street/Yenlo Street couplet allows more access, circulation, pedestrian crossing, speed control, and have smaller right-of-way impacts, making it the preferred alternative. The Wasilla City Council concurred.

This report is an update of the 2006 traffic analysis that began with the study and design of Wasilla Fishhook Road. In 2006, Tryck Nyman Hayes, Inc. prepared a draft Traffic Study for the Wasilla Main Street project (Project Number STP-0525(12) / 54302) for the DOT&PF. For that report, Kinney Engineering, performed safety analyses of key intersections, as well as traffic volume and capacity estimates. KE prepared the traffic volume estimates using a travel demand model created in a program called QRSII, which forecasted traffic volumes on key streets in the network for the year 2025. KE also forecasted turning movements at major intersections and performed capacity analyses at these intersections. The 2006 study considered several planning level road network designs aimed at relieving congestion on north-south roads surrounding Main Street. The alternative selected in this study was a one-way couplet using the alignments of Main Street and Yenlo Street, north of the Parks Highway and Knik-Goose Bay Road and Talkeetna Street, south of the Parks Highway.

In 2011, the 2006 report was updated by KE to include more recent crash data (1999 to 2008), and 2035 traffic volume forecasts derived from the 2025 TransCAD based travel demand model for the Matanuska-Susitna Borough (MSB). The 2025 model was created in 2007 for the MSB Long Range Transportation Plan (LRTP). The 2011 study considered alternative designs of the one-way couplet that was recommended in the 2006 study and determined beginning and end points for the one-way segments, lane needs on segments and at intersections, and intersection control. The 2011 report recommended that both the northbound and southbound sides of the couplet be 3-lane roadways.

In 2015 KE was retained again to evaluate the preferred alternative from the 2012 report, in the light of a Downtown Area Plan that had been completed for Wasilla. One of the concerns in the Area Plan was the need for improved pedestrian facilities in downtown Wasilla. To dedicate right-of-way to improved pedestrian facilities in downtown Wasilla, it was proposed to reduce Wasilla Main Street from 3-lanes to 2-lanes. However, the 2-lane facility is to be designed with curb lines and storm drains so that it may be expanded to 3-lanes when operational improvements are necessary. KE's 2015 report concluded that with reduced lanes the couplet would still operate at LOS D or better in the CBD, with LOS E at Parks Highway intersections due to the capacity of the eastbound and westbound through lanes. Note that the couplet is designed to address congestion in the urban core with a turnaround point at Bogard Road headed north.

Figure 3 shows the alignment and intersection control elements of the preferred alternative, including improvements proposed as a part of the updated study for this current report.

Figure 3. Preferred Alternative Map

This current report updates the traffic forecasts to a 2043 design year with volumes derived from a 2040 travel demand model created for the Municipality of Anchorage (MOA) that includes the MSB.

1.2 Area Plans

The following area planning documents were used as a basis for the design or were considered in the analysis process.

1.2.1 2007 MSB LRTP

The 2007 LRTP assesses growth in the MSB to 2025 and recommends improvements for various transportation modes to support the growth. The LRTP reveals that Main Street will operate at or over capacity by 2015 and that the Parks Highway at Main Street/Knik-Goose Bay Road will

operate near capacity by 2015 and at or over capacity by 2025. The LRTP provides a list of roadways that needed improvements by 2015 to relieve traffic for the next 10 years. Knik-Goose Bay Road/Main Street from Palmer-Wasilla Highway Extension to Bogard Road and Bogard Road from Wasilla Fishhook Road to Seldon Road were identified as needing improvements by the 2015 forecasted traffic volumes. The proposed improvements would convert Knik-Goose Bay Road/Main Street from a two-lane minor arterial to a four-lane major arterial and convert Bogard Road from a minor arterial to a major arterial. The LRTP also recommends converting the Parks Highway from a four-lane highway to a six-lane highway from Lucille Street to Crusey Street.

Wasilla Fishhook Road/Main Street Rehabilitation-improved pedestrian facilities from Glenwood Street (on Knik-Goose Bay Road) to Schrock Road (on Wasilla-Fishhook Road).

The LRTP mentions the Knik-Goose Bay Road Grade Separation Alternatives Analysis that was conducted to relieve traffic congestion at the Parks Highway and Knik-Goose Bay Road intersection and the adjacent railroad crossing. The recommended alternative was to grade separate the railroad crossing, with the railroad overpassing Knik-Goose Bay Road.

1.2.2 2017 Draft MSB LRTP & the Parks Highway Alternative Corridor

The MSB is currently producing a LRTP assessing growth through the year 2035. A draft of this plan has been made available for public review, prior to final publication later this year.

The review copy of the report discusses the Parks Highway Alternative Corridor and states that it would be a new National Highway System (NHS) limited-access connection south of the existing Parks Highway. The corridor would bypass the city of Wasilla by cutting south at or near the Seward Meridian and return to the Parks Highway west of Pittman Road.

Figure 4 shows the most recent proposed alignments for the Parks Highway Alternative Corridor in relation to the study area of the Wasilla Main Street project.

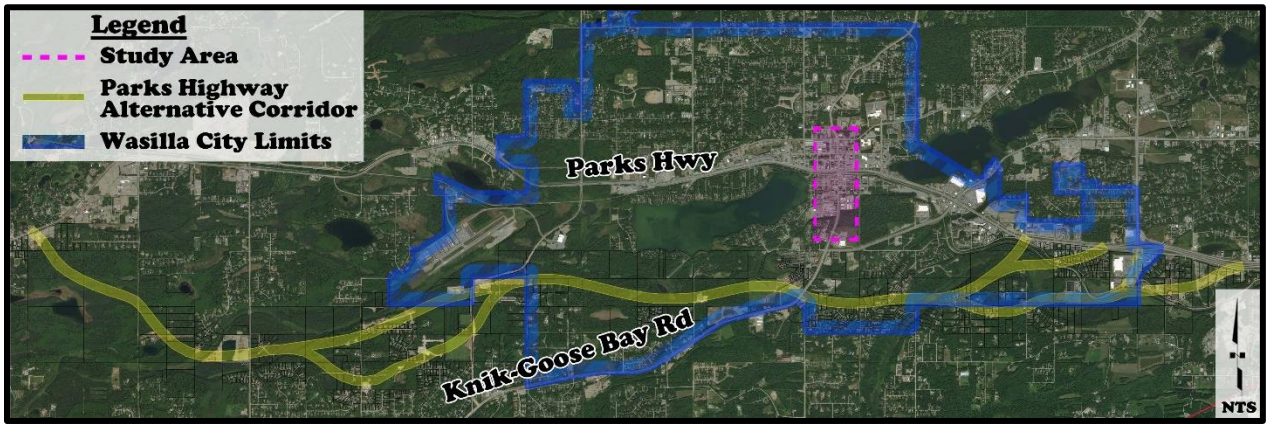


Figure 4. Parks Highway Alternative Corridor Proposed Alignments

The draft LRTP states that the purpose of the Parks Highway Alternative Corridor would be to alleviate heavy traffic volumes on the Parks Highway. If the Parks Highway Alternative Corridor is not constructed, then the LRTP states that the Parks Highway would need to be expanded to 6 or 8 lanes of through traffic.

1.2.3 2011 City of Wasilla Comprehensive Plan

The City of Wasilla Comprehensive Plan identifies issues and concerns within the study area. One issue is traffic congestion, especially vehicles on Main Street southbound turning on to the Parks

Highway. Other issues include poor pedestrian connectivity in the downtown area and the lack of sidewalks. The plan mentions the couplet concept on Yenlo Street and Main Street to improve traffic and to add parking to calm traffic.

The plan suggests pedestrian-focused improvements for the downtown area, which includes constructing sidewalks, orienting buildings towards sidewalks and streets, and installing marked crosswalks at intersections, making downtown more accessible for both vehicles and pedestrians. Landscaping treatments are also recommended to beautify and attract attention to Downtown.

1.2.4 2013 Downtown Area Plan

The 2013 Downtown Area Plan for Wasilla supplements the Comprehensive Plan and focuses on Downtown Wasilla. The plan states that Downtown businesses and other establishments are not easily accessible because of discontinuous and absence of sidewalks. The Plan indicates that the lack of pedestrian facilities, especially on Main Street, hinders pedestrian movement and is unsafe. The plan states that Downtown has poor traffic flow and that there is inadequate and inconvenient parking. A traffic plan is suggested to improve traffic and mentions the couplet on Main Street and Yenlo Street as the preferred alternative to relieve traffic congestion. A survey conducted for the plan revealed that residents would like more landscaping in the area to improve aesthetic appeal. The Downtown Area Plan prompted DOT&PF to reduce traffic lanes from 3 lanes to 2 lanes in the proposed Main Street and Yenlo Street plan, and dedicate the saved lane width to pedestrian facilities on the Wasilla Main Street project. However, the 2-lane facility would be constructed in a manner such that it would be convertible into a 3-lane facility in the future with minimal construction and without the need to purchase additional right-of-way.

1.2.5 Safe Routes to School

The 2014 MSB Safe Routes to School (SRTS) plan identifies deficiencies at elementary and middle schools and recommends improvements for students walking or biking to school. While further engineering studies are required, the SRTS plan recommends the following improvements within the project study area

- Add lighting on Swanson Avenue from Main Street to Crusey Street
- Install a paved and lighted multi-use path on the south side of Bogard Road from Wasilla Fishhook Road/Main Street to Crusey Street.

The proposed couplet design is compatible with these recommendations.

1.2.6 City of Wasilla Official Streets and Highways Plan

The Official Streets and Highways Plan for 2005 to 2025 proposes recommendations to provide a roadway network that supports both population and economic growth in the City of Wasilla. The recommendations within the study area include the following:

- Select and design an alternative transportation corridor to the Parks Highway (short-term) and construct the alternate route (long-term)
- Rehabilitate Parks Highway from Crusey Street to Lucus Road that would include enhancing pedestrian facilities and landscaping (short term)
- Extend Yenlo Street from Swanson Avenue to Bogard Road (short-term project)
- Improve Main Street by either widening the roadway to a four- or five-lane facility or by constructing a one-way couplet with Talkeetna Street/Yenlo Street (long-term)

1.2.7 MASCOT Transit Line

The Mat-Su Community Transit (MASCOT) is a transit line that services the whole MSB community. KE found no planning documents regarding MASCOT's future operations. There is currently one MASCOT bus stop within the study area on Yenlo Street, south of Herning Avenue. Future bus stops within the proposed couplet have not been determined. Off-street bus stop facilities are not currently included in the couplet design.

The location and type of bus stop features are not included in this study. It is recommended that any future bus stop locations in downtown Wasilla should be determined based on engineering analysis and policy similar to that found in the Municipality of Anchorage's Design Criteria Manual, Chapter 7.

1.2.8 Functional Classification and Area Type

Road functional classifications and area type (urban or rural) are used to determine the design criteria of the road.

The American Association of State Highway and Transportation Officials (AASHTO) *A Policy on the Geometric Design of Highways and Streets* (PGDHS) is the primary reference for roadway design. AASHTO and other agencies generally classify roads, streets, and highways under one of three functional classes:

- Arterial - Arterials emphasize mobility and are designed to carry large volumes at an efficient speed.
- Local Road - Local roads are oriented towards access to homes and businesses at the terminal ends of a trip.
- Collector - Collector roads gather and distribute trips between local streets and arterials.

AASHTO and other agencies further provide sub-categories of the classes. For example, arterials may be classified as freeways, expressways, principal arterials or minor arterials and collectors may include major or minor collectors. Figure 5 illustrates the mobility and access balance for each functional class.

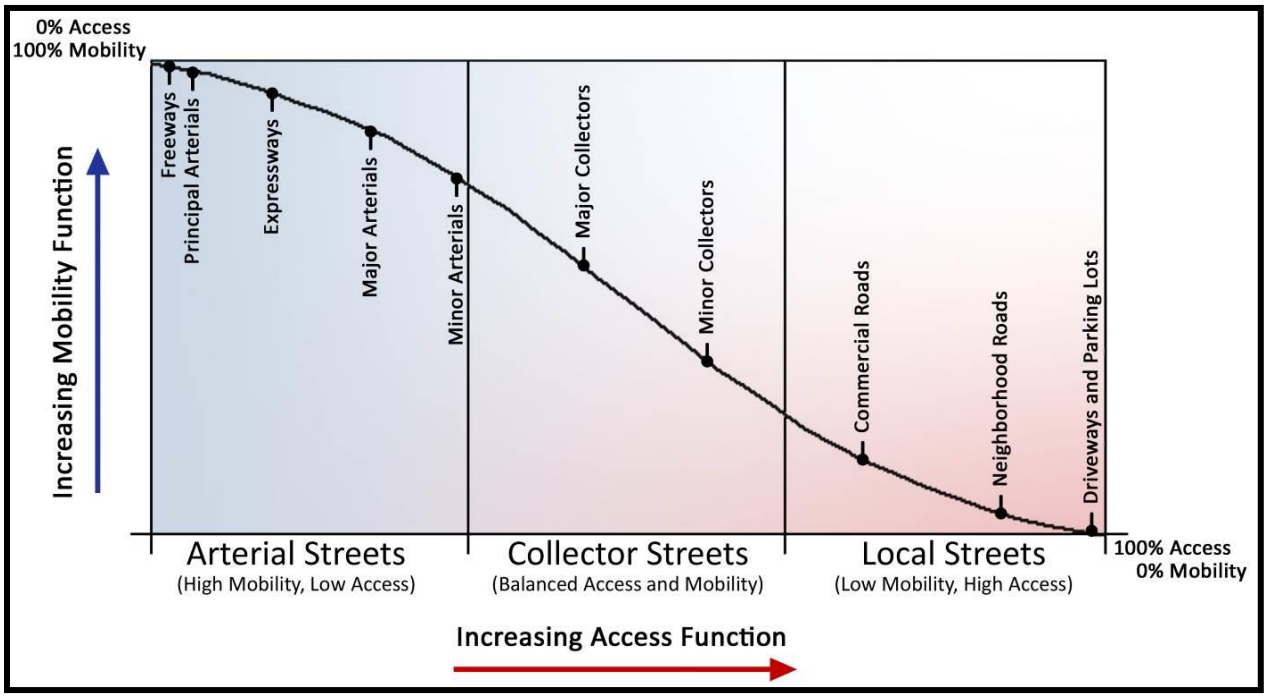


Figure 5. Functional Classification, Relationship of Mobility and Access

It is desirable for a road network to provide a trip movement up and down the hierarchy of functional classes as shown in Figure 6.

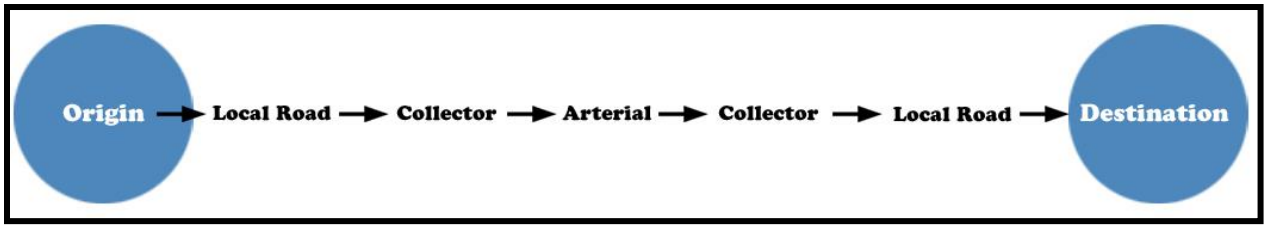


Figure 6. Desirable Road Classification Progression

The DOT&PF presents the most recent existing functional classifications in a Geographic Information System (GIS) database. This database can be viewed in the Statewide Functional Classification GIS Map on the DOT&PF website.

The existing DOT&PF functional classifications of roads in the study area are shown in Figure 7.

The DOT&PF functional class update defines urban and rural land use separately from functional class. The project segments within the study area are classified as urban and are within a "Small Urban Area" as defined by the US Census Bureau. The small urban area is named "Lakes-Knik-Fairview-Wasilla" and contains all of the area within and between Wasilla and Palmer.

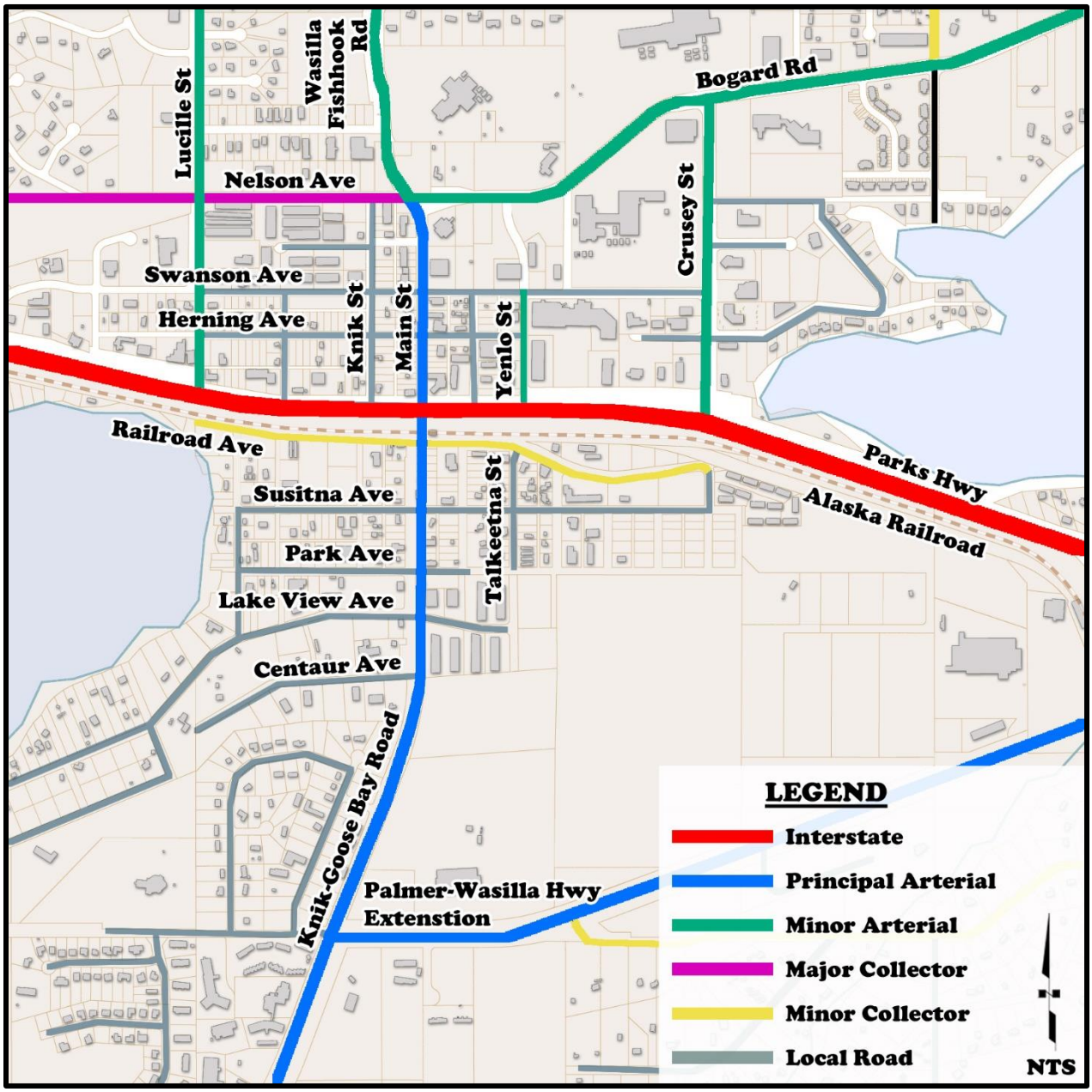


Figure 7. DOT&PF Road Functional Classifications Map

2 Crash Study Update

2.1 Intersection Crash Rates and Crash Significance for Study Intersections

Crash data for intersections within the Wasilla Main Street/Yenlo Street couplet project area were analyzed over a 10-year period (2003-2012) to explore existing conditions. The following 16 intersections are remaining, but will be reconfigured resulting in likely changes in crash patterns. The intersection of Talkeetna Street and Railroad Avenue being eliminated. Remaining intersections include:

- Knik-Goose Bay Road & Enter Way
- Knik-Goose Bay Road & Centaur Street
- Knik-Goose Bay Road & Lake View Avenue
- Knik-Goose Bay Road & Park Avenue
- Knik-Goose Bay Road & Susitna Avenue
- Knik-Goose Bay Road & Railroad Avenue
- Parks Highway & Main Street/Knik-Goose Bay Road
- Main Street & Herning Avenue
- Main Street & Swanson Avenue
- Main Street & Paulson Avenue
- Main Street/Wasilla Fishhook Road & Bogard Road/Nelson Avenue
- Talkeetna Street & Susitna Avenue
- Talkeetna Street & Railroad Avenue
- Parks Highway at Yenlo Street
- Yenlo Street & Herning Avenue
- Yenlo Street & Swanson Avenue

Intersections along Boundary Street, which runs north-south between Main Street and Yenlo Street, were also analyzed. The following intersections are not expected to experience a change in traffic patterns:

- Boundary Street & Parks Highway
- Boundary Street & Herning Avenue
- Boundary Street & Swanson Avenue

Observed crash rates, crashes per million entering vehicles (MEV), were compared against average crash rates published in Alaska Highway Safety Improvement Program (HSIP) Manual. Average intersection crash rates published in the HSIP Manual are organized by the number of approaches an intersection has and whether it is a signalized or unsignalized intersection.

To determine if there is a crash problem at an intersection, the HSIP methodology compares the observed crash rate to a critical crash rate. The critical crash rate is a calculated threshold that indicates the likelihood that the crash rate is above average due to characteristics of the location, and not purely by chance. It is a function of the average crash rate of a facility type, the number of entering vehicles, and a confidence factor which indicates the amount of certainty in the analysis. This analysis was conducted using a 95% confidence interval.

Table 2 presents the intersection crash rates for the 10-year period between 2003 and 2012.

Table 2. Intersection Crash Rates (2003 through 2012)

Intersection	Intersection Crashes	Million Entering Vehicles	Crashes/ MEV	HSIP Average	Critical	Above Average	Above Critical
Knik-Goose Bay Rd & Enter Way	6	39.381	0.15	0.47	0.66	No	No
Knik-Goose Bay Rd & Centaur St	3	35.731	0.08	0.47	0.67	No	No
Knik-Goose Bay Rd & Lake View Ave	18	38.286	0.47	0.47	0.66	**Yes**	No
Knik-Goose Bay Rd & Park Ave	6	36.461	0.16	0.47	0.67	No	No
Knik-Goose Bay Rd & Susitna Ave	11	41.571	0.26	0.57	0.77	No	No
Knik-Goose Bay Rd & Railroad Ave	22	35.913	0.61	0.57	0.79	**Yes**	No
Parks Highway & Main St	234	142.319	1.64	1.47	1.64	**Yes**	No
Main St & Herning Ave	69	46.024	1.50	0.57	0.76	**Yes**	**Yes**
Main St & Swanson Ave	28	52.229	0.54	0.57	0.75	No	No
Main St & Paulson Ave	2	37.629	0.05	0.57	0.78	No	No
Main St & Nelson/Bogard Rd	33	66.990	0.49	1.47	1.71	No	No
Talkeetna St & Susitna Ave	0	14.235	-	0.57	0.93	No	No
Talkeetna St & Railroad Ave	0	5.110	-	0.47	0.88	No	No
Parks Hwy & Yenlo St	81	109.119	0.74	0.47	0.58	**Yes**	**Yes**
Yenlo St & Herning Ave	5	16.790	0.30	0.57	0.90	No	No
Yenlo St & Swanson Ave	6	25.550	0.23	0.51	0.73	No	No
Parks Hwy & Boundary St	79	100.621	0.79	0.51	0.64	**Yes**	**Yes**
Herning & Boundary St	22	16.425	1.34	0.47	0.77	**Yes**	**Yes**
Swanson & Boundary St	2	16.790	0.12	0.57	0.90	No	No

Rate Above Critical

Intersection within Study Area but not Altered by Proposed Improvements

Table 2 indicates four intersections have above-critical crash rates:

- Main Street & Herning Avenue
- Parks Highway & Yenlo Street
- Parks Highway & Boundary Street
- Herning Avenue & Boundary Street

Comparing crash rates from 2003-2012 and 1999-2008 (established in previous studies), the crash rate at Yenlo Street and Parks Highway has increased to above the critical rate despite the number of entering vehicles decreasing slightly. The crash rate at Main Street and Parks Highway has fallen below critical, however it remains at a rate near critical.

2.2 Crash Severity for Study Intersections

Table 3 presents the crash severity distribution at intersections that will undergo changes as part of the proposed couplet. In September 2011, a single vehicle crashed into a retaining wall while headed east on Swanson Avenue, killing both occupants. Reports on the crash indicate that alcohol and or drugs may have been a factor.

During the 10-year study period, 5 crashes resulting in incapacitating injuries were recorded. All five crashes occurred at the intersection of Parks Highway and Main Street: three crashes were rear end crashes, one crash involved a pedestrian, and one crash involved a left turning vehicle versus opposing traffic.

Table 3. 2003-2012 Total Crashes at Affected Intersections by Severity

	Fatality	Incapacitating Injury	Minor Injury	Property Damage Only	TOTAL
Total Intersection Crashes	1	5	118	401	525

The remaining crashes resulted in minor injuries or property damage only.

2.3 Crash Mitigation Estimate

Intersections modified by the installation of the Main Street/ Yenlo Street couplet were evaluated using the same methodology as the 2012 study.

- Northbound and southbound through crashes were reassigned to the proposed one-way roadways to account for the conversion of the formerly two-way streets into a one-way couplet.
- Where new signals are proposed, a 60% crash reduction factor for right angle crashes was applied and corresponding rear-end crashes were increased by 25% (HSIP Handbook).
- At other locations, the only crash reductions that were assumed are for eliminated conflicting movements (such as through vs. opposing left turn where there will no longer be opposing traffic).

Table 4 shows expected crash reductions in the study area. Cells shaded in red indicate where crashes are expected to increase. An increase in crashes is expected along Yenlo Street and Talkeetna Street, due to the relocation of northbound crashes from Main Street/ Knik-Goose Bay

Road to Talkeetna Street/Yenlo Street. However, the overall effect will be a crash reduction of about 10%.

Table 4. Expected Crash Reductions under Preferred Alternative

Intersection	Intersection Crashes 2003 to 2012	Crash Reduction (Number of reduced crashes)	Crash Reduction (Percent of TOTAL crashes)
Knik-Goose Bay Rd & Enter Way	7	0	0.0%
Knik-Goose Bay Rd & Centaur St	3	0	0.0%
Knik-Goose Bay Rd & Lakeview Dr	18	1	5.6%
Knik-Goose Bay Rd & Park Ave	6	4	66.7%
Knik-Goose Bay Rd & Susitna Ave	11	0	0.0%
Knik-Goose Bay Rd & Railroad Ave	22	14	63.6%
Parks Hwy & Main St/Knik-Goose Bay Rd	231	50	21.6%
Main St & Herning Ave	69	6	8.7%
Main St & Swanson Ave	27	11.95	44.3%
Main St & Paulson Ave	2	1	50.0%
Main St/Wasilla Fishhook Rd & Bogard Rd/Nelson Ave	33	7	21.2%
Talkeetna St & Centaur Ave	0	0	0.0%
Talkeetna St &Lake View Ave	0	0	0.0%
Talkeetna St & Park Ave	0	-4	0.0%
Talkeetna St & Susitna Ave	0	-0.75	0.0%
Talkeetna St & Railroad Ave	0	0	0.0%
Parks Hwy & Yenlo St	85	-30.5	-35.9%
Yenlo St & Herning Ave	5	-4	-80.0%
Yenlo St & Swanson Ave	6	-5.4	-90.0%
Yenlo St & Bogard Rd	0	-4	0.0%
Boundary St & Herning Ave	79	0	0.0%
Boundary St & Swanson Ave	22	0	0.0%
Parks Hwy @ Boundary Ave	2	0	0.0%
ALL Affected Intersections	525	50.3	9.6%

Crash Increase	**Intersections within couplet but not altered by proposed improvements.**

3 Volume Conditions

3.1 Average Annual Daily Traffic

3.1.1 2040 AMATS Model

The design year for this analysis is 2043 with a construction year of 2023. The basis for the future volume forecasts is a 2040 area wide travel demand model produced for the Anchorage Metropolitan Area Transportation Solutions (AMATS). The 2040 AMATS model is a macro level TransCAD regional model which includes roads functionally classified as a collectors and arterials within the MOA and the MSB.

At the time of this analysis, the MOA has calibrated and validated the 2040 AMATS model for a 2013 base year and has produced 2040 forecasted socio-economic data; however, the MOA has not completed the future 2040 road network. The 2040 MOA road network is waiting for a finalized version of the Metropolitan Transportation Plan, and the 2040 MSB road network is waiting for the finalized version of the 2035 Long Range Transportation Plan.

Thus, KE modified the available portions of the 2040 model in the MSB region to include a list of committed projects provided by MSB staff from the soon to be published LRTP. Additionally, the model was modified by KE to increase the density of the traffic generation zones near the study area to better estimate the distribution of traffic on smaller road segments and at key intersections. Four separate future models were generated for this study. Models were developed with and without the proposed Main Street Improvements, and with and without the Parks Highway Alternative Corridor.

The Parks Highway Alternative Corridor was included in the model with an alignment similar to those shown previously in Figure 4 on page 15, with a full 4-lane divided capacity with controlled access, and a travel speed of 60 mph, which is equal to the modeled speed of the proposed 4-lane Parks Highway segments between Wasilla and Big Lake. This design is the current plan being considered by DOT&PF and MSB planning divisions. A full capacity, full speed, controlled access freeway will draw east-west trips off the Parks Highway. Note that any reduction in the modeled speed, access control, or capacity of the road segments would result in much fewer trips being moved from the Parks Highway to the Parks Highway Alternative Corridor in 2040, according to modeling. In order to achieve the results shown in this report, the Parks Highway Alternative Corridor must be a more efficient route with lower travel times than the direct Parks Highway route through downtown Wasilla, otherwise the Parks Highway segments will always be at or over capacity with only the overflow traffic moving to the alternative corridor.

The Parks Highway Alternative Corridor reduced the volumes on the Parks Highway by 40%, as well as reducing the volume on Knik-Goose Bay Road by 10%. The volumes on Main Street and Yenlo, and other streets north of the Parks Highway, were not significantly impacted by the Alternative Corridor.

3.1.2 Post Processing & Screenline Analysis

Traffic demands modeled in TransCAD favor routes with higher segment capacity (more lanes and more access control) and shorter travel distance. However, there are other factors not included in the model (such as the number of signalized intersections or other aspects of the road environment) which influence traveler route choice. To more accurately depict these effects on traveler route choice, the TransCAD results for each alternative were subjected to post-processing

analysis in accordance with NCHRP 765 (Analytical Travel Forecasting Approaches for Project-Level Planning and Design). This methodology compares the existing volume to capacity ratio of roads in the base year model to observed real world volume to capacity ratios, then applies the differences to the future year model volumes, considering changes in future capacity. The results of the screenline analysis are adjusted forecasted volumes which better model traveler route choice by taking into account existing travel patterns. Under this methodology, traffic volumes are adjusted to better match the volume to capacity ratios that were observed in the base year of the model. Note that in some cases the total volumes along the screenline are less than the total volumes before the adjustments; in these cases, the removed traffic volumes are assumed to be changing their travel times as opposed to their route choice, due to lack of capacity in the peak hour to meet the modeled demand.

There were five separate screenlines prepared for the post processing of the 2040 model, three running east to west and two running north to south. These screenlines were applied to each of the four future scenario models. The east to west screenlines are shown in Figure 8. The north to south screenlines are shown in Figure 9.

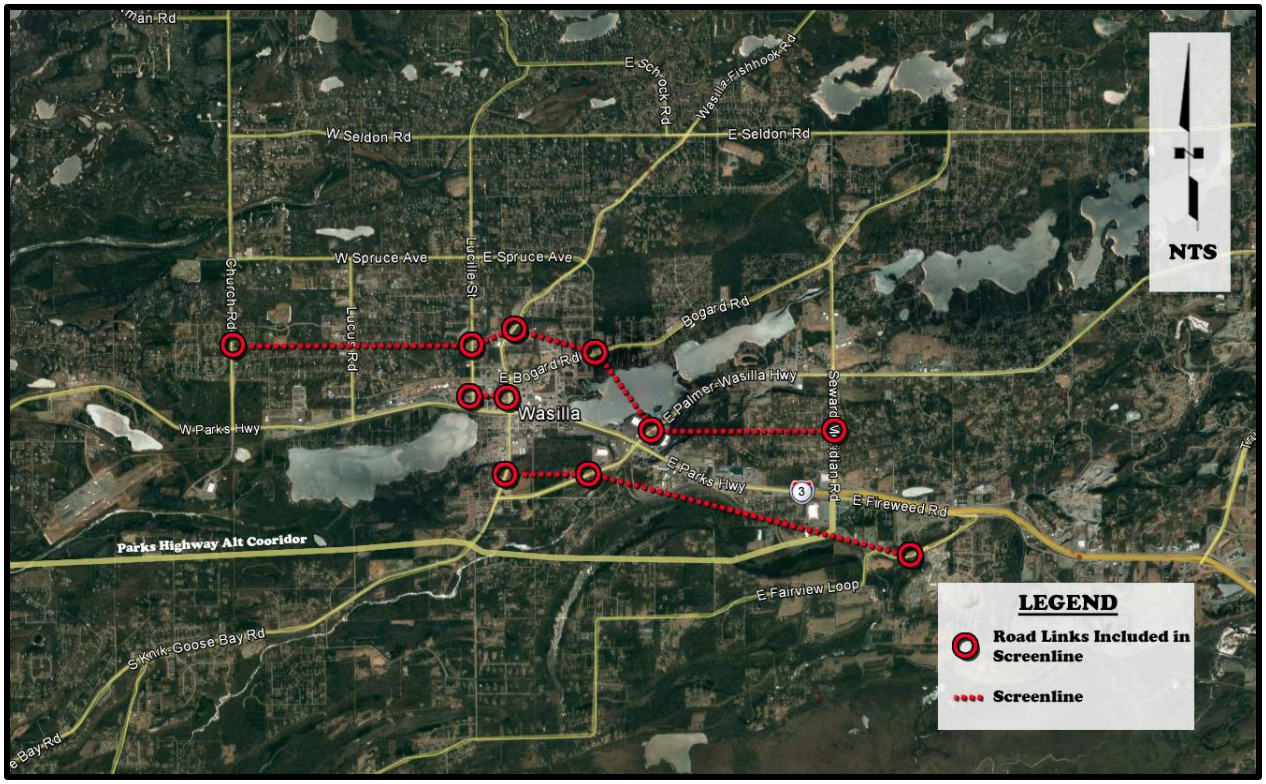


Figure 8. East-West Screenline Locations

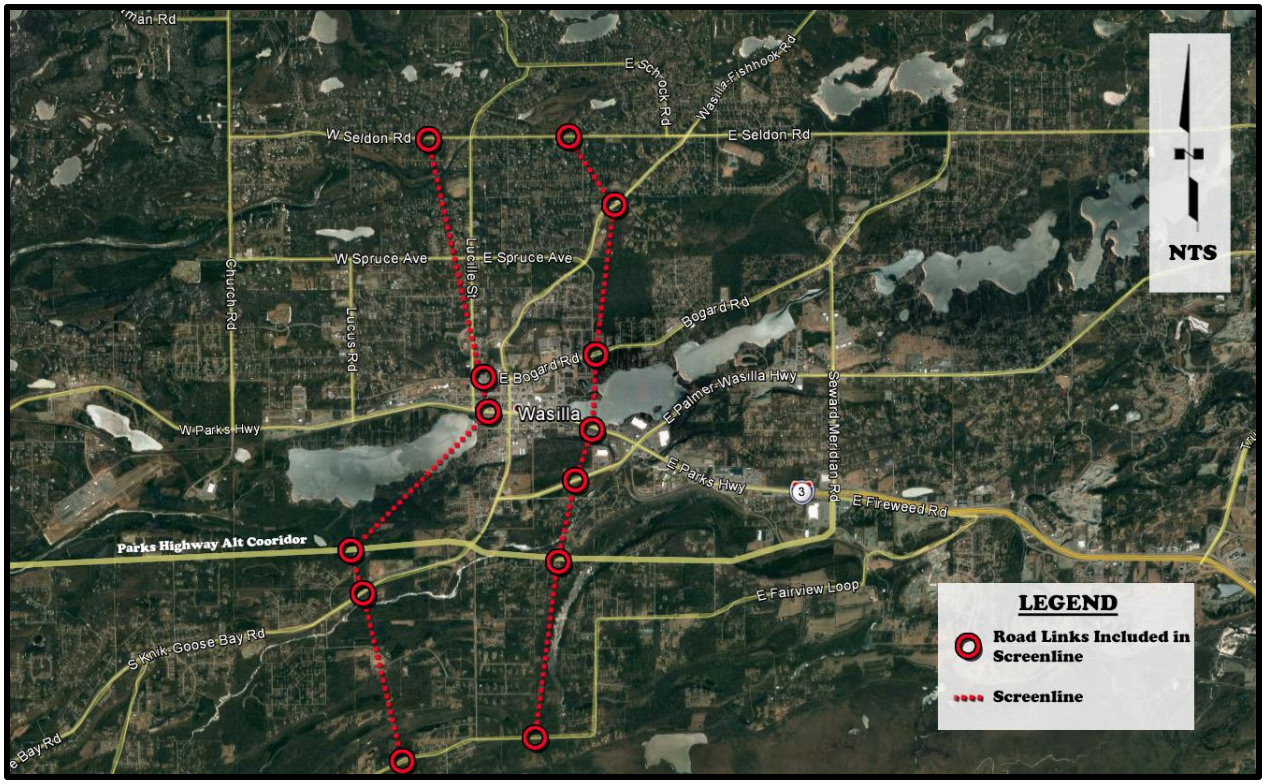


Figure 9. North-South Screenline Locations

The screenline process had a significant effect on the traffic volumes. In general, the results decreased volumes on Wasilla Fishhook Road, Knik-Goose Bay Road, and Main Street/Yenlo Street, and also reduced the Parks Highway volumes east of Main Street. Volumes increased as a result of the screenline process on the Parks Highway west of Main Street, and on Nelson Avenue and Bogard Road.

3.1.3 Annual Growth Rate

The adjusted 2040 AMATS model volumes were used as a base point to project the 2043 design year volumes, as well as the back calculated 2033 midlife volumes and 2023 construction year volumes.

Average annual daily traffic volumes were collected through 2013 from DOT&PF Annual Traffic Volume Report and volumes for 2014 and 2015 were collected from the DOT&PF's AADT Traffic Counts server. An area wide traffic growth rate was estimated by comparing the total existing year volumes of key roads to the projected 2040 volumes. The average growth rate was found to be approximately 1.0%.

This growth rate was applied to all segments in all volume cases with the exception of the Parks Highway, which had a much lower growth rate, likely due to the capacity constraints. Therefore, a growth rate of 0.5% was applied to Parks Highway segments to back calculate the 2023 and 2033 volumes. The 2043 design volumes were conservatively calculated using the 1.0% growth rate for the three years following the model forecasts.

Figure 10 shows the historical volumes on five key segments within the study area. The figure also shows the projected volumes, with symbols indicating the various design years and the actual adjusted 2040 model volumes derived using the screenline methods discussed earlier.

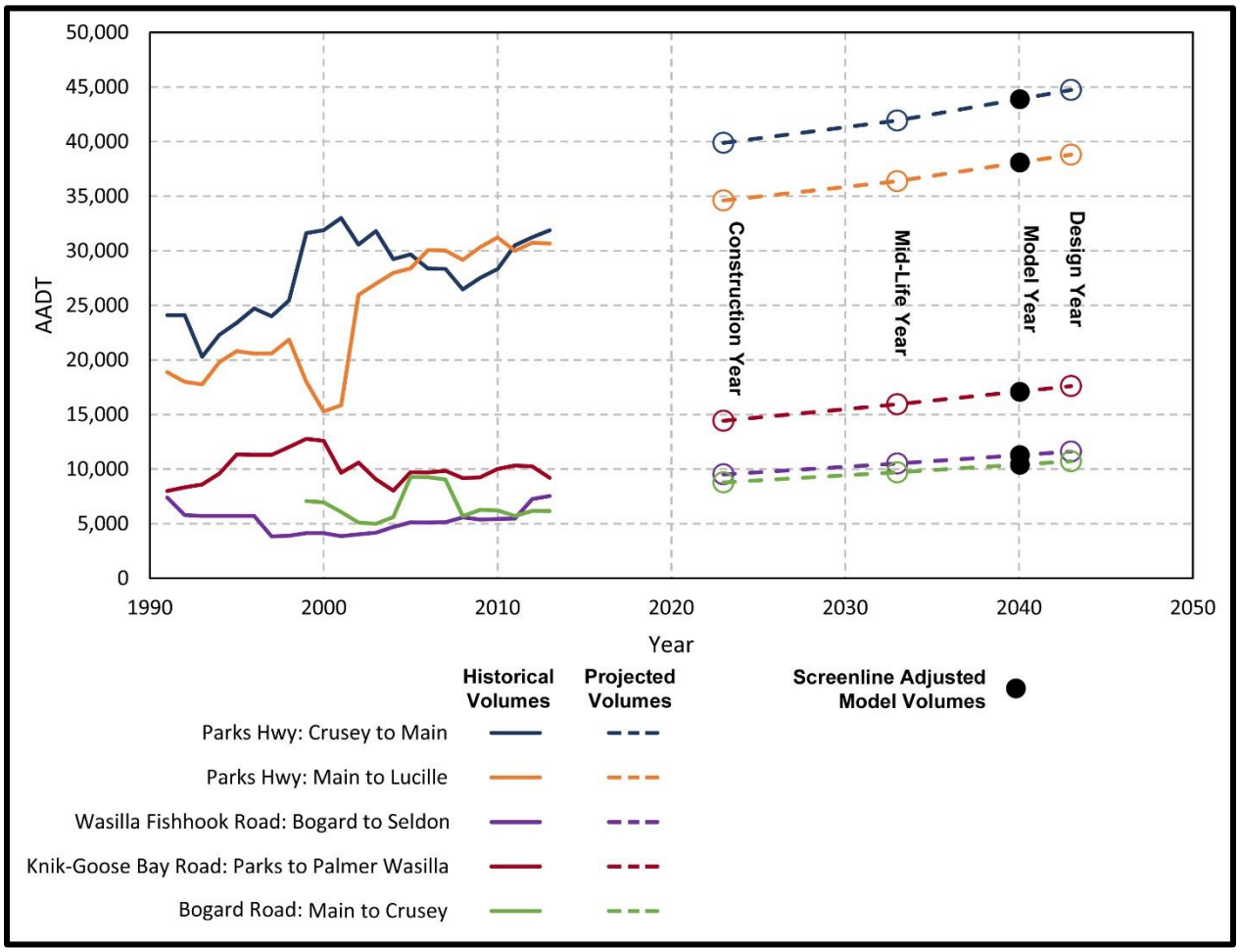


Figure 10. Historical and Project AADTs (Without Parks Hwy Alternative Corridor)

Note that although the background traffic is forecasted to grow at a rate of 1.0%, the segment volumes may not always change gradually. Particularly, once the project is constructed, the distribution of traffic may readjust considerably. Also, in the case of the Parks Highway Alternative Corridor, the volumes will likely drop suddenly the year after the corridor is opened up. It is not known at this time when the Parks Highways Alternative Corridor can be expected to be constructed.

Design AADT volumes are included in the appendix starting on page 58.

3.2 Design Hour Volume

According to the American Association of State Highway and Traffic Officials (AASHTO) the 30th highest peak hour should be used for the design hour volume. The 30th highest volume is typically recorded by a traffic counter which collects data year-round, and the 30th highest volume is typically used because it represents approximately the 85th percentile of the traffic volumes for the entire year. The population of the study area, 8,621 people (2013), falls within AASHTO's

definition of a small urban area of 5,000 to 50,000 people. In urban areas, the 30th highest peak hour is most likely to fall between 8% and 12% of the AADT, according to AASHTO guidance. Using data from a permanent traffic recorder on the Parks highway at Broadview, a 5-year average for the 30th highest peak hour was found to be 10.4%. This was rounded to 10% for analysis.

3.3 Turning Movements

Future intersection turning movement volumes (TMVs) were calculated using the methodology found in the National Cooperative Highway Research Program (NHCRP) Report 765: *Analytical Travel Forecasting Approaches for Project-Level Planning and Design* to forecast future intersection peak hour movements based on forecasted AADTs for the approach roads, design hour volume percentage of total AADT, and expected turning movement proportions.

The forecasted 2043 TMVs can be found starting on page 66. All TMV calculations are for the PM Peak Hour.

3.4 Heavy Vehicle Percentages

The DOT&PF collects vehicle classification data and publishes the findings in the Annual Traffic and Volume Report. At a given site, data is collected for a minimum of one week during the summer. Vehicle classification data collection sites are selected by Highway Performance Monitoring System statistical sampling requirements or by future construction projects. Therefore, with the exception of permanent traffic recorder locations, the location of vehicle classification data collections change from year to year. Heavy vehicle percentages were updated based on values published between 2008 and 2013. Roads without published classification data were assigned heavy vehicle percentages based on previous models.

4 Design Recommendations

4.1 Traffic Signals

Caltrans has a planning level methodology to determine if signals may be warranted at intersections in the future using future traffic AADTs. Projected entering AADT volumes on both the major road and minor road are evaluated with factored traffic signal warrants found in the Manual of Uniform Traffic Control Devices (MUTCD) which use daily volumes instead of hourly volumes.

Caltrans methodology considers an area to be either urban or rural. A rural area is defined as an area with a critical speed limit on major roads of 40 mph or more or a built up isolated area with a population of 10,000 or less. The study area was considered rural for Caltrans future signal warrant analysis.

Within the study area, the intersections at Parks Highway and Main Street/Knik-Goose Bay Road and Main Street/Wasilla Fishhook Road and Nelson Road/Bogard Road are signalized. These two intersections continue to meet traffic signal warrants through the design year.

Table 5 presented on on page 31 indicates which intersections are forecasted to meet Caltrans traffic signal warrants with the construction of a couplet both with and without a Parks Highway Alternative Corridor. The installation of an Alternative Corridor will have little effect on whether an intersection warrants a traffic signal. The only difference is with a Parks Highway Alternative Corridor a traffic signal in warranted at Main Street and Herning Avenue earlier than if there were no Alternative Corridor.

The meeting of a warrant alone does not mean a traffic signal should be installed, and other factors may need to be considered. Years of evaluation are 2023, 2033, and 2043.

The following intersections warrant traffic signals in future, existing signals are indicated with an asterisk:

- Main Street and Bogard Road*
- Main Street and Swanson
- Main Street and Herning Avenue
- Parks Highway and Main Street/ Knik-Goose Bay Road*
- Yenlo Street and Bogard Road
- Yenlo Street and Swanson Avenue
- Yenlo Street and Herning Avenue
- Parks Highway and Yenlo Street/Talkeetna Avenue

While the spacing of signals at irregular intervals along a bidirectional corridor can degrade operations, with correct signal timings the irregular spacing of traffic signals along a one-way corridor does not reduce operations.

Table 5. Caltrans Future Signal Warrants

	No Parks Highway Alternative Corridor			With Parks Highway Alternative Corridor		
Intersection	**2023**	**2033**	**2043**	**2023**	**2033**	**2043**
Main Street and Bogard Road	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Main Street and Paulson Avenue	No	No	No	No	No	No
Main Street and Swanson Avenue	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Main Street and Herning Avenue	No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Parks Highway and Main Street/Knik-Goose Bay Road	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Knik-Goose Bay Road and Railroad Avenue	No	No	No	No	No	No
Knik-Goose Bay Road and Susitna Avenue	No	No	No	No	No	No
Knik-Goose Bay Road and Park Avenue	No	No	No	No	No	No
Knik-Goose Bay Road and Lake View Avenue	No	No	No	No	No	No
Knik-Goose Bay Road and Centaur Avenue	No	No	No	No	No	No
Knik-Goose Bay Rd and Enter Way/Hospital Access	No	No	No	No	No	No
Yenlo Street and Bogard Road	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Yenlo Street and Swanson Avenue	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Yenlo Street and Herning Avenue	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Parks Highway and Yenlo Street/Talkeetna Street	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Talkeetna Street and Susitna Avenue	No	No	No	No	No	No
Talkeetna Street and Park Avenue	No	No	No	No	No	No
Talkeetna Street and Lake View Avenue	No	No	No	No	No	No
Talkeetna Street and Centaur Avenue	No	No	No	No	No	No

A signal is warranted at both Swanson and Herning on both the Main Street and Yenlo Street sides of the couplet. It is preferable to only install a signal on one of the two cross streets, either Swanson or Herning. Modeling and redistribution suggests that the parallel road network is robust enough to allow traffic to divert from one cross street connection to a signalized crossing during high traffic hours of the day. Given the two signal location options, Swanson has the strongest warrant, and has the highest connectivity.

East of Yenlo Street there is limited connectivity for traffic from the Carrs parking lot to access onto Swanson. An access from the Carrs parking lot to Swanson Avenue currently exists on the east side of the Carrs Mall, but this access is designed to deter public use with a narrow one lane shared roadway, perpendicular parking on the north end, and several speed humps. The current design is not considered a reasonable replacement for access at Herning. Connectivity between the Carrs parking lot and Swanson Avenue could be improved by business owners by upgrading the Swanson connection to encouraging public use. This would improve circulation and flow to a signal at Yenlo Street and Swanson Avenue, and further alleviate the need for a signal at Yenlo Street and Herning Avenue.

A signal warrant is nearly met at Susitna Avenue on Talkeetna Street South of the Parks Highway, based on traffic volume projections. The projected future traffic in this area is originating in unknown, unplanned, developments on the east side of Talkeetna Street, and these developments are expected to take place after the construction of the couplet. The volumes generated by a development in this area added to the existing volumes would possibly warrant a signal in the

future if adequate access points are not constructed. With adequate additional access points, the volume would likely be distributed in such a way that the volume would no longer warrant a signal. If a traffic signal south of the Parks Highway were to be warranted, the most favorable location would be at either Lake View Avenue or at Centaur Avenue, which is a new road connection that is currently being discussed.

4.2 Auxiliary Lanes

NCHRP Report 457: Evaluating Intersection Improvements: An Engineering Study Guide provides guidance in determining whether auxiliary turn lanes should be installed at unsignalized intersections. The NCHRP 457 methods synthesizes several guidelines on this matter including AASHTO's PGDHS.

Thresholds for the consideration of the installation of auxiliary lanes provided by guidance within NCHRP 457 are met under both couplet alternatives, with and without a Parks Highway Alternative Corridor. The lane lengths calculated in this analysis are based on PM peak hour volumes in the scenario without an alternative corridor.

An auxiliary lane is composed of three parts, the storage length, the taper length, and the remaining distance it takes a vehicle to decelerate to a stop. The storage length should be derived from the expected queue during design hours. Together, the taper length and the distance required for a vehicle to stop after traversing the taper length, which are the deceleration length with the total length given as a function of speed in PGDHS. A range of taper rates are given as 8:1 to 15:1 (longitudinal: traverse) for roads with speeds of 30mph or less and 50mph or more respectively.

Table 1150-1 of the DOT&PF Preconstruction Manual provides guidance on inclusion of a deceleration length for an auxiliary lane in addition to accommodating queue storage. When deceleration is included, it is desirable for all deceleration to occur outside of the through lanes. Therefore, the desirable length of an auxiliary lane includes length for both queue storage and enough length for a vehicle to decelerate from approach speed to a stop behind the queue. When constrained, an auxiliary lane may be reduced to include queue storage and enough distance (including bay taper and lane) to allow a vehicle to decelerate to a stop behind a queue from a speed 10 mph less than the approach speed.

Table 6 presents the results of the auxiliary turn-lane length analysis, including the minimum and recommended lane lengths for each of the warranted auxiliary lanes. The minimum lane length, according to the DOT&PF Preconstruction Manual (PCM), is 100 feet. There is no maximum stated in the PCM or other references cited in this report, but a practical maximum lane length is 400 feet, in that longer lanes may be viewed by drivers as an added through lane instead of an auxiliary turning lane. In addition, turning vehicles need to enter the auxiliary lane behind the adjacent lane queue, and this length may determine desirable or minimum lane lengths. Note that the left-turn movements from the Parks Highway, at both Main Street and Yenlo Street are recommended to be dual left turn lanes, and the recommended lane length is for both lanes, prior to the start of the taper.

Note that a northbound right-turn lane would be desirable at the intersection of Yenlo Street and Herning Avenue; however, due to right-of-way constraints this lane was not considered in this study.

Table 6. Recommended Auxiliary Turn-Lane Lengths

Intersection	Auxiliary Lane Movement	Approach Speed	95th Percentile Auxiliary Lane Queue (ft)	95th Percentile Adjacent Lane Queue (ft)	Auxiliary Lane Deceleration and Storage		Recommended Auxiliary Lane Length (ft)
					Minimum Auxiliary Lane Length (ft)	Desirable Auxiliary Lane Length (ft)	
Main St & Bogard Rd/Nelson Rd	Southbound Left-Turn	35 mph	29	219	150	225	225
	Southbound Right-Turn	35 mph	219	219	225	225	225
	Westbound Right-Turn	40 mph	11	223	150	275	275
	Eastbound Left-Turn	25 mph	0	186	150	175	175
	Eastbound Right-Turn	25 mph	117	186	150	175	175
Main St and Swanson Rd	Westbound Left-Turn	25 mph	42	33	150	150	150
Main St and Herning Ave	Westbound Left-Turn	25 mph	25	75	150	150	150
Parks Hwy and Main St	Southbound Right-Turn	25 mph	**655**	**409**	**650**	**650**	**400**
	Dual Westbound Left-Turn	45 mph	44	101	150	375	**400**
	Eastbound Right-Turn	45 mph	129	360	275	**450**	**400**
Enter Way with Knik-Goose Bay	Southbound Left-Turn	50 mph	25	0	225	**425**	400
	Northbound Left-Turn	50 mph	25	0	225	**425**	400
Parks Hwy and Yenlo St	Northbound Left-Turn	25 mph	375	349	375	375	375
	Northbound Right-Turn	25 mph	147	349	150	350	350
	Westbound Right-Turn	45 mph	14	**1,133**	175	**1,125**	**400**
	Dual Eastbound Left-Turn	45 mph	245	120	275	**575**	**400**
Yenlo St and Herning Ave	Westbound Right-Turn	15 mph	50	175	150	175	175
	Eastbound Left-Turn	25 mph	0	75	150	150	150
Yenlo St and Swanson Ave	Westbound Right-Turn	25 mph	41	247	150	250	250
	Eastbound Left-Turn	25 mph	75	87	150	150	150

4.3 Signalized Left-turn Phasing

Left-turn signal phasing treatments were determined for each of the signalized intersections using methodology developed in two reference sources: NCHRP 225 and the MOA Design Criteria Manual. The methodology recommend left-turn phasing based on various factors such as: traffic volume levels in both the turn lane and the opposing through lanes, the speed of traffic in the opposing lane, crash history, number of turning lanes, sight distance. The conclusions of the study are presented below in Table 7.

Table 7. Recommended Signalized Left-Turn Phasing

Intersection	Movement	Treatment
Main St and Bogard Rd	Westbound Left Turn	Permissive-Protected
	Southbound Left Turn	Permissive
Main St and Swanson Ave	Westbound Left Turn	Permissive
Main St and Parks Hwy	Westbound Left Turn	Protected
Yenlo Ave and Parks Hwy	Eastbound Left Turn	Protected
Yenlo Ave and Swanson Ave	Eastbound Left Turn	Permissive

Note that both left-turn movements off the Parks Highway onto Knik-Goose Bay Road and Yenlo Avenue are recommended for protected only phasing since they are dual left turn lanes. The westbound left turn at Main Street and Bogard Road is recommended to run in permissive-protected phasing, due to the high forecasted volume of opposing through traffic. All other signalized intersection left-turn movements are recommended to be permissive only.

Note that all permissive left-turn movements are recommended to be designed with flashing yellow arrows. This will optimize the performance and safety of the left-turn movement and configure the signal hardware in such a way that it can be upgraded to a fully protected movement with minimal effort.

5 Operational Performance Analysis

Design volumes were forecasted for build and no build future road network cases. Both of these road networks were forecasted both with and without the construction of the Parks Highway Alternative Corridor, for a total of four volume scenarios. The highest volume build case was the scenario without the Parks Highway Alternative Corridor. The likelihood of the Parks Highway Alternative Corridor being constructed during the life of this project is unknown, since the corridor project is not currently scheduled and funding is still being determined. For this reason, the design recommendations in the previous section and performance analysis in this section will focus on the scenario without the Parks Highway Alternative Corridor constructed, with the understanding that if the Alternative Corridor were to be built the volumes would decrease and the performance would be better than what is shown without the corridor. Performance calculations were made for all of the volume cases and summaries of these results are included in the appendices.

The LOS goals for this project were determined by DOT&PF in the 2011 study. That study determined that, by reducing the number of through lanes on the Main Street/Yenlo Street one-way couplet, vehicular capacity is decreased within the study area to accommodate other modes of transportation. This tradeoff has been recognized by the DOT&PF and a LOS of E is the targeted LOS for this updated analysis.

Note that the LOS goal for this project is for total intersection delay. Delay for stop controlled side streets accessing a free-flowing major road may have lower LOS and still be acceptable, particularly in cases where the side street serves very low volume demands.

Unsignalized intersection analysis was conducted using Highway Capacity Manual (HCM) 2010 methodology. Signals were analyzed using HCM 2000, since the updated HCM 2010 methods do not accurately provide results for situations with one-way phasing. Additionally, HCM 2000 is the methodology used in previous reports and is therefore consistent for comparison with past results. The signals were modeled in Synchro software, and the unsignalized intersections were modeled using Highway Capacity Software 2010 (HCS2010) produced by McTrans.

5.1 No Action Scenario with No Parks Highway Alternative Corridor

Models indicate that the existing vehicle and pedestrian traffic operations are failing along the Knik-Goose Bay/Main Street corridor. Analyzing traffic conditions using projected 2043 peak hour turning movement volumes, traffic operations will continue to degrade under the existing configuration of Main Street/ Knik-Goose Bay Road between Enter Way and Bogard Road. Table 8 and Table 9 show expected future LOS, delay, and volume-to-capacity (v/c) ratios for signalized and unsignalized intersections, respectively. While the signalized intersection of Main Street and Bogard will continue to operate satisfactorily, vehicles at the intersection of Parks Highway and Main Street are expected to experience a LOS F, which indicates long delays and a wait through multiple signal cycles: on average, a vehicle at this intersection will experience 4 minutes of delay during the peak hour, based on demand.

Many intersections along Main Street are two-way stop-controlled intersections. North-south traffic does not stop at these intersections, and thus experiences no delay. However, with few exceptions movements under stop control (eastbound and westbound traffic) will operate with relatively high delay and poor LOS.

The intersection of Swanson Avenue and Main Street is currently operating as an all-way stop-controlled intersection. In 2043, northbound and southbound traffic is expected to operate with a LOS of F while eastbound and westbound traffic operate with a LOS C.

Table 8. Summary of 2043 Signalized Intersections Operations with No Couplet and No Alternative Corridor

			Northbound			Southbound			Eastbound			Westbound			
			Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	OVERALL
Main Street	Bogard Road/ Nelson Avenue	LOS	E	C	B	B	C	B	C	D	A	C	C	A	D
		Delay (s)	70	29	20	20	24	19	32	47	0	25	23	0	36
		v/c Ratio	0.95	0.60	0.15	0.10	0.40	0.05	0.35	0.85	<0.05	0.55	0.55	<0.05	0.85
Main Street	Parks Highway	LOS	F	D	D	E	F	A	F	E	D	F	F	C	F
		Delay (s)	893	55	46	57	320	0	707	68	42	97	178	30	242
		v/c Ratio	2.80	0.50	0.05	0.55	1.55	<0.05	2.35	0.95	0.40	0.85	1.25	0.10	2.50

Table 9. Summary of 2043 Unsignalized Intersections Operations with No Couplet and No Alternative Corridor

			Northbound			Southbound			Eastbound			Westbound		
			Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Main Street	Paulson Avenue	LOS	A	-	-	A	-	-	F					
		Delay	10	-	-	-	-	-	86					
		V/C	0.05	-	-	-	-	-	0.6					
Main Street	Swanson Avenue	LOS	B	F		B	F		C	C		C	D	
		Delay	14	75		15	75		16	22		22	21	
		V/C	0.2	1.75		0.2	1.5		0.2	0.55		0.5	0.75	
Main Street	Herning Avenue	LOS	A	-		A	-		F	F		B	F	
		Delay	10	-		10	-		428	199		13	107	
		V/C	0.05	-		0.05	-		1.65	1.4		0.10	0.95	
Main Street	Railroad Avenue	LOS	A	-		A	-		C			B		
		Delay	0	-		0	-		19			14		
		V/C	<0.05	-		-	-		0.05			0.05		
Knik-Goose Bay	Susitna Avenue	LOS	B	-		B	-		F			F		
		Delay	11	-		11	-		232			938		
		V/C	0.05	-		0.1	-		0.7			2.65		
Knik-Goose Bay	Park Avenue	LOS	B	-		A	-		F					
		Delay	11	-		0	-		109					
		V/C	0.05	-		-	-		0.5					
Knik-Goose Bay	Lake View Avenue	LOS	B	-		B	-		F			F		
		Delay	11	-		11	-		661			299		
		V/C	0.05	-		0.05	-		1.9			1.05		
Knik-Goose Bay	Centaur Avenue	LOS	B	-		-			E					
		Delay	10	-		-			41					
		V/C	<0.05	-		-			0.05					
LOS F						Non-existent Movement								

5.2 No Action Scenario with Parks Highway Alternative Corridor

Summary of traffic operations for the no action with Parks Highway Alternative Corridor scenario are in Appendix C: Operations.

5.3 Couplet Scenario Without Parks Highway Alternative Corridor

Using projected 2035 volumes, the 2016 Wasilla Main Street Update found that a two-lane one-way couplet is an appropriate alternative to improve traffic operations within the study corridor.

Table 10 and Table 11 summarize estimated LOS, delay, and v/c ratio for a 2-lane Wasilla Main Street couplet design with 2043 traffic volumes.

Because of the heavy westbound traffic on Parks Highway during the PM peak period, as much green time as possible is given to the westbound movement at the Parks Highway intersections with Main Street and Yenlo Street. As a result, opposing movements will suffer a poor LOS, most notably the southbound right turn movement at Parks Highway and Main Street and the eastbound left turn movement at Parks Highway and Yenlo Street. Both of these moments are expected to operate with an average delay of about 2 minutes per vehicle, LOS F, and queues of about 26 vehicles and 10 vehicles respectively. The southbound through and northbound through movements at the respective intersections will operate at LOS E.

Although specific movements will operate poorly, the overall LOS of Main Street and Parks Highway and Yenlo Street and Parks Highway will both be LOS C with an expected delay of around 30 seconds per vehicle. Other signalized intersections are expected to operate adequately with most movements performing with a LOS of C or better and all intersections are expected to operate with a LOS of B or C.

Controlled movements at two-way stop controlled intersections, all of which are eastbound or westbound, are expected to perform adequately with LOS of C or higher.

When compared to the existing configuration, the 2-lane one-way couplet performs better. However, two movements will operate at a LOS of F, southbound right-turn movement at Parks Highway and Main Street and the eastbound left-turn movement at Parks Highway and Yenlo Street. The movements with LOS F improve either with an additional westbound through lane along the Parks Highway or with a Parks Highway Alternative Corridor.

Table 10. Summary of 2043 Signalized Intersections Operations with the Couplet and No Parks Highway Alternative Corridor

		Northbound			Southbound			Eastbound			Westbound			
Intersection	**Performance Measure**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**Left**	**Thru**	**Right**	**OVERALL**
Main St & Bogard Rd/ Nelson Ave	Level of Service				C	D		B		B	A	A	A	B
	Delay (s)				25	36		19		16	6	8	9	17
	v/c Ratio				0.05	0.75		0.50		0.30	0.35	0.55	0.35	0.65
Main St & Swanson Ave	Level of Service				B				C		A	A		B
	Delay (s)				11				34		8	6		13
	v/c Ratio				0.60				0.50		0.50	0.25		0.60
Main St & Parks Hwy	Level of Service				E		F*		B	B	D	A		C
	Delay (s)				58		136		18	13	42	7		30
	v/c Ratio				0.85		1.10		0.70	0.40	0.45	0.95		1.05
Yenlo St & Bogard Rd	Level of Service	B		A					B			E		C
	Delay (s)	19		3					17			68		27
	v/c Ratio	0.90		0.35					0.40			0.95		0.95
Yenlo St & Swanson Ave	Level of Service	B						D	C			D	C	C
	Delay (s)	19						39	26			42	28	25
	v/c Ratio	0.75						0.25	0.15			0.75	0.10	0.70
Yenlo St/ Talkeetna Ave & Parks Hwy	Level of Service	E	E	D				F*	A			C	A	C
	Delay (s)	65	63	47				118	4			32	2	34
	v/c Ratio	0.80	0.85	0.35				1.05	0.55			1.05	0.30	1.00
LOS F								Non-existent Movement						

*Congestion on the Parks Highway is to be addressed by other projects

Table 11. Summary of 2043 Unsignalized Intersection Operations with the Couplet and Without Parks Highway Alternative Corridor

			Eastbound			Westbound		
			Left	Thru	Right	Left	Thru	Right
Main Street	Paulson Avenue	HCM Lane LOS		B				
		HCM Control Delay (s)		14				
		HCM Lane V/C Ratio		0.1				
Main Street	Herning Avenue	HCM Lane LOS		F	B	C	E	
		HCM Control Delay (s)		63	13	19	47	
		HCM Lane V/C Ratio		0.70	0.05	0.3	0.55	
Main Street	Railroad Avenue	HCM Lane LOS		B		A		
		HCM Control Delay (s)		12		0		
		HCM Lane V/C Ratio		0.05		<0.05		
Knik-Goose Bay Road	Susitna Avenue	HCM Lane LOS		B		A		
		HCM Control Delay (s)		12		0		
		HCM Lane V/C Ratio		0.05		<0.05		
Knik-Goose Bay Road	Park Avenue	HCM Lane LOS		B		A		
		HCM Control Delay (s)		12		0		
		HCM Lane V/C Ratio		0.05		<0.05		
Knik-Goose Bay Road	Lake View Avenue	HCM Lane LOS		B				
		HCM Control Delay (s)		12				
		HCM Lane V/C Ratio		0.1				
Knik-Goose Bay Road	Centaur Avenue	HCM Lane LOS		B		-		
		HCM Control Delay (s)		11		-		
		HCM Lane V/C Ratio		<0.05		-		
Yenlo Street	Herning Avenue	HCM Lane LOS	A	E			F	C
		HCM Control Delay (s)	5	47			88	18
		HCM Lane V/C Ratio	<0.05	0.55			0.90	0.40
Talkeetna Street	Susitna Avenue	HCM Lane LOS	A			C		
		HCM Control Delay (s)	0			16		
		HCM Lane V/C Ratio	<0.05			0.45		
Talkeetna Street	Park Avenue	HCM Lane LOS	A			B		
		HCM Control Delay (s)	0			11		
		HCM Lane V/C Ratio	<0.05			0.05		
Talkeetna Street	Lake View Avenue	HCM Lane LOS	A					
		HCM Control Delay (s)	0					
		HCM Lane V/C Ratio	<0.05					
Talkeetna Street	Centaur Avenue	HCM Lane LOS	A					
		HCM Control Delay (s)	0					
		HCM Lane V/C Ratio	<0.05					

LOS F | Non-existent Movement

5.3.1 Couplet Scenario Pedestrian Delay

Pedestrian delay was calculated for PM peaks only using HCM2010 methodology. As the volume of traffic on a street decreases, adequate gaps though which pedestrians may cross will increase in frequency, and pedestrians will have more opportunities to cross a road. Therefore, the PM peak, when vehicular volume is the greatest, will have the greatest pedestrian delay. The MUTCD indicates that one gap per minute is of an adequate frequency for acceptable crossing gaps.

Pedestrian crossing analysis was done for both build alternatives, with and without a Parks Highway Alternative Corridor, using forecasted 2043 peak hour volumes and TMVs. Overall, for pedestrians, both alternatives perform similarly with the Parks Highway Alternative Corridor scenario incurring slightly less delay on pedestrians.

Operations for pedestrian traffic is summarized using delay and the frequency of gaps at unmarked crossings and only delay at signalized crossings. As delay increases for pedestrians at uncontrolled locations, pedestrians are likely to cross in shorter gaps, forcing vehicles to yield. When there is excessive delay at signals, pedestrians become more likely to cross against the signal.

5.3.1.1 Pedestrian Delay at Signalized Crossings

Table 12 gives expected pedestrian delay at signalized intersections both with and without a Parks Highway Alternative Corridor.

Table 12. 2043 Pedestrian Delay at Proposed Signalized Intersections both with and without a Parks Highway Alternative Corridor

	No Parks Highway Alternative Corridor				With Parks Highway Alternative Corridor			
	Delay (seconds/pedestrian)				Delay (seconds/pedestrian)			
	EB	SB	WB	NB	EB	SB	WB	NB
Main Street/Wasilla Fishhook Road & Bogard Road/Nelson Avenue	31.5	45.0	45.0	55.6	28.2	35.0	35.0	45.7
Main Street & Swanson Avenue	12.3	45.0	45.0	41.1	13.6	35.0	35.0	31.1
Main Street/Knik-Goose Bay Road & Parks Highway	139.2	70.0	70.0	88.1	52.2	70.0	70.0	88.1
Yenlo Street & Bogard Road	51.8	45.0	45.0	7.5	41.9	35.0	45.0	7.7
Yenlo Street & Swanson Avenue	54.9	45.0	45.0	6.0	45.0	35.0	35.0	14.6
Yenlo Street/ Talkeetna Street & Parks Highway	92.5	70.0	70.0	57.2	66.1	70.0	70.0	62.6

Under both alternatives, when pedestrians are crossing intersections at Parks Highway, they will wait close to or over a minute to cross in any direction with a maximum calculated delay of 139 seconds per eastbound pedestrian at Parks Highway and Main Street under the no Parks Highway Alternative Corridor scenario (52 seconds with the Parks Highway Alternative Corridor). Conversely, pedestrians crossing signalized intersections that are not at Parks Highway will have delays less than one minute.

5.3.1.2 Pedestrian Delay and Gaps at Uncontrolled Crossings

Table 13 summarizes average pedestrian delay and gaps per minute at unmarked unsignalized crossing locations along the Main Street/Yenlo Street Couplet during the PM peak hour with 2043 volumes.

Table 13. 2043 Pedestrian Delay and Gaps per Minute at Unsignalized Crossings both with and without a Parks Highway Alternative Corridor

Crossing Direction	Crossing Location	With Parks Highway Alternative Corridor		Without Parks Highway Alternative Corridor	
		Gaps per Minute	Delay (sec/pedestrian)	Gaps per Minute	Delay (sec/pedestrian)
East-West Crossings	**Main St** Bogard Rd to Swanson Ave	0.81	73.8	0.77	77.3
	Main St Swanson Ave to Parks Hwy	0.95	62.8	0.93	64.3
	Knik-Goose Bay Rd Parks Hwy to Enter Way	2.84	17.0	1.87	30.1
	Yenlo St Bogard Rd to Swanson Ave	1.02	58.6	0.97	61.4
	Yenlo St Swanson Ave to Parks Hwy	0.85	70.5	1.39	41.2
	Talkeetna St Parks Hwy to Enter Way	2.69	18.4	1.72	33.2
North-South Crossings Between Main St and Yenlo St	Bogard Rd	0.07	>300	0.02	>300
	Swanson Ave	1.21	48.4	0.92	67.3
	Herning Ave	2.34	19.5	2.34	19.5
	Railroad Ave	6.66	0.2	6.63	0.6
	Susitna Ave	4.86	2.5	4.55	4.1
	Park Ave	5.09	1.2	5.12	1.0
	Lake View Ave	5.38	3.5	5.79	2.2
	Centaur Ave	5.12	2.3	5.25	1.7

The MUTCD suggests a minimum threshold of one usable crossing gap per minute as a point where pedestrian crossing mitigation should be considered at locations where pedestrian crossings are desired and crossing demand is greater than 20 pedestrians per hour. Crossing gaps at unsignalized mid-block crossings of Main Street and Yenlo Avenue, north of the Parks Highway are at or below one gap per minute during the PM peak hour in 2043; however, observed pedestrian crossing demand was observed to be much lower than 20 pedestrians per hour. During peak hours of the day, pedestrians may divert to a signalized crossing rather than wait for a usable crossing gap. At other hours of the day, outside the PM peak hour, an even greater number of crossing gaps will be available.

No signalized crossing is currently proposed south of the Parks Highway on either Knik-Goose Bay Road or Talkeetna Street; therefore, the nearest protected crossing would be at the Parks Highway. However, the frequency of crossing gaps south of the Parks Highway across Knik-Goose Bay Road and Talkeetna Avenue are greater than one per minute.

Generally, pedestrian delay is expected to be similar with or without a Parks Highway Alternative Corridor.

5.4 Couplet Scenario with Parks Highway Alternative Corridor

Summary of traffic operations for a couplet with Parks Highway Alternative Corridor scenario are in Appendix C: Operations.

5.5 Crossing Treatments

The Alaska Traffic Manual (ATMS) provides guidance in determining if crosswalks should be installed at an unmarked crossing and if additional treatments should be applied at a crossing. Table 14 shows that the number of lanes, the speed limit, and average daily traffic are factors in determining if a crosswalk is appropriate at an unmarked crossing. Additionally, crosswalks should only be considered at locations were 20 or more pedestrians an hour can be observed crossing the road.

On June 13, 2013, between 4:00 PM and 5:00 PM, 17 pedestrians were observed crossing Main Street at Bogard Road/Nelson Avenue. On June 12, 2013 between 4:30 PM and 5:30 PM, 15 pedestrians were observed crossing Main Street at Parks Highway. Taking the intention to make downtown Wasilla more pedestrian friendly and anticipated growth into consideration, 20 pedestrians crossing Main Street and Yenlo Street in an hour is a reasonable assumption.

The two bolded black boxes on Table 14 indicate where Main Street and Yenlo Street fall within the guidelines for the consideration of a crosswalk. With two lanes, no median, posted speed limits of 25 mph and projected volumes between 11,600 and 12,600 vehicles per day Main Street and Yenlo Street can be considered candidates for crosswalks.

However, the ATMS states that crosswalks should not be installed at locations where pedestrians will be diverted from either signalized crossings or grade-separated crossing. In the case of pedestrian hybrid beacons or rectangular rapid flashing beacons, a distance of 300 feet. In the case of a school crossing, a crosswalk should not be installed 400 feet within a signalized crosswalk.

Bogard Road, Swanson Avenue, and Main Street will all be signalized with pedestrian crossings. About 660 feet separates Bogard Road and Swanson Avenue and about 740 feet separates Swanson Avenue and Parks Highway. As such a pedestrian traversing Main Street or Yenlo Street should never be more than 370 feet from a signalized crossing, and therefore additional unsignalized crosswalk treatments are not recommended.

Table 14. Candidacy for Crosswalks at Unmarked Locations

No of Lanes	Raised Median?	Vehicle ADT													
		<9,000				>9,000 to 12,000				>12,000 to 15,000			>15,000		
		Speed Limit (MPH)													
		<30	35	40	>45	<30	35	40	>45	<30	35	>40	<30	35	>40
2	No	C	C	M	N	**C**	C	M	N	**C**	C	N	C	M	N
3	No	C	C	M	N	C	M	M	N	M	M	N	M	N	N
>4	Yes	C	C	M	N	C	M	N	N	M	M	N	N	N	N
>4	No	C	M	N	N	M	M	N	N	N	N	N	N	N	N

Source: FHWA-RD-01-075, Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations, 2002

C	Candidate sites for marked crosswalks. Before marking a crosswalk, the site should be studied to ensure it is suitable. The study may include a review of pedestrian volumes, available gaps, sight distance (see Note 1), vehicle mix, pedestrian mix, distance to adjacent crossings (see Note 2), etc. Crosswalks should not be installed at locations with fewer than 20 pedestrian crossings per peak hour (or 15 for elderly and/or child pedestrians).
M	Marginal candidate sites for marked crosswalks: Pedestrian accident risk may increase if crosswalks are marked. If pedestrian improvements are necessary, other options should be explored before marking crosswalks.
N	Crosswalks should not be installed at these locations.

6 Other Considerations

6.1 On-Street Parking

On-street parking stalls on Main Street, Yenlo Street, and Herning Avenue have been proposed. Front-in angle parking, a technique in which a car drives forward into an angled parking spot, has been proposed on Main Street between Bogard Road/Nelson Avenue and Herning Avenue. Parallel parking has been proposed along Yenlo Street and Herning Avenue. Note that AASHTO states in its Guide for the Development of Bicycle Facilities that under normal circumstances conventional front-in angle parking stalls should not be placed adjacent to bike facilities. Difficulty observing bicyclists and on-coming traffic when backing into the road from the parking raises safety concerns.

Engineering studies show that front-in angle parking results in more crashes than parallel parking. Elvik and Vaa (2004) published a crash modification factor of 0.63 (27% reduction) for parking related crashes when converting front-in angle parking to parallel parking. Box (2002) found a crash modification factor for converting parallel parking to front-in angle parking of 1.18 (18% increase) in parking related crashes by 18%.

Parallel parking and back-in angle parking are two viable alternative parking techniques. Parallel parking is familiar to most drivers, a driver locates an adequate space and then backs into the stall lengthwise along a curb. Advantages of parallel parking include its familiarity and less right of way required per stall. A safety concern of parallel parking is dooring, a type of crash in which a vehicle occupant opens their door and a cyclist crashes into the door.

Back in angle parking is a technique in which a driver backs into an angled on-street parking stall. Although back-in angle parking is unfamiliar to many drivers, the mechanics of the parking maneuver are similar to that of parallel parking. Safety benefits of back-in angle parking include:

- Cyclists and on-coming traffic visible when backing in and pulling out from parking stall
- Doors are not opened into the traveled way eliminating dooring crashes with cyclists
- Doors open out towards the street channeling occupants away from the traffic stream
- Trunk is loadable from the sidewalk, keeping drivers and occupants out of the traveled way

While back-in angle parking offers multiple safety benefits, it has drawbacks as well:

- Drivers can back into objects on the sidewalk including pedestrians
- Vehicle exhaust is expended into the pedestrian way
- Drivers may still choose to park front-in, either crossing on-coming traffic or making large turning maneuvers, which will have a greater impact on traffic flow and safety

6.1.1 On-Street Parking Impacts on Traffic Operations

Methods in the Highway Capacity Manual 2010 state that on-street parking stalls 250 feet upstream of a stop line have an impact on vehicular flow in lane groups adjacent to the parking stalls.

The west side of Yenlo Street between Parks Highway and Swanson Avenue is proposed to be striped with 8.5-foot shoulders. AASHTO recommends 8 feet of space from the curb for parallel parking stalls. However, on roads with posted speed limits of 30 mph or less, 7 feet suffices. The MUTCD indicates that an end parking stall is 20 feet, and stalls located between are 23 to 26 feet

in length. Table 15 below shows the on-street parking stall distribution along both Yenlo and Main Streets and on Herning Avenue. Using a parking stall length of 25 feet, there is space for 24 stalls along Yenlo Street. Of the 24 parking stalls along Yenlo Street, 8 can be considered to influence the northbound traffic flow along Yenlo Road at Swanson Avenue.

Table 15. Proposed Number of Parking Stalls and Parking Maneuvers for Sensitivity Analysis on Yenlo Road

Street	From	To	Parking Stalls
Yenlo Street	Swanson Avenue	Herning Avenue	8
Yenlo Street	Herning Avenue	Parks Highway	16
Main Street	Nelson Avenue/ Bogard Road	Paulson Avenue	3
Main Street	Paulson Avenue	Swanson Avenue	7
Main Street	Swanson Avenue	Herning Avenue	7
Herning Avenue	East Approach and Main Street		6

The analysis used the proposed number of front-in angle parking stalls along Main Street; less parallel parking stalls and about the same number of back-in parking stalls would fit in the same amount of right of way. Table 15 gives the number of proposed parking spaces along each link on Main Street. The 7 proposed parking stalls between Paulson Avenue and Swanson Avenue are with 250 feet of the proposed signal at Swanson Avenue and Main Street.

Approximately six on-street parallel parking stalls have been proposed along the north side of Herning Avenue at Main Street. Operation analysis in the HCM2010 does not account for the effects of on-street parking at stop controlled intersections at two-way stop controlled intersections.

To measure the effect that on-street parking will have on intersections in the vicinity, a sensitivity analysis was performed using different rates of turnover. For the sensitivity analysis, a 60-minute turnover rate (one exit and one entrance per stall per hour) a 30-minute turnover rate (two-exits and two-entrances per stall per hour), and 15-minute turnover rate were used.

Table 16 shows the impacts of parking on southbound traffic along Main Street at Swanson Avenue. The effects of parking maneuvers on vehicle delay is very small. With the additional delay due to parking maneuvers, southbound traffic will still operate at a LOS B.

Table 16. Effect of On-Street Parking on Southbound Main Street Traffic at Swanson Avenue Intersection, No Parks Highway Alternative Corridor

Location	Movement	Number of Stalls	Rate of Turn Over	Maneuvers per Hour	v/c	Intersection Delay (sec/veh)	LOS
Main Street – Paulson Ave to Swanson Ave	Southbound Through	7	No Parking	-	0.59	12.9	B
			60-minutes	14	14.1	12.8	B
			30-minutes	28	0.64	14.7	B
			15-minutes	56	0.68	15.7	B

On-street parking along Yenlo Street has a greater impact on traffic than the on-street parking on Main Street. Comparing a no parking scenario to a scenario in which each stall experiences a turnover rate of 15-minutes, delay at Yenlo Street and Herning Avenue increases by 24.5 seconds per vehicle to a total of 33.4 seconds per vehicle. Nevertheless, the intersection will still operate at LOS C.

Table 17. Effect of On-Street Parking on Northbound Yenlo Street Traffic at Herning Avenue Intersection, No Parks Highway Alternative Corridor

Location	Movement	Number of Stalls	Rate of Turn Over	Maneuvers per Hour	v/c	Intersection Delay (sec/veh)	LOS
Yenlo Street – Herning Ave. to Swanson Ave.	Northbound Through	8	No Parking	-	0.69	24.5	C
			60-minutes	16	0.74	26.5	C
			30-minutes	32	0.76	28.0	C
			15-minutes	64	0.82	33.4	C

6.2 2-Lane vs 3-Lane Couplets and Weaving

One consideration with the current design is the increased effects of weaving and congestion on a 2-lane one-way couplet as compared to a 3-lane couplet. In a 3-lane couplet, progression of traffic in the outside lanes is impacted by blockages caused by parking maneuvers and turning traffic; however, the center lane is generally free flowing with only indirect friction due to traffic weaving from outside lanes. In a 2-lane one-way couplet both lanes are subject to blockages and following traffic does not have the free-flowing adjacent lane to use for weaving.

This analysis was completed without the inclusion of weaving data, using intersection performance methodology from the Highway Capacity Manual (HCM 2000). This methodology uses empirical data to estimate the future performance of intersections. The methodology accounts for the effect of on-street parking with a reduction in the saturated flow rate by identifying the area as a central business district (CBD). Also, the saturated flow rate is further reduced by modeling parking maneuvers per hour along the segment. Both of which result in a reduction of the capacity and an increase in the reported delay. However, the empirical analysis does not directly consider the dynamic impact of weaving and queueing which would require microsimulation, and was outside the scope of this project.

The effect of weaving-related delay could have an impact on operations and safety at closely spaced intersections with large turning volumes in an urban environment, especially in the case of

a 2-lane couplet where both the left and right lane would be affected by the friction of either turning or parking vehicles. Weaving may also have the positive benefit of slowing traffic, and extending the length of gaps for pedestrian crossings.

Note that examples of existing 2-lane one-way couplets were found in other cities throughout the nation; however, no studies were found which compared the operation of 2-lane couplets and 3-lane couplets.

6.3 Yenlo Street and Herning Avenue Right-In-Right-Out Option

The east approach of Herning Avenue and Yenlo Street is an access point to the Carrs Mall. With the increase in volumes on Yenlo Street due to the construction of the Yenlo-Main couplet, vehicles may have more delay leaving the Carrs driveway and queues may impact the parking lot. While it would help operationally to define two exit lanes for the approach, the parking lot layout makes this difficult. One possible solution is to convert the approach to right turn only; however, analysis provided below shows that this option is not favorable.

Table 18 compares projected queues for different alternatives. The number of vehicles are rounded up to the nearest vehicle from HCS2010 outputs and each vehicle is given a length of 25 feet to determine a queue length. Queues remain similar between scenarios when a right-in right-out configuration is not implemented. There is little difference in expected queues between Parks Highway Alternative Corridor scenarios when a right-in right-out policy is implemented as well. With the installation of a Parks Highway Alternative Corridor, the queue on the east approach of the Yenlo Street and Herning Avenue intersection is expected to be 50 feet shorter (2 vehicles) than if there were no Parks Highway Alternative Corridor installed.

Table 18. Queue Comparison of a Right-In-Right-Out Only on the East Approach of Yenlo Street and Herning Avenue (Carrs Mall)

Alternative	With Parks Highway Alternative Corridor?	Queue
Couplet Westbound Shared Through-Right Turn Lane	Yes	30 vehicles (750 feet)
Couplet Westbound Shared Through-Right Turn Lane	No	35 vehicles (875 feet)
Couplet Westbound Right	Yes	7 vehicles (175 feet)
Couplet Westbound Through	Yes	2 vehicles (50 feet)
Couplet Westbound Right	No	7 vehicles (50 feet)
Couplet Westbound Through	No	2 vehicles (50 feet)
Couplet Bypass Carrs Right-in Right-out Only	Yes	6 vehicles (150 feet)
Couplet Carrs Right-in Right-out	Yes	8 vehicles (200 feet)

Table 19 shows movements with an expected increase in volume and the expected peak hour traffic increase with the installation of a right-in right-out only configuration. Westbound through movements at Herning Avenue and Yenlo Street are converted into westbound right turns and then distributed throughout the network. Eastbound through movements at Herning Avenue and Yenlo Street were also distributed.

Table 19. Movements with Increased Volumes with a Right-in Right-Out Only Configuration at Yenlo Street and Herning Avenue

Intersection and Movement		Without Parks Highway Alternative Corridor			With Parks Highway Alternative Corridor		
		Initial	RIRO	Increase	Initial	RIRO	Increase
Herning Avenue & Yenlo Street	Westbound Right	175	335	160	170	355	185
	Northbound Right	110	200	90	110	205	95
Swanson Avenue & Yenlo Street	Northbound Left	75	235	160	70	235	165
Swanson Avenue & Main Street	Westbound Left	200	360	160	195	360	165
Herning Avenue & Main Street	Southbound Through	1035	1135	100	1020	1130	110
	Southbound Right	55	130	75	60	135	75
	Eastbound Right	15	85	70	10	80	70
Parks Highway & Main Street	Southbound Left	260	350	90	320	410	90
Parks Highway & Yenlo Street	Eastbound Left	280	370	90	265	360	95

Both the southbound movements at Parks Highway and the eastbound left movement at Parks Highway and Yenlo Street are operating near or below a LOS of E. Table 20 and Table 21 compare operations between initial volumes and right-in-right-out volumes for the with and without a bypass scenario. There is little effect on the southbound left turn movement at the Parks Highway and Main Street intersection; however, delay increases for eastbound left turning vehicles at Yenlo Street and Parks Highway under the right-in-right-out alternative for the no-bypass scenario.

Table 20. Comparison of Operations at Park Highway Intersections with a Right-in Right-out Only Configuration at Yenlo Street and Herning Avenue without Parks Highway Alternative Corridor

Intersection	Movement	Initial			Right-in Right-out		
		LOS	Delay (sec)	v/c Ratio	LOS	Delay (sec)	v/c Ratio
Parks Highway & Main Street	Southbound Left	F	136	1.12	F	131	1.11
Parks Highway & Yenlo Street	Eastbound Left	F	118	1.05	F	246	1.38

Table 21. Comparison of Operations at Park Highway Intersections with a Right-in Right-out Only Configuration at Yenlo Street and Herning Avenue with Parks Highway Alternative Corridor

Intersection	Movement	Initial			Right-in Right-out		
		LOS	Delay (sec)	v/c Ratio	LOS	Delay (sec)	v/c Ratio
Parks Highway & Main Street	Southbound Left	D	51	0.85	D	41	0.66
Parks Highway & Yenlo Street	Eastbound Left	E	64	0.8	E	73	0.91

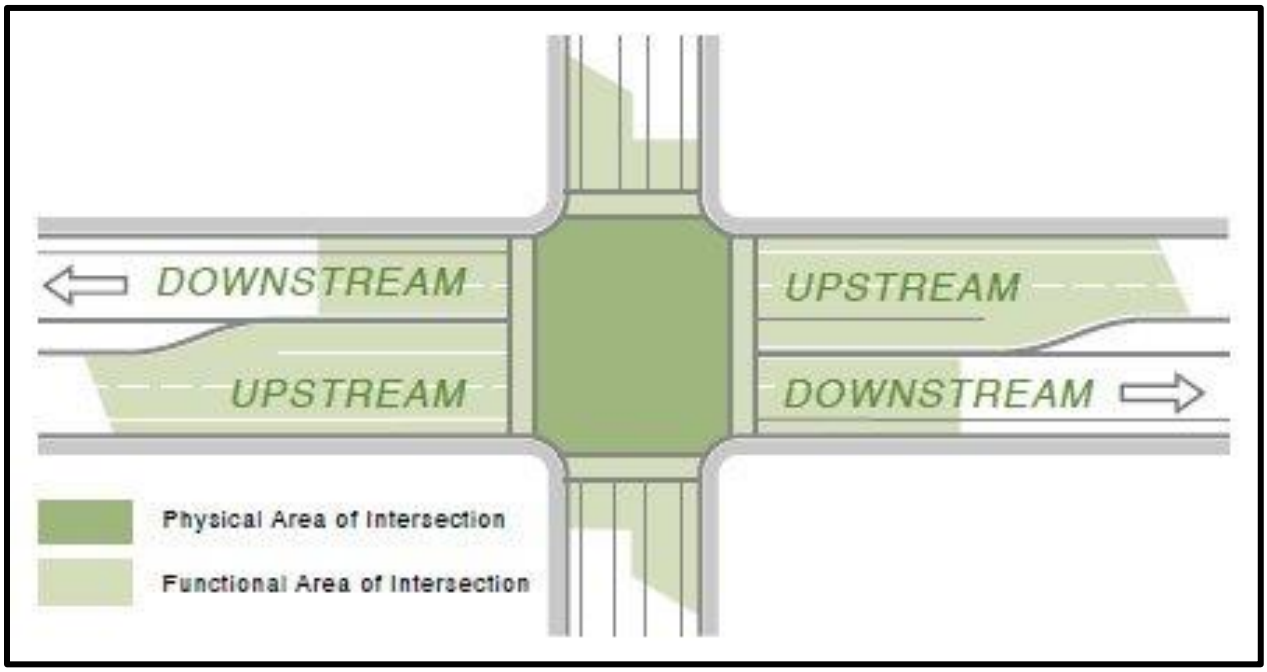
Converting the east approach of Yenlo Street and Herning Avenue into a right-in right-out only configurations is not a perfect solution, as it causes increased out-of-direction travel that impacts the Parks Highway. The eastbound left turn lane at Parks Highway and Yenlo Street is of concern as it is already operating at a LOS F and redirecting traffic to this movement will increase the delay.

Consideration could be given to improving the driveway on Swanson Avenue to allow vehicles to exit the parking lot on a lower volume roadway and access Yenlo Street at a traffic signal.

6.4 Functional Area of Parks Highway Signals and The Effect on Driveways

The functional area of an intersection is defined in the Access Management Manual as the area where intersection operations and conflicts significantly influence driver behavior, vehicles operations, or traffic conditions. While poorly located access points can introduce delay, reduce capacity, break down platoons, or introduce shock waves, right-in right-out only access points can impact operations at downstream left turns as U-turns by drivers unable to turn left out of the driveway will increase.

The Alaska Highway Preconstruction Manual states that unless necessary, there should be no driveways on arterials. Additionally, AASHTO's A Policy on Geometric Design of Highways and Streets states, that when possible a frontage road is the preferred method to access businesses along an access controlled roadway.



Source: FHWA Access Management Manual
Figure 11. Upstream and Downstream Influence Area near Intersections

6.4.1 Downstream Functional Area of Signalized Intersections

Downstream functional area is located on the exit of an intersection. Two possible measurements can be used for determining downstream functional area: the distance it takes to accelerate to speed from a stop, or sight distance. The larger of the two should be used to define the functional length.

Sight distance is the distance required by a driver to respond to a condition downstream from the driver. Decision sight distance is composed perception-reaction time (the time it takes to perceive that an action is needed) and either breaking or maneuvering distance (the distance traveled while responding). AASHTO gives stopping sight distance as 360 feet on a level roadway with a speed limit of 45 mph. However, the Access Management Manual suggests using decision sight distance when defining the downstream functional area. Decision sight distance is greater than stopping sight distance allowing a greater distance for drivers to make more complex decisions and maneuvers before stopping.

The Access Management Manual gives decision sight distances for change in speed, path, or direction and speed. For a 45-mph road given sight distances are 675, 800, and 930 for rural, suburban, and urban roadways, respectively. Wasilla, having a population between 5,000 and 50,000, fits AASHTO's definition of being a small urban community (as given in the PGDHS). Therefore, functional area based on sight distance is 930 feet.

Adequate acceleration length is the distance required for a stopped vehicle to accelerate to roadway speed. The Access Management Manual gives the acceleration length for a 45-mph roadway as 580 feet.

The functional area given as a function of acceleration distances is 580 feet and based on of sight distance is 930 feet. The Access Management Manual states the functional area should be defined by the larger of the two values, so the downstream functional area is 930 feet. Because these conditions are the same for all of the Parks Highway intersections, the intersections of Yenlo Street

and Parks Highway and of Crusey Street and Parks Highway have the same downstream functional area.

6.4.2 Upstream Functional Area of Signalized Intersections

Upstream functional distance is the sum of three distances: distance traveled during perception-reaction time, distance traveled during the deceleration maneuver, and queue storage. For auxiliary lanes, which are composed of a queue storage and deceleration length, the upstream functional area is the sum of the lane length and perception-reaction time.

Perception reaction time is the time is takes for a driver to recognize that an action is needed (in this case the need to stop at a signal) and to initiate breaking. Perception reaction time is dependent on the driver's familiarity with a roadway and the roadway environment. The Access Management Manual suggests a perception reaction time of 1.5 second for signals on urban roadways. At a speed of 45 mph the distance traveled in the perception reaction time is 100 feet.

The distance traveled during the decelerating maneuver at a signalized intersection is defined as the greater of the deceleration length and the impact distance. Deceleration length is the length required for a driver to come to a stop at traffic signal. The impact distance is defined in the Access Management Manual as the distance upstream of an access connection at which the brake lights of a through vehicle in the curb lane are activated in response to the interference of a right-turning vehicle. The Access Management Manual provides 85th percentile deceleration lengths, or the distance at which 85 percent of drivers will be able to stop (only 15% of drivers will require a greater distance to stop). At 45 mph, the 85th percentile distance is 305 feet.

The Access Management Manual also provides guidance in finding the impact length. On a 45-mph road, allowing 2% of vehicles to be impacted, an impact length of 420 feet is recommended.

The deceleration distance is then the greater of the deceleration length and the impact distance. In this case, the impact distance is longer, at 420 feet.

The length to be used for queue storage should be taken as the longest queue experienced in a day. Table 22 shows 95 percentile queues from Synchro rounded up to the nearest 25 feet.

Table 22. Calculated Queue Lengths on Parks Highway between Yenlo Street and Crusey Street

Movement	Yenlo Street & Parks Highway	Crusey Street & Parks Highway
	95th Percentile Queue	95th Percentile Queue
Through	1150 feet	250 feet
Westbound Right	25 feet	-
Eastbound Left	-	125 feet

Table 23 summarizes the previously discussed upstream functional area components and shows how they are added together to calculate the upstream functional area.

Table 23. Upstream Functional Area Summary

Length	Yenlo Street & Parks Highway		Crusey Street & Parks Highway	
	Through	Right	Through	Left
Perception Reaction Distance (ft)	100	100	100	100
Decelerating Maneuver				
Impact Length (ft)	**420**	-	**420**	-
Deceleration Length (ft)	305	1,125	305	450
Queue Length (ft)	1,150		250	
Upstream Functional Length (ft)	1,670	1,225	770	550

6.4.3 Overall Influence Area

Upon calculating the influence areas on Parks Highway at Yenlo Street and Crusey Street, all five driveways along westbound Parks Highway were found to be within an influence area of an adjacent signalized intersection. According to the Access Management Manual full access points are acceptable in areas outside of both the downstream and upstream functional area of adjacent signals. Figure 12 shows the downstream and upstream functional areas for the Crusey Street and Parks Highway intersection and for the proposed Yenlo Street and Parks Highway intersection.

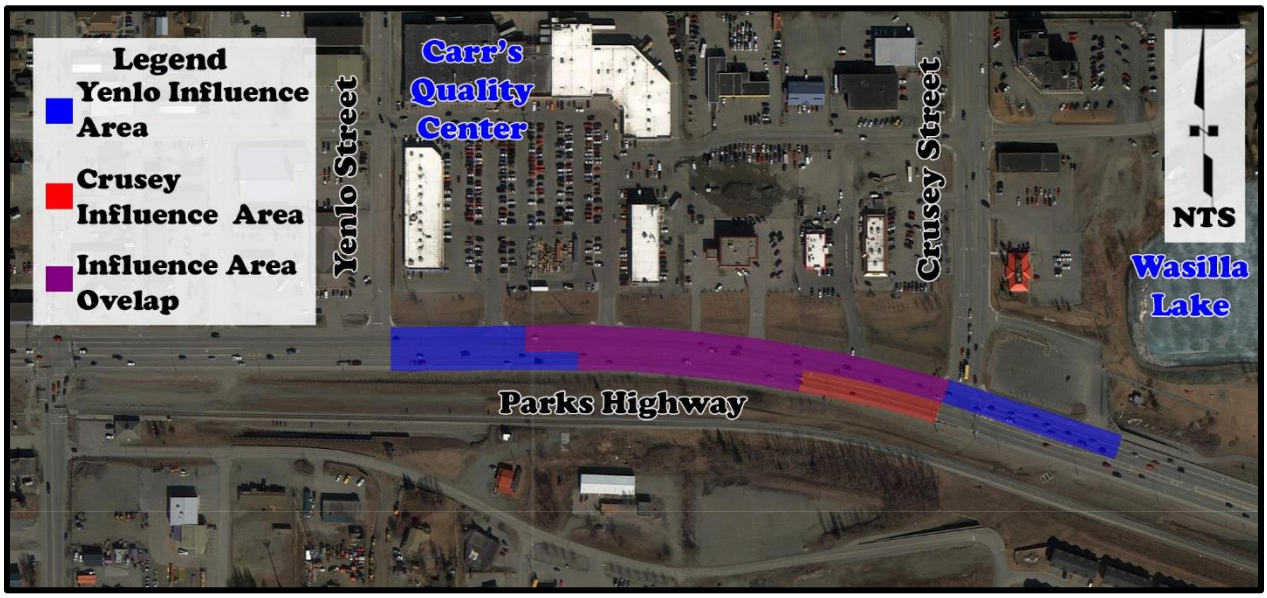


Figure 12. Approximate Influence Areas of Yenlo Street and Crusey Street on Parks Highway

In the existing condition, 4 of the 5 driveways on the westbound Parks Highway allow left turns both in and out. With the installation of the Main Street/Yenlo Street couplet, these five driveways will be located inside the influence area of the newly signalized Yenlo Street intersection. A raised median will be installed on the east approach of the Yenlo Street/Parks Highway limiting traffic at the west-most driveway to right-in right-out traffic only. The remaining driveways in this segment are not recommended to be restricted since removal of access to these properties would necessitate reconfiguration of the street system, and extensive coordination with the area property owners and the City of Wasilla, all of which is outside the scope of this project.

7 Conclusions

The proposed couplet will continue to meet the project purpose and need through the updated design year of 2043. Along the proposed couplet, some intersections will experience increased crash rates due to an increase in traffic volume and a redistribution of trips. However, the installation of a couplet will likely reduce overall crash rates by approximately 10%.

Under the no build condition, performance within the study area will degrade until the operations in 2043 are unacceptable (LOS F) at the signalized intersection of Parks Highway and Main Street, and at the four-way-stop intersection of Main Street and Swanson Avenue. Likewise, the left turns off the side streets will experience very high delay (as high as 15 minutes of average delay for some approaches).

Under the proposed alternative, the traffic signals will all operate at LOS E or better. Only two movements, the dual eastbound left-turn at Parks Highway and Yenlo Street and the southbound right-turn at the intersection of the Parks Highway and Main Street, will operate at LOS F (about two minutes of delay per vehicle for those movements in the PM peak). Analysis determined that improvements to the LOS grade at the Parks Highway intersections would require additional east and westbound through lanes which would require improvements to the highway which are outside the scope of this project. All other intersections meet LOS D or better in the PM peak hour of the 2043 design year.

Under the proposed alternative, forecasted 2043 pedestrian facilities will perform with greater than one useable gap per minute, and a demand of less than 20 pedestrians per hour. Therefore, no crossing mitigations are recommended. The exceptions to this are on the north end, where demand of greater than 20 pedestrians per hour were observed, and some segments of Main Street and Yenlo Avenue are expected to have fewer than 1 useable gap per minute. However, in this area of the CBD protected crossings will be available at new signalized intersections at Main Street and Swanson Avenue, and Yenlo Street and Swanson Avenue.

Analysis of the westbound approach of Herning Avenue to Yenlo Street indicates that the approach is projected to have high enough volumes to warrant an auxiliary right-turn lane. However, due to geometry constraints, it is likely that there will not be adequate space to fit an additional lane at this approach. Even with the additional turn lane, moderate queues of approximately 75 feet are expected. The geometry of the parking lot will make it difficult to accommodate queues even of this length within the parking lot adjacent to the intersection. As a result, consideration was given to converting the westbound approach at Yenlo Street and Herning Avenue to a restricted right-in right-out driveway. The results show that this option would increase delay for critical movements within the network (including the eastbound dual left turn from the Parks Highway onto Yenlo Street) without reducing queues in the Carrs parking lot.

An additional concern is the driveways into the Carrs parking lot along the Parks Highway, on the westbound approach to the proposed Yenlo Street signal. With a new signal being installed at the Parks Highway and Yenlo Street, the driveways are going to become closer to traffic signals and will fall within their influence area. Intersection functional area was calculated for the proposed signals at Parks Highway and Main Street and Parks Highway and Yenlo Street. It is recommended that the west driveway into Carrs, closest to the Yenlo intersection be restricted to Right-in-right-out access only. Other driveways onto the Parks Highway between Crusey and

Yenlo are not recommended for restriction at this time, since the conditions at these driveways are not changing as a result of this project.

8 References

A Policy on Geometric Design of Highways and Streets (6th Edition), American Association of State Highway and Transportation Officials (AASHTO), 2011.

Access Management Manual (2nd Edition), Transportation Research Board of the Academies, (TRB), 2014.

Intersection Channelization Design Guide, National Cooperative Highway Research Program (NCHRP) Report 279, TRB, 1985.

Analytical Travel Forecasting Approaches for Project-Level Planning and Design, NCHRP Report 765, TRB 2014.

Evaluating Intersection Improvements: An Engineering Study Guide, NCHRP Report 457, TRB 2001.

Traffic Impact Analysis: Southcentral Foundation Valley Medical Complex Phase I Wasilla, Alaska, DOWL HKM, 2011.

Synchro 8, Trafficware.

Highway Capacity Software, McTrans.

Highway Capacity Manual (HCM), TRB, 2000.

Alaska Highway Preconstruction Manual, DOT&PF, 2013.

Traffic Engineering Handbook (7th Edition), TRB, 2016.

Access Management Manual, 2nd Edition, TRB, 2014.

FHWA Access Management in the Vicinity of Intersections, FHWA, 2010.

9 Appendix A: AADTs

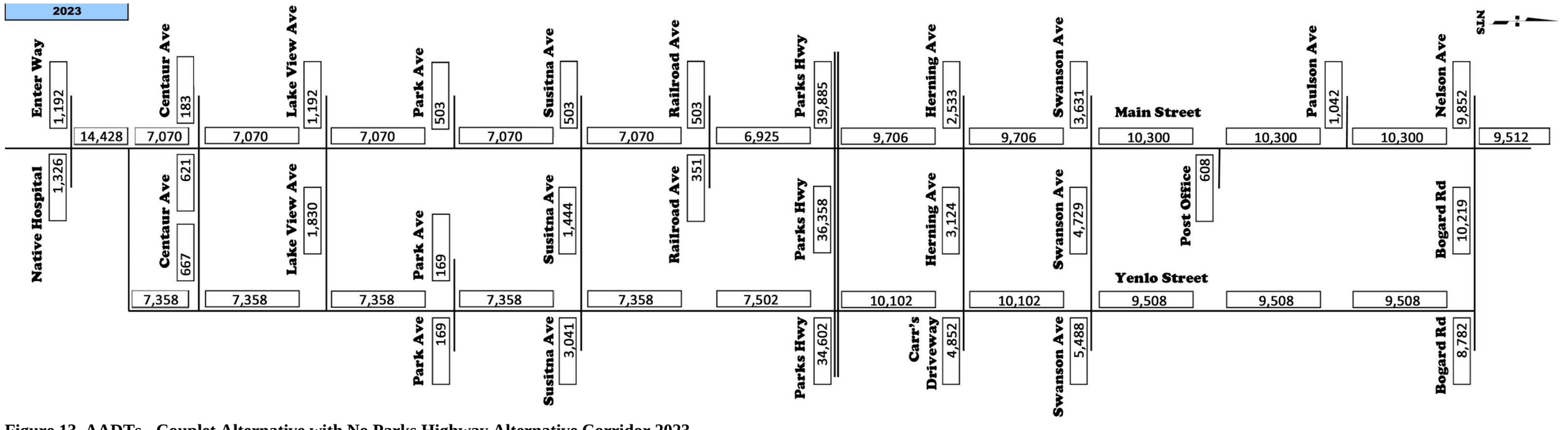


Figure 13. AADTs - Couplet Alternative with No Parks Highway Alternative Corridor 2023

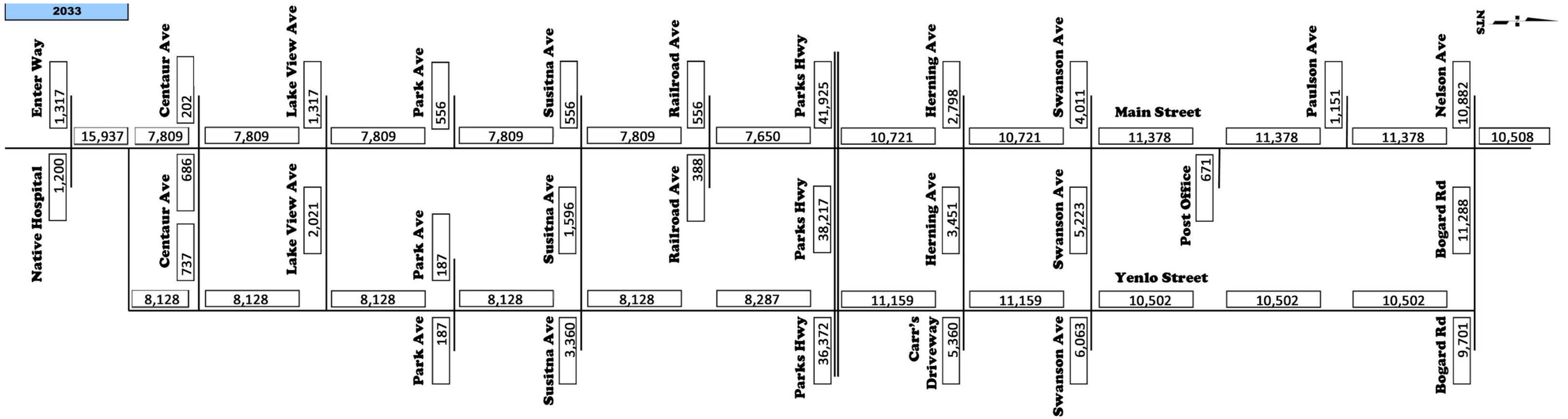


Figure 14. AADTs - Couplet Alternative with No Parks Highway Alternative Corridor 2033

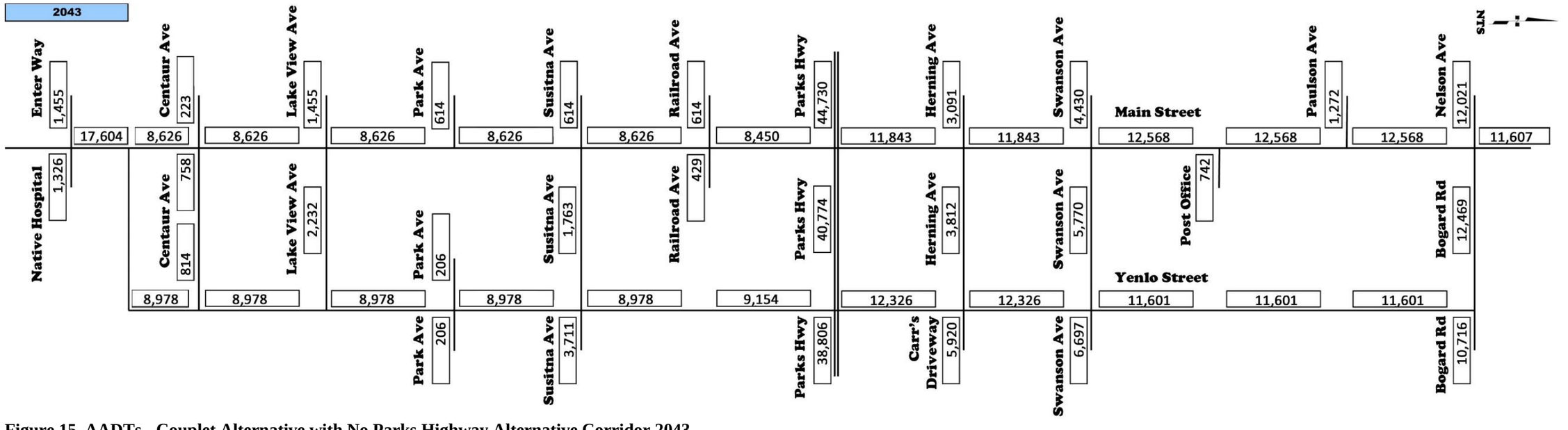


Figure 15. AADTs - Couplet Alternative with No Parks Highway Alternative Corridor 2043

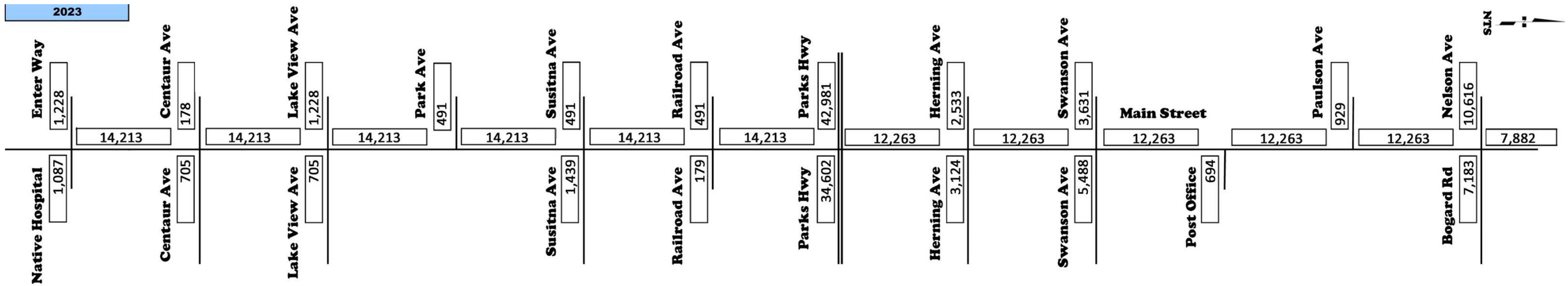


Figure 16. AADTs - No Build Alternative No Parks Highway Alternative Corridor 2023

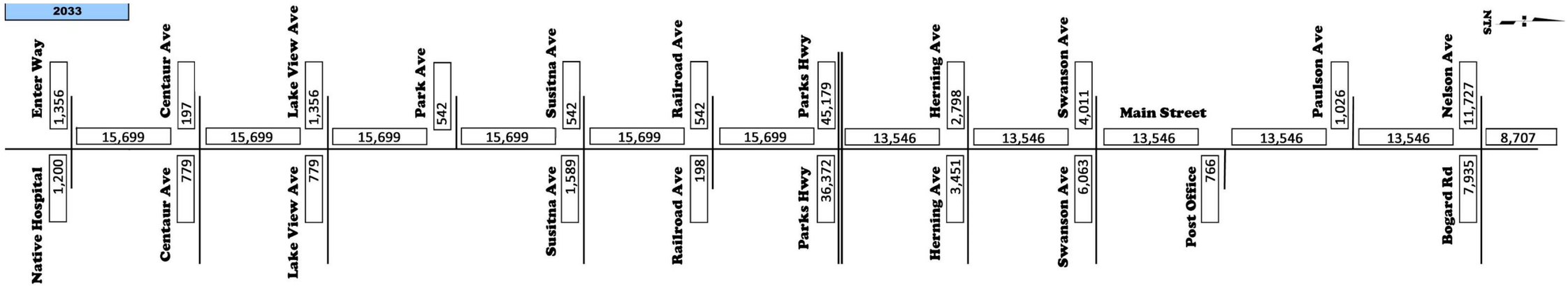


Figure 17. AADTs - No Build Alternative No Parks Highway Alternative Corridor 2033

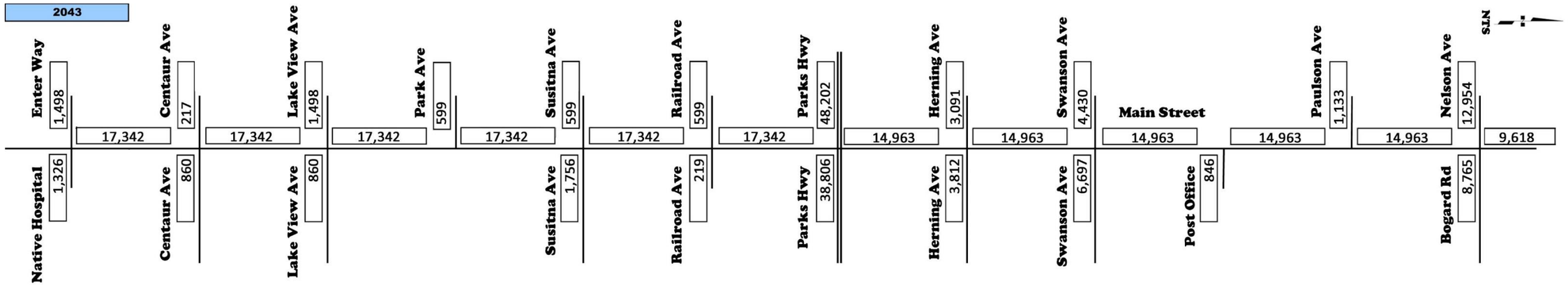


Figure 18. AADTs - No Build Alternative No Parks Highway Alternative Corridor 2043

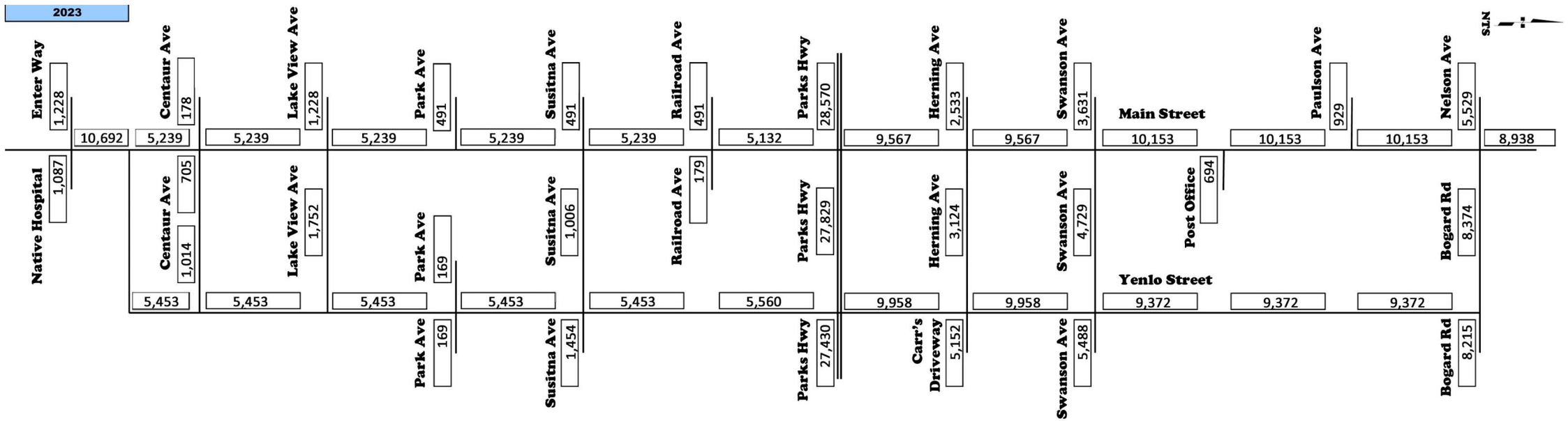


Figure 19. AADTs - Couplet Alternative with Parks Highway Alternative Corridor 2023

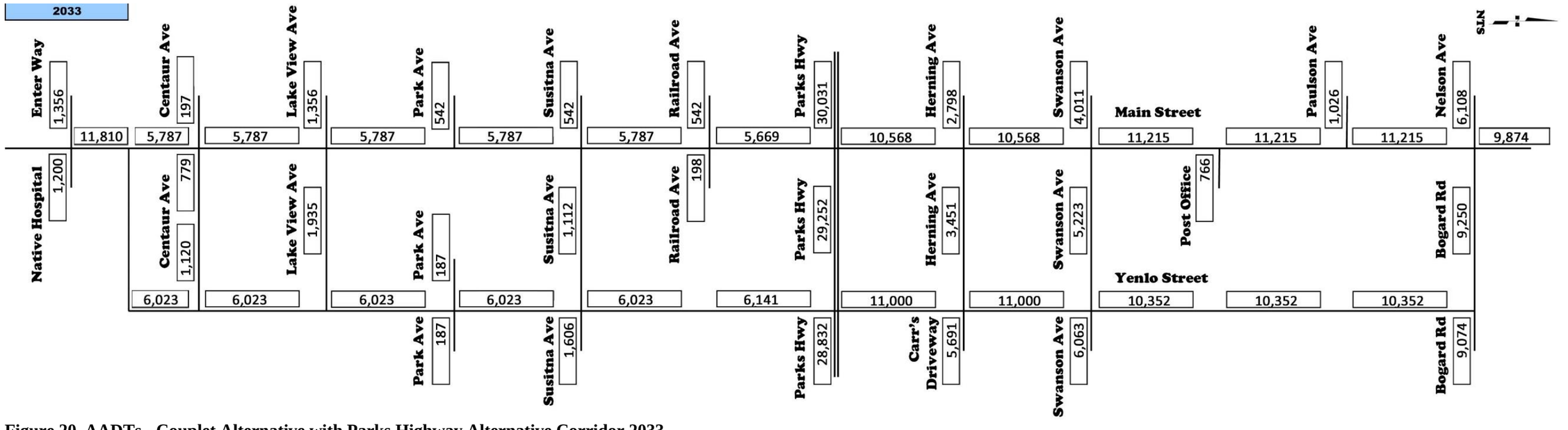


Figure 20. AADTs - Couplet Alternative with Parks Highway Alternative Corridor 2033

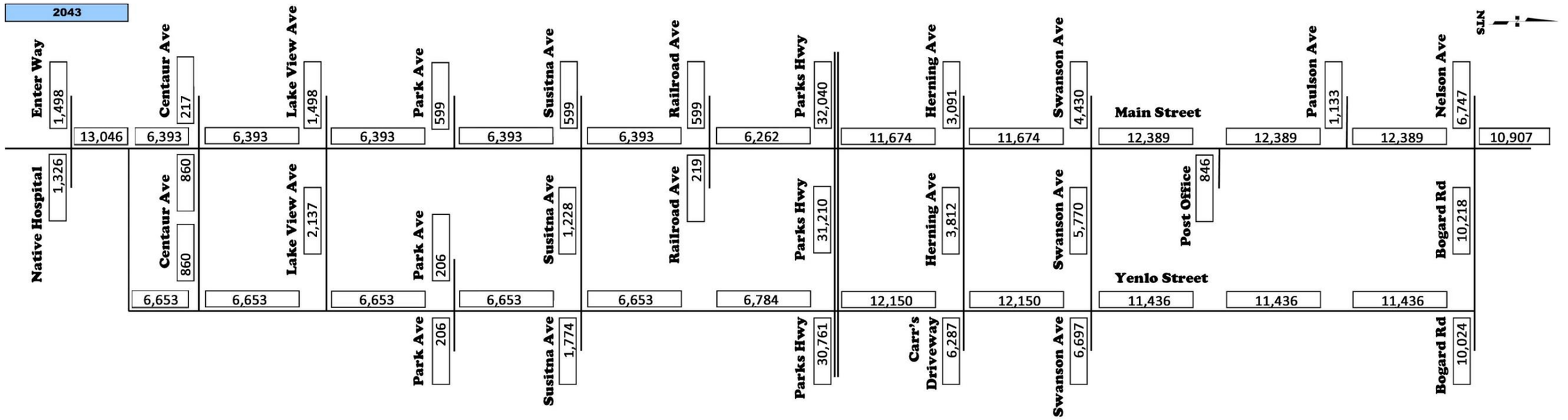


Figure 21. AADTs - Couplet Alternative with Parks Highway Alternative Corridor 2043

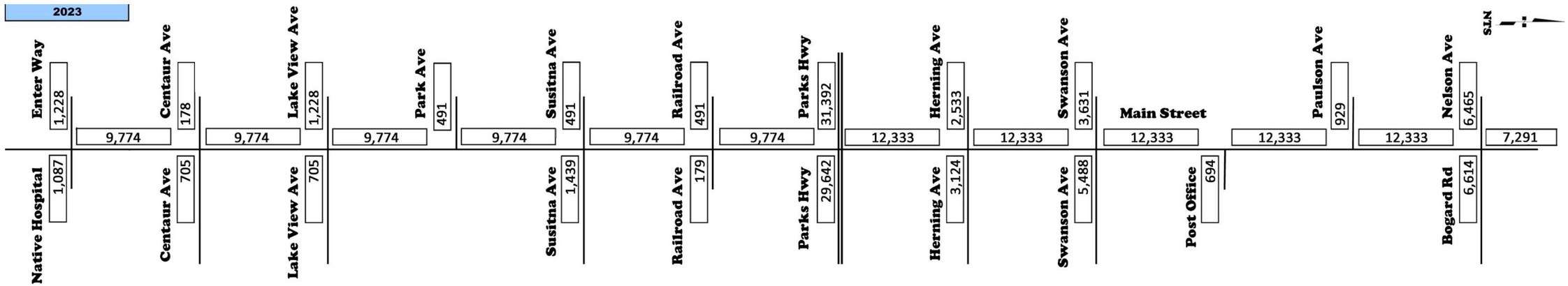


Figure 22. AADTs - No Build Alternative with Parks Highway Alternative Corridor 2023

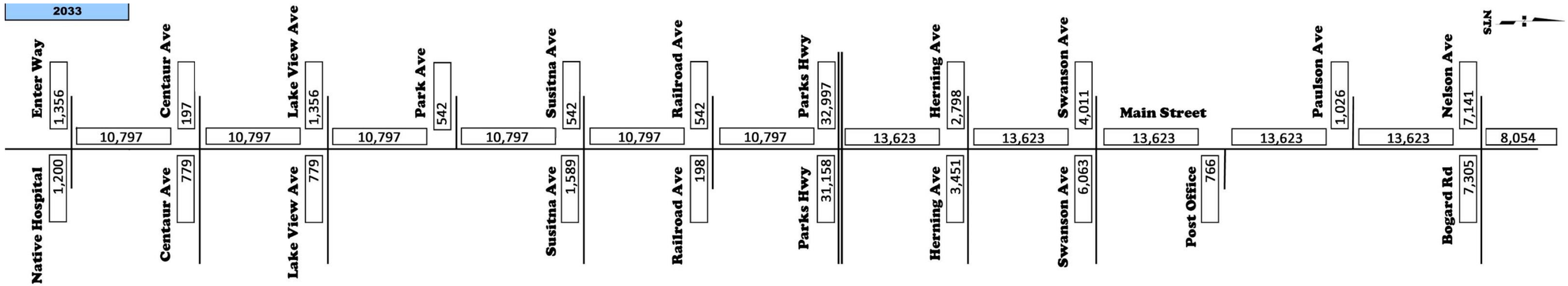


Figure 23. AADTs - No Build Alternative with Parks Highway Alternative Corridor 2033

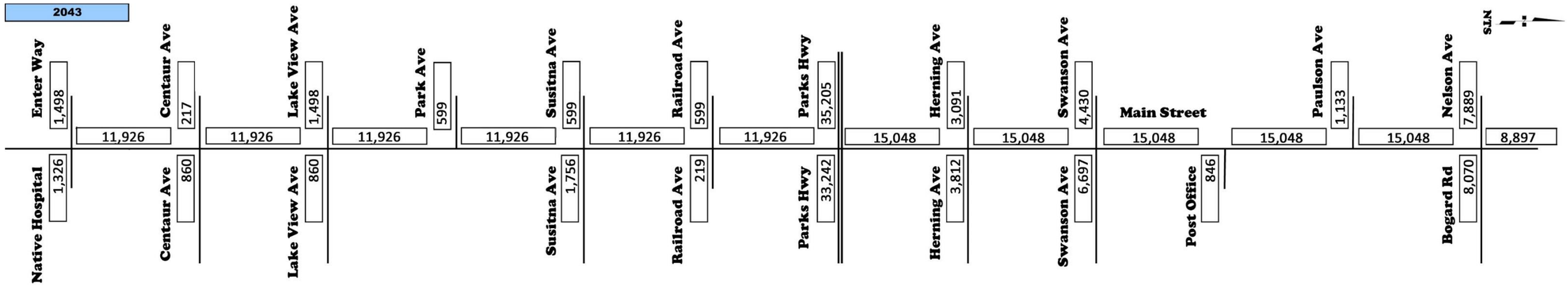


Figure 24. AADTs - No Build Alternative with Parks Highway Alternative Corridor 2043

10 Appendix B: TMVs

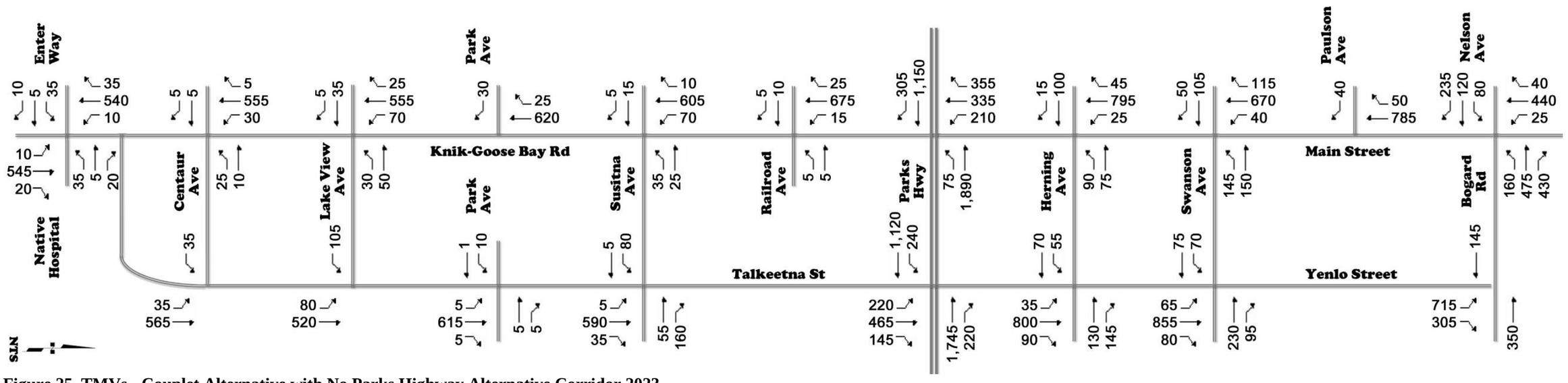


Figure 25. TMVs - Couplet Alternative with No Parks Highway Alternative Corridor 2023

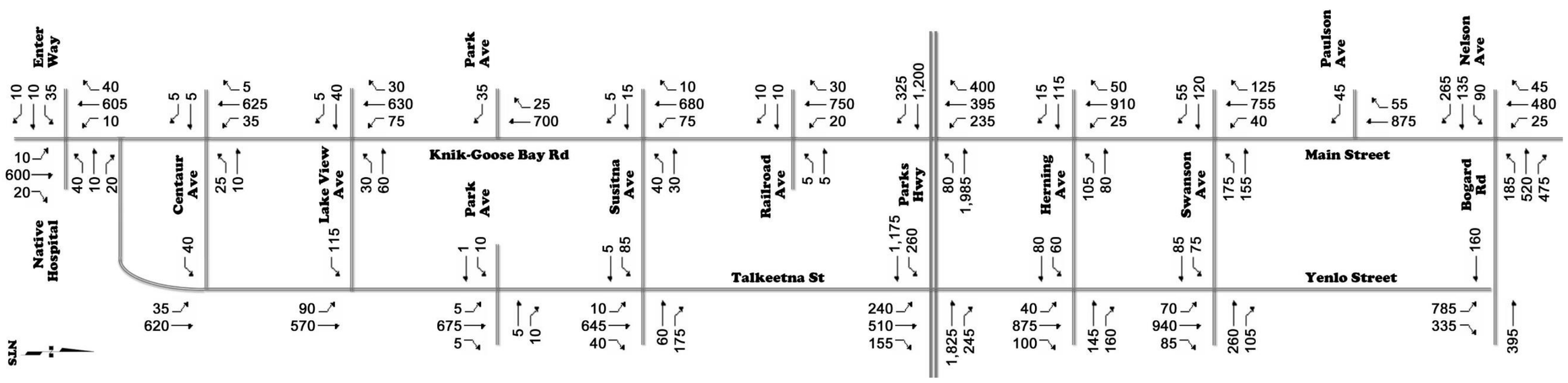


Figure 26. TMVs - Couplet Alternative with No Parks Highway Alternative Corridor 2033

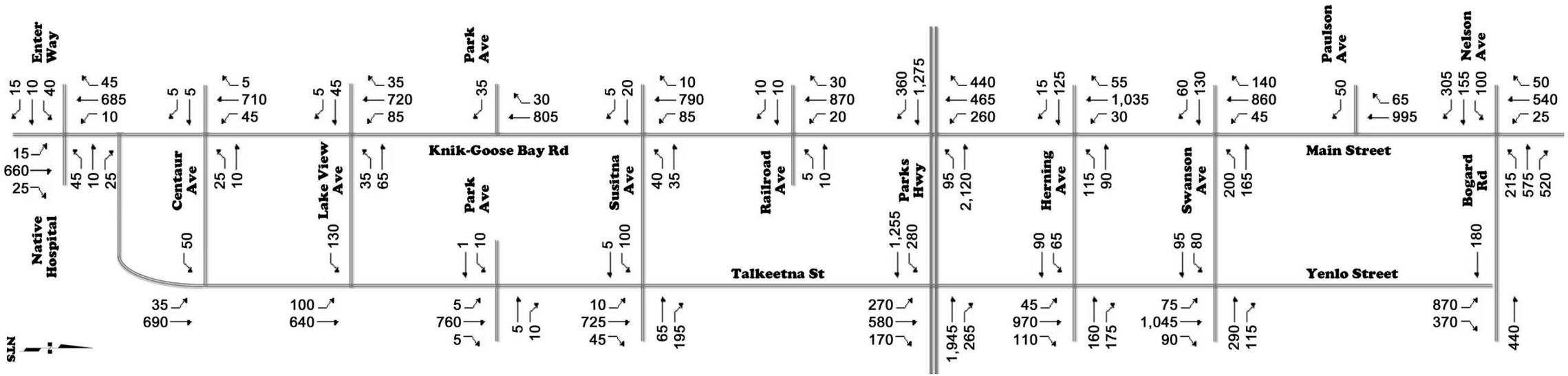


Figure 27. TMVs - Couplet Alternative with No Parks Highway Alternative Corridor 2043

Figure 28. TMVs - No Couplet with No Parks Highway Alternative Corridor 2023

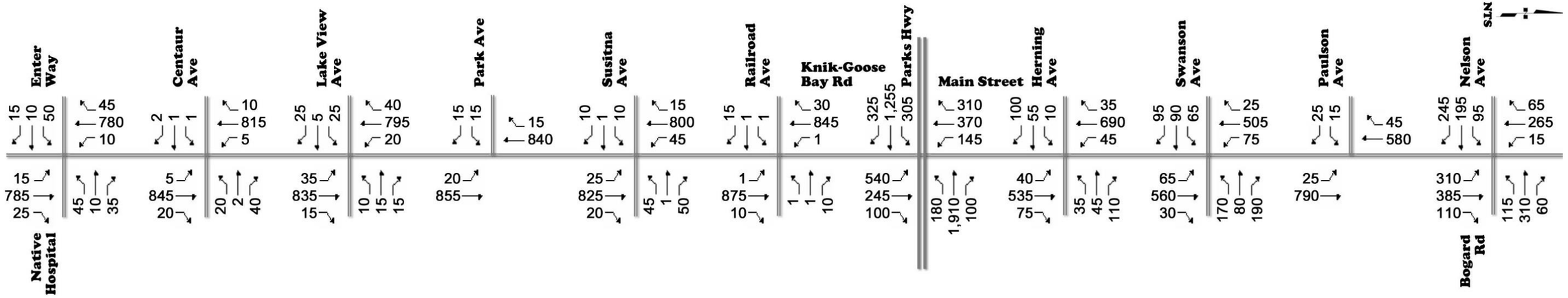


Figure 29. TMVs - No Couplet with No Parks Highway Alternative Corridor 2033

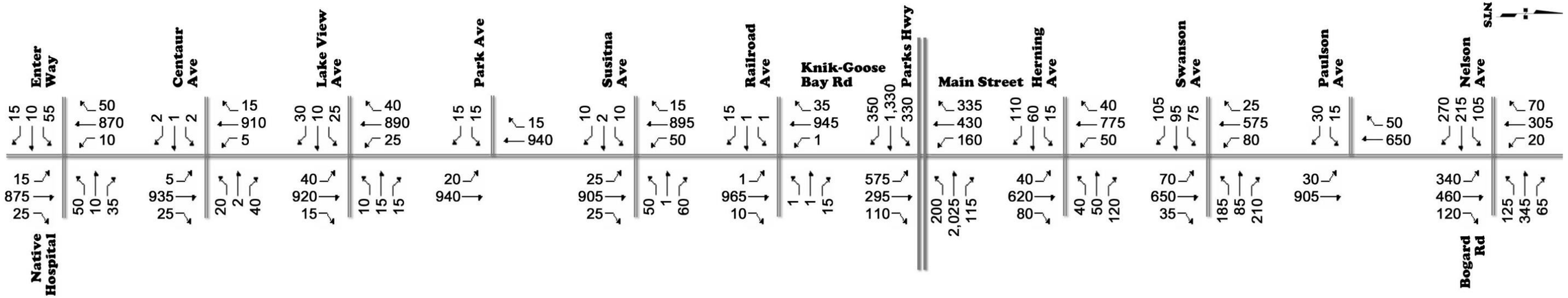


Figure 30. TMVs - No Couplet with No Parks Highway Alternative Corridor 2043

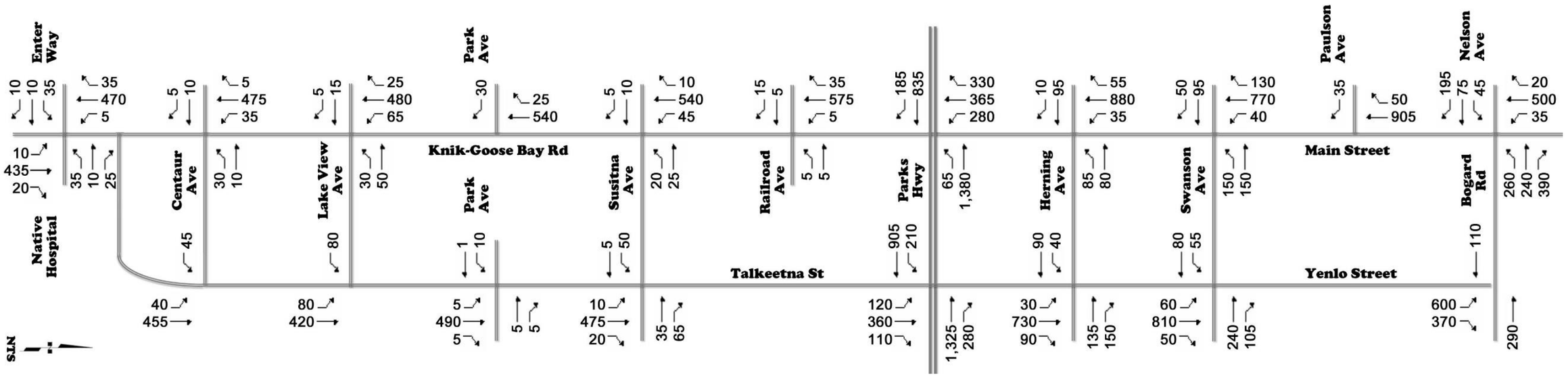


Figure 31. TMVs - Couplet Alternative with Parks Highway Alternative Corridor 2023

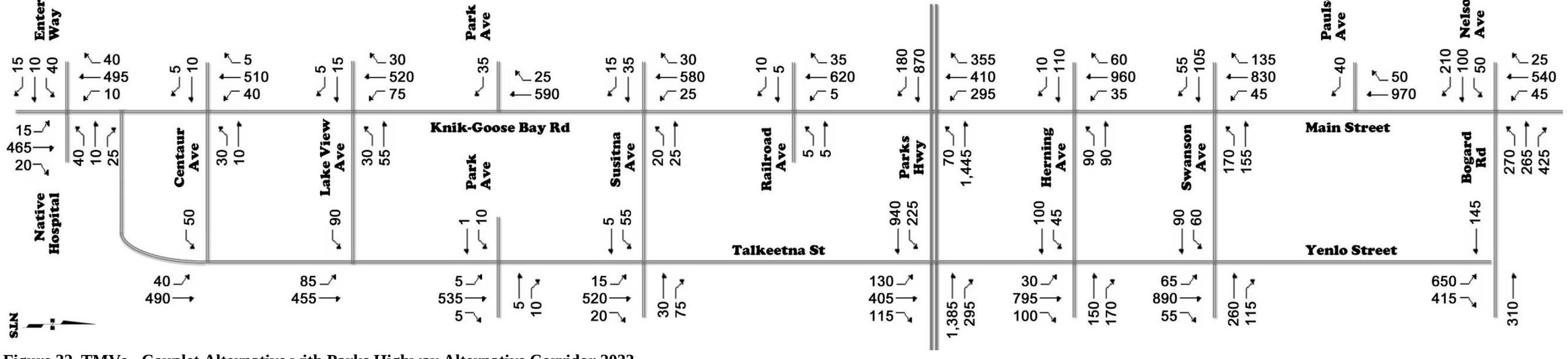


Figure 32. TMVs - Couplet Alternative with Parks Highway Alternative Corridor 2033

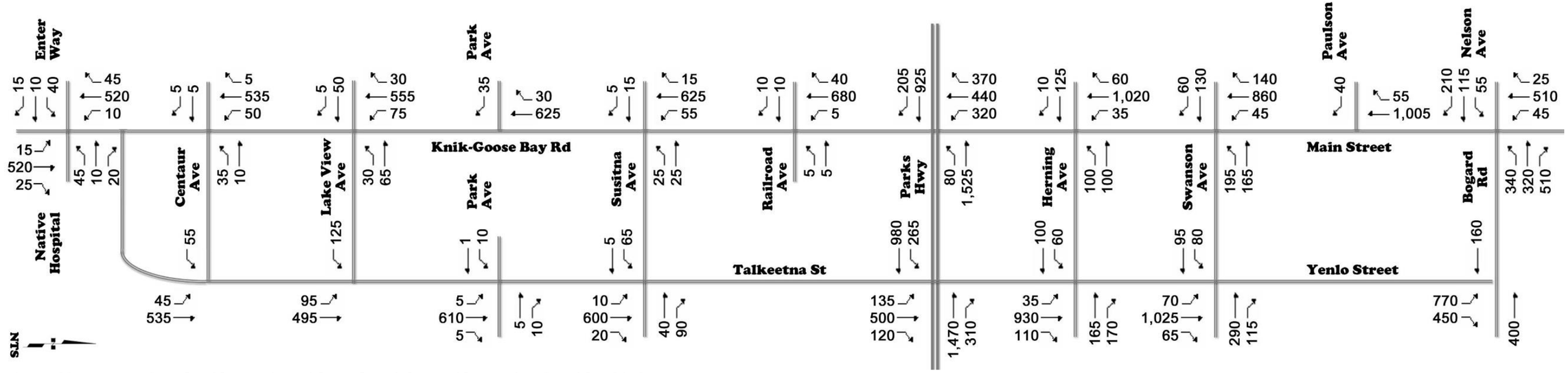


Figure 33. TMVs - Couplet Alternative with Parks Highway Alternative Corridor 2043

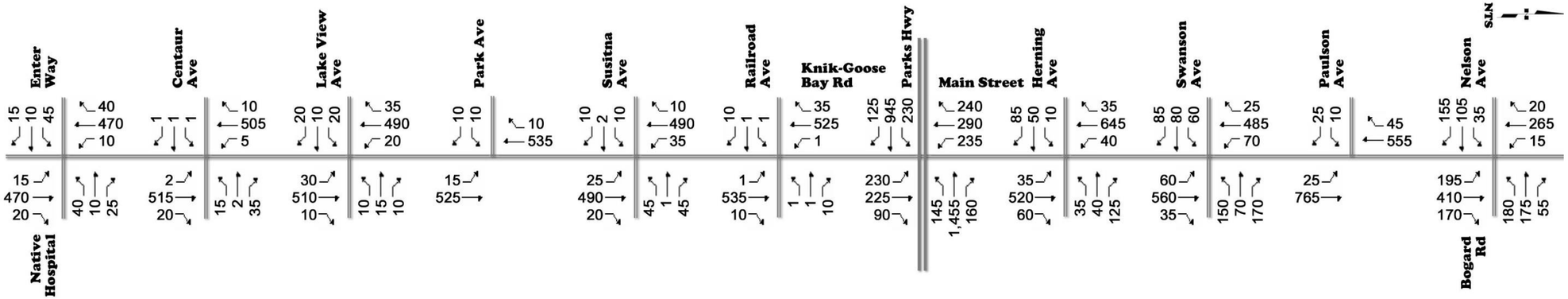


Figure 34. TMVs - No Couplet with Parks Highway Alternative Corridor 2023

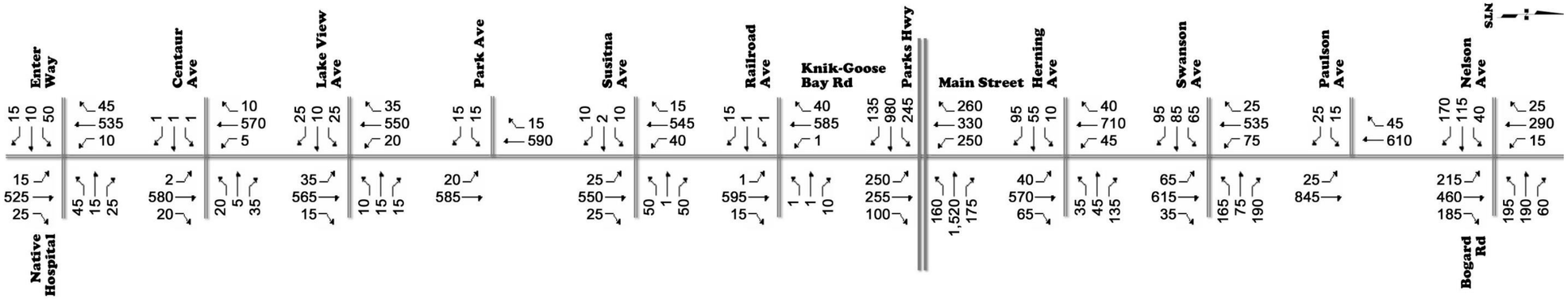


Figure 35. TMVs - No Couplet with Parks Highway Alternative Corridor 2033

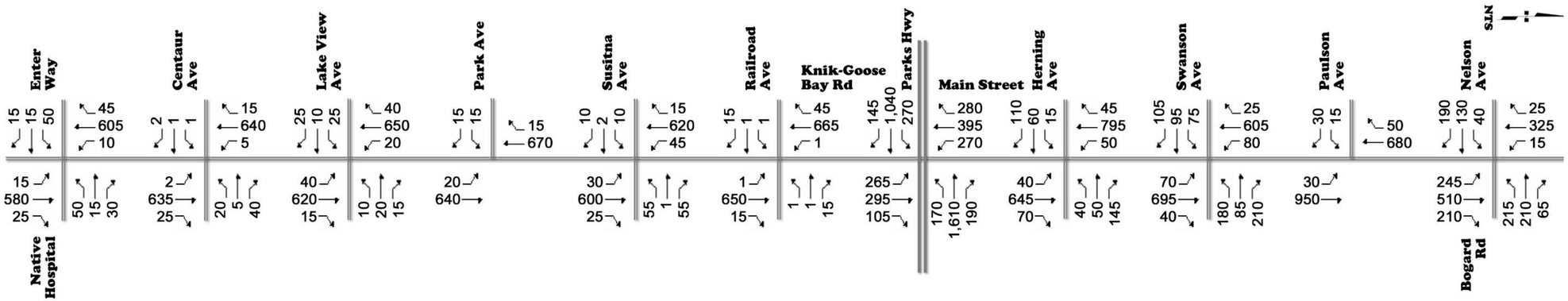


Figure 36. TMVs - No Couplet with Parks Highway Alternative Corridor 2043

11 Appendix C: Operations

Table 24. 2023 Couplet with No Parks Highway Alternative Corridor: Signalized Intersection Operations Summary

			NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	OVERALL
Main Street	Bogard Road/ Nelson Avenue	LOS				C	D			B	B	A	A	B	B
		Delay (s)				27	36			15	13	5	8	12	17
		v/c Ratio				0.05	0.70			0.35	0.15	0.25	0.40	0.30	0.50
Main Street	Swanson Avenue	LOS					A			C		A	A		B
		Delay (s)					9			33		7	6		11
		v/c Ratio					0.50			0.45		0.35	0.25		0.45
Main Street	Parks Highway	LOS					D	F		B	A	D	A		B
		Delay (s)					50	82		15	10	43	4		20
		v/c Ratio					0.70	0.95		0.65	0.30	0.35	0.85		0.90
Yenlo Street	Bogard Road	LOS	B		A					C			D		B
		Delay (s)	11		6					21			50		20
		v/c Ratio	0.70		0.25					0.35			0.85		0.75
Yenlo Street	Swanson Avenue	LOS		B					D	C			D	C	C
		Delay (s)		15					39	30			38	29	21
		v/c Ratio		0.60					0.20	0.15			0.65	0.05	0.55
Yenlo Street/ Talkeetna Avenue	Parks Highway	LOS	E	E	D				F	A			A	A	C
		Delay (s)	59	57	47				86	4			10	1	21
		v/c Ratio	0.70	0.75	0.20				0.90	0.50			0.90	0.25	0.85

Table 25. 2023 Couplet with No Parks Highway Alternative Corridor: Unsignalized Intersection Operations Summary

			EB	WB
Main Street	Paulson Avenue	LOS	B	
		Delay (s)	12	
		v/c Ratio	0.05	
Main Street	Herning Avenue	LOS	B	B
		Delay (s)	12	15
		v/c Ratio	0.05	0.2
Main Street	Railroad Avenue	LOS	B	
		Delay (s)	11	
		v/c Ratio	0.05	
Knik-Goose Bay Road	Susitna Avenue	LOS	B	
		Delay (s)	11	
		v/c Ratio	0.05	
Knik-Goose Bay Road	Park Avenue	LOS	B	
		Delay (s)	11	
		v/c Ratio	0.05	
Knik-Goose Bay Road	Lake View Avenue	LOS	B	
		Delay (s)	11	
		v/c Ratio	0.05	
Knik-Goose Bay Road	Centaur Avenue	LOS	A	
		Delay (s)	10	
		v/c Ratio	<0.05	
Yenlo Street	Herning Avenue	LOS	B	B
		Delay (s)	14	14
		v/c Ratio	0.15	0.3
Talkeetna Street	Susitna Avenue	LOS		B
		Delay (s)		13
		v/c Ratio		0.35
Talkeetna Street	Park Avenue	LOS		B
		Delay (s)		11
		v/c Ratio		
Talkeetna Street	Lake View Avenue	LOS		
		Delay (s)		
		v/c Ratio		
Talkeetna Street	Centaur Avenue	LOS		
		Delay (s)		
		v/c Ratio		

Table 26. 2033 Couplet with No Parks Highway Alternative Corridor: Signalized Intersection Operations Summary

			NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	OVERALL
Main Street	Bogard Road/ Nelson Avenue	LOS				C	D			B	B	A	A	A	B
		Delay (s)				26	37			16	14	5	7	9	16
		v/c Ratio				0.05	0.75			0.40	0.25	0.30	0.45	0.35	0.55
Main Street	Swanson Avenue	LOS					B			C		A	A		B
		Delay (s)					11			33		7	6		12
		v/c Ratio					0.55			0.50		0.40	0.25		0.50
Main Street	Parks Highway	LOS					D	F		B	B	D	A		C
		Delay (s)					51	101		17	12	43	6		24
		v/c Ratio					0.75	1.00		0.70	0.35	0.40	0.90		0.95
Yenlo Street	Bogard Road	LOS	B		A					B			E		C
		Delay (s)	13		4					19			57		22
		v/c Ratio	0.80		0.30					0.35			0.90		0.85
Yenlo Street	Swanson Avenue	LOS		B					D	C			D	C	C
		Delay (s)		16					39	28			40	29	23
		v/c Ratio		0.65					0.25	0.15			0.70	0.05	0.65
Yenlo Street/ Talkeetna Avenue	Parks Highway	LOS	E	E	D				F	A			B	A	C
		Delay (s)	62	59	47				100	4			13	1	24
		v/c Ratio	0.75	0.80	0.25				1.00	0.50			0.95	0.25	0.90

Table 27. 2033 Couplet with No Parks Highway Alternative Corridor: Unsignalized Intersection Operations Summary

			EB	WB
Main Street	Paulson Avenue	LOS	B	
		Delay (s)	13	
		v/c Ratio	0.1	
Main Street	Herning Avenue	LOS	B	C
		Delay (s)	12	17
		v/c Ratio	0.05	0.25
Main Street	Railroad Avenue	LOS	B	
		Delay (s)	12	
		v/c Ratio	0.05	
Knik-Goose Bay Road	Susitna Avenue	LOS	B	
		Delay (s)	11	
		v/c Ratio	0.05	
Knik-Goose Bay Road	Park Avenue	LOS	B	
		Delay (s)	11	
		v/c Ratio	0.05	
Knik-Goose Bay Road	Lake View Avenue	LOS	B	
		Delay (s)	11	
		v/c Ratio	0.05	
Knik-Goose Bay Road	Centaur Avenue	LOS	B	
		Delay (s)	11	
		v/c Ratio	<0.05	
Yenlo Street	Herning Avenue	LOS	B	C
		Delay (s)	15	16
		v/c Ratio	0.15	0.35
Talkeetna Street	Susitna Avenue	LOS		B
		Delay (s)		14
		v/c Ratio		0.4
Talkeetna Street	Park Avenue	LOS		B
		Delay (s)		11
		v/c Ratio		0.05
Talkeetna Street	Lake View Avenue	LOS		
		Delay (s)		
		v/c Ratio		
Talkeetna Street	Centaur Avenue	LOS		
		Delay (s)		
		v/c Ratio		

Table 28. 2023 No Couplet with No Parks Highway Alternative Corridor: Signalized Intersection Operations Summary

			NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	OVERALL
Main Street	Bogard Road/ Nelson Avenue	LOS	B	B	B	B	B	B	D	D		C	C		C
		Delay (s)	16	17	13	12	14	12	41	51		34	30		25
		v/c Ratio	0.40	0.45	0.15	0.05	0.30	<0.05	0.15	0.65		0.65	0.40		0.55
Main Street	Parks Highway	LOS	F	D	D	E	F		F	D	C	C	E	C	E
		Delay (s)	152	48	42	57	112		361	42	31	32	64	32	80
		v/c Ratio	1.10	0.40	0.05	0.65	1.00		1.60	0.60	0.10	0.60	0.95	0.15	1.35

Table 29. 2023 No Couplet with No Parks Highway Alternative Corridor: Signalized Intersection Operations Summary

			NBL	NBT	NBR	SBL	SBT	SBR	EB	EBL	WB	WBL
Main Street	Paulson Avenue	LOS	A						D			
		Delay (s)	9						34			
		v/c Ratio	0.05						0.25			
Main Street	Swanson Avenue	LOS	B	F		B	F		B	C	C	C
		Delay (s)	13	72		13	72		14	18	18	22
		v/c Ratio	0.15	1.4		0.2	1.2		0.2	0.45	0.4	0.6
Main Street	Herning Avenue	LOS	A			A			F	F	F	E
		Delay (s)	9			9			135	65	329	46
		v/c Ratio	0.05			0.05			0.3	0.75	1.05	0.7
Main Street	Railroad Avenue	LOS	A			B			B		B	
		Delay (s)	9			11			12		11	
		v/c Ratio	<0.05			<0.05			<0.05		<0.05	
Knik-Goose Bay Road	Susitna Avenue	LOS	A			A			D		D	
		Delay (s)	9			9			26		35	
		v/c Ratio	0.05			0.05			0.15		0.45	
Knik-Goose Bay Road	Park Avenue	LOS	A						C			
		Delay (s)	9						21			
		v/c Ratio	<0.05						0.1			
Knik-Goose Bay Road	Lake View Avenue	LOS	A			A			D		D	
		Delay (s)	9			9			30		29	
		v/c Ratio	0.05			<0.05			0.25		0.2	
Knik-Goose Bay Road	Centaur Avenue	LOS	A						C			
		Delay (s)	9						16			
		v/c Ratio	<0.05									

Table 30. 2033 No Couplet with No Parks Highway Alternative Corridor: Signalized Intersection Operations Summary

			NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	OVERALL
Main Street	Bogard Road/ Nelson Avenue	LOS	D	C	B	B	C	B	C	D		C	C		C
		Delay (s)	37	24	18	17	21	17	33	46		25	24		30
		v/c Ratio	0.75	0.50	0.10	0.05	0.35	0.05	0.30	0.80		0.50	0.50		0.75
Main Street	Parks Highway	LOS	F	D	D	D	F		F	E	D	E	F	C	F
		Delay (s)	815	53	45	53	244		621	59	40	76	147	30	208
		v/c Ratio	2.65	0.40	0.05	0.45	1.35		2.20	0.85	0.35	0.80	1.20	0.05	2.30

Table 31. 2033 No Couplet with No Parks Highway Alternative Corridor: Signalized Intersection Operations Summary

			NBL	NBT	NBR	SBL	SBT	SBR	EBLn1	EBLn2	WBLn1	WBLn2
Main Street	Paulson Avenue	LOS	A						E			
		Delay (s)	10						50			
		v/c Ratio	0.05						0.4			
Main Street	Swanson Avenue	LOS	B	F		B	F		B	C	C	D
		Delay (s)	14	74		14	73		15	20	20	26
		v/c Ratio	0.2	0.145		0.2	1.3		0.2	0.5	0.45	0.65
Main Street	Herning Avenue	LOS	A			A			F	F	F	F
		Delay (s)	10			9			201	116	792	69
		v/c Ratio	0.05			0.05			0.4	1	1.85	0.8
Knik-Goose Bay Road	Railroad Avenue	LOS							C		B	
		Delay (s)							17		13	
		v/c Ratio							0.05		<0.05	
Knik-Goose Bay Road	Susitna Avenue	LOS	A			A			F		F	
		Delay (s)	10			10			109		400	
		v/c Ratio	0.05			0.05			0.4		1.55	
Knik-Goose Bay Road	Park Avenue	LOS	A						F			
		Delay (s)	10						69			
		v/c Ratio	0.05						0.4			
Knik-Goose Bay Road	Lake View Avenue	LOS	A			A			F		F	
		Delay (s)	10			10			244		125	
		v/c Ratio	0.05			0.05			1.05		0.65	
Knik-Goose Bay Road	Centaur Avenue	LOS	A						D			
		Delay (s)	10						27			
		v/c Ratio	<0.05						<0.05			

Table 32. 2023 Couplet with Parks Highway Alternative Corridor: Signalized Intersection Operations Summary

			NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	OVERALL
Main Street	Bogard Road/ Nelson Avenue	LOS				C	C			B	B	A	A	B	B
		Delay (s)				21	32			13	13	5	5	15	17
		v/c Ratio				0.10	0.80			0.20	0.15	0.35	0.20	0.25	0.50
Main Street	Swanson Avenue	LOS					A			C		C	C		B
		Delay (s)					10			25		23	23		14
		v/c Ratio					0.55			0.35		0.35	0.25		0.50
Main Street	Parks Highway	LOS					D	D		B	A	A	A		B
		Delay (s)					55	55		13	3	2	3		20
		v/c Ratio					0.80	0.70		0.45	0.15	0.10	0.65		0.70
Yenlo Street	Bogard Road	LOS	A		B					B			C		B
		Delay (s)	9		14					15			28		14
		v/c Ratio	0.65		0.25					0.25			0.60		0.65
Yenlo Street	Swanson Avenue	LOS		B					B	B			C	C	B
		Delay (s)		14					13	12			27	21	17
		v/c Ratio		0.60					0.15	0.10			0.60	0.05	0.55
Yenlo Street/ Talkeetna Avenue	Parks Highway	LOS	D	D	D				E	A			C	B	C
		Delay (s)	51	54	47				66	6			21	16	25
		v/c Ratio	0.40	0.60	0.10				0.70	0.40			0.70	0.30	0.65

Table 33. 2023 Couplet with Parks Highway Alternative Corridor: Unsignalized Intersection Operations Summary

			EB	WB
Main Street	Paulson Avenue	LOS	B	
		Delay (s)	13	
		v/c Ratio	0.05	
Main Street	Herning Avenue	LOS	B	C
		Delay (s)	12	16
		v/c Ratio	<0.05	0.2
Main Street	Railroad Avenue	LOS	B	
		Delay (s)	11	
		v/c Ratio	0.05	
Knik-Goose Bay Road	Susitna Avenue	LOS	A	
		Delay (s)	10	
		v/c Ratio	<0.05	
Knik-Goose Bay Road	Park Avenue	LOS	A	
		Delay (s)	10	
		v/c Ratio	0.05	
Knik-Goose Bay Road	Lake View Avenue	LOS	A	
		Delay (s)	10	
		v/c Ratio	0.05	
Knik-Goose Bay Road	Centaur Avenue	LOS	A	
		Delay (s)	10	
		v/c Ratio	<0.05	
Yenlo Street	Herning Avenue	LOS	B	B
		Delay (s)	13	14
		v/c Ratio	0.1	0.3
Talkeetna Street	Susitna Avenue	LOS		B
		Delay (s)		11
		v/c Ratio		0.15
Talkeetna Street	Park Avenue	LOS		A
		Delay (s)		10
		v/c Ratio		
Talkeetna Street	Lake View Avenue	LOS		
		Delay (s)		
		v/c Ratio		
Talkeetna Street	Centaur Avenue	LOS		
		Delay (s)		
		v/c Ratio		

Table 34. 2033 Couplet with Parks Highway Alternative Corridor: Signalized Intersection Operations Summary

			NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	OVERALL
Main Street	Bogard Road/ Nelson Avenue	LOS				C	D			B	B	A	A	B	B
		Delay (s)				21	37			14	13	5	5	15	18
		v/c Ratio				0.10	0.85			0.25	0.15	0.40	0.25	0.30	0.55
Main Street	Swanson Avenue	LOS					B			C		B	B		B
		Delay (s)					14			22		19	18		16
		v/c Ratio					0.70			0.35		0.35	0.20		0.55
Main Street	Parks Highway	LOS					D	D		B	A	A	A		C
		Delay (s)					52	53		15	4	3	5		21
		v/c Ratio					0.80	0.75		0.50	0.15	0.10	0.70		0.75
Yenlo Street	Bogard Road	LOS	A		B					B			C		B
		Delay (s)	10		14					16			29		15
		v/c Ratio	0.70		0.30					0.30			0.65		0.70
Yenlo Street	Swanson Avenue	LOS		B					B	B			C	C	B
		Delay (s)		17					14	13			29	22	19
		v/c Ratio		0.65					0.20	0.15			0.70	0.10	0.60
Yenlo Street/ Talkeetna Avenue	Parks Highway	LOS	D	D	D				E	A			C	B	C
		Delay (s)	51	55	47				64	6			24	17	27
		v/c Ratio	0.45	0.65	0.15				0.75	0.40			0.70	0.30	0.70

Table 35. 2033 Couplet with Parks Highway Alternative Corridor: Unsignalized Intersection Operations Summary

			EB	WB
Main Street	Paulson Avenue	LOS	B	
		Delay (s)	13	
		v/c Ratio	0.1	
Main Street	Herning Avenue	LOS	B	C
		Delay (s)	13	17
		v/c Ratio	<0.05	0.25
Main Street	Railroad Avenue	LOS	B	
		Delay (s)	11	
		v/c Ratio	0.05	
Knik-Goose Bay Road	Susitna Avenue	LOS	B	
		Delay (s)	11	
		v/c Ratio	0.05	
Knik-Goose Bay Road	Park Avenue	LOS	B	
		Delay (s)	11	
		v/c Ratio	0.05	
Knik-Goose Bay Road	Lake View Avenue	LOS	A	
		Delay (s)	10	
		v/c Ratio	0.05	
Knik-Goose Bay Road	Centaur Avenue	LOS	A	
		Delay (s)	10	
		v/c Ratio	<0.05	
Yenlo Street	Herning Avenue	LOS	B	B
		Delay (s)	14	15
		v/c Ratio	0.1	0.35
Talkeetna Street	Susitna Avenue	LOS		B
		Delay (s)		11
		v/c Ratio		0.15
Talkeetna Street	Park Avenue	LOS		A
		Delay (s)		10
		v/c Ratio		
Talkeetna Street	Lake View Avenue	LOS		
		Delay (s)		
		v/c Ratio		
Talkeetna Street	Centaur Avenue	LOS		
		Delay (s)		
		v/c Ratio		

Table 36. 2043 Couplet with Parks Highway Alternative Corridor: Signalized Intersection Operations Summary

			NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	OVERALL
Main Street	Bogard Road/ Nelson Avenue	LOS				C	C			B	B	A	A	B	B
		Delay (s)				21	34			15	13	5	5	12	16
		v/c Ratio				0.10	0.80			0.30	0.20	0.50	0.30	0.35	0.60
Main Street	Swanson Avenue	LOS					B			C		B	B		B
		Delay (s)					14			23		18	16		16
		v/c Ratio					0.75			0.40		0.40	0.20		0.60
Main Street	Parks Highway	LOS					D	D		B	A	A	A		C
		Delay (s)					51	50		18	6	3	6		22
		v/c Ratio					0.85	0.75		0.55	0.15	0.15	0.70		0.80
Yenlo Street	Bogard Road	LOS	B		B					B			D		B
		Delay (s)	16		11					15			36		19
		v/c Ratio	0.85		0.35					0.35			0.80		0.90
Yenlo Street	Swanson Avenue	LOS		C					B	B			C	C	C
		Delay (s)		26					18	12			34	22	26
		v/c Ratio		0.80					0.25	0.15			0.75	0.10	0.70
Yenlo Street/ Talkeetna Avenue	Parks Highway	LOS	D	E	D				E	A			C	B	C
		Delay (s)	50	58	47				64	6			31	20	31
		v/c Ratio	0.40	0.75	0.20				0.80	0.40			0.80	0.35	0.80

Table 37. 2043 Couplet with Parks Highway Alternative Corridor: Unsignalized Intersection Operations Summary

			EB	WB
Main Street	Paulson Avenue	LOS	B	
		Delay (s)	13	
		v/c Ratio	0.1	
Main Street	Herning Avenue	LOS	B	C
		Delay (s)	13	18
		v/c Ratio	<0.05	0.3
Main Street	Railroad Avenue	LOS	B	
		Delay (s)	11	
		v/c Ratio	0.05	
Knik-Goose Bay Road	Susitna Avenue	LOS	B	
		Delay (s)	11	
		v/c Ratio	0.05	
Knik-Goose Bay Road	Park Avenue	LOS	B	
		Delay (s)	11	
		v/c Ratio	0.05	
Knik-Goose Bay Road	Lake View Avenue	LOS	B	
		Delay (s)	11	
		v/c Ratio	0.1	
Knik-Goose Bay Road	Centaur Avenue	LOS	A	
		Delay (s)	10	
		v/c Ratio	<0.05	
Yenlo Street	Herning Avenue	LOS	C	C
		Delay (s)	16	17
		v/c Ratio	0.15	0.35
Talkeetna Street	Susitna Avenue	LOS		B
		Delay (s)		12
		v/c Ratio		0.2
Talkeetna Street	Park Avenue	LOS		B
		Delay (s)		11
		v/c Ratio		
Talkeetna Street	Lake View Avenue	LOS		
		Delay (s)		
		v/c Ratio		
Talkeetna Street	Centaur Avenue	LOS		
		Delay (s)		
		v/c Ratio		

Table 38. 2023 No Couplet with Parks Highway Alternative Corridor: Signalized Intersection Operations Summary

			NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBU	WBL	WBT	WBR	OVERALL
Main Street	Bogard Road/ Nelson Avenue	LOS	B	B	B	B	B	B	D	D			C	C		C
		Delay (s)	16	17	13	12	14	12	41	51			34	30		25
		v/c Ratio	0.40	0.45	0.15	0.05	0.30	<0.05	0.15	0.65			0.65	0.40		0.55
Main Street	Parks Highway	LOS	F	D	D	E	F		F	D	C		C	E	C	E
		Delay (s)	152	48	42	57	112		361	42	31		32	64	32	80
		v/c Ratio	1.10	0.40	0.05	0.65	1.00		1.60	0.60	0.10		0.60	0.95	0.15	1.35

Table 39. 2023 No Couplet with Parks Highway Alternative Corridor: Signalized Intersection Operations Summary

			NBL	NBT	NBR	SBL	SBT	SBR	EBLn1	EBLn2	WBLn1	WBLn2
Main Street	Paulson Avenue	LOS	A						D			
		Delay (s)	9						34			
		v/c Ratio	0.05						0.25			
Main Street	Swanson Avenue	LOS	B	F		B	F		B	C	C	C
		Delay (s)	13	72		13	72		14	18	18	22
		v/c Ratio	0.15	1.4		0.2	1.2		0.2	0.45	0.4	0.6
Main Street	Herning Avenue	LOS	A			A			F	F	F	E
		Delay (s)	9			9			135	65	329	46
		v/c Ratio	0.05			0.05			0.3	0.75	1.05	0.7
Main Street	Railroad Avenue	LOS	A			B			B		B	
		Delay (s)	9			11			12		11	
		v/c Ratio	<0.05			<0.05			<0.05		<0.05	
Knik-Goose Bay Road	Susitna Avenue	LOS	A			A			D		D	
		Delay (s)	9			9			26		35	
		v/c Ratio	0.05			0.05			0.15		0.45	
Knik-Goose Bay Road	Park Avenue	LOS	A						C			
		Delay (s)	9						21			
		v/c Ratio	<0.05						0.1			
Knik-Goose Bay Road	Lake View Avenue	LOS	A			A			D		D	
		Delay (s)	9			9			30		29	
		v/c Ratio	0.05			<0.05			0.25		0.2	
Knik-Goose Bay Road	Centaur Avenue	LOS	A						C			
		Delay (s)	9						16			
		v/c Ratio	<0.05						<0.05			

Table 40. 2033 No Couplet with Parks Highway Alternative Corridor: Signalized Intersection Operations Summary

			NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	OVERALL
Main Street	Bogard Road/ Nelson Avenue	LOS	B	B	B	B	B	B	D	D		D	C		C
		Delay (s)	19	19	14	13	16	12	40	51		36	29		26
		v/c Ratio	0.45	0.50	0.20	0.05	0.30		0.20	0.70		0.70	0.40		0.60
Main Street	Parks Highway	LOS	F	D	D	E	F		F	D	D	D	F	C	F
		Delay (s)	120	46	39	61	151		538	53	38	40	84	35	103
		v/c Ratio	1.00	0.40	0.05	0.70	1.15		2.00	0.70	0.10	0.65	1.00	0.15	1.50

Table 41. 2033 No Couplet with Parks Highway Alternative Corridor: Signalized Intersection Operations Summary

			NBL	NBT	NBR	SBL	SBT	SBR	EBLn1	EBLn2	WBLn1	WBLn2
Main Street	Paulson Avenue	LOS	A						F			
		Delay (s)	10						63			
		v/c Ratio	0.05						0.45			
Main Street	Swanson Avenue	LOS	B	F		B	F		B	C	C	D
		Delay (s)	14	73		14	73		15	20	25	14
		v/c Ratio	0.15	1.6		0.2	1.4		0.2	0.45	0.45	0.65
Main Street	Herning Avenue	LOS	A			A			F	F	F	F
		Delay (s)	10			9			299	138	1,056	91
		v/c Ratio	0.05			0.05			0.55	1.05	2.3	0.95
Main Street	Railroad Avenue	LOS							B		B	
		Delay (s)							13		12	
		v/c Ratio							0.05		<0.05	
Knik-Goose Bay Road	Susitna Avenue	LOS	A			A			D		F	
		Delay (s)	9			9			33		56	
		v/c Ratio	0.05			0.05			0.15		0.65	
Knik-Goose Bay Road	Park Avenue	LOS	A						D			
		Delay (s)	9						26			
		v/c Ratio	<0.05						0.15			
Knik-Goose Bay Road	Lake View Avenue	LOS	A			A			E		D	
		Delay (s)	9			9			43		35	
		v/c Ratio	0.05			<0.05			0.4		0.25	
Knik-Goose Bay Road	Centaur Avenue	LOS	A						C			
		Delay (s)	9						18			
		v/c Ratio	<0.05						<0.05			

Table 42. 2043 No Couplet with Parks Highway Alternative Corridor: Signalized Intersection Operations Summary

			NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBU	WBL	WBT	WBR	OVERALL
Main Street	Bogard Road/ Nelson Avenue	LOS	C	C	B	B	B	B	D	D			D	C		C
		Delay (s)	24	21	16	14	17	13	37	50			45	28		28
		v/c Ratio	0.55	0.55	0.25	0.05	0.35	<0.05	0.15	0.70			0.80	0.45		0.70
Main Street	Parks Highway	LOS	F	D	D	E	F		F	E	D		D	F	C	F
		Delay (s)	138	47	40	70	218		627	57	39		46	104	35	126
		v/c Ratio	1.05	0.45	0.05	0.80	1.30		2.20	0.75	0.10		0.70	1.10	0.20	1.65

Table 43. 2043 No Couplet with Parks Highway Alternative Corridor: Unsignalized Intersection Operations Summary

			NBL	NBT	NBR	SBL	SBT	SBR	EBLn1	EBLn2	WBLn1	WBLn2
Main Street	Paulson Avenue	LOS	A						F			
		Delay (s)	10						107			
		V/C Ratio	0.05						0.65			
Main Street	Swanson Avenue	LOS	B	F		B	F		C	C	C	D
		Delay (s)	14	75		15	74		16	22	21	31
		V/C Ratio	0.20	1.85		0.20	1.60		0.20	0.5	0.50	0.75
Main Street	Herning Avenue	LOS	A			A			F	F		F
		Delay (s)	10			10			2,414	314		228
		V/C Ratio	0.05			0.05			3.35	1.5		1.3
Main Street	Railroad Avenue	LOS							B		B	
		Delay (s)							14		12	
		V/C Ratio							0.05		0.05	
Knik-Goose Bay Road	Susitna Avenue	LOS	A			A			E		F	
		Delay (s)	9			9			45		121	
		V/C Ratio	0.05			0.05			0.2		0.9	
Knik-Goose Bay Road	Park Avenue	LOS	A						D			
		Delay (s)	9						33			
		V/C Ratio	0.05						0.2			
Knik-Goose Bay Road	Lake View Avenue	LOS	A			A			F		F	
		Delay (s)	9			9			68		52	
		V/C Ratio	0.05			<0.05			0.55		0.4	
Knik-Goose Bay Road	Centaur Avenue	LOS	A						C			
		Delay (s)	9						18			
		V/C Ratio	<0.05						<0.05			