

# Hemmer Road Extension & Upgrade: Palmer- Wasilla Highway to Bogard Road

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## Traffic Analysis Report

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Prepared For:  
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## Abbreviations

AADT	Annual Average Daily Traffic
AMATS	Anchorage Metropolitan Area Transportation Solutions
ATM	Alaska Traffic Manual
AWSC	All-Way Stop Controlled
CAR	Critical Accident Rate
CCS	Continuous Count Station
CTP	Community Transportation Program
DOT&PF	Alaska Department of Transportation and Public Facilities
HCM	<i>Highway Capacity Manual</i>
HV%	Heavy Vehicle Percentage
ITE	Institute of Transportation Engineers
LOS	Level of Service
MEV	Million Entering Vehicles
mph	miles per hour
MSB	Matanuska-Susitna Borough
MUTCD	<i>Manual on Uniform Traffic Control Devices</i>
NCHRP	National Cooperative Highway Research Program
OS&HP	Official Streets and Highways Plan
PGDHS	<i>A Policy on Geometric Design of Highways and Streets</i>
PHF	Peak Hour Factor
SSD	Stopping Sight Distance
TMV	Turning Movement Volumes
TWLTL	Two-Way Left-Turn Lane
TWSC	Two-Way Stop Controlled
v/c	Volume to Capacity Ratio
vpd	vehicles per day

## Definition of Terms

**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:** Value of the maximum sustainable hourly flow rate, considering prevailing roadway, environmental, traffic, and control conditions.

**Critical Accident Rate (CAR):** Threshold crash rate for which a calculated higher than average crash rate is considered statistically different from the average population rate, signifying that the elevated crash rate may be caused by underlying contributing factors, instead of randomness.

**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.

**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).

**Stopping Sight Distance (SSD):** Distance along the main line at which a driver on the main line (driver eye height of 3.5 feet from the road surface) can see an object on the road ahead. The minimum SSD provides the main line driver sufficient sight distance to judge and slow or stop without striking the object in the road.

**Volume to Capacity Ratio (v/c):** Measure of how much of the available capacity of a facility is being used, calculated by dividing the demand volume by the capacity of a facility. Values of 0.85 or less are a good design objective so that there is available reserve capacity.

## Executive Summary

The Alaska Department of Transportation and Public Facilities (DOT&PF) has retained Kinney Engineering, LLC to prepare this Traffic Analysis Report for the Hemmer Road Extension and Upgrades project, which will extend Hemmer Road to create a direct connection between Palmer-Wasilla Highway and Bogard Road, as envisioned in the Matanuska-Susitna Borough (MSB) 2017 Long Range Transportation Plan.

This traffic analysis report reviews the existing safety and operations for vehicle, pedestrian, and bicycle modes; forecasts no-build and build volumes for the design year of 2045; and makes recommendations regarding traffic control at the intersections, as well as for the roadway typical section.

Table 1 summarizes the report recommendations.

**Table 1: Build Alternative Recommendations**

Location	Traffic Control	Hemmer Road Lane Configuration
Hemmer Rd & Palmer-Wasilla Hwy	Signal (existing)	Southbound Approach 1 left-turn lane (175 feet long) 1 shared through-and-right-turn lane
Hemmer Rd & Palmer Moose Dr	Two-Way Stop Control (STOP on Palmer Moose Dr and Quil Ave)	Single lanes (no turn lanes)
Hemmer Rd & Folsom Dr	YIELD or STOP on Folsom Dr	Single lanes (no turn lanes)
Hemmer Rd & Bogard Rd	Signal	Northbound Approach 1 left-turn lane 1 right-turn lane (100 feet long)
Hemmer Rd Segment		Two-lane roadway (one lane in each direction). Pedestrian pathway on both sides between Palmer-Wasilla Hwy and Palmer Moose Dr. Pedestrian pathway on east side between Palmer Moose Dr and Bogard Rd.

## 1 Introduction

The Alaska Department of Transportation and Public Facilities (DOT&PF) has retained Kinney Engineering, LLC (KE) to prepare this Traffic Analysis Report for the Hemmer Road Extension and Upgrade project. The project is included in the Matanuska-Susitna Borough (MSB)'s 2017 Long Range Transportation Plan which recommends road projects to the year 2035 horizon. The project will extend Hemmer Road and create a direct connection between Palmer-Wasilla Highway and Bogard Road. The purpose of this study is to evaluate the build alternative needed for the road extension.

Figure 1 presents the vicinity map of the project. Hemmer Road is a north-south roadway located in the MSB, west of the City of Palmer limits. Within the study area, Hemmer Road consists of two road segments that do not connect. On the south end, between Palmer-Wasilla Highway and Palmer Moose Drive, Hemmer Road is a paved, two-lane minor collector roadway that becomes an unpaved, local roadway north of Palmer Moose Drive. On the north end, between Folsom Drive and Bogard Road, Hemmer Road is a paved, local roadway. While the DOT&PF classifies Hemmer Road as a minor collector or a local road, the 2022 MSB *Official States and Highways Plan* (OS&HP) classifies the road as a major collector.

There is a separated pedestrian pathway along the east side of Hemmer Road from Palmer-Wasilla Highway to Palmer Moose Drive.

South of Hemmer Road is Palmer-Wasilla Highway which is a principal arterial roadway running east-west. North of Hemmer Road is Bogard Road which runs east-west and is classified as a minor arterial roadway. Palmer Moose Drive is a minor collector roadway used, in conjunction with Hemmer Road, to travel between Palmer-Wasilla Highway and Bogard Road.

Table 2 presents the traffic control at key intersections within the study area. Along Hemmer Road, the intersecting side streets are stop controlled.

**Table 2: Existing Traffic Control at Key Intersections**

<b>Intersection</b>	<b>Existing Traffic Control</b>
Hemmer Rd & Palmer-Wasilla Hwy	Signal
Hemmer Rd & Palmer Moose Dr	All-Way Stop Control
Hemmer Rd & Folsom Dr	Free (uncontrolled)
Hemmer Rd & Bogard Rd	Two-way Stop Control with stop on Hemmer Rd
Bogard Rd & Palmer Moose Dr	Two-way Stop Control with stop on Palmer Moose Dr



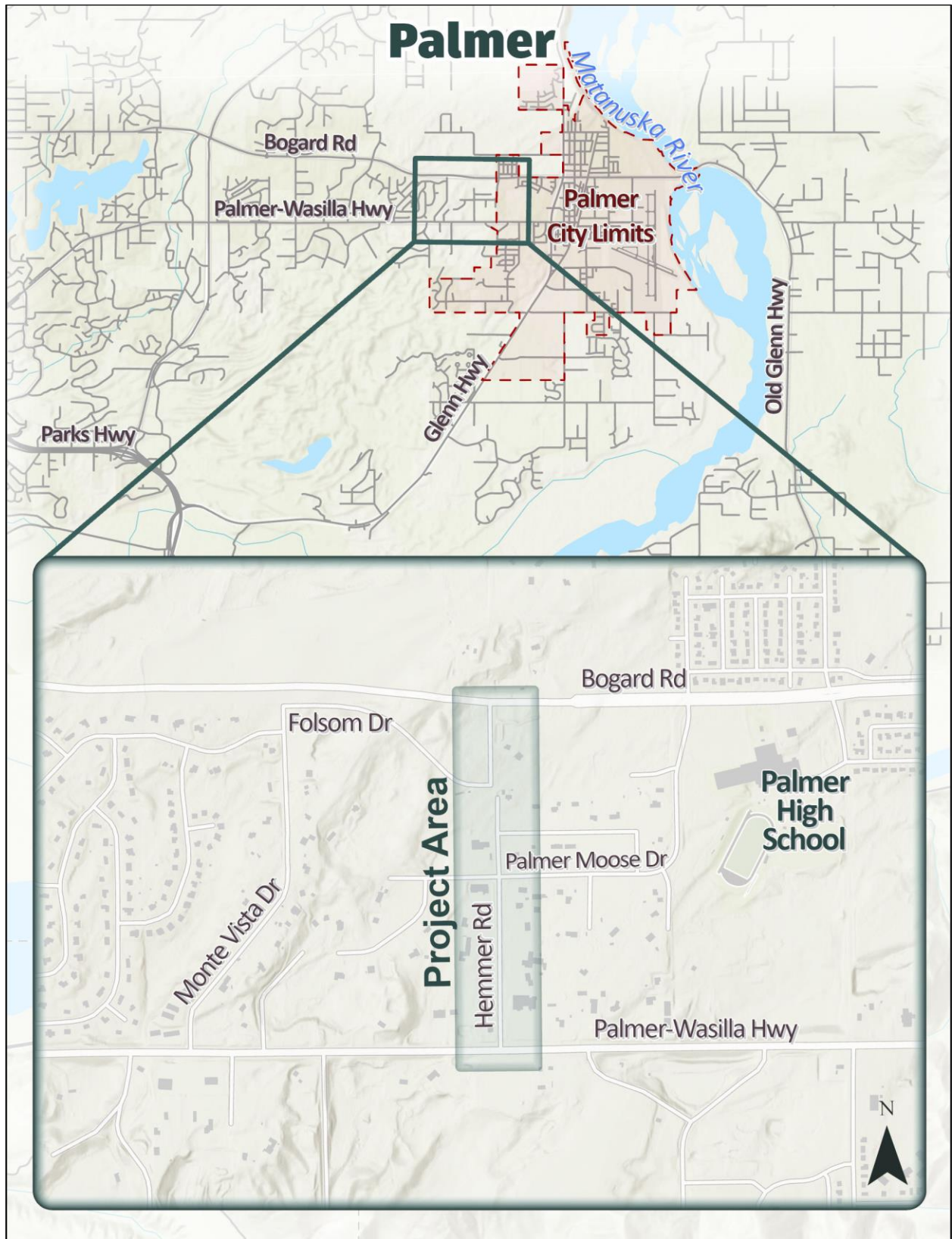
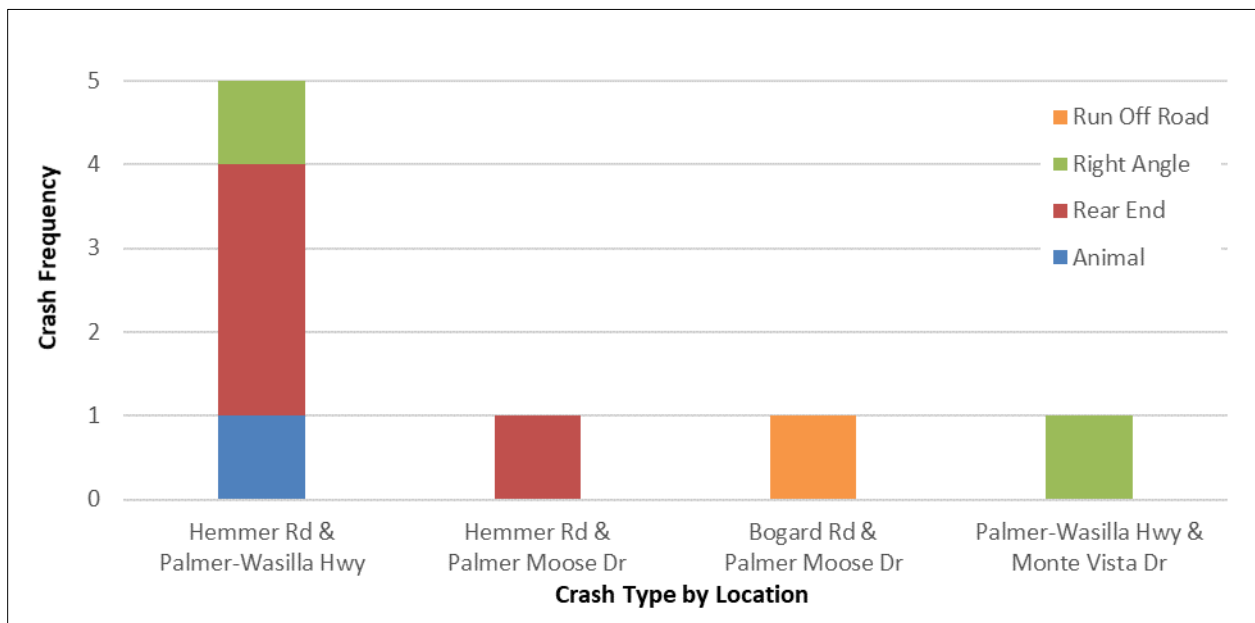


Figure 1: Vicinity Map

## 2 Safety

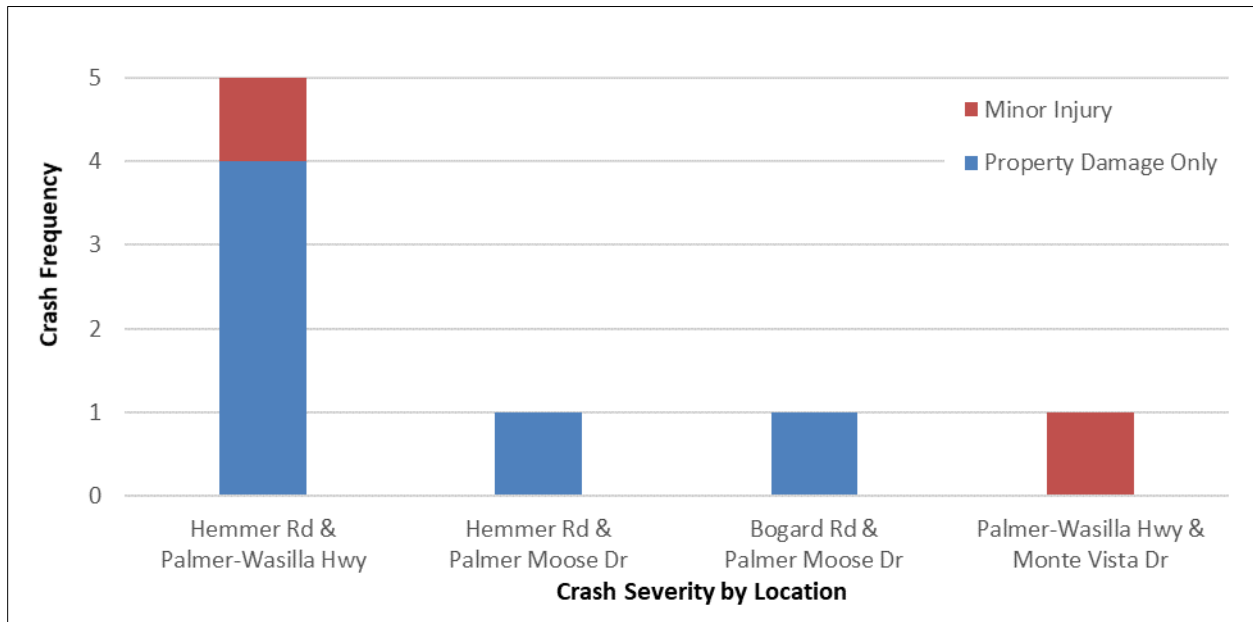
DOT&PF provided crash data for the project study area from 2015 through 2020. In 2015, Bogard Road was extended from 49<sup>th</sup> State Street to the Glenn Highway, providing an alternate east-west connection for the area. Therefore, crashes from 2015 were excluded from the analysis due to the traffic pattern changes caused by the road extension.

Figure 2 presents the crash types that occurred within the study area. No crashes were reported occurring at the Hemmer Road at Bogard Road intersection or along the Hemmer Road segments, so these are not shown in the figure. No crash patterns for the study area were identified as there were few crashes reported for each location (0 to 5 crashes at each location analyzed over the 2016 to 2020 study period). The Hemmer Road intersection at Palmer-Wasilla Highway had the most crashes with the predominant crash type being rear-end crashes which is not unexpected for signalized intersections.



**Figure 2: Crash Type by Location (2016 to 2020)**

The severity of the crashes occurring from 2016 to 2020 in the study area are shown in Figure 3. Intersections on Palmer-Wasilla Highway had crashes with the most severity (minor injuries); one was a single-vehicle crash colliding with an animal near Hemmer Road and the other was the right-angle crash at the Monte Vista Drive intersection.



**Figure 3: Crash Severity by Location (2016 to 2020)**

Crash rates over the 5-year period (2016 to 2020) were calculated based on the number of crashes, the number of years in the study period, and annual average daily traffic (AADT) volumes. The crash rates were compared to statewide averages for similar facilities and the Critical Accident Rate (CAR) using the most recent published values found in the 2018 Alaska *Highway Safety Improvement Program Handbook*. The CAR is a threshold above which the observed rate is statistically higher than average at a 95% confidence level. When a crash rate exceeds the CAR, there is strong evidence that crashes are caused by underlying contributing factors instead of just random occurrences.

Table 3 presents the intersection crash rates, given in terms of crashes per million entering vehicles (MEV). All the intersections analyzed fall below the statewide average, indicating that there is no statistical evidence that the intersections have poor safety performance or have an unusually high crash rate.

**Table 3: Intersection Crashes (2016 to 2020)**

Intersection	Total Crashes	Entering AADT (vehicles/day)	Crash Rate (Crashes/MEV)			Above Average?	Above CAR?
			Calculated	Statewide Average	CAR @ 95% Confidence		
Hemmer Rd & Palmer-Wasilla Hwy	5	13,859	0.20	1.02	1.37	No	No
Hemmer Rd & Palmer Moose Dr	1	1,870	0.29	0.73	1.64	No	No
Hemmer Rd & Bogard Rd	0	5,545	-	0.52	0.95	No	No
Bogard Rd & Palmer Moose Dr	1	3,103	0.18	0.55	1.16	No	No
Palmer Wasilla Hwy & Monte Vista Dr	1	12,114	0.05	0.52	0.80	No	No

Note that the crash rate for the Hemmer Road intersection at Palmer-Wasilla Highway intersection was compared to statewide average rates for similar three-legged intersections. In 2020, a fourth leg was added to the south side of the intersection. No crashes were reported at the intersection under the new configuration during the study period analyzed.

### 3 Existing Operations

#### 3.1 Historical Annual Average Daily Traffic (AADT)

AADT volumes were collected from the DOT&PF Alaska Traffic Data online portal. Table 4 summarizes historical AADT volumes for road segments within the study area.

**Table 4: Historical AADTs - Hemmer Road Project Area Segments**

Road	Extents	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Hemmer Rd	Palmer-Wasilla Hwy to Palmer Moose Dr	1,962	2,120	1,935	1,814	2,144	1,927	1,984	982	660	740
Palmer Moose Dr	Hemmer Rd to Bogard Rd					750	618	645	708	580	689
Bogard Rd	49 <sup>th</sup> State St to Glenn Hwy					3,000	6,095	6,286	6,433	5,910	6,690
Palmer-Wasilla Hwy	49 <sup>th</sup> State St to Hemmer Rd	15,590	13,656	13,900	14,110	12,506	12,680	13,155	11,829	10,400	11,900
Palmer-Wasilla Hwy	Hemmer Rd to Glenn Hwy	12,533	13,510	12,665	13,911	14,319	14,519	15,063	13,784	12,100	13,500

#### 3.2 Existing Turning Movement Volumes

Turning movement volumes (TMVs) for the study intersections were collected by KE in October 2022. Intersections on Bogard Road and Palmer-Wasilla Highway were observed for 8 hours throughout the day, while intersections on Hemmer Road were observed for 4 hours. Figure 4 through Figure 6 present the intersection TMVs for the AM, midday, and PM peak hours. The AM peak captures both commute traffic as well as school arrival traffic for the nearby high school.

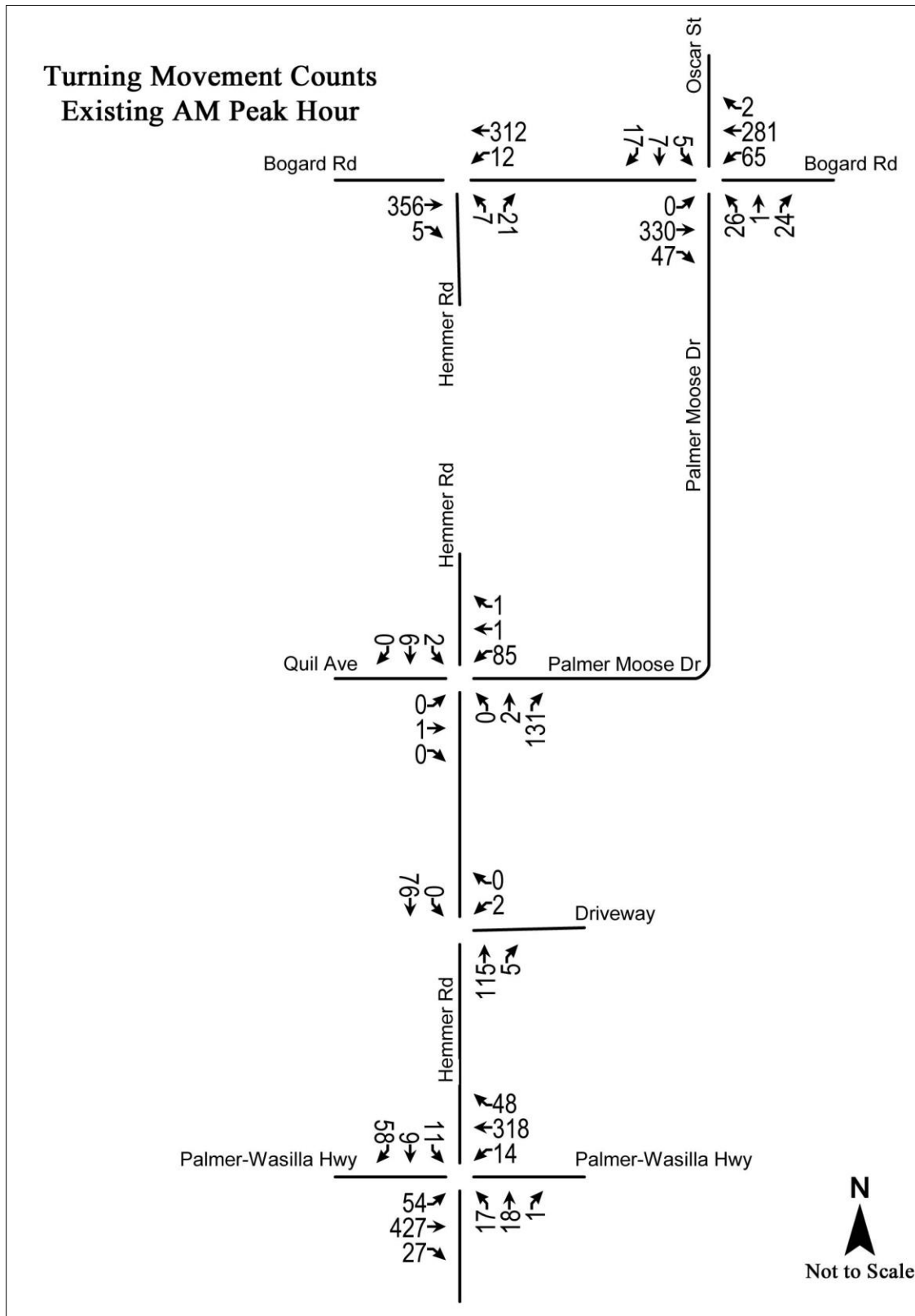


Figure 4: Existing TMVs – AM Peak Hour

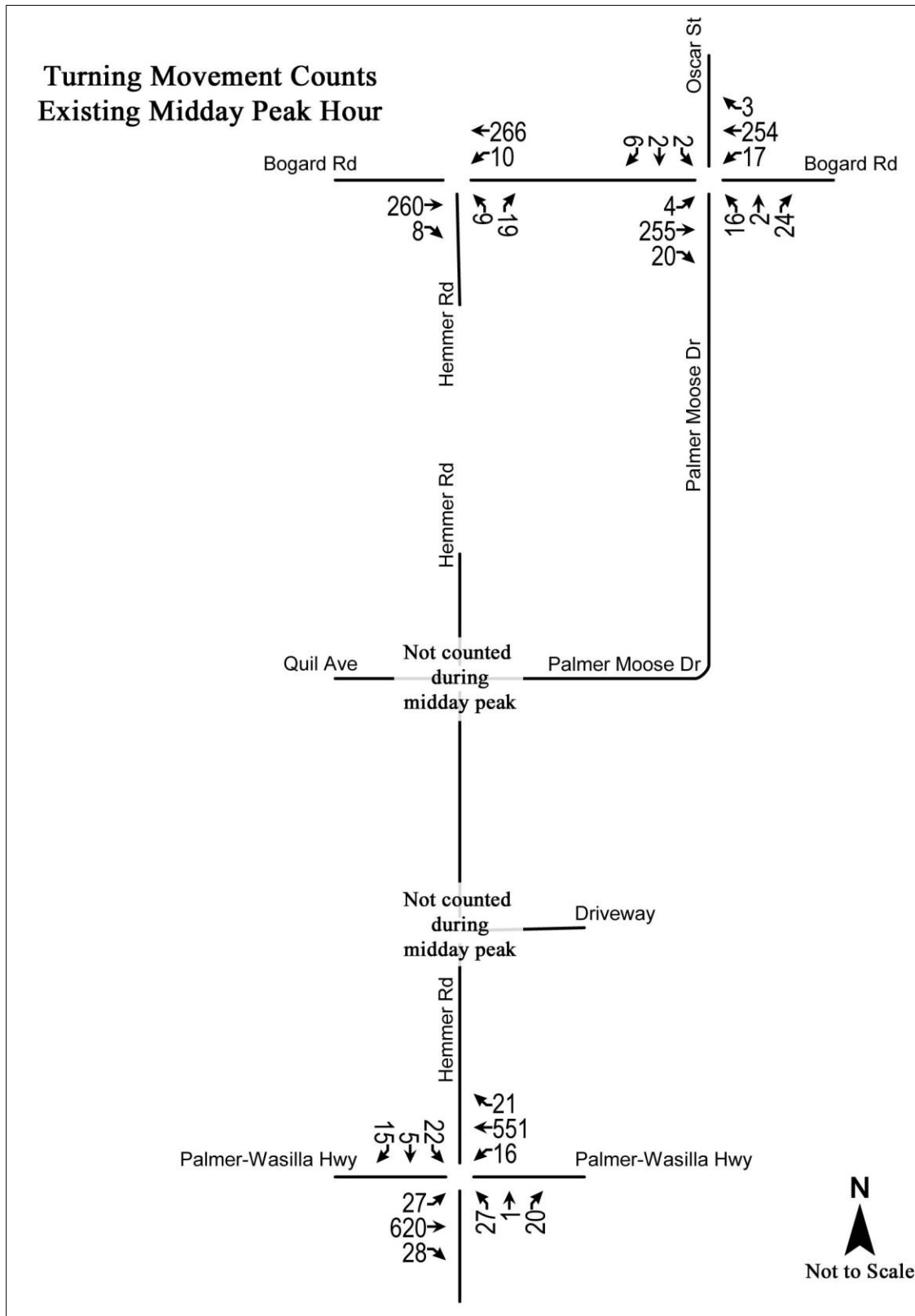


Figure 5: Existing TMVs – Midday Peak Hour

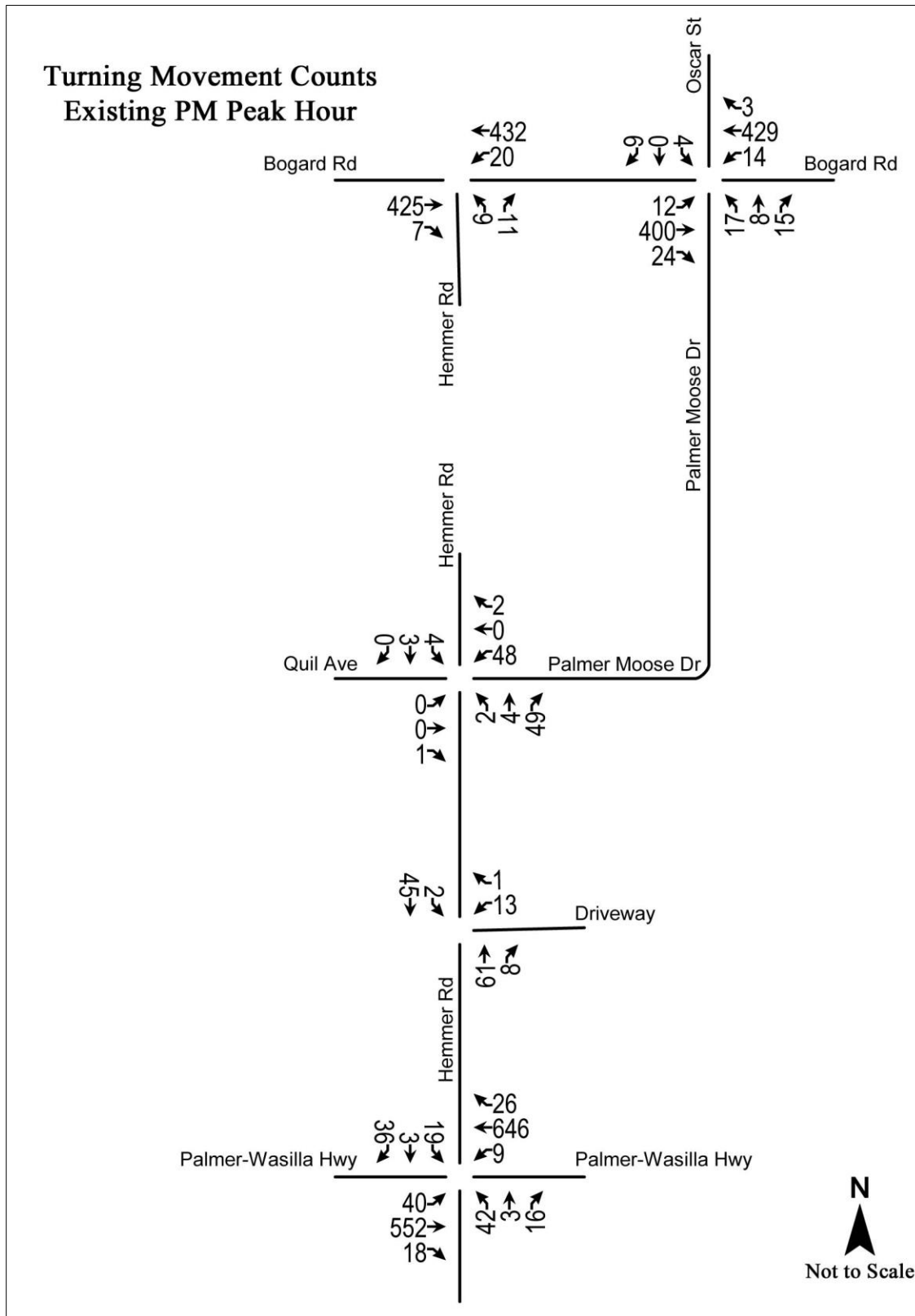


Figure 6: Existing TMVs – PM Peak Hour



### 3.2.1 Peak Hour Factors

Peak hour factors (PHFs) are used to convert hourly volumes to 15-minute design flow rates for capacity analyses. They represent the uniformity of traffic volumes over an hourly period and range from 0.25 (all traffic arrives in one 15-minute period and no additional traffic arrives for the rest of the hour) to 1.0 (equal number of vehicles arrive during each 15-minute period).

Table 5 shows the adjusted PHFs used for the analysis of the AM, midday, and PM peaks at the study intersections.

**Table 5: Existing Peak Hour Factors**

Intersection	Peak Period		
	AM	Midday	PM
Hemmer Rd & Bogard Rd	0.78	0.94	0.92
Bogard Rd & Palmer Moose Dr	0.83	0.96	0.81
Hemmer Rd & Palmer Moose Dr	0.71	-	0.83
Hemmer Rd & Office Park Driveway	0.68	-	0.86
Hemmer Rd & Palmer-Wasilla Hwy	0.76	0.94	0.91

### 3.2.2 Heavy Vehicle Percentages

Heavy vehicle percentages (HV%) are taken into account during the analysis of intersection capacity. Average HV% were taken from 24-hour hose counts on Hemmer Road and Palmer Moose Drive. For Bogard Road and Palmer-Wasilla Highway, the HV% comes from nearby Continuous Count Stations (CCS). The existing HV% used for analysis are shown in Table 6. A summary of the 24-hour counts is found in the Appendix A starting on page 43.

**Table 6: Existing Heavy Vehicle Percentages**

Segment	HV%
Hemmer Rd: Palmer-Wasilla Hwy to Palmer Moose Dr	2%
Hemmer Rd: Folsom Dr to Bogard Rd	2%
Palmer Moose Dr	2%
Bogard Rd	5%
Palmer-Wasilla Hwy	6%

### 3.3 Existing Intersection Capacity

Traffic operation analyses were conducted using Synchro Software for both signalized and unsignalized intersections, which rely on Highway Capacity Manual (HCM) methodologies.

Capacity analyses for unsignalized intersections consider delay for the stop- and yield-controlled movements only. For two-way stop-controlled (TWSC) intersections, since the main street

through traffic experiences no delay, operations for uncontrolled movements are not reported. In contrast, all approaches experience delay at signalized intersections and unsignalized all-way stop controlled (AWSC) intersections; therefore, operations are reported for all approaches individually and for the entire intersection.

Figure 7 through Figure 9 summarizes the existing movement delays for TWSC intersections and existing intersection operations for AWSC and signalized intersections for the peak hour periods studied (AM, midday, and PM peak). All of the intersections and movements operate at level of service (LOS) C or better, with minimal delay. Synchro reports of the existing traffic operations are found in Appendix B starting on page 50.

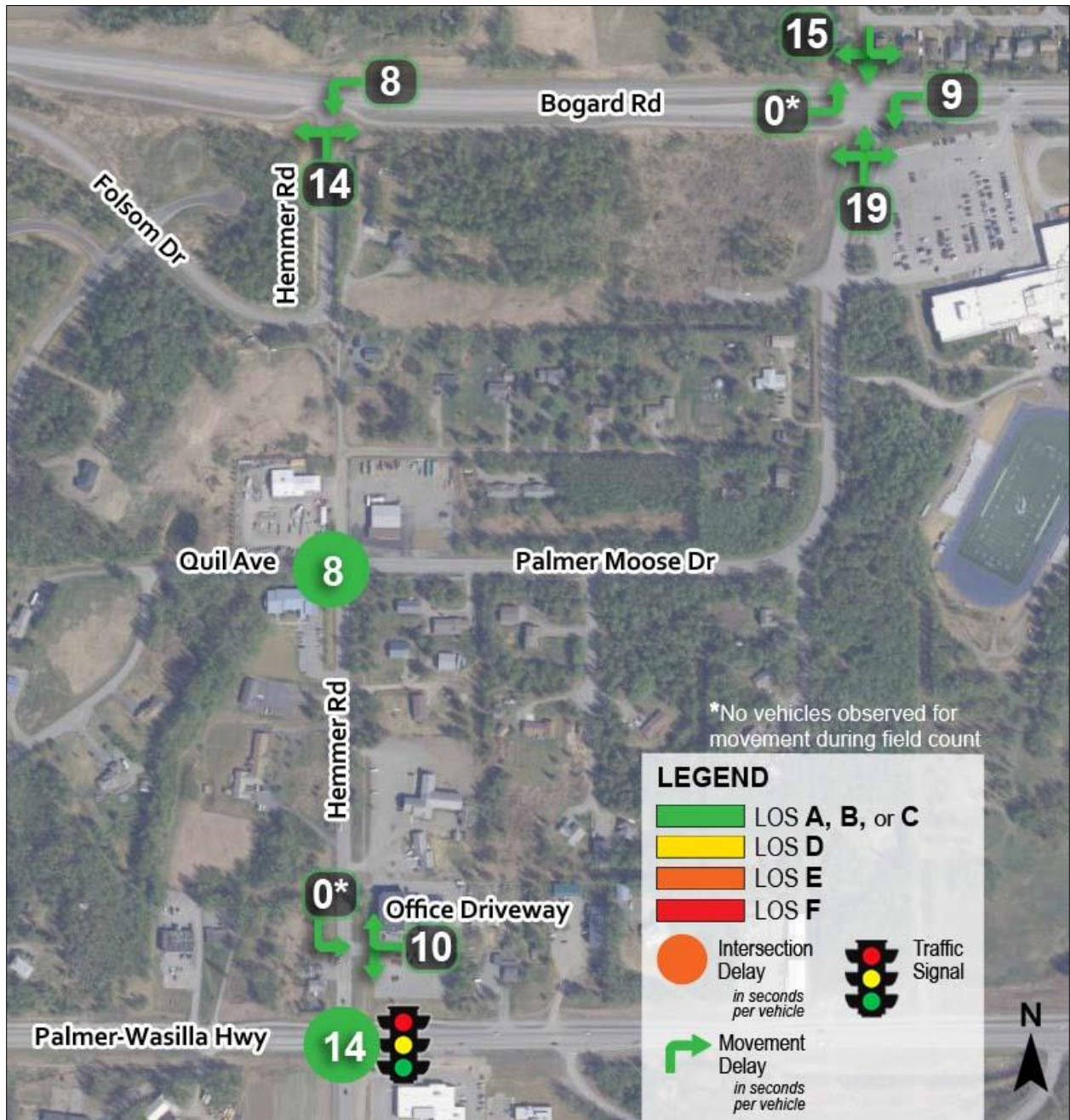


Figure 7: Existing LOS – AM Peak Hour

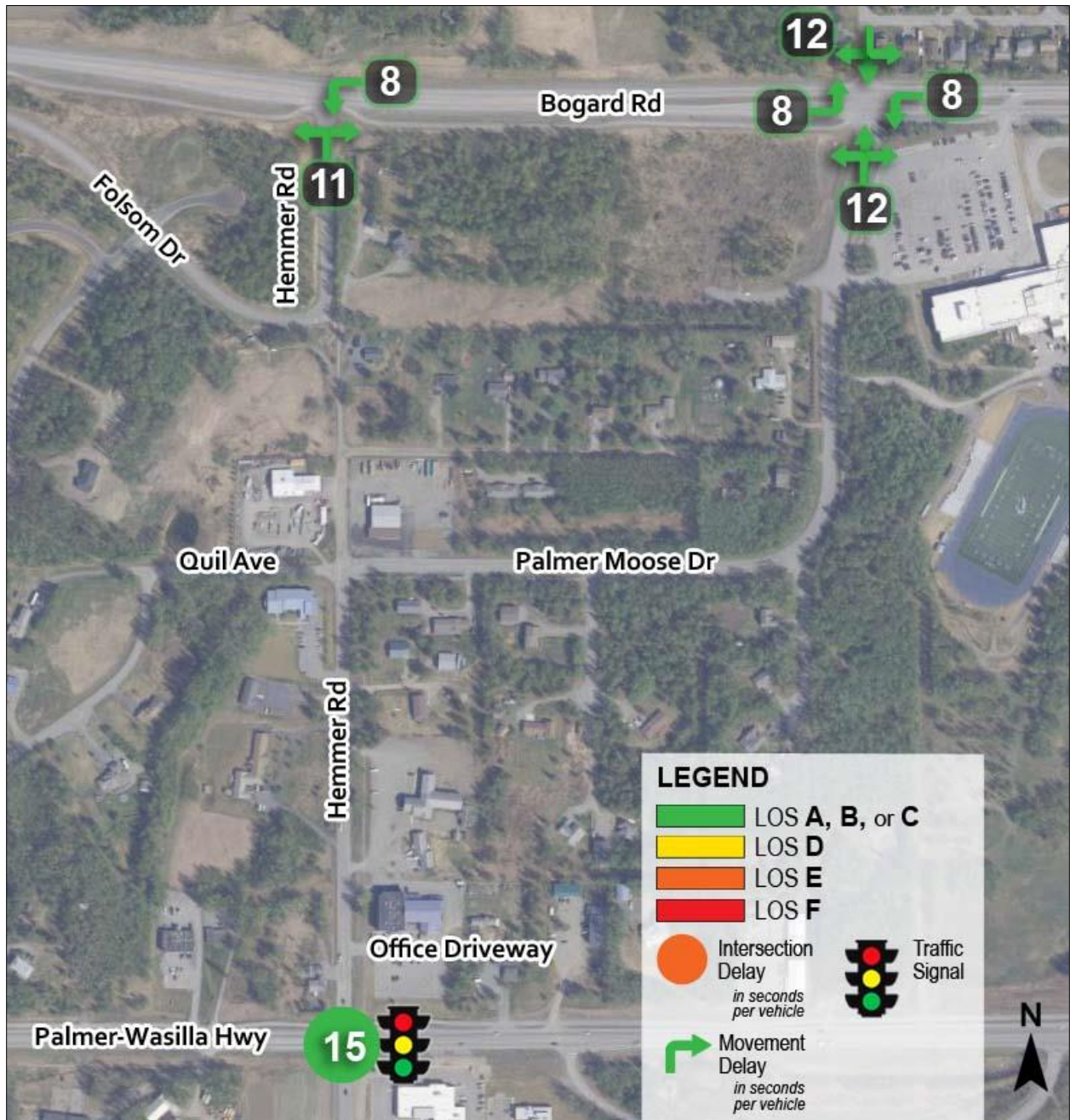


Figure 8: Existing LOS – Midday Peak Hour

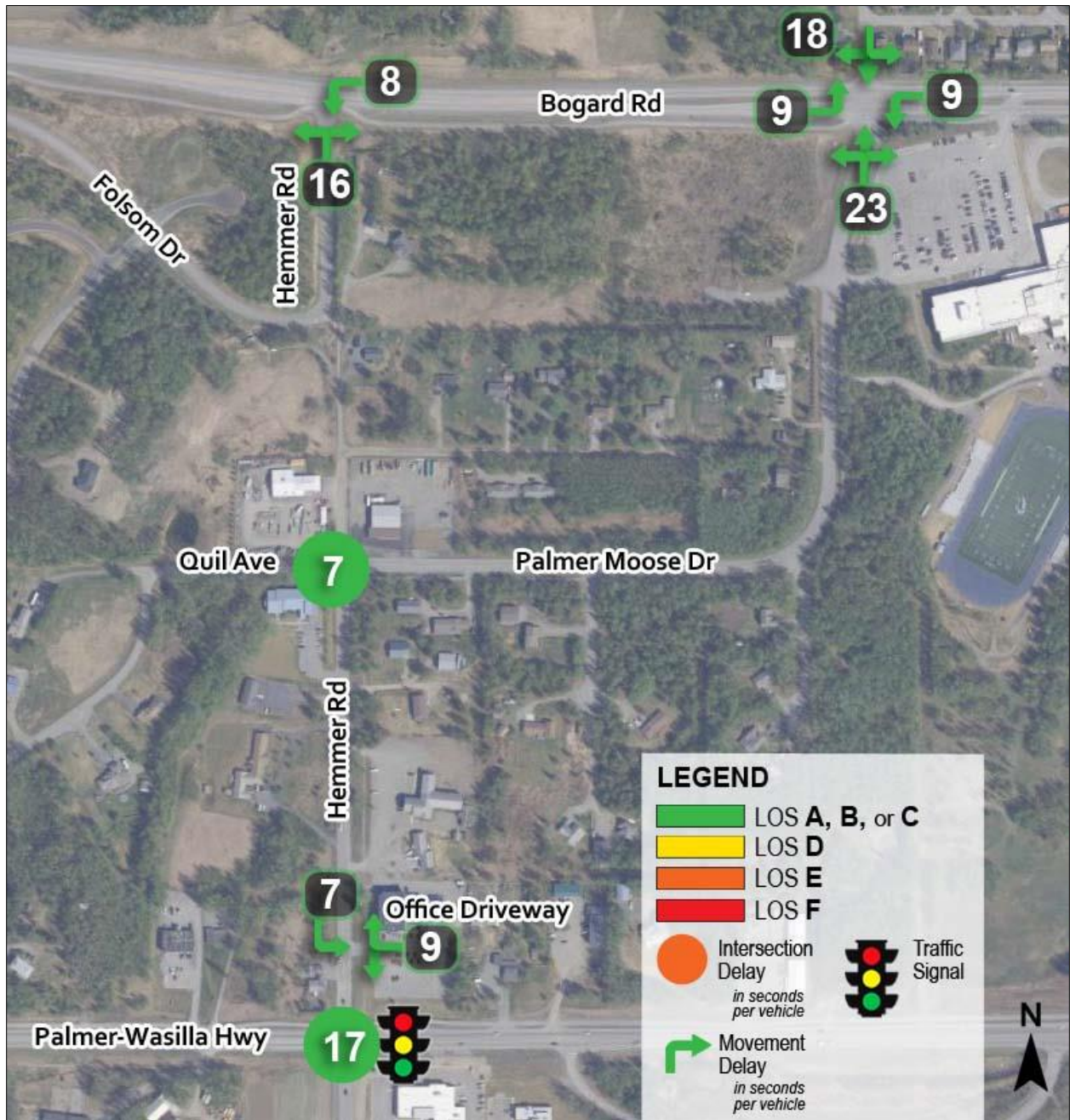
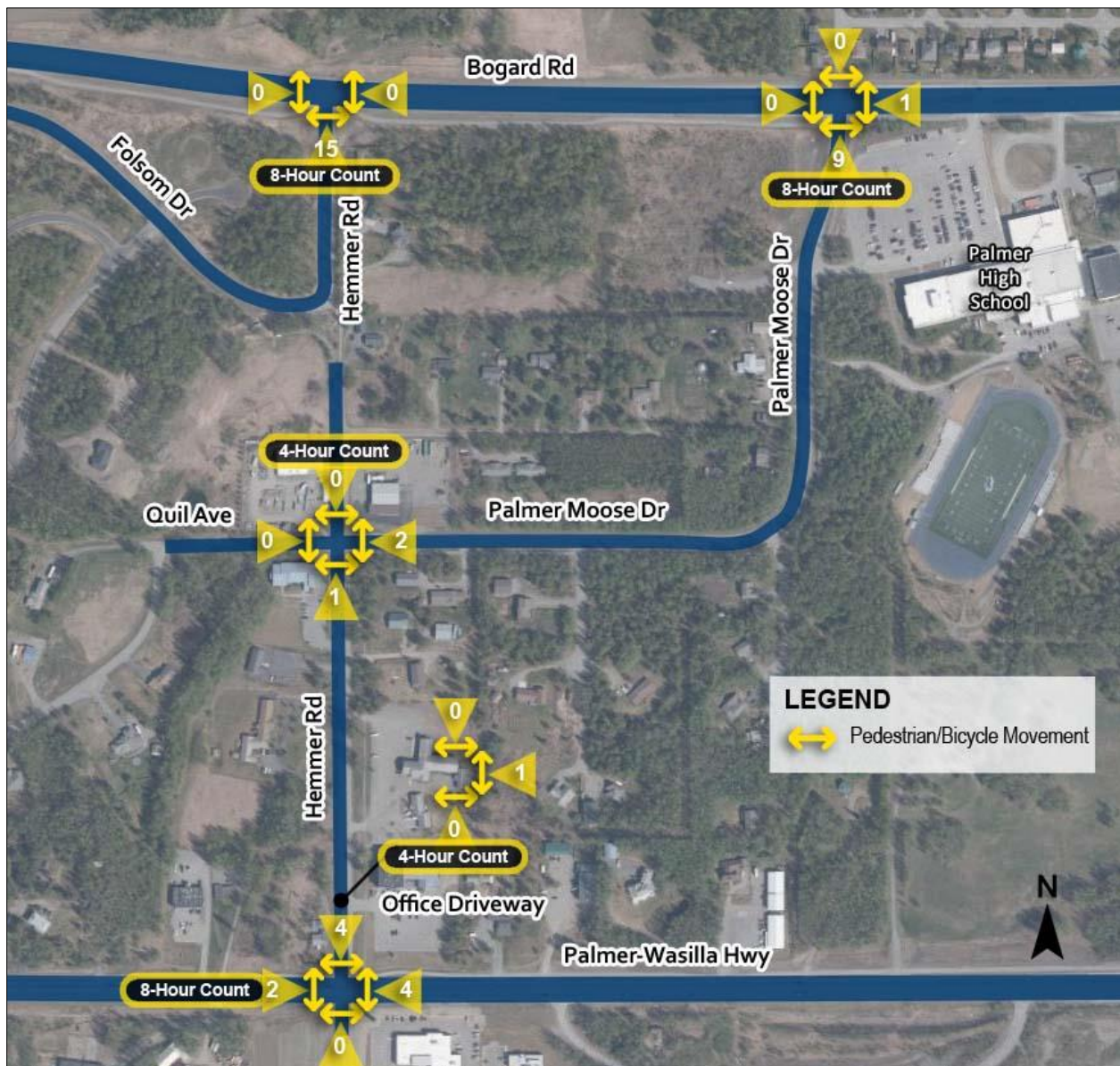


Figure 9: Existing LOS – PM Peak Hour

## 4 Future No Build Conditions

### 4.1 Existing Pedestrian and Bicycle Considerations

Pedestrians and bicycles crossing the roadway at the study intersections were counted at the same time as the vehicle counts. Figure 10 presents the total number of pedestrians and bicycles observed. The figure also indicates the number of hours the intersections were observed. Of the intersections with 8-hour counts, most pedestrians and bicyclists were observed traveling along Bogard Road.



**Figure 10: Total Pedestrian & Bicycle Volumes Observed**

Walking along Hemmer Road and crossing at the Palmer Moose Drive intersection, vehicles yield to pedestrians at all driveways and intersections. As such, pedestrians experience no delay

for the existing condition except when crossing mid-block. Midblock crossing delay was not calculated.

## 4.2 No Build Traffic Volume Forecasts

Base forecasted volumes from the Anchorage Metropolitan Area Transportation Solutions (AMATS) 2040 travel demand model were used to develop forecasted construction year (2025), mid-life year (2035), and design year (2045) volumes. Since the AMATS model does not include the Bogard Road extension to the Glenn Highway, post-processing methodologies presented in the National Cooperative Highway Research Program (NCHRP) Report 765: *Analytical Travel Forecasting Approaches for Project Level Planning and Design* were applied to forecast future volumes. Model volumes were also adjusted based on the historical traffic demand and available capacity on Bogard Road and Palmer-Wasilla Highway. Adjusted 2040 volumes were then grown to 2045 volumes using annual growth rates calculated from 2021 to 2040 for each of the roadways.

Table 7 presents the forecasted no build volumes for the 2025 construction, 2035 mid-life, and 2045 design years.

**Table 7: Forecasted No Build AADT Volumes**

Segment	Extents	2021	2025	2035	2045
Hemmer Rd	Palmer-Wasilla Hwy to Palmer Moose Dr	1,000	1,150	1,300	1,500
Hemmer Rd	Folsom Dr to Bogard Rd	500	500	550	650
Bogard Rd	49 <sup>th</sup> State St to Glenn Hwy	6,500	7,000	9,000	11,250
Palmer Moose Dr	Hemmer Rd to Bogard Rd	900	1,150	1,300	1,450
Palmer-Wasilla Hwy	49 <sup>th</sup> State St to Hemmer Rd	12,000	13,000	16,500	20,750
Palmer-Wasilla Hwy	Hemmer Rd to Glenn Hwy	14,000	15,000	20,000	26,000

## 4.3 No Build Turning Movement Volumes

Future intersection TMVs were calculated using methodology found in NCHRP 765 to predict future intersection movements. The methodology is based on the projected AADT volumes of the approach roads, existing turning movement proportions, and design hour volume percentages determined from the 24-hour hose counts and CCS data. Table 8 presents the design hour percentages used.

**Table 8: No Build Design Hour Percentages**

Segment	Design Hour Percentages		
	AM	Midday	PM
Hemmer Rd: Palmer-Wasilla Hwy to Palmer Moose Dr	15%	6%	7%
Hemmer Rd: Folsom Dr to Bogard Rd	7%	8%	8%
Palmer Moose Dr	15%	6%	7%
Bogard Rd	7%	6%	9%
Palmer-Wasilla Hwy	7%	7%	9%

Figure 11 through Figure 13 present the forecasted no build intersection TMVs.



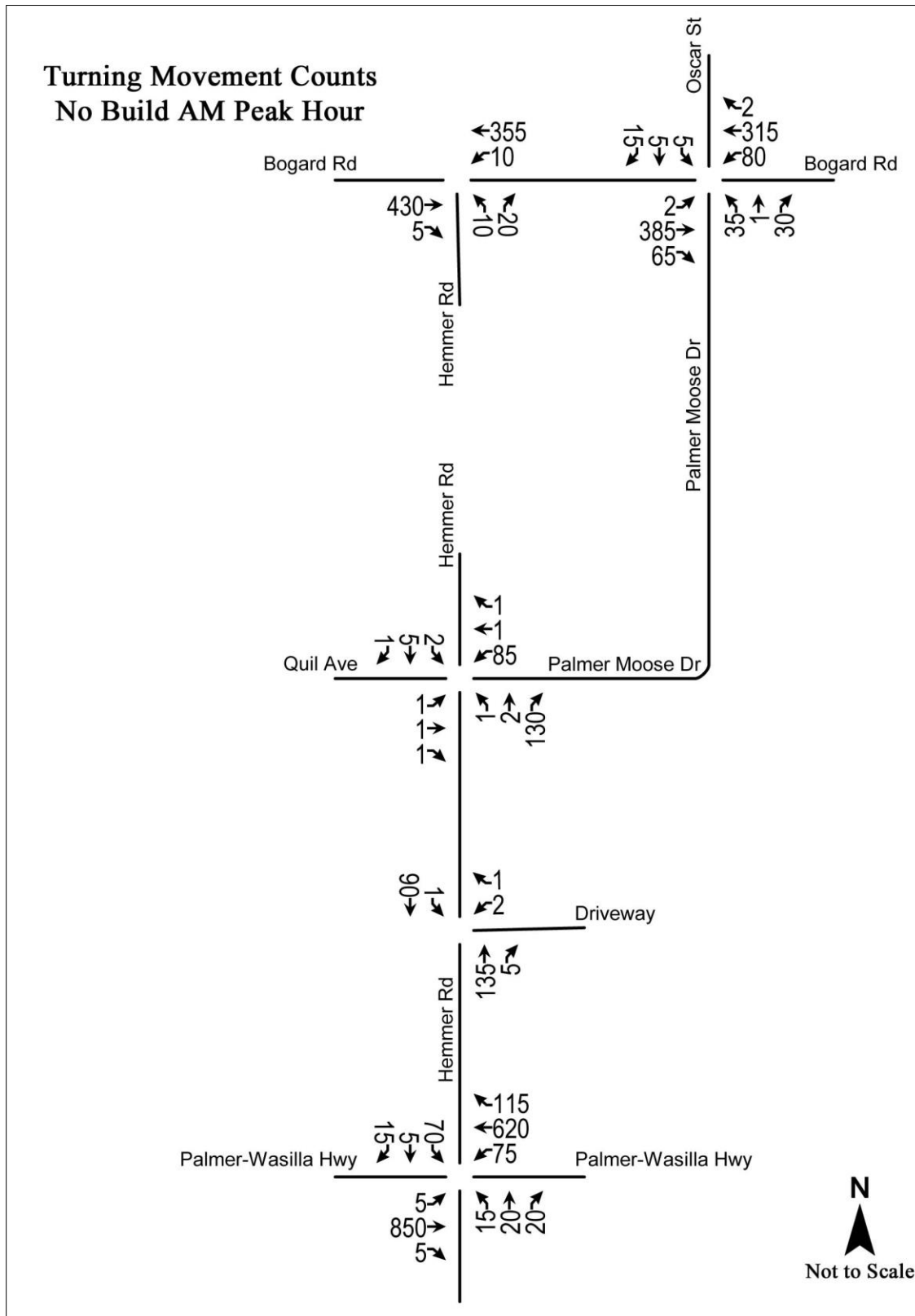


Figure 11: No Build TMVs – AM Peak Hour

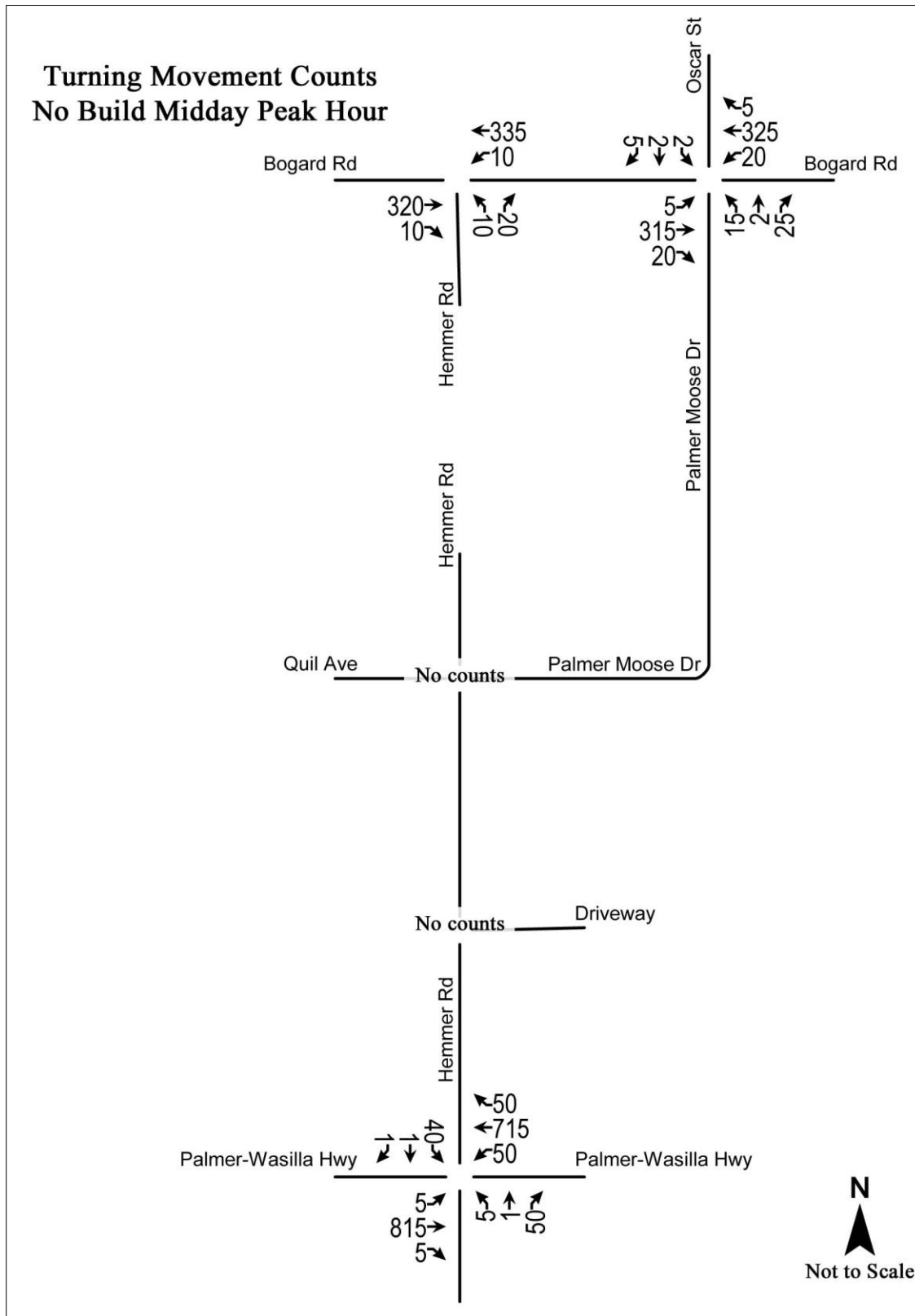


Figure 12: No Build TMVs – Midday Peak Hour

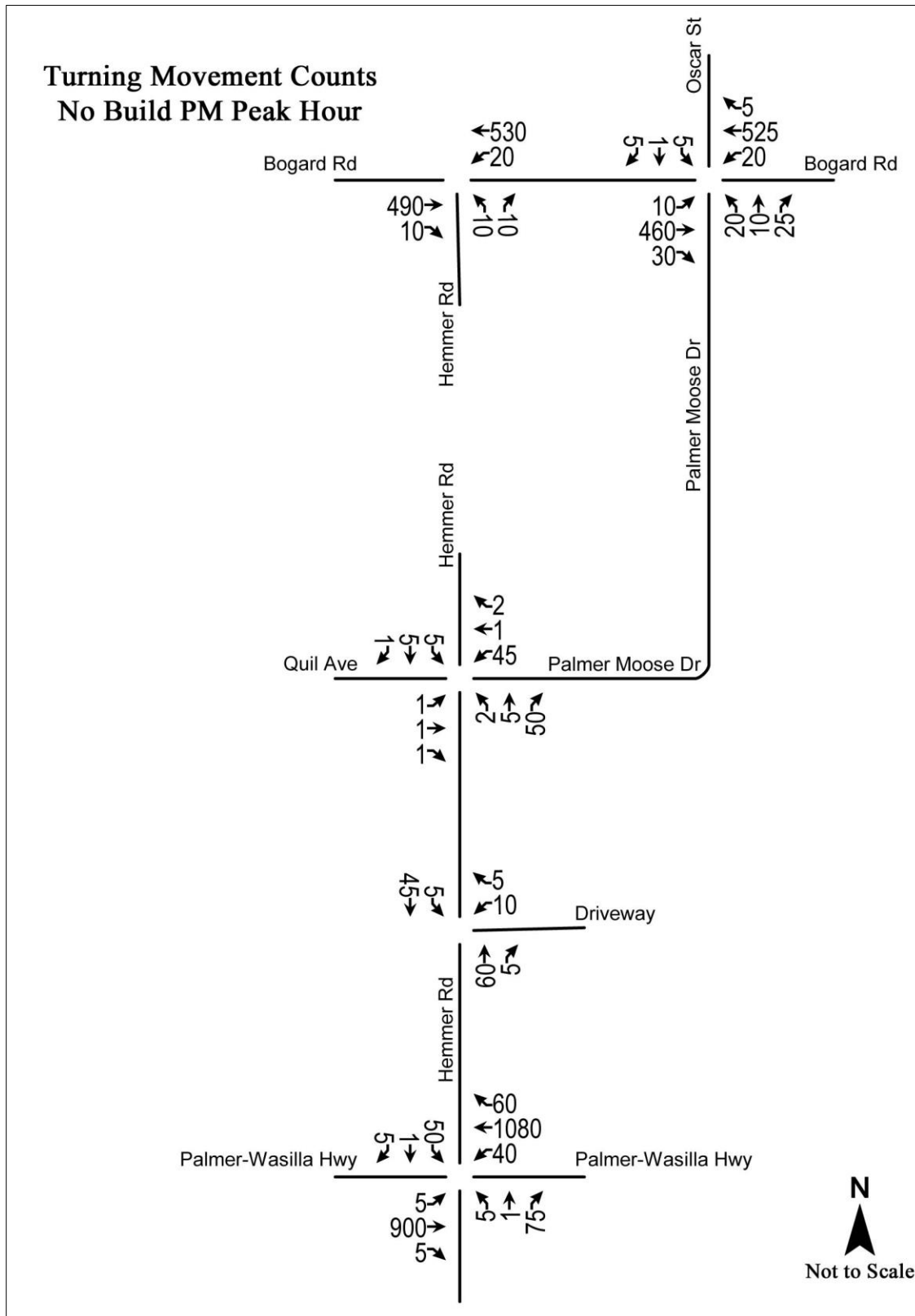


Figure 13: No Build TMVs – PM Peak Hour

#### **4.4 No Build Intersection Capacity**

Future 2045 operations were analyzed under no build conditions. In general, it was assumed that the future PHFs would be equivalent to existing PHFs. However, for intersections with movements operating over capacity, intersection PHFs were increased since operating over capacity would result in traffic going through the intersection more evenly over the hour (have a higher PHF value). The percentage of heavy vehicles in the study area was assumed to remain constant through the 2045 design year.

Figure 14 through Figure 16 present the movement and intersection delays at the study intersections for the AM, midday, and PM peak hours. The Hemmer Road and Palmer-Wasilla Highway signal is expected to operate at LOS D conditions during the 2045 PM peak with the westbound through movement experiencing about 45 seconds of delay per vehicle (LOS F conditions). Signal operations during the 2045 AM and midday peak hours are anticipated to operate at LOS C conditions with the Hemmer Road approaches (north and southbound) experiencing the most delay with about 1 minute of delay per vehicle.

Most of the unsignalized intersections are expected to operate at LOS C or better during the 2045 no build peak hours. The north and southbound approaches at the Bogard Road and Palmer Moose Road intersection is anticipated to operate at LOS D conditions during the 2045 AM and PM peak hours with delays of about 30 seconds per vehicle.

Synchro reports under no build conditions are shown in Appendix C starting on page 69.

#### **4.5 No Build Pedestrian and Bicycle Considerations**

For the no build condition, vehicles yield to pedestrians at all driveways and unsignalized intersections. As such, pedestrians experience no delay for the existing condition except when crossing mid-block. Midblock crossing delay was not calculated.

Measures of pedestrian and bicycle operations do not depend on the number of people walking or biking, so volume forecasts for these modes were not completed.

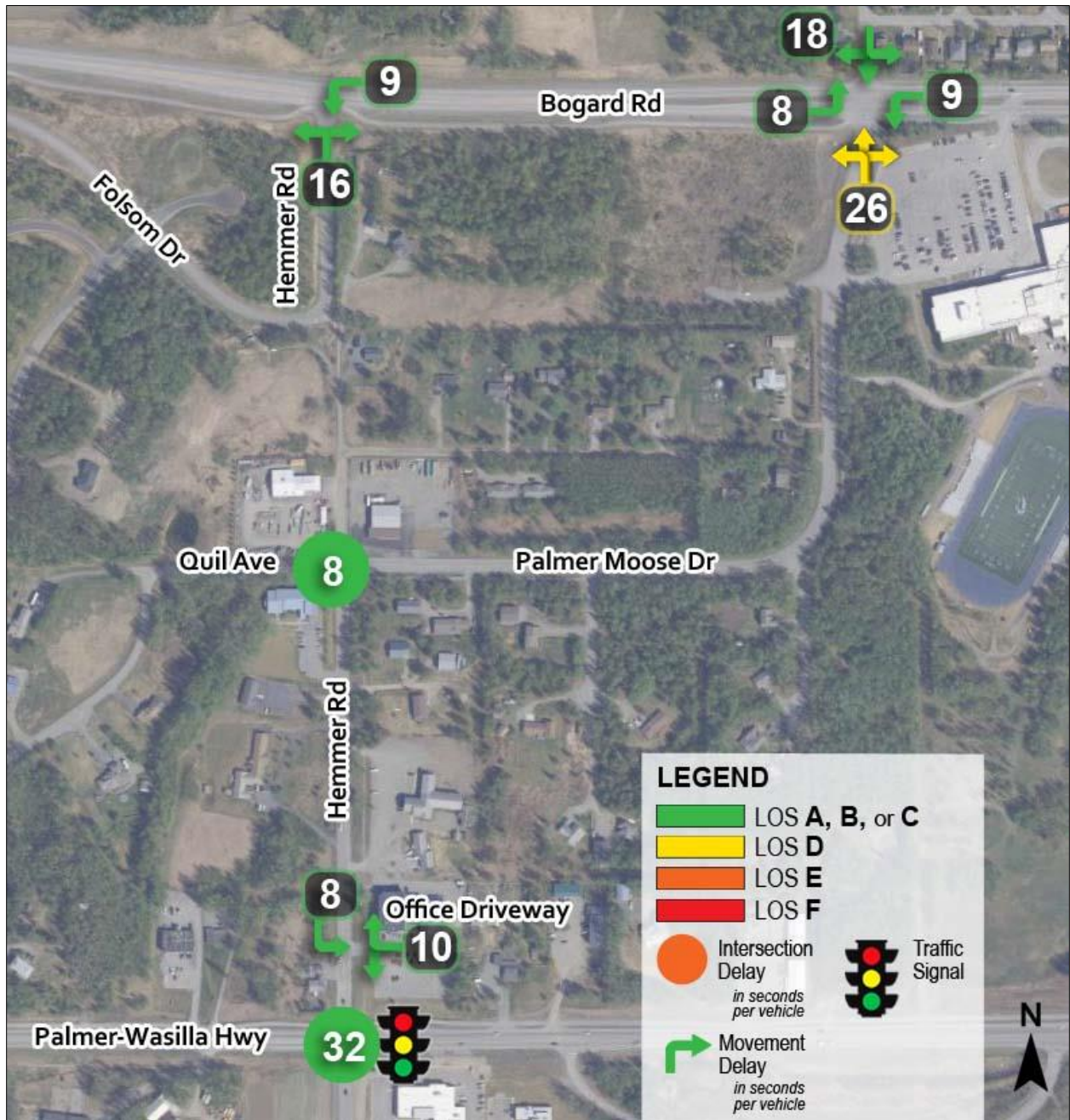


Figure 14: 2045 No Build LOS – AM Peak Hour

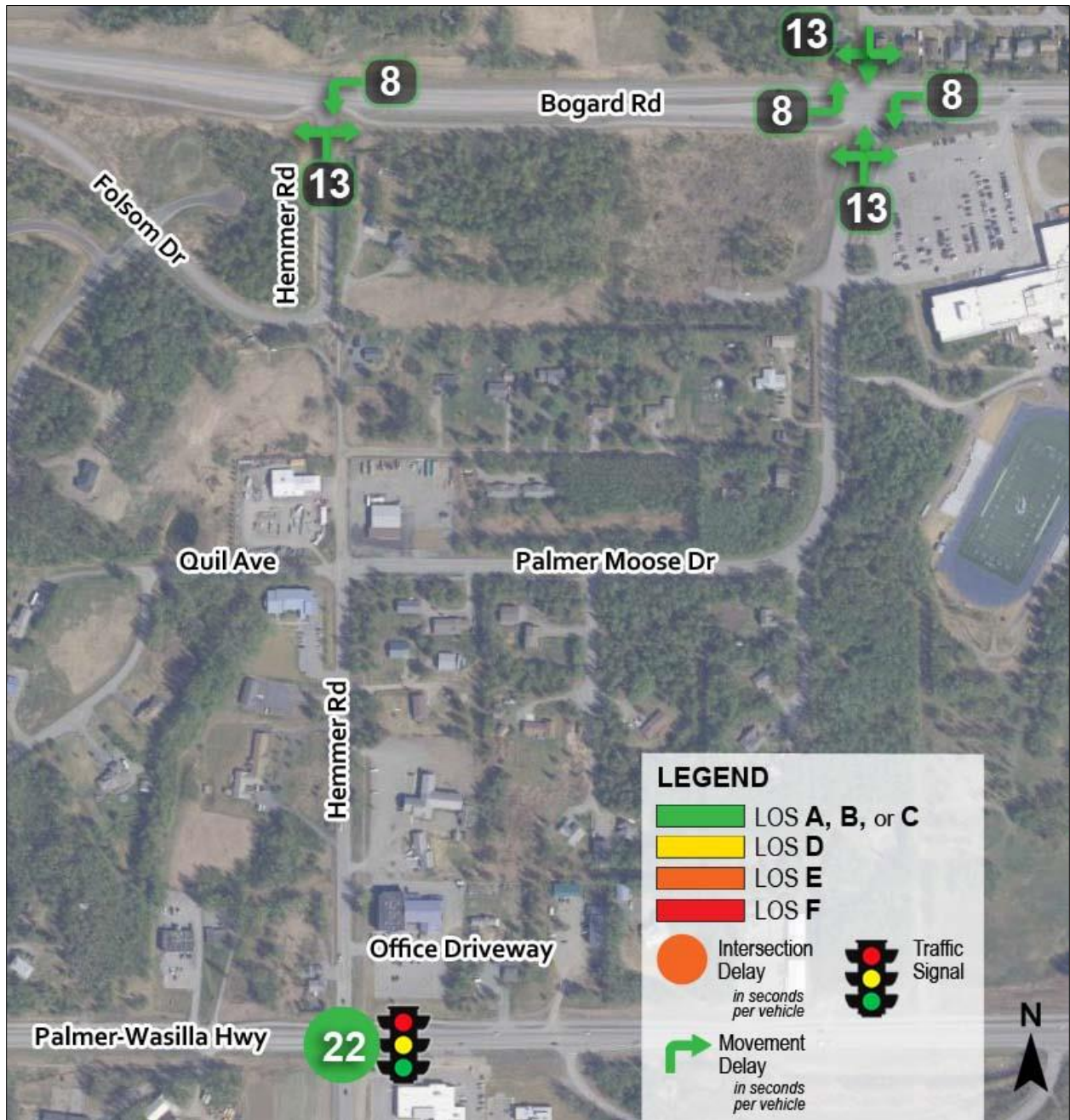


Figure 15: 2045 No Build LOS – Midday Peak Hour

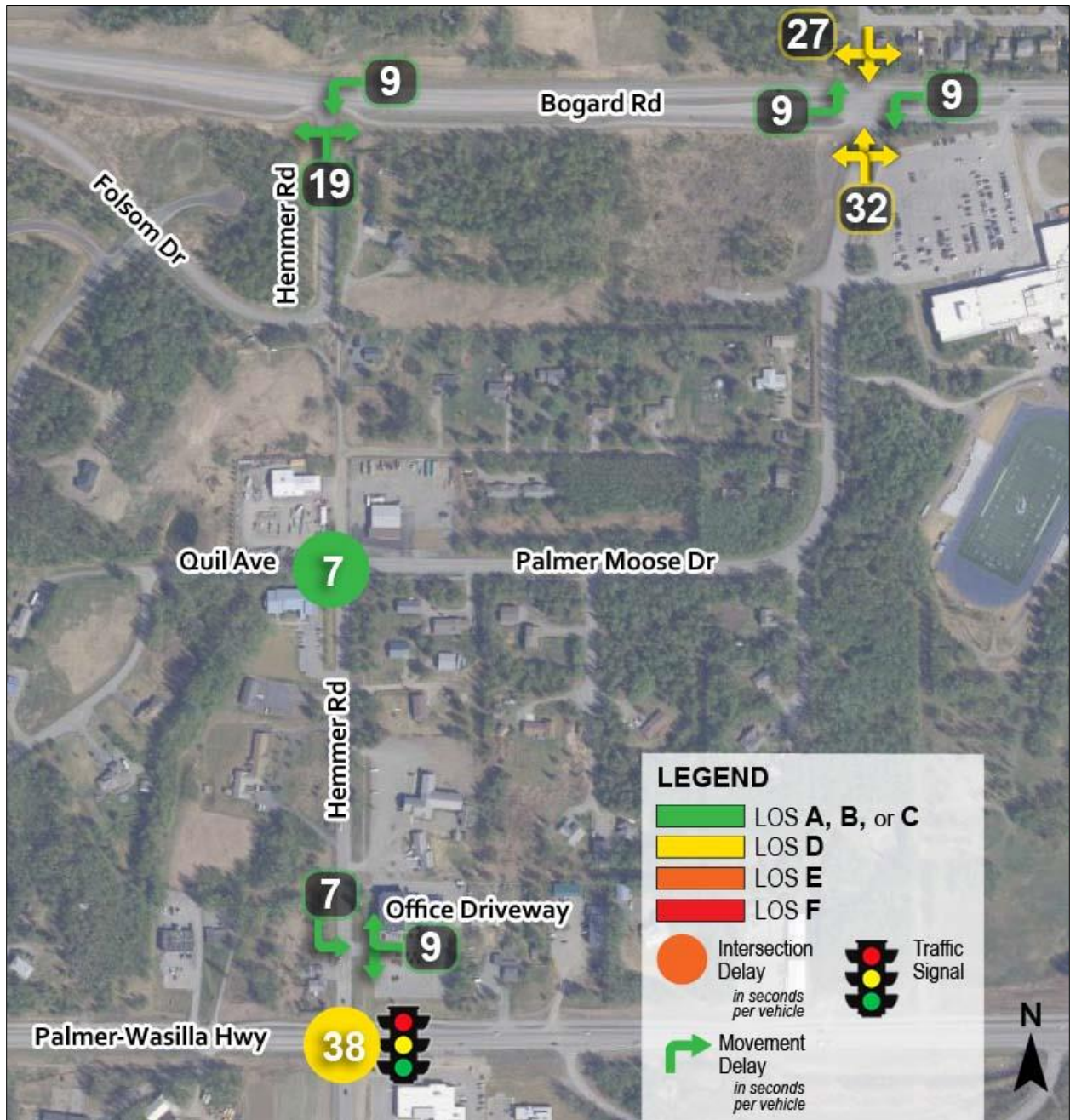


Figure 16: 2045 No Build LOS – PM Peak Hour

## 5 Future Build Conditions

### 5.1 Build Traffic Volume Forecasts

Future build condition volumes were forecasted similar to no build volumes. Additional adjustments were made to estimate how traffic would adjust given the more direct connection between Palmer-Wasilla Highway and Bogard Road at Hemmer Road. It was assumed that some traffic would move from Palmer Moose Drive to Hemmer Road; however, school traffic to and from the south would continue to use Palmer Moose Drive. Minor adjustments were also made to 49<sup>th</sup> State Street, Felton Street, Trunk Road, and the Glenn Highway, with some traffic from each of these roads being redirected to Hemmer Road.

Table 9 presents the forecasted build volumes for the 2025 construction, 2035 mid-life, and 2045 design years.

**Table 9: Forecasted Build AADTs**

Segment	Extents	2021	2025	2035	2045
Hemmer Rd	Palmer-Wasilla Hwy to Palmer Moose Dr	1,000	2,800	3,150	3,600
Hemmer Rd	Palmer Moose Dr to Bogard Rd	-	2,600	2,950	3,300
Bogard Rd	49 <sup>th</sup> State St to Glenn Hwy	6,500	7,000	9,000	11,250
Palmer Moose Dr	Hemmer Rd to Bogard Rd	900	700	800	900
Palmer-Wasilla Hwy	49 <sup>th</sup> State St to Hemmer Rd	12,000	13,000	16,500	20,750
Palmer-Wasilla Hwy	Hemmer Rd to Glenn Hwy	14,000	15,500	20,000	26,000
Folsom Dr	Hemmer Rd to Monte Vista Dr	500	500	550	650

The full build-out condition for Hemmer Road, as presented in the recently adopted *Official Streets and Highways Plan* (OS&HP) and other area planning documents, is for Hemmer Road to extend from the Glenn Highway (near the Inner Springer Loop/Claire Street intersection) to Palmer-Fishhook Road. If Hemmer Road is fully extended in the future, traffic volumes would likely increase, since Hemmer Road could provide a shorter and faster route for additional trips. Table 10 shows the forecasted 2045 volumes for Hemmer Road developed using a sketch planning methodology. Note that these volumes are consistent with forecasted volumes for Hemmer Road of 4,000 to 5,000 vehicles per day (vpd) that were developed as part of the Glenn Highway MP 34 to 42 Reconstruction project.



**Table 10: Forecasted Full Build AADTs**

<b>Segment</b>	<b>Extents</b>	<b>2045</b>
Hemmer Rd	Glenn Hwy to Palmer-Wasilla Hwy	5,500
Hemmer Rd	Palmer-Wasilla Hwy to Bogard Rd	4,750
Hemmer Rd	Bogard Rd to Palmer-Fishhook Rd	4,500

## **5.2 Build Turning Movement Volumes**

2045 build condition TMVs were calculated using the same methodology as the no build condition TMVs. Figure 17 through Figure 19 present the forecasted TMVs under the build condition.

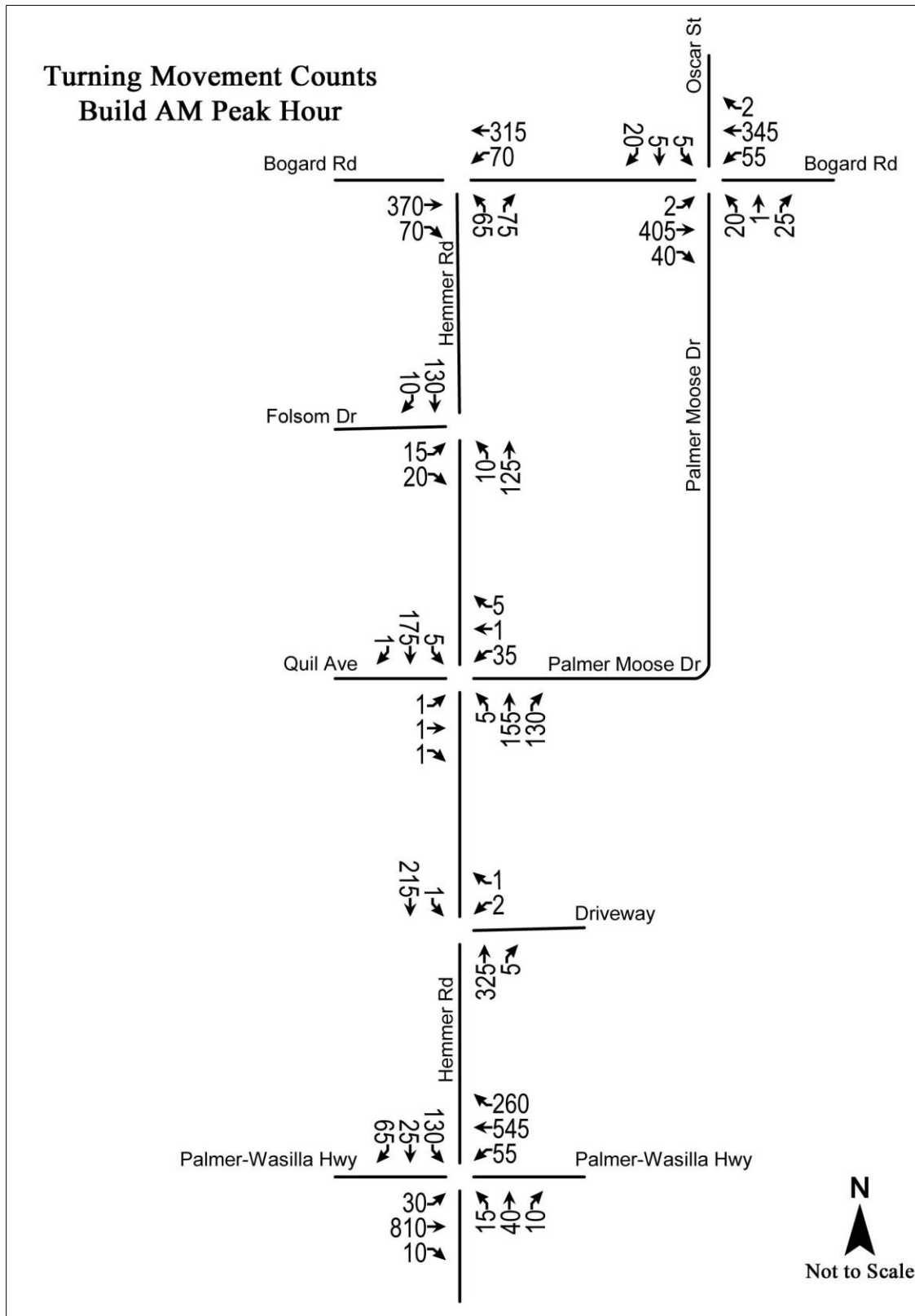


Figure 17: Build TMVs – AM Peak Hour

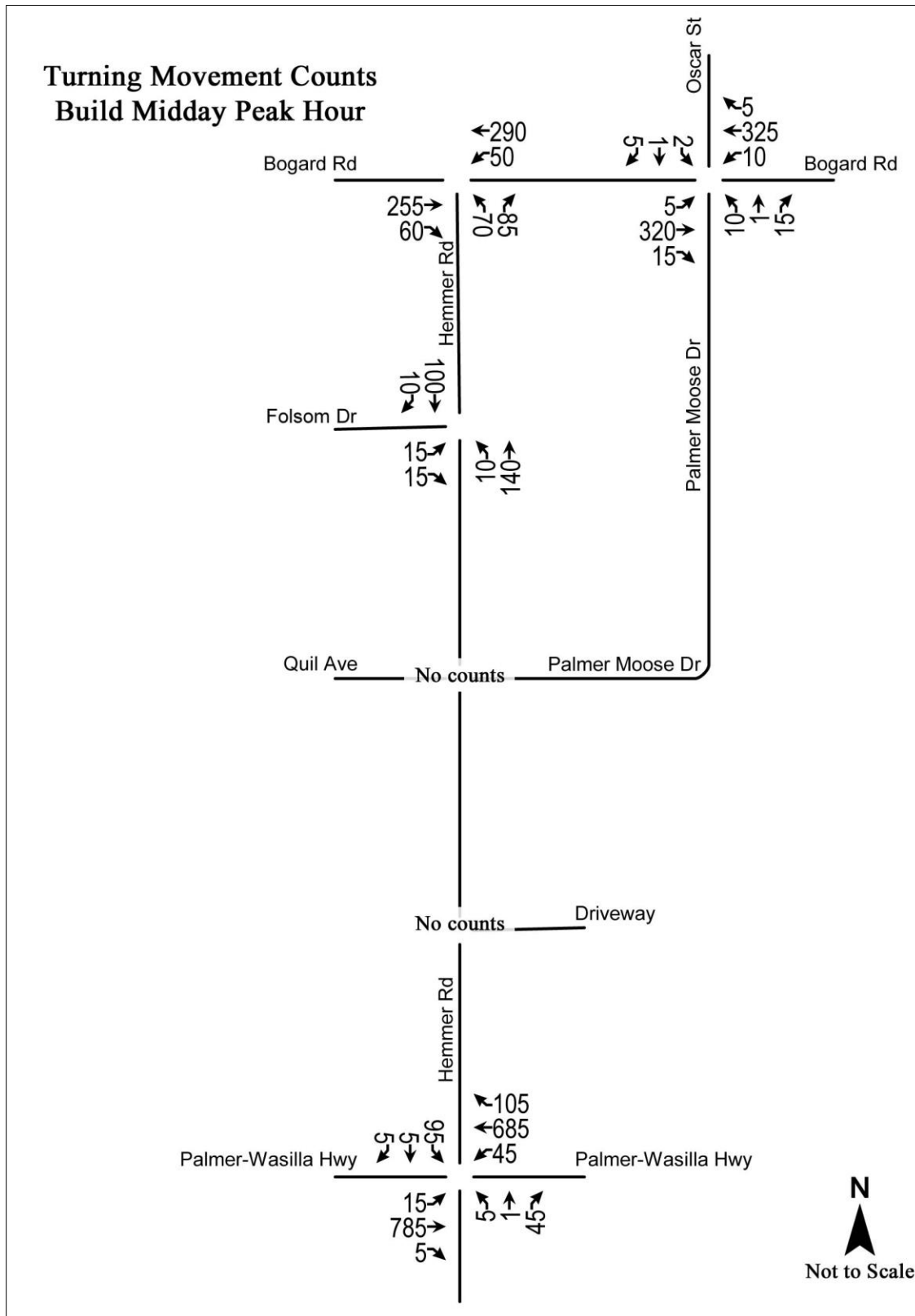


Figure 18: Build TMVs – Midday Peak Hour

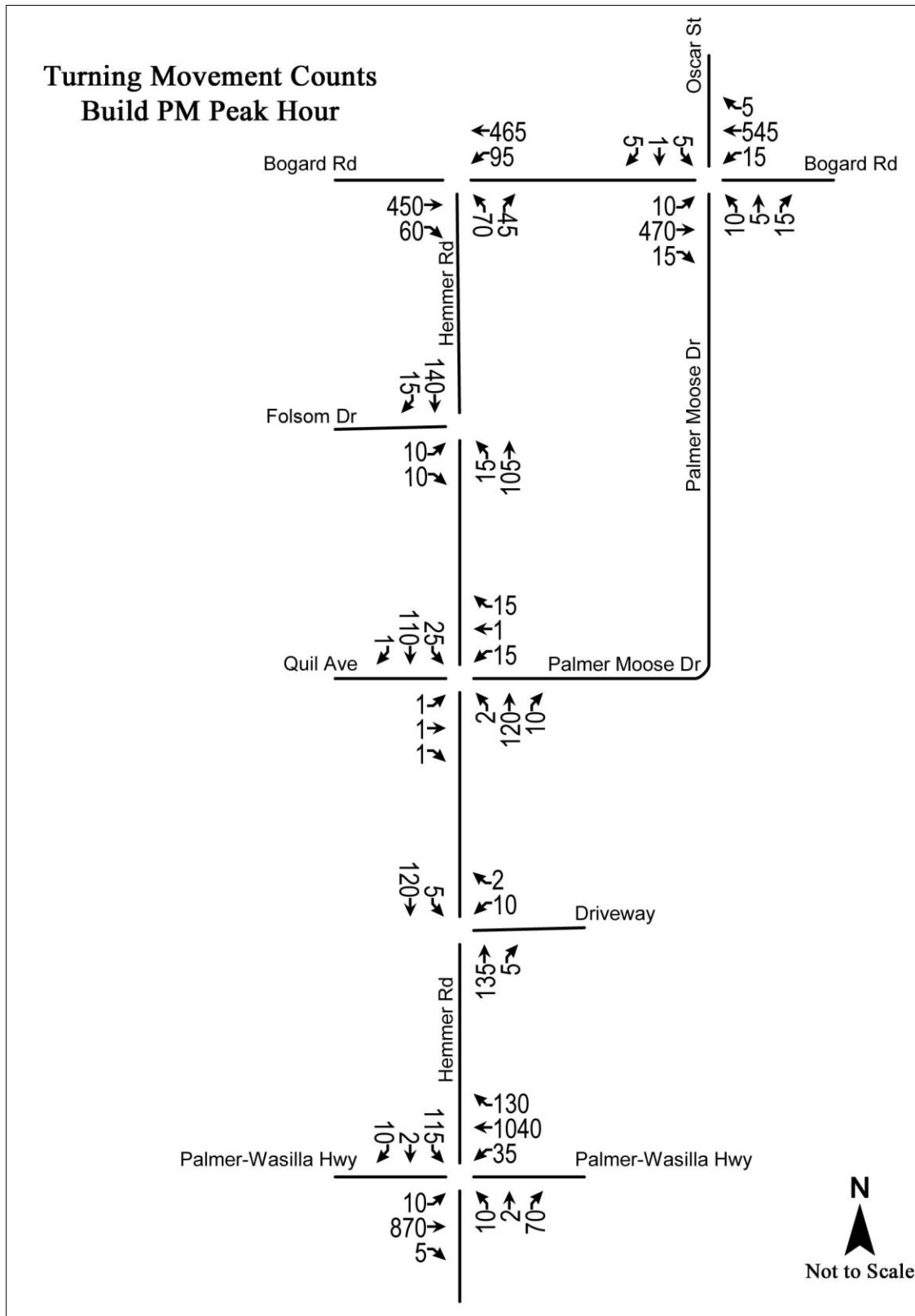


Figure 19: Build TMVs – PM Peak Hour

## 5.3 Build Intersection Control

### 5.3.1 Hemmer Road & Palmer Moose Drive

The Manual on Uniform Traffic Control Devices (MUTCD) has guidance on when TWSC is an appropriate control for an intersection. Forecasted traffic and build road conditions for the Hemmer Road at Palmer Moose Drive intersection are anticipated to meet one condition for a TWSC intersection:

- Vehicular traffic volume exceeds 6,000 vpd on the major road – **criteria not met**
- Restricted sight distance requiring road user to stop to observe conflicting traffic – **criteria met**
- Crash records indicate three or more crashes that could be corrected by the installation of a STOP sign, or 5 or more crashes were reported within a two-year period – **criteria not met**

A Google Earth aerial review of intersection sight distances under yield control was conducted for the Palmer Moose Drive and Quil Avenue approaches. Based on the existing road configurations in the area, sight lines are obstructed by trees and buildings. The sight obstructions are assumed to continue under build conditions. Therefore, it is recommended that the Hemmer Road at Palmer Moose Drive intersection operate under TWSC.

### 5.3.2 Hemmer Road & Folsom Drive

The MUTCD has guidance on when TWSC is an appropriate control for an intersection, as well as if YIELD or STOP signs are appropriate.

The MUTCD TWSC is appropriate at the intersection if one or more of the following conditions are met:

- Vehicular traffic volume exceeds 6,000 vpd on the major road – **criteria not met**
- Restricted sight distance requiring road user to stop to observe conflicting traffic – **criteria not met (assumed design would meet sight distance)**
- Crash records indicate three or more crashes that could be corrected by the installation of a STOP sign, or 5 or more crashes were reported within a two-year period – **criteria not met**

The MUTCD also has guidance on the appropriate usage of YIELD or STOP signs. The MUTCD states that a YIELD or a STOP sign is appropriate at an intersection if one or more of the following conditions are met:

- Normal right-of-way rule not expected to provide reasonable compliance with the law at an intersection where a less important road meets a more important road – **criteria met**
- Minor road is entering a designated through highway or street – **criteria not met**
- Intersection is within a signalized area – **criteria not met**

A YIELD or STOP sign is appropriate on the Folsom Drive approach. The right-of-way rule (for an intersection with no regulatory signs) is that drivers approaching the intersection must yield

right-of-way to any road user (such as a vehicle or pedestrian) already in the intersection. The Hemmer Road at Folsom Drive intersection is currently under free flow conditions, where Hemmer Road curves and turns into Folsom Drive (and vice versa), and vehicles do not need to stop. The Hemmer Road Extension would add another leg to the intersection transforming it into a T-intersection. Vehicles on Folsom Drive may not comply with the right-of-way rule under build conditions since they do not need to stop under existing conditions.

### **5.3.3 Hemmer Road & Bogard Road**

The warrant for signals was analyzed for the Hemmer Road at Bogard Road intersection. The California Department of Transportation (Caltrans) has developed a methodology for analyzing signal warrants based on AADT that was adopted by the Institute of Transportation Engineers (ITE). The methodology considers the entering average daily traffic volumes, number of approach lanes, and area type. This method uses future AADT volumes as the input variables and estimates whether the intersection would meet the Signal Warrant 1 found in the MUTCD in a design year. In using AADT, the Caltrans methods can be directly applied to planning-level forecast volumes.

MUTCD Signal Warrant 1 has three conditions. If traffic volumes at the intersection satisfies one of the conditions, then a signal can be considered. Condition A (minimum vehicular volume) is met when the volume on the side street is large enough to consider signal warrants. Condition B (interruption of continuous traffic) is met when the volume on the major street is so heavy that the side-street traffic experiences excessive delay or conflict in entering or crossing the major street. The last condition is the combination of conditions A and B and is satisfied when the volumes on the major and side streets meet a percentage of the volume thresholds for the other conditions.

There are separate thresholds for urban areas (100% volume thresholds) and rural areas (70% volume thresholds) for the warrant analysis. Rural area thresholds may be used if either the intersection lies within an isolated community with a population of less than 10,000 people, or if the posted speed on the major road is greater than 40 miles per hour (mph). Bogard Road (the major road) is a 45-mph roadway; therefore, the rural thresholds were used for the analysis.

Signal warrants for the Hemmer Road at Bogard Road intersection were analyzed under forecasted 2025, 2035, and 2045 build volumes. Table 11 summarizes the volume thresholds under each condition and the entering volumes for the years analyzed with Bogard Road as the major road and Hemmer Road as the minor road. A signal is warranted by 2035 under Condition B.

**Table 11: Signal Warrant Summary - Hemmer Road at Bogard Road**

<b>Condition A</b>	<b>2025</b>		<b>2035</b>		<b>2045</b>	
	<b>Major Road Bogard Rd</b>	<b>Minor Road Hemmer Rd</b>	<b>Major Road Bogard Rd</b>	<b>Minor Road Hemmer Rd</b>	<b>Major Road Bogard Rd</b>	<b>Minor Road Hemmer Rd</b>
Volume	7,000	1,300	9,000	1,475	11,250	1,650
Threshold	5,600	1,680	5,600	1,680	5,600	1,680
Condition Met?	No		No		No	
<b>Condition B</b>	<b>2025</b>		<b>2035</b>		<b>2045</b>	
	<b>Major Road Bogard Rd</b>	<b>Minor Road Hemmer Rd</b>	<b>Major Road Bogard Rd</b>	<b>Minor Road Hemmer Rd</b>	<b>Major Road Bogard Rd</b>	<b>Minor Road Hemmer Rd</b>
Volume	7,000	1,300	9,000	1,475	11,250	1,650
Threshold	8,400	850	8,400	850	8,400	850
Condition Met?	No		Yes		Yes	

**5.3.3.1 Left-Turn Phasing**

Left-turn phasing for the proposed Hemmer Road and Bogard Road signal was determined by *NCHRP Web-Only Report 284: Decision-Making Guide for Traffic Signal Phasing*, which bases recommendations for left-turn phasing on traffic volumes, cycle length, vehicle speeds, sight distance, lane configuration, and the number of left-turn crashes. Based on the methodology, the westbound left turn is recommended to have protected-permissive phasing.

**5.3.3.2 Dismissed Roundabout Alternative**

A roundabout was considered and dismissed for the Hemmer Road and Bogard Road intersection. The intersection is adjacent to a system of regularly-placed signalized intersections. Table 12 presents the nearby signalized intersections on Bogard Road and the distance between them. The table also shows that the proposed signal on Hemmer Road is greater than the minimum spacing recommended in the *Alaska Highway Preconstruction Manual* (0.25 miles) for adequate signal progression.

**Table 12: Signalized Intersections on Bogard Road**

<b>Bogard Road Intersection</b>	<b>Next Intersection (to the east)</b>	<b>Distance between Signals</b>
Hemmer Road (proposed)	Felton Street	0.50 miles
Felton Street	Glenn Highway	0.50 miles
Glenn Highway	Alaska Street	0.15 miles

Under coordinated timing, regularly-placed signals platoon the major road traffic, allowing high traffic volumes to move smoothly through the system. Roundabouts do not facilitate the movement of platoons. As such, traffic from the coordinated signal system will arrive at the roundabout in a platoon, resulting in increased delay as the roundabout serves each vehicle individually.

Furthermore, a previous study of the Hemmer Road and Bogard Road intersection concluded that a signal was warranted, and, as a result, signal poles were plumbed at the intersection.

## 5.4 Build Intersection Configuration

Guidance from NCHRP Report 457: *Evaluating Intersection Improvements: An Engineering Study Guide* was used to determine the lane configurations at the Hemmer Road intersections. NCHRP 457 provides recommendations for the number of through lanes or exclusive turn lanes for both unsignalized and signalized intersections.

### 5.4.1 Hemmer Road & Palmer-Wasilla Highway

The southbound Hemmer Road approach is recommended to have one exclusive left-turn lane and one shared through-and-right-turn lane. NCHRP 457 recommends that at least two approach lanes on the minor-road approach should be considered when a minor road intersects with an arterial street or highway at a signal; the two lanes could be any combination of movements. Palmer-Wasilla Highway (the major road) is classified as a principal arterial by DOT&PF. Peak hour volumes meet thresholds for an exclusive left-turn lane but do not meet thresholds for any exclusive right-turn lanes.

Figure 20 presents the proposed intersection configuration at Hemmer Road and Palmer-Wasilla Highway.

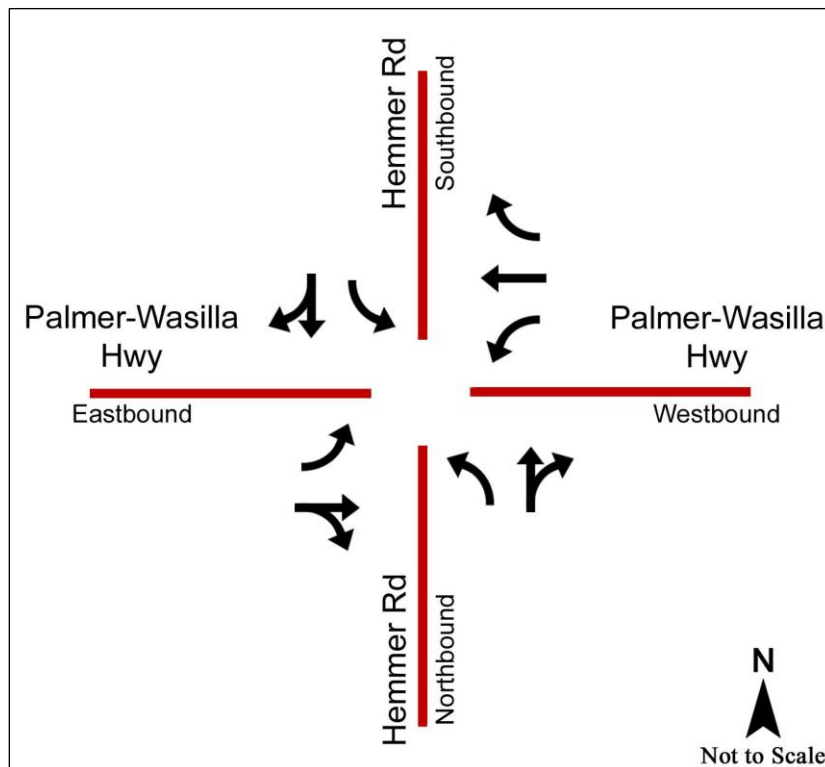


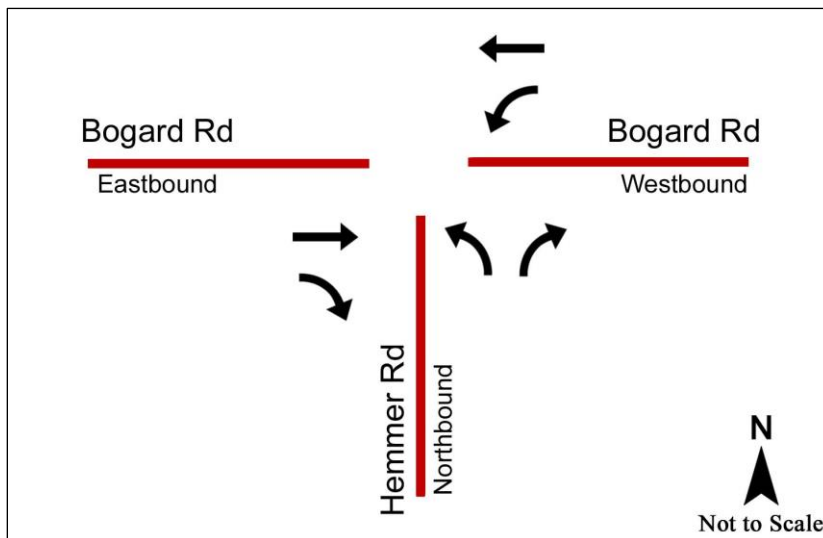
Figure 20: Proposed Lane Configuration at Hemmer Road & Palmer-Wasilla Highway



### 5.4.2 Hemmer Road & Bogard Road

The northbound approach is recommended to have one left-turn lane and one right-turn lane. At least two approach lanes should be considered for the Hemmer Road approach because Bogard Road (the major road) is classified as a minor arterial by DOT&PF. Since the northbound Hemmer Road approach has two movements (a left turn and a right turn), each movement could have its own lane.

Figure 21 presents the proposed intersection configuration at Hemmer Road and Bogard Road.



**Figure 21: Proposed Intersection Configuration at Hemmer Road & Bogard Road**

### 5.4.3 Unsignalized Hemmer Road Intersections

No turn lanes are recommended at any unsignalized Hemmer Road intersections in the study. Forecasted 2045 build volumes at the intersections do not meet thresholds found in *NCHRP 457 Evaluating Intersection Improvements* for additional lanes on Hemmer Road or on the side streets.

## 5.5 Build Intersection Capacity

Figure 22 through Figure 24 present 2045 operations at the studied intersections with the extension of Hemmer Road. Synchro reports under build conditions are shown in Appendix D starting on page 88.

Both signalized intersections on Hemmer Road are anticipated to operate at LOS C or better throughout the day under build conditions. At the Palmer-Wasilla Highway signal, movement delays are up to one minute during the AM and PM peak hours. At the proposed Bogard Road signal, the northbound Hemmer Road approach is anticipated to have the most delay with about 45 seconds per vehicle during the peak hours.

Most of the unsignalized intersections are expected to operate at LOS C or better during the 2045 build peak hours with 20 seconds of delay per vehicle. The Bogard Road at Palmer Moose Drive

intersection is expected to have the most delay in the PM peak with almost 30 seconds per vehicle on the stop-controlled approaches.

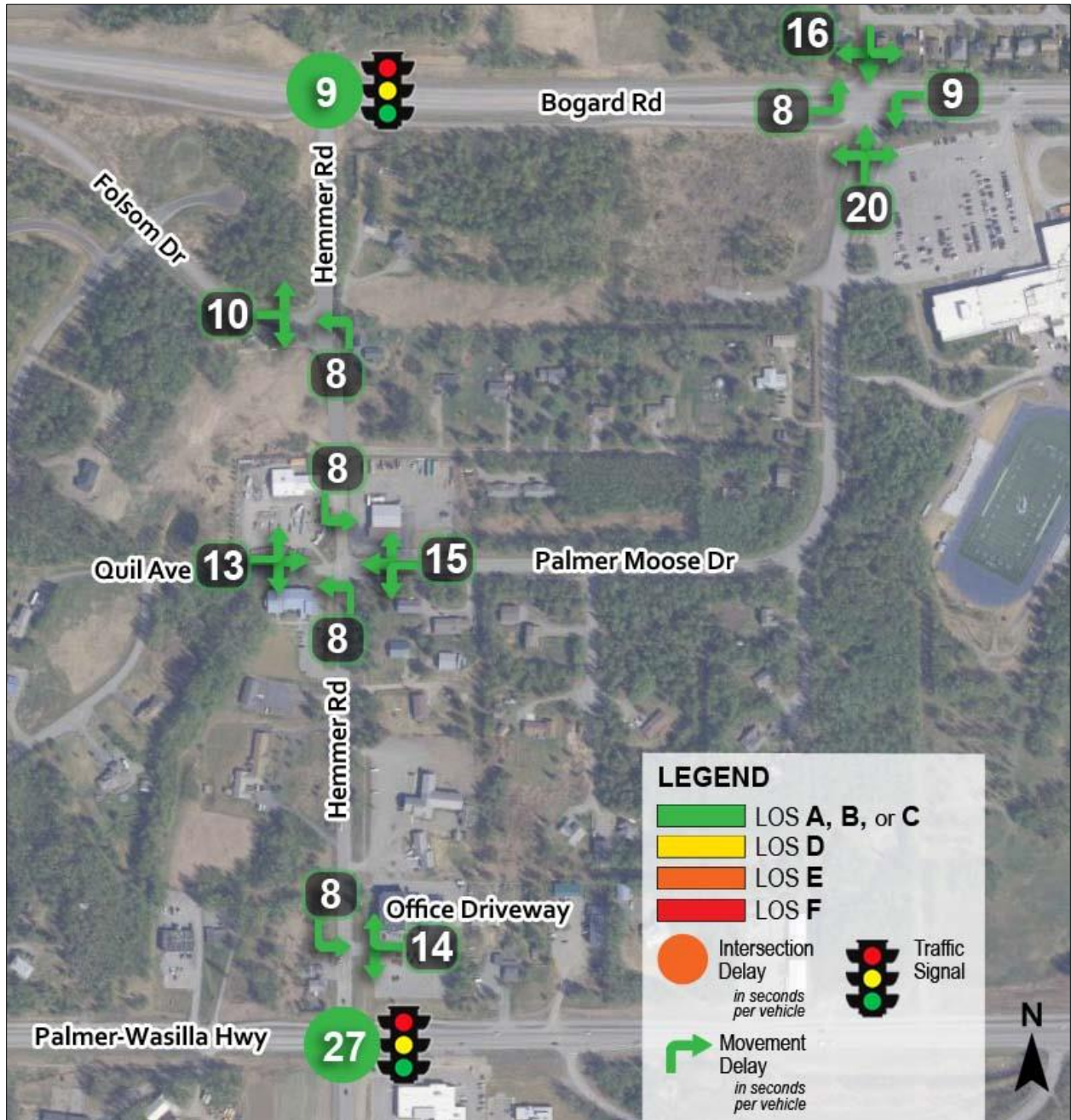


Figure 22: 2045 Build LOS – AM Peak Hour

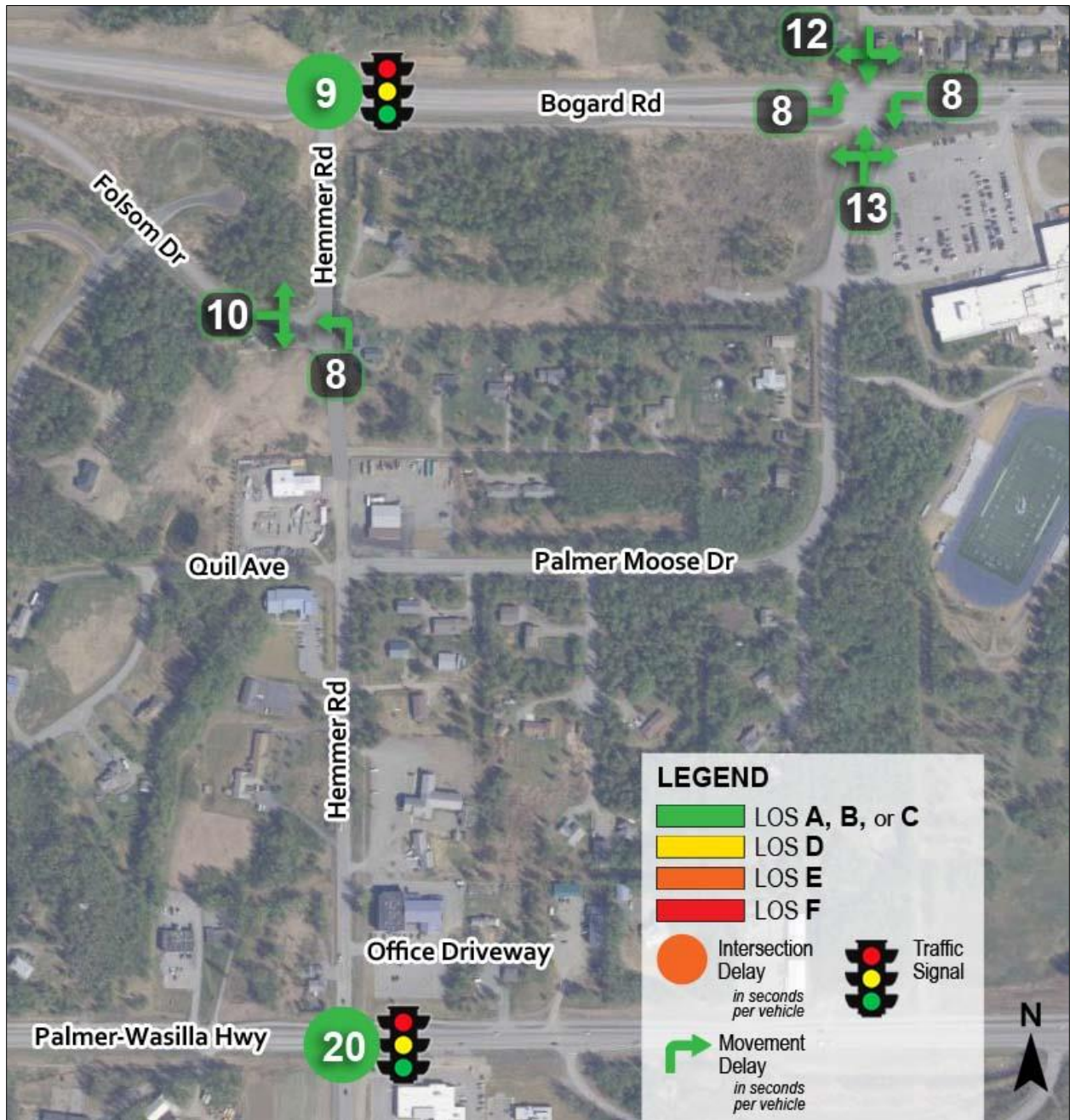


Figure 23: 2045 Build LOS – Midday Peak Hour

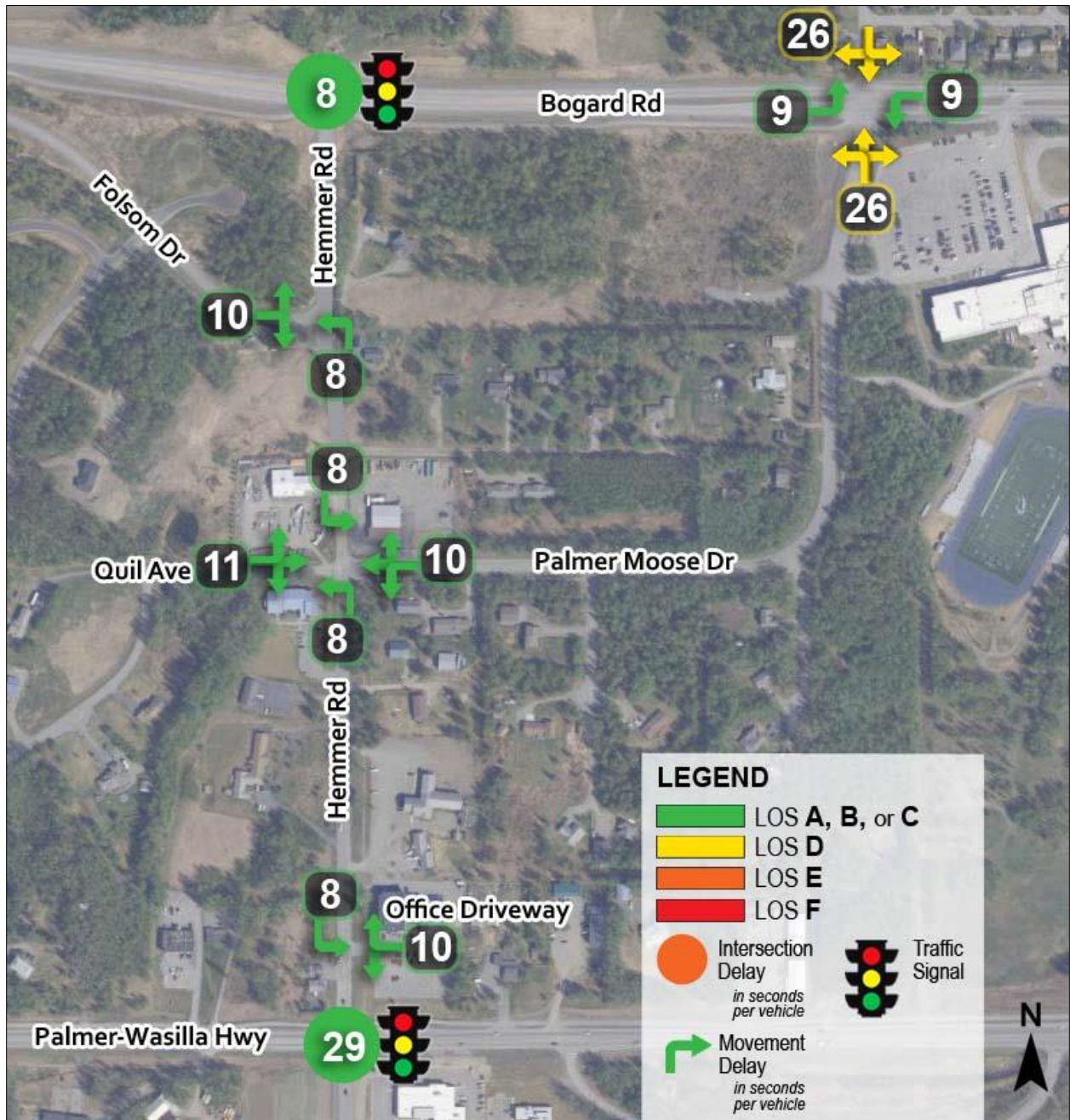


Figure 24: 2045 Build LOS – PM Peak Hour

## 5.6 Build Pedestrian and Bicycle Considerations

### 5.6.1 Pedestrian Pathway

The MSB desires a connected non-motorized network. A goal of the MSB 2035 *Long Range Transportation Plan* is to improve the roadway network connectivity for motorized and non-motorized users. The MSB *Safe Routes to School Walk Zone Inventory and Recommendations* advocates for the improvement and addition of sidewalks to create routes to schools and separate pedestrians and vehicles. The MSB is currently developing a Bike and Pedestrian Plan with the

vision of creating a safer and more connected network for bicycles and pedestrians to accommodate the fast-growing MSB population.

The 2012 American Association of State Highway and Transportation Officials (AASHTO) *Guide for the Development of Bicycle Facilities* has general guidance on bicycle facilities and indicates that marked shared lanes, bike lanes, or shared pathways are appropriate treatments for Hemmer Road based on traffic volumes, posted speeds, and the roadway functional classification. The Federal Highway Administration's 2019 *Bikeway Selection Guide* presents a preferred bikeway type based on volume and speed. Using forecasted 2045 volumes and the 35-mph posted speed limit on Hemmer Road, separated bike lanes or shared-use paths are recommended.

For urban collector roads, the AASHTO's 2011 *A Policy on Geometric Design of Highways and Streets* recommends pedestrian facilities on both sides of the road for commercial areas and at least one side of the road for residential areas (though desirable on both sides). Within the study area, Hemmer Road has a mixture of residential and commercial land uses. The north end consists of mostly residential areas located on the east side of the road. The south end has more developed areas with a mix of residential and commercial uses.

Based on this guidance, shared pathways are recommended on both sides of Hemmer Road between Palmer-Wasilla Highway and Palmer Moose Drive. Between Palmer Moose Drive and Bogard Road, a shared pathway is desirable for both sides of Hemmer Road, but a shared path on one side of the road would be adequate.

### **5.6.2 Pedestrian Crossings**

Marked crosswalks were considered for pedestrians to cross Hemmer Road at Folsom Drive and at Palmer Moose Drive using guidance from the Alaska Traffic Manual (ATM). Based on the daily 2045 volumes and 35-mph posted speed limit on Hemmer Road, marked crosswalks are appropriate at both locations. However, the ATM uses a minimum pedestrian volume threshold of 20 pedestrians crossing per peak hour (or 15 elderly and/or child pedestrians); the minimum pedestrian volume was not met during the intersection volume counts conducted at the Hemmer Road at Palmer Moose Drive intersection.

Crossing delays were calculated for pedestrians crossing Hemmer Road at Folsom Drive and at Palmer Moose Drive. The calculations assumed a crosswalk length of 32 feet (one 12-foot lane in each direction, with 4-foot shoulders) and a yield rate of zero (meaning the analysis assumes drivers do not yield to pedestrians so that pedestrians must wait for gaps in the traffic). While delay does not depend upon the volume of pedestrians, it does reflect the volume of traffic using the roadway to be crossed. As such, 2045 vehicle volumes were used when calculating pedestrian delay.

Table 13 presents the 2045 pedestrian delays for crossing Hemmer Road at Folsom Drive and at Palmer Moose Drive. For most of the day, pedestrian delays are anticipated to be less than

10 seconds per pedestrian. Crossing Hemmer Road at the Palmer Moose Drive intersection during the AM peak has the most delay with 20 seconds per pedestrian, due to the high volume of traffic traveling to and from the school in the morning. According to the HCM 2010, pedestrian delay of 30 seconds or more results in a high likelihood of pedestrian risk-taking. Delay between 5 and 20 seconds is considered to result in low to moderate likelihood of pedestrian risk-taking.

**Table 13: 2045 Build Pedestrian Delays Crossing Hemmer Road**

Hemmer Road Crossing	Average Pedestrian Delay (seconds/pedestrian)		
	AM	Midday	PM
at Folsom Dr	8	7	8
at Palmer Moose Dr	20	not measured	8

## 5.7 Build Condition Safety

Under build conditions, since Hemmer Road would provide a direct connection between Palmer-Wasilla Highway and Bogard Road, traffic would increase on Hemmer Road and decrease at adjacent north-south roads. The volume changes could reduce crashes at existing routes between the two roads and can increase crashes at the Hemmer Road intersections. For example, crashes occurring at the Bogard Road and Palmer Moose Drive intersection could move to the Hemmer Road and Bogard Road intersection. Because there were few crashes during the 5-year study period, the increase in crashes is not expected to be a safety concern.

While Hemmer Road at Bogard Road had no reported crashes during the 5-year study period, the installation of signals is expected to increase crashes at the intersection since traffic at Bogard Road, which is currently operating free (uncontrolled), would need to stop under the new traffic control. The 2022 *Alaska Highway Safety Improvement Program Handbook* reports the installation of a new traffic signal would decrease right-angle crashes by 60% and increase rear-end crashes by 25%. However, with few crashes in the study area, the increased crash rate for the Hemmer Road at Bogard Road intersection is expected to continue to be lower than the statewide average.

## 5.8 Proposed Typical Section

A *Reconnaissance Report for Hemmer Road Improvements* between Palmer-Wasilla Highway and Bogard Road was prepared in October 2020. This report compared the costs for four different typical section alternatives for the new roadway. The report did not include volume forecasting, or operational or safety analyses. The four typical sections that were evaluated are:

- 5-lane section (two 12-foot through lanes in each direction, with a 16-foot center two-way-left-turn lane (TWLTL), a 10-foot pathway on the east side, and a 5-foot attached sidewalk on the west side)

- 3-lane section (one 12-foot through lane in each direction, with a 16-foot center TWLTL, a 10-foot pathway on the east side, and a 5-foot attached sidewalk on the west side)
- 3-lane section with shoulder (4-foot shoulders, one 12-foot through lane in each direction, with a 16-foot center TWLTL, a 10-foot pathway on the east side, and a 5-foot attached sidewalk on the west side)
- 2-lane section with shoulder (4-foot shoulders, one 12-foot through lane in each direction, and 5-foot attached sidewalk on both sides)

The Community Transportation Program (CTP) nomination that received funding for this project proposed a 3-lane typical section, with a center TWLTL.

Given the forecasted build volumes for this section of Hemmer Road (3,600 to 4,750 vehicles per day), either a 3-lane or a 2-lane typical section would adequately serve the expected volumes. In addition to traffic volumes, a few other considerations play a role in choosing between a 2-lane and a 3-lane section:

- *Vehicle Operations.* A TWLTL acts as a left-turn lane to pull left-turning vehicles out of the through lanes, reducing impacts to through traffic. As such, a TWLTL reduces vehicle delay where there are many access points and many vehicles making left turns. In the case of Hemmer Road, our analysis shows that with the forecasted combination of through and left-turn volumes, left-turn lanes are not needed operationally at the unsignalized intersections within the corridor.
- *Pedestrian Operations.* Pedestrians are expected to be crossing Hemmer Road at the Palmer Moose Drive intersection and at the Folsom Drive intersection. Pedestrian delay increases with the width of road they must cross. Pedestrian delay for a 2-lane typical section was presented in Section 5.6.2 Pedestrian Crossings. Table 14 presents the delay for a 3-lane typical section (a 12-foot lane in each direction with a 16-foot center TWLTL and 4-foot shoulders).

**Table 14: 2045 Build Pedestrian Delays Crossing Hemmer Road for 3-Lane Cross Section**

Hemmer Road Crossing	Average Pedestrian Delay (seconds/pedestrian)		
	AM	Midday	PM
at Folsom Dr	18	16	17
at Palmer Moose Dr	50	not measured	17

Comparing Table 13 with Table 14, pedestrian delay is more than doubled by adding the 16-foot center TWLTL. Moreover, pedestrian delay in the morning peak at Palmer Moose Drive of more than 45 seconds results in a very high likelihood of pedestrian risk taking. This delay could be decreased by encouraging drivers to yield to pedestrians using signs, markings, or signals, or by reducing the crossing distance. For example, by constructing a median refuge island. These types of treatments could be appropriate if at least 15 schoolchildren are expected to be using the crossing regularly.

- *Safety.* Analyses of TWLTLs indicate a reduction in crashes of about 26% for a roadway with a TWLTL as compared to a roadway with no median. In the case of Hemmer Road, the crash experience is minimal. As such, installation of a TWLTL would have a minimal effect on safety.
- *Geometric Design.* Based on the cost estimates developed for the *Reconnaissance Report for Hemmer Road Improvements*, the cost of adding a TWLTL is 5 to 10% more than the cost of a 2-lane typical section, due to increased ROW and construction costs. Maintenance costs will also be higher both for snow removal and for repaving. If left-turn lanes were needed to accommodate turning traffic at high-volume driveways and side streets, installation of a TWLTL could reduce the need for repeated widening and then narrowing of the road cross section; however, the analysis does not indicate the need for turn lanes at the unsignalized intersections.

For Hemmer Road, because the benefits of a TWLTL to vehicle operations and safety are minimal and the impacts to pedestrian delay and overall costs are more significant, a 2-lane typical section is recommended. As described in Section 5.6.1 Pedestrian Pathway, shared pathways are recommended on both sides of Hemmer Road between Palmer-Wasilla Highway and Palmer Moose Drive. Between Palmer Moose Drive and Bogard Road, a shared pathway is desirable for both sides of Hemmer Road, but a shared path on one side of the road would be adequate.

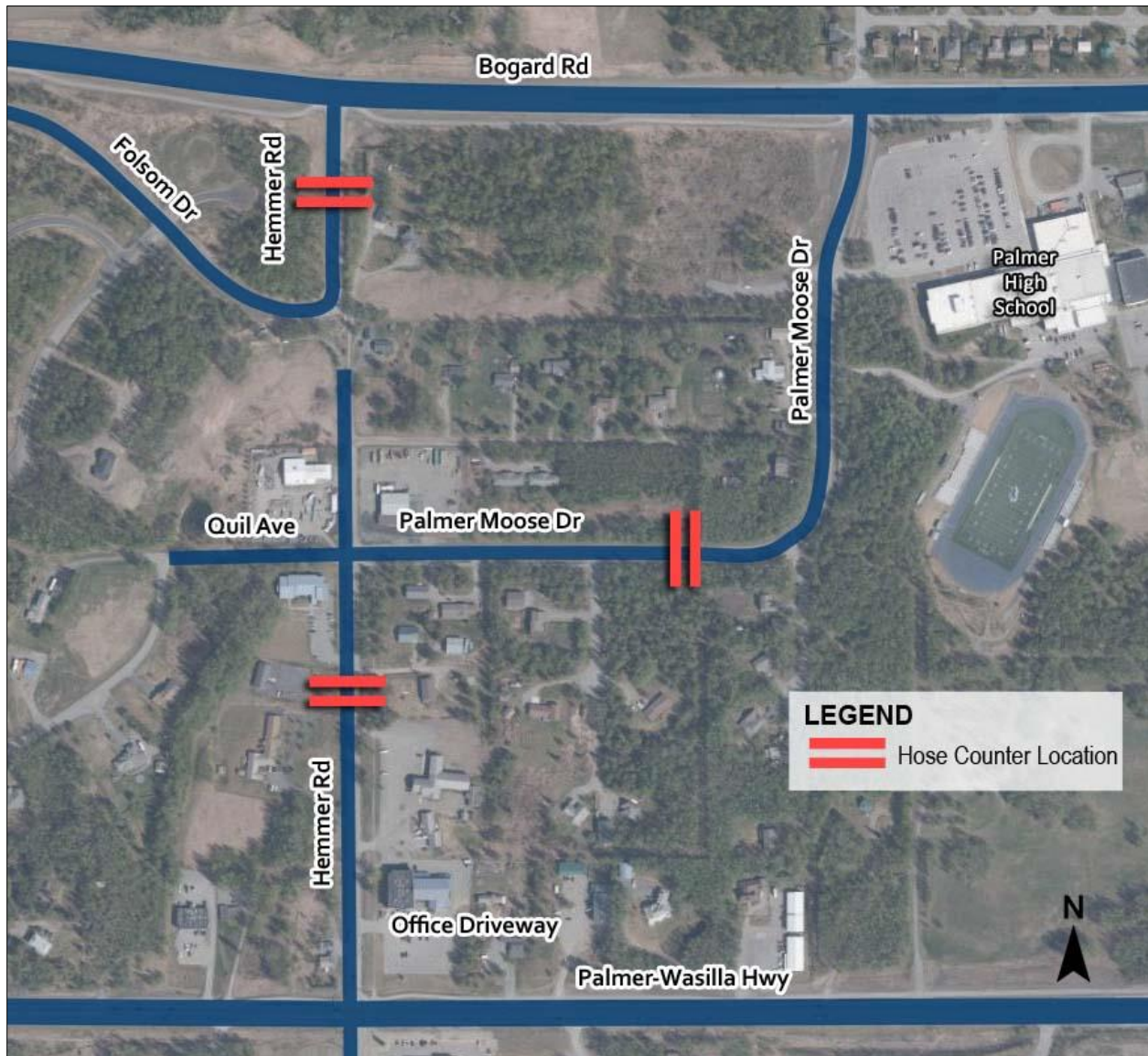


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## Appendix A 24-Hour Counts

Three hose counters were deployed on Hemmer Road and on Palmer Moose Drive in October 2022 to gather 24-hour volumes. Figure A-1 presents the hose counter locations.



**Figure A-1: Hose Counter Locations**

Table A-1 through Table A-3 present the hourly volumes recorded at each hose counter location. The data indicates that the AM peak has the highest volumes, making up an average of about 15% of the daily traffic during the weekdays at the southern Hemmer Road location and at the Palmer Moose Drive location. The AM peak contains both morning commute traffic and Palmer High School arrival traffic.

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**Table A-1: Hourly Hose Count Volumes on Hemmer Road south of Palmer Moose Drive**

Hour	Thursday, October 6, 2022		Friday, October 7, 2022		Saturday, October 8, 2022		Sunday, October 9, 2022		Monday, October 10, 2022		Tuesday, October 11, 2022		Wednesday, October 12, 2022		Thursday, October 13, 2022		Friday, October 14, 2022	
	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB
12:00 AM			3	0	2	5	1	2	0	1	2	0	2	1	1	0	1	0
1:00 AM			1	1	0	2	3	3	2	1	2	1	1	2	3	1	1	1
2:00 AM			1	0	2	0	3	1	1	1	0	0	2	1	0	0	0	0
3:00 AM			1	1	0	0	1	2	0	0	0	1	1	1	1	1	0	1
4:00 AM			2	1	0	1	2	2	1	2	0	1	0	1	0	0	1	4
5:00 AM			1	5	2	1	1	5	1	5	3	8	5	6	3	6	3	5
6:00 AM			13	8	2	3	2	1	10	9	9	10	12	13	14	11	11	10
7:00 AM			108	68	2	10	8	6	26	18	117	79	113	68	108	53	121	51
8:00 AM			23	32	6	11	23	10	88	60	29	44	21	26	24	30	35	30
9:00 AM			19	17	15	20	27	8	42	41	23	28	23	32	20	19	27	29
10:00 AM			30	28	11	21	19	25	32	45	39	32	35	30	39	28		
11:00 AM			42	49	18	29	15	27	43	36	37	39	36	37	35	39		

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Hour	Thursday, October 6, 2022		Friday, October 7, 2022		Saturday, October 8, 2022		Sunday, October 9, 2022		Monday, October 10, 2022		Tuesday, October 11, 2022		Wednesday, October 12, 2022		Thursday, October 13, 2022		Friday, October 14, 2022	
	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB
12:00 PM			33	28	16	29	26	28	46	41	30	32	34	34	39	35		
1:00 PM			55	57	30	16	23	17	48	34	56	47	59	44	51	49		
2:00 PM			71	82	29	21	15	18	96	117	97	106	81	89	85	98		
3:00 PM	8	8	55	41	31	22	20	17	36	53	48	47	45	36	39	43		
4:00 PM	46	42	52	37	21	27	19	15	59	25	55	42	43	29	40	24		
5:00 PM	43	35	53	42	25	20	13	11	39	28	54	26	69	33	47	29		
6:00 PM	45	27	33	21	21	18	17	19	26	49	34	14	35	24	30	34		
7:00 PM	25	20	27	11	17	12	16	14	16	6	15	34	22	20	26	23		
8:00 PM	25	15	13	10	15	8	7	15	25	9	12	8	14	18	28	14		
9:00 PM	6	5	14	7	8	5	8	2	8	4	5	12	5	13	7	13		
10:00 PM	8	3	9	6	7	6	5	3	3	4	7	3	0	1	4	1		
11:00 PM	2	4	6	5	5	4	1	2	2	5	1	3	4	1	1	4		

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**Table A-2: Hourly Hose Count Volumes on Hemmer Road south of Bogard Road**

Hour	Thursday, October 6, 2022		Friday, October 7, 2022		Saturday, October 8, 2022		Sunday, October 9, 2022		Monday, October 10, 2022		Tuesday, October 11, 2022		Wednesday, October 12, 2022		Thursday, October 13, 2022		Friday, October 14, 2022	
	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB
12:00 AM			0	2	0	0	0	1	2	2	1	0	0	0	1	1	0	0
1:00 AM			0	1	1	0	2	0	0	0	0	0	0	1	0	0	0	0
2:00 AM			0	2	0	0	0	0	0	1	1	0	0	0	0	0	0	0
3:00 AM			1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
4:00 AM			0	1	0	0	1	1	1	0	2	1	1	0	2	1	1	0
5:00 AM			3	0	1	0	0	0	0	0	2	0	2	0	0	0	0	1
6:00 AM			2	2	0	0	2	0	5	2	5	4	4	4	6	1	6	1
7:00 AM			26	9	3	2	3	1	15	7	23	10	17	10	22	15	27	9
8:00 AM			17	9	5	5	14	0	29	15	19	4	17	9	17	7	20	5
9:00 AM			13	9	20	9	5	3	20	12	12	12	20	14	9	11	16	16
10:00 AM			17	8	14	14	10	6	13	20	9	4	12	5	13	9	7	9
11:00 AM			15	13	15	6	8	10	13	8	8	9	11	13	10	12		

Hemmer Road Extension & Upgrade: Palmer-Wasilla Highway to Bogard Road

CFHWY00885/0001743

Traffic Analysis Report

June 2023

Hour	Thursday, October 6, 2022		Friday, October 7, 2022		Saturday, October 8, 2022		Sunday, October 9, 2022		Monday, October 10, 2022		Tuesday, October 11, 2022		Wednesday, October 12, 2022		Thursday, October 13, 2022		Friday, October 14, 2022	
	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB
12:00 PM			24	11	13	18	15	12	20	17	19	19	15	17	23	14		
1:00 PM			21	19	16	17	9	7	14	18	24	21	16	15	20	22		
2:00 PM			22	21	14	15	6	12	27	30	25	25	29	20	20	16		
3:00 PM			23	27	14	10	9	6	28	25	30	28	13	13	13	17		
4:00 PM			17	19	10	7	10	7	18	18	15	22	15	20	17	19		
5:00 PM	1	7	26	29	15	13	8	14	14	21	19	21	16	19	10	20		
6:00 PM	22	14	15	16	12	7	10	9	14	13	11	11	12	10	12	16		
7:00 PM	5	10	5	5	8	8	7	5	9	5	5	21	11	10	12	18		
8:00 PM	5	8	6	8	5	10	7	4	3	10	7	4	7	11	3	6		
9:00 PM	3	2	4	7	1	5	4	5	4	6	0	6	2	5	3	5		
10:00 PM	0	5	4	6	4	3	3	2	0	1	1	1	3	3	0	2		
11:00 PM	1	0	5	2	2	2	0	3	1	2	3	0	0	1	0	0		

**Table A-3: Hourly Hose Count Volumes on Palmer Moose Drive west of curve**

Hour	Thursday, October 6, 2022		Friday, October 7, 2022		Saturday, October 8, 2022		Sunday, October 9, 2022		Monday, October 10, 2022		Tuesday, October 11, 2022		Wednesday, October 12, 2022	
	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
12:00 AM			3	0	2	2	2	2	0	1	2	0	1	0
1:00 AM			1	1	0	2	3	3	2	1	2	1	1	1
2:00 AM			1	0	1	0	3	0	1	1	0	1	1	0
3:00 AM			1	1	0	0	1	1	0	0	0	1	1	2
4:00 AM			2	1	0	1	2	4	1	2	0	1	0	1
5:00 AM			1	6	2	0	1	4	1	4	3	5	5	5
6:00 AM			11	5	2	2	2	1	10	8	9	8	11	11
7:00 AM			112	60	2	10	1	3	28	17	116	78	117	59
8:00 AM			23	29	8	11	13	12	90	58	28	39	21	24
9:00 AM			21	17	9	14	12	9	40	34	18	25	20	27
10:00 AM			28	26	9	19	18	14	28	39	34	28	28	31
11:00 AM			39	39	18	22	20	10	41	30	34	34	33	28

Hemmer Road Extension & Upgrade: Palmer-Wasilla Highway to Bogard Road

CFHWY00885/0001743

Traffic Analysis Report

June 2023

Hour	Thursday, October 6, 2022		Friday, October 7, 2022		Saturday, October 8, 2022		Sunday, October 9, 2022		Monday, October 10, 2022		Tuesday, October 11, 2022		Wednesday, October 12, 2022	
	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
12:00 PM			30	35	13	22	21	21	38	38	26	23	28	32
1:00 PM			53	46	28	12	19	11	45	26	44	42	56	40
2:00 PM			65	79	24	18	12	20	88	122	88	101	72	84
3:00 PM			42	36	29	23	18	11	29	43	52	43	44	34
4:00 PM	16	19	44	26	17	22	16	12	58	25	52	45	46	34
5:00 PM	34	31	47	37	20	16	11	8	37	26	53	29	60	38
6:00 PM	36	27	22	16	20	22	15	17	21	48	38	21	35	26
7:00 PM	24	20	21	11	13	12	11	13	11	6	14	34	21	19
8:00 PM	25	16	9	11	11	7	5	11	22	7	8	11	13	21
9:00 PM	4	6	13	6	6	4	8	2	6	4	4	6	1	8
10:00 PM	6	2	9	5	6	6	1	1	2	4	5	3	1	2
11:00 PM	2	4	2	5	4	3	2	3	2	4	1	3	0	0



## Appendix B Existing Traffic Operations

HCM 2010 TWSC  
 1: Hemmer Rd & Bogard Rd, Existing AM

Intersection						
Int Delay, s/veh	0.7					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↘	↑	↘	
Traffic Vol, veh/h	356	5	12	312	7	21
Future Vol, veh/h	356	5	12	312	7	21
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	200	300	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	78	78	78	78	78	78
Heavy Vehicles, %	5	2	2	5	25	25
Mvmt Flow	456	6	15	400	9	27

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	462	0	886
Stage 1	-	-	-	-	456
Stage 2	-	-	-	-	430
Critical Hdwy	-	-	4.12	-	6.65
Critical Hdwy Stg 1	-	-	-	-	5.65
Critical Hdwy Stg 2	-	-	-	-	5.65
Follow-up Hdwy	-	-	2.218	-	3.725
Pot Cap-1 Maneuver	-	-	1099	-	287
Stage 1	-	-	-	-	593
Stage 2	-	-	-	-	610
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1099	-	283
Mov Cap-2 Maneuver	-	-	-	-	283
Stage 1	-	-	-	-	593
Stage 2	-	-	-	-	601

Approach	EB	WB	NB
HCM Control Delay, s	0	0.3	13.7
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	449	-	-	1099	-
HCM Lane V/C Ratio	0.08	-	-	0.014	-
HCM Control Delay (s)	13.7	-	-	8.3	-
HCM Lane LOS	B	-	-	A	-
HCM 95th %tile Q(veh)	0.3	-	-	0	-

HCM 2010 TWSC

2: Palmer Moose Dr & Bogard Rd, Existing AM

Intersection												
Int Delay, s/veh	2.5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↙	↑	↗	↙	↗			↕			↕	
Traffic Vol, veh/h	0	330	47	65	281	2	26	1	24	5	7	17
Future Vol, veh/h	0	330	47	65	281	2	26	1	24	5	7	17
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	325	-	325	250	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	83	83	83	83	83	83	83	83	83	83	83	83
Heavy Vehicles, %	2	5	2	2	5	2	13	2	13	2	2	2
Mvmt Flow	0	398	57	78	339	2	31	1	29	6	8	20

Major/Minor	Major1		Major2		Minor1		Minor2					
Conflicting Flow All	341	0	0	455	0	0	908	895	398	938	951	340
Stage 1	-	-	-	-	-	-	398	398	-	496	496	-
Stage 2	-	-	-	-	-	-	510	497	-	442	455	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.23	6.52	6.33	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.23	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.23	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.617	4.018	3.417	3.518	4.018	3.318
Pot Cap-1 Maneuver	1218	-	-	1106	-	-	245	280	628	244	260	702
Stage 1	-	-	-	-	-	-	606	603	-	556	545	-
Stage 2	-	-	-	-	-	-	526	545	-	594	569	-
Platoon blocked, %		-	-	-	-	-						
Mov Cap-1 Maneuver	1218	-	-	1106	-	-	219	260	628	219	242	702
Mov Cap-2 Maneuver	-	-	-	-	-	-	219	260	-	219	242	-
Stage 1	-	-	-	-	-	-	606	603	-	556	506	-
Stage 2	-	-	-	-	-	-	467	506	-	566	569	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	0		1.6		19.1		15.4	
HCM LOS					C		C	

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	317	1218	-	-	1106	-	-	382
HCM Lane V/C Ratio	0.194	-	-	-	0.071	-	-	0.091
HCM Control Delay (s)	19.1	0	-	-	8.5	-	-	15.4
HCM Lane LOS	C	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	0.7	0	-	-	0.2	-	-	0.3

HCM 2010 AWSC  
 3: Hemmer Rd & Palmer Moose Dr, Existing AM

Intersection	
Intersection Delay, s/veh	7.9
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	1	0	85	1	1	0	2	131	2	6	0
Future Vol, veh/h	0	1	0	85	1	1	0	2	131	2	6	0
Peak Hour Factor	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71
Heavy Vehicles, %	2	2	2	13	2	2	2	2	17	2	2	2
Mvmt Flow	0	1	0	120	1	1	0	3	185	3	8	0
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	7.5	8.6	7.5	7.5
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	0%	0%	98%	25%
Vol Thru, %	2%	100%	1%	75%
Vol Right, %	98%	0%	1%	0%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	133	1	87	8
LT Vol	0	0	85	2
Through Vol	2	1	1	6
RT Vol	131	0	1	0
Lane Flow Rate	187	1	123	11
Geometry Grp	1	1	1	1
Degree of Util (X)	0.191	0.002	0.159	0.014
Departure Headway (Hd)	3.669	4.481	4.657	4.468
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	983	803	766	805
Service Time	1.669	2.481	2.713	2.472
HCM Lane V/C Ratio	0.19	0.001	0.161	0.014
HCM Control Delay	7.5	7.5	8.6	7.5
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.7	0	0.6	0

HCM 2010 TWSC  
 4: Hemmer Rd & Driveway, Existing AM

Intersection						
Int Delay, s/veh	0.1					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W		T			T
Traffic Vol, veh/h	2	0	115	5	0	76
Future Vol, veh/h	2	0	115	5	0	76
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	68	68	68	68	68	68
Heavy Vehicles, %	2	2	17	2	2	17
Mvmt Flow	3	0	169	7	0	112

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	285	173	0	0	176
Stage 1	173	-	-	-	-
Stage 2	112	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12
Critical Hdwy Stg 1	5.42	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218
Pot Cap-1 Maneuver	705	871	-	-	1400
Stage 1	857	-	-	-	-
Stage 2	913	-	-	-	-
Platoon blocked, %			-	-	-
Mov Cap-1 Maneuver	705	871	-	-	1400
Mov Cap-2 Maneuver	705	-	-	-	-
Stage 1	857	-	-	-	-
Stage 2	913	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.1	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	705	1400
HCM Lane V/C Ratio	-	-	0.004	-
HCM Control Delay (s)	-	-	10.1	0
HCM Lane LOS	-	-	B	A
HCM 95th %tile Q(veh)	-	-	0	0

## Queues

### 5: Palmer-Wasilla Hwy & Hemmer Rd, Existing AM
























Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	71	598	18	418	63	22	25	14	88
v/c Ratio	0.11	0.50	0.03	0.37	0.06	0.10	0.10	0.07	0.40
Control Delay	7.3	16.0	7.9	14.8	0.1	28.1	30.9	26.7	15.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.3	16.0	7.9	14.8	0.1	28.1	30.9	26.7	15.7
Queue Length 50th (ft)	6	82	1	95	0	13	14	8	7
Queue Length 95th (ft)	36	#419	13	250	0	19	26	15	29
Internal Link Dist (ft)		520		977			186		159
Turn Bay Length (ft)	300		125		125			100	
Base Capacity (vph)	662	1208	541	1128	1002	214	474	203	411
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.11	0.50	0.03	0.37	0.06	0.10	0.05	0.07	0.21

#### Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

HCM 2010 Signalized Intersection Summary  
 5: Palmer-Wasilla Hwy & Hemmer Rd, Existing AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	54	427	27	14	318	48	17	18	1	11	9	58
Future Volume (veh/h)	54	427	27	14	318	48	17	18	1	11	9	58
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	0.95		1.00	0.96		0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1814	1749	1850	1814	1745	1814	1814	1814	1850	1581	1609	1850
Adj Flow Rate, veh/h	71	562	33	18	418	35	22	24	0	14	12	8
Adj No. of Lanes	1	1	0	1	1	1	1	1	0	1	1	0
Peak Hour Factor	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76
Percent Heavy Veh, %	2	6	2	2	6	2	2	2	2	17	2	17
Cap, veh/h	595	996	59	455	1003	878	246	197	0	221	87	58
Arrive On Green	0.06	0.61	0.61	0.03	0.57	0.57	0.03	0.11	0.00	0.02	0.10	0.10
Sat Flow, veh/h	1727	1635	96	1727	1745	1528	1727	1814	0	1506	881	588
Grp Volume(v), veh/h	71	0	595	18	418	35	22	24	0	14	0	20
Grp Sat Flow(s),veh/h/ln	1727	0	1731	1727	1745	1528	1727	1814	0	1506	0	1469
Q Serve(g_s), s	1.5	0.0	19.4	0.4	12.7	0.9	1.1	1.1	0.0	0.8	0.0	1.2
Cycle Q Clear(g_c), s	1.5	0.0	19.4	0.4	12.7	0.9	1.1	1.1	0.0	0.8	0.0	1.2
Prop In Lane	1.00		0.06	1.00		1.00	1.00		0.00	1.00		0.40
Lane Grp Cap(c), veh/h	595	0	1055	455	1003	878	246	197	0	221	0	145
V/C Ratio(X)	0.12	0.00	0.56	0.04	0.42	0.04	0.09	0.12	0.00	0.06	0.00	0.14
Avail Cap(c_a), veh/h	614	0	1055	535	1003	878	317	477	0	298	0	387
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	7.4	0.0	11.0	8.4	11.3	8.8	36.3	38.3	0.0	36.2	0.0	39.1
Incr Delay (d2), s/veh	0.1	0.0	2.2	0.0	1.3	0.1	0.2	0.3	0.0	0.1	0.0	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.0	9.9	0.2	6.4	0.4	0.5	0.6	0.0	0.3	0.0	0.5
LnGrp Delay(d),s/veh	7.5	0.0	13.2	8.4	12.6	8.9	36.5	38.5	0.0	36.3	0.0	39.5
LnGrp LOS	A		B	A	B	A	D	D		D		D
Approach Vol, veh/h		666			471			46				34
Approach Delay, s/veh		12.6			12.1			37.5				38.2
Approach LOS		B			B			D				D
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	7.6	64.9	7.2	15.3	10.9	61.6	8.1	14.4				
Change Period (Y+Rc), s	5.0	7.0	5.0	5.0	5.0	7.0	5.0	5.0				
Max Green Setting (Gmax), s	7.0	34.0	7.0	25.0	7.0	34.0	7.0	25.0				
Max Q Clear Time (g_c+I1), s	2.4	21.4	2.8	3.1	3.5	14.7	3.1	3.2				
Green Ext Time (p_c), s	0.0	2.9	0.0	0.1	0.0	2.3	0.0	0.0				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay			14.1									
HCM 2010 LOS			B									

HCM 2010 TWSC  
 1: Hemmer Rd & Bogard Rd, Existing MID

Intersection						
Int Delay, s/veh	0.7					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↘	↑	↘	↗
Traffic Vol, veh/h	260	8	10	266	9	19
Future Vol, veh/h	260	8	10	266	9	19
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	200	300	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	5	2	2	5	25	25
Mvmt Flow	277	9	11	283	10	20

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	286	0	582 277
Stage 1	-	-	-	-	277 -
Stage 2	-	-	-	-	305 -
Critical Hdwy	-	-	4.12	-	6.65 6.45
Critical Hdwy Stg 1	-	-	-	-	5.65 -
Critical Hdwy Stg 2	-	-	-	-	5.65 -
Follow-up Hdwy	-	-	2.218	-	3.725 3.525
Pot Cap-1 Maneuver	-	-	1276	-	439 710
Stage 1	-	-	-	-	720 -
Stage 2	-	-	-	-	698 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1276	-	435 710
Mov Cap-2 Maneuver	-	-	-	-	435 -
Stage 1	-	-	-	-	720 -
Stage 2	-	-	-	-	692 -

Approach	EB	WB	NB
HCM Control Delay, s	0	0.3	11.4
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	590	-	-	1276	-
HCM Lane V/C Ratio	0.05	-	-	0.008	-
HCM Control Delay (s)	11.4	-	-	7.8	-
HCM Lane LOS	B	-	-	A	-
HCM 95th %tile Q(veh)	0.2	-	-	0	-



HCM 2010 TWSC  
 2: Palmer Moose Dr & Bogard Rd, Existing MID

Intersection												
Int Delay, s/veh	1.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↑	↗	↖	↗			↕			↕	
Traffic Vol, veh/h	4	255	20	17	254	3	16	2	24	2	2	6
Future Vol, veh/h	4	255	20	17	254	3	16	2	24	2	2	6
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	325	-	325	250	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	96	96	96	96	96	96	96	96	96	96	96	96
Heavy Vehicles, %	2	5	2	2	5	2	13	2	13	2	2	2
Mvmt Flow	4	266	21	18	265	3	17	2	25	2	2	6

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	268	0	0	287	0	0	581	578	266	601	598	267
Stage 1	-	-	-	-	-	-	274	274	-	303	303	-
Stage 2	-	-	-	-	-	-	307	304	-	298	295	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.23	6.52	6.33	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.23	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.23	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.617	4.018	3.417	3.518	4.018	3.318
Pot Cap-1 Maneuver	1296	-	-	1275	-	-	409	427	747	412	416	772
Stage 1	-	-	-	-	-	-	709	683	-	706	664	-
Stage 2	-	-	-	-	-	-	680	663	-	711	669	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1296	-	-	1275	-	-	399	420	747	391	409	772
Mov Cap-2 Maneuver	-	-	-	-	-	-	399	420	-	391	409	-
Stage 1	-	-	-	-	-	-	707	681	-	704	655	-
Stage 2	-	-	-	-	-	-	663	654	-	683	667	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.1			0.5			12.2			11.5		
HCM LOS							B			B		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	546	1296	-	-	1275	-	-	563
HCM Lane V/C Ratio	0.08	0.003	-	-	0.014	-	-	0.019
HCM Control Delay (s)	12.2	7.8	-	-	7.9	-	-	11.5
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0.3	0	-	-	0	-	-	0.1

HCM 2010 AWSC  
 3: Hemmer Rd & Palmer Moose Dr, Existing MID

Intersection	
Intersection Delay, s/veh	0
Intersection LOS	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	0	0	0	0	0	0	0	0	0	0	0
Future Vol, veh/h	0	0	0	0	0	0	0	0	0	0	0	0
Peak Hour Factor	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Heavy Vehicles, %	2	2	2	13	2	2	2	2	17	2	2	2
Mvmt Flow	0	0	0	0	0	0	0	0	0	0	0	0
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	0	0	0	0
HCM LOS	-	-	-	-

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	0%	0%	0%	0%
Vol Thru, %	100%	100%	100%	100%
Vol Right, %	0%	0%	0%	0%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	0	0	0	0
LT Vol	0	0	0	0
Through Vol	0	0	0	0
RT Vol	0	0	0	0
Lane Flow Rate	0	0	0	0
Geometry Grp	1	1	1	1
Degree of Util (X)	0	0	0	0
Departure Headway (Hd)	3.934	3.934	3.934	3.934
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	0	0	0	0
Service Time	1.934	1.934	1.934	1.934
HCM Lane V/C Ratio	0	0	0	0
HCM Control Delay	6.9	6.9	6.9	6.9
HCM Lane LOS	N	N	N	N
HCM 95th-tile Q	0	0	0	0

HCM 2010 TWSC  
 4: Hemmer Rd & Driveway, Existing MID

Intersection						
Int Delay, s/veh	0					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W		T			T
Traffic Vol, veh/h	0	0	0	0	0	0
Future Vol, veh/h	0	0	0	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	25	25	25	25	25	25
Heavy Vehicles, %	2	2	17	2	2	17
Mvmt Flow	0	0	0	0	0	0

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	4	0	0	0	0	0
Stage 1	0	-	-	-	-	-
Stage 2	4	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	1018	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	1019	-	-	-	-	-
Platoon blocked, %						
Mov Cap-1 Maneuver	1018	-	-	-	-	-
Mov Cap-2 Maneuver	1018	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	1019	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	0	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-
HCM Control Delay (s)	-	-	0	0
HCM Lane LOS	-	-	A	A
HCM 95th %tile Q(veh)	-	-	-	-

## Queues

### 5: Palmer-Wasilla Hwy & Hemmer Rd, Existing MID
























Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	29	690	17	586	22	29	22	23	21
v/c Ratio	0.05	0.56	0.04	0.49	0.02	0.12	0.10	0.11	0.12
Control Delay	7.9	17.6	8.2	17.5	0.0	27.4	14.4	26.8	19.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.9	17.6	8.2	17.5	0.0	27.4	14.4	26.8	19.1
Queue Length 50th (ft)	5	198	3	227	0	14	1	11	3
Queue Length 95th (ft)	23	#699	16	#551	0	29	19	25	20
Internal Link Dist (ft)		520		977			186		159
Turn Bay Length (ft)	300		125		125			100	
Base Capacity (vph)	540	1241	472	1205	1061	235	409	217	379
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.05	0.56	0.04	0.49	0.02	0.12	0.05	0.11	0.06

#### Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.  
Queue shown is maximum after two cycles.

HCM 2010 Signalized Intersection Summary  
 5: Palmer-Wasilla Hwy & Hemmer Rd, Existing MID

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	27	620	28	16	551	21	27	1	20	22	5	15
Future Volume (veh/h)	27	620	28	16	551	21	27	1	20	22	5	15
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	0.95		0.95	0.95		0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1814	1748	1850	1814	1745	1814	1814	1814	1850	1581	1631	1850
Adj Flow Rate, veh/h	29	660	29	17	586	13	29	1	2	23	5	1
Adj No. of Lanes	1	1	0	1	1	1	1	1	0	1	1	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	6	2	2	6	2	2	2	2	17	2	17
Cap, veh/h	466	1014	45	387	1043	914	261	51	102	238	120	24
Arrive On Green	0.04	0.61	0.61	0.03	0.60	0.60	0.04	0.10	0.10	0.03	0.09	0.09
Sat Flow, veh/h	1727	1662	73	1727	1745	1529	1727	521	1042	1506	1306	261
Grp Volume(v), veh/h	29	0	689	17	586	13	29	0	3	23	0	6
Grp Sat Flow(s),veh/h/ln	1727	0	1735	1727	1745	1529	1727	0	1564	1506	0	1567
Q Serve(g_s), s	0.6	0.0	24.4	0.3	19.3	0.3	1.4	0.0	0.2	1.3	0.0	0.3
Cycle Q Clear(g_c), s	0.6	0.0	24.4	0.3	19.3	0.3	1.4	0.0	0.2	1.3	0.0	0.3
Prop In Lane	1.00		0.04	1.00		1.00	1.00		0.67	1.00		0.17
Lane Grp Cap(c), veh/h	466	0	1059	387	1043	914	261	0	153	238	0	144
V/C Ratio(X)	0.06	0.00	0.65	0.04	0.56	0.01	0.11	0.00	0.02	0.10	0.00	0.04
Avail Cap(c_a), veh/h	525	0	1059	469	1043	914	321	0	411	299	0	412
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	8.4	0.0	12.0	9.5	11.6	7.8	36.5	0.0	38.7	36.4	0.0	39.3
Incr Delay (d2), s/veh	0.1	0.0	3.1	0.0	2.2	0.0	0.2	0.0	0.1	0.2	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.0	12.4	0.2	9.9	0.1	0.7	0.0	0.1	0.5	0.0	0.1
LnGrp Delay(d),s/veh	8.5	0.0	15.1	9.6	13.8	7.8	36.6	0.0	38.8	36.6	0.0	39.4
LnGrp LOS	A		B	A	B	A	D		D	D		D
Approach Vol, veh/h		718			616			32			29	
Approach Delay, s/veh		14.8			13.5			36.8			37.2	
Approach LOS		B			B			D			D	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	7.5	65.0	8.2	14.3	8.7	63.8	8.7	13.7				
Change Period (Y+Rc), s	5.0	7.0	5.0	5.0	5.0	7.0	5.0	5.0				
Max Green Setting (Gmax), s	7.0	34.0	7.0	25.0	7.0	34.0	7.0	25.0				
Max Q Clear Time (g_c+I1), s	2.3	26.4	3.3	2.2	2.6	21.3	3.4	2.3				
Green Ext Time (p_c), s	0.0	2.6	0.0	0.0	0.0	2.9	0.0	0.0				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay			15.2									
HCM 2010 LOS			B									

HCM 2010 TWSC  
 1: Hemmer Rd & Bogard Rd, Existing PM

Intersection						
Int Delay, s/veh	0.5					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↖	↑	↘	↙
Traffic Vol, veh/h	425	7	20	432	9	11
Future Vol, veh/h	425	7	20	432	9	11
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	200	300	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	5	2	2	5	25	25
Mvmt Flow	462	8	22	470	10	12

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	470	0	976
Stage 1	-	-	-	-	462
Stage 2	-	-	-	-	514
Critical Hdwy	-	-	4.12	-	6.65
Critical Hdwy Stg 1	-	-	-	-	5.65
Critical Hdwy Stg 2	-	-	-	-	5.65
Follow-up Hdwy	-	-	2.218	-	3.725
Pot Cap-1 Maneuver	-	-	1092	-	253
Stage 1	-	-	-	-	589
Stage 2	-	-	-	-	556
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1092	-	248
Mov Cap-2 Maneuver	-	-	-	-	248
Stage 1	-	-	-	-	589
Stage 2	-	-	-	-	545

Approach	EB	WB	NB
HCM Control Delay, s	0	0.4	15.8
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	356	-	-	1092	-
HCM Lane V/C Ratio	0.061	-	-	0.02	-
HCM Control Delay (s)	15.8	-	-	8.4	-
HCM Lane LOS	C	-	-	A	-
HCM 95th %tile Q(veh)	0.2	-	-	0.1	-

HCM 2010 TWSC

2: Palmer Moose Dr & Bogard Rd, Existing PM

Intersection												
Int Delay, s/veh	1.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↑	↗	↖	↑	↗		↕			↕	
Traffic Vol, veh/h	12	400	24	14	429	3	17	8	15	4	0	6
Future Vol, veh/h	12	400	24	14	429	3	17	8	15	4	0	6
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	325	-	325	250	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	81	81	81	81	81	81	81	81	81	81	81	81
Heavy Vehicles, %	2	5	2	2	5	2	13	2	13	2	2	2
Mvmt Flow	15	494	30	17	530	4	21	10	19	5	0	7

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	534	0	0	524	0	0	1094	1092	494	1120	1120	532
Stage 1	-	-	-	-	-	-	524	524	-	566	566	-
Stage 2	-	-	-	-	-	-	570	568	-	554	554	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.23	6.52	6.33	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.23	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.23	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.617	4.018	3.417	3.518	4.018	3.318
Pot Cap-1 Maneuver	1034	-	-	1043	-	-	182	215	554	184	206	547
Stage 1	-	-	-	-	-	-	517	530	-	509	507	-
Stage 2	-	-	-	-	-	-	488	506	-	517	514	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1034	-	-	1043	-	-	175	208	554	167	200	547
Mov Cap-2 Maneuver	-	-	-	-	-	-	175	208	-	167	200	-
Stage 1	-	-	-	-	-	-	509	522	-	501	499	-
Stage 2	-	-	-	-	-	-	474	498	-	483	506	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.2			0.3			23.3			18.2		
HCM LOS							C			C		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	246	1034	-	-	1043	-	-	286
HCM Lane V/C Ratio	0.201	0.014	-	-	0.017	-	-	0.043
HCM Control Delay (s)	23.3	8.5	-	-	8.5	-	-	18.2
HCM Lane LOS	C	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	0.7	0	-	-	0.1	-	-	0.1

HCM 2010 AWSC  
 3: Hemmer Rd & Palmer Moose Dr, Existing PM

Intersection	
Intersection Delay, s/veh	7.3
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	0	1	48	0	2	2	4	49	4	3	0
Future Vol, veh/h	0	0	1	48	0	2	2	4	49	4	3	0
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Heavy Vehicles, %	2	2	2	13	2	2	2	2	17	2	2	2
Mvmt Flow	0	0	1	58	0	2	2	5	59	5	4	0
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	6.5	7.8	6.8	7.3
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	4%	0%	96%	57%
Vol Thru, %	7%	0%	0%	43%
Vol Right, %	89%	100%	4%	0%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	55	1	50	7
LT Vol	2	0	48	4
Through Vol	4	0	0	3
RT Vol	49	1	2	0
Lane Flow Rate	66	1	60	8
Geometry Grp	1	1	1	1
Degree of Util (X)	0.065	0.001	0.074	0.01
Departure Headway (Hd)	3.52	3.509	4.419	4.207
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	1012	1016	812	847
Service Time	1.562	1.543	2.437	2.252
HCM Lane V/C Ratio	0.065	0.001	0.074	0.009
HCM Control Delay	6.8	6.5	7.8	7.3
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.2	0	0.2	0



HCM 2010 TWSC  
 4: Hemmer Rd & Driveway, Existing PM

Intersection						
Int Delay, s/veh	1.1					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W		T			T
Traffic Vol, veh/h	13	1	61	8	2	45
Future Vol, veh/h	13	1	61	8	2	45
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	86	86	86	86	86	86
Heavy Vehicles, %	2	2	17	2	2	17
Mvmt Flow	15	1	71	9	2	52

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	132	76	0	0	80
Stage 1	76	-	-	-	-
Stage 2	56	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12
Critical Hdwy Stg 1	5.42	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218
Pot Cap-1 Maneuver	862	985	-	-	1518
Stage 1	947	-	-	-	-
Stage 2	967	-	-	-	-
Platoon blocked, %			-	-	-
Mov Cap-1 Maneuver	861	985	-	-	1518
Mov Cap-2 Maneuver	861	-	-	-	-
Stage 1	947	-	-	-	-
Stage 2	966	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.2	0	0.3
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	869	1518
HCM Lane V/C Ratio	-	-	0.019	0.002
HCM Control Delay (s)	-	-	9.2	7.4
HCM Lane LOS	-	-	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0

## Queues

### 5: Palmer-Wasilla Hwy & Hemmer Rd, Existing PM
























Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	44	627	10	710	29	46	21	21	43
v/c Ratio	0.10	0.49	0.02	0.59	0.03	0.20	0.09	0.10	0.23
Control Delay	8.0	14.8	8.6	19.8	0.0	29.1	16.3	26.4	14.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	8.0	14.8	8.6	19.8	0.0	29.1	16.3	26.4	14.6
Queue Length 50th (ft)	7	170	2	307	0	23	2	10	2
Queue Length 95th (ft)	30	#613	11	#720	0	40	19	23	27
Internal Link Dist (ft)		520		977			186		159
Turn Bay Length (ft)	300		125		125			100	
Base Capacity (vph)	439	1286	537	1204	1060	233	415	218	376
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.10	0.49	0.02	0.59	0.03	0.20	0.05	0.10	0.11

#### Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.  
Queue shown is maximum after two cycles.

HCM 2010 Signalized Intersection Summary  
 5: Palmer-Wasilla Hwy & Hemmer Rd, Existing PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	40	552	18	9	646	26	42	3	16	19	3	36
Future Volume (veh/h)	40	552	18	9	646	26	42	3	16	19	3	36
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	0.94		0.95	0.95		0.94
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1814	1747	1850	1814	1745	1814	1814	1814	1850	1581	1595	1850
Adj Flow Rate, veh/h	44	607	19	10	710	17	46	3	2	21	3	4
Adj No. of Lanes	1	1	0	1	1	1	1	1	0	1	1	0
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	6	2	2	6	2	2	2	2	17	2	17
Cap, veh/h	375	1034	32	421	1013	887	273	106	70	244	51	68
Arrive On Green	0.05	0.61	0.61	0.02	0.58	0.58	0.05	0.11	0.11	0.03	0.09	0.09
Sat Flow, veh/h	1727	1685	53	1727	1745	1528	1727	995	663	1506	599	798
Grp Volume(v), veh/h	44	0	626	10	710	17	46	0	5	21	0	7
Grp Sat Flow(s),veh/h/ln	1727	0	1738	1727	1745	1528	1727	0	1658	1506	0	1397
Q Serve(g_s), s	0.9	0.0	20.7	0.2	27.3	0.4	2.2	0.0	0.3	1.2	0.0	0.4
Cycle Q Clear(g_c), s	0.9	0.0	20.7	0.2	27.3	0.4	2.2	0.0	0.3	1.2	0.0	0.4
Prop In Lane	1.00		0.03	1.00		1.00	1.00		0.40	1.00		0.57
Lane Grp Cap(c), veh/h	375	0	1066	421	1013	887	273	0	176	244	0	120
V/C Ratio(X)	0.12	0.00	0.59	0.02	0.70	0.02	0.17	0.00	0.03	0.09	0.00	0.06
Avail Cap(c_a), veh/h	415	0	1066	518	1013	887	311	0	436	308	0	368
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	10.8	0.0	11.1	8.8	14.1	8.5	36.3	0.0	38.1	35.8	0.0	39.9
Incr Delay (d2), s/veh	0.1	0.0	2.4	0.0	4.0	0.0	0.3	0.0	0.1	0.2	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	10.4	0.1	14.2	0.2	1.1	0.0	0.1	0.5	0.0	0.2
LnGrp Delay(d),s/veh	11.0	0.0	13.4	8.8	18.2	8.5	36.6	0.0	38.1	36.0	0.0	40.1
LnGrp LOS	B		B	A	B	A	D		D	D		D
Approach Vol, veh/h		670			737			51			28	
Approach Delay, s/veh		13.3			17.8			36.7			37.0	
Approach LOS		B			B			D			D	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	6.6	65.3	8.0	15.1	9.8	62.1	9.9	13.1				
Change Period (Y+Rc), s	5.0	7.0	5.0	5.0	5.0	7.0	5.0	5.0				
Max Green Setting (Gmax), s	7.0	34.0	7.0	25.0	7.0	34.0	7.0	25.0				
Max Q Clear Time (g_c+I1), s	2.2	22.7	3.2	2.3	2.9	29.3	4.2	2.4				
Green Ext Time (p_c), s	0.0	2.9	0.0	0.0	0.0	1.9	0.0	0.0				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay			16.8									
HCM 2010 LOS			B									

## Appendix C      2045 No Build Traffic Operations

HCM 2010 TWSC  
 1: Hemmer Rd & Bogard Rd, 2045 No Build AM

Intersection						
Int Delay, s/veh	0.7					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Vol, veh/h	430	5	10	355	10	20
Future Vol, veh/h	430	5	10	355	10	20
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	200	300	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	78	78	78	78	78	78
Heavy Vehicles, %	5	2	2	5	25	25
Mvmt Flow	551	6	13	455	13	26

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	557	0	1032 551
Stage 1	-	-	-	-	551 -
Stage 2	-	-	-	-	481 -
Critical Hdwy	-	-	4.12	-	6.65 6.45
Critical Hdwy Stg 1	-	-	-	-	5.65 -
Critical Hdwy Stg 2	-	-	-	-	5.65 -
Follow-up Hdwy	-	-	2.218	-	3.725 3.525
Pot Cap-1 Maneuver	-	-	1014	-	234 492
Stage 1	-	-	-	-	534 -
Stage 2	-	-	-	-	577 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1014	-	231 492
Mov Cap-2 Maneuver	-	-	-	-	231 -
Stage 1	-	-	-	-	534 -
Stage 2	-	-	-	-	569 -

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	16.3
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	357	-	-	1014	-
HCM Lane V/C Ratio	0.108	-	-	0.013	-
HCM Control Delay (s)	16.3	-	-	8.6	-
HCM Lane LOS	C	-	-	A	-
HCM 95th %tile Q(veh)	0.4	-	-	0	-

HCM 2010 TWSC  
 2: Palmer Moose Dr & Bogard Rd, 2045 No Build AM

Intersection												
Int Delay, s/veh	3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↙	↑	↗	↙	↗			↕			↕	
Traffic Vol, veh/h	2	385	65	80	315	2	35	1	30	5	5	15
Future Vol, veh/h	2	385	65	80	315	2	35	1	30	5	5	15
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	325	-	325	250	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	83	83	83	83	83	83	83	83	83	83	83	83
Heavy Vehicles, %	2	5	2	2	5	2	13	2	13	2	2	2
Mvmt Flow	2	464	78	96	380	2	42	1	36	6	6	18

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	382	0	0	542	0	0	1053	1042	464	1099	1119	381
Stage 1	-	-	-	-	-	-	468	468	-	573	573	-
Stage 2	-	-	-	-	-	-	585	574	-	526	546	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.23	6.52	6.33	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.23	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.23	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.617	4.018	3.417	3.518	4.018	3.318
Pot Cap-1 Maneuver	1176	-	-	1027	-	-	195	230	576	190	207	666
Stage 1	-	-	-	-	-	-	555	561	-	505	504	-
Stage 2	-	-	-	-	-	-	478	503	-	535	518	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1176	-	-	1027	-	-	172	208	576	164	187	666
Mov Cap-2 Maneuver	-	-	-	-	-	-	172	208	-	164	187	-
Stage 1	-	-	-	-	-	-	554	560	-	504	457	-
Stage 2	-	-	-	-	-	-	416	456	-	499	517	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	0			1.8			25.6			17.7		
HCM LOS							D			C		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	253	1176	-	-	1027	-	-	313
HCM Lane V/C Ratio	0.314	0.002	-	-	0.094	-	-	0.096
HCM Control Delay (s)	25.6	8.1	-	-	8.9	-	-	17.7
HCM Lane LOS	D	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	1.3	0	-	-	0.3	-	-	0.3

HCM 2010 AWSC  
 3: Hemmer Rd & Palmer Moose Dr, 2045 No Build AM

Intersection	
Intersection Delay, s/veh	7.9
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	1	1	1	85	1	1	1	2	130	2	5	1
Future Vol, veh/h	1	1	1	85	1	1	1	2	130	2	5	1
Peak Hour Factor	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71
Heavy Vehicles, %	2	2	2	13	2	2	2	2	17	2	2	2
Mvmt Flow	1	1	1	120	1	1	1	3	183	3	7	1
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
Approach	EB			WB			NB			SB		
Opposing Approach	WB			EB			SB			NB		
Opposing Lanes	1			1			1			1		
Conflicting Approach Left	SB			NB			EB			WB		
Conflicting Lanes Left	1			1			1			1		
Conflicting Approach Right	NB			SB			WB			EB		
Conflicting Lanes Right	1			1			1			1		
HCM Control Delay	7.4			8.6			7.5			7.5		
HCM LOS	A			A			A			A		

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %		1%	33%	98%
Vol Thru, %		2%	33%	1%
Vol Right, %		98%	33%	1%
Sign Control		Stop	Stop	Stop
Traffic Vol by Lane		133	3	87
LT Vol		1	1	85
Through Vol		2	1	1
RT Vol		130	1	1
Lane Flow Rate		187	4	123
Geometry Grp		1	1	1
Degree of Util (X)		0.191	0.005	0.159
Departure Headway (Hd)		3.68	4.347	4.66
Convergence, Y/N		Yes	Yes	Yes
Cap		982	828	765
Service Time		1.681	2.347	2.716
HCM Lane V/C Ratio		0.19	0.005	0.161
HCM Control Delay		7.5	7.4	8.6
HCM Lane LOS		A	A	A
HCM 95th-tile Q		0.7	0	0.6

HCM 2010 TWSC  
 4: Hemmer Rd & Driveway, 2045 No Build AM

Intersection						
Int Delay, s/veh	0.2					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W		T			T
Traffic Vol, veh/h	2	1	135	5	1	90
Future Vol, veh/h	2	1	135	5	1	90
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	68	68	68	68	68	68
Heavy Vehicles, %	2	2	17	2	2	17
Mvmt Flow	3	1	199	7	1	132

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	337	203	0	0	206
Stage 1	203	-	-	-	-
Stage 2	134	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12
Critical Hdwy Stg 1	5.42	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218
Pot Cap-1 Maneuver	658	838	-	-	1365
Stage 1	831	-	-	-	-
Stage 2	892	-	-	-	-
Platoon blocked, %			-	-	-
Mov Cap-1 Maneuver	657	838	-	-	1365
Mov Cap-2 Maneuver	657	-	-	-	-
Stage 1	831	-	-	-	-
Stage 2	891	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.1	0	0.1
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	708	1365
HCM Lane V/C Ratio	-	-	0.006	0.001
HCM Control Delay (s)	-	-	10.1	7.6
HCM Lane LOS	-	-	B	A
HCM 95th %tile Q(veh)	-	-	0	0



## Queues

### 5: Palmer-Wasilla Hwy & Hemmer Rd, 2045 No Build AM
























Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	6	1006	88	729	135	18	48	82	24
v/c Ratio	0.01	0.96	0.42	0.63	0.14	0.10	0.29	0.53	0.15
Control Delay	7.2	45.5	12.2	16.4	4.1	45.7	36.3	63.8	27.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.2	45.5	12.2	16.4	4.1	45.7	36.3	63.8	27.5
Queue Length 50th (ft)	1	789	15	244	8	15	22	72	6
Queue Length 95th (ft)	6	#1218	44	636	44	33	54	105	29
Internal Link Dist (ft)		520		977			186		159
Turn Bay Length (ft)	300		125		125			100	
Base Capacity (vph)	421	1043	212	1155	987	187	273	155	230
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.96	0.42	0.63	0.14	0.10	0.18	0.53	0.10

#### Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

HCM 2010 Signalized Intersection Summary  
 5: Palmer-Wasilla Hwy & Hemmer Rd, 2045 No Build AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	850	5	75	620	115	15	20	20	70	5	15
Future Volume (veh/h)	5	850	5	75	620	115	15	20	20	70	5	15
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	0.96		0.94	0.95		0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1632	1571	1665	1632	1571	1632	1632	1632	1665	1423	1470	1665
Adj Flow Rate, veh/h	6	1000	6	88	729	107	18	24	2	82	6	2
Adj No. of Lanes	1	1	0	1	1	1	1	1	0	1	1	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	2	6	2	2	6	2	2	2	2	17	2	17
Cap, veh/h	329	1040	6	159	1105	969	214	127	11	188	114	38
Arrive On Green	0.01	0.67	0.67	0.05	0.70	0.70	0.02	0.09	0.09	0.05	0.11	0.11
Sat Flow, veh/h	1555	1560	9	1555	1571	1378	1555	1478	123	1355	1042	347
Grp Volume(v), veh/h	6	0	1006	88	729	107	18	0	26	82	0	8
Grp Sat Flow(s),veh/h/ln	1555	0	1569	1555	1571	1378	1555	0	1602	1355	0	1389
Q Serve(g_s), s	0.2	0.0	86.2	2.5	37.2	3.6	1.5	0.0	2.2	7.0	0.0	0.7
Cycle Q Clear(g_c), s	0.2	0.0	86.2	2.5	37.2	3.6	1.5	0.0	2.2	7.0	0.0	0.7
Prop In Lane	1.00		0.01	1.00		1.00	1.00		0.08	1.00		0.25
Lane Grp Cap(c), veh/h	329	0	1047	159	1105	969	214	0	138	188	0	152
V/C Ratio(X)	0.02	0.00	0.96	0.55	0.66	0.11	0.08	0.00	0.19	0.44	0.00	0.05
Avail Cap(c_a), veh/h	388	0	1047	161	1105	969	251	0	276	188	0	240
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	10.8	0.0	22.4	36.4	11.9	6.9	55.0	0.0	61.5	58.1	0.0	57.8
Incr Delay (d2), s/veh	0.0	0.0	19.9	4.0	3.1	0.2	0.2	0.0	0.7	1.6	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	42.7	2.5	16.9	1.4	0.6	0.0	1.0	3.1	0.0	0.3
LnGrp Delay(d),s/veh	10.8	0.0	42.3	40.4	15.0	7.1	55.1	0.0	62.2	59.7	0.0	58.0
LnGrp LOS	B		D	D	B	A	E		E	E		E
Approach Vol, veh/h		1012			924			44				90
Approach Delay, s/veh		42.1			16.5			59.3				59.6
Approach LOS		D			B			E				E
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	11.8	103.7	12.0	17.5	6.5	109.0	8.6	20.9				
Change Period (Y+Rc), s	5.0	7.0	5.0	5.0	5.0	7.0	5.0	5.0				
Max Green Setting (Gmax), s	7.0	84.0	7.0	25.0	7.0	84.0	7.0	25.0				
Max Q Clear Time (g_c+I1), s	4.5	88.2	9.0	4.2	2.2	39.2	3.5	2.7				
Green Ext Time (p_c), s	0.0	0.0	0.0	0.1	0.0	5.8	0.0	0.0				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay			31.8									
HCM 2010 LOS			C									

HCM 2010 TWSC  
 1: Hemmer Rd & Bogard Rd, 2045 No Build MID

Intersection						
Int Delay, s/veh	0.6					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↘	↑	↘	
Traffic Vol, veh/h	320	10	10	335	10	20
Future Vol, veh/h	320	10	10	335	10	20
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	200	300	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	5	2	2	5	25	25
Mvmt Flow	340	11	11	356	11	21

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	351	0	718 340
Stage 1	-	-	-	-	340 -
Stage 2	-	-	-	-	378 -
Critical Hdwy	-	-	4.12	-	6.65 6.45
Critical Hdwy Stg 1	-	-	-	-	5.65 -
Critical Hdwy Stg 2	-	-	-	-	5.65 -
Follow-up Hdwy	-	-	2.218	-	3.725 3.525
Pot Cap-1 Maneuver	-	-	1208	-	364 653
Stage 1	-	-	-	-	672 -
Stage 2	-	-	-	-	645 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1208	-	361 653
Mov Cap-2 Maneuver	-	-	-	-	361 -
Stage 1	-	-	-	-	672 -
Stage 2	-	-	-	-	639 -

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	12.5
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	514	-	-	1208	-
HCM Lane V/C Ratio	0.062	-	-	0.009	-
HCM Control Delay (s)	12.5	-	-	8	-
HCM Lane LOS	B	-	-	A	-
HCM 95th %tile Q(veh)	0.2	-	-	0	-

HCM 2010 TWSC  
 2: Palmer Moose Dr & Bogard Rd, 2045 No Build MID

Intersection												
Int Delay, s/veh	1.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↙	↑	↗	↙	↑			↕			↕	
Traffic Vol, veh/h	5	315	20	20	325	5	15	2	25	2	2	5
Future Vol, veh/h	5	315	20	20	325	5	15	2	25	2	2	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	325	-	325	250	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	96	96	96	96	96	96	96	96	96	96	96	96
Heavy Vehicles, %	2	5	2	2	5	2	13	2	13	2	2	2
Mvmt Flow	5	328	21	21	339	5	16	2	26	2	2	5

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	344	0	0	349	0	0	725	724	328	747	743	342
Stage 1	-	-	-	-	-	-	338	338	-	384	384	-
Stage 2	-	-	-	-	-	-	387	386	-	363	359	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.23	6.52	6.33	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.23	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.23	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.617	4.018	3.417	3.518	4.018	3.318
Pot Cap-1 Maneuver	1215	-	-	1210	-	-	327	352	689	329	343	701
Stage 1	-	-	-	-	-	-	654	641	-	639	611	-
Stage 2	-	-	-	-	-	-	615	610	-	656	627	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1215	-	-	1210	-	-	318	345	689	310	336	701
Mov Cap-2 Maneuver	-	-	-	-	-	-	318	345	-	310	336	-
Stage 1	-	-	-	-	-	-	651	638	-	636	601	-
Stage 2	-	-	-	-	-	-	598	600	-	627	624	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.1			0.5			13.4			13		
HCM LOS							B			B		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	471	1215	-	-	1210	-	-	461
HCM Lane V/C Ratio	0.093	0.004	-	-	0.017	-	-	0.02
HCM Control Delay (s)	13.4	8	-	-	8	-	-	13
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0.3	0	-	-	0.1	-	-	0.1

HCM 2010 AWSC  
 3: Hemmer Rd & Palmer Moose Dr, 2045 No Build MID

Intersection	
Intersection Delay, s/veh	0
Intersection LOS	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	0	0	0	0	0	0	0	0	0	0	0
Future Vol, veh/h	0	0	0	0	0	0	0	0	0	0	0	0
Peak Hour Factor	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Heavy Vehicles, %	2	2	2	13	2	2	2	2	17	2	2	2
Mvmt Flow	0	0	0	0	0	0	0	0	0	0	0	0
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	0	0	0	0
HCM LOS	-	-	-	-

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	0%	0%	0%	0%
Vol Thru, %	100%	100%	100%	100%
Vol Right, %	0%	0%	0%	0%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	0	0	0	0
LT Vol	0	0	0	0
Through Vol	0	0	0	0
RT Vol	0	0	0	0
Lane Flow Rate	0	0	0	0
Geometry Grp	1	1	1	1
Degree of Util (X)	0	0	0	0
Departure Headway (Hd)	3.934	3.934	3.934	3.934
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	0	0	0	0
Service Time	1.934	1.934	1.934	1.934
HCM Lane V/C Ratio	0	0	0	0
HCM Control Delay	6.9	6.9	6.9	6.9
HCM Lane LOS	N	N	N	N
HCM 95th-tile Q	0	0	0	0

HCM 2010 TWSC  
 4: Hemmer Rd & Driveway, 2045 No Build MID

Intersection						
Int Delay, s/veh	0					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W		T			T
Traffic Vol, veh/h	0	0	0	0	0	0
Future Vol, veh/h	0	0	0	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	25	25	25	25	25	25
Heavy Vehicles, %	2	2	25	2	2	17
Mvmt Flow	0	0	0	0	0	0

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	4	0	0	0	0	0
Stage 1	0	-	-	-	-	-
Stage 2	4	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	1018	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	1019	-	-	-	-	-
Platoon blocked, %						
Mov Cap-1 Maneuver	1018	-	-	-	-	-
Mov Cap-2 Maneuver	1018	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	1019	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	0	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-
HCM Control Delay (s)	-	-	0	0
HCM Lane LOS	-	-	A	A
HCM 95th %tile Q(veh)	-	-	-	-

## Queues

### 5: Palmer-Wasilla Hwy & Hemmer Rd, 2045 No Build MID
























Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	5	872	53	761	53	5	54	43	2
v/c Ratio	0.01	0.83	0.19	0.66	0.05	0.02	0.32	0.26	0.01
Control Delay	7.2	28.8	8.1	17.4	0.1	33.0	16.6	40.0	31.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.2	28.8	8.1	17.4	0.1	33.0	16.6	40.0	31.5
Queue Length 50th (ft)	1	505	9	257	0	3	1	28	1
Queue Length 95th (ft)	7	#1021	33	#841	0	12	35	50	8
Internal Link Dist (ft)		520		977			186		159
Turn Bay Length (ft)	300		125		125			100	
Base Capacity (vph)	383	1049	272	1148	996	222	331	163	299
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.83	0.19	0.66	0.05	0.02	0.16	0.26	0.01

#### Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

HCM 2010 Signalized Intersection Summary  
 5: Palmer-Wasilla Hwy & Hemmer Rd, 2045 No Build MID

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	815	5	50	715	50	5	1	50	40	1	1
Future Volume (veh/h)	5	815	5	50	715	50	5	1	50	40	1	1
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	0.96		0.93	0.94		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1632	1571	1665	1632	1571	1632	1632	1632	1665	1423	1521	1665
Adj Flow Rate, veh/h	5	867	5	53	761	34	5	1	6	43	1	0
Adj No. of Lanes	1	1	0	1	1	1	1	1	0	1	1	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	6	2	2	6	2	2	2	2	17	2	17
Cap, veh/h	307	996	6	246	1066	935	212	14	86	197	170	0
Arrive On Green	0.01	0.64	0.64	0.05	0.68	0.68	0.01	0.08	0.08	0.05	0.11	0.00
Sat Flow, veh/h	1555	1560	9	1555	1571	1377	1555	191	1144	1355	1521	0
Grp Volume(v), veh/h	5	0	872	53	761	34	5	0	7	43	1	0
Grp Sat Flow(s),veh/h/ln	1555	0	1569	1555	1571	1377	1555	0	1335	1355	1521	0
Q Serve(g_s), s	0.1	0.0	52.0	1.3	34.7	0.9	0.3	0.0	0.6	3.3	0.1	0.0
Cycle Q Clear(g_c), s	0.1	0.0	52.0	1.3	34.7	0.9	0.3	0.0	0.6	3.3	0.1	0.0
Prop In Lane	1.00		0.01	1.00		1.00	1.00		0.86	1.00		0.00
Lane Grp Cap(c), veh/h	307	0	1002	246	1066	935	212	0	101	197	170	0
V/C Ratio(X)	0.02	0.00	0.87	0.22	0.71	0.04	0.02	0.00	0.07	0.22	0.01	0.00
Avail Cap(c_a), veh/h	388	0	1002	263	1066	935	292	0	290	218	331	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	10.9	0.0	16.9	18.8	11.5	6.1	44.6	0.0	49.4	45.9	45.4	0.0
Incr Delay (d2), s/veh	0.0	0.0	10.3	0.4	4.1	0.1	0.0	0.0	0.3	0.6	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	25.1	0.9	16.0	0.4	0.1	0.0	0.2	1.3	0.0	0.0
LnGrp Delay(d),s/veh	10.9	0.0	27.2	19.2	15.6	6.2	44.6	0.0	49.7	46.5	45.4	0.0
LnGrp LOS	B		C	B	B	A	D		D	D	D	
Approach Vol, veh/h		877			848			12			44	
Approach Delay, s/veh		27.1			15.4			47.6			46.4	
Approach LOS		C			B			D			D	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	10.7	80.4	10.2	13.7	6.0	85.1	6.0	17.9				
Change Period (Y+Rc), s	5.0	7.0	5.0	5.0	5.0	7.0	5.0	5.0				
Max Green Setting (Gmax), s	7.0	54.0	7.0	25.0	7.0	54.0	7.0	25.0				
Max Q Clear Time (g_c+I1), s	3.3	54.0	5.3	2.6	2.1	36.7	2.3	2.1				
Green Ext Time (p_c), s	0.0	0.0	0.0	0.0	0.0	4.7	0.0	0.0				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay			22.2									
HCM 2010 LOS			C									



HCM 2010 TWSC  
 1: Hemmer Rd & Bogard Rd, 2045 No Build PM

Intersection						
Int Delay, s/veh	0.5					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↖	↑	↘	↙
Traffic Vol, veh/h	490	10	20	530	10	10
Future Vol, veh/h	490	10	20	530	10	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	200	300	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	5	2	2	5	25	25
Mvmt Flow	533	11	22	576	11	11

Major/Minor	Major1	Major2	Minor1	Minor2	Minor3
Conflicting Flow All	0	0	544	0	1153
Stage 1	-	-	-	-	533
Stage 2	-	-	-	-	620
Critical Hdwy	-	-	4.12	-	6.65
Critical Hdwy Stg 1	-	-	-	-	5.65
Critical Hdwy Stg 2	-	-	-	-	5.65
Follow-up Hdwy	-	-	2.218	-	3.725
Pot Cap-1 Maneuver	-	-	1025	-	197
Stage 1	-	-	-	-	545
Stage 2	-	-	-	-	495
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1025	-	193
Mov Cap-2 Maneuver	-	-	-	-	193
Stage 1	-	-	-	-	545
Stage 2	-	-	-	-	485

Approach	EB	WB	NB
HCM Control Delay, s	0	0.3	19
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	279	-	-	1025	-
HCM Lane V/C Ratio	0.078	-	-	0.021	-
HCM Control Delay (s)	19	-	-	8.6	-
HCM Lane LOS	C	-	-	A	-
HCM 95th %tile Q(veh)	0.3	-	-	0.1	-

HCM 2010 TWSC  
 2: Palmer Moose Dr & Bogard Rd, 2045 No Build PM

Intersection												
Int Delay, s/veh	2.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↙	↑	↗	↙	↑	↗		↕			↕	
Traffic Vol, veh/h	10	460	30	20	525	5	20	10	25	5	1	5
Future Vol, veh/h	10	460	30	20	525	5	20	10	25	5	1	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	325	-	325	250	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	81	81	81	81	81	81	81	81	81	81	81	81
Heavy Vehicles, %	2	5	2	2	5	2	13	2	13	2	2	2
Mvmt Flow	12	568	37	25	648	6	25	12	31	6	1	6

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	654	0	0	605	0	0	1297	1296	568	1333	1330	651
Stage 1	-	-	-	-	-	-	592	592	-	701	701	-
Stage 2	-	-	-	-	-	-	705	704	-	632	629	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.23	6.52	6.33	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.23	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.23	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.617	4.018	3.417	3.518	4.018	3.318
Pot Cap-1 Maneuver	933	-	-	973	-	-	132	162	502	131	155	469
Stage 1	-	-	-	-	-	-	474	494	-	429	441	-
Stage 2	-	-	-	-	-	-	410	440	-	468	475	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	933	-	-	973	-	-	126	156	502	112	149	469
Mov Cap-2 Maneuver	-	-	-	-	-	-	126	156	-	112	149	-
Stage 1	-	-	-	-	-	-	468	488	-	423	430	-
Stage 2	-	-	-	-	-	-	393	429	-	423	469	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.2			0.3			31.6			27		
HCM LOS							D			D		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	202	933	-	-	973	-	-	177
HCM Lane V/C Ratio	0.336	0.013	-	-	0.025	-	-	0.077
HCM Control Delay (s)	31.6	8.9	-	-	8.8	-	-	27
HCM Lane LOS	D	A	-	-	A	-	-	D
HCM 95th %tile Q(veh)	1.4	0	-	-	0.1	-	-	0.2

HCM 2010 AWSC  
 3: Hemmer Rd & Palmer Moose Dr, 2045 No Build PM

Intersection	
Intersection Delay, s/veh	7.2
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	1	1	1	45	1	2	2	5	50	5	5	1
Future Vol, veh/h	1	1	1	45	1	2	2	5	50	5	5	1
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Heavy Vehicles, %	2	2	2	13	2	2	2	2	17	2	2	2
Mvmt Flow	1	1	1	54	1	2	2	6	60	6	6	1
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
Approach	EB			WB			NB			SB		
Opposing Approach	WB			EB			SB			NB		
Opposing Lanes	1			1			1			1		
Conflicting Approach Left	SB			NB			EB			WB		
Conflicting Lanes Left	1			1			1			1		
Conflicting Approach Right	NB			SB			WB			EB		
Conflicting Lanes Right	1			1			1			1		
HCM Control Delay	7			7.8			6.8			7.2		
HCM LOS	A			A			A			A		

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	4%	33%	94%	45%
Vol Thru, %	9%	33%	2%	45%
Vol Right, %	88%	33%	4%	9%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	57	3	48	11
LT Vol	2	1	45	5
Through Vol	5	1	1	5
RT Vol	50	1	2	1
Lane Flow Rate	69	4	58	13
Geometry Grp	1	1	1	1
Degree of Util (X)	0.067	0.004	0.071	0.015
Departure Headway (Hd)	3.53	3.987	4.429	4.128
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	1008	895	810	863
Service Time	1.574	2.022	2.448	2.175
HCM Lane V/C Ratio	0.068	0.004	0.072	0.015
HCM Control Delay	6.8	7	7.8	7.2
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.2	0	0.2	0

HCM 2010 TWSC  
 4: Hemmer Rd & Driveway, 2045 No Build PM

Intersection						
Int Delay, s/veh	1.3					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W		T			T
Traffic Vol, veh/h	10	5	60	5	5	45
Future Vol, veh/h	10	5	60	5	5	45
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	86	86	86	86	86	86
Heavy Vehicles, %	2	2	17	2	2	17
Mvmt Flow	12	6	70	6	6	52

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	137	73	0	0	76
Stage 1	73	-	-	-	-
Stage 2	64	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12
Critical Hdwy Stg 1	5.42	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218
Pot Cap-1 Maneuver	856	989	-	-	1523
Stage 1	950	-	-	-	-
Stage 2	959	-	-	-	-
Platoon blocked, %			-	-	-
Mov Cap-1 Maneuver	853	989	-	-	1523
Mov Cap-2 Maneuver	853	-	-	-	-
Stage 1	950	-	-	-	-
Stage 2	955	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.1	0	0.7
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	894	1523
HCM Lane V/C Ratio	-	-	0.02	0.004
HCM Control Delay (s)	-	-	9.1	7.4
HCM Lane LOS	-	-	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0

## Queues

### 5: Palmer-Wasilla Hwy & Hemmer Rd, 2045 No Build PM
























Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	5	952	42	1137	63	5	80	53	6
v/c Ratio	0.03	0.88	0.17	0.98	0.06	0.02	0.40	0.36	0.03
Control Delay	7.4	33.1	8.0	43.3	1.1	43.0	16.6	55.3	30.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.4	33.1	8.0	43.3	1.1	43.0	16.6	55.3	30.2
Queue Length 50th (ft)	1	622	7	717	0	4	1	46	1
Queue Length 95th (ft)	6	#1235	26	#1600	10	15	49	78	15
Internal Link Dist (ft)		520		977			186		159
Turn Bay Length (ft)	300		125		125			100	
Base Capacity (vph)	157	1077	244	1157	988	204	293	146	233
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.03	0.88	0.17	0.98	0.06	0.02	0.27	0.36	0.03

#### Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

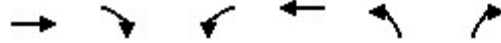
HCM 2010 Signalized Intersection Summary  
 5: Palmer-Wasilla Hwy & Hemmer Rd, 2045 No Build PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	900	5	40	1080	60	5	1	75	50	1	5
Future Volume (veh/h)	5	900	5	40	1080	60	5	1	75	50	1	5
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	0.95		0.93	0.94		0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1632	1571	1665	1632	1571	1632	1632	1632	1665	1423	1454	1665
Adj Flow Rate, veh/h	5	947	5	42	1137	42	5	1	8	53	1	1
Adj No. of Lanes	1	1	0	1	1	1	1	1	0	1	1	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	6	2	2	6	2	2	2	2	17	2	17
Cap, veh/h	63	1080	6	225	1135	995	193	11	86	178	71	71
Arrive On Green	0.01	0.69	0.69	0.04	0.72	0.72	0.01	0.07	0.07	0.04	0.11	0.11
Sat Flow, veh/h	1555	1561	8	1555	1571	1378	1555	147	1176	1355	651	651
Grp Volume(v), veh/h	5	0	952	42	1137	42	5	0	9	53	0	2
Grp Sat Flow(s),veh/h/ln	1555	0	1570	1555	1571	1378	1555	0	1323	1355	0	1302
Q Serve(g_s), s	0.1	0.0	68.9	1.1	104.7	1.3	0.4	0.0	0.9	5.2	0.0	0.2
Cycle Q Clear(g_c), s	0.1	0.0	68.9	1.1	104.7	1.3	0.4	0.0	0.9	5.2	0.0	0.2
Prop In Lane	1.00		0.01	1.00		1.00	1.00		0.89	1.00		0.50
Lane Grp Cap(c), veh/h	63	0	1086	225	1135	995	193	0	97	178	0	141
V/C Ratio(X)	0.08	0.00	0.88	0.19	1.00	0.04	0.03	0.00	0.09	0.30	0.00	0.01
Avail Cap(c_a), veh/h	125	0	1086	239	1135	995	254	0	228	184	0	225
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	43.1	0.0	17.5	23.2	20.1	5.8	56.7	0.0	62.7	58.8	0.0	57.7
Incr Delay (d2), s/veh	0.5	0.0	10.0	0.4	27.2	0.1	0.1	0.0	0.4	0.9	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.0	32.6	0.9	53.3	0.5	0.2	0.0	0.3	2.0	0.0	0.1
LnGrp Delay(d),s/veh	43.6	0.0	27.5	23.6	47.4	5.8	56.7	0.0	63.1	59.7	0.0	57.8
LnGrp LOS	D		C	C	F	A	E		E	E		E
Approach Vol, veh/h		957			1221			14			55	
Approach Delay, s/veh		27.6			45.1			60.8			59.7	
Approach LOS		C			D			E			E	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	10.7	107.3	11.4	15.6	6.3	111.7	6.3	20.7				
Change Period (Y+Rc), s	5.0	7.0	5.0	5.0	5.0	7.0	5.0	5.0				
Max Green Setting (Gmax), s	7.0	84.0	7.0	25.0	7.0	84.0	7.0	25.0				
Max Q Clear Time (g_c+I1), s	3.1	70.9	7.2	2.9	2.1	106.7	2.4	2.2				
Green Ext Time (p_c), s	0.0	5.5	0.0	0.0	0.0	0.0	0.0	0.0				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay			38.1									
HCM 2010 LOS			D									

## Appendix D      2045 Build Traffic Operations

## Queues

### 1: Hemmer Rd & Bogard Rd, 2045 Build AM









Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	474	90	90	404	83	96
v/c Ratio	0.43	0.09	0.14	0.31	0.37	0.35
Control Delay	13.7	3.6	5.3	6.4	32.9	9.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	13.7	3.6	5.3	6.4	32.9	9.3
Queue Length 50th (ft)	125	0	9	58	39	0
Queue Length 95th (ft)	238	19	32	141	55	23
Internal Link Dist (ft)	407			1427	518	
Turn Bay Length (ft)		200	300			100
Base Capacity (vph)	1103	967	639	1315	450	455
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.43	0.09	0.14	0.31	0.18	0.21

#### Intersection Summary



HCM 2010 Signalized Intersection Summary  
 1: Hemmer Rd & Bogard Rd, 2045 Build AM

								
Movement	EBT	EBR	WBL	WBT	NBL	NBR		
Lane Configurations	↑	↑	↑	↑	↑	↑		
Traffic Volume (veh/h)	370	70	70	315	65	75		
Future Volume (veh/h)	370	70	70	315	65	75		
Number	2	12	1	6	7	14		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)		0.99	1.00		1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00		
Adj Sat Flow, veh/h/ln	1762	1814	1814	1762	1581	1581		
Adj Flow Rate, veh/h	474	53	90	404	83	11		
Adj No. of Lanes	1	1	1	1	1	1		
Peak Hour Factor	0.78	0.78	0.78	0.78	0.78	0.78		
Percent Heavy Veh, %	5	2	2	5	17	17		
Cap, veh/h	1119	972	657	1363	115	103		
Arrive On Green	0.64	0.64	0.08	0.77	0.08	0.08		
Sat Flow, veh/h	1762	1530	1727	1762	1506	1344		
Grp Volume(v), veh/h	474	53	90	404	83	11		
Grp Sat Flow(s),veh/h/ln	1762	1530	1727	1762	1506	1344		
Q Serve(g_s), s	10.7	1.0	1.3	5.4	4.3	0.6		
Cycle Q Clear(g_c), s	10.7	1.0	1.3	5.4	4.3	0.6		
Prop In Lane		1.00	1.00		1.00	1.00		
Lane Grp Cap(c), veh/h	1119	972	657	1363	115	103		
V/C Ratio(X)	0.42	0.05	0.14	0.30	0.72	0.11		
Avail Cap(c_a), veh/h	1119	972	677	1363	452	403		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(l)	1.00	1.00	1.00	1.00	1.00	1.00		
Uniform Delay (d), s/veh	7.3	5.5	4.3	2.7	36.1	34.4		
Incr Delay (d2), s/veh	1.2	0.1	0.1	0.6	8.1	0.5		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	5.5	0.5	0.6	2.8	2.1	0.2		
LnGrp Delay(d),s/veh	8.5	5.6	4.4	3.2	44.2	34.8		
LnGrp LOS	A	A	A	A	D	C		
Approach Vol, veh/h	527			494	94			
Approach Delay, s/veh	8.2			3.4	43.1			
Approach LOS	A			A	D			
Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	11.1	57.8		11.1		68.9		
Change Period (Y+Rc), s	5.0	7.0		5.0		7.0		
Max Green Setting (Gmax), s	7.0	32.0		24.0		44.0		
Max Q Clear Time (g_c+I1), s	3.3	12.7		6.3		7.4		
Green Ext Time (p_c), s	0.1	2.7		0.2		2.4		
<b>Intersection Summary</b>								
HCM 2010 Ctrl Delay			9.0					
HCM 2010 LOS			A					

HCM 2010 TWSC  
 2: Palmer Moose Dr & Bogard Rd, 2045 Build AM

Intersection												
Int Delay, s/veh	2.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	2	405	40	55	345	2	20	1	25	5	5	20
Future Vol, veh/h	2	405	40	55	345	2	20	1	25	5	5	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	325	-	325	250	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	83	83	83	83	83	83	83	83	83	83	83	83
Heavy Vehicles, %	2	5	2	2	5	2	2	3	2	2	2	2
Mvmt Flow	2	488	48	66	416	2	24	1	30	6	6	24

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	418	0	0	536	0	0	1056	1042	488	1081	1089	417
Stage 1	-	-	-	-	-	-	492	492	-	549	549	-
Stage 2	-	-	-	-	-	-	564	550	-	532	540	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.53	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.53	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.53	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.027	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1141	-	-	1032	-	-	203	229	580	195	215	636
Stage 1	-	-	-	-	-	-	558	546	-	520	516	-
Stage 2	-	-	-	-	-	-	510	514	-	531	521	-
Platoon blocked, %		-	-	-	-	-						
Mov Cap-1 Maneuver	1141	-	-	1032	-	-	181	214	580	175	201	636
Mov Cap-2 Maneuver	-	-	-	-	-	-	181	214	-	175	201	-
Stage 1	-	-	-	-	-	-	557	545	-	519	483	-
Stage 2	-	-	-	-	-	-	454	481	-	501	520	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	0			1.2			20.3			16.4		
HCM LOS							C			C		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	291	1141	-	-	1032	-	-	353
HCM Lane V/C Ratio	0.19	0.002	-	-	0.064	-	-	0.102
HCM Control Delay (s)	20.3	8.2	-	-	8.7	-	-	16.4
HCM Lane LOS	C	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	0.7	0	-	-	0.2	-	-	0.3

HCM 2010 TWSC  
 3: Hemmer Rd & Palmer Moose Dr, 2045 Build AM

Intersection												
Int Delay, s/veh	1.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	1	1	1	35	1	5	5	155	130	5	175	1
Future Vol, veh/h	1	1	1	35	1	5	5	155	130	5	175	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	71	71	71	71	71	71	71	71	71	71	71	71
Heavy Vehicles, %	2	2	2	3	2	2	2	17	3	2	17	2
Mvmt Flow	1	1	1	49	1	7	7	218	183	7	246	1

Major/Minor	Minor2		Minor1			Major1		Major2				
Conflicting Flow All	589	676	247	586	585	310	247	0	0	401	0	0
Stage 1	261	261	-	324	324	-	-	-	-	-	-	-
Stage 2	328	415	-	262	261	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.13	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.13	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.13	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.527	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	420	375	792	420	423	730	1319	-	-	1158	-	-
Stage 1	744	692	-	686	650	-	-	-	-	-	-	-
Stage 2	685	592	-	741	692	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	410	370	792	414	417	730	1319	-	-	1158	-	-
Mov Cap-2 Maneuver	410	370	-	414	417	-	-	-	-	-	-	-
Stage 1	739	687	-	681	645	-	-	-	-	-	-	-
Stage 2	672	588	-	733	687	-	-	-	-	-	-	-

Approach	EB		WB			NB		SB		
HCM Control Delay, s	12.8		14.5			0.1		0.2		
HCM LOS	B		B							

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1319	-	-	468	437	1158	-	-
HCM Lane V/C Ratio	0.005	-	-	0.009	0.132	0.006	-	-
HCM Control Delay (s)	7.7	0	-	12.8	14.5	8.1	0	-
HCM Lane LOS	A	A	-	B	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0.5	0	-	-

HCM 2010 TWSC  
 4: Hemmer Rd & Driveway, 2045 Build AM

Intersection						
Int Delay, s/veh	0.1					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W		T			T
Traffic Vol, veh/h	2	1	325	5	1	215
Future Vol, veh/h	2	1	325	5	1	215
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	68	68	68	68	68	68
Heavy Vehicles, %	2	2	17	2	2	17
Mvmt Flow	3	1	478	7	1	316

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	800	482	0	0	485
Stage 1	482	-	-	-	-
Stage 2	318	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12
Critical Hdwy Stg 1	5.42	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218
Pot Cap-1 Maneuver	354	584	-	-	1078
Stage 1	621	-	-	-	-
Stage 2	738	-	-	-	-
Platoon blocked, %			-	-	-
Mov Cap-1 Maneuver	354	584	-	-	1078
Mov Cap-2 Maneuver	354	-	-	-	-
Stage 1	621	-	-	-	-
Stage 2	737	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	13.9	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	407	1078
HCM Lane V/C Ratio	-	-	0.011	0.001
HCM Control Delay (s)	-	-	13.9	8.3
HCM Lane LOS	-	-	B	A
HCM 95th %tile Q(veh)	-	-	0	0

## Queues

### 5: Hemmer Rd & Palmer-Wasilla Hwy, 2045 Build AM

























Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	35	965	65	641	306	18	59	153	105
v/c Ratio	0.07	0.85	0.27	0.54	0.29	0.09	0.34	0.86	0.42
Control Delay	6.6	28.7	8.9	16.1	6.1	38.8	48.2	87.8	21.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	6.6	28.7	8.9	16.1	6.1	38.8	48.2	87.8	21.6
Queue Length 50th (ft)	6	586	12	275	41	12	39	116	20
Queue Length 95th (ft)	22	#1024	35	485	106	28	69	149	63
Internal Link Dist (ft)		848		933			281		173
Turn Bay Length (ft)	300		125		125			100	
Base Capacity (vph)	490	1141	243	1177	1043	205	355	177	342
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.07	0.85	0.27	0.54	0.29	0.09	0.17	0.86	0.31

#### Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

HCM 2010 Signalized Intersection Summary  
 5: Hemmer Rd & Palmer-Wasilla Hwy, 2045 Build AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	30	810	10	55	545	260	15	40	10	130	25	65
Future Volume (veh/h)	30	810	10	55	545	260	15	40	10	130	25	65
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	0.97		0.95	0.96		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1814	1746	1850	1814	1745	1814	1814	1814	1850	1581	1639	1850
Adj Flow Rate, veh/h	35	953	12	65	641	244	18	47	4	153	29	10
Adj No. of Lanes	1	1	0	1	1	1	1	1	0	1	1	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	2	6	2	2	6	2	2	2	2	17	2	17
Cap, veh/h	386	1066	13	230	1101	964	241	161	14	222	148	51
Arrive On Green	0.04	0.62	0.62	0.05	0.63	0.63	0.03	0.10	0.10	0.06	0.13	0.13
Sat Flow, veh/h	1727	1720	22	1727	1745	1529	1727	1641	140	1506	1153	397
Grp Volume(v), veh/h	35	0	965	65	641	244	18	0	51	153	0	39
Grp Sat Flow(s),veh/h/ln	1727	0	1742	1727	1745	1529	1727	0	1780	1506	0	1550
Q Serve(g_s), s	0.9	0.0	59.0	1.6	26.8	8.8	1.1	0.0	3.3	7.0	0.0	2.8
Cycle Q Clear(g_c), s	0.9	0.0	59.0	1.6	26.8	8.8	1.1	0.0	3.3	7.0	0.0	2.8
Prop In Lane	1.00		0.01	1.00		1.00	1.00		0.08	1.00		0.26
Lane Grp Cap(c), veh/h	386	0	1080	230	1101	964	241	0	175	222	0	198
V/C Ratio(X)	0.09	0.00	0.89	0.28	0.58	0.25	0.07	0.00	0.29	0.69	0.00	0.20
Avail Cap(c_a), veh/h	414	0	1080	240	1101	964	293	0	356	222	0	310
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	10.0	0.0	20.2	22.8	13.5	10.1	45.2	0.0	52.3	51.5	0.0	48.8
Incr Delay (d2), s/veh	0.1	0.0	11.3	0.7	2.3	0.6	0.1	0.0	0.9	8.6	0.0	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	31.5	1.2	13.5	3.8	0.5	0.0	1.7	5.2	0.0	1.2
LnGrp Delay(d),s/veh	10.1	0.0	31.6	23.4	15.7	10.8	45.4	0.0	53.3	60.1	0.0	49.2
LnGrp LOS	B		C	C	B	B	D		D	E		D
Approach Vol, veh/h		1000			950			69			192	
Approach Delay, s/veh		30.8			15.0			51.2			57.9	
Approach LOS		C			B			D			E	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	11.3	84.5	12.0	17.3	9.9	85.8	8.3	21.0				
Change Period (Y+Rc), s	5.0	7.0	5.0	5.0	5.0	7.0	5.0	5.0				
Max Green Setting (Gmax), s	7.0	64.0	7.0	25.0	7.0	64.0	7.0	25.0				
Max Q Clear Time (g_c+I1), s	3.6	61.0	9.0	5.3	2.9	28.8	3.1	4.8				
Green Ext Time (p_c), s	0.0	1.8	0.0	0.2	0.0	5.3	0.0	0.1				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay				27.0								
HCM 2010 LOS				C								

HCM 2010 TWSC  
 6: Hemmer Rd & Folsom Drive, 2045 Build AM

Intersection						
Int Delay, s/veh	1.4					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	T			T		T
Traffic Vol, veh/h	15	20	10	125	130	10
Future Vol, veh/h	15	20	10	125	130	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	78	78	78	78	78	78
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	19	26	13	160	167	13

Major/Minor	Minor2	Major1		Major2	
Conflicting Flow All	360	174	180	0	0
Stage 1	174	-	-	-	-
Stage 2	186	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-
Pot Cap-1 Maneuver	639	869	1396	-	-
Stage 1	856	-	-	-	-
Stage 2	846	-	-	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	633	869	1396	-	-
Mov Cap-2 Maneuver	633	-	-	-	-
Stage 1	847	-	-	-	-
Stage 2	846	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	10.1	0.6	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1396	-	749	-	-
HCM Lane V/C Ratio	0.009	-	0.06	-	-
HCM Control Delay (s)	7.6	0	10.1	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0.2	-	-

## Queues













### 1: Hemmer Rd & Bogard Rd, 2045 Build MID



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	271	64	53	309	74	90
v/c Ratio	0.23	0.06	0.06	0.23	0.33	0.34
Control Delay	10.5	4.0	5.0	5.8	32.3	9.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	10.5	4.0	5.0	5.8	32.3	9.5
Queue Length 50th (ft)	61	0	5	40	35	0
Queue Length 95th (ft)	155	22	25	127	59	32
Internal Link Dist (ft)	407			1427	518	
Turn Bay Length (ft)		200	300			100
Base Capacity (vph)	1163	1006	825	1322	450	451
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.23	0.06	0.06	0.23	0.16	0.20
<b>Intersection Summary</b>						



HCM 2010 Signalized Intersection Summary  
 1: Hemmer Rd & Bogard Rd, 2045 Build MID

									
Movement	EBT	EBR	WBL	WBT	NBL	NBR			
Lane Configurations									
Traffic Volume (veh/h)	255	60	50	290	70	85			
Future Volume (veh/h)	255	60	50	290	70	85			
Number	2	12	1	6	7	14			
Initial Q (Qb), veh	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)		0.99	1.00		1.00	1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1762	1814	1814	1762	1581	1581			
Adj Flow Rate, veh/h	271	38	53	309	74	12			
Adj No. of Lanes	1	1	1	1	1	1			
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94			
Percent Heavy Veh, %	5	2	2	5	17	17			
Cap, veh/h	1149	998	820	1366	112	100			
Arrive On Green	0.65	0.65	0.06	0.78	0.07	0.07			
Sat Flow, veh/h	1762	1530	1727	1762	1506	1344			
Grp Volume(v), veh/h	271	38	53	309	74	12			
Grp Sat Flow(s),veh/h/ln	1762	1530	1727	1762	1506	1344			
Q Serve(g_s), s	5.1	0.7	0.7	3.8	3.8	0.7			
Cycle Q Clear(g_c), s	5.1	0.7	0.7	3.8	3.8	0.7			
Prop In Lane		1.00	1.00		1.00	1.00			
Lane Grp Cap(c), veh/h	1149	998	820	1366	112	100			
V/C Ratio(X)	0.24	0.04	0.06	0.23	0.66	0.12			
Avail Cap(c_a), veh/h	1149	998	867	1366	452	403			
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00			
Uniform Delay (d), s/veh	5.7	5.0	3.6	2.4	36.0	34.6			
Incr Delay (d2), s/veh	0.5	0.1	0.0	0.4	6.4	0.5			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	2.6	0.3	0.3	1.9	1.8	0.3			
LnGrp Delay(d),s/veh	6.2	5.0	3.6	2.8	42.5	35.1			
LnGrp LOS	A	A	A	A	D	D			
Approach Vol, veh/h	309			362		86			
Approach Delay, s/veh	6.1			2.9		41.4			
Approach LOS	A			A		D			
Timer	1	2	3	4	5	6	7	8	
Assigned Phs	1	2	4		6				
Phs Duration (G+Y+Rc), s	9.8	59.2	11.0		69.0				
Change Period (Y+Rc), s	5.0	7.0	5.0		7.0				
Max Green Setting (Gmax), s	7.0	32.0	24.0		44.0				
Max Q Clear Time (g_c+I1), s	2.7	7.1	5.8		5.8				
Green Ext Time (p_c), s	0.0	1.5	0.2		1.7				
<b>Intersection Summary</b>									
HCM 2010 Ctrl Delay			8.6						
HCM 2010 LOS			A						

HCM 2010 TWSC  
 2: Palmer Moose Dr & Bogard Rd, 2045 Build MID

Intersection												
Int Delay, s/veh	0.8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↙	↑	↗	↙	↗			↕			↕	
Traffic Vol, veh/h	5	320	15	10	325	5	10	1	15	2	1	5
Future Vol, veh/h	5	320	15	10	325	5	10	1	15	2	1	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	325	-	325	250	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	96	96	96	96	96	96	96	96	96	96	96	96
Heavy Vehicles, %	2	5	2	2	5	2	13	2	13	2	2	2
Mvmt Flow	5	333	16	10	339	5	10	1	16	2	1	5

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	344	0	0	349	0	0	708	707	333	722	721	342
Stage 1	-	-	-	-	-	-	343	343	-	362	362	-
Stage 2	-	-	-	-	-	-	365	364	-	360	359	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.23	6.52	6.33	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.23	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.23	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.617	4.018	3.417	3.518	4.018	3.318
Pot Cap-1 Maneuver	1215	-	-	1210	-	-	336	360	684	342	353	701
Stage 1	-	-	-	-	-	-	650	637	-	657	625	-
Stage 2	-	-	-	-	-	-	632	624	-	658	627	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1215	-	-	1210	-	-	330	356	684	330	349	701
Mov Cap-2 Maneuver	-	-	-	-	-	-	330	356	-	330	349	-
Stage 1	-	-	-	-	-	-	647	634	-	654	620	-
Stage 2	-	-	-	-	-	-	621	619	-	639	624	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.1			0.2			13.1			12.4		
HCM LOS							B			B		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	472	1215	-	-	1210	-	-	498
HCM Lane V/C Ratio	0.057	0.004	-	-	0.009	-	-	0.017
HCM Control Delay (s)	13.1	8	-	-	8	-	-	12.4
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	0.1

HCM 2010 TWSC  
 3: Hemmer Rd & Palmer Moose Dr, 2045 Build MID

Intersection												
Int Delay, s/veh	0											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	0	0	0	0	0	0	0	0	0	0	0
Future Vol, veh/h	0	0	0	0	0	0	0	0	0	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	25	25	25	25	25	25	25	25	25	25	25	25
Heavy Vehicles, %	2	2	2	3	2	2	2	17	3	2	17	2
Mvmt Flow	0	0	0	0	0	0	0	0	0	0	0	0

Major/Minor	Minor2		Minor1			Major1		Major2				
Conflicting Flow All	4	4	4	4	4	0	4	0	0	0	0	0
Stage 1	4	4	-	0	0	-	-	-	-	-	-	-
Stage 2	0	0	-	4	4	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.13	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.13	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.13	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.527	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	1017	891	1080	1015	891	-	1618	-	-	-	-	-
Stage 1	1018	892	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	1016	892	-	-	-	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	-	891	1080	1015	891	-	1618	-	-	-	-	-
Mov Cap-2 Maneuver	-	891	-	1015	891	-	-	-	-	-	-	-
Stage 1	1018	892	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	1016	892	-	-	-	-	-	-	-

Approach	EB		WB			NB		SB			
HCM Control Delay, s	0		0			0		0			
HCM LOS	A		A								

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1618	-	-	-	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-	-	-	-
HCM Control Delay (s)	0	-	-	0	0	0	-	-
HCM Lane LOS	A	-	-	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	-	-	-	-	-

HCM 2010 TWSC  
 4: Hemmer Rd & Driveway, 2045 Build MID

Intersection						
Int Delay, s/veh	0					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W		T			T
Traffic Vol, veh/h	0	0	0	0	0	0
Future Vol, veh/h	0	0	0	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	25	25	25	25	25	25
Heavy Vehicles, %	2	2	17	2	2	17
Mvmt Flow	0	0	0	0	0	0

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	4	0	0	0	0	0
Stage 1	0	-	-	-	-	-
Stage 2	4	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	1018	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	1019	-	-	-	-	-
Platoon blocked, %						
Mov Cap-1 Maneuver	1018	-	-	-	-	-
Mov Cap-2 Maneuver	1018	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	1019	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	0	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-
HCM Control Delay (s)	-	-	0	0
HCM Lane LOS	-	-	A	A
HCM 95th %tile Q(veh)	-	-	-	-

## Queues

### 5: Hemmer Rd & Palmer-Wasilla Hwy, 2045 Build MID

























Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	16	840	48	729	112	5	49	101	10
v/c Ratio	0.04	0.76	0.16	0.62	0.11	0.02	0.27	0.55	0.04
Control Delay	6.9	24.0	7.6	17.3	2.9	33.0	16.0	51.5	28.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	6.9	24.0	7.6	17.3	2.9	33.0	16.0	51.5	28.3
Queue Length 50th (ft)	3	417	8	218	0	3	1	68	3
Queue Length 95th (ft)	14	#905	31	#725	30	12	33	98	18
Internal Link Dist (ft)		848		933			281		173
Turn Bay Length (ft)	300		125		125			100	
Base Capacity (vph)	417	1107	307	1181	1029	247	359	183	335
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.04	0.76	0.16	0.62	0.11	0.02	0.14	0.55	0.03

#### Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

HCM 2010 Signalized Intersection Summary  
 5: Hemmer Rd & Palmer-Wasilla Hwy, 2045 Build MID

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	15	785	5	45	685	105	5	1	45	95	5	5
Future Volume (veh/h)	15	785	5	45	685	105	5	1	45	95	5	5
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	0.96		0.94	0.94		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1814	1746	1850	1814	1745	1814	1814	1814	1850	1581	1689	1850
Adj Flow Rate, veh/h	16	835	5	48	729	69	5	1	5	101	5	1
Adj No. of Lanes	1	1	0	1	1	1	1	1	0	1	1	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	6	2	2	6	2	2	2	2	17	2	17
Cap, veh/h	369	1077	6	321	1125	986	250	20	98	241	177	35
Arrive On Green	0.02	0.62	0.62	0.05	0.64	0.64	0.01	0.08	0.08	0.06	0.13	0.13
Sat Flow, veh/h	1727	1733	10	1727	1745	1530	1727	249	1246	1506	1357	271
Grp Volume(v), veh/h	16	0	840	48	729	69	5	0	6	101	0	6
Grp Sat Flow(s),veh/h/ln	1727	0	1744	1727	1745	1530	1727	0	1495	1506	0	1629
Q Serve(g_s), s	0.4	0.0	40.5	1.1	29.3	1.9	0.3	0.0	0.4	7.0	0.0	0.4
Cycle Q Clear(g_c), s	0.4	0.0	40.5	1.1	29.3	1.9	0.3	0.0	0.4	7.0	0.0	0.4
Prop In Lane	1.00		0.01	1.00		1.00	1.00		0.83	1.00		0.17
Lane Grp Cap(c), veh/h	369	0	1083	321	1125	986	250	0	118	241	0	213
V/C Ratio(X)	0.04	0.00	0.78	0.15	0.65	0.07	0.02	0.00	0.05	0.42	0.00	0.03
Avail Cap(c_a), veh/h	432	0	1083	343	1125	986	340	0	325	241	0	354
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	10.2	0.0	15.9	14.2	12.5	7.6	42.7	0.0	49.0	45.6	0.0	43.6
Incr Delay (d2), s/veh	0.0	0.0	5.4	0.2	2.9	0.1	0.0	0.0	0.2	1.2	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.0	21.0	0.6	14.9	0.8	0.1	0.0	0.2	3.0	0.0	0.2
LnGrp Delay(d),s/veh	10.2	0.0	21.4	14.4	15.4	7.7	42.7	0.0	49.2	46.8	0.0	43.7
LnGrp LOS	B		C	B	B	A	D		D	D		D
Approach Vol, veh/h		856			846			11			107	
Approach Delay, s/veh		21.2			14.7			46.2			46.6	
Approach LOS		C			B			D			D	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	10.5	78.4	12.0	14.1	7.8	81.1	6.0	20.0				
Change Period (Y+Rc), s	5.0	7.0	5.0	5.0	5.0	7.0	5.0	5.0				
Max Green Setting (Gmax), s	7.0	54.0	7.0	25.0	7.0	54.0	7.0	25.0				
Max Q Clear Time (g_c+I1), s	3.1	42.5	9.0	2.4	2.4	31.3	2.3	2.4				
Green Ext Time (p_c), s	0.0	4.3	0.0	0.0	0.0	5.0	0.0	0.0				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay			19.8									
HCM 2010 LOS			B									

HCM 2010 TWSC  
 6: Hemmer Rd & Folsom Drive, 2045 Build MID

Intersection						
Int Delay, s/veh	1.3					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	T			T		T
Traffic Vol, veh/h	15	15	10	140	100	10
Future Vol, veh/h	15	15	10	140	100	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	16	16	11	149	106	11

Major/Minor	Minor2	Major1		Major2	
Conflicting Flow All	283	112	117	0	-
Stage 1	112	-	-	-	-
Stage 2	171	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-
Pot Cap-1 Maneuver	707	941	1471	-	-
Stage 1	913	-	-	-	-
Stage 2	859	-	-	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	701	941	1471	-	-
Mov Cap-2 Maneuver	701	-	-	-	-
Stage 1	906	-	-	-	-
Stage 2	859	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.7	0.5	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1471	-	803	-	-
HCM Lane V/C Ratio	0.007	-	0.04	-	-
HCM Control Delay (s)	7.5	0	9.7	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

## Queues













### 1: Hemmer Rd & Bogard Rd, 2045 Build PM



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	489	65	103	505	76	49
v/c Ratio	0.44	0.07	0.16	0.38	0.34	0.21
Control Delay	13.7	4.0	5.3	7.0	32.5	9.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	13.7	4.0	5.3	7.0	32.5	9.8
Queue Length 50th (ft)	129	0	10	76	36	0
Queue Length 95th (ft)	308	23	43	230	60	23
Internal Link Dist (ft)	407			1427	518	
Turn Bay Length (ft)		200	300			100
Base Capacity (vph)	1107	961	632	1320	450	422
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.44	0.07	0.16	0.38	0.17	0.12
<b>Intersection Summary</b>						



HCM 2010 Signalized Intersection Summary  
 1: Hemmer Rd & Bogard Rd, 2045 Build PM

								
Movement	EBT	EBR	WBL	WBT	NBL	NBR		
Lane Configurations								
Traffic Volume (veh/h)	450	60	95	465	70	45		
Future Volume (veh/h)	450	60	95	465	70	45		
Number	2	12	1	6	7	14		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)		0.99	1.00		1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00		
Adj Sat Flow, veh/h/ln	1762	1814	1814	1762	1581	1581		
Adj Flow Rate, veh/h	489	38	103	505	76	6		
Adj No. of Lanes	1	1	1	1	1	1		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92		
Percent Heavy Veh, %	5	2	2	5	17	17		
Cap, veh/h	1120	972	657	1368	110	99		
Arrive On Green	0.64	0.64	0.08	0.78	0.07	0.07		
Sat Flow, veh/h	1762	1530	1727	1762	1506	1344		
Grp Volume(v), veh/h	489	38	103	505	76	6		
Grp Sat Flow(s),veh/h/ln	1762	1530	1727	1762	1506	1344		
Q Serve(g_s), s	11.2	0.7	1.5	7.2	3.9	0.3		
Cycle Q Clear(g_c), s	11.2	0.7	1.5	7.2	3.9	0.3		
Prop In Lane		1.00	1.00		1.00	1.00		
Lane Grp Cap(c), veh/h	1120	972	657	1368	110	99		
V/C Ratio(X)	0.44	0.04	0.16	0.37	0.69	0.06		
Avail Cap(c_a), veh/h	1120	972	672	1368	452	403		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00		
Uniform Delay (d), s/veh	7.4	5.4	4.4	2.8	36.2	34.5		
Incr Delay (d2), s/veh	1.2	0.1	0.1	0.8	7.4	0.3		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	5.8	0.3	0.7	3.7	1.9	0.1		
LnGrp Delay(d),s/veh	8.6	5.5	4.5	3.6	43.5	34.8		
LnGrp LOS	A	A	A	A	D	C		
Approach Vol, veh/h	527			608	82			
Approach Delay, s/veh	8.4			3.7	42.9			
Approach LOS	A			A	D			
Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	11.3	57.8		10.9		69.1		
Change Period (Y+Rc), s	5.0	7.0		5.0		7.0		
Max Green Setting (Gmax), s	7.0	32.0		24.0		44.0		
Max Q Clear Time (g_c+I1), s	3.5	13.2		5.9		9.2		
Green Ext Time (p_c), s	0.1	2.8		0.2		3.1		
<b>Intersection Summary</b>								
HCM 2010 Ctrl Delay			8.4					
HCM 2010 LOS			A					

HCM 2010 TWSC  
 2: Palmer Moose Dr & Bogard Rd, 2045 Build PM

Intersection												
Int Delay, s/veh	1.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↙	↑	↗	↙	↑	↗		↕			↕	
Traffic Vol, veh/h	10	470	15	15	545	5	10	5	15	5	1	5
Future Vol, veh/h	10	470	15	15	545	5	10	5	15	5	1	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	325	-	325	250	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	81	81	81	81	81	81	81	81	81	81	81	81
Heavy Vehicles, %	2	5	2	2	5	2	13	2	13	2	2	2
Mvmt Flow	12	580	19	19	673	6	12	6	19	6	1	6

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	679	0	0	599	0	0	1322	1321	580	1340	1337	676
Stage 1	-	-	-	-	-	-	604	604	-	714	714	-
Stage 2	-	-	-	-	-	-	718	717	-	626	623	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.23	6.52	6.33	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.23	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.23	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.617	4.018	3.417	3.518	4.018	3.318
Pot Cap-1 Maneuver	913	-	-	978	-	-	126	157	494	130	153	453
Stage 1	-	-	-	-	-	-	467	488	-	422	435	-
Stage 2	-	-	-	-	-	-	403	434	-	472	478	-
Platoon blocked, %		-	-	-	-	-						
Mov Cap-1 Maneuver	913	-	-	978	-	-	120	152	494	118	148	453
Mov Cap-2 Maneuver	-	-	-	-	-	-	120	152	-	118	148	-
Stage 1	-	-	-	-	-	-	461	482	-	417	427	-
Stage 2	-	-	-	-	-	-	389	426	-	443	472	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.2			0.2			26.4			26.2		
HCM LOS							D			D		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	205	913	-	-	978	-	-	183
HCM Lane V/C Ratio	0.181	0.014	-	-	0.019	-	-	0.074
HCM Control Delay (s)	26.4	9	-	-	8.8	-	-	26.2
HCM Lane LOS	D	A	-	-	A	-	-	D
HCM 95th %tile Q(veh)	0.6	0	-	-	0.1	-	-	0.2

HCM 2010 TWSC  
 3: Hemmer Rd & Palmer Moose Dr, 2045 Build PM

Intersection												
Int Delay, s/veh	1.8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	1	1	1	15	1	15	2	120	10	25	110	1
Future Vol, veh/h	1	1	1	15	1	15	2	120	10	25	110	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	83	83	83	83	83	83	83	83	83	83	83	83
Heavy Vehicles, %	2	2	2	3	2	2	2	17	3	2	17	2
Mvmt Flow	1	1	1	18	1	18	2	145	12	30	133	1

Major/Minor	Minor2		Minor1			Major1		Major2				
Conflicting Flow All	359	355	134	350	349	151	134	0	0	157	0	0
Stage 1	194	194	-	155	155	-	-	-	-	-	-	-
Stage 2	165	161	-	195	194	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.13	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.13	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.13	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.527	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	596	571	915	603	575	895	1451	-	-	1423	-	-
Stage 1	808	740	-	845	769	-	-	-	-	-	-	-
Stage 2	837	765	-	804	740	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	572	557	915	590	561	895	1451	-	-	1423	-	-
Mov Cap-2 Maneuver	572	557	-	590	561	-	-	-	-	-	-	-
Stage 1	806	723	-	843	767	-	-	-	-	-	-	-
Stage 2	817	763	-	783	723	-	-	-	-	-	-	-

Approach	EB		WB			NB		SB		
HCM Control Delay, s	10.6		10.4			0.1		1.4		
HCM LOS	B		B							

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1451	-	-	647	705	1423	-	-
HCM Lane V/C Ratio	0.002	-	-	0.006	0.053	0.021	-	-
HCM Control Delay (s)	7.5	0	-	10.6	10.4	7.6	0	-
HCM Lane LOS	A	A	-	B	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0.2	0.1	-	-

HCM 2010 TWSC  
 4: Hemmer Rd & Driveway, 2045 Build PM

Intersection						
Int Delay, s/veh	0.6					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W		T			T
Traffic Vol, veh/h	10	2	135	5	5	120
Future Vol, veh/h	10	2	135	5	5	120
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	86	86	86	86	86	86
Heavy Vehicles, %	2	2	17	2	2	17
Mvmt Flow	12	2	157	6	6	140

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	312	160	0	0	163	0
Stage 1	160	-	-	-	-	-
Stage 2	152	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	681	885	-	-	1416	-
Stage 1	869	-	-	-	-	-
Stage 2	876	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	678	885	-	-	1416	-
Mov Cap-2 Maneuver	678	-	-	-	-	-
Stage 1	869	-	-	-	-	-
Stage 2	872	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.2	0	0.3
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	706	1416
HCM Lane V/C Ratio	-	-	0.02	0.004
HCM Control Delay (s)	-	-	10.2	7.6
HCM Lane LOS	-	-	B	A
HCM 95th %tile Q(veh)	-	-	0.1	0

## Queues

### 5: Hemmer Rd & Palmer-Wasilla Hwy, 2045 Build PM



Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	11	961	38	1143	143	11	79	126	13
v/c Ratio	0.08	0.82	0.15	0.93	0.14	0.05	0.37	0.73	0.06
Control Delay	7.9	27.8	7.7	35.2	4.8	44.1	16.1	77.1	26.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.9	27.8	7.7	35.2	4.8	44.1	16.1	77.1	26.2
Queue Length 50th (ft)	2	551	6	576	10	9	2	~118	2
Queue Length 95th (ft)	10	#1154	24	#1513	53	25	50	160	23
Internal Link Dist (ft)		848		933			281		173
Turn Bay Length (ft)	300		125		125			100	
Base Capacity (vph)	144	1168	250	1227	1050	238	318	173	240
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.08	0.82	0.15	0.93	0.14	0.05	0.25	0.73	0.05

#### Intersection Summary






















~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

HCM 2010 Signalized Intersection Summary  
 5: Hemmer Rd & Palmer-Wasilla Hwy, 2045 Build PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	870	5	35	1040	130	10	2	70	115	2	10
Future Volume (veh/h)	10	870	5	35	1040	130	10	2	70	115	2	10
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	0.96		0.94	0.94		0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1814	1746	1850	1814	1745	1814	1814	1814	1850	1581	1613	1850
Adj Flow Rate, veh/h	11	956	5	38	1143	113	11	2	9	126	2	2
Adj No. of Lanes	1	1	0	1	1	1	1	1	0	1	1	0
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	6	2	2	6	2	2	2	2	17	2	17
Cap, veh/h	142	1185	6	286	1228	1077	224	22	97	205	79	79
Arrive On Green	0.02	0.68	0.68	0.04	0.70	0.70	0.02	0.08	0.08	0.05	0.11	0.11
Sat Flow, veh/h	1727	1735	9	1727	1745	1531	1727	273	1227	1506	722	722
Grp Volume(v), veh/h	11	0	961	38	1143	113	11	0	11	126	0	4
Grp Sat Flow(s),veh/h/ln	1727	0	1744	1727	1745	1531	1727	0	1500	1506	0	1445
Q Serve(g_s), s	0.3	0.0	56.4	0.9	81.5	3.4	0.8	0.0	1.0	7.0	0.0	0.4
Cycle Q Clear(g_c), s	0.3	0.0	56.4	0.9	81.5	3.4	0.8	0.0	1.0	7.0	0.0	0.4
Prop In Lane	1.00		0.01	1.00		1.00	1.00		0.82	1.00		0.50
Lane Grp Cap(c), veh/h	142	0	1192	286	1228	1077	224	0	118	205	0	159
V/C Ratio(X)	0.08	0.00	0.81	0.13	0.93	0.10	0.05	0.00	0.09	0.61	0.00	0.03
Avail Cap(c_a), veh/h	195	0	1192	305	1228	1077	277	0	259	205	0	249
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	29.2	0.0	16.2	17.5	18.4	6.9	55.6	0.0	62.0	60.9	0.0	57.6
Incr Delay (d2), s/veh	0.2	0.0	5.9	0.2	13.7	0.2	0.1	0.0	0.3	5.4	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.0	28.9	0.6	43.4	1.5	0.4	0.0	0.4	4.9	0.0	0.1
LnGrp Delay(d),s/veh	29.4	0.0	22.1	17.7	32.1	7.1	55.7	0.0	62.3	66.3	0.0	57.7
LnGrp LOS	C		C	B	C	A	E		E	E		E
Approach Vol, veh/h		972			1294			22				130
Approach Delay, s/veh		22.2			29.5			59.0				66.1
Approach LOS		C			C			E				E
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	10.5	106.1	12.0	16.4	7.5	109.1	7.5	20.9				
Change Period (Y+Rc), s	5.0	7.0	5.0	5.0	5.0	7.0	5.0	5.0				
Max Green Setting (Gmax), s	7.0	84.0	7.0	25.0	7.0	84.0	7.0	25.0				
Max Q Clear Time (g_c+I1), s	2.9	58.4	9.0	3.0	2.3	83.5	2.8	2.4				
Green Ext Time (p_c), s	0.0	7.7	0.0	0.0	0.0	0.4	0.0	0.0				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay			28.8									
HCM 2010 LOS			C									

HCM 2010 TWSC  
 6: Hemmer Rd & Folsom Drive, 2045 Build PM

Intersection						
Int Delay, s/veh	1					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	T		T		T	
Traffic Vol, veh/h	10	10	15	105	140	15
Future Vol, veh/h	10	10	15	105	140	15
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	11	11	16	114	152	16

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	306	160	168	0	-	0
Stage 1	160	-	-	-	-	-
Stage 2	146	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	686	885	1410	-	-	-
Stage 1	869	-	-	-	-	-
Stage 2	881	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	678	885	1410	-	-	-
Mov Cap-2 Maneuver	678	-	-	-	-	-
Stage 1	859	-	-	-	-	-
Stage 2	881	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.8	0.9	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1410	-	768	-	-
HCM Lane V/C Ratio	0.012	-	0.028	-	-
HCM Control Delay (s)	7.6	0	9.8	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-