HEMMER ROAD EXTENSION AND UPGRADE, PALMER-WASILLA HIGHWAY TO BOGARD ROAD

Project No.: 0001(743)/CFHWY00885

DESIGN STUDY REPORT

ALASKA
DEPARTMENT OF TRANSPORTATION
AND PUBLIC FACILITIES

PREPARED BY: DOT&PF Central Region – Design and Construction
4111 Aviation Avenue
Anchorage, AK 99502

March 2025

Revised May 2019

ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
DESIGN AND ENGINEERING SERVICES – CENTRAL REGION

DESIGN STUDY REPORT

For

Hemmer Road Extension and Upgrade, Palmer-Wasilla Highway to Bogard Road

Project No.: 0001(743)/CFHWY00885

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Approved:

_____

Luke S. Bowland, P.E. Date
Preconstruction Engineer

NOTICE TO USERS

This report reflects the thinking and design decisions at the time of publication. Changes frequently occur during the evolution of the design process, so persons who may rely on information contained in this document should check with the Alaska Department of Transportation and Public Facilities for the most current design. Contact the Design Project Manager, Chris Bentz, at 907-269-0652 for this information.

PLANNING CONSISTENCY

This document has been prepared by the Alaska Department of Transportation and Public Facilities according to currently acceptable design standards and Federal regulations, and with the input offered by the local government and public. The department's Planning Section has reviewed and approved this report as being consistent with present community planning.

CERTIFICATION

The Alaska Department of Transportation and Public Facilities hereby certify that this document was prepared in accordance with Section 520.4.1 of the current edition of the department's Highway Preconstruction Manual and CFR Title 23, Highway Section 771.111(h).

The department has considered the project's social and economic effects upon the community, its impacts on the environment and its consistency with planning goals and objectives as approved by the local community. All records are on file with Central Region - Design and Engineering Services Division, Highway Design Section, 4111 Aviation Avenue, Anchorage, AK 99502.

Luke S. Bowland, P.E. Preconstruction Engineer	Date	Todd Vanhove Chief, Planning	Date

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LIST OF ACRONYMS

AADT	Annual Average Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
ADA	Americans with Disabilities Act
AHDM	Alaska Highway Drainage Manual
ANSI	American National Standards Institute
APDES	Alaska Pollutant Discharge Elimination System
ATM	Alaska Traffic Manual
ATMS	Alaska Traffic Manual Supplement
BMP	Best Management Practice
CFR	Code of Federal Regulations
CGP	Alaska Construction General Permit
DEC	Alaska Department of Environmental Conservation
DOT	U.S. Department of Transportation
DOT&PF	Alaska Department of Transportation and Public Facilities
DOJ	U.S. Department of Justice
ESCP	Erosion and Sediment Control Plan
EPA	Environmental Protection Agency
FHWA	Federal Highway Administration
HMA	Hot Mix Asphalt
HPCM	Alaska Highway Preconstruction Manual
HMCP	Hazardous Material Control Plan
HSIP	Highway Safety Improvement Program
LOS	Level of Service
MADT	Monthly Average Daily Traffic
MEA	Matanuska Electric Association
MTA	Matanuska Telephone Association
MPH	Miles per Hour
MS4	Municipal Separate Storm Sewer Systems
MSB	Matanuska-Susitna Borough
MUTCD	Manual on Uniform Traffic Control Devices
NPDES	National Pollutant Discharge Elimination System
PGDHS	A Policy on Geometric Design of Highways and Streets
PIP	Public Information Plan
PROWAG	Proposed Accessibility Standards for Pedestrian Facilities in the Public Right-of-Way
PWH	Palmer-Wasilla Highway
RDG	Roadside Design Guide
ROW	Right-of-Way
SWMM	Storm Water Management Model
SWPPP	Storm Water Pollution Prevention Plan
TMP	Traffic Management Plan
TOP	Transportation Operations Plan
TRB	Transportation Research Board
USGS	United States Geological Survey

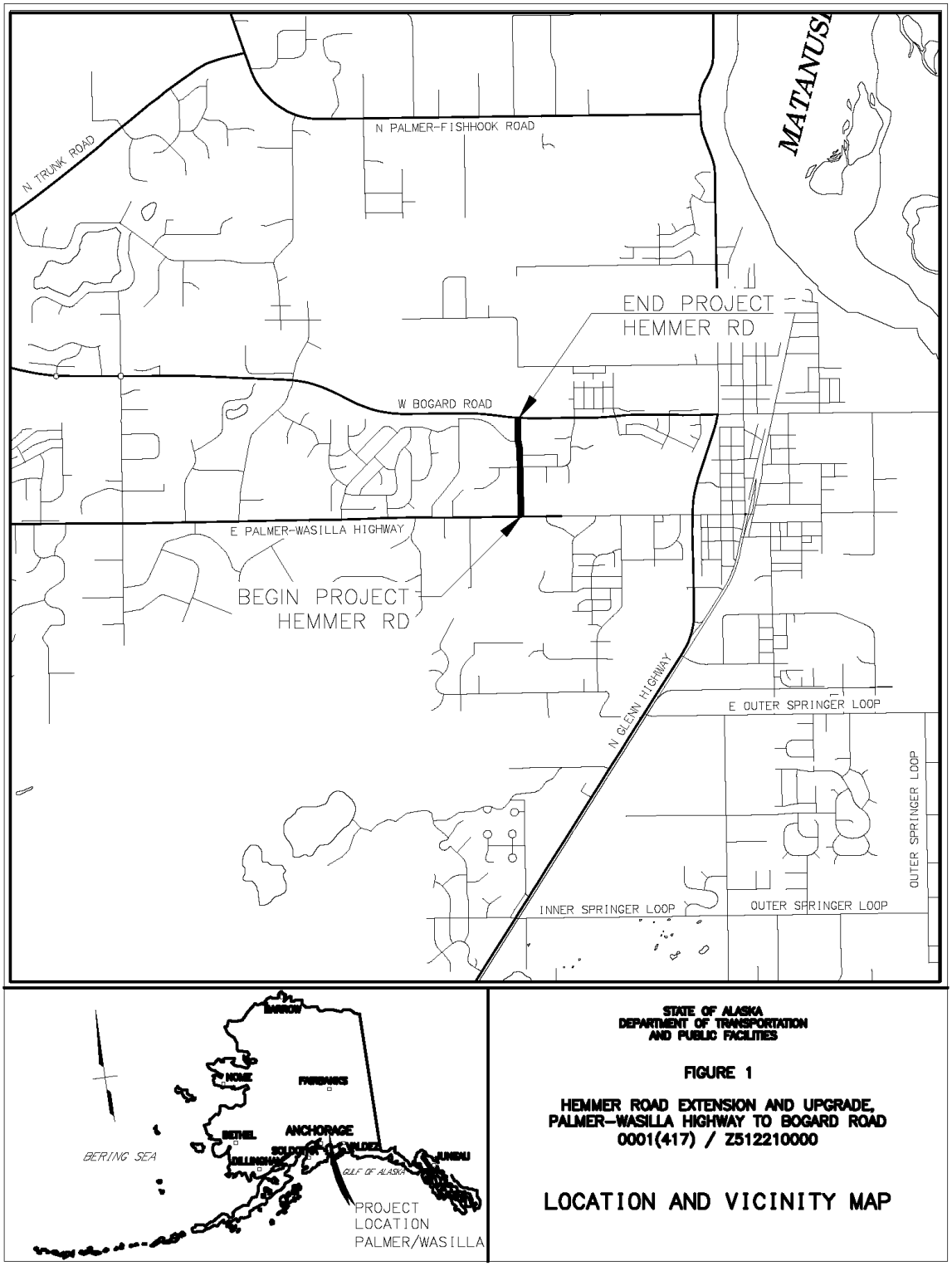

Figure 1 Location and Vicinity Map

1.0 PROJECT DESCRIPTION

1.1 Project Location and Description

The Alaska Department of Transportation and Public Facilities (DOT&PF) in cooperation with the Federal Highway Administration (FHWA), is proposing to reconstruct and extend Hemmer Road from its intersection with Palmer-Wasilla Highway (PWH) north to Bogard Road. The existing portions of Hemmer Road are owned and maintained by the Matanuska-Susitna Borough (MSB) and will remain under the ownership of the MSB post-construction. This connection/extension project was originally a Matanuska-Susitna Borough project but was nominated to the DOT&PF Community Transportation Program (CTP) by the MSB in 2019. The project is located in Sections 31 and 32, Township 18 North, Range 2 East, of the Seward Meridian; 61.603 Latitude, -149.1485 Longitude. See Figure 1 for the location and vicinity map.

This project will reconstruct the existing portions of Hemmer Road between the PWH and Bogard intersections and construct a new segment between E Chalet Drive and E Folsom Drive, providing a new north-south road connection between the PWH and Bogard Road. The roadway is proposed to consist of a two-lane section with turn pockets and a designated multi-use pathway along the east side of the roadway. Work also includes improving ditching and drainage, addition of signalization at the Bogard intersection, ADA improvements at curb ramps, utility relocations, and signage and striping.

1.2 Existing Facilities and Land Use

Land use in the vicinity of the project is mixed consisting of a variety of single family residential, multifamily residential, and community facilities including a church, medical offices, and industrial and retail commercial facilities.

N Hemmer Road currently consists of two existing road segments that do not connect. The existing portions of N Hemmer Road extend from E Maple Springs Way (south of the Palmer Wasilla Highway) north to E Chalet Drive, and from E Folsom Drive northward to Bogard Road. The existing southern portion from Maple Springs to PWH is paved and varies in width from 22-36 feet. From the PWH intersection north, Hemmer Road consists of a two-lane paved roadway averaging 36 feet in width, terminating 1,200 feet north at its intersection with Palmer Moose Drive/Chalet Drive. The road continues, unpaved and approximately 20-feet wide, northward 600 feet to intersect Chalet Drive from the east. Chalet Drive is also unpaved and provides access to several single-family homes east of the corridor. An unpaved driveway extends northward from Chalet Drive to provide access to one single family home on the east side of the corridor and a few outbuildings on the west side of the corridor (located directly south of Folsom Road), terminating before reaching the northern segment of North Hemmer Road. From its intersection with Bogard, North Hemmer Road extends southward for 600 feet, terminating at the intersection with Folsom Drive, a short distance before intercepting the driveway serving the outbuildings mentioned above.

Hemmer Road is classified as a minor collector from its intersection with the PWH northward to its intersection with Palmer Moose/Quil. The portions of Hemmer Road between Maple Springs Way and PWH; Palmer Moose northward to Chalet; and Folsom northward to Bogard, are currently classified as local roads. Palmer Moose Drive is classified as a minor collector while Maple Springs Way, Quil, Chalet, and Folsom are classified as local streets. Bogard Road and the Palmer Wasilla Highway (PWH) are both classified as arterials (minor and principle, respectively) and provide major east-west connections within the MSB and between the cities of Palmer and Wasilla.

The existing intersection of Hemmer Road and Palmer-Wasilla Highway is signalized with left turn pockets on all four legs. The intersections of Hemmer Road with Maple Springs, Palmer Moose/Quil, Chalet, and Folsom, are stop controlled on the minor streets. The intersection of Hemmer Road and Bogard is plumbed for a signal with poles in place but has not been activated, thus functions as a stop-control intersection on the minor leg (i.e. N Hemmer Road).

Existing pedestrian facilities along Hemmer Road consist of a separated 6-foot-wide paved pathway along the east side of the road from PWH to Palmer Moose Drive, where it connects to a separated pathway along Palmer Moose Drive. No pathway exists on Hemmer Road north of this point and therefore the pathway on Palmer Moose Drive currently functions as a circuitous north-south connector between PWH and Bogard road in addition to providing access to Palmer High School.

Existing utilities within the proposed project area include:
- Matanuska Electric Association (MEA) overhead and underground electric.
- Matanuska Telephone Association (MTA) underground telecommunications, coaxial underground cable.
- ENSTAR Natural Gas Company underground 6-inch gas transmission main, 4-inch distribution gas main, 2-inch gas distribution main and several gas service lines.
- City of Palmer Water Facilities underground water main and fire hydrant.

In general, these utilities are located along the west side of the corridor and cross the roadway at several locations. The City of Palmer water main is located within the project limits on the north end of the project only, at the Hemmer/Bogard road intersection. This consists of a 12-inch mainline along the north side of Bogard Road with a hydrant and mainline stub located in the southeast quadrant of the North Hemmer/Bogard intersection. Illumination exists at the PWH intersection, Bogard Road intersection, and Palmer Moose Drive intersection.

Additionally, two public water systems are located within the project area: Palmer Family Church of the Nazarene, PWSID# 227432; and Hemmer Building, PWSID# 227643.

1.3 Purpose and Need

The purpose of the project is to extend and upgrade Hemmer Road to provide a new north-south road between the Palmer-Wasilla Highway and Bogard Road. There currently exists only one north-south connection constructed to collector road standards in the four mile stretch between the Glenn Highway and Trunk Road leading to congestion and a lack of north-south connectivity.

2.0 DESIGN STANDARDS AND GUIDELINES

Design standards and guidelines that apply to the Hemmer Road Extension and Upgrade, Palmer-Wasilla Highway to Bogard Road Project, are contained in the following publications:

Standards:

- A Policy on Geometric Design of Highways and Streets (PGDHS), 7th Edition, AASHTO, 2018.
- Roadside Design Guide (RDG), 4th Edition, AASHTO, 2011.
- Alaska Highway Preconstruction Manual (HPCM), DOT&PF, 2023 as amended.
- Alaska Highway Drainage Manual (AHDM), DOT&PF, 2006.

- The Alaska Traffic Manual (ATM), consisting of the Manual on Uniform Traffic Control Devices (MUTCD), 2009 as amended, U.S. DOT, FHWA) and the Alaska Traffic Manual Supplement (ATMS), DOT&PF, 2016.
- ADA Standards for Transportation Facilities, DOT, 2006.
- ADA Standards for Accessible Design, DOJ, 2010.
- Guide for the Development of Bicycle Facilities, 4th Edition, AASHTO, 2012.
- Highway Capacity Manual (HCM), 5th Edition, TRB, 2010.
- Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT ≤ 400), AASHTO, 2001.

Guidelines:

- Proposed Accessibility Standards for Pedestrian Facilities in the Public Right-of-Way (PROWAG), U.S. Access Board, 2011.
- Guide for the Planning, Design, and Operation of Pedestrian Facilities, 1st Edition, AASHTO, 2004.

Appendix A contains the project Design Criteria and Design Designation.

3.0 DISCUSSION OF ALTERNATIVES

Prior to this project being nominated to the CTP, planning level investigations into design alternatives were conducted by the Matanuska-Susitna Borough. Long-range planning efforts by the Matanuska-Susitna Borough include proposals for future build-out of Hemmer Road to link the Glenn Highway to Palmer-Fishhook Road, alleviating higher traffic volumes based on growth projections for the Core Area. As this project is a segment of this future planned linkage, the MSB considered either a two-lane, a three-lane, or a five-lane urban section. Based on traffic modeling conducted as a part of this project, a two- or three-lane section was determined to be sufficient for projected AADT at the project design year. Pedestrian use was also considered when comparing the lane alternatives; a two-lane section provides more crossing opportunities for pedestrians due to a narrower roadway width. As a result of this analysis and to minimize ROW impacts and construction and maintenance costs, a two-lane section was selected for further consideration. Therefore, the alternatives presented here include variations on a two-lane section, and a 'No Build' alternative.

3.1 First Alternative

The first alternative is the No-Build alternative. Leaving Hemmer Road as-is would not address the need for an additional north/south connection or alleviate localized traffic congestion and therefore would not fulfill the purpose of this project. This alternative would not have any ROW or construction costs, or environmental impacts in the project area.

3.2 Second Alternative

The second alternative consists of a 2-lane urban roadway section with turn pockets and multi-use sidewalk facilities along both sides. This alternative includes a storm sewer system for collection and conveyance of stormwater and allows the existing signalized intersection configurations to remain.

3.3 Third Alternative

This alternative consists of a 2-lane rural roadway section with separated pedestrian facilities along the east side of the corridor. As this alternative includes ditching rather than a curb and gutter stormwater system, the footprint of the roadway and drainage structures is larger than that of the second alternative. In order to keep the project within the same ROW footprint as the second alternative, pathway is provided on only the east side of the corridor. This alternative also allows the existing signalized intersection configurations to remain.

4.0 PREFERRED ALTERNATIVE

The preferred alternative is the third alternative.

This alternative is adequate for the current and projected traffic volumes and will fulfill the project objectives of providing a link between PWH and Bogard Road and alleviating traffic congestion while also minimizing impacts to adjoining properties and providing improved pedestrian accommodation.

During public involvement efforts, participants voiced support for a separated pathway featured in the third alternative rather than a connected pathway/sidewalk featured in the second alternative, due to comfortability associated with greater separation from the travel lane and perceived increased safety. The MSB as future owner of the new facility has voiced support of the third alternative due to decreased maintenance efforts of a rural section with ditches as compared to an urban section with curb and gutter.

The first alternative was eliminated because it does not advance the project goals of providing increased access and connectivity to this area.

5.0 TYPICAL SECTIONS

The typical section along the proposed Hemmer Road extension includes a 12-foot lane and 4-foot shoulder in each direction, with multi-use pathway on the east side of the corridor. Left-hand turn pockets will be included at the intersections of Hemmer Road with Bogard Road and PWH; turn lane width will be 12-foot. A rural section with ditch and separated pathway is proposed for the corridor, with a few exceptions where ROW or grade constraints exist. A minimum clear zone of 14-feet from edge of travel way will be maintained along Hemmer Road. Fore and fill slopes will be constructed at 4:1 with cut back slopes at 2:1.

The pathway will be 10 foot wide with 2-foot shoulders and separated except for where curb and gutter sections occur. The new pathway will tie into the existing ADA crossings and pathway at the Hemmer/Palmer Wasilla Highway and Hemmer/Bogard Road intersections, thereby providing a continuous multi-use link between the existing Palmer Wasilla Highway and Bogard Road pathways. Fore and fill slopes off the pathway will vary.

To match existing conditions, the typical section for the tie-in to Palmer Moose Drive will include 12-foot lanes and 6-foot shoulders with an 8-foot separated pathway. A mailbox pullout on Hemmer Road is being relocated onto Palmer Moose Drive and will taper out to 12 feet from edge of travel way for a distance of 50 feet.

The typical sections for tie-ins to E. Quil Avenue, E. Chalet Drive, and E. Folsom Drive are proposed to include 12-foot lanes, no shoulders, and 4:1 foreslopes.

The typical sections are provided in Appendix B.

6.0 HORIZONTAL AND VERTICAL ALIGNMENT

6.1 Horizontal Alignment

The existing portions of Hemmer Road are posted at 35 mph. The design speed for this project was selected based on the Matanuska-Susitna Boroughs Core Area Comprehensive Plan (2007 Update), which lists a design speed of 40 mph.

6.2 Vertical Alignment

The proposed finished grade elevation of Hemmer Road is largely controlled by the elevations of the existing intersections, particularly Bogard Road and PWH. The profile of the reconstructed roadway will largely match the existing Hemmer Road profile, varying between 0.57% and 1.33%. The profile will reach a maximum grade of 5% where the two existing portions of Hemmer Road are connected by the new extension.

7.0 EROSION AND SEDIMENT CONTROL

The project includes temporary and permanent measures to control or prevent erosion and sedimentation during and after construction. The contractor will prepare a Storm Water Pollution Prevention Plan (SWPPP) prior to construction that conforms to the DOT&PF Best Management Practices (BMPs) for Erosion and Sediment Control in accordance with the DOT&PF contract specifications and following the guidelines of the Erosion and Sediment Control Plan (ESCP) provided to the contractor. The contractor will submit the SWPPP for approval by the Construction Project Engineer. The contractor will conduct construction activities in accordance with the approved SWPPP. Appropriate erosion and siltation controls will be used and maintained in optimal condition during construction and all other exposed soils/fills will be permanently stabilized. Temporary BMP's will remain in place until permanent erosion and sediment control measures are in place and soil is permanently stabilized.

8.0 DRAINAGE

The global topography of the project area is generally north to south. Stormwater in the project area infiltrates or flows south along ditches on both sides of Hemmer Road. Culverts beneath the approach roads facilitate southward flow of drainage along the west and east ditch lines. A natural low area on the west side of the corridor opposite Chalet Drive appears to capture runoff from the area including the northern portion of the corridor. Runoff on the southern half of the project appears to collect in the ditches and run westward in a large ditch on the north side of PWH into a low area on an adjoining undeveloped parcel west of the project boundary. There are no known wetlands within the project limits.

The new stormwater drainage system will consist of both deep ditches and storm drain culverts to transport runoff to an infiltration basin near the south end of the project, with an overflow pipe crossing the Hemmer/PWH intersection to outlet in the existing ditch along the Hemmer Road South. This project is expected to produce minimal or negligible impacts to the current runoff volumes. All culverts through the project corridor will be replaced in kind or with storm drain infrastructure.

9.0 SOIL CONDITIONS

A preliminary geotechnical report was developed by Central Region Materials section in August of 2024 based on subsurface investigations completed in May of 2024. Soils were found to range from organics to gravel, with the existing structural section consisting of sands and gravel with silt w/sand below. Bore logs from the proposed extension segment of the project showed organics and soil to an average depth of 5.8' below ground surface (7.5' max) and sand w/gravel beneath. Groundwater was encountered in three of the eleven testholes, ranging from 8' to 15.5' below ground surface. No material source investigations were performed as a part of this project.

10.0 ACCESS CONTROL FEATURES

No new accesses will be added to Hemmer Road as a part of this project with the exception of new access road for the proposed infiltration basin. Access to the infiltration basin will be restricted.

Two properties, a commercial and a residential, will have their driveways relocated from Hemmer Road to Chalet Drive. Two adjoining properties on Hemmer Road will have their driveways combined onto an existing shared access easement. One existing driveway on Quil Avenue will be shifted westward due to proximity to the intersection with Hemmer Road.

Additional access to Hemmer Road will be managed through driveway permits and future project evaluation.

11.0 TRAFFIC ANALYSIS

Kinney Engineering, LLC, performed a traffic analysis of this corridor, included in Appendix C, in order to evaluate the build alternative needed for the road extension.

Future volumes were forecasted used projections of current volume growth rates. 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 49th State Street, Felton Street, Trunk Road, and the Glenn Highway, with some traffic from each of these roads being redirected to Hemmer Road. Table 1 presents the forecasted build volumes for the 2025 construction, 2035 mid-life, and 2045 design years.

Table 1: Forecasted Build AADTs

Segment	Extents	2021	2025	2035	2045
Hemmer Rd	Palmer-Wasilla Hwy to Palmer Moose Dr	1000	2800	3150	3600
Hemmer Rd	Palmer Moose Dr to Bogard Rd	-	2600	2950	3300
Bogard Rd	49th State St to Glenn Hwy	6500	7000	9000	11,250
Palmer Moose Dr	Hemmer Rd to Bogard Rd	900	700	800	900
Palmer-Wasilla Hwy	49th 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
Folsom Dr	Hemmer Rd to Monte Vista Dr	500	500	550	650

Given the forecasted build volumes for this segment of the corridor, either a 3-lane or a 2-lane section was found to serve the expected volumes. However, an analysis of turning movements at the unsignalized intersections within the corridor show that a two-way-left-turn-lane (TWLTL) would not be needed operationally to accommodate the projected traffic. A 3-lane section is projected to adversely impact opportunities for pedestrian mid-block crossings, as without a median refuge island, larger (and less frequent) gaps in traffic would be needed for pedestrians to safely traverse the additional 16-foot center TWLTL.

12.0 SAFETY IMPROVEMENTS

This project will establish clear zones, lane and shoulder widths, roadway cross-slopes, minimum horizontal radii, vertical curvature, superelevation, and sight distance requirements stipulated by the PGDHS and HPCM. Drainage improvements including cross slope, ditch establishment, and culverts will address the potential for ponding on the roadway or roadway embankment overtopping. Resurfacing the roadway will increase driver safety by eliminating ruts and cracking of current asphalt. New signing and striping will also meet current design standards for crashworthiness, reflectivity, etc. along the roadway. Activation of the signalization at the Bogard/Hemmer intersection will provide improved accessibility for vehicular traffic turning onto or off Hemmer Road as well as for pedestrian traffic using the intersection. The design will include a lengthened turn pocket on Hemmer Road for south-bound traffic turning left (east) onto the Palmer Wasilla Highway (PWH), to accommodate additional vehicle storage at this intersection.

As part of this project, conflict points along Hemmer Road will be reduced as several driveways will be relocated onto side streets and/or combined. Driveways will be adjusted to meet current standards for spacing, width, and radii. Similarly, the mailbox pullout currently located on the east side of the Hemmer Road corridor directly north of the PWH intersection is being relocated onto Palmer Moose Drive. This is in accordance with MSB stipulations to locate mailbox pullouts on minor streets and spacing from intersections and driveways.

Safety improvements for pedestrian and other non-motorized users will also be included in this project. A designated pedestrian/share-use pathway currently only exists along the segment of Hemmer Road from the PWH intersection to Palmer Moose Drive. This project will include reconstruction and widening of this portion of the pathway and extend it northward to Bogard Road, linking to existing pathway along the Bogard Road corridor. This will provide a direct pedestrian/shared-use connection between Bogard Road and the PWH and creating a loop with existing pathway along Palmer Moose Drive.

13.0 RIGHT-OF-WAY REQUIREMENTS

The Hemmer Road Extension Project will require additional ROW acquisition.

The existing right of way along the southern segment of Hemmer Road (i.e. from its intersection with Palmer Moose/Quil Avenue southward to the project limits) is largely adequate for the roadway footprint itself; however, partial strip acquisitions will be necessary to accommodate turn radii, ditching, and pathway features. Currently, portions of the separated pathway along the east side of Hemmer Road are located outside the existing right-of-way. The Table below shows a summary of the type of acquisitions proposed.

Table 2: ROW Acquisitions

Lot #	MSB Partial ID No.	Acquisition Type	Parcel Type	Impacts
1	15020	Partial	Residential	Land
2	79997	Partial	Commercial	Land
2	42498	Partial	Commercial	Land
1	23787	Partial	Commercial	Land
1	58258	Partial	Commercial	Land & Parking
TR 1	540425	Partial	Residential	Land
TR 2	540426	Partial	Residential	Land
1	52660	Partial	Residential	Land & Driveway
C22	20176	Partial	Commercial	Land & Parking

Right of way acquired along Hemmer Road will be transferred to the Matanuska-Susitna Borough upon completion of the project.

Temporary Construction Easements and Permits will be required to complete the project.

14.0 PEDESTRIAN AND BICYCLE FACILITIES

The existing pedestrian facilities consist of a 6-foot wide separated pathway on the east side of the corridor from PWH to Palmer Moose Drive, which continues east along Palmer Moose Drive, eventually connecting to Bogard road. No designated pathway currently exists north from Palmer Moose/Quil Drive intersection to Chalet, or from Bogard Road south to Folsom Dr, although the existing shoulders do provide space for pedestrian/multi-modal users. The proposed design includes a 10-foot wide shared use pathway along the east side of the corridor from PWH to Bogard Road. The pedestrian/shared-use facilities will be constructed to ADA standards and will create a direct connection between existing pedestrian/shared-use facilities on Bogard Road and the PWH as well as Palmer Moose Drive.

15.0 UTILITY RELOCATION AND COORDINATION

Utility companies with facilities in the project limits include ENSTAR Natural Gas Company, Matanuska Electric Association, Matanuska Telephone Association, GCI Communications, and City of Palmer Public Water. Utilities will require relocation, and agreements will need to be developed, at select locations throughout the project, to address the following conflicts:

15.1 General Communications Inc. (GCI)

General Communications Inc. (GCI) owns and operates telecommunication throughout the project limits. Existing infrastructure includes underground and overhead components along the Palmer Wasilla Highway and underground along the west side of the Hemmer Road corridor, terminating just north of Chalet Drive, with crossings at two locations in between. Coordination with the utility is ongoing.

15.2 Matanuska Electric Association (MEA)

Matanuska Electric Association (MEA) owns and operate both aerial and underground distribution lines throughout the project limits. Aboveground and underground lines exist at the Palmer Wasilla intersection and along the west side of the Hemmer Road corridor, with seven overhead crossings between the PWH and Folsom Road intersections. Additionally, MEA has a streetlight pole and service at the northeast quadrant of the Hemmer Road/Palmer Moose intersection. Coordination with the utility is ongoing.

15.3 Matanuska Telephone Association (MTA)

Matanuska Telephone Association (MTA) owns and operates underground communication lines throughout the project limits with two crossings within the Hemmer Road corridor. Coordination with the utility is ongoing.

15.4 ENSTAR Natural Gas Co.

ENSTAR Natural Gas owns and operates transmission and distribution facilities throughout the project limits. Existing distribution infrastructure primarily exists on the west side of the Hemmer Road corridor but crosses Hemmer Road at several locations to serve the east side of the corridor. For the segment of Hemmer Road south of the PWH, infrastructure is located solely on the east side of the corridor. Transmission lines are located along both the PWH and Bogard Road corridors running parallel to the respective roadway alignments (i.e. east to west). The PWH transmission line passes through the PWH/Hemmer Road intersection on the southern side of the intersection, while the Bogard Road transmission line passes is located on the north side of the Bogard/Hemmer intersection and lies outside the project limits. Coordination with the utility is ongoing.

15.5 City of Palmer Public Water Main

No impacts or relocations to the City of Palmer water system are anticipated as a part of this project.

16.0 PRELIMINARY WORK ZONE TRAFFIC CONTROL

The HPCM, Section 1400.2 sets forth the criteria for determining if a project is to be classified as a "Significant Project" for purposes of determining the level of effort required in developing a Traffic Management Plan (TMP). Though the project is classified as a Minor Collector, the project is not located

within the Anchorage urban area, roadway AADTs are below 30,000 vpd, and in the event of a full closure, a practical alternate route is available. Therefore, the project is not considered a "Significant Project." The TMP for this project will not require a Public Information Plan (PIP) or Traffic Operation Plan (TOP).

16.1 Traffic Control Plan (TCP)

The contractor will develop a TCP during construction to safely guide and protect the traveling public in work zones, in accordance with the Alaska Traffic Manual (ATM) and the project specification. The plan will be assessed and approved by the Construction Project Engineer and the Traffic Control Engineer.

The contractor is responsible for providing advance notice to the public, including local businesses, residents, and road travelers, of construction activities that could cause delays, detours, or affect access to adjacent properties.

16.2 Public Information Plan (PIP)

A Public Information Plan is not anticipated for this project.

16.3 Transportation Operations Plan (TOP)

A Transportation Operations Plan is not anticipated for this project.

17.0 STRUCTURAL SECTION AND PAVEMENT DESIGN

The preliminary mainline and pathway structural section design is based on recommendations provided by the DOT&PF Central Region Materials section from in-situ and laboratory testing in accordance with the Alaska Flexible Pavement Design Manual.

Mainline Hemmer Road:

- 2" HMA, Type II, Class A, PG 52-40E
- STE-1 Asphalt for Tack Coat
- 2" ATB (or HMA, Type II, Class A, PG 52-40E)
- 6" Aggregate Base Course, Grading D-1
- 36" Selected Material, Type A (NOTE: For the segment of Hemmer Road south of the PWH classified as a local road, 24" of Type A is proposed.)
- Geotextile, Separation
- Existing embankment or Selected Material, Type C, as needed in deep fills to bottom of new embankment

The section for the Palmer Wasilla Highway will be reconstructed to match existing.

- 2" HMA, Type II, Class A, PG 52-40E
- STE-1 Asphalt for Tack Coat
- 2" ATB (or HMA, Type II, Class A, PG 52-40E)
- STE-1 Asphalt for Tack Coat
- 2" ATB (or HMA, Type II, Class A, PG 52-40E)
- 2" Aggregate Base Course, Grading D-1
- Existing ground/Selected Material

Minor streets including Palmer Moose Drive, Quil Avenue, Chalet Drive, and Folsom will utilize the following section:

- 2” HMA, Type II, Class A, PG 52-40E
- 4” Aggregate Base Course, Grading D-1
- 36” Selected Material, Type A
- Existing ground/Selected Material

Separated Asphalt Pathway:

- 2” Asphalt Pathway
- 4” Aggregate Base Course, Grading D-1
- 24” (*min) Selected Material, Type A
- Geotextile, Separation
- Selected Material, Type C – as needed in deep fills to bottom of new embankment

Connected Asphalt Pathway:

- 2” Asphalt Pathway
- 6” Aggregate Base Course, Grading D-1
- 24” (*min) Selected Material, Type A
- Existing ground/Selected Material

Typical sections are shown in Appendix C.

Material sources for this project will be contractor supplied.

18.0 COST ESTIMATE

The project cost estimate is as follows:

Preliminary Engineering	$	2,000,000
Right-of-Way	$	1,120,000
Utility Relocation	$	830,000
Construction	$	9,500,000
Total	$	12,950,000

Costs reflect estimate as of the date of this report.

19.0 ENVIRONMENTAL COMMITMENTS AND CONSIDERATIONS

The proposed project does not involve any unusual circumstances or significant environmental impacts; it meets the criteria for classification as a Categorical Exclusion per 23 CFR 771.117. A Categorical Exclusion for the project was approved on April 30, 2024.

The contractor will be required to prepare and implement a Storm Water Pollution Prevention Plan (SWPPP) that conforms to the DOT&PF BMPs for Erosion and Sediment Control in accordance with the DOT&PF contract specifications. Appropriate erosion and siltation controls will be used and maintained in optimal condition during construction and all other exposed soils/fills will be permanently stabilized.

The contractor will be required to dispose of solid waste at an Alaska Department of Environmental Conservation (ADEC) approved landfill.

An Erosion and Sediment Control Plan (ESCP) will be made available to the contractor to use as guidance in developing the SWPPP.

The contractor is responsible for obtaining all necessary permits and clearances for materials sites, disposal sites, and staging areas unless DOT&PF has obtained all necessary permits. See the Environmental Document in Appendix C for project specific commitments.

20.0 BRIDGES

No bridges are within the project limits.

21.0 EXCEPTIONS TO DESIGN STANDARDS

There are no exceptions to design standards for this project.

22.0 MAINTENANCE CONSIDERATIONS

Hemmer Road is owned and maintained by the Matanuska-Susitna Borough and will remain the responsibility of the MSB post-construction. Additionally, maintenance responsibility for right-of-way acquired as a part of this project will be transferred to the Matanuska-Susitna Borough.

The project will add additional pavement surface area for snow removal, new storm drain systems, new curb and gutter, additional pathway, and a new infiltration basin. Drainage improvements are expected to increase maintenance efforts.

23.0 ITS FEATURES

No ITS elements will be incorporated into this project.

APPENDIX A

Approved Design Criteria and Design Designation

PROJECT DESIGN CRITERIA

Project Name: Hemmer Road Extension -Palmer-Wasilla Hwy to Bogard Rd – CFHWY00885

State Project No.: 00885 Federal Project No.: 1743

Functional Classification: Minor Collector Terrain: Rolling

Present ADT (2022): 740 Mid-Design ADT (2037): 1016 Design ADT (2047): 1238

DHV (%): 12.30 Trucks (%): 5.5 Directional Split (%/%): 55/45

Pavement Design Year: 2042 Pavement Design ESAL: TBD

Design Turning Vehicle: WB-67

Project Type: New Construction/Reconstruction NHS: ☐ Non-NHS: ☒

FHWA 10 CONTROLLING DESIGN CRITERIA		SOURCE	STANDARD	AS PROPOSED	WAIVER
Design Speed[1]		PGDHS (7th) 6.3.1.1	30-40 mph	40 mph	No
Lane Width	Travel	PGDHS (7th) 6.3.2.1	10-12 ft	12 ft	No
	Auxiliary	PGDHS (7th) 6.3.2.1	10-12 ft	12 ft	No
Shoulder Width	Outside	PGDHS (7th) 6.3.1.1, directs to Table 6-5 HPCM directs to PGDHS	4 ft	4 ft	No
	Inside	N/A	N/A ft	N/A ft	No
	Auxiliary	N/A	N/A ft	N/A ft	No
Horizontal Curve Radius, min		PGDHS (7th) 3.3.5 Table 3-8 HPCM Figure 1120-1, pg. 1120-3	553 ft 510 ft	553 ft	No
Superelevation Rate, e, max		PGDHS (7th) 3.3.5 Table 3-8 HPCM Figure 1120-2, pg. 1120-4	2-4% 6%	4%	No
Stopping Sight Distance (SDD), min		PGDHS (7th) 6.3.1.8 Tables 6-3 and 3-2 (interpolation from proposed max. grade) HPCM Figure 1120-1, pg. 1120-3	327 ft	327 ft	No
Grade	Min.[2]	PGDHS (7th) 6.3.1.5 HPCM Figure 1120-1	0.3% 0.3%	0.5%	No
	Max.	PGDHS (7th) 6.3.1.5 Table 6-7 HPCM Figure 1120-1	10% 8%	5%	No
Cross Slope		HPCM Figure 1130-1	2%	2%	No
Vertical Clearance: Overhead Utility (OHU), Bottom of Signal Housing (BSH)		HPCM Table 1130-1	20.5 ft (OHU) 17.5 ft (BSH)	20.5 ft	No
Design Loading Structural Capacity[1]		N/A	N/A	N/A	No

[1] On low speed roadways (<50 mph) on the NHS, only Design Speed and Design Loading Structural Capacity require a Design Exception; all other criteria require a Design Waiver. For projects off the NHS, all criteria require a Design Waiver.

[2] Minimum grade is not one of the FHWA 10 Controlling Design Criteria and will require a Design Waiver for any variance.

OTHER DESIGN CRITERIA		SOURCE	STANDARD	AS DESIGNED	WAIVER
Superelevation Transition, Δ		PGDHS (7th) 3.3.8.2.1 Table 3-16a	84	84	No
Bridge Clear-Roadway Width		N/A	N/A ft	N/A ft	No
Vertical Curvature (min)	K (crest)	PGDHS (7th) 3.4.6.2 Table 3-35	44	44	No
	K (sag)	PGDHS (7th) 3.4.6.3 Table 3-37	64	64	No
Lateral Offset to Obstruction		HPCM Table 1130-9, pg. 1130-20 RDG (4th) Chapter 10.1.3.1	5.0 ft 4-6 ft	5.0 ft	No
Surfacing Material		HPCM 1180.3.1 AKFPD Section 7.3	HMA	HMA	No
Clear Zone	Slope (fill)	HPCM Table 1130-2, pg. 1130-6 RDG (4th) Chapter 3 Table 3-1	1V:5H to 1V:4H	1V:4H	No
	Width (fill)		12-14 ft	14 ft	No
	Slope (cut)		1V:5H to 1V:4H	1V:4H	No
	Width (cut)		10-12 ft	12 ft	No
Bicycle Lane Width		N/A	N/A	N/A	No
Sidewalk/Pathway Width (Shared Use)		GDBF (4th) 5.2.1	8-14 ft	8-10 ft	No
Intersection Sight Distance, Passenger Car	Left Turn (GB Case B1)	PGDHS (7th) 9.5.3.2.1 Table 9-7	445 ft	445 ft	No
	Right Turn (GB Case B2)	PGDHS (7th) 9.5.3.2.2 Table 9-9	385 ft	385 ft	No
	Crossing (GB Case B3)	PGDHS (7th) 9.5.3.2.3 Table 9-11	385 ft	385 ft	No
Passing Sight Distance		PGDHS (7th) 6.2.1.8 Table 6-4 HPCM 1120-3 Figure 1120-1	600 ft 1470 ft	1470 ft	No
Degree of Access Control		PGDHS (7th) 7.3.8.1	Partial Access		No
Median	Treatment	PGDHS (7th) 6.3.2.4	Asphalt (no median)		No
	Width		0-4 ft	0 ft	No
Illumination		PGDHS (7th) 6.3.8 HPCM 1170-1	As necessary		No
Curb Type		PGDHS 4.7 Alaska Standard Plan	Mountable curb and gutter		No

Notes:

Proposed by: Claire L Ellis Date: 4/30/2024
Designer (Consultant or Staff)

Recommended by: Chris Bentz Date: 4/30/2024
Engineering Manager

Accepted by: _____ Date: _____
Regional Preconstruction Engineer

DESIGN DESIGNATION

State Route Number: 2361013X000 Route Name: Hemmer Rd

Project Limits: _____

State Project Number: CFHWY00885 Federal Aid Number: 1743

Project Description: Hemmer Rd Extension and Upgrade: Palmer-Wasilla Hwy to Bogard Rd

Design Functional Classification:

- [ ] Freeway
- [ ] Rural Arterial
- [ ] Urban Arterial
- [ ] Other _____
- [x] Collector, type __ Major
- [ ] Local Recreational Rd.
- [ ] Local Resource Recovery Rd.
- [ ] Rural Local Rd.
- [ ] Urban Local St.
- [ ] Local Service Rd.

Project Type:

- [x] New Construction - Reconstruction
- [ ] Preventive Maintenance (PM)
- [ ] 3R
- [ ] HSIP

Project Design Life (years): 5 [ ] 10 [ ] 20 [x] 25 [ ] 30 [ ] Other _____

Traffic Projections:

	Current Year	Construction Year	Mid - Life Year	Design Year
	2022	2027	2037	2047
2-Way AADT*	740	833	1,016	1,238
2-Way DHV	12.30%	12.30%	12.3	12.3
Peak Hour Factor	0.92	0.92	0.92	0.92
Directional Distribution	55/45	55/45	55/45	55/45
Percent Recreational Vehicles	N/A	N/A	N/A	N/A
Percent Commercial Trucks	5.5%	5.5%	5.5%	5.5%
Growth Rate (%)	2%	2%	2%	2%
ESALs	N/A	N/A	N/A	N/A
Pedestrians (Number/Day)	N/A	N/A	N/A	N/A
Bicyclists (Number/Day)	N/A	N/A	N/A	N/A

* Use AFDM Traffic Data Request Form, Figure 6.1 for pavement design. Form 6.1 is available on-line at: http://www.dot.state.ak.us/stwddes/dcsprecon/assets/pdf/other/traffic_data_req_form.pdf

Design Vehicle: WB-67

Level of Service (Urban Only): _____

Design Speed: 40 MPH

Terrain: [ ] Level [x] Rolling [ ] Mountainous

Attach intersection diagrams to this document, when appropriate.

APPROVED Keri Jachna FOR L.S. Preconstruction Engineer DATE 11/23/22

Figure 1100-1
Design Designation Form

APPENDIX B

Typical Sections

NO.	DATE	REVISION

STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
ALASKA	0001743/CFHWY00885	2027	B01	B05

DESIGNED BY ZDK
CHECKED BY CLE
DRAFTED BY ZDK

SCALE 1" =5'

DATE 2/27/2025 TIME 11:02 AM

DRAWING LOCATION
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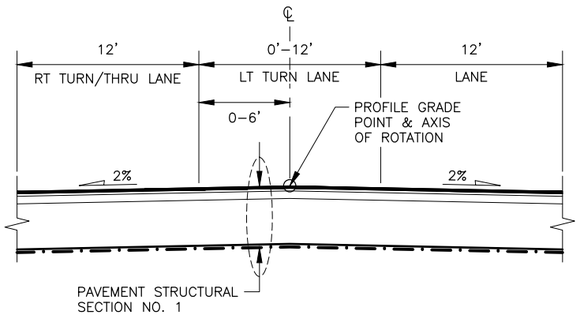
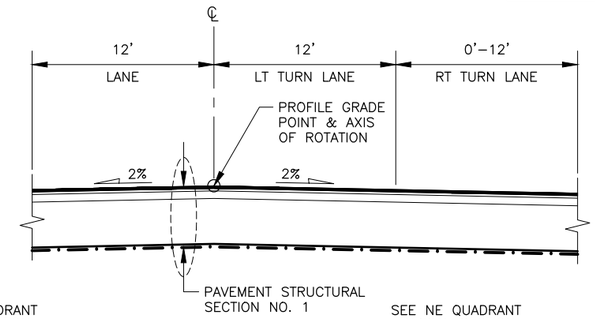


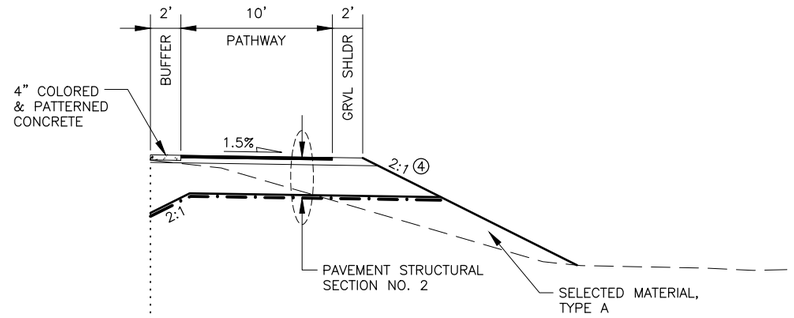
HEMMER TURN LANE WIDENING SOUTH

PALMER–WASILLA HWY TO STA. 106+50



HEMMER TURN LANE WIDENING NORTH

STA. 121+80 TO BOGARD RD

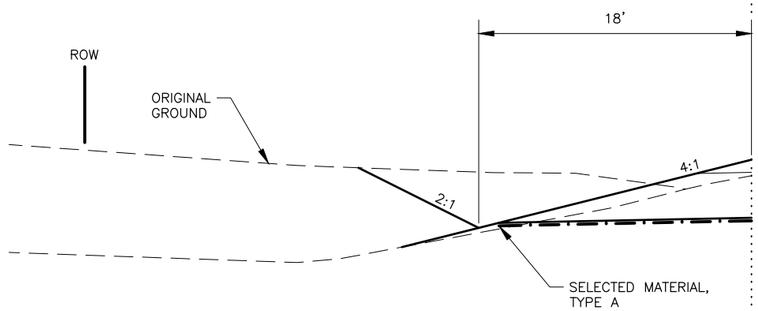


PATH ADJACENT

STA. 113+42 TO STA. 115+97
STA. 125+00 TO EOP

SEE NW QUADRANT TYPICAL SECTION B02

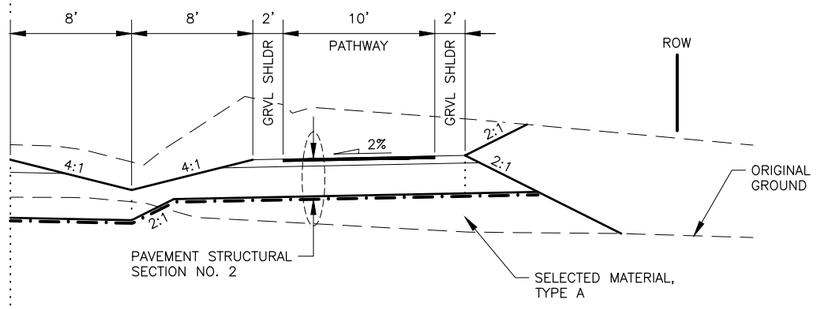
SEE NE QUADRANT TYPICAL SECTION B02



DEEPER DITCH

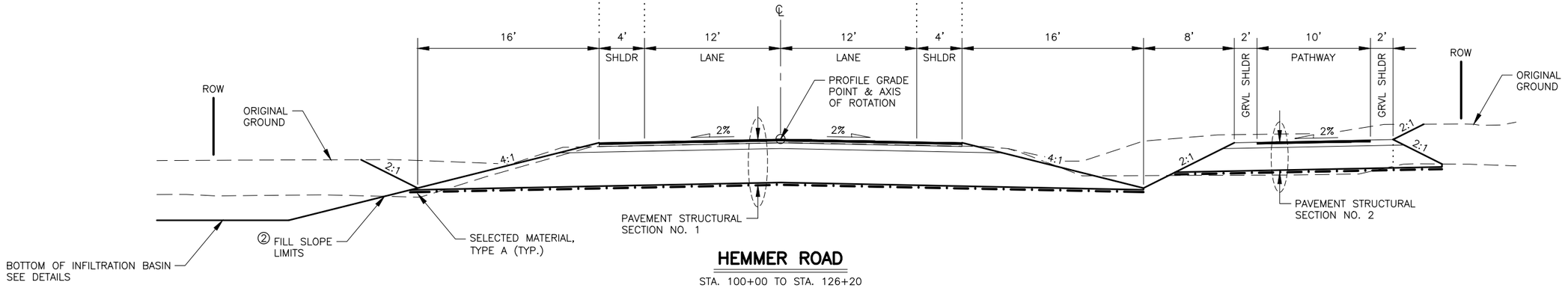
STA. 113+12 TO EOP

TURN LANE WIDENING EXTENTS



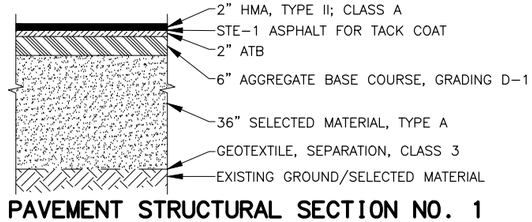
SHALLOW SWALE

STA. 116+71 TO STA. 125+00

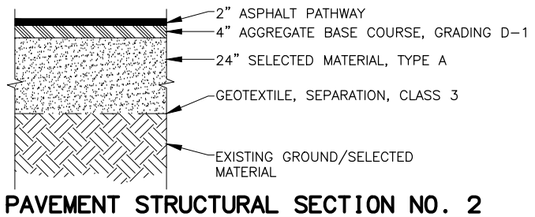


HEMMER ROAD

STA. 100+00 TO STA. 126+20



PAVEMENT STRUCTURAL SECTION NO. 1



PAVEMENT STRUCTURAL SECTION NO. 2

NOTES:

1. WITHIN TWO (2) DAYS AFTER PAVING, PLACE AGGREGATE BASE COURSE, GRADING D–1 AGAINST PAVEMENT EDGE TO ENSURE THERE IS NO VERTICAL DROP AT THE EDGE OF PAVEMENT. USE APPROVED TRAFFIC CONTROL DEVICES IN THE INTERIM. APPLIES TO ALL SECTIONS.

② CONTINUE 4:1 FILL/EXCAVATION TO ELEVATION 273' WHERE ADJACENT TO INFILTRATION BASIN. REFER TO INFILTRATION BASIN GRADING DETAILS.

3. WHERE CURB, BACKING CURB, CONCRETE BUFFER, OR CURB RAMPS ARE PRESENT, PLACE 2" OF AGGREGATE BASE COURSE, GRADING D–1 FOR LEVELING, OR AS DIRECTED BY THE ENGINEER. APPLIES TO ALL SECTIONS.

④ USE 4:1 FORE SLOPE BEHIND PATHWAY FROM STA. 113+31 TO STA 116+13 RT.

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
AND PUBLIC FACILITIES

HEMMER ROAD EXTENSION: PALMER–WASILLA HIGHWAY TO BOGARD ROAD

TYPICAL SECTIONS

STATE OF ALASKA DOT&PF
4111 AVIATION AVENUE
ANCHORAGE, AK 99502
(907) 269–0590

NO.	DATE	REVISION

STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
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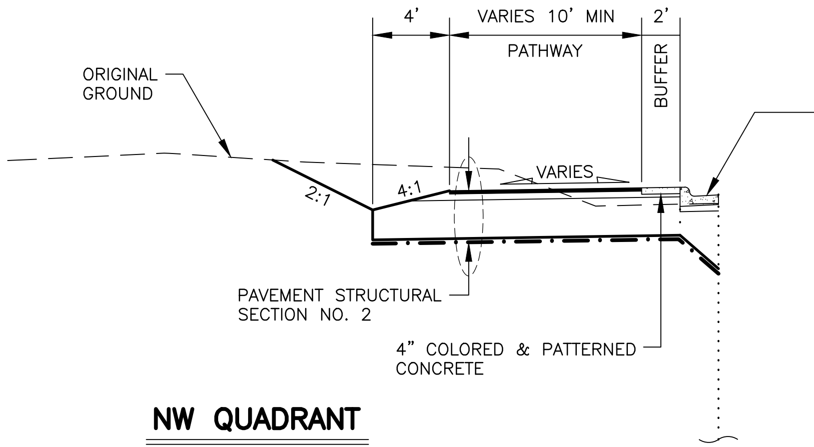
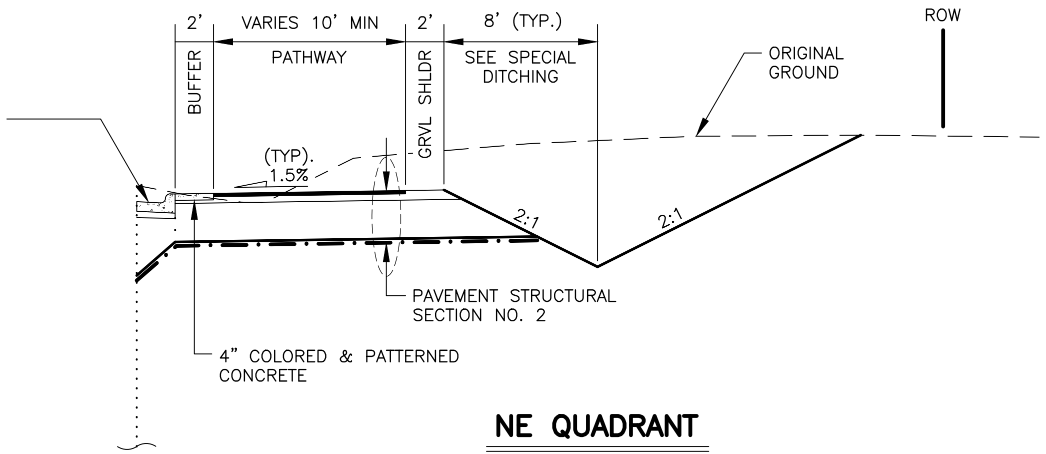


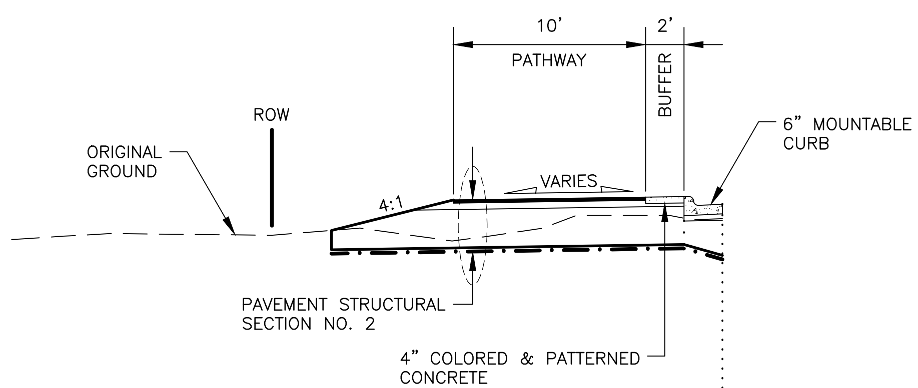
NW QUADRANT

STA. 100+20 TO STA. 101+40



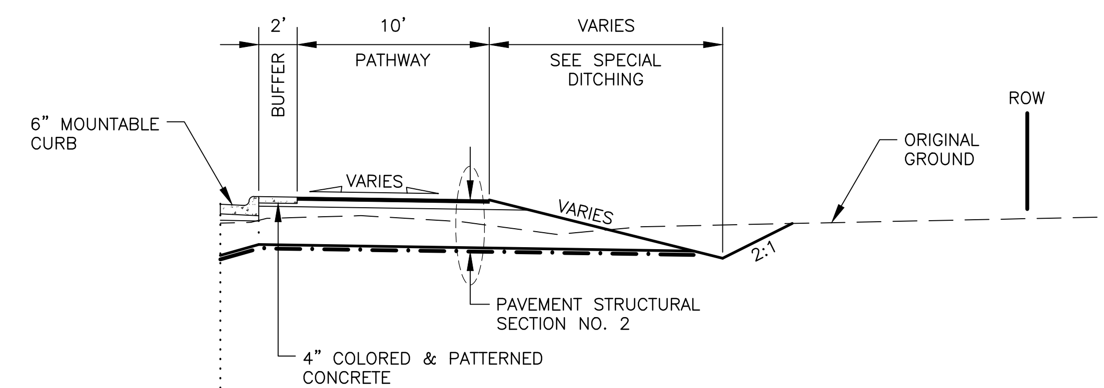
NE QUADRANT

STA. 100+32 TO STA. 102+41



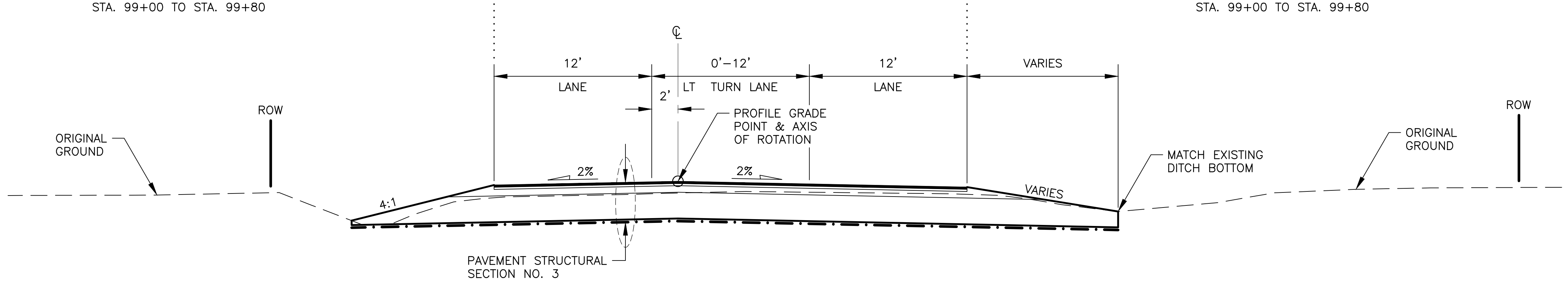
SW QUADRANT

STA. 99+00 TO STA. 99+80



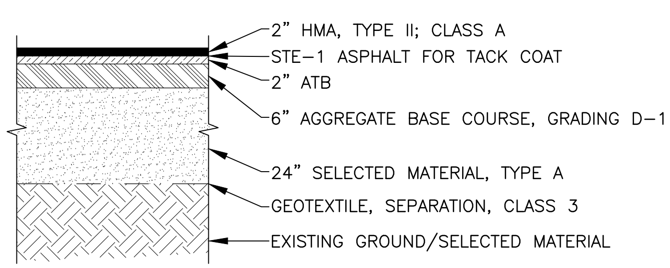
SE QUADRANT

STA. 99+00 TO STA. 99+80



HEMMER ROAD

STA. 98+00 TO STA. 100+00



PAVEMENT STRUCTURAL SECTION NO. 3

NOTES:

1. SEE G SHEETS FOR GRADING PLANS AND ADDITIONAL LAYOUT AT INTERSECTION QUADRANTS.
2. ALL PATHWAY CROSS SLOPES SHOWN AS VARIES SHALL BE ±2% MAX GRADE. SEE GRADING PLANS FOR MORE INFORMATION.

PIH REVIEW

STATE OF ALASKA DOT&PF
4111 AVIATION AVENUE
ANCHORAGE, AK 99502
(907) 269-0590

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
AND PUBLIC FACILITIES

HEMMER ROAD EXTENSION:
PALMER–WASILLA HIGHWAY TO
BOGARD ROAD

TYPICAL SECTIONS

DESIGNED BY	ZDK
CHECKED BY	CLE
DRAFTED BY	ZDK
SCALE	1" =5'
DATE	2/27/2025
TIME	11:02 AM

DRAWING LOCATION
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NO.	DATE	REVISION

STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
ALASKA	0001743/CFHWY00885	2027	B03	B05

DESIGNED BY ZDK
CHECKED BY CLE
DRAFTED BY ZDK

SCALE 1" =5'

DATE TIME 2/27/2025 11:02 AM

DRAWING LOCATION
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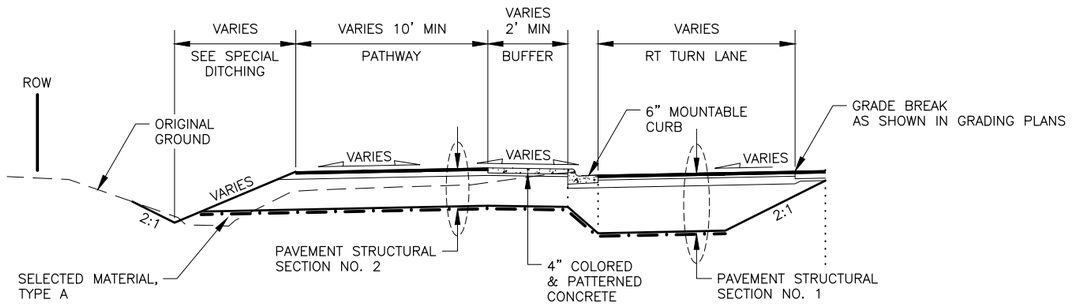
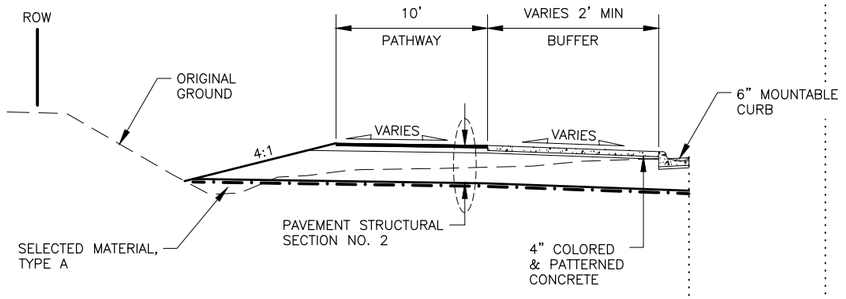


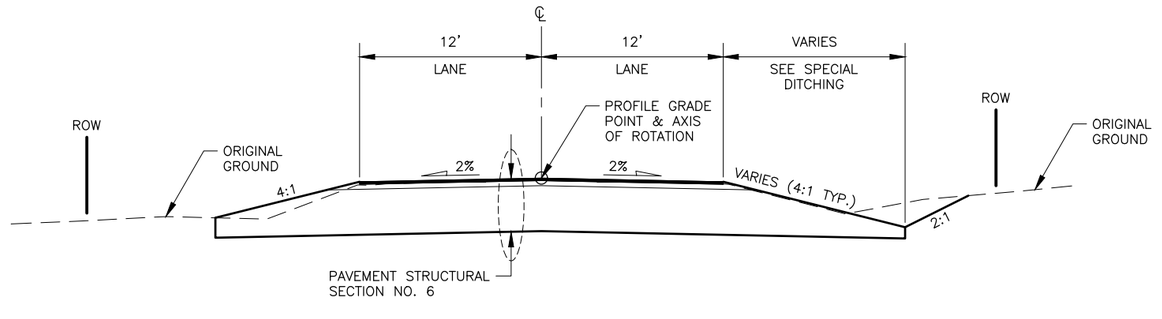
PATHWAY ON LT
NE QUADRANT

STA. 1026+22 TO STA. 1027+25

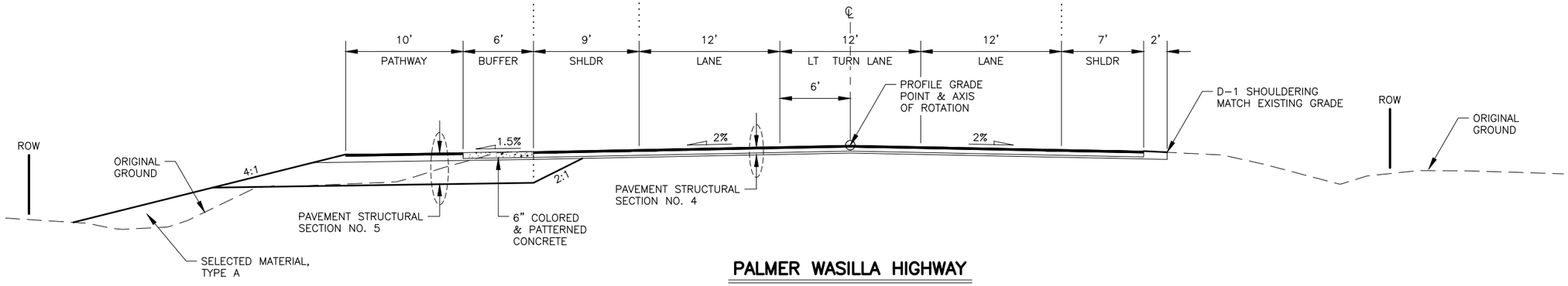


PATHWAY ON LT
NW QUADRANT

STA. 1025+15 TO STA. 1025+78



E QUIL AVE
E CHALET DR & E FOLSOM DR

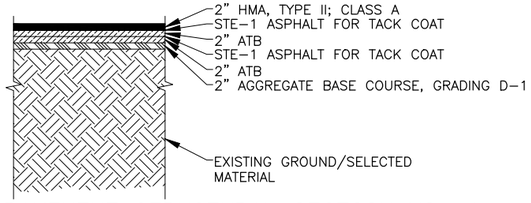


PALMER WASILLA HIGHWAY

STA. 1022+60 TO STA. 1026+85

NOTES:

1. SEE G SHEETS FOR GRADING PLANS AND ADDITIONAL LAYOUT AT INTERSECTION QUADRANTS.
2. ALL PATHWAY CROSS SLOPES SHOWN AS VARIES SHALL BE ±2% MAX GRADE. SEE GRADING PLANS FOR MORE INFORMATION.



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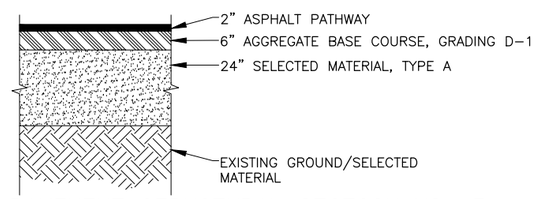

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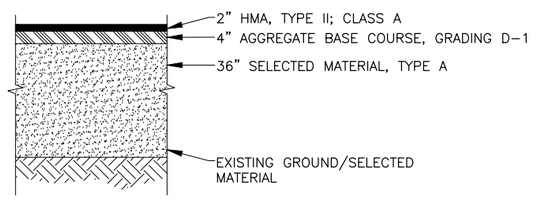

PAVEMENT STRUCTURAL SECTION NO. 6

STATE OF ALASKA DOT&PF
4111 AVIATION AVENUE
ANCHORAGE, AK 99502
(907) 269-0590

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
AND PUBLIC FACILITIES

HEMMER ROAD EXTENSION: PALMER-WASILLA HIGHWAY TO BOGARD ROAD

TYPICAL SECTIONS

NO.	DATE	REVISION

STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
ALASKA	0001743/CFHWY00885	2027	B04	B05

DESIGNED BY ZDK
CHECKED BY CLE
DRAFTED BY ZDK

SCALE 1" =5'

DATE 2/27/2025 TIME 11:02 AM

DRAWING LOCATION
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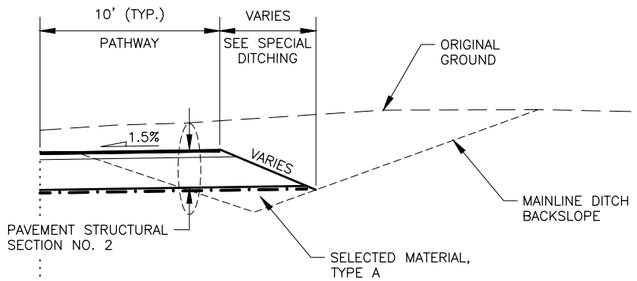
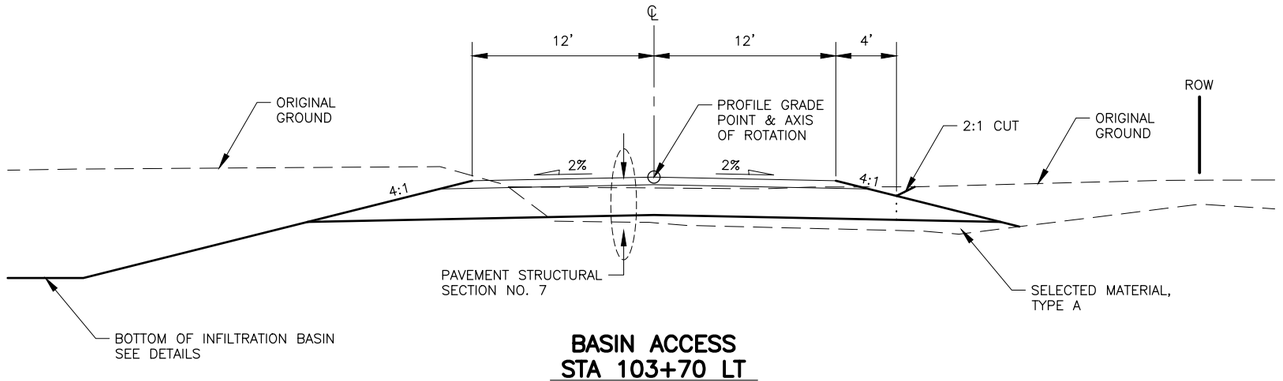
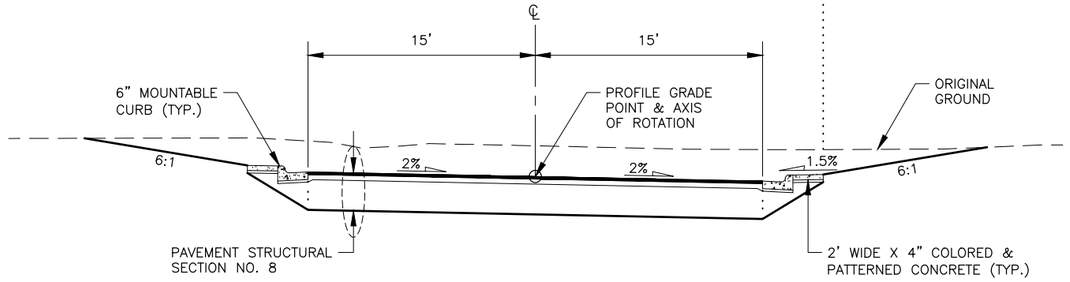


SIDEWALK ON RT

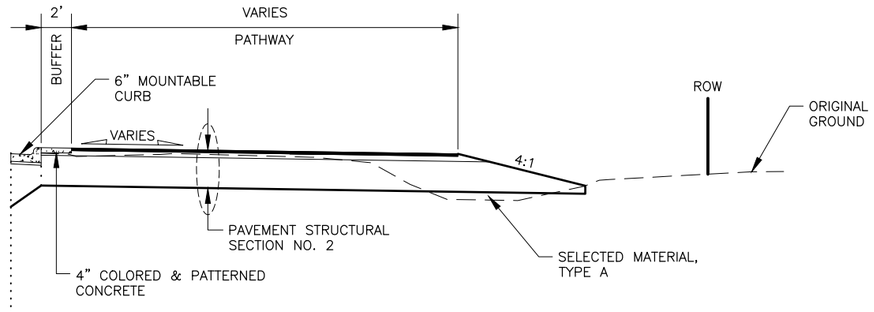
STA. 10+22 TO STA. 10+52



BASIN ACCESS STA 103+70 LT

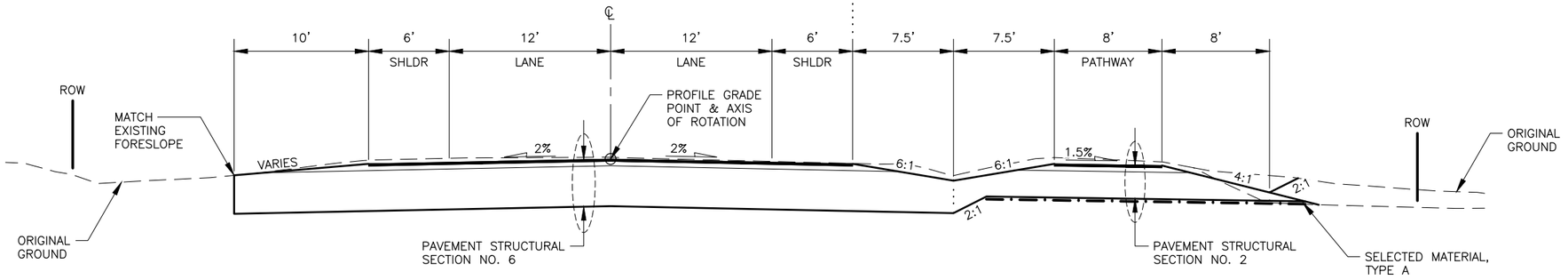


DRIVEWAY STA 102+61 RT

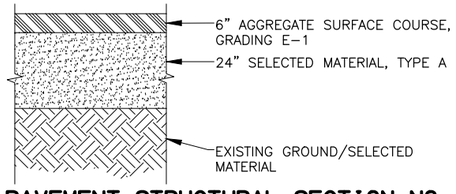


SIDEWALK ON RT

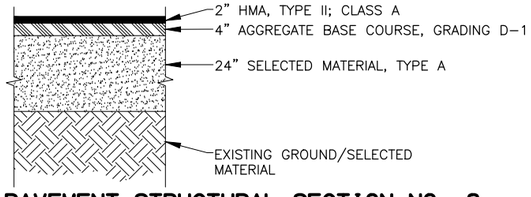
STA. 10+16 TO STA. 10+66



E PALMER MOOSE DR



PAVEMENT STRUCTURAL SECTION NO. 7



PAVEMENT STRUCTURAL SECTION NO. 8

NOTES:

1. SEE G SHEETS FOR GRADING PLANS AND ADDITIONAL LAYOUT AT INTERSECTION QUADRANTS.
2. ALL PATHWAY CROSS SLOPES SHOWN AS VARIES SHALL BE ±2% MAX GRADE. SEE GRADING PLANS FOR MORE INFORMATION.

STATE OF ALASKA DOT&PF
4111 AVIATION AVENUE
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STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
AND PUBLIC FACILITIES

HEMMER ROAD EXTENSION: PALMER-WASILLA HIGHWAY TO BOGARD ROAD

TYPICAL SECTIONS

NO.	DATE	REVISION

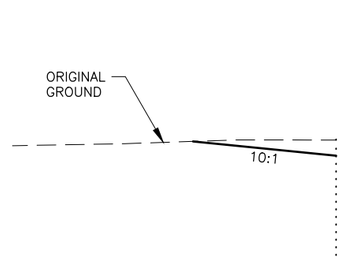
STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
ALASKA	0001743/CFHWY00885	2027	B05	B05

DESIGNED BY ZDK
CHECKED BY CLE
DRAFTED BY ZDK

SCALE 1" =5'

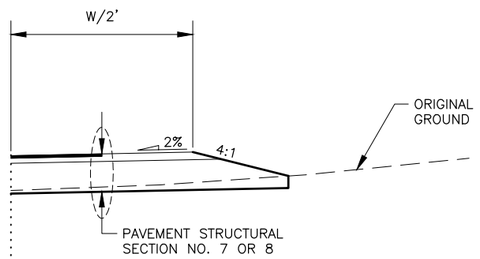
DATE 2/27/2025 TIME 11:02 AM

DRAWING LOCATION
W:\PROJECTS\HEMMER RD EXTENSION- PALMER-WASILLA HWY TO BOGARD RD - CFHWY00885\CIV3D\PLANSET\00885_B01_TYP.DWG



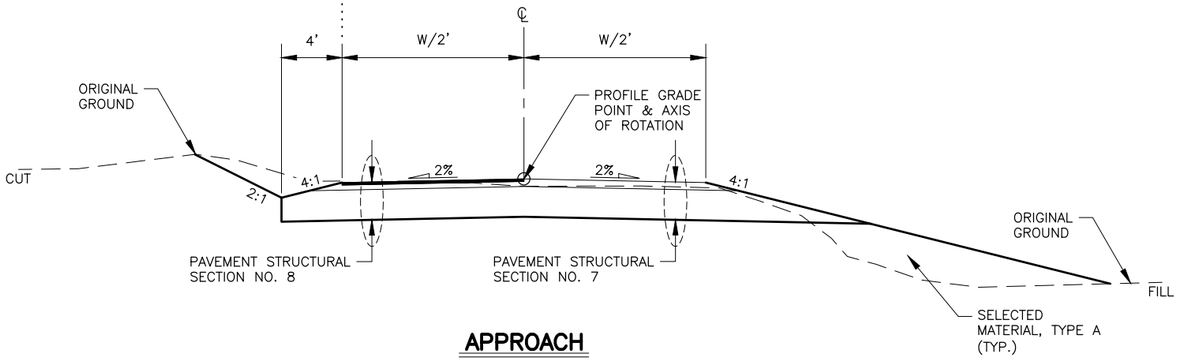
FLAT CUT

SEE APPROACH SUMMARY TABLE

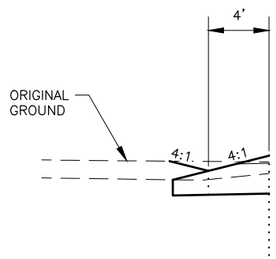


REVERSE CROWN

SEE APPROACH SUMMARY TABLE

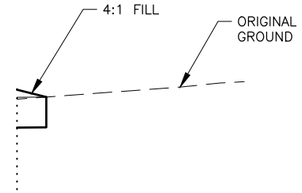


APPROACH



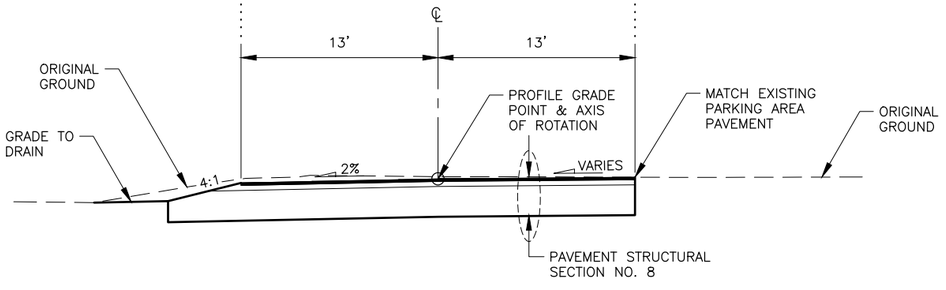
NORMAL CUT–FILL

STA. 10+90 TO STA. 11+83



FILL RT

STA. 11+04 TO STA. 11+44



DRIVEWAY STA 110+07 LT

NOTES:

1. WHERE APPROACHES HAVE A REVERSE CROWN THEY ARE TO BE PITCHED IN THE DOWNHILL DIRECTION FOR DRAINAGE. REVERSE CROWN CAN BE APPLIED TO EITHER SIDE.
2. FLAT CUT CAN BE APPLIED TO EITHER SIDE.

STATE OF ALASKA
CLAIRE E. [illegible]
REGISTERED PROFESSIONAL ENGINEER
PIH REVIEW

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STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
AND PUBLIC FACILITIES

HEMMER ROAD EXTENSION: PALMER–WASILLA HIGHWAY TO BOGARD ROAD

TYPICAL SECTIONS

APPENDIX C

Traffic Analysis

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

IRIS Program No. CFHWY00885
Federal Project No. 0001743

Traffic Analysis Report

June 2023

Prepared For:
Alaska Department of Transportation and Public Facilities

Prepared By:
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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	*Highway Capacity Manual*
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	*Manual on Uniform Traffic Control Devices*
NCHRP	National Cooperative Highway Research Program
OS&HP	Official Streets and Highways Plan
PGDHS	*A Policy on Geometric Design of Highways and Streets*
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

Intersection	Existing Traffic Control
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

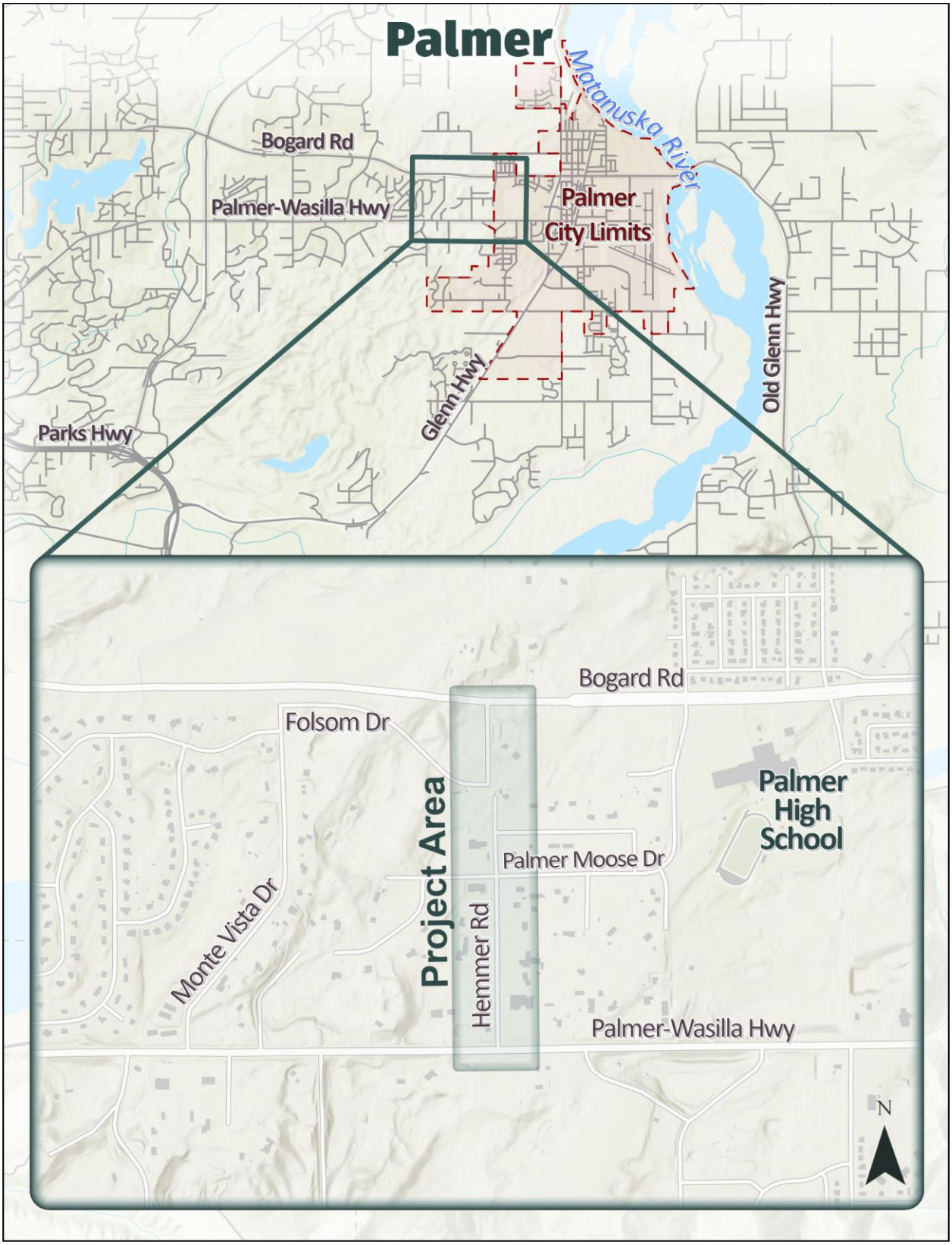

Figure 1: Vicinity Map

2 Safety

DOT&PF provided crash data for the project study area from 2015 through 2020. In 2015, Bogard Road was extended from 49th 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.

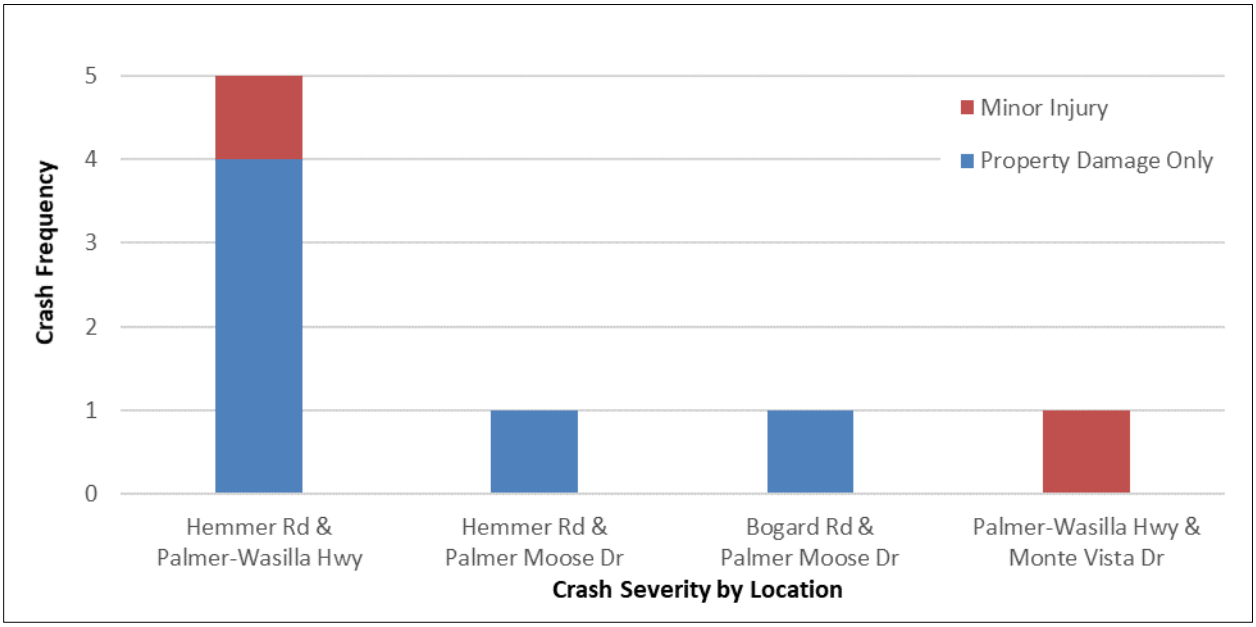

Figure 3: Crash Severity by Location (2016 to 2020)

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	49th State St to Glenn Hwy					3,000	6,095	6,286	6,433	5,910	6,690
Palmer-Wasilla Hwy	49th 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.

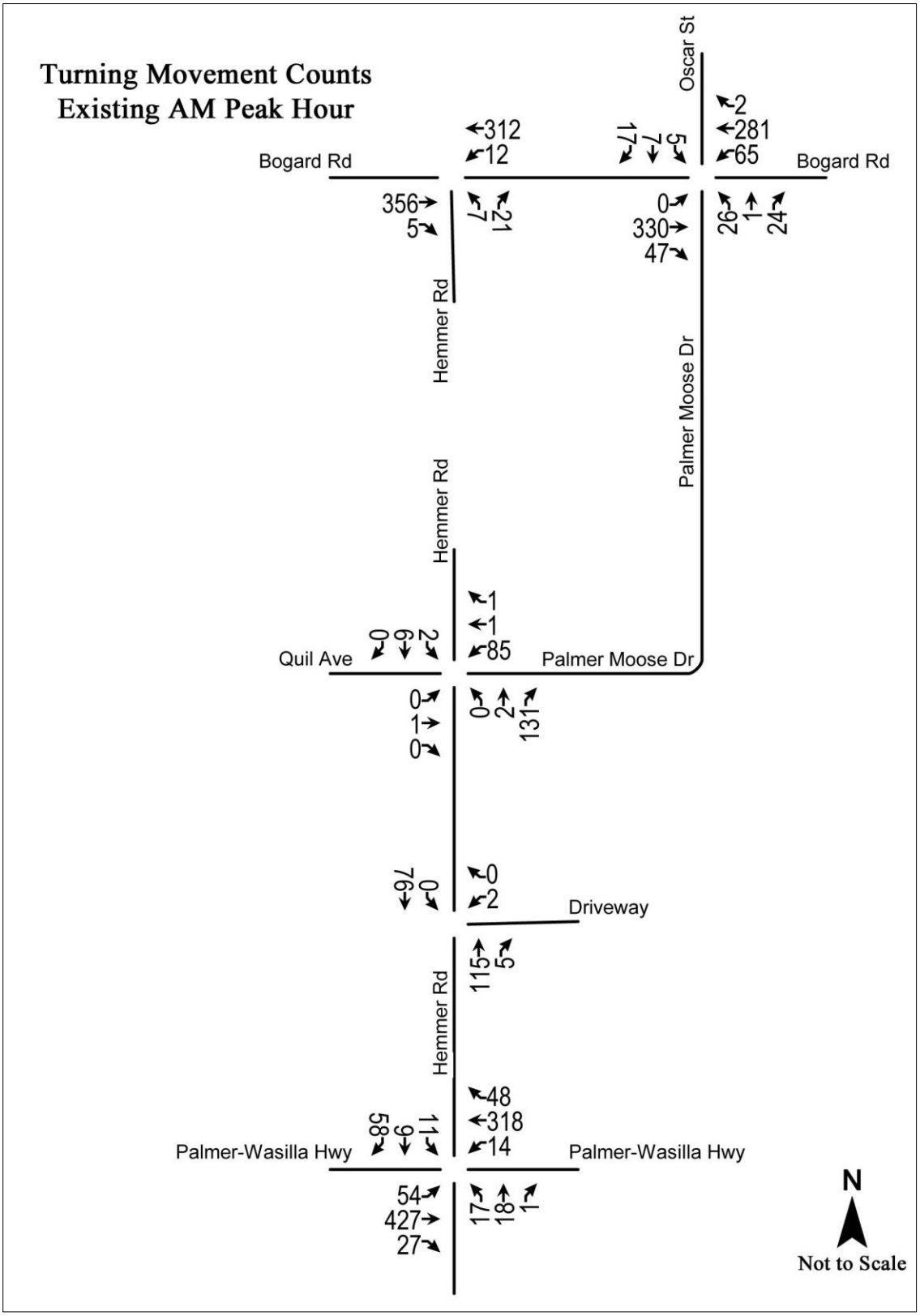

Figure 4: Existing TMVs – AM Peak Hour

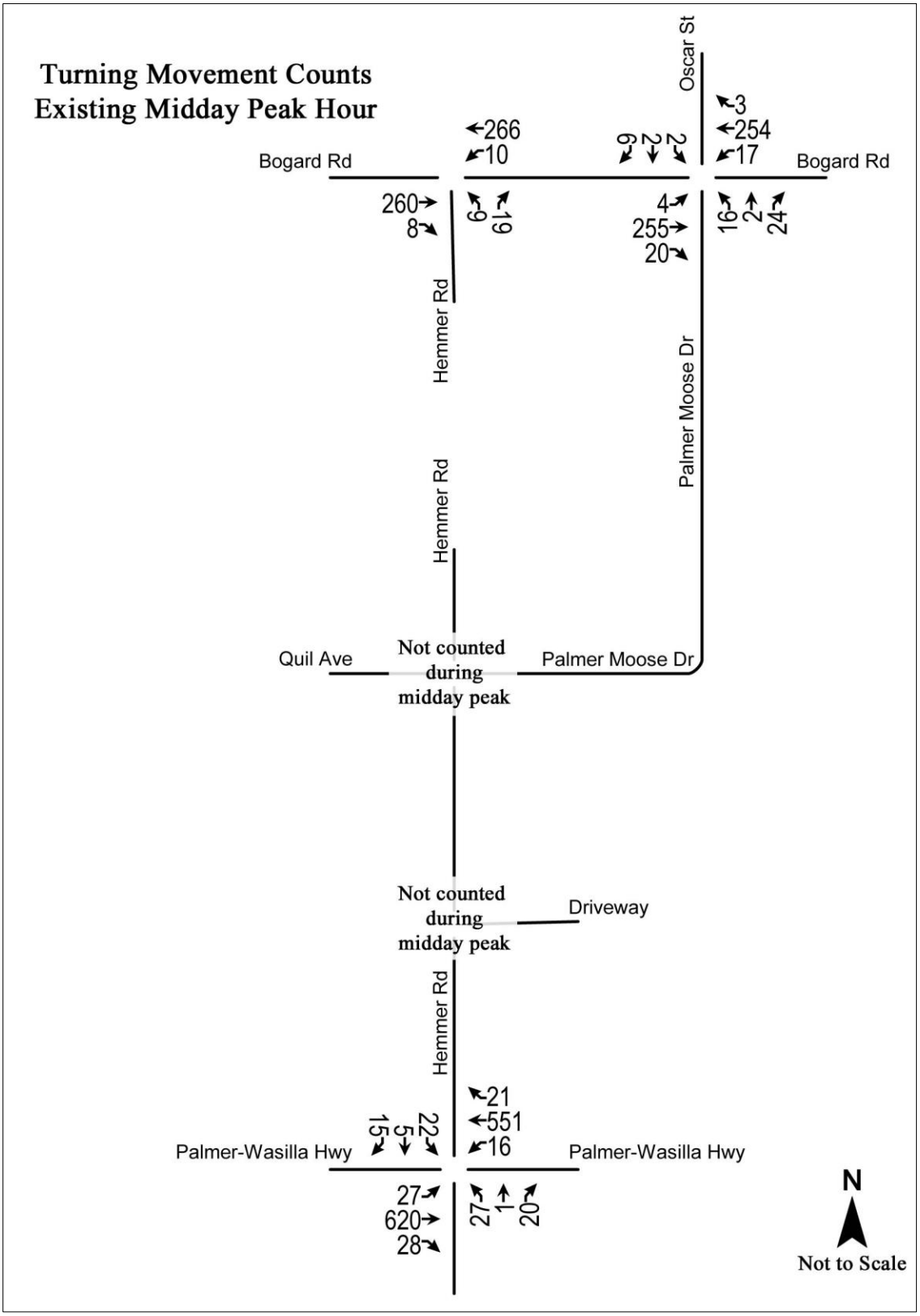

Figure 5: Existing TMVs – Midday Peak Hour

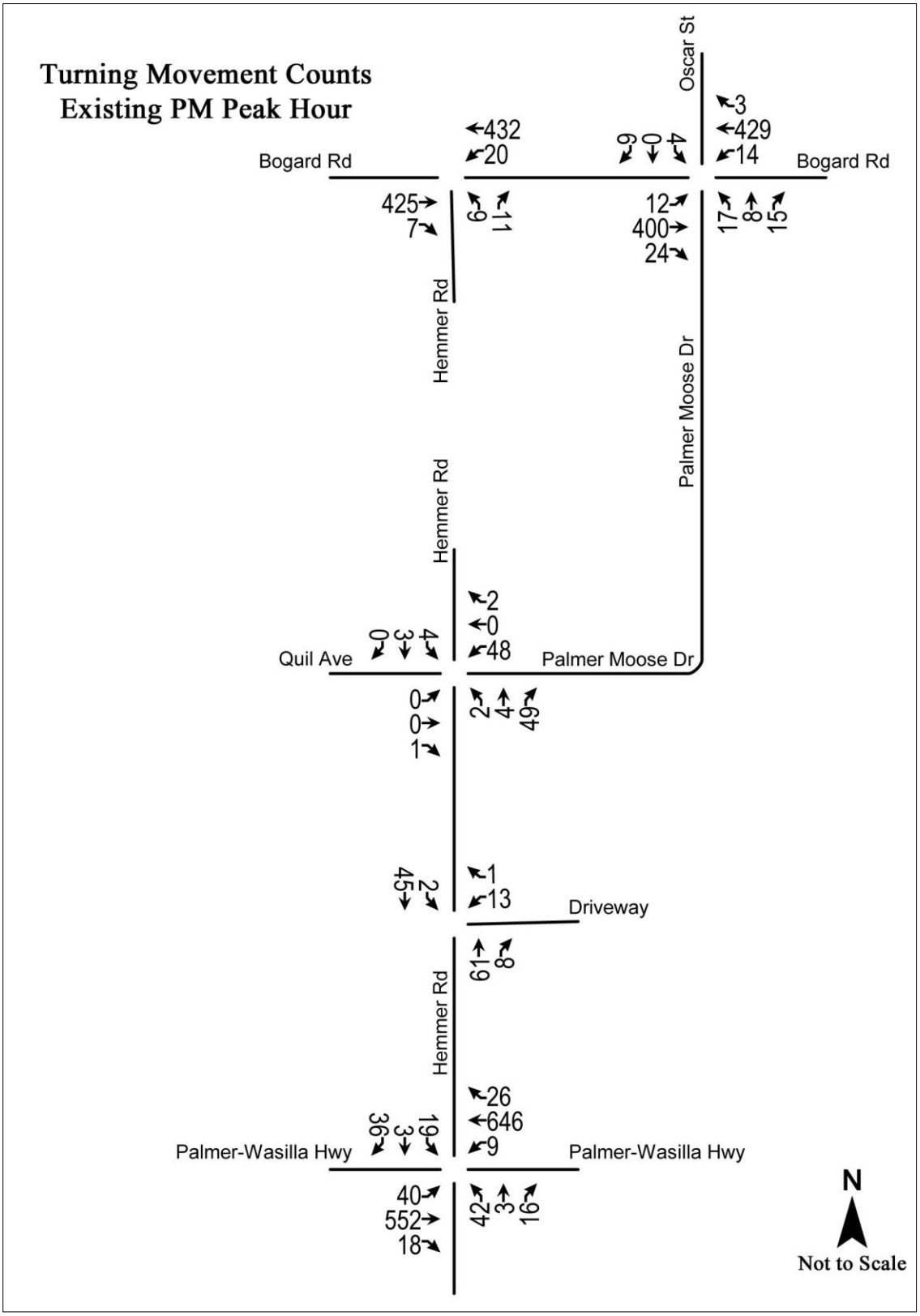

Figure 6: Existing TMVs – PM Peak Hour

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.

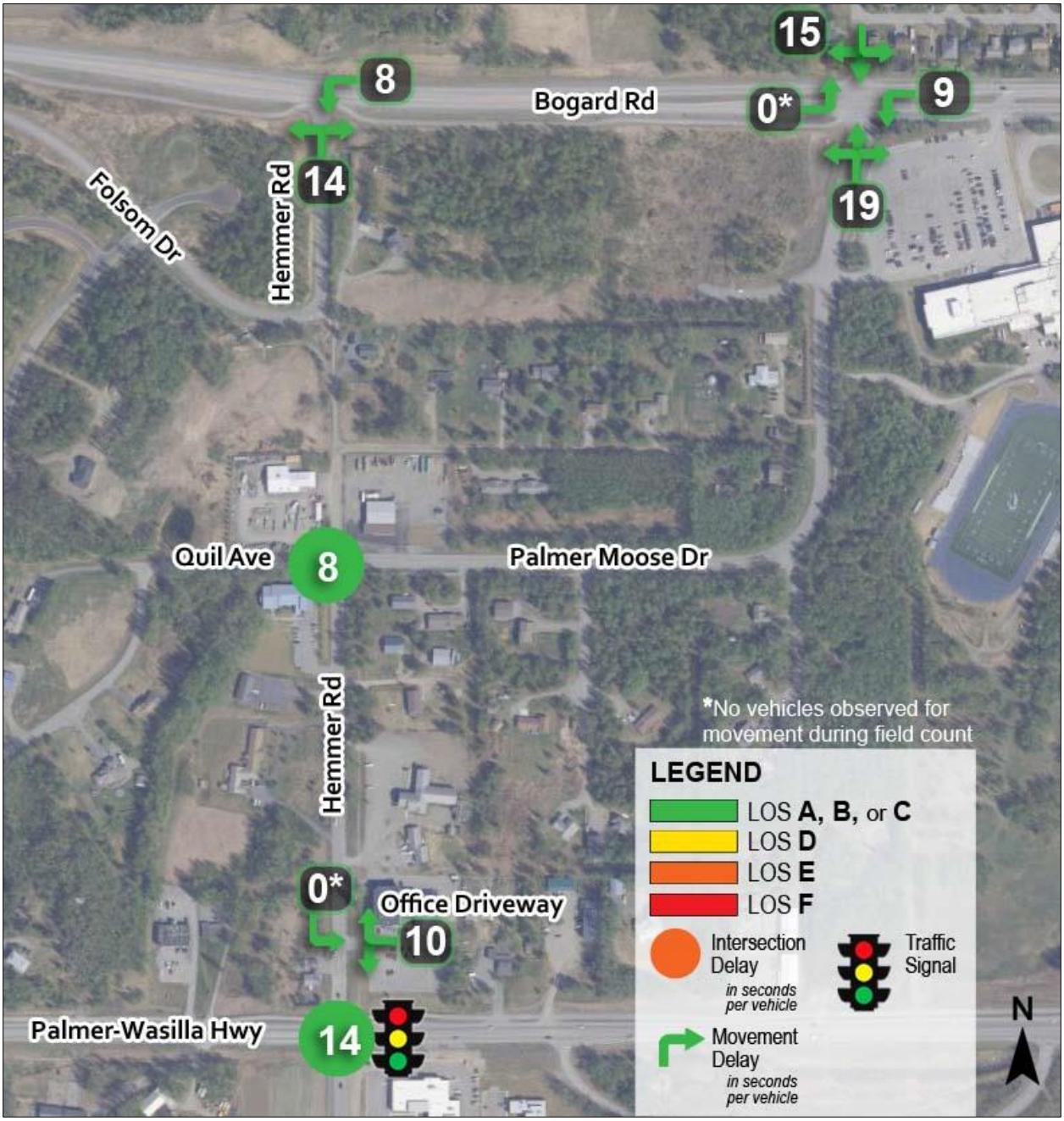

Figure 7: Existing LOS – AM Peak Hour

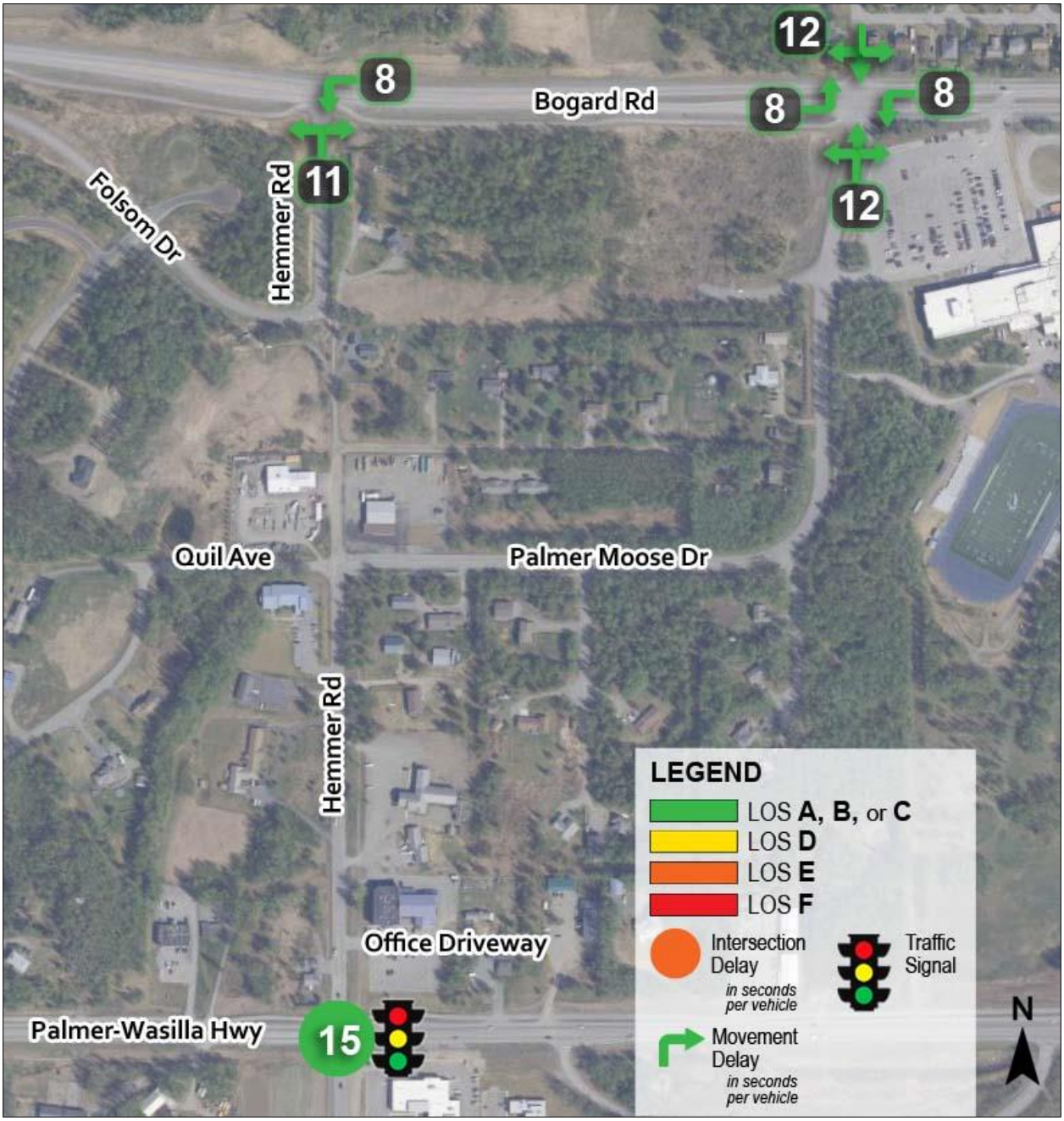

Figure 8: Existing LOS – Midday Peak Hour

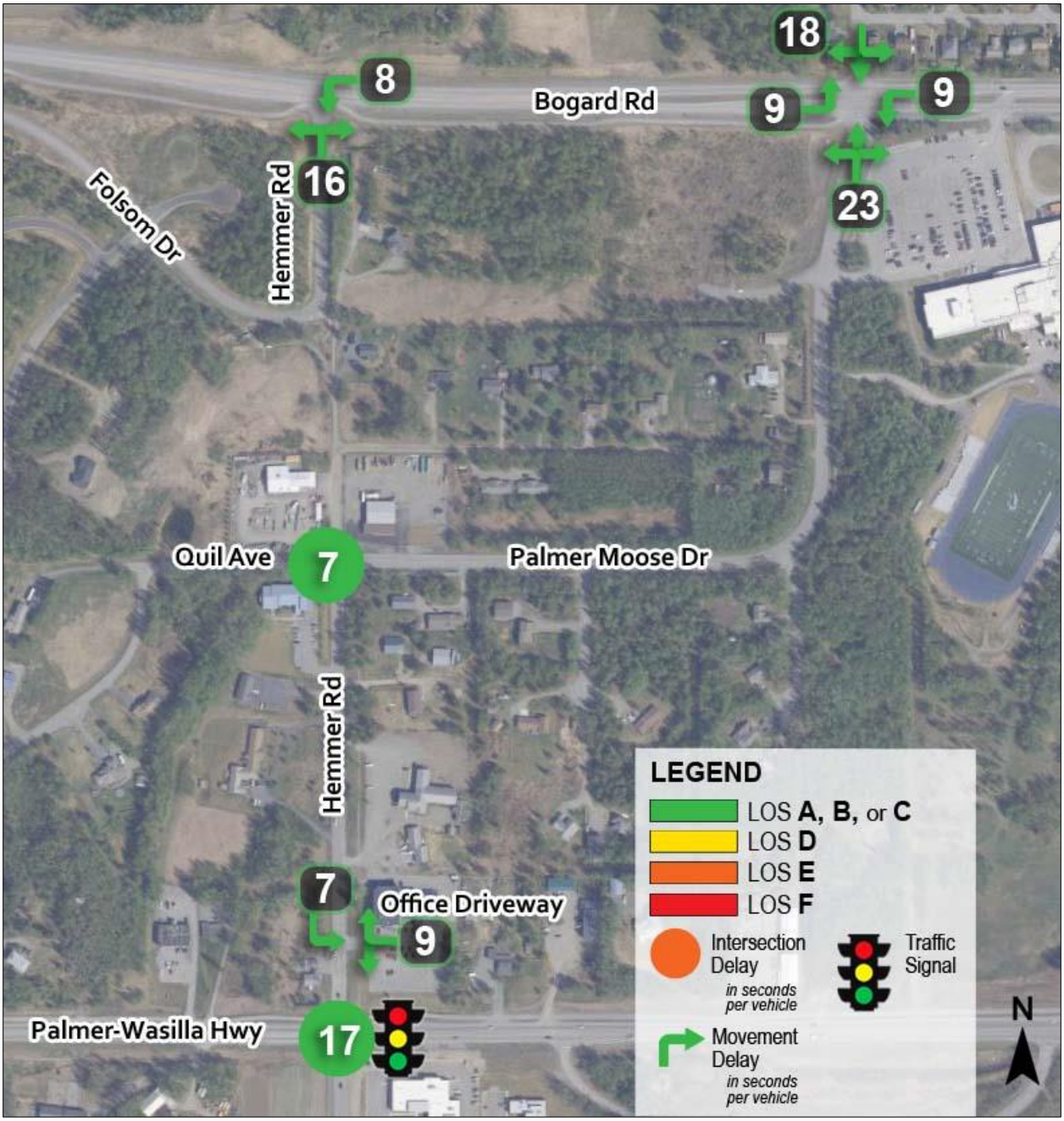

Figure 9: Existing LOS – PM Peak Hour

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.

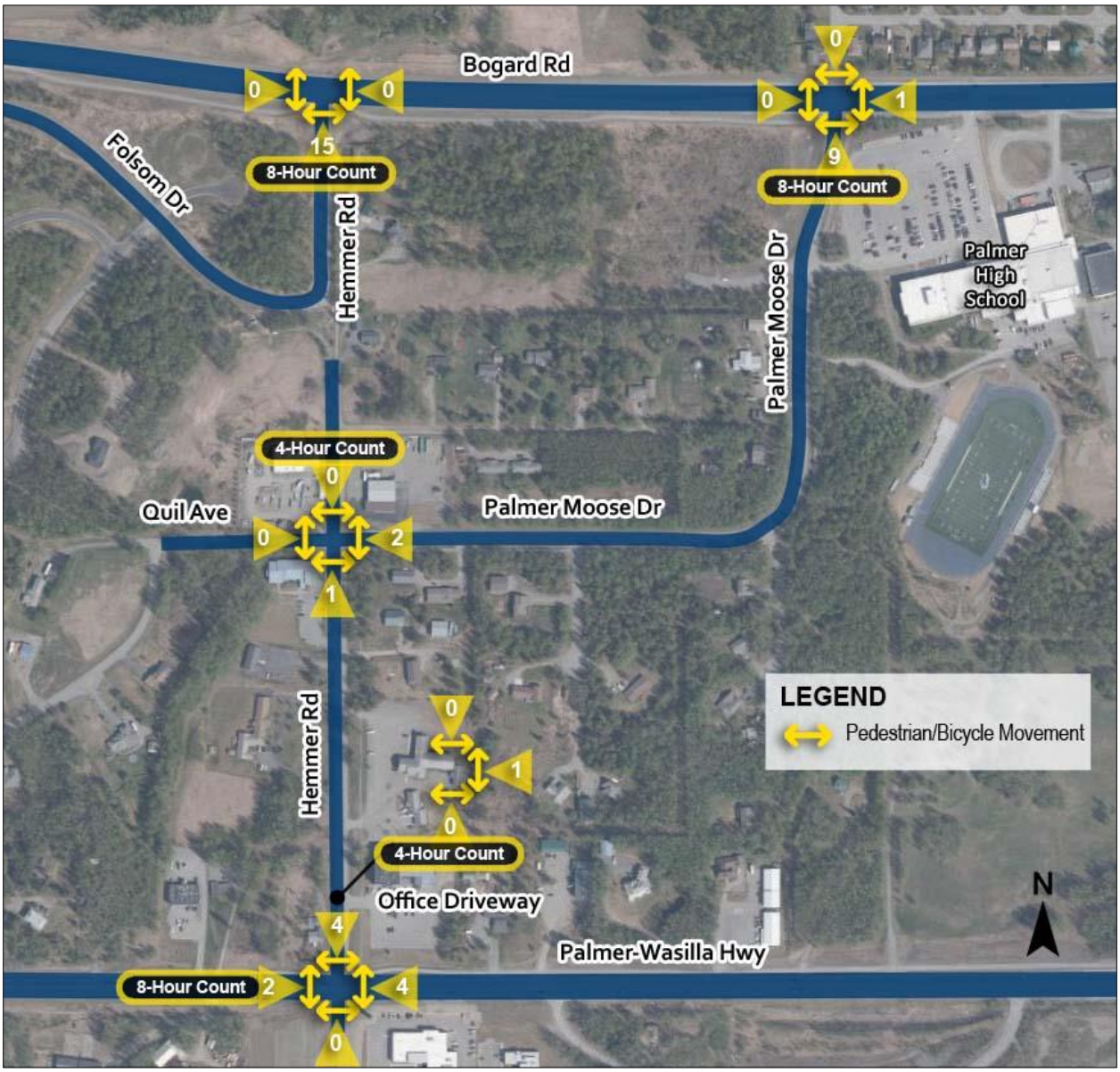

Figure 10: Total Pedestrian & Bicycle Volumes Observed

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	49th 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	49th 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.

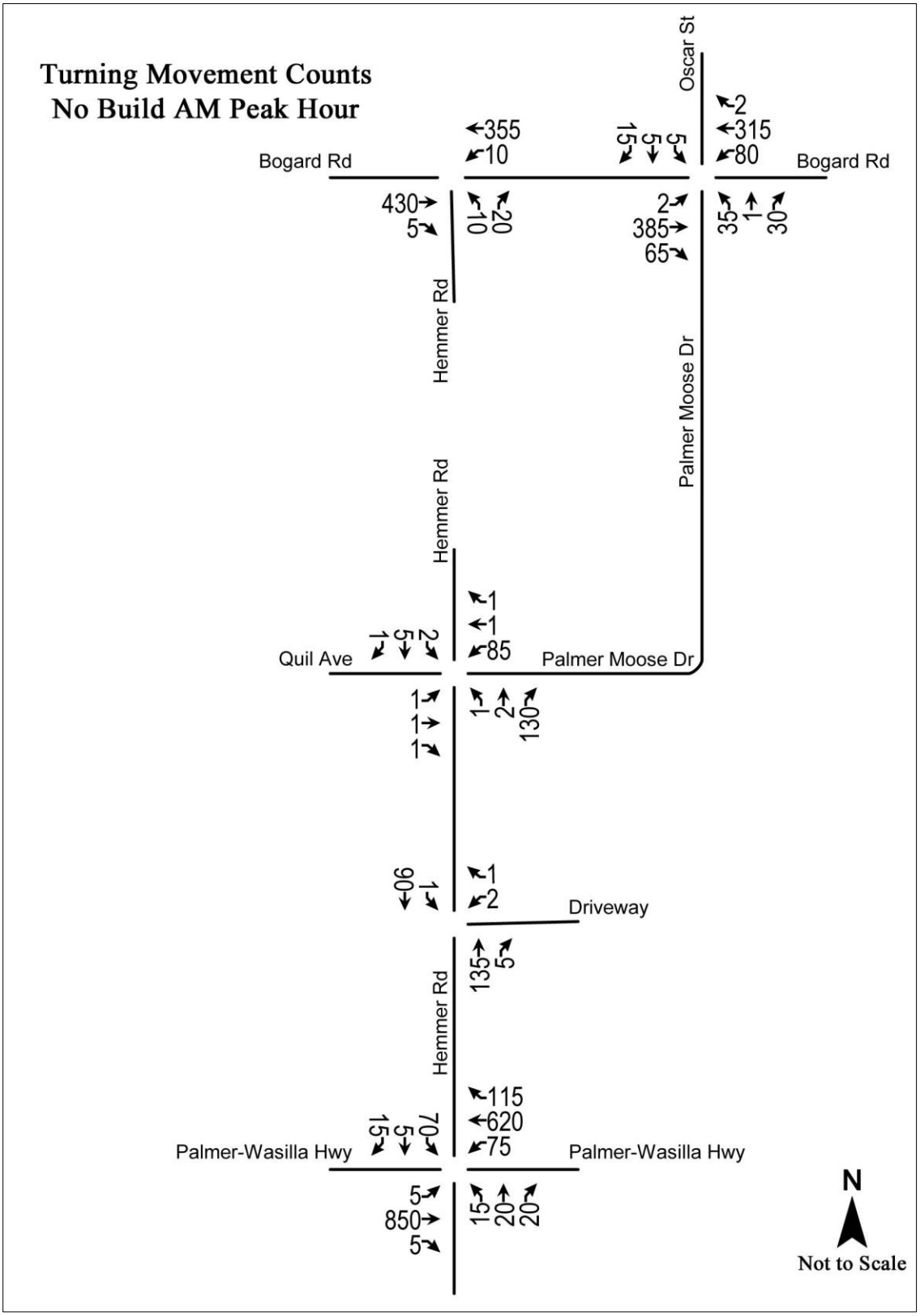

Figure 11: No Build TMVs – AM Peak Hour

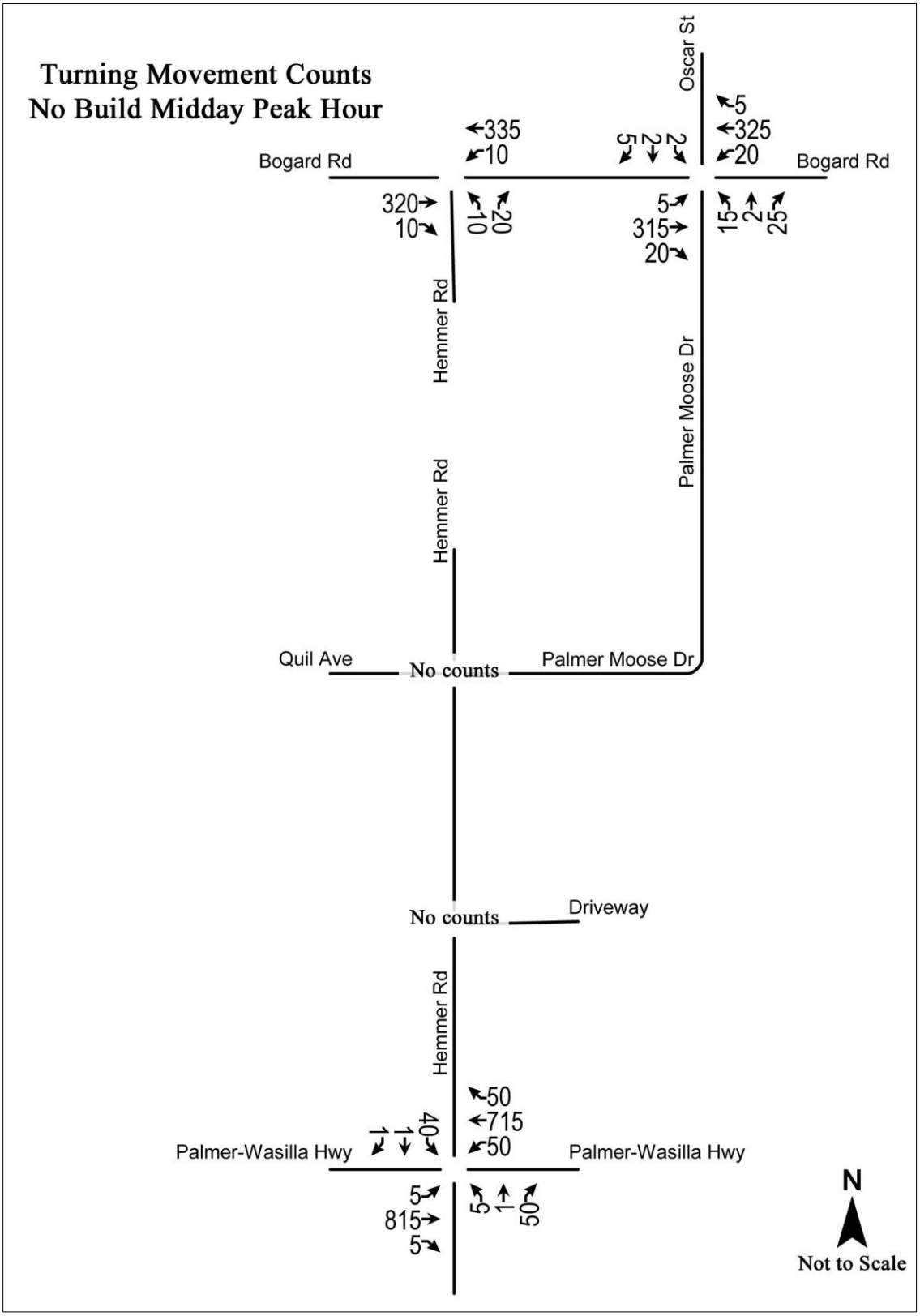

Figure 12: No Build TMVs – Midday Peak Hour

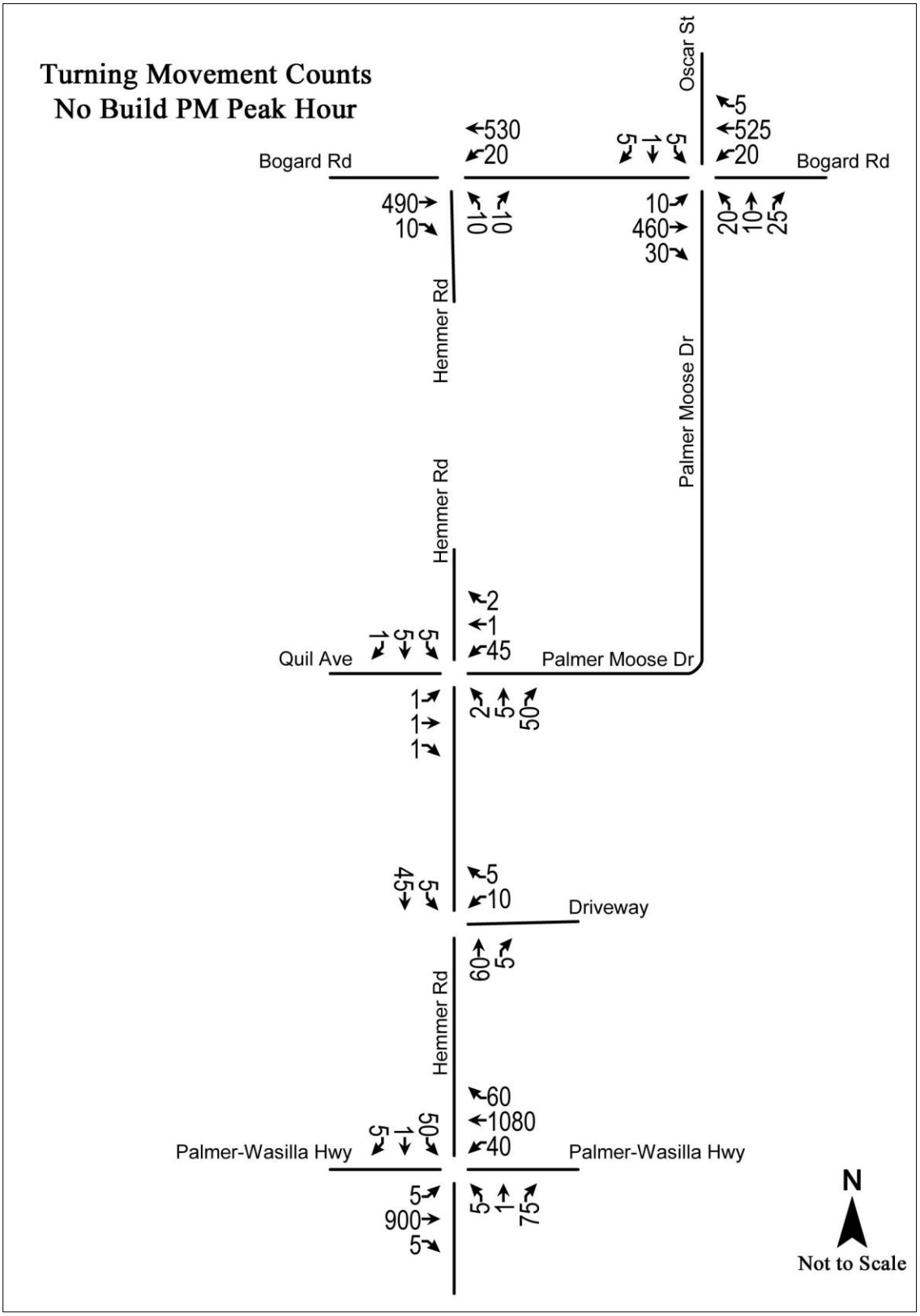

Figure 13: No Build TMVs – PM Peak Hour

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.

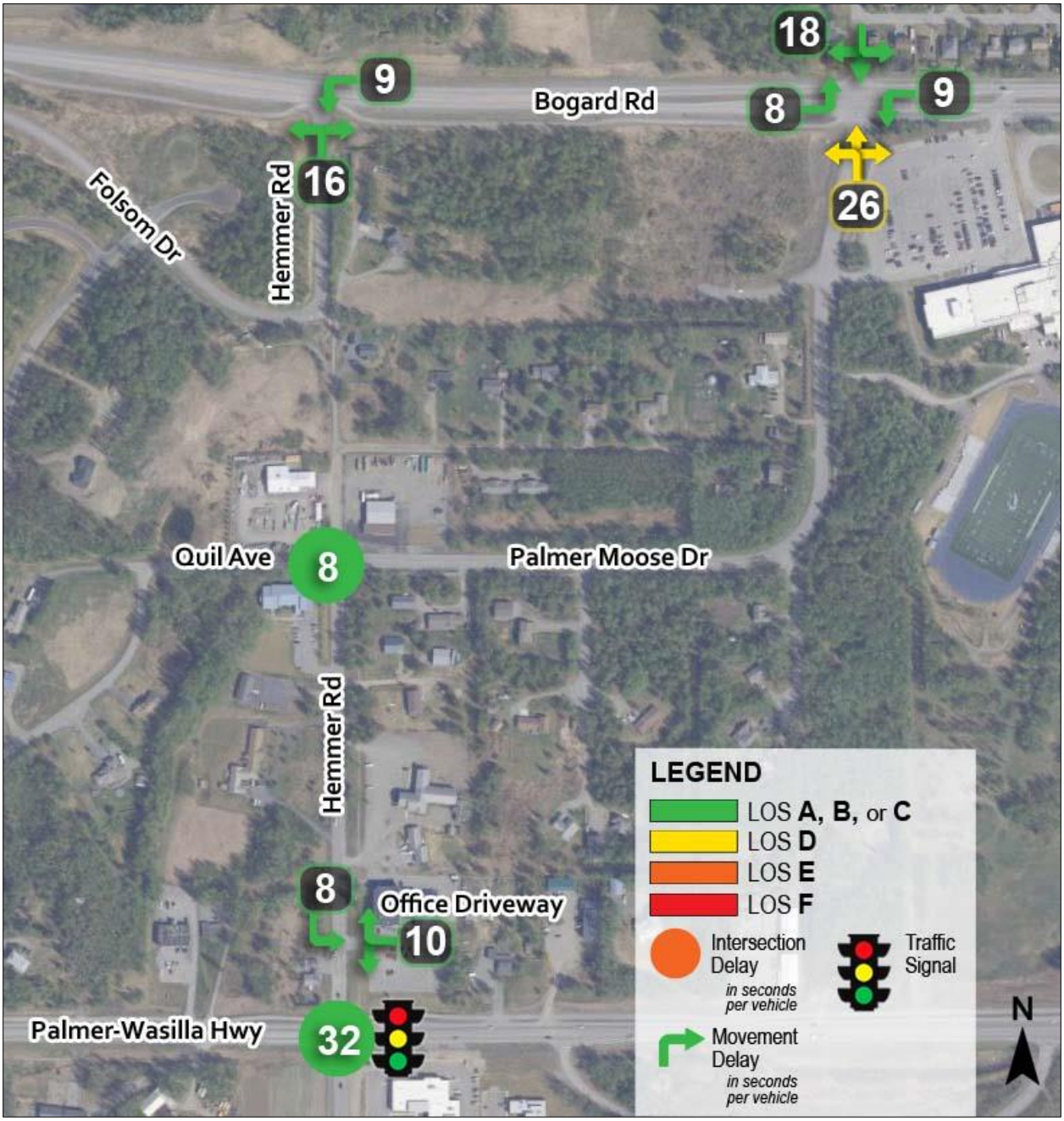

Figure 14: 2045 No Build LOS – AM Peak Hour

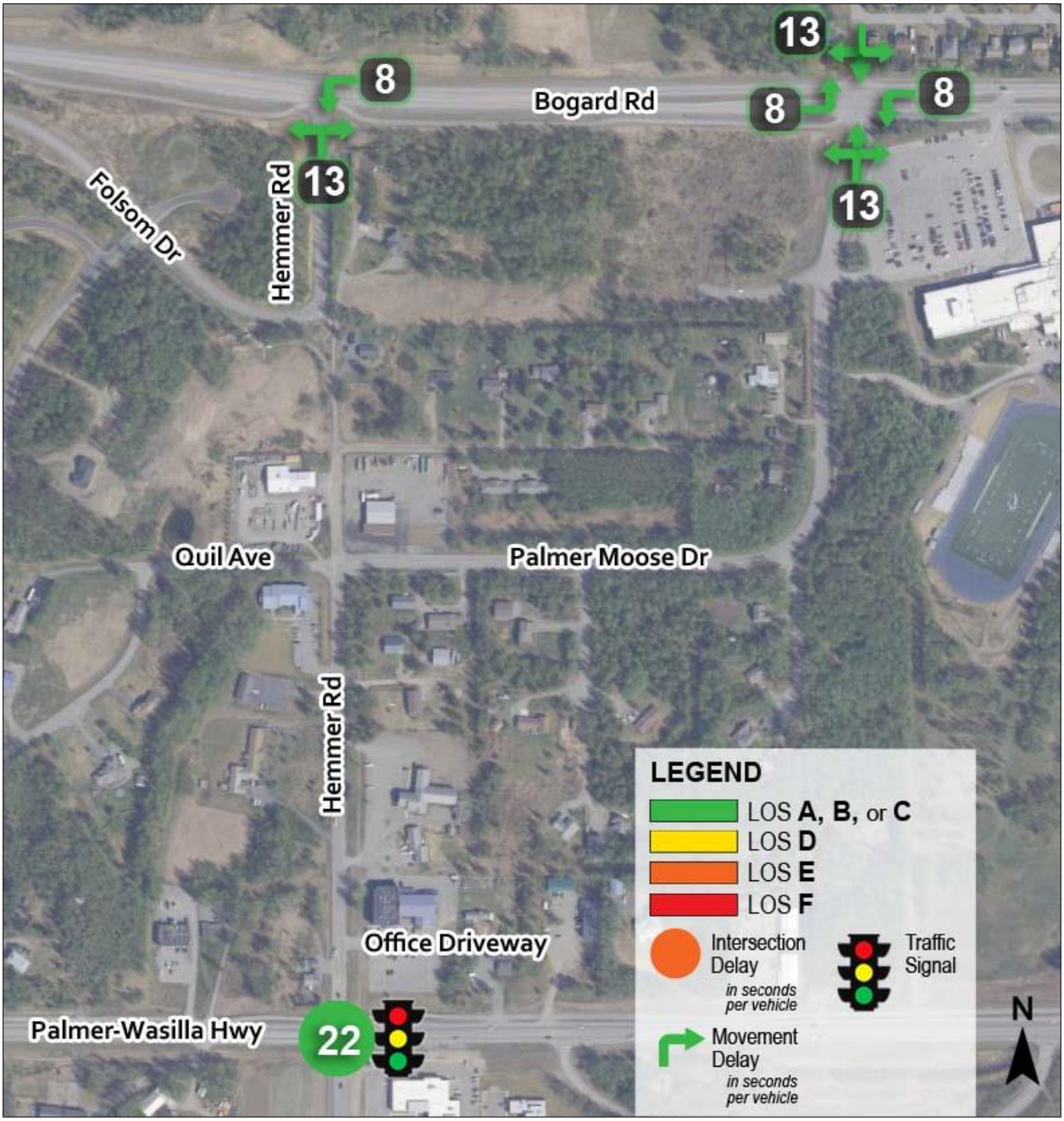

Figure 15: 2045 No Build LOS – Midday Peak Hour

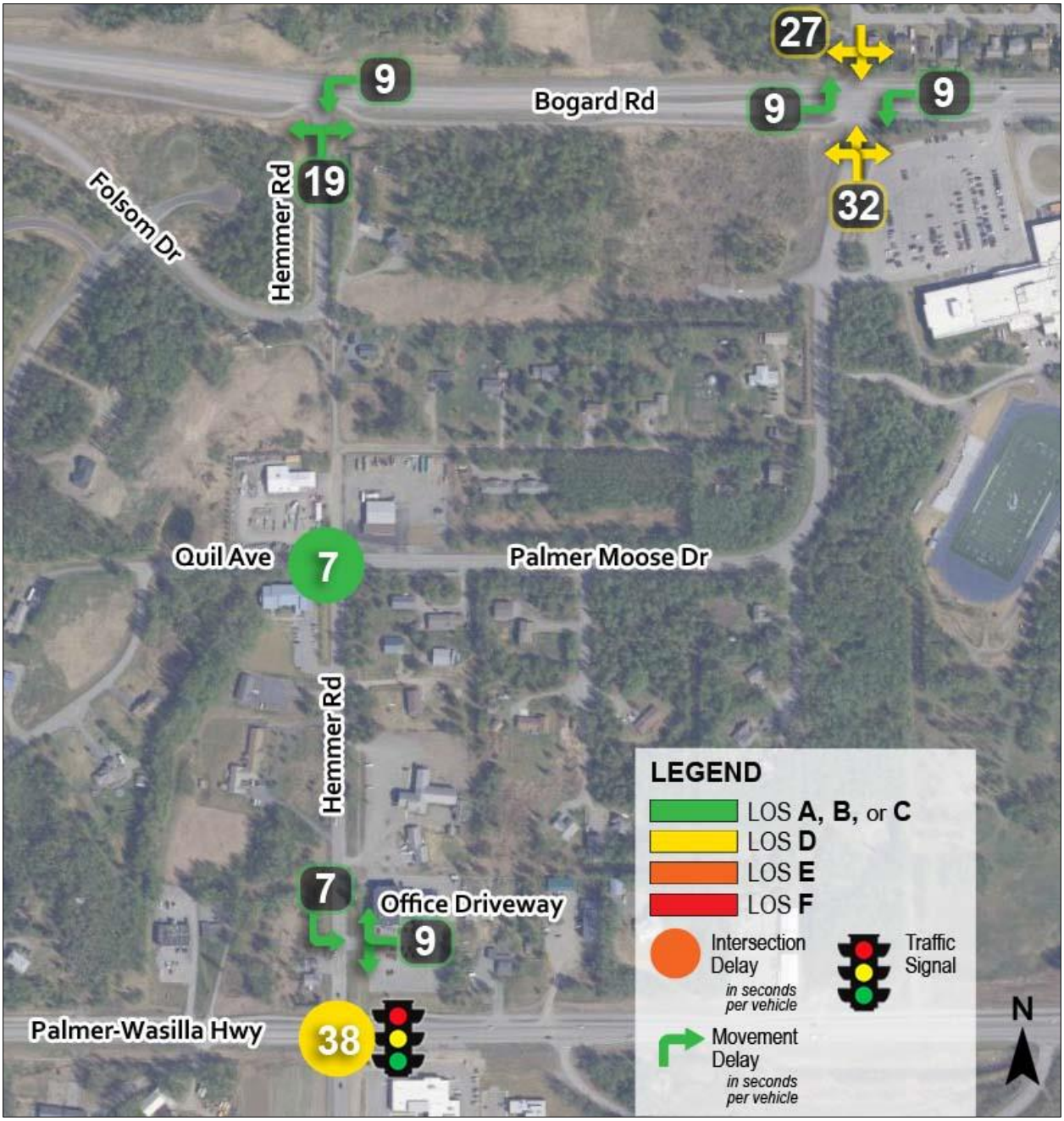

Figure 16: 2045 No Build LOS – PM Peak Hour

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 49th 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	49th 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	49th 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

Segment	Extents	2045
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.

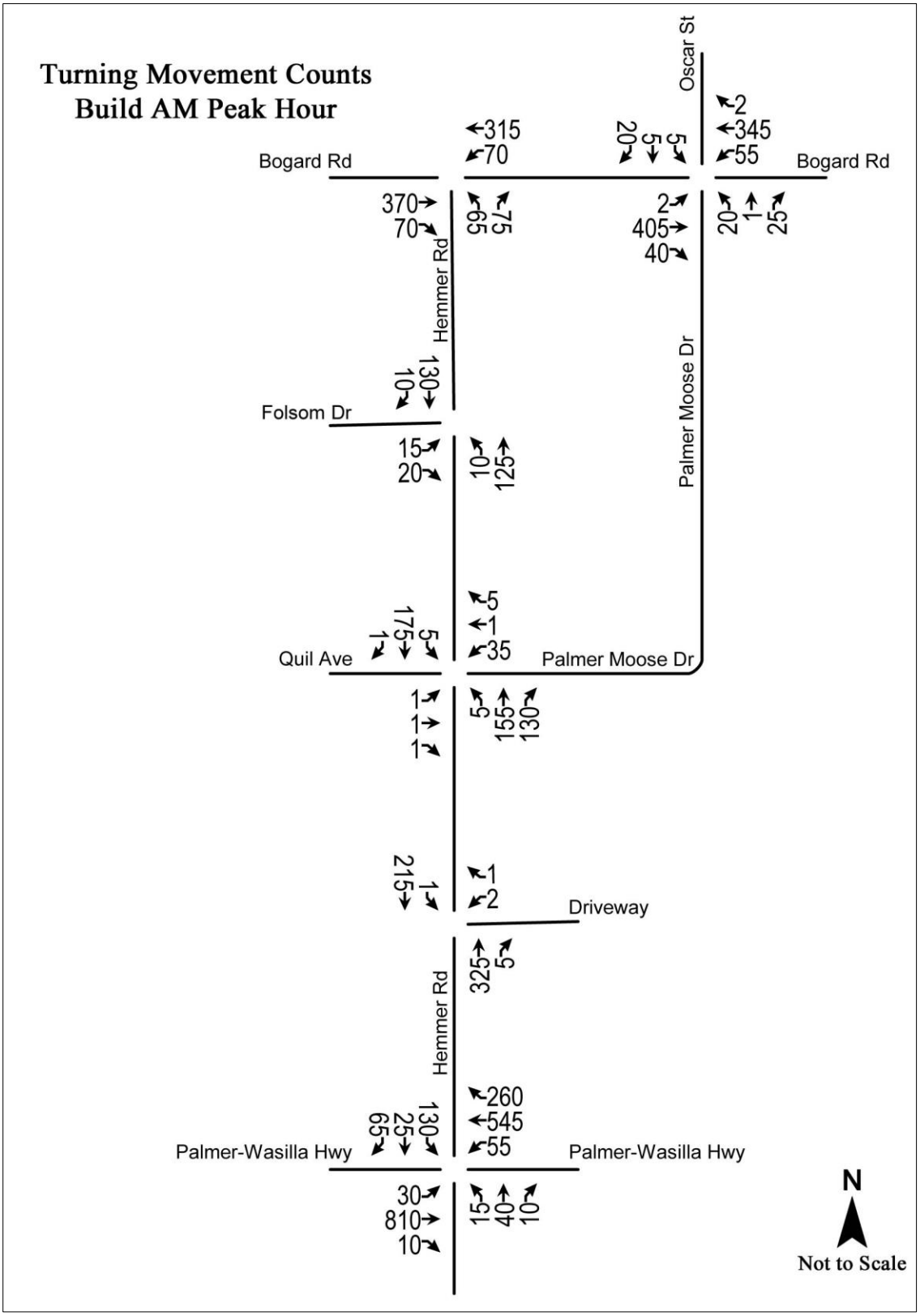

Figure 17: Build TMVs – AM Peak Hour

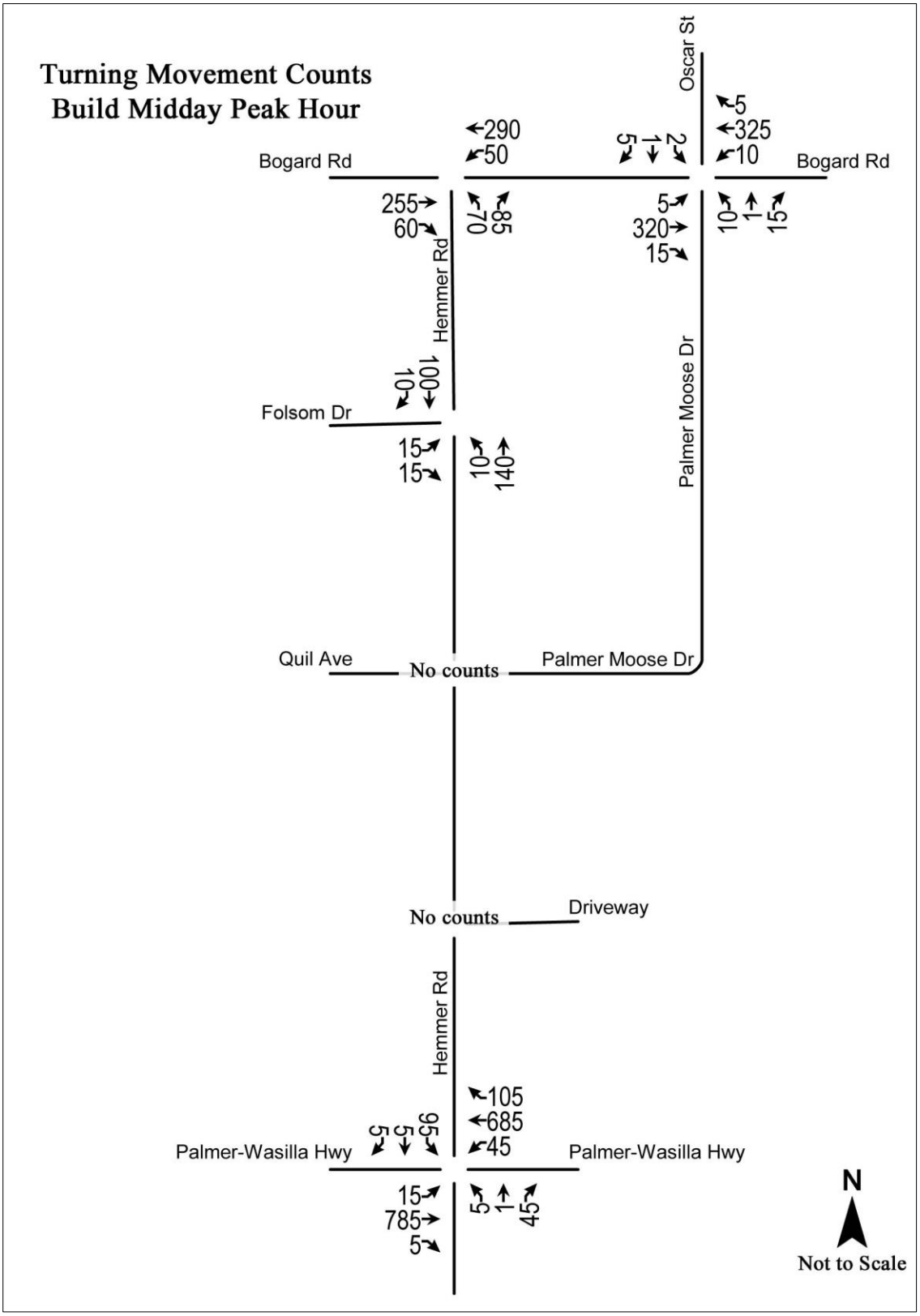

Figure 18: Build TMVs – Midday Peak Hour

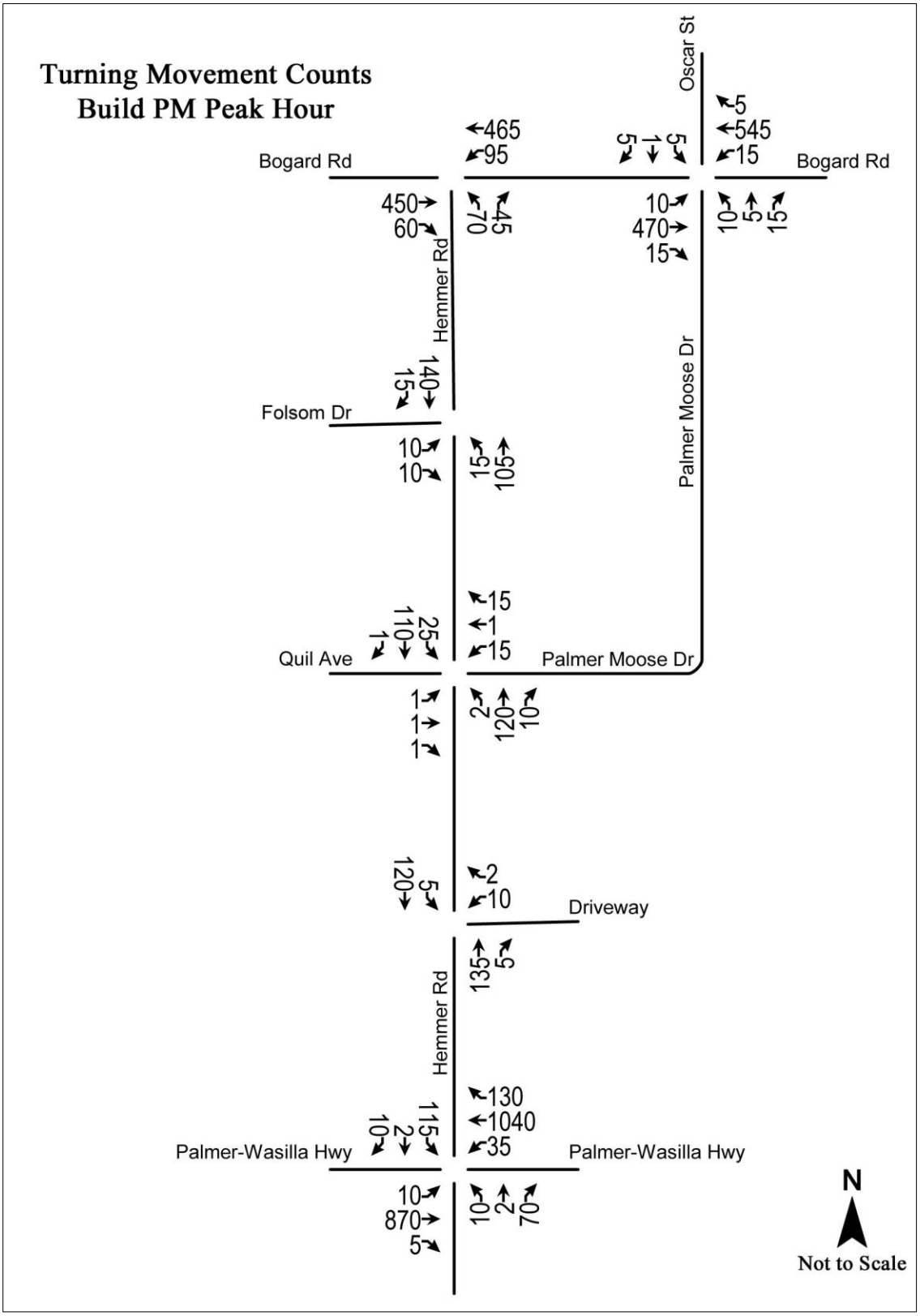

Figure 19: Build TMVs – PM Peak Hour

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

Condition A	**2025**		**2035**		**2045**	
	Major Road *Bogard Rd*	**Minor Road** *Hemmer Rd*	**Major Road** *Bogard Rd*	**Minor Road** *Hemmer Rd*	**Major Road** *Bogard Rd*	**Minor Road** *Hemmer Rd*
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	
Condition B	**2025**		**2035**		**2045**	
	Major Road *Bogard Rd*	**Minor Road** *Hemmer Rd*	**Major Road** *Bogard Rd*	**Minor Road** *Hemmer Rd*	**Major Road** *Bogard Rd*	**Minor Road** *Hemmer Rd*
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

Bogard Road Intersection	**Next Intersection (to the east)**	**Distance between Signals**
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.

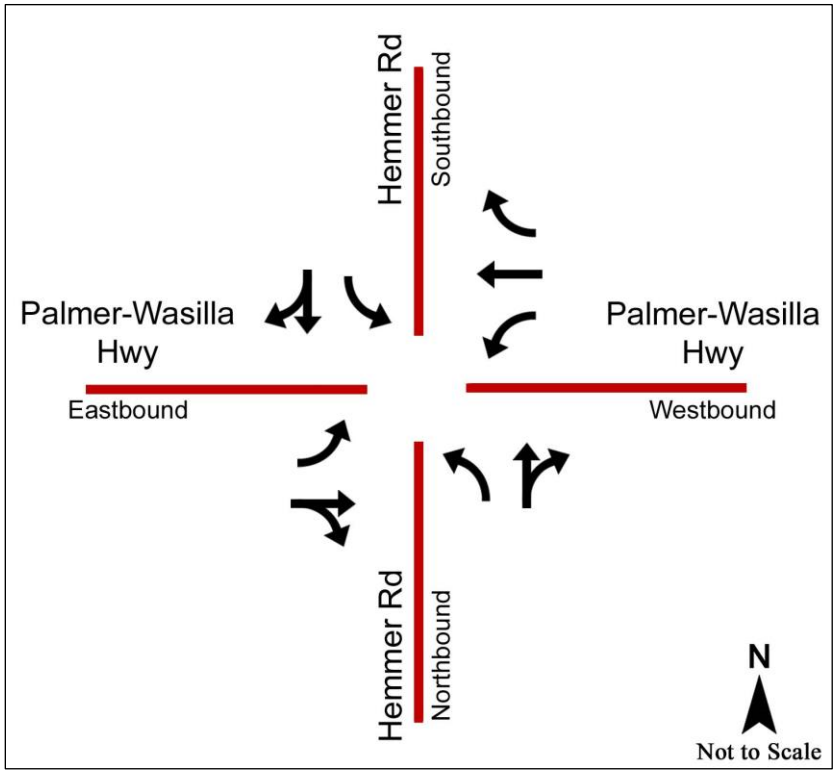

Figure 20: Proposed Lane Configuration at Hemmer Road & Palmer-Wasilla Highway

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.

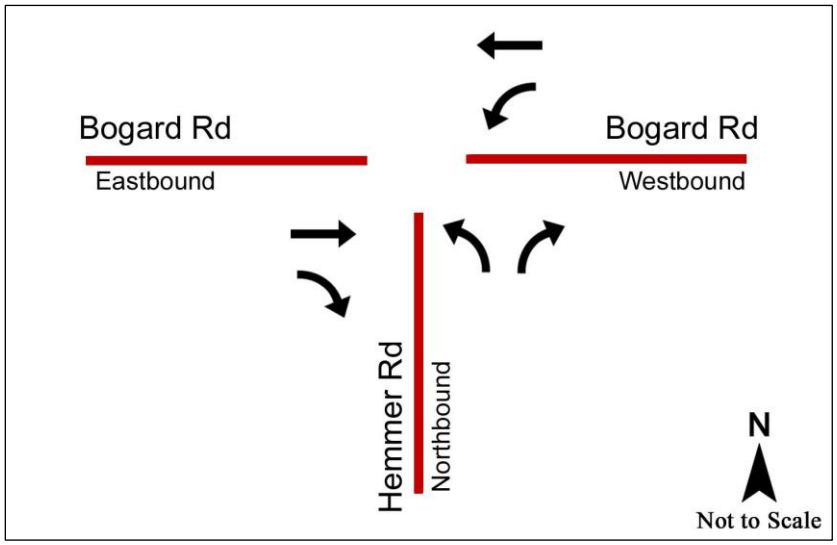

Figure 21: Proposed Intersection Configuration at Hemmer Road & Bogard Road

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.

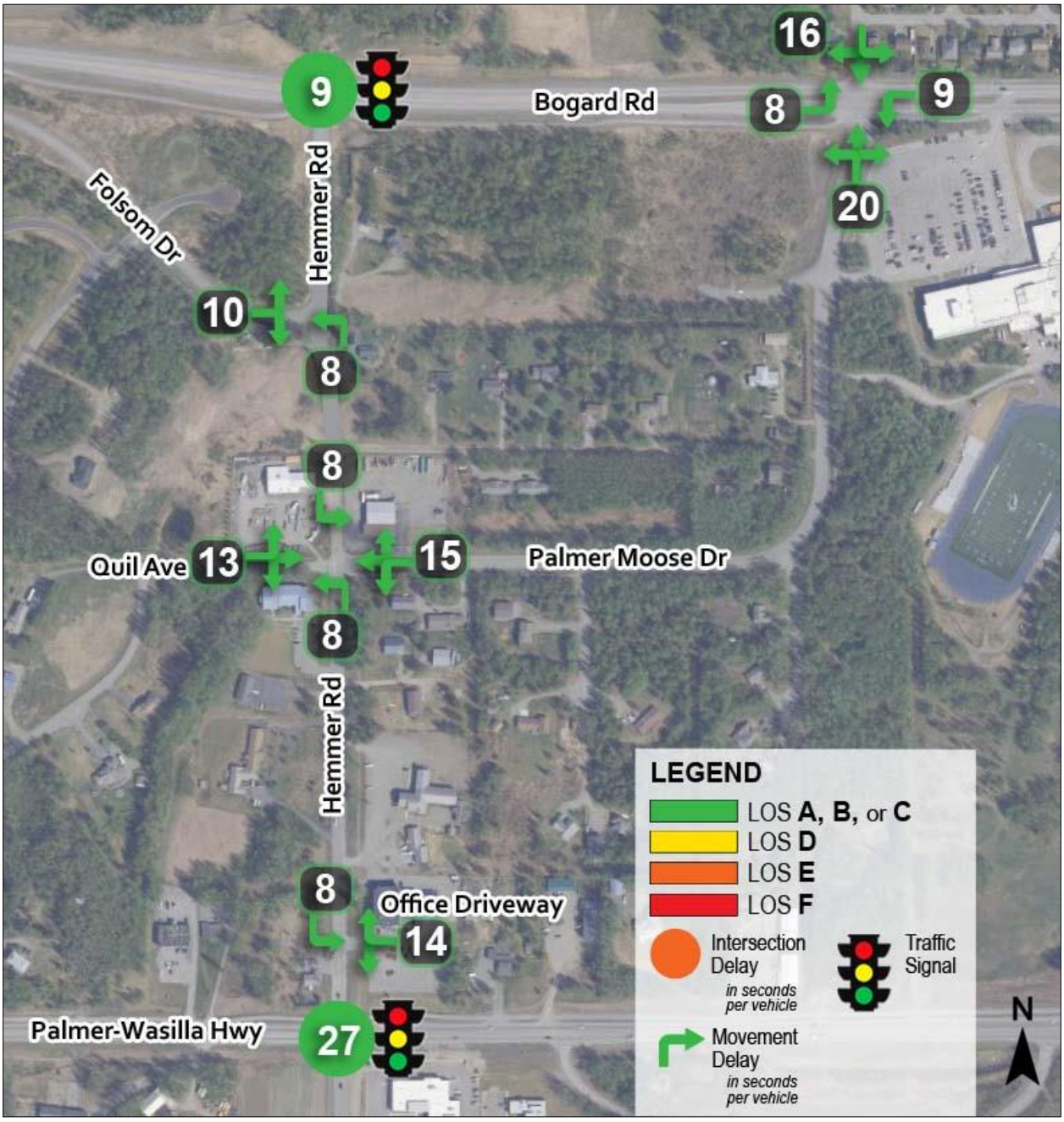

Figure 22: 2045 Build LOS – AM Peak Hour

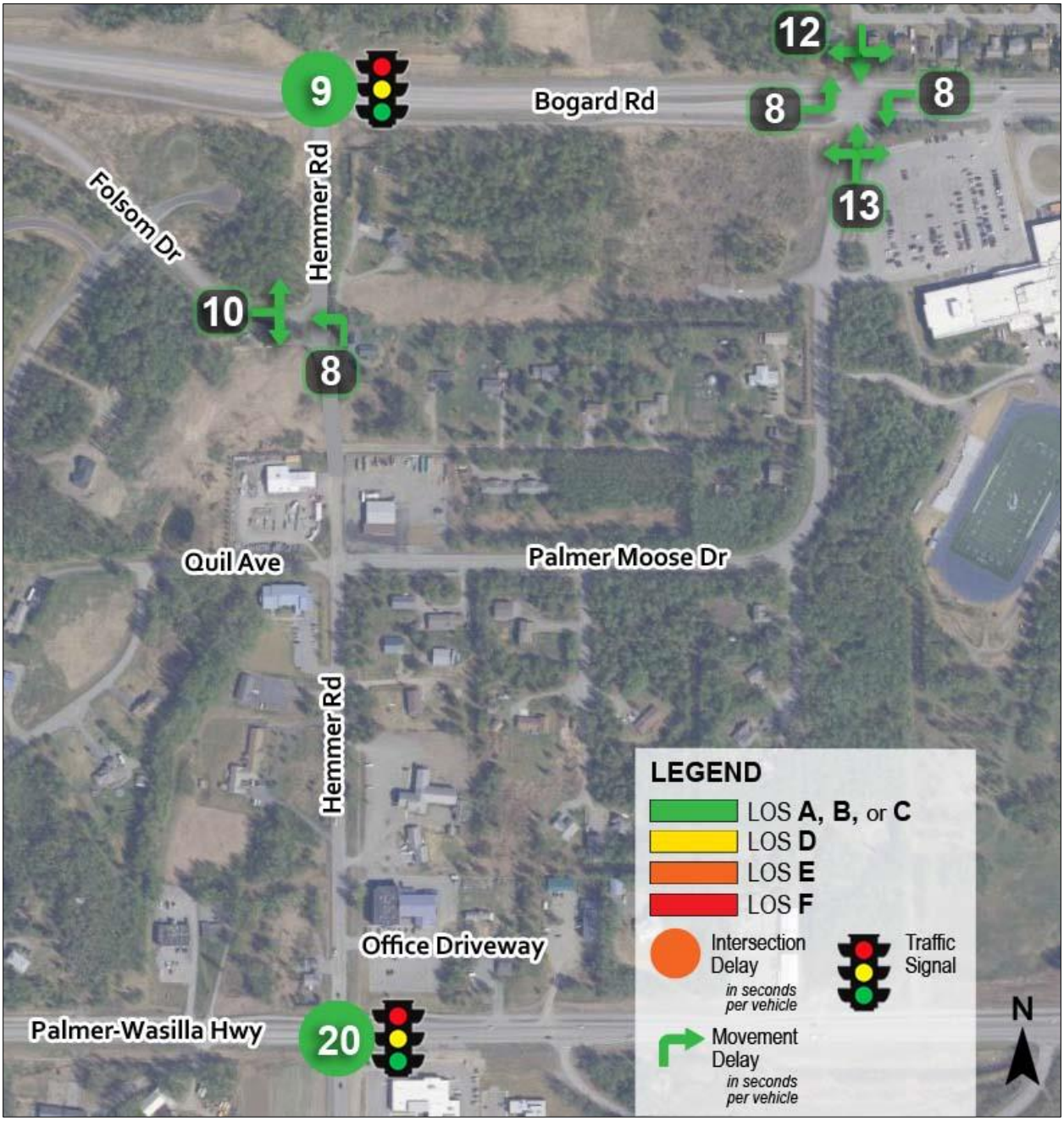

Figure 23: 2045 Build LOS – Midday Peak Hour

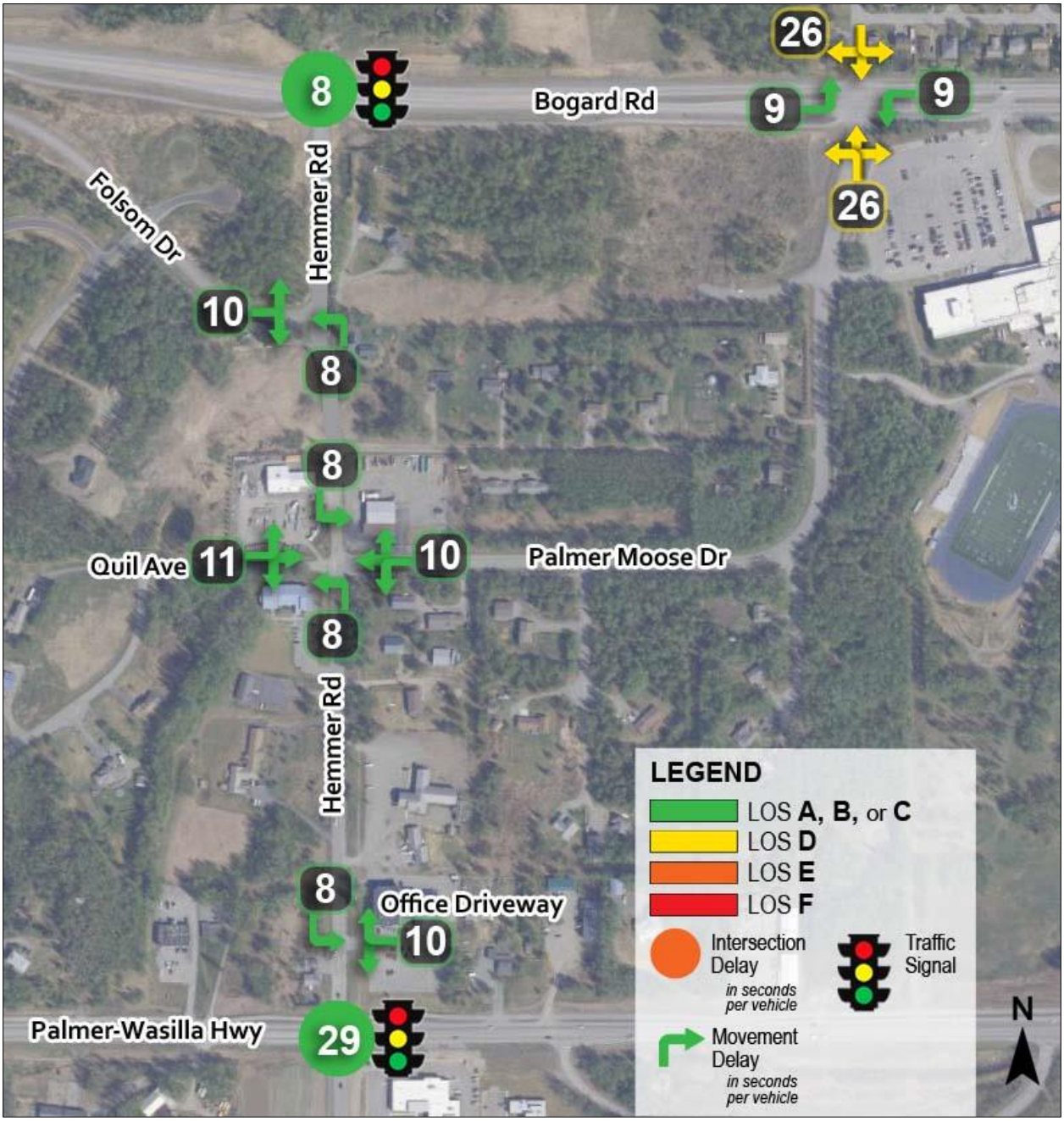

Figure 24: 2045 Build LOS – PM Peak Hour

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.

6 References

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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.

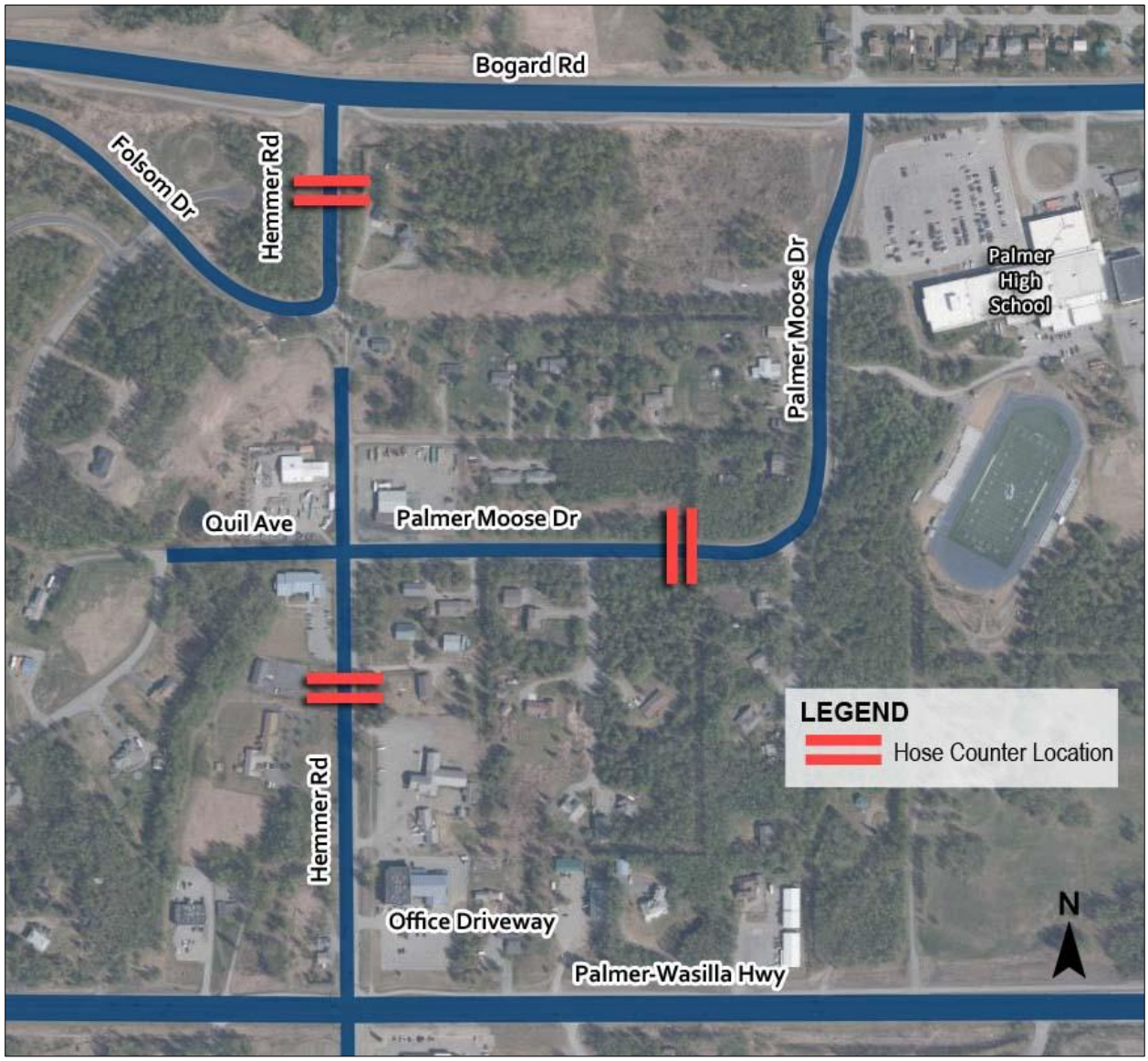


Figure A-1: Hose Counter Locations

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.

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

	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	
Hour	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		

	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	
Hour	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		

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

	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	
Hour	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		

	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	
Hour	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

	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	
Hour	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

	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	
Hour	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

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	456
Stage 1	-	-	-	-	456	-
Stage 2	-	-	-	-	430	-
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	-	-	1099	-	287	559
Stage 1	-	-	-	-	593	-
Stage 2	-	-	-	-	610	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1099	-	283	559
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	-

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

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

Intersection	
Int Delay, s/veh	0.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
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	0
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	NBR	WBLn1	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.

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

Intersection Summary	
HCM 2010 Ctrl Delay	14.1
HCM 2010 LOS	B

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	-

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

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

Intersection	
Int Delay, s/veh	0

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
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	NBR	WBLn1	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)	-	-	-	-	-

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.

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

Intersection Summary	
HCM 2010 Ctrl Delay	15.2
HCM 2010 LOS	B

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	462
Stage 1	-	-	-	-	462	-
Stage 2	-	-	-	-	514	-
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	-	-	1092	-	253	555
Stage 1	-	-	-	-	589	-
Stage 2	-	-	-	-	556	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1092	-	248	555
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	-

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

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

Intersection	
Int Delay, s/veh	1.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
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	0
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	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	869	1518	-
HCM Lane V/C Ratio	-	-	0.019	0.002	-
HCM Control Delay (s)	-	-	9.2	7.4	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0	-

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.

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

Intersection Summary	
HCM 2010 Ctrl Delay	16.8
HCM 2010 LOS	B

Appendix C 2045 No Build Traffic Operations

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	-

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

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%	25%
Vol Thru, %	2%	33%	1%	62%
Vol Right, %	98%	33%	1%	12%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	133	3	87	8
LT Vol	1	1	85	2
Through Vol	2	1	1	5
RT Vol	130	1	1	1
Lane Flow Rate	187	4	123	11
Geometry Grp	1	1	1	1
Degree of Util (X)	0.191	0.005	0.159	0.014
Departure Headway (Hd)	3.68	4.347	4.66	4.398
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	982	828	765	818
Service Time	1.681	2.347	2.716	2.403
HCM Lane V/C Ratio	0.19	0.005	0.161	0.013
HCM Control Delay	7.5	7.4	8.6	7.5
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.7	0	0.6	0

Intersection	
Int Delay, s/veh	0.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
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	0
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	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	708	1365	-
HCM Lane V/C Ratio	-	-	0.006	0.001	-
HCM Control Delay (s)	-	-	10.1	7.6	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0	0	-

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

Intersection Summary	
HCM 2010 Ctrl Delay	31.8
HCM 2010 LOS	C

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	-

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

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

Intersection	
Int Delay, s/veh	0

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
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	NBR	WBLn1	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)	-	-	-	-	-

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.

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

Intersection Summary	
HCM 2010 Ctrl Delay	22.2
HCM 2010 LOS	C

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	
Conflicting Flow All	0	0	544	0	1153	533
Stage 1	-	-	-	-	533	-
Stage 2	-	-	-	-	620	-
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	-	-	1025	-	197	504
Stage 1	-	-	-	-	545	-
Stage 2	-	-	-	-	495	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1025	-	193	504
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	-

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

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

Intersection	
Int Delay, s/veh	1.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
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	0
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	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	894	1523	-
HCM Lane V/C Ratio	-	-	0.02	0.004	-
HCM Control Delay (s)	-	-	9.1	7.4	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0	-

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.

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

Intersection Summary	
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

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(I)	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		

Intersection Summary	
HCM 2010 Ctrl Delay	9.0
HCM 2010 LOS	A

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

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	-	-

Intersection	
Int Delay, s/veh	0.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
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	0
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	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	407	1078	-
HCM Lane V/C Ratio	-	-	0.011	0.001	-
HCM Control Delay (s)	-	-	13.9	8.3	0
HCM Lane LOS	-	-	B	A	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.

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

Intersection Summary	
HCM 2010 Ctrl Delay	27.0
HCM 2010 LOS	C

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
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

Intersection Summary

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		

Intersection Summary	
HCM 2010 Ctrl Delay	8.6
HCM 2010 LOS	A

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

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	-	-	-	-	-	-	-

Intersection	
Int Delay, s/veh	0

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
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	NBR	WBLn1	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.

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

Intersection Summary	
HCM 2010 Ctrl Delay	19.8
HCM 2010 LOS	B

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
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	-	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

Intersection Summary

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		

Intersection Summary	
HCM 2010 Ctrl Delay	8.4
HCM 2010 LOS	A

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

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	-	-

Intersection	
Int Delay, s/veh	0.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
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	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	706	1416	-
HCM Lane V/C Ratio	-	-	0.02	0.004	-
HCM Control Delay (s)	-	-	10.2	7.6	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0	-

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.

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

Intersection Summary	
HCM 2010 Ctrl Delay	28.8
HCM 2010 LOS	C

Intersection	
Int Delay, s/veh	1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
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	-	-

The information in this report is compiled for highway safety planning purposes. Federal law prohibits its discovery or admissibility in litigation against state, tribal or local government that involves a location or locations mentioned in the collision data. 23 U.S.C. § 407; 23 U.S.C. § 148(g); *Walden v. DOT*, 27 P.3d 297, 304-305 (Alaska 2001).

APPENDIX E

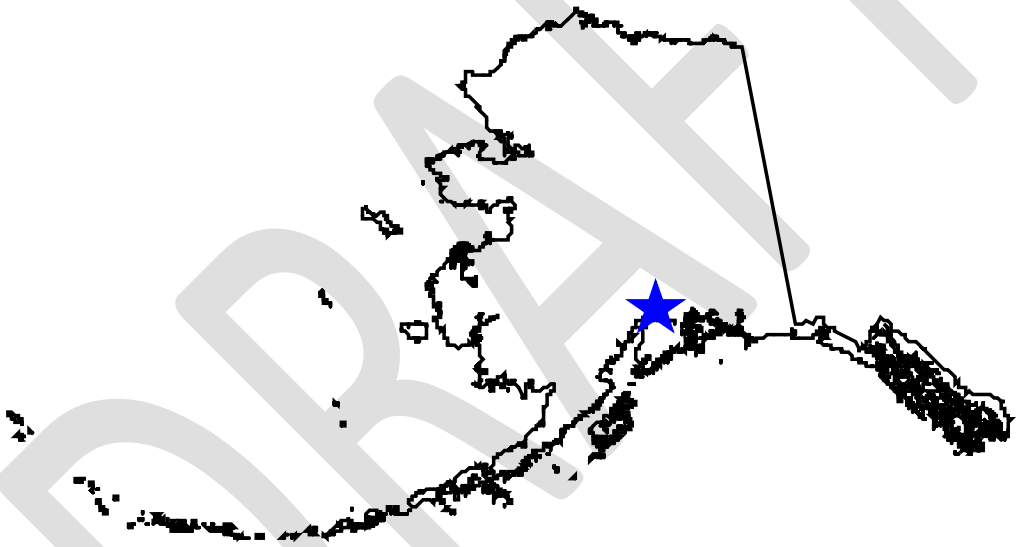
Material Recommendations

GEOTECHNICAL RECOMMENDATIONS

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

Project No. 0001743 / CFHWY00885

August 2024



Prepared By
ALASKA DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES
Central Region Materials
Anchorage, Alaska

ALASKA
Department of Transportation And Public Facilities

GEOTECHNICAL RECOMMENDATIONS

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

Project No.: 0001743 / CFHWY00885

August 2024

Prepared By:

Stephen Wehe, E.I.T.
Central Region Materials

Recommended for Approval By:

David Eguires-Lee, P.E.
Central Region Materials

Stamp will be added at final

Approved By:

Mitch Miller, P.E.
Regional Geotechnical Engineer

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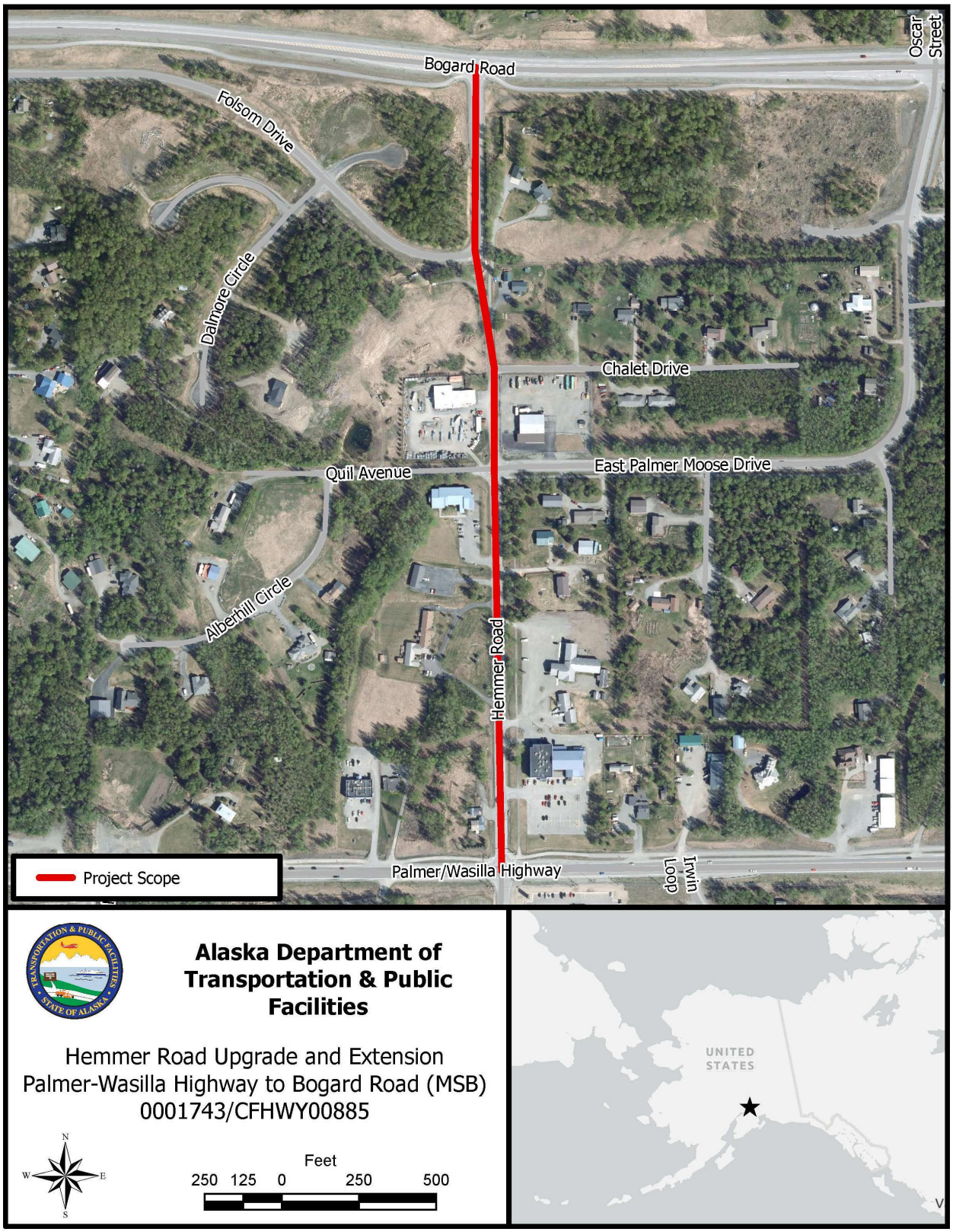
APPENDICIES


Bogard Road
Oscar Street
Folsom Drive
Dalmore Circle
Chalet Drive
East Palmer Moose Drive
Quil Avenue
Alberhill Circle
Hemmer Road
Palmer/Wasilla Highway
Irwin Loop
Project Scope
Alaska Department of Transportation & Public Facilities
Hemmer Road Upgrade and Extension
Palmer-Wasilla Highway to Bogard Road (MSB)
0001743/CFHWY00885
N
W
E
S
Feet
250 125 0 250 500
UNITED STATES

1.0 INTRODUCTION

SCOPE

The purpose of these investigations and analyses is to gather data and provide geotechnical recommendations for the project. This report presents recommendations based on the results of the subsurface geotechnical investigation completed in May 2024 by Central Region Materials (CRM). The Final Recommendations will include the Draft Bore Logs and Map in Appendix A.

PROJECT DESCRIPTION

This project proposes to upgrade the existing section of Hemmer Road from the Palmer-Wasilla Highway north and extend Hemmer Road further north to Bogard Road adding travel lanes, turn lanes, shoulders, amenities for pedestrians, and features for drainage, safety, and roadside hardware. A traffic signal at the intersection of Hemmer Road and the Bogard Road will also be included.

REFERENCES

The following information was provided to CRM and serves as our preliminary basis for understanding the scope of the project:

- Preliminary Review F-Sheets, Hemmer Road Extension: Palmer-Wasilla Highway to Bogard Road, Project No. 0001743 / CFHWY00885, June 2024.

HISTORICAL PROJECT INFORMATION

Historical as-builts along the project corridor, along with the results of the geotechnical investigation, were used to help determine the existing structural section. This historical information is attached as Appendix B.

- As-Builts, Hemmer Road Grading, Paving & Drainage, Project No. OS – 1(008), 1976.

LIMITATIONS

This report documents subsurface geotechnical conditions based on analyses of extracted materials taken from locations on the project site, and provides interpretation of anticipated site conditions on the project. This report recommends design and construction criteria for the project based off of the information available to CRM at the time of this writing, and is only intended for the project design criteria staff.

2.0 CLIMATE

Climate data for this project was obtained from the Matanuska Agricultural Experimental Station through the Western Regional Climate Center (WRCC). Annual total precipitation averaged 15.27”, with total snowfall averaging 47.7”. Average temperatures ranged from 4.5°F (January) to 67.4°F (July) (see the table on the next page), with extreme temperatures from the previous 20 years ranging from -29°F (January 2009) to 88°F (July 2019).

MATANUSKA AG EXP STN, ALASKA (505733)

Period of Record Monthly Climate Summary

Period of Record : 07/04/1917 to 05/31/2016

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	21.6	27.5	34.3	46.2	58.1	65.6	67.4	65.0	56.6	43.0	28.7	22.4	44.7
Average Min. Temperature (F)	4.5	9.8	15.8	27.3	36.3	44.5	48.2	46.2	38.7	27.2	13.1	6.3	26.5
Average Total Precipitation (in.)	0.84	0.71	0.50	0.44	0.71	1.38	2.17	2.59	2.44	1.47	0.96	1.06	15.27
Average Total SnowFall (in.)	8.3	8.3	6.2	2.2	0.2	0.0	0.0	0.0	0.1	4.0	7.9	10.6	47.7
Average Snow Depth (in.)	4	4	2	1	0	0	0	0	0	1	2	4	2

Percent of possible observations for period of record.
Max. Temp.: 96.6% Min. Temp.: 96.6% Precipitation: 96.5% Snowfall: 95.8% Snow Depth: 89%
Check Station Metadata or Metadata graphics for more detail about data completeness.

Western Regional Climate Center, wrcc@dri.edu

3.0 EXISTING CONDITIONS

STATION TO STATION DESCRIPTIONS

This section will present generalized subsurface profiles based on the bore logs and laboratory test results. At the time of this draft report, these are still being developed. The Final Recommendations will include the Station-to-Station Descriptions as well as the detailed results of the geotechnical investigation.

DRAINAGE AND GROUNDWATER RECOMMENDATIONS

Groundwater

The depth of the groundwater (GW) table is varied throughout the project area, ranging from 8’ to 15.5’ BGS. It is also noted that the GW table was encountered in only three of the 11 THs advanced in the project area. The full results of the drilling investigation will be presented in the Final Recommendations.

Drainage Recommendations

Surface drainage along proposed road surfaces should be designed to sheet drain towards the proposed ditch line in a manner that minimizes erosion potential. Ditch profiles should be contoured to culverts, drainage basins, etc. to move surface water away from the embankment to eliminate water ponding at the toe. Ditches should be constructed to a minimum depth of 3’ below the pavement surface where design and existing conditions allow (after placement of topsoil) to promote natural drainage within the structural section and protect against frost heaving.

4.0 EARTHWORK

CLEARING AND GRUBBING

Clearing is recommended, in accordance with Section 201-3.02, in areas where the proposed final alignment of the roadway will require sight distances beyond what is currently existing to meet design standards.

Grubbing is recommended within the proposed road and pathway footprints in accordance with Section 201-3.03. Waste from grubbing should be disposed of in designated waste areas (see Waste Excavation recommendations) or hauled off the project to contractor provided waste areas. All slopes of existing embankment within the project area need to be grubbed prior to placement of any new embankment material.

EXCAVATION & EMBANKMENT

General Excavation

Project geotechnical borings show that the existing soils range from organics to gravel, with a number of potentially useable portions; therefore, it is recommended that the excavation be paid for under the 203(3) Unclassified Excavation item. See station to station descriptions for potential usability of material. All potentially useable materials should be tested to confirm conformance to specifications. Unusable excavation should be disposed of in designated or contractor provided areas.

The alignment of the extension of Hemmer Road runs through undeveloped land, approximately from Sta. 116+50 to Sta. 120+00, which consists of organic soils from the surface down to a maximum depth of 7.5' BGS. Remove this material prior to placing any new embankment material and backfill with useable Selected Material.

General Embankment

Based on the field logs of the geotechnical investigation, the existing structural section primarily consists of sands and gravels with a layer of silt with sand beneath. Off-road bore logs showed organic soil down to an average of 5.8' BGS and sand with gravel beneath. The P200 levels will be available in the Final Recommendations with the laboratory test results.

SLOPE RECOMMENDATIONS

Cut/Fill slopes should not be constructed steeper than 2H:1V. Slopes designed steeper should be further evaluated to determine if embankment stabilization is needed.

Benching is strongly recommended in accordance with Section 203-3.03, Embankment Construction. Consider adding a note to plans to ensure contractor compliance. All slopes should be vegetated by seeding or other measures to establish native vegetation, minimizing erosion potential.

WASTE EXCAVATION

Designated waste areas may be included in the project where possible (within existing right-of-way and environmental constraints) for the disposal of cleared/grubbed vegetation and unusable excavation. The following criteria are recommended for designated waste areas (when connected to the proposed embankment):

- Waste areas should be located in areas with firm thawed ground to reduce potential for subgrade failure after loaded with waste material.
- Waste areas should have a 3% (min.) cross slope from the embankment to direct drainage away from the embankment.
- Waste slopes should be restricted to no steeper than 3H:1V to eliminate shear failure.

Recommend leaving a 10' buffer between the toe of waste and ROW in order to allow access for construction and maintenance equipment

MATERIAL SOURCES

No material source investigations were performed for this project as all materials are expected to be imported from local private sources.

5.0 STRUCTURAL SECTION RECOMMENDATIONS

PAVEMENT AND STRUCTURAL SECTION DESIGN CRITERIA

- Construction Year: 2027 (*per July 2024 Project Status Book*)
- Design Life: 20 years
- 2019 AADT: 982 (491 per lane)
- Projected Construction Year AADT: 1,151 (633 per design lane)
- Design ESALs: 237,094

PAVEMENT AND STRUCTURAL SECTION RECOMMENDATION

The following recommendations were developed using bore logs, laboratory test results, and the Mechanistic and Excess Fines Design processes in accordance with the general policies of the Alaska Flexible Pavement Design Manual, specifically "GP-6" that requires a stabilized base course. The recommendation provides a new pavement layer to support the projected traffic for a 20-year design life.

Hemmer Road

- 2" HMA, Type II, Class A, PG 52-40E
- STE-1 Asphalt for Tack Coat
- 2" ATB (or HMA, Type II, Class A, PG 52-40E)
- 6" Aggregate Base Course, Grading D-1
- 36" Selected Material, Type A
- Geotextile, Separation
- Existing embankment or Selected Material, Type C, as needed in deep fills to bottom of new embankment

Asphalt Pathway

- 2" Asphalt Pathway
- 4" Aggregate Base Course, Grading D-1
- 24" (*min) Selected Material, Type A
- Geotextile, Separation
- Selected Material, Type C – *as needed in deep fills to bottom of new embankment*

**Increase layer thickness to match bottom of adjacent roadway layer to allow better drainage within the road section where structural prisms overlap.*

Alternative Recommendation

An alternative is being presented due to the possibility that the ownership of this road, upon the completion of construction, will be turned over to the Matanuska-Susitna Borough, which would fall under the exception detailed above. In this case, the following structural section is a design alternative using the same design criteria that will also support the projected traffic for a 15-year design life.

Hemmer Road

- 3" HMA, Type II, Class A, PG 52-40E
- 6" Aggregate Base Course, Grading D-1
- 36" Selected Material, Type A
- Geotextile, Separation
- Existing embankment or Selected Material, Type C, as needed in deep fills to bottom of new embankment

APPENDIX A

Draft Bore Logs and Map

PLACEHOLDER

APPENDIX B

Historical Project Data

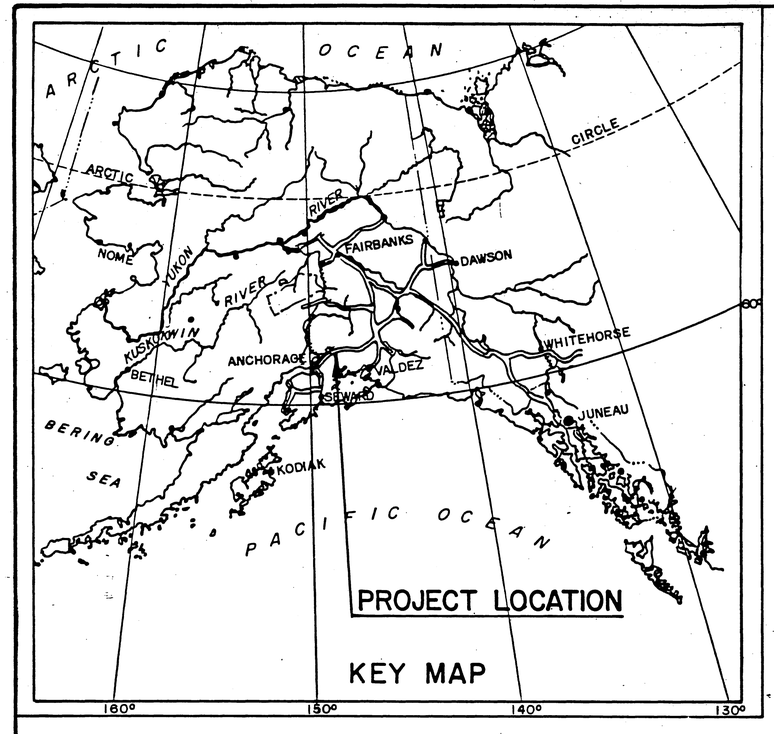
Saved electronically

AS BUILT PLANS

STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
ALASKA	OS-1(008)	76	1	4
ROUTE 136848		M.P 0.0-0.3		

STATE OF ALASKA
DEPARTMENT OF HIGHWAYS

PLAN AND PROFILE
PROPOSED HIGHWAY PROJECT
GRADING, PAVING & DRAINAGE
HEMMER ROAD
OS-1(008)

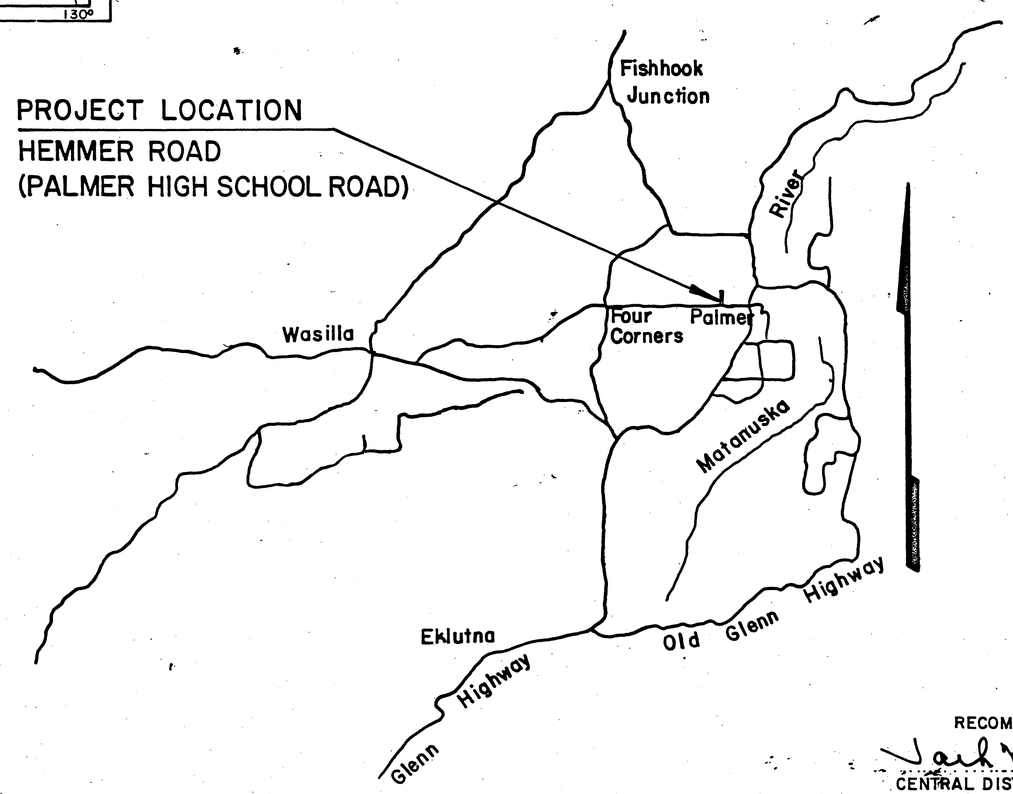


INDEX OF SHEETS

SHEET NO.	DESCRIPTION
1	Title Sheet
2	Typical Section
3	Estimate of Quantities
4	Plan Sheet

PROJECT SUMMARY	
Width of Surfacing	36'
Length of Surfacing	1350'
Length of Project	1350'

DESIGN DESIGNATION	
ADT 1975	335
ADT 1995	1300
DHV (15%)	195
D	35/65
T	5%



The following STANDARD DRAWINGS apply to this project: A-1, C-00.01, C-10.00, C-11.01, D-02.02, I-40.10, M-16.03, S-05.00, S-30.11, T-21.00.

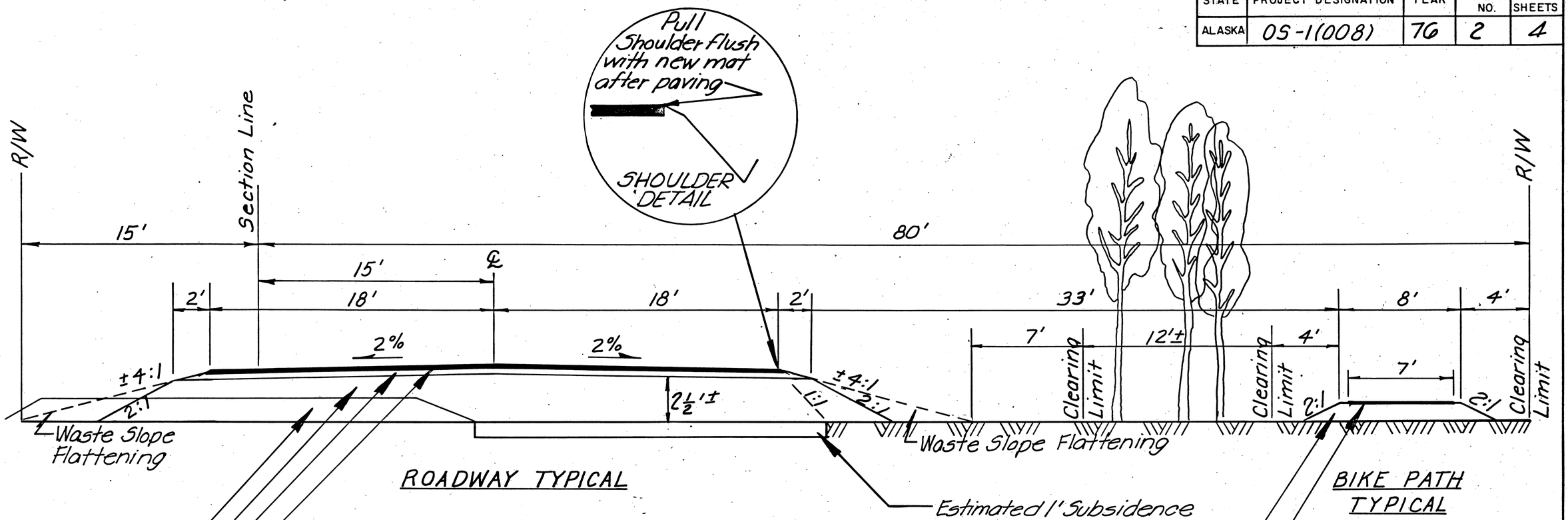
Project Engineer: Charles Fletcher
Contractor: Herman Bros. Co., Inc.
Contract Began: October 12, 1976
Contract Ended: June 15, 1977

STATE OF ALASKA
DEPARTMENT OF HIGHWAYS

RECOMMENDED FOR APPROVAL
Date 8/2/76
CENTRAL DISTRICT HIGHWAY ENGINEER

APPROVED
Date 12 Aug 76
COMMISSIONER OF HIGHWAYS

STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
ALASKA	05-1(008)	76	2	4



Profile Grade to be as determined by the engineer.

The beginning ~~150~~ 500± feet of project shall be excavated full width to 3½ feet below top of select material, or until encountering suitable foundation material, as determined by the engineer.

STATE OF ALASKA
DEPARTMENT OF HIGHWAYS

HEMMER ROAD

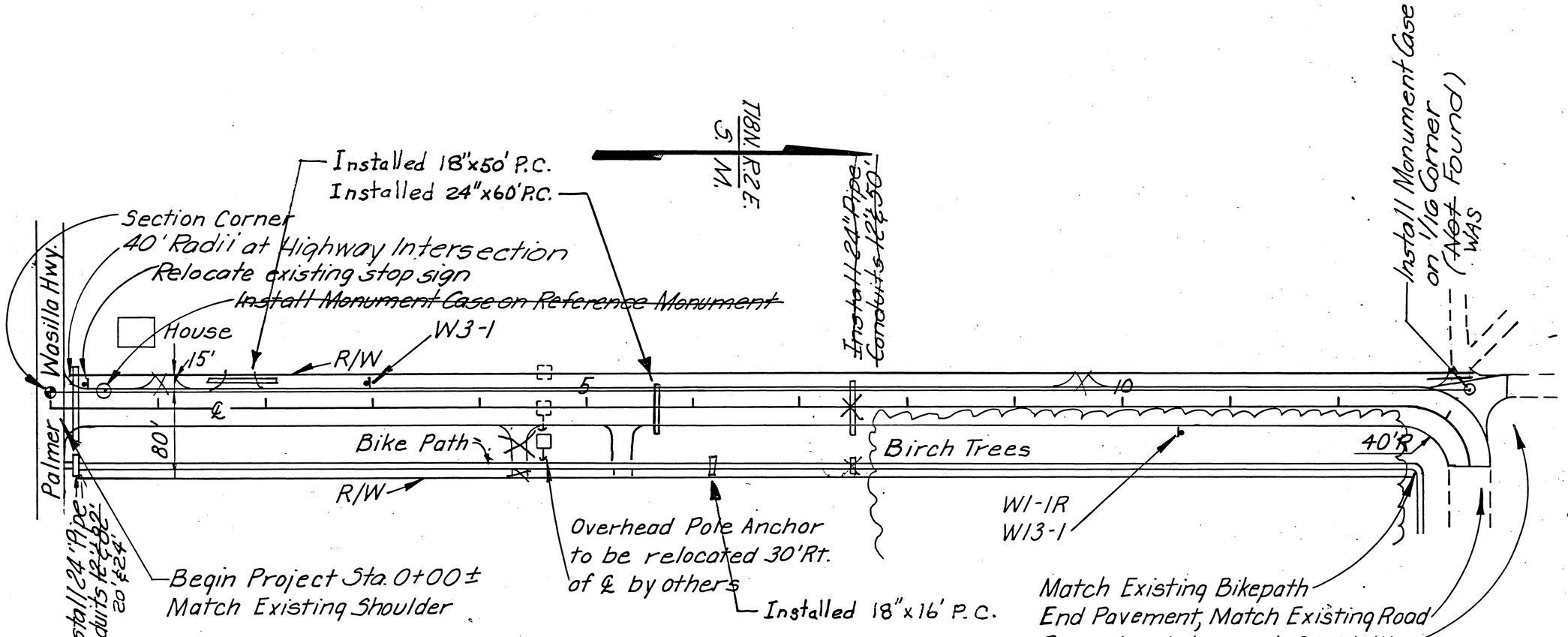
ESTIMATE OF QUANTITIES

STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
ALASKA	OS-I(008)	76	3	4

ITEM NO.	ITEM	UNIT	SHEET NUMBERS									
1	Furnish & Maintain Engineering Facilities	L.S.				ALL REQ'D		All Reqd.				
110	Mobilization	L.S.				ALL REQ'D		All Reqd.				
111(1)	Temporary Erosion & Pollution Control	C.S.				ALL REQ'D		None				
113(1)	Flagging	M.H.				100		19				
114(1)	Construction Engineering by Contractor	L.S.				ALL REQ'D		All Reqd.				
201(3A)	Clearing & Grubbing	ACRE				.68		1.033				
203(3)	Unclassified Excavation	C.Y.				500		4.197				
203(5B)	Borrow	TON				10,800		11,338				
301(1)	Crushed Aggregate Base, Grading "C"	TON				2,200		2,247				
401(1)	Hot Asphalt Pavement	TON				670		731.75				
401(2)	AC-2.5 Asphalt Cement (AC-5) EWO#2	TON				44		38.94				
603(22G)	24" Pipe Conduit	L.F.				156		154				
614(2)	Monument Cases	EACH				2		1				
615(1)	Standard Signs	S.F.				22		22				
627(1)	Watering	M.G.				65		None				
670(1)	Painted Traffic Markings	L.S.				ALL REQ'D		All Reqd				
683(1)	Approaches	EACH				5		5				
603(22E)	18" Pipe Conduit (EWO#1)	L.F.						66				

HEMMER ROAD ESTIMATE

STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
ALASKA	OS-1(008)	76	4	4



SIGN SCHEDULE

TYPE	SIZE	LEGEND	LOCATION
W3-1	36" x 36"	Stop Ahead	3+00 21½' Lt.
W1-1R	36" x 36"	↱	10+50 21½' Rt.
W13-1	24" x 24"	15 M.P.H.	Mount under W1-1R

Use 2½" x 2½" square tube post for new sign installations with sleeve type concrete foundations.

The Contractor shall be responsible for locating and arranging for preservation of any existing utilities which may be damaged by this construction.

STATE OF ALASKA
DEPARTMENT OF HIGHWAYS

HEMMER ROAD

HEMMER ROAD (OS-1(008))

APPENDIX G

Approved Environmental Document

State of Alaska
Department of Transportation & Public Facilities

CATEGORICAL EXCLUSION DOCUMENTATION FORM
(NEPA Assignment Program Projects)

The environmental review, consultation, and other actions required by the applicable Federal environmental laws for this project are being, or have been carried out by the DOT&PF pursuant to 23 U.S.C. 327 and a Memorandum of Understanding dated April 13, 2023 and executed by FHWA and DOT&PF.

I. Project Information

A. Project Name: Hemmer Rd Extension and Upgrade, Palmer Wasilla Hwy to Bogard Rd (MSB)

B. State Project Number: CFHWY00885

C. Federal Project Number: 0001743

D. Primary/Ancillary Project Connections: N/A

E. COA Determination: Unlisted CE

F. Project Scope:

TIP or STIP: STIP

Need ID: 32721

Project Scope:

The Project will extend and upgrade approximately 0.50 miles of Hemmer Road (Rd) from the Palmer-Wasilla Highway to Bogard Road consisting of two travel lanes and a center turn lane. Improvements include a traffic signal at the Bogard Road intersection, shoulders, pedestrian and bicycle infrastructure, drainage and safety items.

G. Project Purpose And Need:

The purpose of the project is to extend and upgrade Hemmer Road to provide a new north-south road between the Palmer-Wasilla Highway and Bogard Road. There currently exists only one north-south connection constructed to collector road standards in the four mile stretch between the Glenn Highway and Trunk Road leading to congestion and a lack of north-south connectivity.

H. Project Description:

The project will reconstruct Hemmer Road from its intersection with Palmer-Wasilla Hwy north, and extend Hemmer Road north to Bogard Road. Project features include the construction of new two lane road. Also planned are a two-way-center-left-turn lane (if warranted), separated pathway for pedestrians and/or sidewalk, and a traffic signal at the intersection of Hemmer Road and Bogard Road. The road may currently be described as: paved road for the first quarter mile (from the Wasilla Highway), 0.13 miles of gravel road (about 325 feet of which currently function solely as a driveway for two homes), a gap of about 55 feet where no road exists, and paved road the remaining approximate 590 feet (East Folsom Drive) to its intersection with Bogard Road.

Additional improvements may include as needed:

- Paving
- Pathway and/or sidewalk
- Roadway lighting
- Roadway realignment
- Signalization
- Shoulders
- Signing and striping
- Pedestrian amenities
- Roadside hardware
- Brush clearing and grubbing
- Drainage features

Attachments

Environmental Consequences

Project Plans & Location Information

- Project Plans and Location Info CFHWY00885.pdf

Right-of-Way Impacts

- Lots Table.pdf CFHWY00885.pdf

Historic Properties and Cultural Impacts

- CFHWY00885 Hemmer Road Extension and Upgrade PWH to Bogard Road_ALL.pdf CFHWY00885.pdf
- CFHWY00885 Hemmer Road Extension_FONHPA_ALL.pdf CFHWY00885.pdf
- 2023-00191_FHWA_Hemmer-Bogard-Rd-Ext_SHPO-Re-Response RVH.pdf CFHWY00885.pdf
- CFHWY00885 Hemmer Road Extension PWH to Bogard_lighting_signed_3.18.24.pdf CFHWY00885.pdf
- CFHWY00885 L&V and Project Area.pdf CFHWY00885.pdf
- Hemmer Road SHPO Non-Concurrence and DOT&PF Response.pdf CFHWY00885.pdf

Water Quality Impacts

- DEC Drinking Water Comments - Consultation - CFHWY00885.pdf CFHWY00885.pdf

Noise Impacts (23 CFR 772)

- 230925 Hemmer Noise Report.pdf CFHWY00885.pdf

Comments and Coordination

Public Involvement

- Frontiersman - Hemmer Road Extension and upgrade.pdf CFHWY00885.pdf
- NOI - CFHWY00885 OPN.pdf CFHWY00885.pdf
- 2023-12-15_00885 Handout for Transportation Fair.pdf CFHWY00885.pdf

Agency Involvement

- Agency Scoping re CFHWY00885 sent 2-18-22.pdf CFHWY00885.pdf
- CFHWY00885ScopingDistributionList 2.18.22.pdf CFHWY00885.pdf
- Comments Compiled CFHWY00885.pdf CFHWY00885.pdf

Environmental Commitments

Environmental Commitments and Mitigation Measures [23 CFR 771.109(b)]

- dec-eh-dw-recommendations-for-general-project-activities-near-a-pws-source.pdf CFHWY00885.pdf
- DEC_PWS_Map.pdf CFHWY00885.pdf

II. Environmental Consequences

A. Land Use and Transportation Plans	Yes	No
1. Were land use plans for this area reviewed? If yes, include source, link, and date accessed.	☑	☐

Matanuska-Susitna Borough Comprehensive Development Plan

https://matsugov.us/docs/general/14173/borough-wide-comprehensive-plan.pdf

12/26/2023

Matanuska-Susitna Borough Core Area Comprehensive Plan 2007 Update

https://matsugov.us/docs/plans/14442/sandy-formatted-core-area-comp-plan1.pdf

12/26/2023

a. Is the project consistent with land use plan(s)?	☑	☐
2. Were transportation plans for this area reviewed?	☑	☐

MSB 2035 Long Range Transportation Plan

https://matsugov.us/docs/general/13985/Combined-Document.pdf

12/26/2023

Alaska Statewide Active Transportation Plan, Master Plan 2019

https://dot.alaska.gov/stwdplng/areaplans/modal_system/docs/AK-Statewide-Active-Transportation-Plan.pdf

12/26/2023

2022 MSB Official Streets and Highways Plan

https://matsugov.us/docs/general/22822/OSHP-2022-Final.pdf

12/26/2023

a. Is the project consistent with transportation plan(s)?	☑	☐
3. Would the project induce adverse indirect and cumulative effects on land use or transportation?	☐	☑

Summary
Summarize how the project is consistent or inconsistent with land use and transportation plan(s).

This project is consistent with land use and transportation plans developed for the Matanuska-Susitna Borough (MSB). The project supports such concepts as improving the efficiency and safety of the existing transportation system and providing transportation choices as the MSB Comprehensive Development Plan calls for. Agreement is found with the MSB 2035 Long Range Transportation Plan and the MSB Core Area Comprehensive Plan 2007 Update. The 2022 MSB Official Streets and Highways Plan classifies Hemmer Road as a major collector in support of corridor planning. The project is anticipated by the MSB 2035 Long Range Transportation Plan. The project additionally supports principles of the Alaska Statewide Active Transportation Plan, Master Plan 2019 which indicates intent "to improve safety, increase accessibility, and promote healthy lifestyles in our communities" and "to develop a safer and more efficient active transportation network and infrastructure to encourage walking and bicycling."

B. Right-of-Way Impacts	Yes	No
1. Are there any temporary right-of-way (ROW) impacts (e.g., Temporary Construction Easements (TCEs), Temporary Construction Permits (TCPs), utility relocates, construction staging area)?	☑	☐
2. Is additional permanent ROW required?	☑	☐
a. Are there any full parcel acquisitions?	☐	☑
b. Are more than 25 partial parcel acquisitions required?	☐	☑
c. Are business or residential relocations required?	☐	☑
3. Will there be property transfer from a local, state, or federal agency?	☐	☑
4. Will the project require an ANILCA Title XI approval?	☐	☑

Summary
Summarize ROW impacts, if any. Include any project-specific commitments or mitigative measures in Section V.

The project is likely to require some permanent ROW acquisition. Nine potential sliver takes have been identified. Additionally, TCEs and/or TCPs may be required.

Attachments

- Lots Table.pdf CFHWY00885.pdf

C. Environmental Justice Impacts (E.O. 12898)	Yes	No
1. Is there potential to affect environmental justice (EJ) populations?	☐	☑

Summary
Summarize EJ population impacts and mitigation, if any. Include any project-specific commitments or mitigative measures in Section V.

Review of the U.S. Environmental Protection Agency (EPA) Environmental Justice Screening and Mapping Tool indicated no low income or minority populations within the project area. Properties in the project corridor would see increased traffic while the larger area would benefit from reduced congestion. The absence of low income or minority populations within the project area supports the anticipated outcome of no such populations adversely impacted by the project.

D. Historic Properties and Cultural Impacts	Yes	No
1. Is a National Register of Historic Places listed or eligible property in the proposed Area of Potential Effect (APE)?	☐	☑
2. Was a programmatic allowance processed for the project under the Section 106 Programmatic Agreement?	☐	☑
3. Was Section 106 consultation initiated or a Direct to Findings worksheet completed?	☑	☐
a. Was a direct to findings worksheet completed?	☐	☑

D. Historic Properties and Cultural Impacts | **Yes** | **No**

b. Date Consultation Initiation Letters sent

10/9/2023

Attachments

- CFHWY00885 Hemmer Road Extension and Upgrade PWH to Bogard Road_ALL.pdf CFHWY00885.pdf

c. List consulting parties:

Consulting parties for this project include the Mat-Su Borough, the Knik Tribe, Chickaloon Village Tribal Council, Native Village of Eklutna, Knikatnu Inc., Chickaloon-Moose Creek Native Association, Eklutna Inc., Cook Inlet Region, Incorporated, the Alaska Association for Historic Preservation, Palmer Historical Society, Wasilla-Knik Historical Society, and the State Historic Preservation Officer.

d. Were any comments received? ☑ ☐

On October 10, 2023 the Knik tribe indicated no further comments for the project.

4. Was a Section 106 "Finding of Effect" completed? ☑ ☐

Attachments

- CFHWY00885 Hemmer Road Extension_FONHPA_ALL.pdf CFHWY00885.pdf

a. Date "Finding of Effect" Letters sent:

11/29/2023

b. State "Finding of Effect":

- No Effect

c. Were there any changes to consulting parties? ☐ ☑

d. Were any comments received? ☑ ☐

On December 28, 2023, SHPO responded to the Finding of Effect with non-concurrence and stated a belief that Hemmer Road should be reconsidered as potentially eligible under Criterion B for association with the Hemmer family.

on January 31, 2024 DOT&PF responded to SHPO's concerns.

5. Date State Historic Preservation Officer (SHPO) concurred with "Finding of Effect":

2/15/2024

Attachments

- 2023-00191_FHWA_Hemmer-Bogard-Rd-Ext_SHPO-Re-Response RVH.pdf CFHWY00885.pdf

6. Will there be an adverse effect on a historic property? ☐ ☑

Summary
Summarize impacts to historic properties and mitigation, if any. List affected sites (by AHRS number only) and any commitments or mitigative measures. Also include any project-specific commitments or mitigative measures in Section V.

A professionally qualified individual from DOT&PF, accompanied by a representative of the Chickaloon Village Tribal Council, performed a field survey of the project site. A report of investigations was submitted to the repository maintained by the Office of History and Archaeology. Initially SHPO did not concur with the DOT&PF finding of no adverse effect on a historic property, however concurrence was received from SHPO on February 15, 2024. Based upon the field work and research which identified no historic properties within the project APE that are eligible for listing, and based on SHPO concurrence, the project anticipates no effect on historic properties. No environmental commitments or mitigative measures are required for this project. A PA 106 Streamlined Project Review Screening Record was executed by a DOT&PF PQI on March 18, 2024, to include street lighting. The form indicated that the additional work included no activities which are not covered under the Appendix B Programmatic Allowances and/or which do not meet the conditions.

Attachments

- CFHWY00885 Hemmer Road Extension PWH to Bogard_lighting_signed_3.18.24.pdf CFHWY00885.pdf
- CFHWY00885 L&V and Project Area.pdf CFHWY00885.pdf
- Hemmer Road SHPO Non-Concurrence and DOT&PF Response.pdf CFHWY00885.pdf

E. Section 4(f)/6(f) Impacts	**Yes**	**No**
1. Section 4(f) (23 CFR 774)		
a. Was detailed Section 4(f) resource identification conducted for this project, other than that required for Section 106 compliance?	☑	☐
b. Does a Section 4(f) resource exist within or adjacent to the project area?	☐	☑
2. Section 6(f) (36 CFR 59)		
a. Does a Section 6(f) Land and Water Conservation Fund Act (LWCFA) resource exist within or adjacent to the project area?	☐	☑

Summary
Summarize Section 4(f)/6(f) involvement, if any.

No recreational facilities are present within or adjacent to the project area and no historic properties were identified within the project APE . No section 6(f) funded resources exist within or adjacent to the project area. It is anticipated that there will be no use of a Section 4(f) resource and no conversion of a Section 6(f) resource as neither is present.

F. Contaminated Sites and Hazardous Materials Impacts	**Yes**	**No**
1. Include source, link, and date accessed of databases used.		

Alaska DEC Contaminated Sites

https://www.arcgis.com/apps/mapviewer/index.html?webmap=315240bfbaf84aa0b8272ad1cef3cad3

3/13/2024

F. Contaminated Sites and Hazardous Materials Impacts	Yes	No
2. Are there known or potentially contaminated sites within or adjacent to the existing ROW?	☐	☑
3. Would a documented hazardous material site be acquired?	☐	☑
4. Are there contaminated sites within 1,500 feet of where excavation dewatering is anticipated?	☐	☑

Summary
Summarize the contaminated site impacts and mitigation, if any.

A review of the Alaska Department of Environmental Conservation (ADEC) Contaminated Sites Database indicated no contaminated sites within, adjacent to, or within 1,500 feet of the project area. The project is anticipated to have minimal potential for encountering contaminated soils during construction, however should this occur, ADEC would be consulted for guidance.

G. Floodplain Impacts (23 CFR 650, Subpart A)	Yes	No
1. Does the project encroach into a mapped base floodplain or a potential unmapped base floodplain?	☐	☑
2. Does the project conform to local flood hazard requirements?	☑	☐
3. Is the project consistent with E.O. 11988 (Floodplain Protection)?	☑	☐

Summary
Describe any encroachments into mapped and unmapped floodplains and summarize impacts. For c(26, 27, or 28) CE classifications describe whether encroachments are functionally dependent.

A review of the Federal Emergency Management Agency Flood Insurance Rate Map panels 02170C8135E (effective date 3/17/2011) indicated that the project area is located within an area of minimal flood hazard (Zone X). Encroachment into a floodway or a base floodplain is not anticipated as a result of the project.

H. Wetland and Waterbody Impacts	Yes	No
1. Would the project affect wetlands or other Waters of the U.S. (WOTUS), as defined by the U.S. Army Corps of Engineers (USACE) (Section 404).	☐	☑
2. Is a USACE authorization anticipated?	☐	☑
3. Will the project involve navigable waters as defined by the U.S. Coast Guard (USCG) (Section 9)?	☐	☑
4. Will the project affect a designated Wild and Scenic River or land adjacent to a Wild and Scenic River, including those on the Nationwide Rivers Inventory?	☐	☑

a. Estimated fill quantities below:

Summary
Summarize wetland and waterbody impacts and mitigation, if any.

A small pond adjacent to the project area may be utilized to receive stormwater from the finished project, and minor ditch work and/or vegetation grubbing could occur in its immediate vicinity. It is anticipated there will be no impact to WOTUS. Should it be necessary to work within any WOTUS, the project will be designed to minimize WOTUS impacts to the extent practicable and such work would fall within the parameters of a nationwide 404 permit.

I. **Fish and Wildlife Impacts**	Yes	No
1. Anadromous and resident fish habitat.		
a. Include source, link, and date accessed of databases used.		
National Oceanic and Atmospheric Administration (NOAA) Fisheries Essential Fish Habitat Mapper https://www.habitat.noaa.gov/apps/efhmapper/?page=page_2&views=view_34 3/13/2024 Alaska Department of Fish and Game (ADF&G) Alaska Fish Resource Monitor https://experience.arcgis.com/experience/1a4eb07b42ff4ebb8c71ba45adaedf0c/ 4/11/2024		
b. Is anadromous or resident fish habitat present in project area (Title 16.05.841 and 16.05.871)?	☐	☑
2. Essential Fish Habitat (EFH).		
a. Include source, link, and date accessed of databases used.		
National Oceanic and Atmospheric Administration NOAA Fisheries Essential Fish Habitat Mapper https://www.habitat.noaa.gov/apps/efhmapper/?page=page_2&views=view_34 3/13/2024		
b. Is EFH present in project area?	☐	☑
3. Threatened and Endangered (T&E) Species		
a. Include source, link, and date accessed of databases used.		
On November 1, 2012, the USFWS issued a letter stating that there are no federally listed or proposed species, or designated or proposed critical habitat under USFWS jurisdiction in the Matanuska-Susitna or Anchorage areas. No impact to threatened or endangered species or critical habitat areas is expected as a result of the project.		
b. Are listed threatened or endangered species present in the project area?	☐	☑
4. Marine Mammals.		
a. Is the project located in the marine environment?	☐	☑
5. Wildlife Resources:		
a. Is the project in an area of high wildlife/vehicle accidents?	☐	☑
b. Would the project bisect migration corridors?	☐	☑
c. Would the project segment habitat?	☐	☑
6. Bald and Golden Eagle Protection Act.		

I. Fish and Wildlife Impacts	Yes	No

a. Include source, link, and date accessed of databases used.

Southeast Alaska GIS Library Documented Eagle Nest Sites

https://data-seakgis.opendata.arcgis.com/datasets/seakgis::documented-eagle-nest-sites/explore?location=61.606973%2C-149.184175%2C13.37

12/27/2023

b. Is the project visible from an eagle nesting tree?	☐	☑
c. Is the project within 330 feet of an eagle nesting tree?	☐	☑
d. Is the project within 660 feet of an eagle nesting tree?	☐	☑
e. Will the project require blasting or other activities that produce extreme loud noises within 1/2 a mile from an active nest?	☐	☑
f. Is an eagle permit required?	☐	☑
7. Is the project consistent with the Migratory Bird Treaty Act?	☑	☐

Summary
Summarize fish and wildlife impacts and mitigation, if any.

Fish

Review of the NOAA Fisheries Essential Fish Habitat Mapper and the ADF&G Alaska Fish Resource Monitor there are no fish streams or water bodies present within the project area, and no work is anticipated to occur within the small pond adjacent to the project area. No impact to fish or EFH is anticipated.

Wildlife

Review of the ADF&G Moose-Vehicle Collisions (MVC) in Alaska MatSu webpage indicated that from 2013-2016 the project area had one incident of MVC and two others in the vicinity. The vicinity of the project demonstrated a moderate potential for MVC on the ADF&G heat map. No other wildlife species found within the project area are likely to cause a similar level of common driving hazard, though other wild or domestic animals may be found in the area. The project would likely result in increased traffic in the immediate area, thus potentially disrupting local wildlife. It is not anticipated the potential disruption would significantly alter wildlife habitat or migration corridors due to the many square miles of moose habitat in the surrounding area. In addition to the viability of the region for moose habitat, special focus is made to benefit this species in the nearby Palmer Hay Flats State Game Refuge to the southwest and the nearby Matanuska Valley Moose Range to the northeast. Some wildlife may avoid the project area during construction activities, but the project is not likely to cause significant adverse impacts to wildlife.

Migratory Birds and Eagle Nests

Review of the USFWS Information for Planning and Consultation (IPAC) system indicated that migratory birds migrate through and may nest within the project area and could be disturbed by clearing operations. Vegetation clearing would be avoided from May 1 through July 15, as recommended by the USFWS guidelines. Bald and Golden eagles are found within the project area according to IPAC. Prior to construction, DOT&PF may conduct a survey of the project area to determine if active eagle nests occur within the primary (330 foot) or secondary (660 foot) zones. If active eagle nests are identified within 660 feet of the project area prior to or during construction, DOT&PF will seek guidance from the USFWS on how to proceed.

J. **Invasive Species Impacts**	Yes	No

1. Include source, link, and date accessed of databases used.

Alaska Exotic Plants Information Clearinghouse

https://aknhp.uaa.alaska.edu/apps/akepic/

3/11/2024

2. Are invasive species present in project area?	☑	☐
3. Does the project include all practicable measures to minimize the introduction or spread of invasive species, making the project consistent with E.O. 13112 (Invasive Species)?	☑	☐

Summary
Summarize invasive species impacts and mitigation, if any.

A review of the University of Alaska, Anchorage Exotic Plants Information Clearinghouse Invasive Plants Mapper identified non-native plant surveys with positive results for non-native species within or adjacent to the project area. Ground cover disturbing activities would be minimized, and disturbed areas re-vegetated with native soil and seed to minimize potential introduction of invasive species, in accordance with Executive Order 13112.

K. **Water Quality Impacts**	Yes	No
1. Will there be temporary degradation of water quality?	☑	☐
2. Is a public or private drinking water source or protection area within or adjacent to the project?	☑	☐

Attachments

- DEC Drinking Water Comments - Consultation - CFHWY00885.pdf CFHWY00885.pdf

3. Would the project result in a discharge of storm water to a WOTUS? [40 CFR 230.3(o)]	☑	☐
4. Would the project discharge storm water into or affect an ADEC-designated Impaired Waterbody?	☐	☑
5. Will the project involve more than one (1) acre of ground-disturbing activities?	☑	☐
6. Is there a Municipal Separate Storm Sewer System (MS4) APDES permit, or will runoff be mixed with discharges from an APDES permitted industrial facility?	☐	☑

Summary
Summarize the water quality impacts and mitigation, if any.

During construction, ground disturbing activities and storm water runoff may result in temporarily increased turbidity of nearby streams, wetlands, and other water bodies. A small pond is located immediately adjacent to the project area, and no other WOTUS have been identified within or adjacent to the project area. Adverse impacts to water quality would be minimized by implementing a Stormwater Pollution Prevention Plan and utilizing best management practices during construction. Additionally, DEC's Recommendations for General Project Activities near a PWS (public water source) will be followed as it pertains to the several PWS in the project area, thus minimizing or altogether avoiding negative impacts to those resources.

L. **Air Quality Impacts**	Yes	No
1. Will there be temporary degradation of air quality?	☑	☐
2. Is the project located in an air quality maintenance area or nonattainment area (CO or PM-10 or PM-2.5)?	☐	☑

Summary
Summarize air quality impacts and mitigation, if any.

A review of the EPA Air Data Air Quality Monitors web page utilizing non-attainment layers for criteria pollutants indicated that the project is not located within an air quality non-attainment or maintenance area. As a result regional and project level air quality conformity is not required. Air quality impacts from project construction are anticipated to be minimal and temporary. No significant long-term impacts to air quality are anticipated as a result of the project.

M. **Noise Impacts (23 CFR 772)**	Yes	No
1. Will there be temporary noise impacts?	☑	☐
2. Does the project involve any of the following Type I project actions listed below (23 CFR 772.5)?	☑	☐
• An increase in the number of through lanes. • Construction of highway on a new location.		
3. Are any lands listed in 23 CFR 772.11(c) adjacent to the project? Identify all below.	☑	☐
• Category B: Residential. • Category C (exterior): Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, daycare centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings. • Category D (interior): Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.		
4. Does the noise analysis identify a noise impact?	☐	☑

Summary
Summarize noise impacts and mitigation, if any.

Noise levels were predicted for 15 receiver sites within the project area. The predicted noise levels indicated that no receivers are expected to approach or exceed the respective noise abatement criteria under the 2045 Build condition. Furthermore, while some receivers are indicated to have large increases (over 10 dBA) in noise levels from existing to build conditions, the increase is below the defined 15 dBA needed to be considered a substantial impact.

The noise analysis concluded that there are no noise impacts under the 2045 Build condition and that no noise abatement measures are recommended.

Attachments

- 230925 Hemmer Noise Report.pdf CFHWY00885.pdf

N. Social and Economic Impacts	Yes	No
1. Would the project affect neighborhoods or community cohesion?	☐	☑
2. Would the project affect school boundaries, recreation areas, churches, businesses, police and fire protection, etc.?	☑	☐
3. Would the project affect the elderly, handicapped, non-drivers, transit-dependent, minority and ethnic groups, or the economically disadvantaged?	☑	☐
4. Would the project affect travel patterns and accessibility (e.g., vehicular, commuter, bicycle, or pedestrian)?	☑	☐
a. Would the project include temporary delays and detours of traffic?	☑	☐
5. The project will have adverse economic impacts on the regional and/or local economy, such as effects on development, tax revenues and public expenditures, employment opportunities, accessibility, and retail sales.	☐	☑
6. The project will adversely affect established businesses or business districts.	☐	☑
a. Would the project have temporary impacts on businesses?	☑	☐

Summary
Summarize social and economic impacts and mitigation, if any.

The addition of roadway resulting in a new North/South connection between Palmer Wasilla Highway and Bogard Road will serve to reduce congestion in the vicinity. The project will not affect school boundaries, recreation areas, or neighborhood or community cohesion. Police and fire protection may experience improvements to access and response times due to the establishment of a new North/South direct route between the two arterial roadways (Bogard Road and Palmer-Wasilla Hwy). Addition of separated pathway will provide improvements for bicyclists and pedestrians. Minor impacts to a church, businesses, and travelers caused by temporary delays and detours during construction may occur. The project is anticipated to benefit the region long term through reduction of traffic congestion. Local offices, long-term care facilities and places of worship may be impacted with minor improvements in accessibility of the facilities due to improved road, and in some cases may be impacted by partial acquisitions required for road construction. No adverse social or economic impacts are anticipated. Reduction in congestion does not harm social or economic aspects of a community as no routes are removed and no access to homes, business, places of worship, or facilities for recreation is reduced.

III. Comments and Coordination

A. Public Involvement	**Yes**	**No**
1. Was public involvement for project completed?	☑	☐
2. Was the project public noticed?	☑	☐
a. Newspaper name and date of notice:	☑	☐

Frontiersman

2/27/2022

Attachments

- Frontiersman - Hemmer Road Extension and upgrade.pdf CFHWY00885.pdf

b. Alaska Online Public Notice date:	☑	☐

2/23/2022 to 3/25/2022

Attachments

- NOI - CFHWY00885 OPN.pdf CFHWY00885.pdf

c. Were public notices completed for specific resource impacts (e.g., floodplain, Section 4(f))?	☐	☑
3. Was a public meeting held?	☐	☑
4. Is there any unresolved controversy on human, natural, or economic grounds?	☐	☑

Summary
Summarize public comments and coordination efforts for this project. Discuss pertinent issues raised.

This project is not generally controversial. The project area is not heavily populated, and the overall area will benefit from another North/South connector road within the region. No public comments were received. The project was one of 34 projects featured at the 1/25/24 Mat-Su Transportation Fair held at the Alaska State Fairgrounds, Raven Hall in Palmer, Alaska. The fair was attended by 256 individuals who signed in, and many more who did not sign the attendance roster. DOT&PF employees and representatives were available to answer project-related questions at the transportation fair.

Attachments

- 2023-12-15_00885 Handout for Transportation Fair.pdf CFHWY00885.pdf

B. Agency Involvement	**Yes**	**No**
1. Was an agency scoping conducted?	☑	☐

2/18/2022

Attachments

- Agency Scoping re CFHWY00885 sent 2-18-22.pdf CFHWY00885.pdf
- CFHWY00885ScopingDistributionList 2.18.22.pdf CFHWY00885.pdf

2. Was an agency scoping meeting held?	☐	☑

B. Agency Involvement	Yes	No
3. Was a field review completed with agencies?	☐	☑

Summary
Summarize agency coordination efforts for this project.

Responses (attached) were received from the following agencies and their subareas:

ADEC - Air Quality - stated a conformity analysis is not required. Additionally, permitting and procedures were addressed related to open burning and other construction processes which could result in emission of particulates into ambient air.

ADEC - Public water system sources in the vicinity of the project were identified, and *Recommendations for General Project Activities near a PWS* was attached.

ADEC - Solid Waste - expressed no concerns related to this project.

ADF&G - Expressed that a fish habitat permit is not required at this time.

Chickaloon Village Traditional Council requested a project level meeting, notes attached.

Alaska Department of Natural Resources - State Historic Preservation Officer (SHPO) expressed an expectation to address concerns or issues through the Section 106 consultation process.

Attachments

- Comments Compiled CFHWY00885.pdf CFHWY00885.pdf

IV. Permits and Authorizations

A. Permits and Authorizations	Yes	No
1. USACE, Section 404/10 Includes Abbreviated Permit Process, Nationwide Permit, and General Permit	☐	☑
2. Coast Guard, Section 9	☐	☑
3. ADF&G Fish Habitat Permit (Title 16.05.871 and Title 16.05.841)	☐	☑
4. Flood Hazard	☐	☑
5. ADEC Non-domestic Wastewater Plan Approval	☐	☑
6. Requires 401 Cert	☐	☑
7. ADEC APDES	☑	☐
8. Eagle Permit	☐	☑
9. Incidental Take Authorization	☐	☑
10. Local (Borough or City) permit (e.g., noise)	☐	☑
10. Other Permits	☐	☑

Summary

The above-indicated permit will be acquired as needed. It is anticipated the APDES Construction General Permit will be utilized as the project will impact in excess of one acre.

V. Environmental Commitments

A. Environmental Commitments and Mitigation Measures [23 CFR 771.109(b)]	Yes	No
1. Are there project-specific environmental commitments for this project?	☑	☐

Summary
Summarize changes to environmental commitments and mitigation measures from original environmental document.

DOT&PF and their Contractor(s) shall:

DEC's Recommendations for General Project Activities near a PWS will be followed as it pertains to the several PWS in the project area

Attachments

- DEC_PWS_Map.pdf CFHWY00885.pdf
- dec-eh-dw-recommendations-for-general-project-activities-near-a-pws-source.pdf CFHWY00885.pdf

VI. Environmental Documentation Approval

A. Environmental Documentation Approval	Yes	No
1. Do any unusual circumstances exist, as described in 23 CFR 771.117(b)?	☐	☑
2. Does the project meet the criteria of one of the following DOT&PF Programmatic Approvals authorized in the Nov. 13, 2017 "Chief Engineer Directive - Programmatic Categorical Exclusions"?	☐	☑

Summary

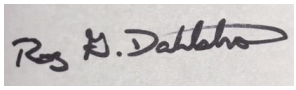
This project is an unlisted CE, thus the General Programmatic Approval Conditions do not come into consideration. For this reason an unlisted CE can not be programmatic.

VII. (e) Constraints

A. 23 CFR 771.117(e) Constraints	Yes	No
Does the project involve any of the following? Supporting information for responses must be provided in the impact discussions for each of the applicable impact categories. *If YES is selected for any item, the project cannot be approved under 23 CFR 771.117(c)(26-28).*		
1. An acquisition of more than a minor amount of right-of-way or that would result in any residential or non-residential displacements.	☐	☐
2. An action that needs a bridge permit from the U.S. Coast Guard, or an action that does not meet the terms and conditions of a U.S. Army Corps of Engineers nationwide or general permit under Section 404 of the Clean Water Act and/or Section 10 of the Rivers and Harbors Act of 1899.	☐	☐
3. A finding of "adverse effect" to historic properties under the National Historic Preservation Act.	☐	☐
4. The use of a resource protected under 23 U.S.C. 138 or 49 U.S.C. 303 [Section 4(f)] except for actions resulting in de minimis impacts.	☐	☐
5. A finding of "may affect, likely to adversely affect" threatened or endangered species or critical habitat under the Endangered Species Act.	☐	☐
6. Construction of temporary access, or the closure of an existing road, bridge, or ramps, that would result in major traffic disruptions.	☐	☐
7. Changes in access control.	☐	☐
8. A floodplain encroachment other than functionally dependent uses (e.g. bridges, wetlands) or actions that facilitate open space use (e.g. recreational trails, bicycle and pedestrian paths).	☐	☐
9. Construction activities in, across or adjacent to a river component designated or proposed for inclusion in the National System of Wild and Scenic Rivers.	☐	☐

Summary

Environmental Documentation Approval Signatures

Prepared by:  Date: 4/30/2024

Roy Dahlstrom

Environmental Impact Analyst II

Reviewed by:  Date: 4/30/2024

Chris Bentz

Project Manager

Approved by: Date: 4/30/2024

Brian Elliott

Central Region Environmental Manager

Recommended by:  Date: 4/30/2024

Matthew Dietrick

NEPA Manager

APPENDIX H

Approved Design Exceptions and Design Waivers

APPENDIX J

Design Memos