Design Study Report

92ND AVENUE PROJECT

Prepared For:

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NOTICE TO USERS

This report reflects the student engineer's opinions and design decisions as of March 2013. As this project proceeds in the design process, changes may need to be made to address the required conditions. Anyone intending to use this document for planning purposes should be aware that changes may have occurred in the project since publication. Additionally, it should be noted that engineering students at the University of Alaska, Anchorage, have conducted this design and the design has not been certified by a registered professional engineer.

PLANNING CONSISTENCY

The 92nd Avenue Grade Separation Design Group prepared this report in accordance with currently accepted design standards and Federal Regulations. Students also sought input from the state, government, and public entities affected by the proposed design.

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LIST OF ACRONYMS

AADT	Annual Average Daily Traffic
AASHTO	American Association of State Highway & Transportation Officials
AMATS	Anchorage Metropolitan Area Transportation Solutions
ADEC	Alaska Department of Environment Conservation
ADNR	Alaska Department of Natural Resources
AKDOT & PF	Alaska Department of Transportation & Public Facilities
BMP	Best Management Practices
CWA	Clean Water Act
DDG	Drainage Design Guideline
EPA	Environmental Protection Agency
EO	Executive Order
EPA	Environmental Protection Agency
ESAL	Equivalent Single Axle Load
FHWA	Federal Highway Administration
GDHS	Geometric Design of Highways and Streets
HCM	Highway Capacity Manual
HMA	Hot Mix Asphalt
HDL	Hattenburg, Dilley and Linnell
LID	Low Impact Development
LOS	Level of Service
LRTP	Long-Range Transportation Plan
MOA	Municipality of Anchorage
MUTCD	Manual on Uniform Traffic Control Devices
NEPA	National Environmental Protection Act
NPDES	National Pollutant Discharge Elimination System
NSH	New Seward Highway
OSH	Old Seward Highway
ROW	Right-of-Way
SWPPP	Storm Water Pollution Prevention Program
TRB	Transportation Research Board
USGS	United States Geological Survey
USACE	U.S. Army Corps of Engineers

1.0 INTRODUCTION

South Anchorage has three major roadways allowing for access east-to-west. The level of service provided by these roadways is not adequate. The Anchorage Bowl 2025 Long-Range Transportation Plan recommended the addition of three new east-west street connections across the New Seward Highway (NSH). High levels of congestion center on Dimond Boulevard and the NSH Highway due to shopping centers and other services provided in the area. The delays and inefficient flow of traffic show need for alternative routes.

1.1 PROJECT NEED

The NSH and Dimond Blvd. Interchange has a failing level of service. The current configuration cannot be modified to provide adequate capacity due to right-of-way constraints. Thus, through traffic to Abbott Road requires a new access route.

1.2 PROJECT SCOPE

The scope of this project will consist of the following:

- Construct grade separated interchange connecting Academy Dr. and 92nd Avenue underneath the NSH.
- Construct separated pathways to accommodate pedestrian and bicycle traffic.
- Make major drainage improvements including a created wetland to accommodate increased water run-off.
- Purchase adequate right-of-way to accommodate the new facility.

2.0 EXISTING CONDITIONS

2.1 ROADWAY CONDITIONS

The segment of the New Seward Highway between Dimond Boulevard and O'Malley Road is currently a four-lane divided freeway with controlled access. The posted speed is 65 miles per hour (MPH). The existing portion of 92nd Avenue west of the New Seward Highway is a local road, providing access to both residential and business properties.

Currently there is no access to 92nd Ave from the NSH. However, during Phase 1 of the 92nd Ave Grade Separation Project, NSH on and off ramps will be built at 92nd Ave. To complete access to Abbott Road, 92nd Avenue must transverse the Seward Highway and Brayton Drive in order to connect at Academy Drive.

2.2 TRAFFIC CONDITIONS

Congested traffic conditions exist at the NSH and Dimond Blvd interchange as this is the main access point to the Dimond Center from the NSH. Traffic circulation is limited with the current configuration as alternative access from the Dimond Center to the NSH and Lake Otis Pkwy is limited to Dowling Rd or O'Malley Rd.

3.0 DESIGN STANDARDS

Various standard design guidelines were used in 92nd Ave Project, including the following publications and documents:

- A Policy on Geometric Design of Highways and Streets 5th Edition, AASHTO, 2004
- AASHTO Guide for Design of Pavement Structures 4th Edition, AASHTO, 1993
- AASHTO Guide Specification for LRFD Seismic Bridge Design, 2nd Edition (2011).
- AASHTO LRFD Bridge Design Specifications, AASHTO, 6th Edition (2012)
- Alaska Highway Preconstruction Manual, AKDOT&PF, 2005
- Alaska Flexible Pavement Design Manual, AKDOT&PF and FHWA, 2004
- Alaska Standard Specifications for Highway Construction, AKDOT&PF, 2004
- Anchorage Bowl 2025 LRTP with 2027 Revisions, MOA, 2005
- Highway Capacity Manual 2010, AASHTO, 2010
- Manual on Uniform Traffic Control Devices, FHWA, 2009
- Roadside Design Guide, AASHTO, 2011

4.0 DESIGN ALTERNATIVES

4.1 NO-BUILD ALTERNATIVE

Under the no-build alternative, Phase II of the 92nd Ave Grade Separation Project would not be constructed. Phase I would be the extent of the project; providing one off ramp and one on ramp at 92nd Ave, and no through access would be constructed beneath NSH, *see Figure 4.1*.

Phase I will increase the size of 92nd Ave into two lanes, one in each direction, with an interior two-way-left-turn-lane to provide access to the residential neighborhood south of 92nd Ave. From there the westbound lane will expand to four turning lanes, two right-only and two left-only where 92nd Ave intersects the OSH. A signal will be built at the OSH and 92nd Ave intersection.

Residential and commercial traffic going towards Abbott Road would continue to use the Dimond Blvd. and NSH intersection, as would traffic traveling north to access the shopping center. This activity will contribute to current and future congestion in the surrounding network. An additional repercussion of the no-build alternative is that pedestrians, not given adequate crossing points, will continue cross the NSH roadway causing hazardous conditions for both vehicular and pedestrian traffic.

Figure 4.1: 92nd Ave Grade Separation Phase I

4.2 PREFERRED ALTERNATIVE

The preferred alternative for Phase II will tie into the planned Phase I 92nd Ave Grade Separation project with some changes in roadway configuration: the SB NSH off ramp will be expand from one lane into two right-only turning lanes with one shared through and left-turn lane; a signal will be built at the intersection of the ramps and 92nd Ave; and 92nd Ave will be expanded to six lanes immediately west of the NSH ramps. The OSH and 92nd intersection will remain as planned in Phase I.

The preferred alternative extends 92nd Ave underneath the NSH to Brayton Drive and provides additional access to Brayton Drive from northbound NSH via an off-ramp. The existing bicycle path to the west of NSH will be preserved and integrated into the project; and pedestrian facilities will be constructed along 92nd Ave.

The preferred alternative has the following components:

- Grade-separation at 92nd Ave and NSH
    - SB NSH On- and off- ramps at 92nd Ave
    - NB NSH Off-ramp onto Brayton Drive south of 92nd Ave
- Concrete deck bulb tee girder NSH bridge (4 lanes) over 92nd Ave
- Four travelled lanes (12 ft) along 92nd Ave, two in each direction, expanding to four westbound turning lanes west of the NSH ramps with two eastbound lanes
- 92nd Avenue extension to Brayton Dr
- Signalized intersections at OSH, NSH ramps, and Brayton Dr
- Preservation of the bicycle pathway to the west of NSH
- Pedestrian facilities along 92nd Avenue
- Storm water drainage to account for high water table

The preferred alternative provides an East-West access route along 92nd Avenue for traffic to and from the Dimond Center and Old Seward Highway (OSH), effectively improving traffic circulation and working to relieve current and future congestion in the surrounding road network. Pedestrian pathways along 92nd Avenue provide a safe route for pedestrians to cross the NSH; and existing bicycle facilities are preserved.

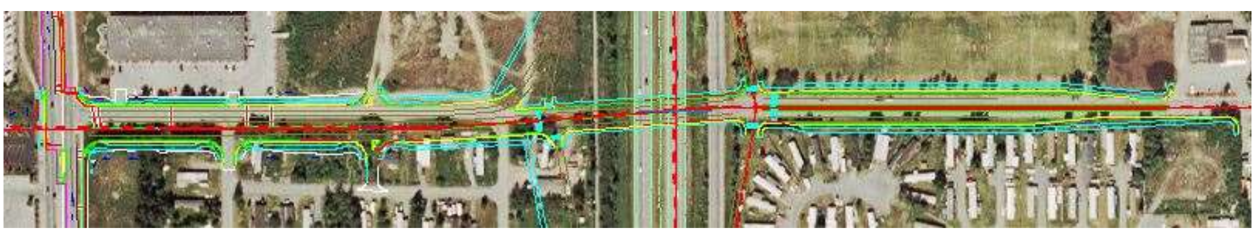

Figure 4.2: Preferred Alternative for 92nd Ave Grade Separation Phase II

5.0 TRAFFIC ANALYSIS

5.1 INTRODUCTION

This project will improve traffic circulation around the Dimond Center shopping district. The existing NSH & Dimond Blvd interchange provides inadequate capacity and level of service for current and future traffic volumes. Provision of an additional East-West access corridor will improve network capacity and work to reduce congestion at that intersection.

Several alternatives were analyzed within this report to develop an efficient design for 92^{nd} Ave Phase 2 with adequate design year (2034) level of service that retained residential access for adjacent neighborhoods while providing access to the OSH.

5.2 METHODOLOGY

Design standards utilized include the Transportation Research Board (TRB) Highway Capacity Manual 2010; the AASHTO Manual on Uniform Traffic Control Devices; the AASHTO Policy on Geometric Design of Highways and Streets; the AKDOT Alaska Highway Preconstruction Manual; and other AKDOT and MOA guidelines, methods, and standards.

5.3 DATA COLLECTION

The traffic data used for analysis and design in this report was gathered from AKDOT sources as well as traffic volume data from Kinney Engineering, LLC. This traffic volume data included AADT and turning movement volumes (TMV) developed from the MOA 2007 AMATS traffic model.

2034 projections of 2024 volume data were calculated using a 1.0% compound growth rate. This growth rate is based on the assumption that within Anchorage the traffic growth rate is comparable to the population growth rate (1.0%) predicted through 2036 by the Alaska Department of Labor.

5.4 ANALYSIS PROCEDURE

Various alternatives were modeled using traffic analysis software, Synchro 7.1. Analysis criteria used to refine the intersection alternatives included: level of service and delay, and lane group volume-over-capacity ratios. 95^{th} percentile queue lengths were also observed to ensure they did not extend into nearby intersections or onto the freeway.

Level of Service is defined by the expected delay experienced by a vehicle at a signalized intersection or roundabout. As 92nd Ave will be classified as a minor arterial once the 92nd corridor is completed (MOA *LRTP*, 2005, p.134), a LOS of C is considered an appropriate level of service in accordance with AASHTO *GDHS* guidelines.

Table 5.1: Unsignalized & Roundabout LOS, TRB HCM 2010, Chapter 21

Level of Service	**Delay**
v/c ≤ 1.00	*(s/veh)*
A	0-10
B	>10-15
C	>15-25
D	>25-35
E	>35-50
F	>50

Table 5.2: Signalized Intersection LOS, TRB HCM 2010, Chapter 18

Level of Service	**Delay**
v/c ≤ 1.00	*(s/veh)*
A	≤10
B	>10-20
C	>20-35
D	>35-55
E	>55-80
F	>80

The Volume-over-Capacity ratios indicate the percentage of demand volume to capacity of a lane group. In analysis of alternatives volume-over-capacity ratios of each lane group were evaluated toward the development of a recommended alternative. In accordance with HCM 2010 guidelines, if a volume-over-capacity ratio greater than 1.00 existed at any lane group of an intersection, the intersection was assigned a LOS F.

Table 5.3: v/c Ratios and Capacity Conditions, TRB HCM 2010, Chapter 31

Critical Volume-to-Capacity Ratio	**Capacity Condition**
v/c≤0.85	Under capacity
0.85<v/c≤0.95	Near capacity
0.95<v/c≤1.00	At capacity
v/c>1.00	Over capacity

5.5 ALTERNATIVES ANALYZED

5.5.1 Alternative 1

Alternative 1 consisted of a single-lane roundabout at the planned Commercial/Residential Access and 92^{nd} Ave intersection and a single-lane roundabout at the Brayton Dr. and 92^{nd} Ave intersection. This alternative was significantly below the required capacity for the expected 2034 traffic demand, and was not considered further.

5.5.2 Alternative 2

Alternative 2 consisted of a double-lane roundabout at the planned Residential Access and 92^{nd} Ave intersection and a double-lane roundabout at the Brayton Dr. and 92^{nd} Ave intersection. The NSH Off-Ramp was free-flowing. The limited space between the NSH Off-Ramp and the roundabout at the Residential Access, created a bottleneck for westbound traffic, and a LOS of E. This alternative also had an unacceptable LOS of D at Brayton Dr.

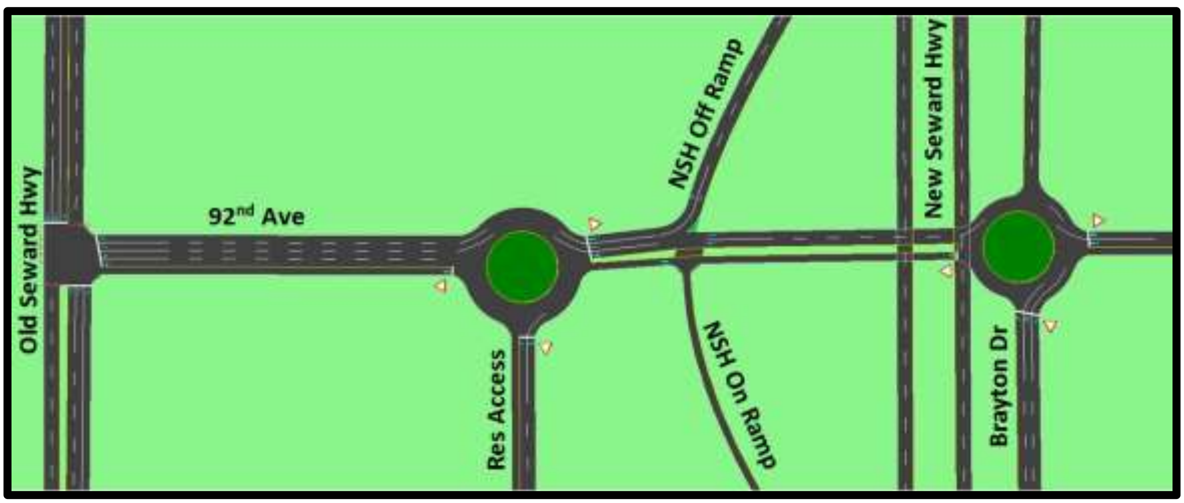

Figure 5.1: Alternative 2

Table 5.4: Alternative 2: 2034 PM Delay and Level of Service

Intersection	Delay (s)	LOS
OSH & 92^{nd} Ave	22.4	C
Residential Access & 92^{nd} Ave	38.8	E
Brayton Dr. & 92^{nd} Ave	28.1	D

5.5.3 Alternative 3

Alternative 3 consisted of a double-lane roundabout at the NSH Off-Ramp and 92nd Ave intersection, with an additional channelized right-turn onto 92nd Ave; and a double-lane roundabout at the intersection of Brayton Dr. and 92nd Ave. The planned Commercial/Residential Access is sign-controlled.

While this alternative provided excellent access, LOS at the NSH ramps was unacceptable (a LOS of F) and queues on the NSH Off-Ramp extended to the highway in the simulation. This alternative also had an unacceptable LOS of F at Brayton Dr.

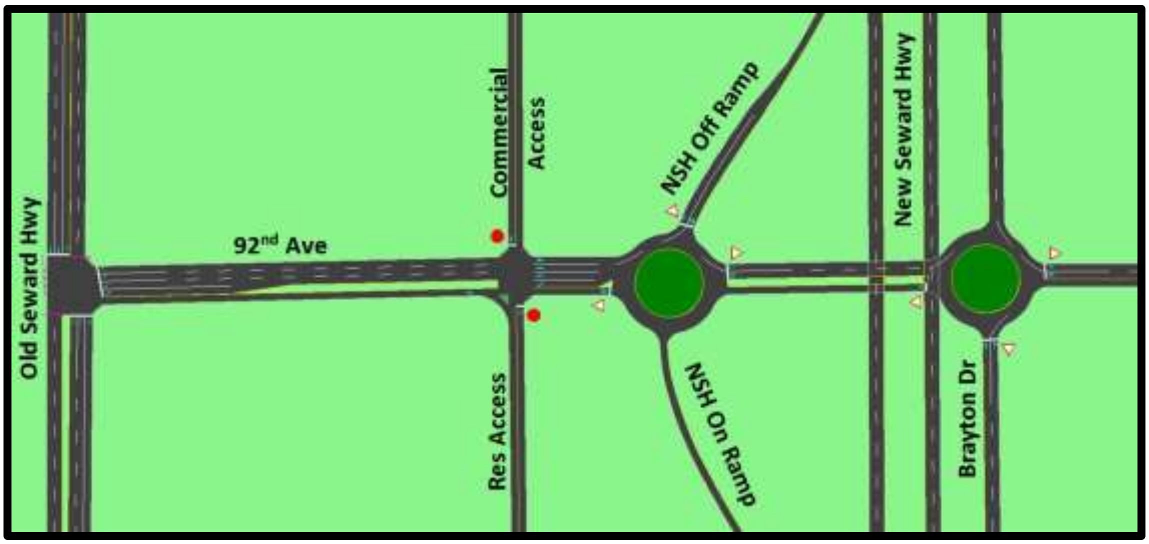

Figure 5.2: Alternative 3

Table 5.5: Alternative 3: 2034 PM Delay and Level of Service

Intersection	Delay (s)	LOS
OSH & 92nd Ave	22.1	C
NSH Ramps & 92nd Ave	156.5	F
Brayton Dr. & 92nd Ave	63.7	F

5.5.4 Alternative 4

Alternative 4 consisted of a signal at the NSH On- and Off-Ramps and 92nd Ave intersection, and a double-lane roundabout at the intersection of Brayton Dr. and 92nd Ave. The planned Commercial/Residential Access is sign-controlled.

While this alternative provided adequate level of service at the NSH ramps, this alternative had an unacceptable LOS of F at Brayton Dr.

Figure 5.3: Alternative 4

Table 5.6: Alternative 4: 2034 PM Delay and Level of Service

Intersection	Delay (s)	LOS
OSH & 92nd Ave	16.0	B
NSH Ramps & 92nd Ave	16.7	B
Brayton Dr. & 92nd Ave	84.4	F

5.5.5 Alternative 5

Alternative 5 consisted of a signal at the Commercial/Residential Access and 92nd Ave intersection and at the intersection of Brayton Dr. and 92nd Ave. This alternative provided adequate level of service, however ramp traffic could not effectively weave to turn left into the Residential Access, and westbound through traffic could not effectively weave to turn right into the Commercial Access. In addition, NSH Off-Ramp traffic could not travel eastbound in this alternative.

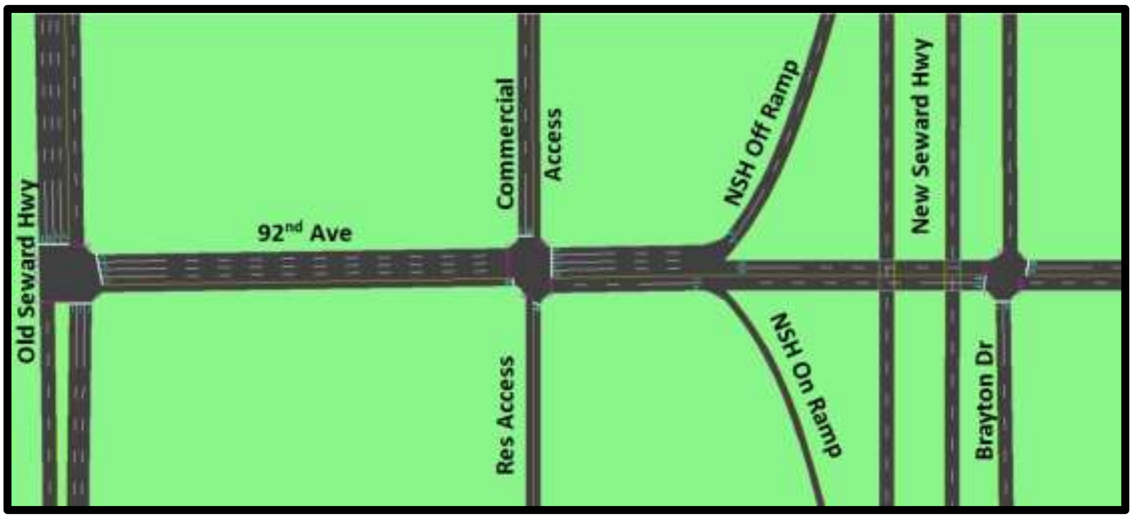

Figure 5.4: Alternative 5

Table 5.7: Alternative 5: 2034 PM Delay and Level of Service

Intersection	Delay (s)	LOS
OSH & 92nd Ave	13.9	B
Commercial/Residential Access & 92nd Ave	19.8	B
Brayton Dr. & 92nd Ave	24.6	C

5.5.6 Preferred Alternative

The preferred alternative consisted of a signal at the southbound NSH On- and Off-Ramps and 92nd Ave intersection, and a signal at the intersection of Brayton Dr. and 92nd Ave. The planned Commercial Access was not analyzed per client recommendation.

The Residential Access is sign-controlled allowing traffic to travel eastbound only. Because of the low amount of traffic from the Residential Access, it was determined that traffic may travel to the Brayton Dr. and 92nd Ave signal and make u-turns to travel westbound, due to safety considerations. Use of a signal at Brayton Dr. eliminated the inadequate LOS present in the double-lane roundabout alternative and provided adequate level of service with low delays.

Signalizing left-turning traffic from the NSH Off-Ramp allows for traffic to travel eastbound from the highway. Diverting right-turning traffic into two free-flowing exclusive westbound through lanes reduces the possibility of queue lengths extending to the NSH, and no significant queues were observed in the traffic simulation.

Northbound NSH traffic may access 92nd Ave via the off ramp onto Brayton Dr.; while 92nd Ave traffic must travel north on Brayton Dr. to the pre-existing Abbott Rd. and Brayton Dr. intersection then travel west on Abbott Rd. to access the northbound NSH.

Figure 5.5: Preferred Alternative

For both the build (2014) and design year (2034) this alternative was analyzed for a signalized T-intersection at Old Seward Highway and 92nd Ave, as this is the configuration planned in Phase 1 of the 92nd Ave Grade Separation Project.

5.6 RESULTS AND CONCLUSIONS

The traffic analysis in this report was performed on peak PM traffic volumes for the build year of 2014, and the design year of 2034. Peak AM TMVs were not available and were not analyzed.

For the recommended alternative acceptable levels of service were achieved up through the design year. The table below summarizes delay and level of service:

Table 5.8: PM Delay and Level of Service

Intersection	2014		2034	
	Delay (s)	LOS	Delay (s)	LOS
OSH & 92nd Ave	15.8	B	23.6	C
NSH Ramps & 92nd Ave	9.7	A	16.9	C
Brayton Dr. & 92nd Ave	17.0	B	21.6	C

5.7 RECOMMENDATIONS

The preferred alternative places three signals within less than ¼ mile of each other. A minimum signal spacing of ½ mile is recommended in the Alaska Highway Preconstruction Manual due to progression considerations, as lowered speeds between signals may reduce traffic capacity.

To adjust for signal proximity, signals in the Preferred Alternative were modeled as coordinated Pre-timed signals. However, it is recommended the signal plan be adjusted to account for fluctuation between AM and PM volumes. Finally, signals should be warranted in accordance with MUTCD standards.

6.0 ROADWAY GEOMETRY

6.1. INTRODUCTION

The purpose of the project, 92^{nd} Avenue Phase II, is to connect the existing road, Academy Drive, to the east of the New Seward Highway to 92^{nd} Avenue Phase I on the west of the New Seward Highway by utilization of either bridging over the New Seward Highway, or going under it. Due to high groundwater table and a short project length, it was decided to raise the New Seward Highway and have the two roads meet grades underneath.

6.2 DESIGN STANDARDS

The 2004 AASHTO Policy on Geometric Design of Highways and Streets 5^{th} Edition, 2011 AASHTO Roadside Design Guide 4^{th} Edition, AK DOT&PF Preconstruction Manual, and the FHWA Course on Bicycle and Pedestrian Transportation were used in order to create the following design.

6.3 INTERSECTIONS

6.3.1 92nd Avenue and Brayton Drive

Three alternatives were considered for the intersection of 92^{nd} Avenue and Brayton Drive: a roundabout, stop signs, and signalization. Each of these alternatives was analyzed both by Traffic Analysis and Roadway Geometry.

In order to minimize land acquisition, a roundabout would have to be placed partially under the NSH Overpass. This would require the bridge to be two-span, thus drastically increasing the price of the project, *see Figure 6.1*. Also, the projected volumes by the Traffic Analysis team would require a two lane roundabout, further increasing the size of the roundabout and therefore the size of the bridge and land acquisition. Therefore, a roundabout was not selected.

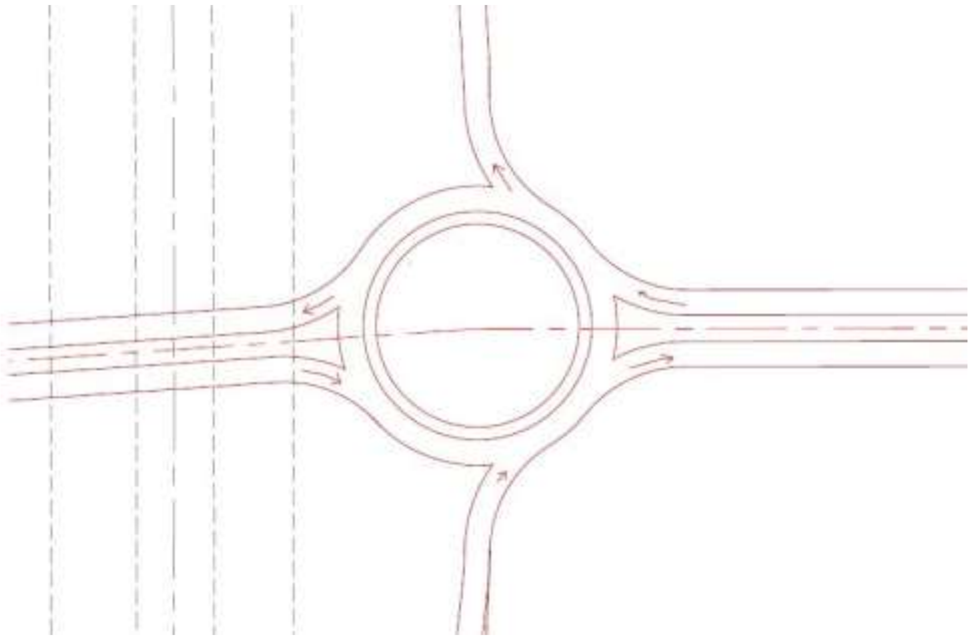

Figure 6.1 Roundabout at Brayton Drive

The stop sign alternative was only briefly considered due to its inefficiency from the Traffic Analysis report. The geometry of the stop sign alternative is similar to that of the signalized intersections and therefore is acceptable for Roadway Geometry. *See Figure 6.2* for the stop sign alternative.

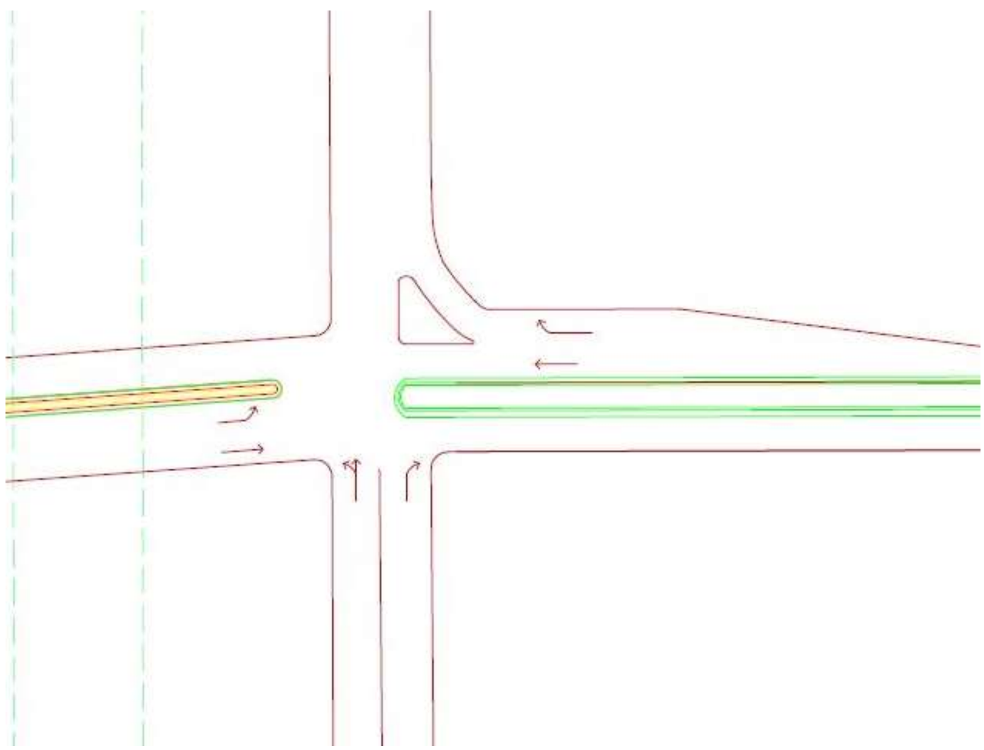

Figure 6.2: Stop Signs at Brayton Drive

A signalized intersection is the preferred alternative for the intersection of 92nd Avenue and Brayton Drive because it requires minimal land acquisition, allows for a single span bridge, and effectively moves the projected traffic volumes. *See Figure 6.3* below for the selected alternative for 92nd Avenue and Brayton Drive.

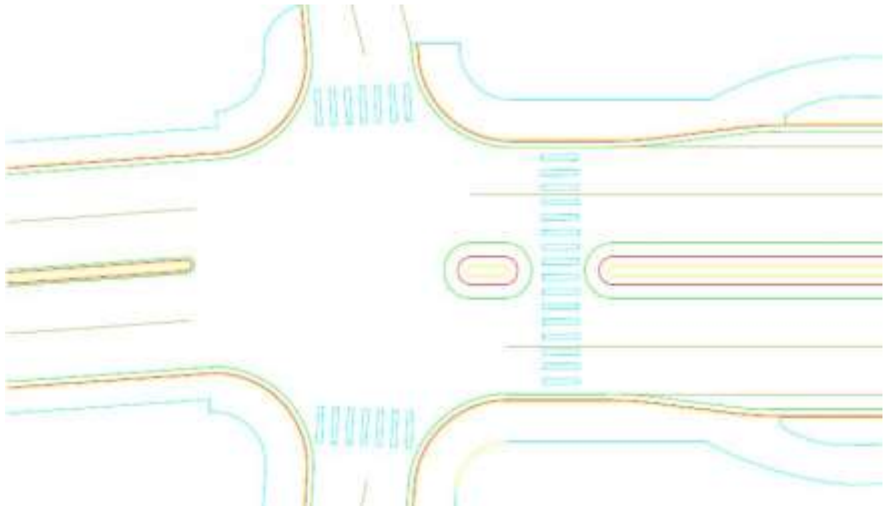

Figure 6.3: Signalized Intersection at Brayton Drive

6.3.2 92nd Avenue and Southbound New Seward Highway

92nd Avenue Phase I incorporated Southbound off and on ramps for the NSH at 92nd Avenue. This project had several ways of connecting into the existing off ramp geometry. All of the options involve widening the space between ramps to allow for lanes from the east to connect through to the Old Seward Highway (OSH).

One of the options considered was to re-align the off and on ramps to come together in a roundabout near the highway. This option was thrown out very early on due to a lack of space in this area and the potential for traffic to back up onto the highway. No image is available of this alternative.

Another option considered was to only allow traffic coming from the NSH to turn west, towards the OSH, *see Figure 6.4*. A slightly different version of this alternative includes a westward lane on 92nd Avenue that would yield to oncoming traffic and allow traffic to get onto the NSH, *see Figure 6.5*. Neither of these alternatives were selected because traffic traveling south on the NSH would not be able to get back onto the highway or travel east on 92nd Avenue.

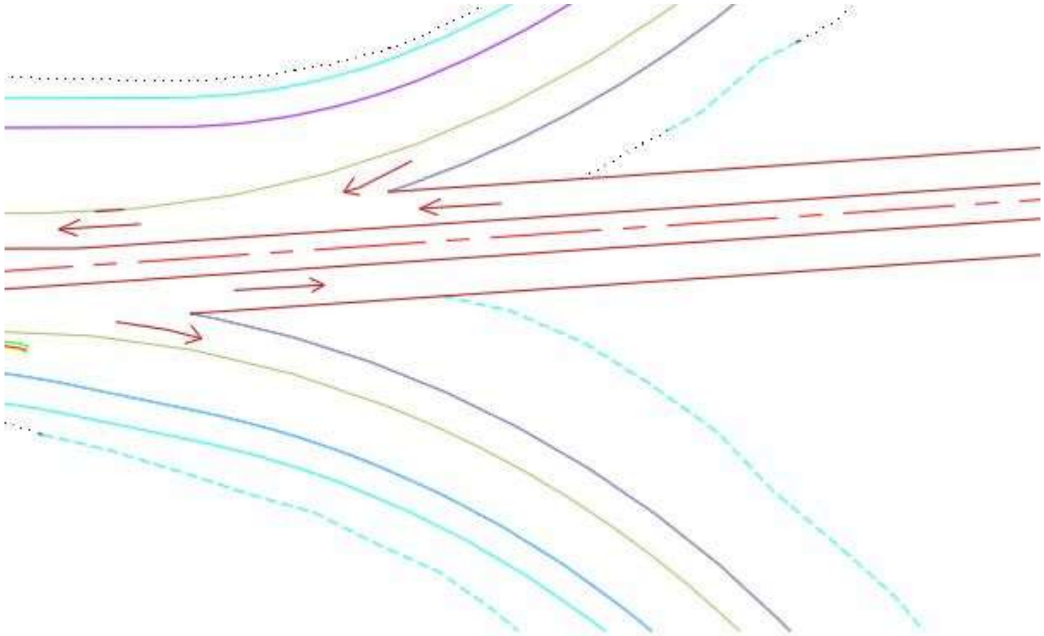

Figure 6.4: New Seward Highway Off Ramps Version 1

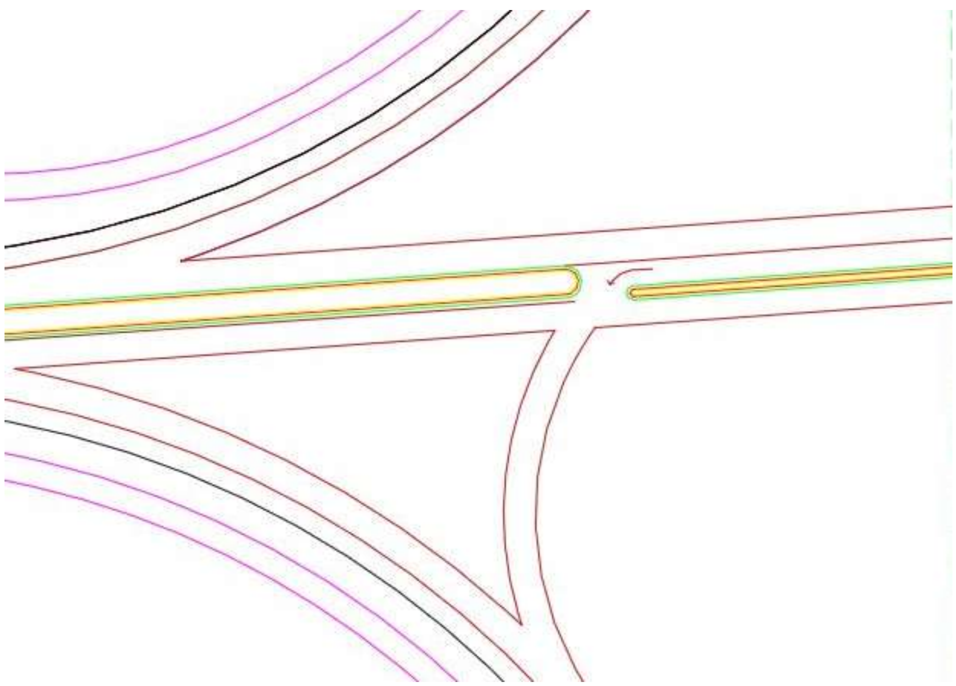

Figure 6.5: New Seward Highway Off Ramps Version 2

The selected alternative includes two lanes coming from the southbound off ramp of NSH and both turning west on onto 92nd Avenue, similar to the first alternative considered. This alternative also includes a signalized intersection allowing traffic to turn east or continue back onto the NSH. *See Figure 6.6*.

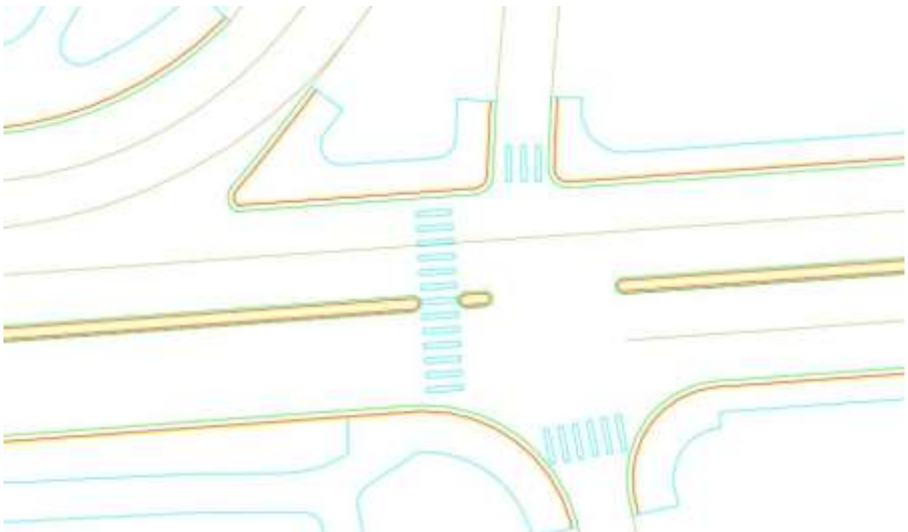

Figure 6.6: New Seward Highway Off Ramps Preferred Alternative

6.3.3 92nd Avenue and Residential Access

There are two residential roads connecting into the project area near the OSH. The first residential access is not going to change from its original location, except for moving south to allow for additional lanes, *see Figure 6.7*.

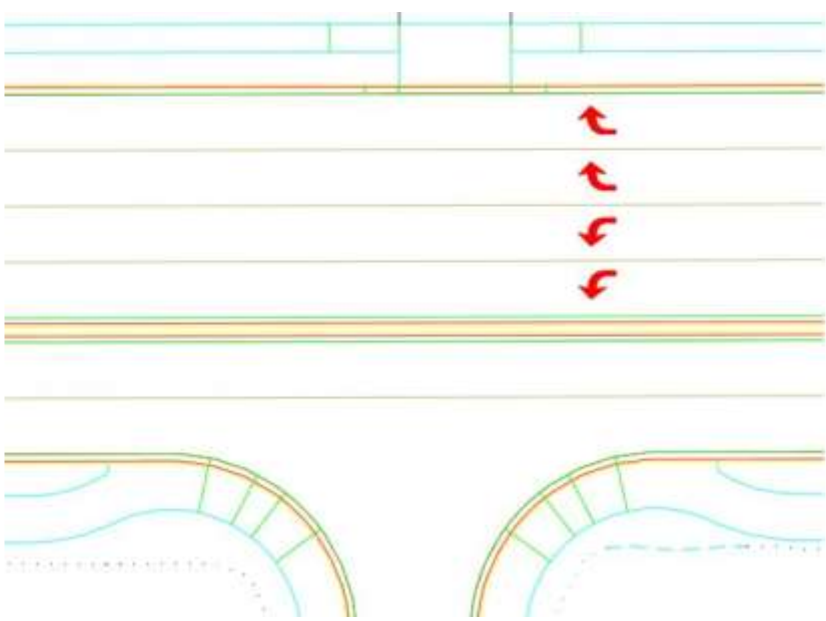

Figure 6.7: Residential Access

The second residential access was moved west during 92nd Ave Phase I, with a new commercial access added across 92nd Avenue. There was originally thought to be a very large volume of cars traveling in and out of the new commercial access, so this intersection needed modification.

The first alternative considered was a roundabout, *see Figure 6.8*. This alternative was viable with only one lane coming from the east and one lane from the off-ramp merging together before the roundabout. However, after Traffic Analysis determined two lanes were needed from both directions, a roundabout was no longer feasible because traffic would not have enough room to merge.

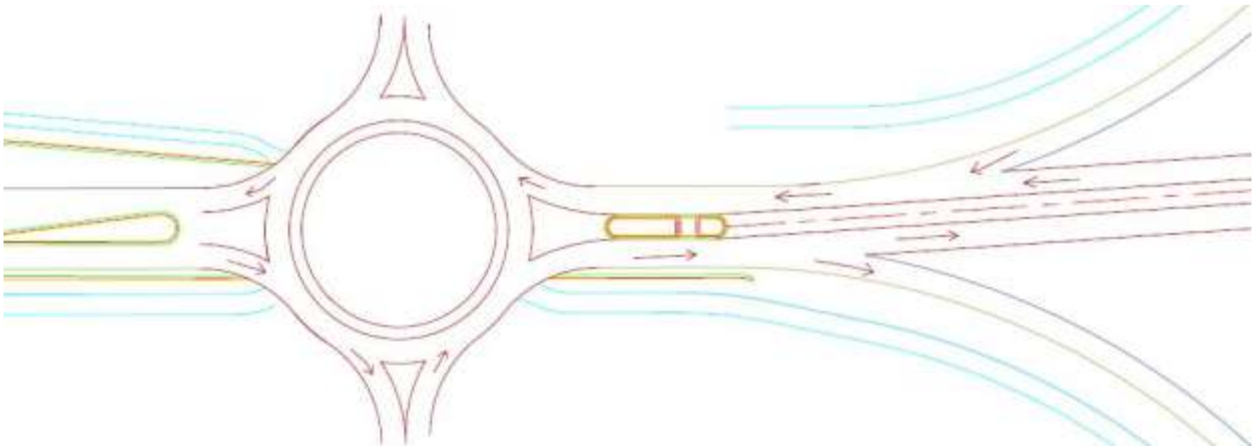

Figure 6.8: Roundabout at Residential Access

Another alternative considered was to have stop signs at the residential and commercial access at 92nd Avenue, *see Figure 6.9*. This option was not viable because the number of lanes on 92nd Avenue in this area increased, thereby making it unsafe to make left turns in this area.

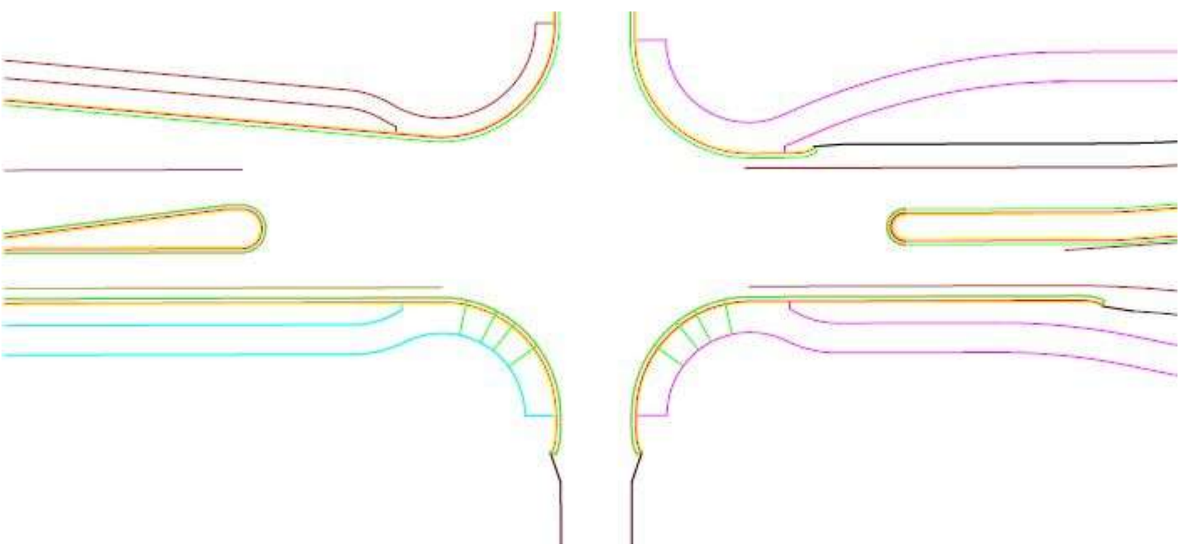

Figure 6.9: Residential & Commercial Access with Stop Signs

The selected alternative has free flowing traffic on 92nd Avenue and stop signs on the residential and commercial access that only allow right turns. This is the safest option for these low volume roads, because left turns are prohibited by medians. *See Figure 6.10*.

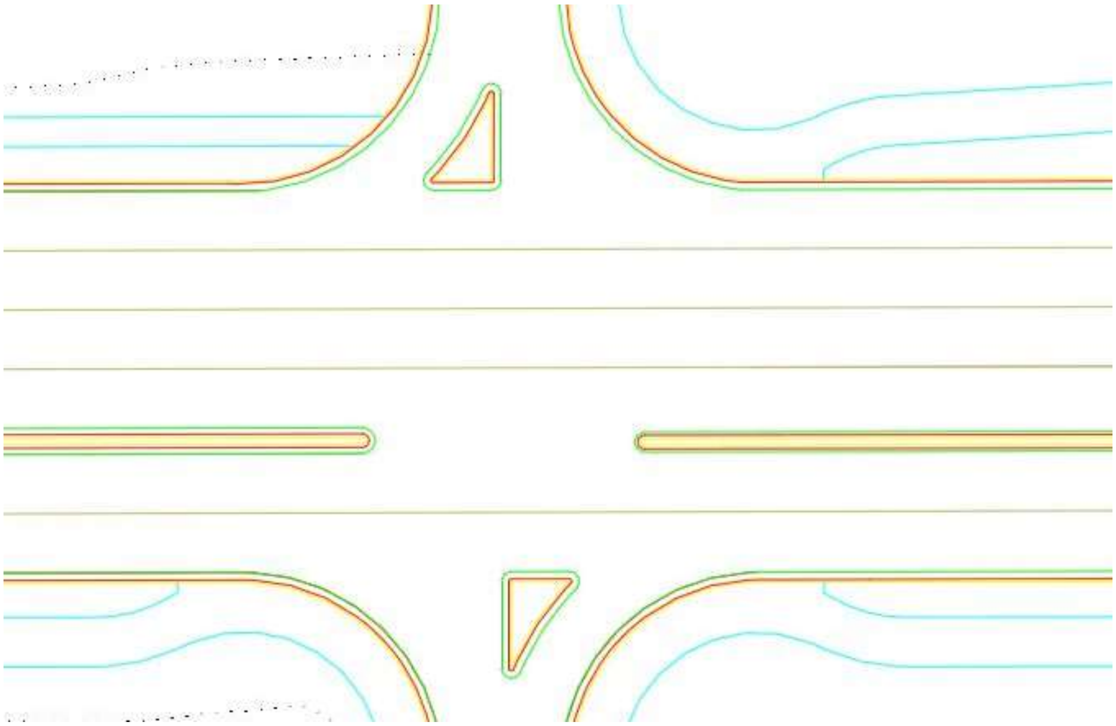

Figure 6.10: Residential and Commercial Access Preferred Alternative

6.4 TYPICAL SECTIONS

The selected alternative will have four typical sections for 92nd Avenue ranging from two 12-ft lanes where it meets Vanguard all the way up to six 12-ft lanes where it meets Old Seward Highway. On the East side of the New Seward Highway, 92nd Avenue will have 10-ft bike lanes and 7-ft sidewalks in both directions until it meets the New Seward Highway underpass. The bike lanes will phase out before the signalized intersection with Brayton Drive and the sidewalks will continue at a width of 6-ft. The sidewalks and bike paths to the west of the New Seward Highway will be 10-ft and 10-ft on the northern side of 92nd Avenue and 7-ft and 10-ft on the southern side of 92nd Avenue, respectively. Median widths will vary between no median and a 14-ft median.

The New Seward Highway will not be widened to six lanes for this project. It will be replaced with four 12-ft lanes, 8-ft inner and 10-ft outer shoulders on both sides, and a 36-ft median. Side slopes will be at 10:1 for 4-ft with guardrails and then 2:1 after that.

Brayton Drive will be matched to its existing section of two lanes with 4:1 side slopes. Detailed drawings of each typical section can be found in *Appendix B.4*.

6.5 HORIZONTAL AND VERTICAL ALIGNMENTS

The horizontal and vertical alignments for 92nd Ave and NSH were developed to meet the following objectives:

- Requisite design criteria
- Minimize ROW impacts
- Minimize earthwork quantities
- Minimize wetland impacts
- Avoid disturbing existing access to adjacent land
- Provide required underpass clearance at bridge crossing
- Avoid potential disturbance to nearby residential areas
- Minimize project costs

The existing elevations of Abbott Rd and Academy Dr have a separation of more than 20-ft, though the elevation change that must be met for this project is much smaller than that value due to Phase I raising the Abbott end first. The Academy end of 92nd Avenue must be lowered under the NSH to match with Abbott, but not so far as to interfere with the extremely high water table in the area. This creates a unique challenge in balancing grade changes with water table levels in the design process. *See Figure 6.11* for the chosen vertical alignment.

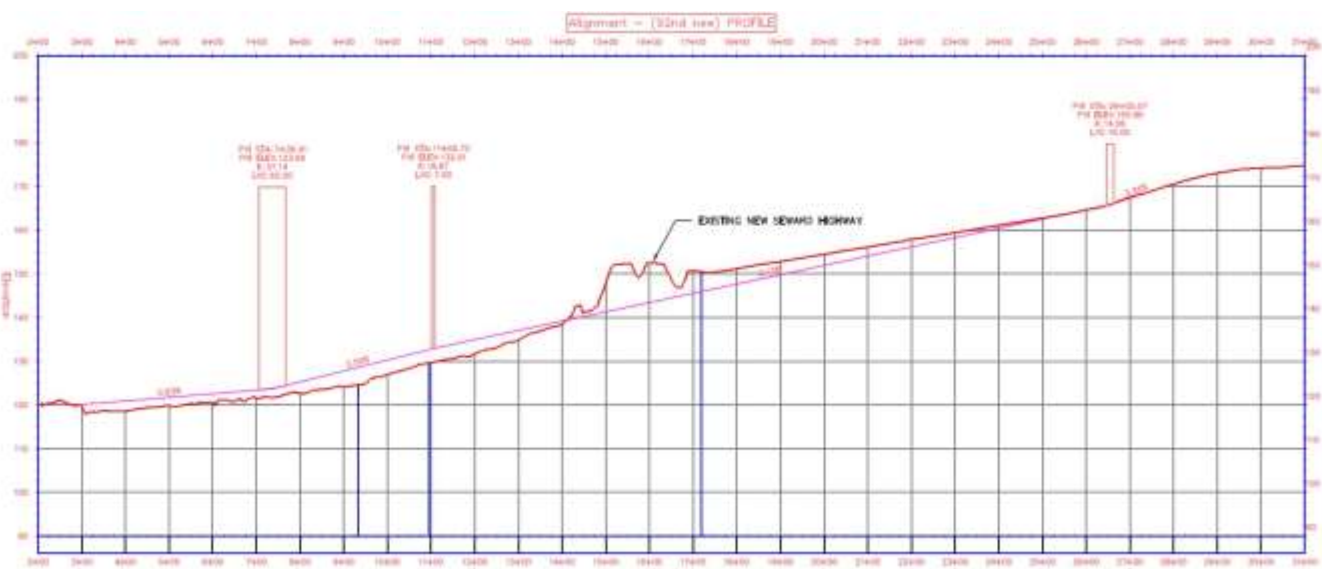

Figure 6.11: 92nd Avenue Vertical Alignment

The NSH has to be raised over 15-ft at its highest point and must meet the existing grade without interfering with the Dimond Boulevard on and off ramps. This too creates a unique challenge in keeping a safe grade for the highway and preventing the side slopes from reaching out too far.

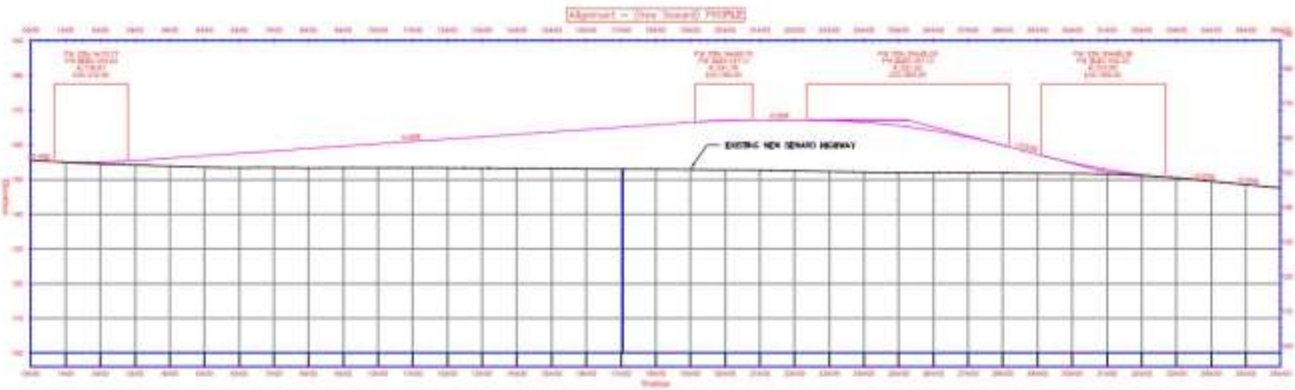

Figure 6.12: New Seward Highway Vertical Alignment

7.0 PAVEMENT DESIGN

7.1 INTRODUCTION

Provision of a stable pavement structure is essential to the adequate performance of a roadway. The selected alternative takes into account the effects of design life traffic loadings and environmental effects, while providing a safe, sustainable, and efficient pavement structure. Layer depths are provided for 92nd Ave, the NSH ramps, the NSH, and Brayton Dr.

7.2 DESIGN METHODOLOGY

Standards referenced include the American Association of State Highway and Transportation Officials (AASHTO) Guide for Design of Pavement Structures and the Alaska Department of Transportation and Public Facilities (AKDOT) Alaska Flexible Pavement Design Manual.

7.3 DESIGN CRITERIA

Design criteria used to develop pavement structure include the pavement performance analysis period (design life); traffic loadings in the form of ESALs; pavement reliability; environmental effects; expected pavement performance; and the resilient moduli of pavement layers.

7.3.1 Analysis Period

The design life of the pavement structure of 20 years corresponds to the design life expected for the roadway. This is a typical expected pavement design life.

7.3.2 Design Life Traffic

Traffic loadings over the course of the design life were determined in the form of 18-kip equivalent single-axle loads (ESALs). Passenger car traffic was considered insignificant, and truck equivalency factors were used to convert non-standard truck loadings into ESALs. As the roadway under consideration has no existing traffic, and vehicle weight studies cannot be performed, the truck equivalency factors used were AKDOT standard factors. Vehicle classification information from surrounding roads was used to develop percent of truck traffic (%) by truck type for 92nd Ave and NSH on and off ramps.

Estimated 2014 AADTs (annual average daily traffic as vehicles per day) were projected using a 1.0% compound traffic growth rate over the 20-year design life. Lane distribution factors, which estimate the distribution of traffic over the roadway lanes, was conservatively estimated as 1.00 for both 92nd and the NSH on and off-ramps as over much of these roadways two or fewer lanes exist.

Finally design lane factors, which estimate the directional distribution of traffic, were assumed to be 1.00 for the NSH on and off-ramps, and 0.70 for 92nd Ave as this is the directional split from the traffic demand model by Kinney Engineering, LLC. Detailed ESAL calculations are presented in *Appendix C: Pavement Design*.

7.3.3 Pavement Reliability

The reliability factor is the statistical reliability of the pavement providing adequate service over the course of its design life. As the functional classification of 92nd Ave will be minor arterial at the completion of the 92nd Ave corridor, a conservative reliability factor of 95% was used. In addition, a conservative standard deviation value for flexible pavements of 0.50 was used.

7.3.4 Environmental Effects

Environmental effects of concern include freezing temperatures and local high water table. To account for seasonal effects from frost heave and spring thaw, the minimum effective roadbed soil resilient modulus was used in layer depth calculations. Moisture coefficients for the base and subbase take into account expected moisture levels and drainage quality.

7.3.5 Pavement Performance

The structural and functional performance of the pavement over the course of its design life is measured by the present serviceability index (PSI) of the pavement. A standard initial serviceability index of 4.2 (AASHTO standard value); and a terminal serviceability index of 2.25, as determined by the functional classification of 92nd Ave were used to determine a change in PSI of 1.95 for the design life.

7.3.6 Resilient Moduli

Each layer of the pavement structure has a different resilient modulus, a measure of the ability of the layer to withstand the effects of repeated traffic loads. Layer coefficients correspond to the resilient modulus of each layer and are used to determine the necessary depths of each layer. The minimum effective roadbed soil resilient modulus was used to account for weakened soil due to spring thaw.

7.4 PAVEMENT STRUCTURE SUMMARY

7.4.1 Surface Course

The surface course provides the wearing surface of the pavement as well as binding the base course. It must be designed to withstand environmental conditions and traffic loadings over the design life of the pavement, while retaining adequate surface roughness for safety purposes in adverse weather conditions.

7.4.2 Base Course & Subbase Course

The base and subbase courses provide the structural strength of the pavement structure. The base and subbase consist of well-graded crushed aggregate with adequate drainage capabilities. The base and subbase course must also be of adequate strength to withstand expected traffic loadings.

7.4.3 Subgrade

The subgrade consists of the native soil or a selected material as necessary to provide structural stability to the overlying pavement courses.

7.5 PAVEMENT ALTERNATIVES

Four alternatives were considered for the pavement structure based on variations in asphalt concrete and base course selections. Traditional hot mix asphalt (HMA) Type II and Rubberized HMA were considered; as well as Aggregate Base D-1 and asphalt-treated Aggregate Base D-1. Rubberized HMA consists of traditional asphalt concrete mixed with crumb rubber processed from tires.

Across 92nd fill requirements varied, and information on the depth of excavation is provided in *Appendix C: Pavement Design*. Native soils may be used as subgrade where they provide equivalent bearing capacity to subgrade fill, and where native soils do not contain organics, fine sands, or clay. Select Material Type C will be used as subgrade where necessary and may be considered to extend to an infinite depth for purposes of pavement design.

7.4.1 Alternative 1

The first alternative considered consisted of hot mix asphalt (HMA) Type II as surface course, Aggregate Base D-1 as base course, and Select Material Type A as subbase course. To provide adequate stability, required depths calculated for subbase were extensive and this alternative was determined to be inefficient.

7.4.2 Alternative 2

The second alternative considered consisted of HMA Type II as surface course, asphalt-treated Aggregate Base D-1 over untreated Aggregate Base D-1 as base course, and Select Material Type A as subbase course. While this alternative provided adequate structural stability, traditional HMA lacks many of the benefits rubberized HMA provides for extreme climate conditions.

7.4.3 Alternative 3

The third alternative considered consisted of rubberized HMA as surface course, Aggregate Base D-1 as base course, and Select Material Type A as subbase course. To provide adequate stability, required depths calculated for subbase were extensive and this alternative was determined to be inefficient.

7.6 RECOMMENDED ALTERNATIVE

Rubberized HMA was selected for the surface course due to its superior performance under adverse environmental conditions, its tested & reliable usage as a surface course, and for reasons of noise pollution and sustainability. In particular rubberized HMA provides excellent thermal and fatigue resistance, leading to better lifetime performance and lower maintenance costs.

Rubberized HMA sustains less moisture-induced damage than traditional HMA due to anti-oxidant qualities of crumb rubber; and provides higher skid resistance improving the safety of traffic operations in adverse weather conditions. Use of rubberized HMA reduces noise impacts to nearby residential neighborhoods; and finally, use of rubberized HMA supports sustainable design as it recycles waste tires which would otherwise occupy landfill or disposal sites.

Asphalt treated base is commonly used to reduce the required thickness of the HMA layer (and associated costs), as it provides significantly greater strength than untreated base course. However to reduce the costs associated with ATB rather than untreated base, a minimal amount of asphalt-treated Aggregate Base D-1 will be used over an additional layer of untreated Aggregate Base D-1. Hence this duel layer base course structure provides adequate stability more economically and efficiently than a single layer base course structure.

Select Material Type A (also known as Borrow) was selected as the subbase course as it is a traditional subbase material. This well-graded aggregate provides excellent stability while retaining adequate drainage capabilities, essential for the high water table present along 92nd Ave.

7.6.1 Structural Calculations

The structural strength of the pavement layers is designated by the structural number of each layer. Once calculated, structural numbers, a function of the design criteria previously discussed and presented below, may then be used to calculate layer depths. Minimum recommended layer depths given ESALs were also taken into consideration. The pavement structure used for the NSH matches existing conditions, and corresponding structural calculations were considered unnecessary. Detailed calculations of layer depths may be found in *Appendix C: Pavement Design*.

Table 7.1: Design Criteria

Criteria		**Value**
ESALs	92nd Ave	2,230,000
	Brayton Dr	1,310,000
	SB NSH On-Ramp	450,000
	SB NSH Off-Ramp	3,030,000
	NB NSH Off-Ramp	940,000
Analysis Period		20 years
Reliability		95%
Standard Deviation		0.50
ΔPSI		1.95

7.6.2 Pavement Typical Sections

For 92nd Ave the pavement structure consists of:

- Four (4) inches of Hot Mixed Asphalt Type R, over
- Three (3) inches of Asphalt Treated Base, over
- Three (3) inches of Crushed Aggregate Base Course, over
- Twenty-four (24) inches of Select Material, Type A

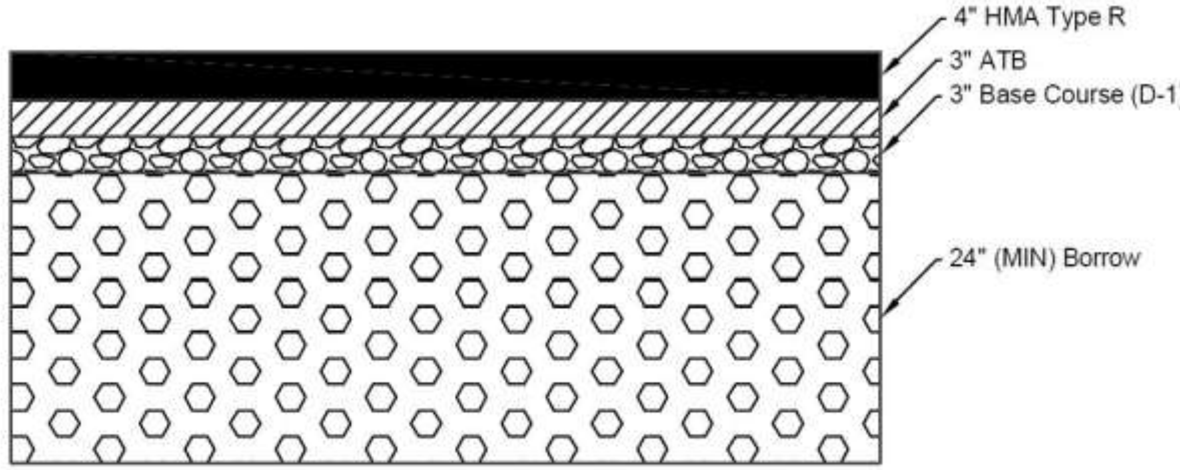

Figure 7.1: 92nd Ave Typical Section

For the NSH the pavement structure matches existing conditions, and consists of:

- Two (2) inches of Hot Mixed Asphalt, over
- Four (4) inches of Asphalt Treated Base, over
- Four (4) inches of Crushed Aggregate Base Course, over
- Twenty-four (24) inches of Select Material, Type A

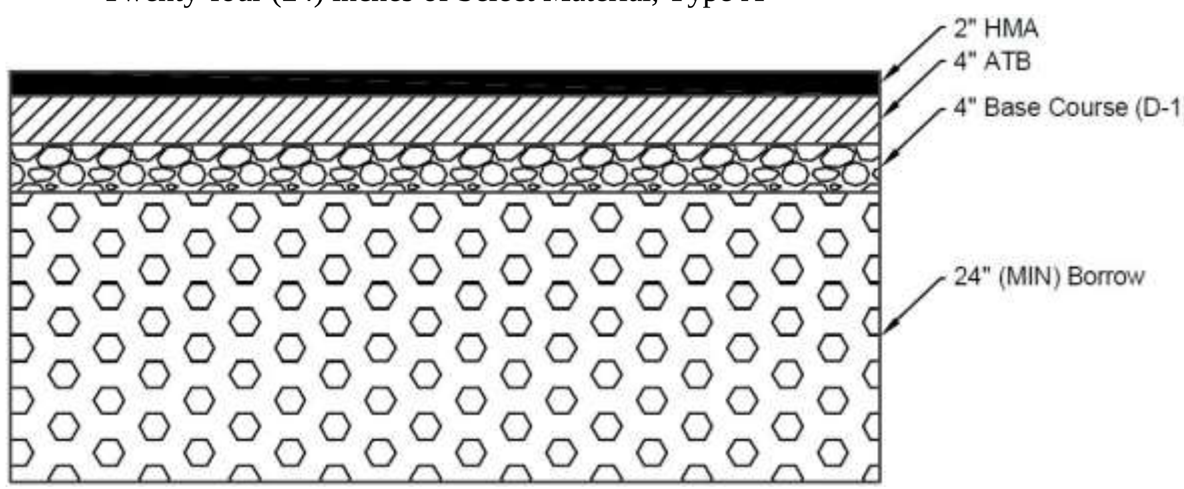

Figure 7.2: NSH Typical Section

For the SB NSH On-Ramp the pavement structure consists of:

- Three (3) inches of Hot Mixed Asphalt Type R, over
- Two (2) inches of Asphalt Treated Base, over
- Two (2) inches of Crushed Aggregate Base Course, over
- Twenty-two (22) inches of Select Material, Type A

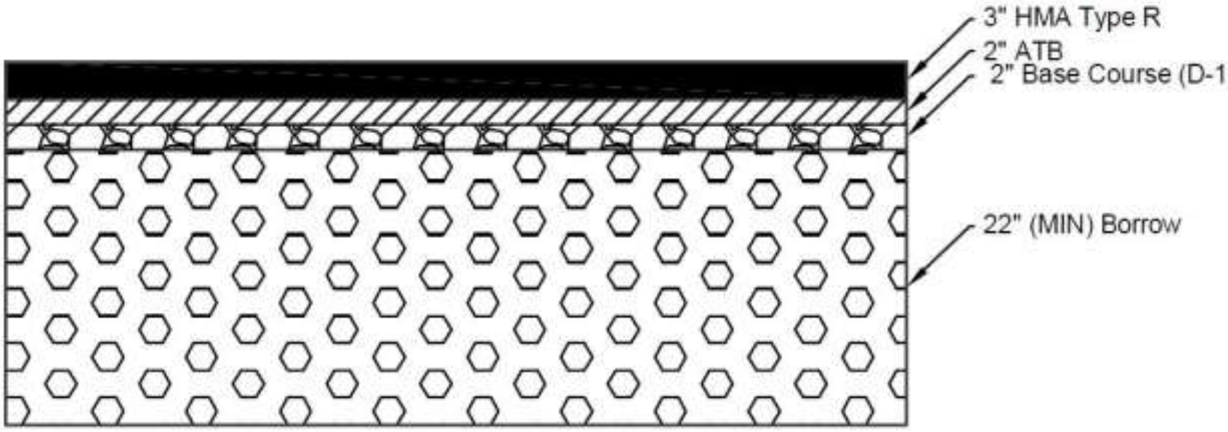

Figure 7.3: SB NSH On-Ramp Typical Section

For the SB NSH Off-Ramp the pavement structure consists of:

- Four (4) inches of Hot Mixed Asphalt Type R, over
- Three (3) inches of Asphalt Treated Base, over
- Two (2) inches of Crushed Aggregate Base Course, over
- Twenty-eight (28) inches of Select Material, Type A

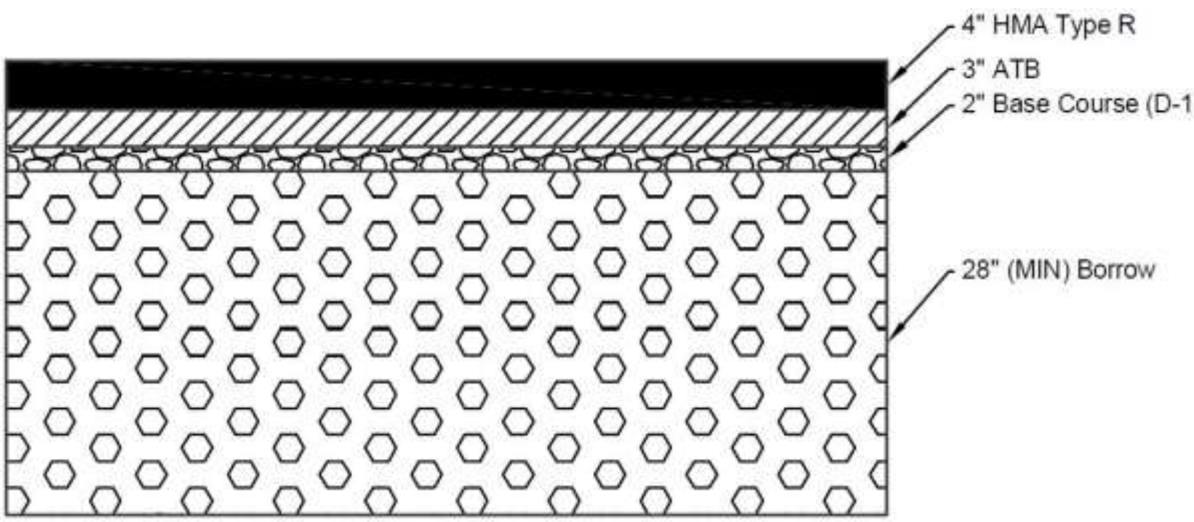

Figure 7.4: SB NSH Off-Ramp Typical Section

For the NB NSH Off-Ramp the pavement structure consists of:

- Three (3) inches of Hot Mixed Asphalt Type R, over
- Two (2) inches of Asphalt Treated Base, over
- Two (2) inches of Crushed Aggregate Base Course, over
- Twenty-two (22) inches of Select Material, Type A

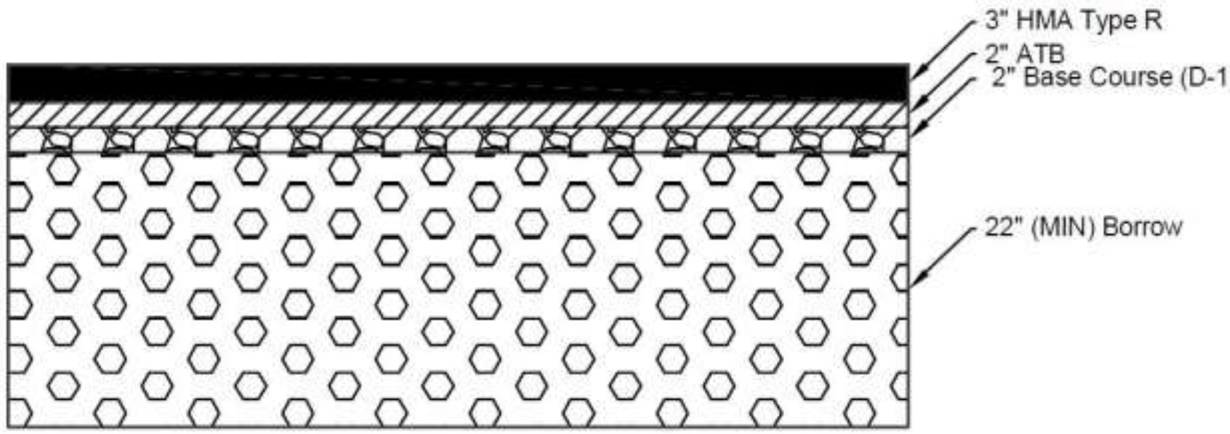

Figure 7.5: NB NSH Off-Ramp Typical Section

For Brayton Drive the pavement structure consists of:

- Three (3) inches of Hot Mixed Asphalt Type R, over
- Three (3) inches of Asphalt Treated Base, over
- Three (3) inches of Crushed Aggregate Base Course, over
- Twenty-four (24) inches of Select Material, Type A

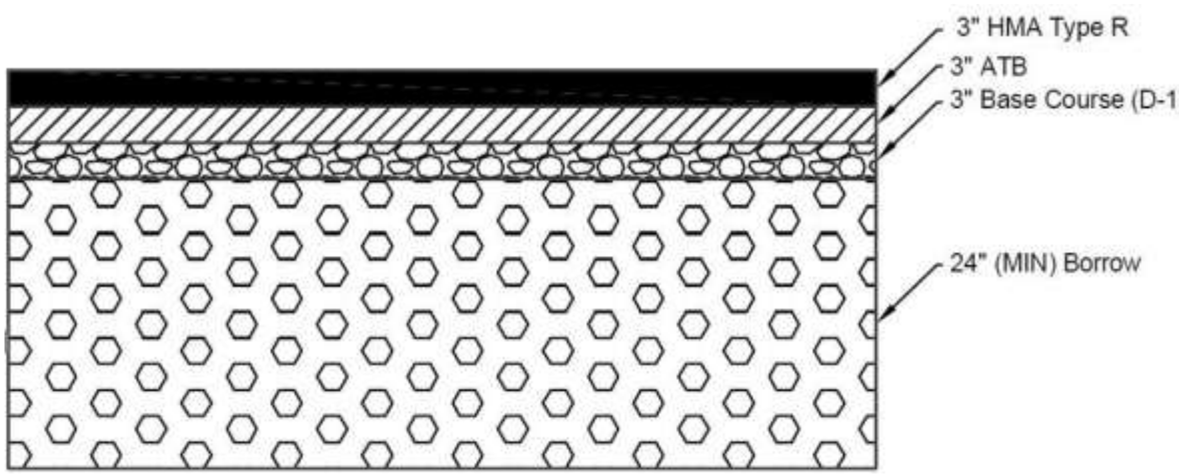

Figure 7.6: Brayton Dr Typical Section

7.6.3 Construction Recommendation

For ease of construction, it is recommended that all NSH ramps within the scope of this project use the same pavement structure. To meet the minimum structural requirements of each ramp, a pavement structure consisting of: four inches of HMA Type R, over three inches of ATB, over two inches of D-1 base course, over twenty-two inches of Select Material Type A, should be used for the NSH ramps within the scope of this project.

7.7 PEDESTRIAN FACILITIES

Pedestrian facilities utilized standardized sidewalk pavement structure from AKDOT. The sidewalk pavement consists of:

- Four (4) inches of Portland Cement Concrete, over
- Two (2) inches of Crushed Aggregate Base Course, over
- Twenty-four (24) inches of Select Material, Type A

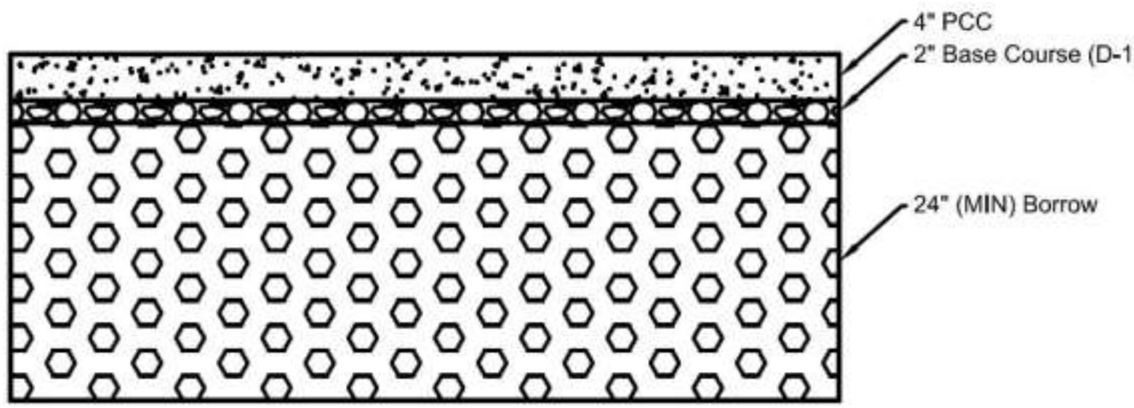

Figure 7.7: Sidewalk Typical Section

8.0 OVERPASS DESIGN

The following section provides information for the design of the overpass located on the NSH at 92nd Ave. The overpass will allow access from the east side of the NSH (Academy Dr.) to the west side (92nd Ave.), and vice versa. Details for the overpass can be found in *Appendix D: Overpass Design*.

8.1 DESIGN PARAMETERS

The two bridge options for this project included lowering the NSH and building a bridge over the highway, or raising the NSH and using it as an overpass, allowing for traffic to flow underneath on 92nd Ave. Due to safety and cost considerations, the overpass design was selected as the optimal alternative. Selecting the overpass alternative will allow the pedestrians to traverse flatter grades, provide protection from snow, as well as minimize costs by decreasing the span of the bridge.

8.2 BRIDGE ALTERNATIVES

8.2.1 Concrete

A concrete bridge was considered as an alternative design based on its local availability, high strength, and lower maintenance and installation costs. Also, precast, pre-stressed concrete bridge components are easy to erect. With a concrete decked bulb tee girder, the flanges act as the deck formwork, which speeds up the construction time. Pre-stressed concrete members experience less cracking since the members are designed to be in compression, therefore require less maintenance.

8.2.2 Steel

A steel bridge was also considered as an alternative due to its high strength-to-weight ratio, as well as its span range. Steel bridges too can be erected quickly. Nevertheless, steel is usually more expensive than concrete. Steel is susceptible to corrosion, which means higher maintenance costs. However, steel can be painted, at an additional cost, to avoid corrosion. Furthermore, the energy it takes to produce steel is costly.

8.3 ALTERNATIVE SELECTION

The concrete decked bulb tee girder bridge alternative was selected over the steel plate girder bridge after considering cost and availability. A concrete decked bulb tee bridge requires less maintenance costs and can be manufactured from local materials, while steel bridges have higher maintenance costs due to inspection, paint stripping, and re-painting. The client has approved the selection.

8.4 BRIDGE DETAILS

The bridge alternative selected has the NSH crossing over the connection of 92nd Ave. and Academy Dr. The bridge will be single-spanned with pre-stressed decked bulb-tee girders, supported by two abutments and HP14x117 piles. The Alaska DOT&PF Preconstruction Manual requires a vertical clearance of 16.5 feet above the paved surface (92nd Avenue). Also, the bridge will be skewed at an angle of 4°. Detailed drawings can be found in *Appendix D: Overpass Design*.

8.5 DESIGN LOADS

Design loads considered for the NSH bridge included dead loads and live loads. Seismic loads were not considered in this design. The total dead load consisted of weights of the girders, F-shape barriers, asphalt overlay and railings along the bridge. No utilities were placed on the bridge and no intermediate diaphragms were used in the 35% design. The live loads were determined using a HL-93 design vehicle. A bulb tee program provided by AK DOT&PF, *Decked Bulb-Tee Girder Design 2007 LRFD,* was used to determine the minimum number of girders necessary to design the bridge safely by analyzing the bridge loads and adjusting the flange widths. The most economical girder size was then selected. Shear and moment diagrams were produced and the maximum moment was determined (see *Appendix D: Overpass Design*).

8.6 SUPERSTRUCTURE

The superstructure is the portion of the bridge that directly supports vehicular and pedestrian traffic. Included in the superstructure are the bridge deck, the supporting structural members, and the bridge railings.

8.6.1 Deck

Once the longitudinal keyway grout between the girders has cured, a waterproofing membrane will be placed on the deck, and then a 4 inch asphalt overlay will be placed.

8.6.2 Girders

Using the bulb tee program provided, it was decided the safest and most cost effective bulb tee would be 66 inches deep, with a top flange width of 66 inches. Each girder will be spaced 0.5 inches apart, with 7.25 inch overhangs on both ends. Each girder is 143 feet in length. A total of 20 girders will be used.

8.6.3 Railings

As a safety measure, 27 inch high guardrails will be installed along the outer edge of the shoulders. Also included for safety purposes will be 32 inch high F-shape median barriers.

8.7 SUBSTRUCTURE

The bridge substructure supports the superstructure and distributes the bridge loads to the soil. It consists of abutments, piers, footings, and piles. This is a single span bridge; therefore no intermediate supports are necessary. Since this is only a 35% design, only abutments and pilings were considered in the design.

8.7.1 Abutments

The abutments will be fabricated using reinforced Portland Cement Concrete. Each abutment has a cross sectional area of 3 ft deep by 3 ft wide and is 109 feet long. They will be buried approximately 1.5 feet into the structural fill. The side slopes in front of the abutment will be at 2:1, using structural fill. The slope allows for expansion, should the projected amount of traffic exceed the capacity of 92nd Avenue.

8.7.2 Piles

A geotechnical investigation will be required to determine the necessary depth of the H-piles. However, it is estimated from similar structures around the corridor that the HP 14x117 piles will be driven 70 feet into the ground, providing support for the bridge. Due to excessive costs, 36 inch pipe piles were not selected for this design.

9.0 UTILITY RELOCATION AND COORDINATION

This section summarizes the main existing utilities in the area, as well as the main utility conflicts. The Utility Conflict Report is included in *Appendix E*.

9.1 EXISTING UTILITIES

Following is a list of the major existing utilities within the project limit.

9.1.1 Water – AWWU

AWWU operates the following water facilities within the project area:

- A 36" water main runs along 92nd Avenue from station 3+00 to 14+50 and then turns north on the New Seward Highway.
- A 12" water main exists on 92nd Avenue between station 17+50 to 27+00.
- Several service connections, fire hydrants, and water valves throughout the project area.

9.1.2 Sanitary Sewer – AWWU

AWWU operates the following sanitary sewer facilities within the project area:

- An 8" sanitary sewer line runs along 92nd Avenue between 3+00 to 8+00.
- An 8" sanitary sewer line runs along 92nd Avenue between 17+50 to 25+20.
- Several manholes exist throughout the project area.

9.1.3 Natural Gas – ENSTAR

ENSTAR operates a natural gas distribution and transmission system within the project area. The following facilities exists within the project area:

- A gas line exists on 92nd Avenue between stations 21+70 to 27+00. This gas line will not be affected.

9.1.4 Telephone – ACS

ACS owns and operates telephone communication facilities within the project area. The following is a list of key facilities that will be impacted by the proposed construction:

- An overhead telecommunications line on 92nd Avenue station 3+00 to 14+20.
- An underground telecommunications line on 92nd Avenue station 17+50 to 26+50.
- An underground telecommunications line on 92nd Avenue station 17+80 to 27+00.
- A pedestal on 92nd Avenue station 17+80.

9.1.5 Television – GCI

GCI owns and operates communication facilities within the proposed project area that consist of a combination of fiber optic and coaxial cable. The following is a list of key facilities that will be impacted by the proposed activities:

- 0.500 Coaxial overhead CATV on 92nd Avenue station 3+00 to 14+20.
- 0.500 Coaxial underground CATV on 92nd Avenue station 17+50 to 27+00.
- 0.750 Coaxial underground CATV on 92nd Avenue station 17+50 to 27+50.
- Fiber optic line on 92nd Avenue station 17+50 to 24+70.
- Fiber Optic vault on 92nd Avenue at station 24+70
- Several CATV vaults along the project area.

9.1.6 Electrical – CEA

CEA owns and operates electric facilities in project area. Transmission, distribution, and service facilities will be impacted by the proposed construction activities. The following is a list of key impacted facilities:

1. 1 Phase overhead electric line with 9 poles that runs on 92nd Avenue between stations 3+00 to 14+20.
2. 1 Phase underground electric line on 92nd Avenue station 17+50 to 26+50.
3. An electric box on Brayton Drive.

9.2 UTILITY CONFLICTS

9.2.1 Utility Conflicts – 92nd Avenue Station 3+00 to 17+50

Table 9.1: Utility Conflicts– 92nd Avenue Station 3+00 to 17+50

Station	Offset	Utility	Conflict Description	Recommended Resolution
03+00 to 14+20	10 R	ACS	50-count overhead telephone line	Relocate to 5' south of sidewalk
03+00 to 14+20	10 R	CEA	1 Phase overhead electric line (9 poles)	Relocate to 5' south of sidewalk
03+00 to 14+20	3 R	GCI	0.500 Coax overhead CATV	Relocate 60' south
03+20	40 L	AWWU	Sanitary sewer manhole	Adjust to grade
04+90	3 R	GCI	CATV Vault	Relocate 60' south
06+20	40 L	AWWU	Sanitary sewer manhole	Adjust to grade
07+30	3 R	GCI	CATV Vault	Relocate 60' south
08+10	35 L	AWWU	Sanitary sewer manhole	Adjust to grade
08+55	3 R	GCI	CATV Vault	Relocate 60' south
09+60	3 R	GCI	CATV Vault	Relocate 60' south
10+75	3 R	GCI	CATV Vault	Relocate 60' south
12+80	3 R	GCI	CATV Vault	Relocate 60' south
14+60	50 L	AWWU	Fire hydrant	Relocate to station 13+60
14+60	50 L	AWWU	Fire hydrant	Relocate to station 13+60

9.2.2 Utility Conflicts – 92nd Avenue Station 17+50to 27+00

Table 9.2: Utility Conflicts– 92nd Avenue Station 17+50 to 27+00

Station	Offset	Utility	Conflict Description	Recommended Resolution
17+50	25 L	AWWU	Sanitary sewer manhole	Adjust to grade
17+50 to 24+70	30 L	GCI	Fiber optic line	Relocate 30' north
17+50 to 25+20	25 L	AWWU	8" Sanitary sewer line	Adjust in place
17+50 to 26+50	60 R	ACS	26-Count underground telephone line	Adjust in place
17+50 to 26+50	60 R	CEA	1 Phase underground electric line	Adjust in place
17+50 to 27+00	5 R	AWWU	12" Water line	Adjust in place
17+50 to 27+00	35 R	GCI	0.500 Coax underground CATV	Relocate 25' south
17+50 to 27+00	50 R	GCI	0.750 Coax underground CATV	Relocate 15' south
17+60	10 R	AWWU	Water valve box and gate valve	Adjust to grade
17+70	20 R	AWWU	Fire hydrant	Relocate 20' south
17+80	25 R	ACS	Pedestal	Relocate 50' southeast
17+80 to 27+00	25 R	ACS	26-Count underground telecomm line	Relocate 40' south
18+50	5 R	AWWU	Water valve box and gate valve	Adjust to grade
19+20	5 L	AWWU	Water valve box and gate valve	Adjust to grade
19+30	30 L	AWWU	Sanitary sewer manhole	Adjust to grade
19+60	60 R	AWWU	Sanitary sewer manhole	Adjust to grade
20+30	5 L	AWWU	Water valve box and gate valve	Adjust to grade
21+00	20 L	AWWU	Sanitary sewer manhole	Adjust to grade
21+61	5 L	AWWU	Water valve box and gate valve	Adjust to grade
22+75	20 R	AWWU	Fire hydrant	Relocate 25' south
22+75	5 R	AWWU	Water valve box and gate valve	Adjust to grade
24+35	5 L	AWWU	Water valve box and gate valve	Adjust to grade
24+70	30 L	GCI	Fiber optic vault	Relocate 30' north
25+20	15 L	AWWU	Sanitary sewer manhole	Adjust to grade
26+40	20 R	AWWU	Water valve box and gate valve	Adjust to grade
26+50	20 R	AWWU	Water valve box and gate valve	Adjust to grade
26+55	5 L	AWWU	Water valve box and gate valve	Adjust to grade

10.0 STORM WATER CONTROL

10.1 INTRODUCTION AND PROJECT BACKGROUND

10.1.1 Introduction

The senior design class of 2013 is redesigning the 92nd and Academy roadway and it will be incorporating a storm water runoff control system. In the past storm water was typically handled by removing it from populated areas as soon as possible and not considering too much where it might end up. Due to this practice it has taken a toll on our environment. The impacts we are currently seeing is accelerated erosion, disruption of natural hydrology, loss of natural habitat, and declining water quality.

For urban areas the most significant characteristic of runoff is suspended-solids content. Surface runoff may contain more than three times the concentration of suspended solids in untreated sewages. For these reasons storm surface water must be managed and treated properly. To manage storm water the Environmental Protection Agency (EPA) has established rules and regulations. For this project what will be shown is construction of a conveyance system and considerations of a specialized detention pond.

10.1.2 Background

For the 92nd Project there are many challenges in designing a functioning storm water system. Some of these challenges are availability of space, roadway geometry constraints, and estimated high seasonal ground water. The management of these design constraints will be discussed in detail in the following sections. The storm water conveyance design system will be broken into two project areas, east of the NSH and the west side.

On the west side of the NSH Hattenburg, Dilley and Linnell (HDL) has created a draft design for storm water control in that area. For the project we will retain the majority of their design and only make slight adjustment, because our design slightly differs.

For the east side of the NSH we will be designing an entirely new storm water system, because currently there is no major system located on Academy Drive. Also, a detention pond will be constructed on the west side; it will mostly be serving the purposes of the storm water from the east side.

10.2 STORM WATER DESIGN DOCUMENTS

10.2.1 Introduction

In 1972 the CWA was enacted, this policy was established in light of the apparent pollutants that were discharging into water sources. The most significant portion of the CWA was the establishment of National Pollutant Discharge Elimination System permits (NPDES).

The NPDES comes from section 402 of the CWA and requires all construction sites, industrial facilities, commercial facilities, and municipalities to properly manage storm water discharge. Under the NPDES all storm water that is discharged must achieve specified Water Quality Standards (WQS) before being discharged into the Nation's waters. The Municipality of Anchorage (MOA) has been issued its own NPDES and in response has created their own regulations for managing storm water pollutants.

10.2.2 MOA Storm Water Treatment

To meet requires described in the NPDES, MOA has created several documents to establish guidelines and regulations for managing storm water. Some of the main documents used for design guidelines are the *Storm Water Treatment Plan Review*, *Drainage Design Guidelines*, and *Low Impact Development*.

For the design of the 92nd Project supplemental documents where used for design purposes. Supplemental documents include the *FHWA Urban Drainage Design Manual*, *Alaska Storm Water Guide*, *Anchorage Intensity-Duration-Frequency Curves Update, and Seward Highway: 92nd Avenue Connector Project Hydrologic and Hydraulic Summary Report-Draft.*

10.2.2.1 Storm Water Treatment Plan

The Storm Water Treatment plan that was submitted by MOA is used to outline guidance on storm water management for construction sites, BMPs, dewatering requirements, developing storm water treatment plans, and many other aspects for storm water management.

For the 92nd Project this document is used for storm water management. The document provides a list of requirements that must be fulfilled for submission of developing a storm water management treatment plan.

The steps involved in developing a storm treatment plan is listed below, but all requirements may not be required.

1. Determine Applicable Plan Components
2. Collect and analyze Existing conditions Information
3. Prepare Preliminary Development layout
4. Perform Existing and Proposed Conditions Section , including Off site analysis
5. Prepare Permanent Storm water Quality Control Plan
6. Finalize Development Layout
7. Prepare a Storm Water Pollution Prevention Plan
8. Prepare Dewatering Plan
9. Include a Maintenance and Operation Manual
10. Submit As-Built Drawings

The storm water design proposal for the 92nd Project will cover portions of items 1-6 and portions of item 10.

10.2.2.2 Drainage Design Guidelines

The Drainage Design Guideline document that has been provided by MOA is a comprehensive document that outlines what is needed for designing a water conveyance system and guidelines for reporting documents. For the 92nd Project this document will provide guidelines in determining drainage area, design storms (IDF curve, Storm Volume, Duration, and etc.), runoff response, storm water controls, and channel erosion and deicing controls. Supplemental materials that will be used in conjugation with this document are the Urban Drainage Manual and the Anchorage Intensity-Duration-Frequency Curves Update.

10.2.2.3 Low Impact Development

The Low Impact Development design guidance manual describes options and design parameters that may be used for the placement and design of LIDs. For the 92nd Project this document will be used to design the storm water detention device that will be incorporated with the storm water conveyance system. Supplemental documents for the design of the LID will include the Alaska Storm Water Guide and the Maryland Stormwater Design Manual.

10.3 DESIGN AND RECOMMENDATIONS

10.3.1 Introduction

The steps in creating storm water system can be generalized in a three step process:

- Pre-Construction Hydrologic and Hydraulic Study
- Storm water Design
- Post-Construction Hydrologic and Hydraulic Study

The design process of this report will be going over the stormwater design. A lot of the important data that is incorporated in the Pre-Construction Hydrologic and Hydraulic Study will be derived from the Seward Highway: 92nd Avenue Connector Project (HDL, 2011) document. This document will provide the necessary information to create a storm water system. It also should be noted that the proposed storm water system from this report will retain the storm water design it has created for the existing 92nd Avenue. Slight changes to their design will be discussed later in the report. Documents that will be used are maps of existing storm water systems, proposed storm water system, and potentially typical drawings.

For a storm water design the process will be broken down into three basic steps:

- Drainage Area
- Storm Water Conveyance
- LID Design

The drainage area is the surface area of the land that will be affecting the storm water design. With defined drainage area you will be able to start designing a storm water conveyance system. Knowing how the water is being conveyed you can determine where it needs to go. For this project an LID will be used to retain storm water.

10.3.2 Drainage Area

As briefly described in the introduction, the place to start for a design process is determining the drainage area. The documents used in determining the drainage area is a USGS map of the Anchorage area (*see Appendix F2.4*) and the Hydrologic and Hydraulic report created by HDL. For the area west of the NSH HDL has already created a drainage area, but east of the NSH there was no immediate data available for a drainage area. With the two previously stated documents a drainage area was determined for the eastern portion of the project.

The drainage area of concern was determined based on the existing contour of the area. Some drainage areas were not considered, because those areas were assumed to be handled by existing drainage structures. Then, portions of the drainage area were sectioned based on their surface composition (grassy area, unimproved grassy area, urban areas, and etc.). Areas were also sectioned off based on the roadway design.

A drainage map of the construction area is found in *Appendix F2.1*, the total drainage area was estimated to be 27 acres. The next step in the process was then designing the water conveyance system.

10.3.3 Conveyance System

Due to the size of the drainage area the (< 200 acres) it is justifiable to use the Rational Method for determining peak flows. Steps in using the Rational Method were followed in the Urban Drainage Manual. With a determined runoff coefficient and known drainage area (with a use of an IDF curve) a flow can be determined. The IDF curve was obtained from Anchorage Intensity-Duration-Frequency Curves Update, this curve can be found in *Appendix F2.2*. The conveyance system will use a system of inlets, corrugated steel pipes ranging from 18”-24” in diameter, and culverts. Details of the design can be found in the plan set.

10.3.4 Inlet Placement and Design

The water conveyance system will start in Academy and tie into existing systems and direct storm water flow west into 92nd. Storm water will be directed off the roads and into gutters that have been designed into the road. Drop inlets will be placed on the gutters and will be spaced accordingly to the grade of the roadway and geometry. Inlets will be placed according to the following criteria:

- At all low points in the gutter grades
- Immediately upstream of median breaks, entrance/exit ramps gores, cross walks, and street interactions.
- Immediately downstream of bridges.
- Immediately upgrade of cross slope reversals
- Immediately upgrade from pedestrian cross walks.
- At the end of channels in cut sections
- On side streets immediately upgrade from intersections
- Behind curbs, shoulder or sidewalks to drain low area

West of the NSH a conveyance system will already be in place. A few adjustments will have to be made for the existing conveyance system. The majority of the system will remain intact, but a few inlets will be removed and additional inlets will be placed in. A summary of these changes can be found in the plan sets.

10.3.6 LID/BMP Design

The design of an LID/BMP is a delicate process, almost artistic. It is a combination of standard civil construction and natural habitat design. The two major constraints for the design is the availability of space for the detention pond and high season ground water. Due to the high ground water the floor of the detention pond will have been constructed of an impermeable material, clay would be a potential candidate.

The design of the LID will be of a multi-pond system. Water conveyed from the eastern portion of the NSH will be the major contributor for the detention pond and additional surface water surrounding the LID will most likely collect in the ponds. The first collection point of storm water from the east is going to be an oil grit separator.

The oil grit separator will remove major amounts of sediments (to include trash and suspended-solids) and oil. The oil grit separator will require maintenance access and must be cleaned periodically. Also the oil grit separator will serve as a transition from storm pipe to surface water via corrugated pipe. As of now Anchorage does not have standards for oil grit separators. There is currently a committee outlining the details and requirements for oil grit separators.

The water is then directed to three separate detention ponds. The pond system itself is based on the concept of a multi-pond detention system described in the Maryland Storm Water Design Manual (see *Appendix F2.5*). The pond system is divided by riparian weirs that will control the flow rate from pond to pond; this will allow additional suspended particles to settle to the bottom of the pond.

The vegetation in and surrounding the ponds will remove additional pollutants that may remain in the water. Water in the ponds is expected to be returned to the environment through evaporation and transpiration. It is a consideration that the water flowing in the last pond may actually be fit enough to return to the environment, but this will require a conveyance system that leads out of the project and further design studies of LIDs.

Below is an image of the proposed pond locations.

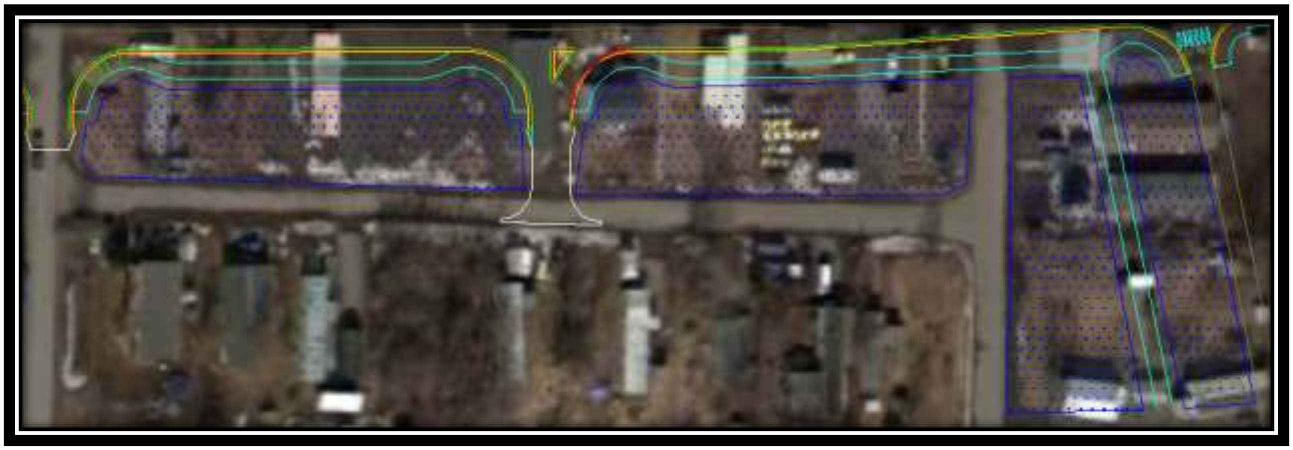

Figure 10.1: Pond Locations

The concept of riparian weirs is a new concept to LIDs. As stated earlier their purpose is to control flow from pond to pond, with the intent to promote settling of solids. Their construction will be composed of rip-rap material and culverts. The culverts will be designed to act as a weir should the incoming flow exceed the rate that is permeating through the rip-rap base.

10.3.6.1 Volume of Pond Size Rational Method/NRCS Method

To determine the approximate size of the pond two methods were applied to determine the approximate volume the detention ponds would be required to detain. The two methods used where the NRCS method and the Rational method. Volume methods where determined for 2-yr, 10-yr, 25-yr, and 100-yr storm for a 24-hr period. A volume summary is located in *Table 10.1: Volume Summary*.

Due to the size of the drainage basin in question it is appropriate to use the NRCS method to determine an estimate of expected volume. Typically, to achieve a more accurate volume a more extensive study is required. Though the rational method is used to determine volume flow, a volume was calculated for a 24 hour period. A comparison was done between these two volumes. Due to a large percentage of error that occurs during volume calculation, the value of 118,000 ft^3 was used to determine sizing of the ponds. Details of calculations can be found in *Appendix F*.

Table 10.1: Volume Summary

Storm Event, yr	Volume NRCS, ft^3	Volume Rational, ft^3
2	16,719	60,749
10	40,370	84,915
25	55,515	97,780
100	81,875	117,939

Quarter ellipsoids and half cylinders where used to determine approximate depth of the ponds. It has been determined that the max depth a pond may have should not exceed 6ft. The ponds should have a general shape of a lens with gradual slopes on all sides that eventually meet at the max depth. Theses ponds will have irregular shapes, because there design will be based on the existing structures and current environment. With a max depth of 6ft the ponds should be sufficient to handle water volume form the determined drainage basin.

Anther design consideration is that the ponds do exist in another drainage basin, to which a volume flow has not been calculated. In this area HDL has planned a storm water conveyance structure with a built in detention system. This system is designed to handle water volume for that area. So by using this existing structure an overflow inlet will be built into one of the ponds. When the ponds become inundated with additional water from the surrounding area the water can be appropriately directed into the structures that were designed to handle that water volume.

10.3.7 Other Design Considerations

Another design proposal is to create a conveyance system in which water is retained in the system itself. This method is proposed by HDL and the design process goes in depth in their Hydrology and Hydraulics report. A summary of their hydraulic analysis is that a retention pond was not feasible, existing system storm system is currently over design capacity in their area. So by placing oversized pipes and oil grit separators the will retain storm water onsite.

10.4 CONCLUSION

This portion of the report was intended to achieve a 35% design for a storm water system. A drainage area has been determined along with a proposal of a water conveyance/retention system. The design of the conveyance system is possibility with the inclusion of a detention pond. The implementation of LIDs for the Anchorage district is a new concept and rules/regulations have not been fully developed for implementing the detention ponds.

Overall, it is currently not recommend installing detention ponds based on high ground water levels and limited impact studies. This portion of the report explored the possibility of applying detention ponds and it seems plausible to use them. Using detention ponds will fulfill MS4 requirements for Anchorage's NPDES and may prove beneficial for the environment. Before placing detention ponds a more thorough impact report needs to be conduction for the Anchorage area.

Though using a detention pond may be an ideal solution, reality is conventional methods of storm water will most likely be used for the area. Without in-depth reports on detention ponds for the Anchorage area, detention ponds may prove unpredictable and potentially may not serve their intended purpose. It would seem more logical to imitate HDL's proposal for storm water control, due to the fact that their system would produce more expected results. Even with the lack of an in-depth study on detention ponds it is a good exercise to explore the option of implementing them.

11.0 ENVIRONMENTAL

An important part of project development for transportation facilities is consideration of potential environmental impacts. The United States Army Corps of Engineers (USACE) will prepare an environmental assessment, in accordance with the National Environmental Protection Act (NEPA), as a part of their Section 404 wetlands permit. Environmental issues will be addressed in detail in the environmental assessment. The environmental assessment is a critical aspect of project development. Documentation and language must be reviewed and updated to most current version throughout the project. Some of the major issues are stated below and can be found in detail in the Environmental Assessment (*Appendix G*).

11.0.1 Environmental Commitments

- The project will not encroach on the class A wetlands other than those within the existing ROW as identified by the Corps of Engineers.
- The project will include permanent Best Management Practices (BMPs) for storm water discharges including an oil/water separator prior to outfall into any possible point sources.
- The construction contract will require the Contractor to develop and implement a Storm Water Pollution Prevention Plan (SWPPP) to treat storm water, comply with the municipal noise ordinance, apply water and/or palliatives to control dust, and provide advanced public notice of road closures, detours, or delays.
- If archaeological resources are encountered during construction, work will be halted, and the State Historic and Preservation Office will be contacted. If contamination is encountered, work will be halted, and the State of Alaska Department of Environmental Conservation (ADEC) will be contacted.

11.1 WETLANDS

Wetlands functions are the physical, chemical, and biological processes that take place within a wetlands system. Wetland functions are considered valuable because they provide ecological, hydrological, and social benefits. However, different wetlands perform different functions, and not all wetlands perform all the functions to the same degree.

As it currently stands no area has been official marked as wetlands in the proposed construction area. There is a small area that is currently under study for potential wetland labeling. On the next page is an image that has been developed by the permitting team. The area marked will be evaluated in the summer of 2013 and then it will be determined if the area is indeed a wetland.

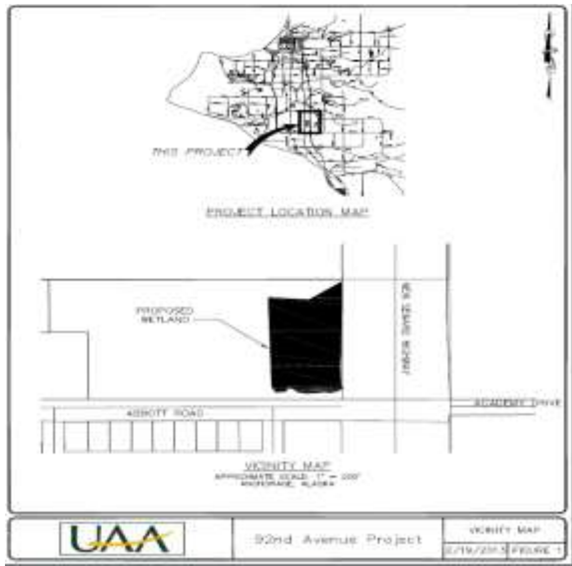

Figure 11.1: Wetland Proposed Area

If the proposed area is determined to be a wetland, mitigating steps will be implemented in a manner as proposed in the *New Seward Highway Rabbit Creek Road to 36th Avenue: Environment Assessment Volume 1*. Guidelines and regulations associate with Section 404 of the Clean Water Act and Executive Order (EO) 11990 outline project proponents to take measures in avoiding or minimizing adverse impacts to wetlands. The actions outlined in the following sections will be taken to minimize impacts to any newly created wetlands.

11.1.1 Design Project

The 92nd Project Roadway Geometry does currently go over the possible wetland. As of now it is difficult to alter current design to avoid impacts. If the proposed wetland area increases further into the roadway geometry it is unlikely that the design will be altered. Most likely a wetland of equal size will be constructed in another location for compensation. If any of the remaining area can be practically preserved/reconstructed methods to do so will be implemented, but not the extent that it may impact public safety. Roadway geometry will not be altered if the users of the roadway may be harmed due to impractical design to preserve possible wetlands.

11.1.2 Design Measures

The major area of concern is the south bound off ramp on the New Seward Highway. This off ramp goes directly over the potential wetlands. No design measures have been created at this time to minimize adverse impacts to potential wetland.

11.1.3 Methods

Two methods will be employed to protect the hydrologic, water quality, and vegetative habitat functions of the wetlands that would be temporarily disturbed during the construction of the project:

1. By using a geotextile and aggregate as a cover to allow construction vehicles to pass over without significantly disturbing underlying wetland soil. Then the cover will be removed after construction
2. When construction activities are completed in the wetland the soli will be re-contoured and re-vegetated with native plant species.

11.1.4 Compensation

When wetland preservation is unavoidable and areas are lost or fragmented there will be compensation by preservation, restoration, or create of wetland functions elsewhere. Also the purchase of mitigation credits from an approved wetland mitigating bank. The Anchorage Debit-Credit Method will be used to determine the compensation for wetland losses that are not avoidable.

11.2 WILDLIFE

Due to the project area being within the Midtown area of Anchorage there are no major animal habitats located within the project limits. Currently there is a relatively low amount of planned clearing and grubbing. Once construction begins the clearing and grubbing schedule will need to work around the outlined dates designated for clearing under the Migratory Bird Treaty Act.

11.3 NOISE POLUTION

The traditional definition of noise is “unwanted or disturbing sound”. Sound becomes unwanted when it either interferes with normal activities such as sleeping, conversation, or disrupts or diminishes one’s quality of life. The fact that you can’t see, taste or smell it may help explain why it has not received as much attention as other types of pollution, such as air pollution, or water pollution.

The air around us is constantly filled with sounds, yet most of us would probably not say we are surrounded by noise. Though for some, the persistent and escalating sources of sound can often be considered an annoyance. This “annoyance” can have major consequences, primarily to one’s overall health. Noise creates a major problem to residents that live near the 92nd Ave project.

The figure below shows noise level of each source:

dB LEVEL	NOISE SOURCE
10	Normal breathing
20	Rustling leaves
30	Quiet conversation
50	Normal conversation
60	Loud television
80	Noisy office
100	Loud car horn
120	Jet plan take-off (100 feet)
130	Threshold of pain

CHANGE IN dB LEVEL	NOISE SOURCE
1 dB	Generally not perceptible
3 dB	Just barely perceptible
5 dB	Clearly noticeable
10 dB	Twice or 1/2 as loud
20 dB	Four times or 1/4 as loud

Figure 11.2: Noise Level

11.4 WATER QUALITY

Water resources in the Anchorage bowl are continual being affected by continuing land development of road systems, urban areas, and commercial areas. With regards to the proposed 92nd improvements there will be an increase in storm water runoff, surface water pollution, decreased infiltration, and changes in natural stream flow regimens. The majority of the roadway will be increasing from one lane roadway to a two way roadway with the addition of on and off ramps to the New Seward Highway.

Due to these roadway changes there will be less pervious ground cover in the area. It is expected that with these roadway improvements and continued urban/commercial development there will be a gradual decrease of water quality in the immediate area. This decline in water quality has been observed in other areas experiencing similar developments. The North Fork and South Fork of Little Campbell Creek are currently listed as impaired water bodies due to presences of fecal coliform bacteria. It is expected that these two rivers will either remain or continue to degrade even further as development continues.

During construction activities water quality will be directly affected. For the 92nd improvements there will be replacing of culverts, placement of storm water conveyance systems, retention ponds, added lanes, added ramps, multi-use pathways, and intersections. The major pollutant that is created by these activities is sedimentation runoff, which is not a major concern due to fact that there are no surface/runner water habitats in the proposed construction area. Sedimentation runoff will be an issue should a significant storm event occurs during construction. The potential for sediment discharge will immediately cease upon the completion of construction. Indirect impacts from highway runoff with potential pollutants (oils, greases, asbestos, fuels, and etc.…) are likely to increase with increases of traffic volumes over time.

It is expected that there will an impact on the watershed in the proposed design area. As stated previously there will be a decrease in infiltration surfaces due to the expanded roadway design. It is also expected that there will be a slight increase in commercial development and urban development is not expected to change significantly in the immediate area. There will be an increase in storm water runoff from lots, roads, urban, and commercial areas. It is planned that the majority of the roadway runoff will be collected by the storm water system and a significant amount shouldn't reach groundwater**.**

11.5 GROUND WATER

Groundwater is a significant concern in this project. In the months of May and October seasonal groundwater levels are typically at their highest (Table 11.2-Ground Water Level by Month). It has also been determined that during these peak flow months water can be visibly seen in some of the areas. To minimize adverse effects to ground water quality and future roadway use many precautions must be taken. These precautions need to be implemented in the design phase, during construction, and post construction.

11.5.1 Design Phase

In the design phase the seasonal ground water levels for high, average, and low flow have been plotted on the project profile (*see Fig. 11.2-Groundwater Level Project Profile*). In current conditions it can be seen that ground water levels will rise beyond the existing surface level in the western portion of the project. To mitigate adverse effects road geometry has limited the removal of the existing surface in the eastern portion and increased the level of the western portion on an average of 3 ft. Across the project seasonal ground water is (at its highest) 3ft beneath the project roadway level.

11.5.2 Construction Phase

During the construction phase it will be the contractor's responsibility in mitigating adverse effects to ground water quality. The contractor will be required to submit a SWPPP that must be in compliance with the NPDES General Permit. The SWPPP may include silt fences, waddles, and BMPs. If the contractor desires to draw water from non-municipal source for construction use they will be required to submit an ADNR Temporary Water Use Permit.

Sites for waste material will be required to be stabilized to prevent runoff and erosion. Contractors will be required to obtain all necessary permits and permissions for waste sites. Disposal sites must not be located 150 ft. within greenbelts, streams, and associated riprap Arian area, wetlands, or any other open water.

If an unknown contamination is encountered during construction work in the surrounding areas would immediately stop and ADEC would be contacted. Proper cleanup and investigation would be conducted responsible parties and government agencies. Contaminated material would be handled in accordance with an ADEC-approved corrective action plan.

11.5.3 Post Construction

In the post construction phase there will be minimal impact to groundwater with regards to the roadway design. The majority of storm water surface runoff from roadways will be conveyed in a storm water system and retained in a LID device. Details of concerns of the LID will be discussed in the proceeding paragraphs.

The final concern for ground water quality will be the placement and use of the LID device that will be built into the project. Details of the LID will be found in the Storm Water Protection of the DSR. Though the LID is built beneath the seasonal high ground water level the flooring will be constructed with an impermeable material. Contamination between the ground water and the LID is highly unlikely due the design quality of the LID (built for 100yr- 24 hour storm event). Even with the unlikely hood of cross contamination it is recommended the surrounding areas either be placed on city water or deepen their wells.

Figure 11.2: Groundwater Level Project Profile

12.0 PERMITTING

The permitting process exists to prevent monetary fines and damages that can result from a project's impact on the environment. The scope of the design level permitting process includes obtaining all data and information needed to complete the application process and producing the five main application components: the application, mitigation statement, vicinity map, plan view of the site and cross-sections. The permits required for 92nd Avenue are briefly described below, and corresponding figures can be found in *Appendix H*.

12.1 FEDERAL PERMITS

12.1.1 Section 404 Permit – U.S. Army Corps of Engineers

The Federal Clean Water Act requires a section 404 permit to be obtained for the project in order to mitigate potential contamination or pollution of existing bodies of water and to ensure water quality standards are upheld. Sources of contamination resulting from the 92nd Avenue project must be identified and control measures put in place to minimize any negative impact on water sources in the area.

12.2 STATE PERMITS

12.2.1 Section 401 Permit – ADEC

The section 401 permit is also required by the Federal Clean Water Act and is issued by the Alaska Department of Environmental Conservation in order to protect wetland environments that may be impacted by the project. Wetlands include bogs, marshes, permafrost areas and other saturated environments. Wetlands serve as a critical part of the ecosystem and provide a breeding ground for plants and animals as well as natural water quality improvement through filtering; therefore they must be protected from damage. This permit is filed in conjunction with the section 404 permit listed above, and pertains to any wetlands identified to exist within the project area.

13.0 RIGHT OF WAY

Both the east and west sides of the NSH require additional ROW for the proposed project. Academy Dr. is lined with mobile homes on one side and a community soccer field on the other while 92nd Ave. has commercial properties on one side and more mobile homes on the other. ROW acquisitions will be necessary along the corridor in order to include on-an-off ramps, increase the number of lanes, as well as accommodate for bike lanes and pedestrian sidewalks. Nearly every property along 92nd Ave. and Academy Dr. will be affected. In an attempt to reduce costs, only a portion of the property will be acquired.

13.1 EXISTING ROW

The existing ROW consists of the current corridors on either side of the NSH. Current ROW on Academy Dr. is 60 feet wide. Another AKDOT&PF project on the west side of the NSH is scheduled to begin construction prior to the 92nd Ave. at NSH project. Therefore, no property must be acquired on that side of the highway. ROW on 92nd Ave. will range from 145-215 feet wide long when construction for this project begins.

13.2 ROW ACQUISITION

The proposed ROW will be 140 feet wide. The ROW necessary to acquire in order to complete the project as designed will impact 23 homes and 2 other parcels of land. The acquisitions will affect a mobile home lot, residential homes, a church, and a community soccer field. *See Figure 13.1* for the proposed ROW alignment which also shows the properties affected by this expansion.

Figure 13.1: Proposed Right-of-Way

The 2013 value of each parcel of land was found using the Municipality of Anchorage parcel viewer. Also found here was the parcel identification number and total area. After the fraction of land to obtain was determined, the total cost per property was calculated. From there, the final cost of property acquisition was totaled.

A contingency factor of 1.4 was included to account for any additional costs, including relocation costs and possible litigation costs. See *Table 13.1* for a summary of the projected ROW property acquisition costs. A detailed analysis can be found in *Appendix I: Right-of-Way*.

Table 13.1: Summary of Acquisition Costs	
Land Acquisition Value	$600,083
Mobile Homes Value	$644,000
Factor	1.4
Total	**$1,741,716**

14.0 PUBLIC INVOLVEMENT

The objective of public involvement is to identify any concerns the public may have with the project design. From there, the comments are incorporated into the final design of the project. Public involvement is also responsible for keeping the public informed on updates to the project, including any changes to the design and the duration of construction.

14.1 STAKEHOLDER PARTICIPATION

Project stakeholders include sponsors, those actively involved in the project, those who have an interest in the completion of the project, and those who may have an influence in the project completion. Since the project takes place around residential areas, the level of stakeholder participation will be high.

Representatives of the 2013 Seawolf Engineering presented the alternative selected for the 92nd Avenue Grade Seperation at a Taku-Community Council Meeting on March 14th. Stakeholders were encouraged to bring forth any comments or concerns related to the design, construction, and impacts of the project.

14.2 STAKEHOLDER COMMENTS AND CONCERTNS

Stakeholders at the meetings had questions concerning water levels, funding, start dates, improvements to Academy at Vanguard, the number of homes affected, and bike lanes. One stakeholder recommended a website be created for the project which will be taken into consideration. For more details, see *Appendix J: Public Involvement*.

Other community council meetings have been held in the past by the DOT&PF. One major concern stakeholders were having with the project was the expected ROW. Individuals impacted by ROW issues discussed concerns, which were addressed by explaining some of the challenges involved in moving the ROW to the north, including taking away most of the parking from the buildings on Vanguard, as well as the desire to keep the roadway in alignment. Also, the ROW acquisition and relocation process was explained in more detail for homeowners.

Considering this is only a 35% design, certain concerns voiced by stakeholders will not be addressed by the 2013 Seawolf Engineering students. DOT&PF are aware of the issues and will take them into consideration in going forward with the project.

14.3 MEDIA

No media was used for this project, however media is a crucial addition to any project involving the public. Typically a website is created and public meetings are advertised. This gives the public a way to stay updated on the project, as well as voice any comments or concerns.

15.0 COST ESTIMATE

A summary of the current cost estimate can be found in the table shown below (for a detailed estimate, refer to *Appendix K*).

Table 15.1: Cost Estimate	
GENERAL BID ITEMS TOTAL	$19,278,937
DESIGN ENGINEERING	$31,531
RIGHT OF WAY ACQUISITION	$1,741,716
CONSTRUCTION COSTS	$3,153,098
UTILITIES	$1,182,700
4.79% ICAP	$1,360,811
TOTAL PROJECT COST	$29,770,223 ~ **$30,000,000**

This estimate was based on costs and items from similar projects using historical bid tab information. Most items were calculated by the number amount or quantity of the item. This quantity would then be multiplied by a unit price. Some items will be listed as lump sum items. Lump sum items are composed of multiple smaller items added together.

16.0 CONSTRUCTION PHASING

The key role of construction phasing is to keep traffic flowing smoothly during construction while maximizing the construction work. With the highway being directly affected from construction, it will be a difficult task to keep traffic flowing with the least amount of disturbance. The different phases will allow traffic to be diverted or rerouted to nearby roads in order to minimize congestion, and ensure the safety of the construction workers. Construction will take place in 4 phases.

16.1 PHASE 1.0

The contractor will start clearing the ROW on east side of NSH. Once everything has been cleared out, the temporary Brayton Dr alignment will be constructed. This temporary alignment will be as close to the final alignment. Then apply temporary pavement along the new alignment. After the alignment is finished, the northbound traffic on the NSH will be shifted onto the temporary road. *See Figure 16.1*.

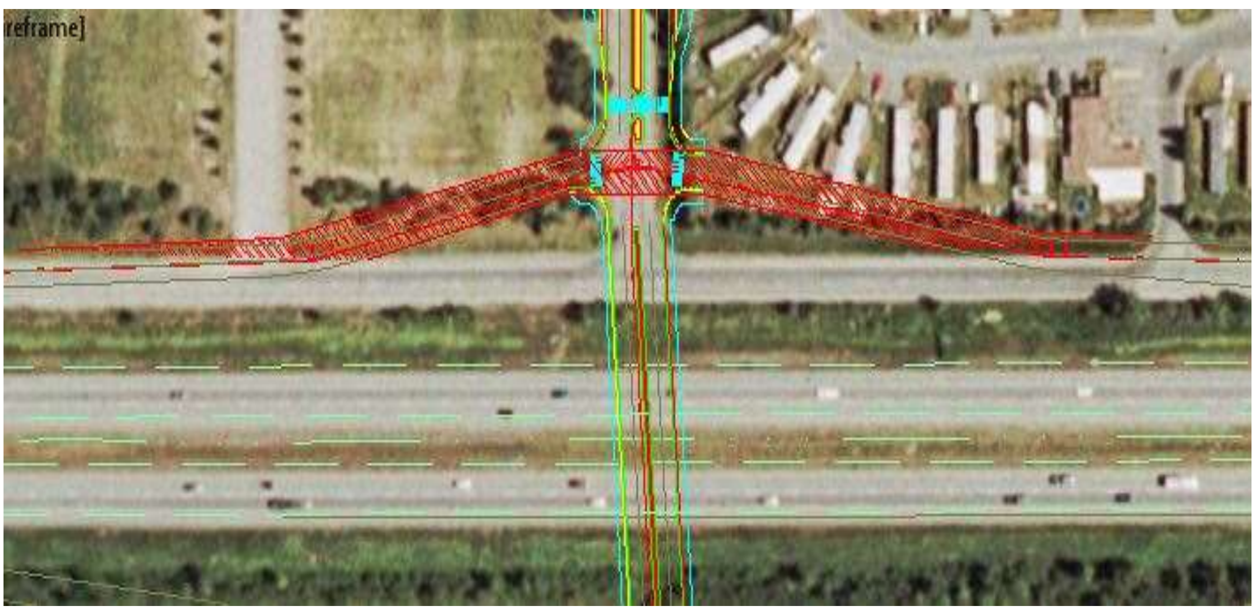

Figure 16.1: 92nd Avenue and Brayton Drive Phase 1

16.1.1 Phase 1.1

Fill small portion of median between Brayton Drive and northbound New Seward Highway lanes. This will allow southbound traffic to be diverted onto northbound lanes. Apply temporary pavement over the filled medians. Once that is completed, move southbound traffic onto northbound lanes and close the southbound portion for construction. *See Figure 16.2*.

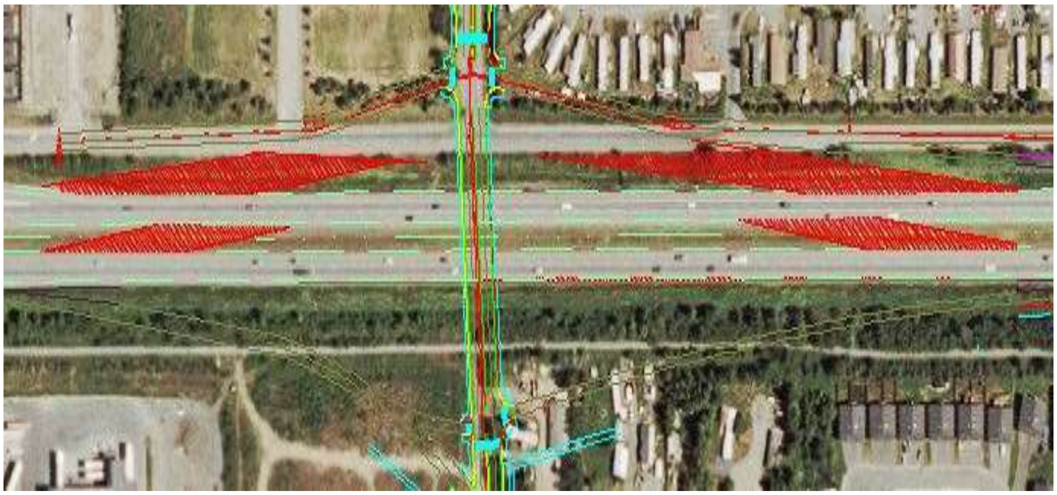

Figure 16.2: New Seward Highway Phase 1.1

16.1.2 Phase 1.2

Start removing pavement from southbound lanes. After pavement has been removed, start excavating out existing material. Then begin to fill southbound mainline with structural fill and stabilize the slopes for bridge abutment. Work will be conducted from both the north and south side of the road. Once the highway is raised to final grade, start constructing the bridge. *See Figure 16.3*.

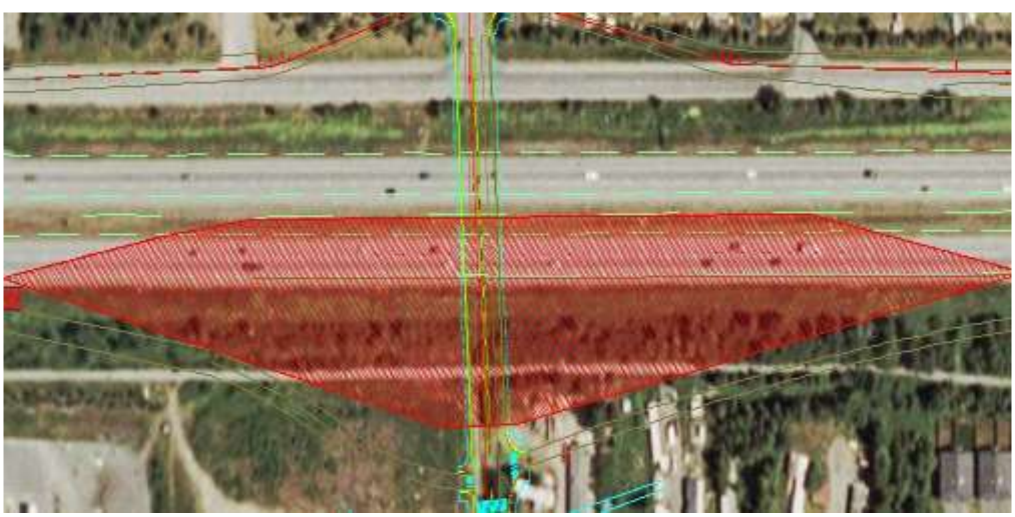

Figure 16.3: New Seward Highway Phase 1.2

16.2 PHASE 2.0

Close existing southbound Seward Highway off-ramp onto 92nd Ave. Start excavating out muck and materials around the area of new off-ramp alignment and remove old off-ramp. Once that is complete, start backfilling with structural fill to final grade. Begin constructing the southbound off-ramp to tie into 92nd Ave. Initiate construction of off-ramp from the highway end and move down towards 92nd Ave. Coordinate with work being done on 92nd Ave. Construct portion of off-ramp tying into 92nd Ave. in conjunction with phase 2.1. Upon completion of new off-ramp, pave the new road. *See Figure 16.4* and *Figure 16.5.*

Figure 16.4: New Seward Highway Off-Ramp Phase 2.0

16.2.1 Phase 2.1

Remove curb and gutter along south side of existing 92nd Ave. Remove pavement and relocate storm water pipes and catch basins. Construct new lane heading east on 92nd Ave. expanding it to two lanes from one. Construct lane tying southbound off-ramp into 92nd Ave. Tie newly constructed eastbound lane with southbound on-ramp. Reconstruct curb and gutter and pave. *See Figure 16.5* and *Figure 16.6.*

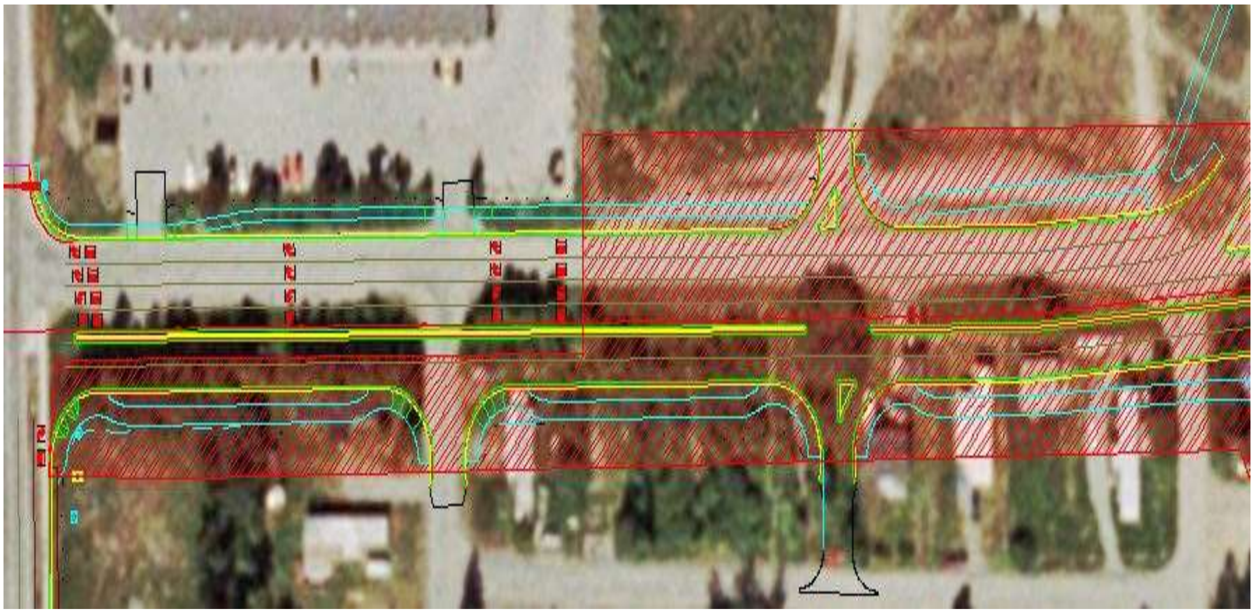

Figure 16.5: 92nd Avenue Phase 2.1

Figure 16.6: 92nd Avenue On-Ramp Phase 2.1

16.3. PHASE 3.0

Assuming bridgework is completed for southbound lanes, begin paving southbound mainline and bridge. Reroute traffic back onto southbound mainline. Remove pavement on the northbound mainline. Excavate out any bad quality material. Then backfill until northbound lanes are up to grade.

Similarly to Phase 1.2, fill from both the north and south side of the highway. Continue bridge construction. Once bridge is complete, pave northbound mainline and bridge. Reroute traffic back over onto mainline from Brayton Dr. *See Figure 16.7.*

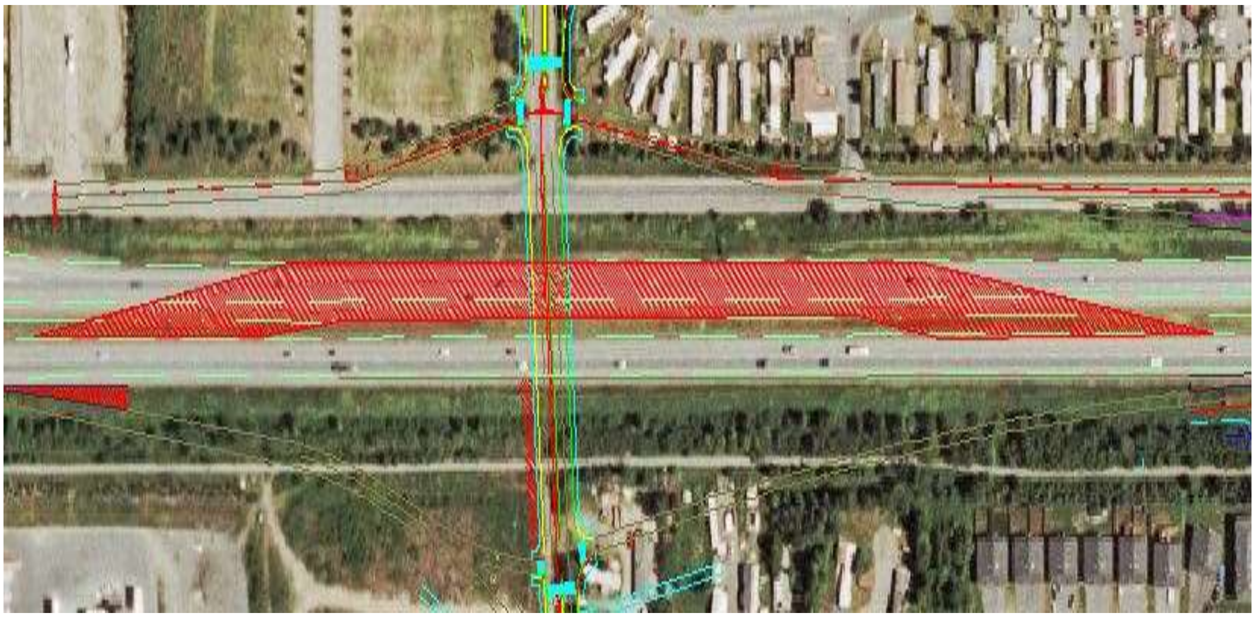

Figure 16.7: New Seward Highway Phase 3.0

16.3.1 Phase 3.1

Remove temporary alignment connecting northbound mainline and Brayton Drive. Construct final slopes along northbound mainline. Begin filling in ditch to construct new northbound off-ramp onto Brayton Drive from NSH. Once it is compacted and up to grade, pave to tie into NSH and Brayton Drive. *See Figure 16.8.*

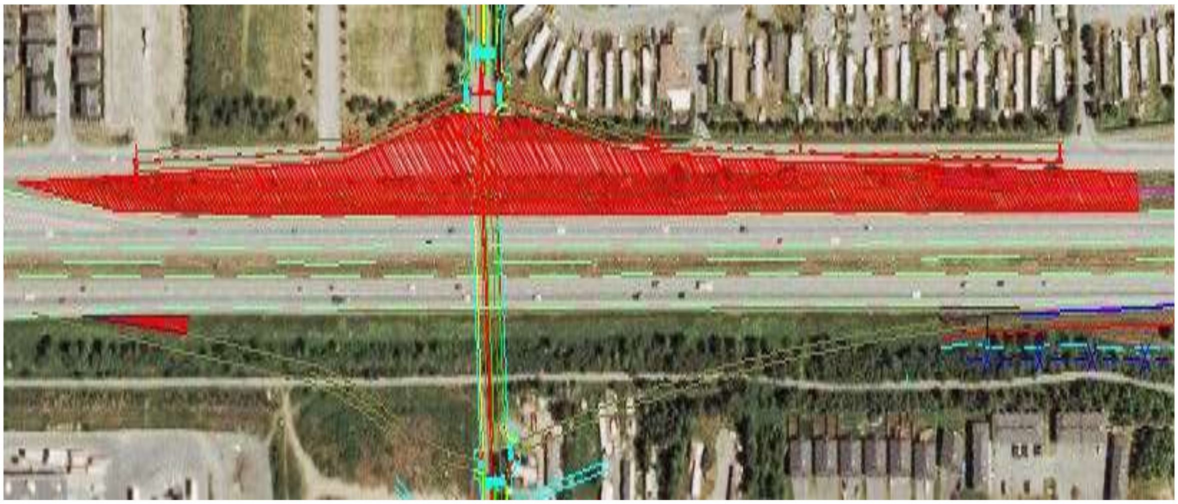

Figure 16.8: New Seward Highway Phase 3.1

16.3.2 Phase 3.2

Excavate muck and existing materials under new bridge and backfill with quality material. Install new storm pipes and catch basins according to specifications. Construct curb, gutter, and sidewalk along underpass. Then pave under the bridge to connect the intersection of 92nd Ave. and Brayton Drive to 92nd Ave. on the west side of the Seward Highway. *See Figure 16.9.*

Figure 16.9: 92nd Avenue Underpass Phase 3.2

16.4 PHASE 4

Divert eastbound traffic on Academy Drive onto westbound lanes. Then close off the eastbound lanes for construction. Remove pavement, curb, and gutter along south side of Academy Drive. Fill road up to final grade and install curb, gutter, median, and sidewalk. Pave the road and switch traffic back onto eastbound lanes. *See Figure 16.10*.

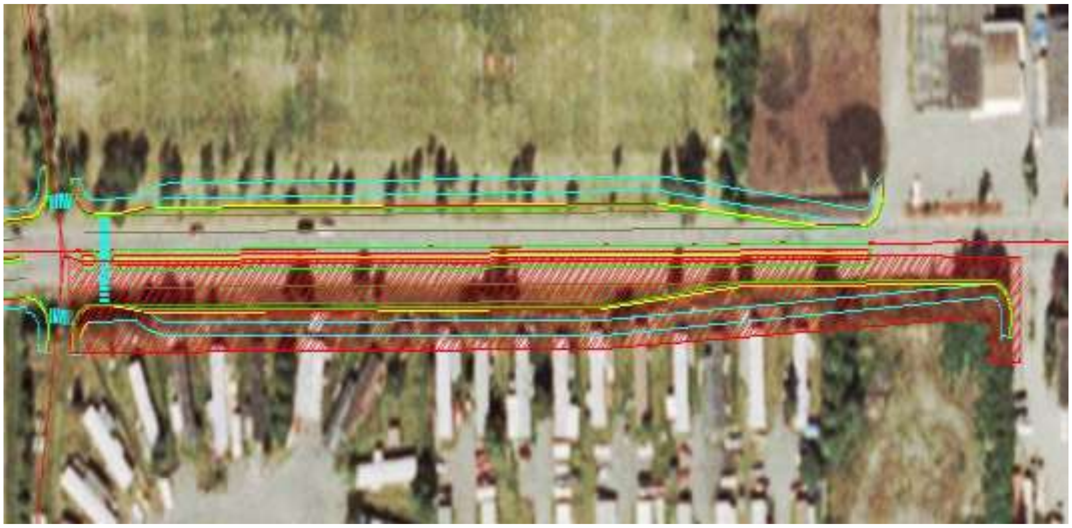

Figure 16.10: Academy Drive Phase 4.0

16.4.1 Phase 4.1

After traffic is shifted over to the eastbound lanes, close westbound lanes for construction. Start removing pavement. Excavate out existing material depending on the condition of the existing material. Install any necessary storm pipes and catch basins. Once all underground work is complete, backfill with new material and bring road up to final grade. Install curb, gutter, median, and bike path. Pave and reopen eastbound lanes. Reroute traffic back to finalized traffic flow formation. *See Figure 16.11*.

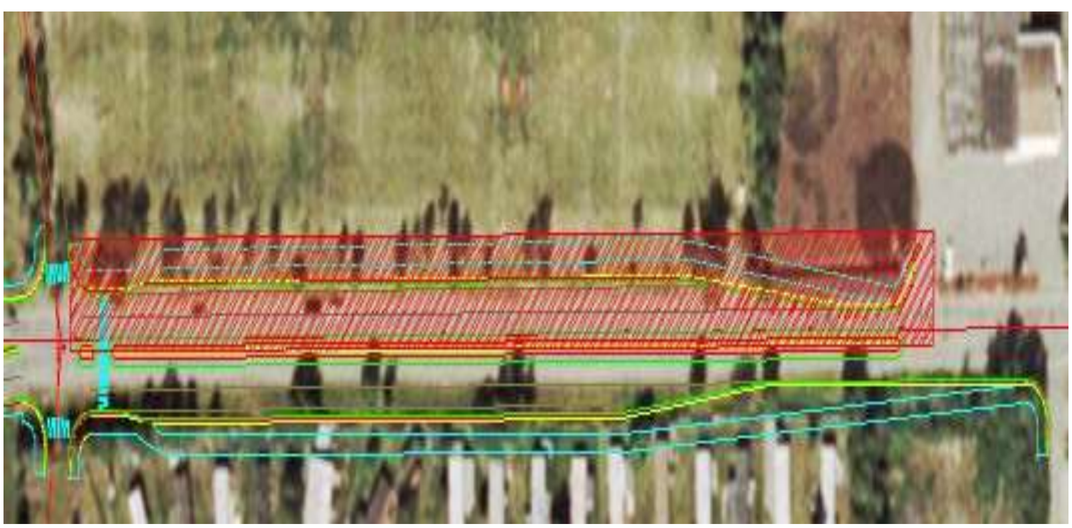

Figure 16.11: Academy Drive Phase 4.1

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APPENDICES

APPENDIX A: TRAFFIC ANALYSIS

A1.0 TURNING MOVEMENT VOLUME MAPS

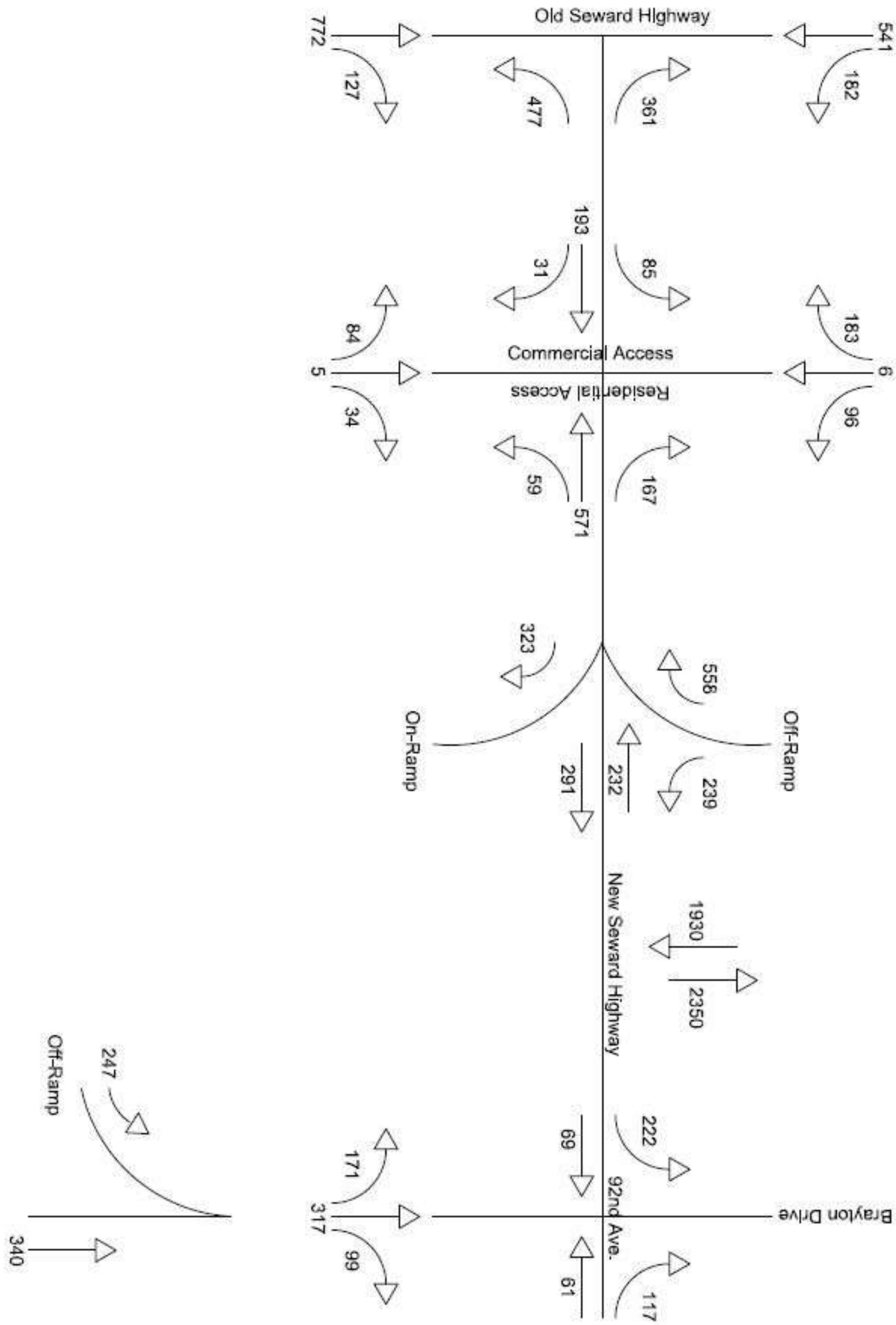


Figure A.1.1: 2014 PM TMVs

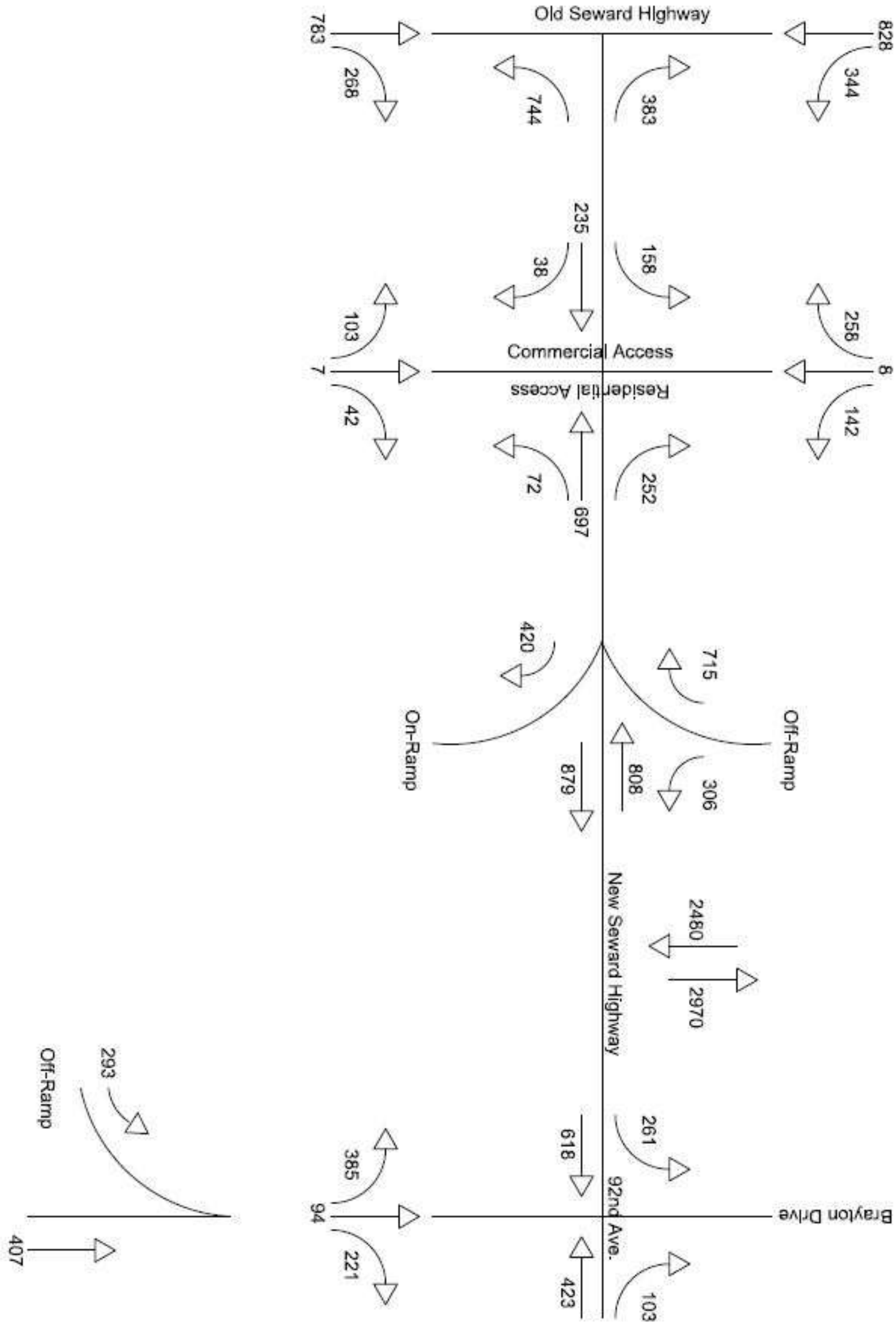


Figure A.1.2: 2034 PM TMVs

A2.0 SYNCHRO 7.1 OUTPUT FOR PREFERRED ALTERNATIVE

A2.1 2014 Synchro 7.1 Output

HCM Signalized Intersection Capacity Analysis
3: 92nd Ave & OSH

3/26/2013

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	477	361	772	127	182	541
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	6.0	6.0	4.0	5.0
Lane Util. Factor	0.97	0.88	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3273	2656	3374	1509	1687	3374
Flt Permitted	0.95	1.00	1.00	1.00	0.22	1.00
Satd. Flow (perm)	3273	2656	3374	1509	386	3374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	502	380	813	134	192	569
RTOR Reduction (vph)	0	277	0	85	0	0
Lane Group Flow (vph)	502	103	813	49	192	569
Turn Type		Perm		Perm	pm+pt	
Protected Phases	8		2		1	6
Permitted Phases		8		2	6	
Actuated Green, G (s)	16.2	16.2	21.8	21.8	33.8	33.8
Effective Green, g (s)	16.2	16.2	21.8	21.8	33.8	33.8
Actuated g/C Ratio	0.27	0.27	0.36	0.36	0.56	0.56
Clearance Time (s)	5.0	5.0	6.0	6.0	4.0	5.0
Lane Grp Cap (vph)	884	717	1226	548	369	1901
v/s Ratio Prot	c0.15		c0.24		c0.06	0.17
v/s Ratio Perm		0.04		0.03	0.23	
v/c Ratio	0.57	0.14	0.66	0.09	0.52	0.30
Uniform Delay, d1	18.9	16.6	16.0	12.6	7.6	6.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.6	0.4	2.8	0.3	5.2	0.4
Delay (s)	21.5	17.0	18.9	12.9	12.8	7.3
Level of Service	C	B	B	B	B	A
Approach Delay (s)	19.6		18.0			8.7
Approach LOS	B		B			A

Intersection Summary			
HCM Average Control Delay	15.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	57.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBU	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Volume (vph)	39	222	69	0	0	61	117	171	317	99	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0			5.0			7.5			
Lane Util. Factor		1.00	1.00			0.95			0.95			
Frt		1.00	1.00			0.90			0.97			
Flt Protected		0.95	1.00			1.00			0.99			
Satd. Flow (prot)		1687	1776			3041			3241			
Flt Permitted		0.48	1.00			1.00			0.99			
Satd. Flow (perm)		858	1776			3041			3241			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	41	234	73	0	0	64	123	180	334	104	0	0
RTOR Reduction (vph)	0	0	0	0	0	87	0	0	31	0	0	0
Lane Group Flow (vph)	0	275	73	0	0	100	0	0	587	0	0	0
Turn Type	pm+pt	pm+pt						Perm				
Protected Phases	7	7	4			8			2			
Permitted Phases	4	4						2				
Actuated Green, G (s)		27.0	27.0			16.0			17.0			
Effective Green, g (s)		27.0	27.0			16.0			15.5			
Actuated g/C Ratio		0.49	0.49			0.29			0.28			
Clearance Time (s)		5.0	5.0			5.0			6.0			
Lane Grp Cap (vph)		512	872			885			913			
v/s Ratio Prot		c0.06	0.04			0.03						
v/s Ratio Perm		c0.21							0.18			
v/c Ratio		0.54	0.08			0.11			0.64			
Uniform Delay, d1		8.8	7.4			14.3			17.3			
Progression Factor		1.00	1.00			1.00			1.00			
Incremental Delay, d2		4.0	0.2			0.3			3.5			
Delay (s)		12.8	7.6			14.6			20.8			
Level of Service		B	A			B			C			
Approach Delay (s)			11.7			14.6			20.8			0.0
Approach LOS			B			B			C			A

Intersection Summary			
HCM Average Control Delay	17.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	51.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBR
Lane Configurations	
Volume (vph)	0
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.95
Adj. Flow (vph)	0
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	291	323	0	232	0	0	0	0	239	0	558
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0					5.0		2.0
Lane Util. Factor		0.95			0.95					1.00		0.88
Frt		0.92			1.00					1.00		0.85
Flt Protected		1.00			1.00					0.95		1.00
Satd. Flow (prot)		3107			3374					1687		2656
Flt Permitted		1.00			1.00					0.95		1.00
Satd. Flow (perm)		3107			3374					1687		2656
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	306	340	0	244	0	0	0	0	252	0	587
RTOR Reduction (vph)	0	212	0	0	0	0	0	0	0	0	0	313
Lane Group Flow (vph)	0	434	0	0	244	0	0	0	0	252	0	274
Turn Type				Perm						Prot		custom
Protected Phases		4			8					1		
Permitted Phases				8								6
Actuated Green, G (s)		17.0			17.0					18.0		21.0
Effective Green, g (s)		17.0			17.0					18.0		21.0
Actuated g/C Ratio		0.38			0.38					0.40		0.47
Clearance Time (s)		5.0			5.0					5.0		2.0
Lane Grp Cap (vph)		1174			1275					675		1239
v/s Ratio Prot		c0.14			0.07					c0.15		
v/s Ratio Perm												0.10
v/c Ratio		0.37			0.19					0.37		0.22
Uniform Delay, d1		10.1			9.4					9.5		7.1
Progression Factor		1.00			1.00					1.00		1.00
Incremental Delay, d2		0.9			0.3					1.6		0.4
Delay (s)		11.0			9.7					11.1		7.5
Level of Service		B			A					B		A
Approach Delay (s)		11.0			9.7			0.0			8.6	
Approach LOS		B			A			A			A	

Intersection Summary			
HCM Average Control Delay	9.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	51.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

A2.2 2034 Synchro 7.1 Output

HCM Signalized Intersection Capacity Analysis
3: 92nd Ave & OSH 3/26/2013

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	744	383	783	268	344	828
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	6.0	6.0	4.0	5.0
Lane Util. Factor	0.97	0.88	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3273	2656	3374	1509	1687	3374
Flt Permitted	0.95	1.00	1.00	1.00	0.18	1.00
Satd. Flow (perm)	3273	2656	3374	1509	328	3374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	783	403	824	282	362	872
RTOR Reduction (vph)	0	289	0	193	0	0
Lane Group Flow (vph)	783	114	824	89	362	872
Turn Type		Perm		Perm	pm+pt	
Protected Phases	8		2		1	6
Permitted Phases		8		2	6	
Actuated Green, G (s)	17.0	17.0	19.0	19.0	33.0	33.0
Effective Green, g (s)	17.0	17.0	19.0	19.0	33.0	33.0
Actuated g/C Ratio	0.28	0.28	0.32	0.32	0.55	0.55
Clearance Time (s)	5.0	5.0	6.0	6.0	4.0	5.0
Lane Grp Cap (vph)	927	753	1068	478	384	1856
v/s Ratio Prot	c0.24		0.24		c0.14	0.26
v/s Ratio Perm		0.04		0.06	c0.38	
v/c Ratio	0.84	0.15	0.77	0.19	0.94	0.47
Uniform Delay, d1	20.3	16.1	18.5	14.9	11.5	8.2
Progression Factor	1.08	1.61	1.00	1.00	1.00	1.00
Incremental Delay, d2	8.9	0.4	5.4	0.9	33.5	0.9
Delay (s)	30.9	26.3	23.9	15.8	45.0	9.0
Level of Service	C	C	C	B	D	A
Approach Delay (s)	29.3		21.9			19.6
Approach LOS	C		C			B

Intersection Summary			
HCM Average Control Delay	23.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	74.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBU	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Volume (vph)	110	261	618	0	0	423	103	385	94	221	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0			5.0			7.5			
Lane Util. Factor		1.00	1.00			0.95			0.95			
Frt		1.00	1.00			0.97			0.95			
Flt Protected		0.95	1.00			1.00			0.97			
Satd. Flow (prot)		1687	1776			3275			3128			
Flt Permitted		0.27	1.00			1.00			0.97			
Satd. Flow (perm)		471	1776			3275			3128			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	116	275	651	0	0	445	108	405	99	233	0	0
RTOR Reduction (vph)	0	0	0	0	0	35	0	0	90	0	0	0
Lane Group Flow (vph)	0	391	651	0	0	518	0	0	647	0	0	0
Turn Type	pm+pt	pm+pt						Perm				
Protected Phases	7	7	4			8			2			
Permitted Phases	4	4						2				
Actuated Green, G (s)		32.0	32.0			16.0			17.0			
Effective Green, g (s)		32.0	32.0			16.0			15.5			
Actuated g/C Ratio		0.53	0.53			0.27			0.26			
Clearance Time (s)		5.0	5.0			5.0			6.0			
Lane Grp Cap (vph)		474	947			873			808			
v/s Ratio Prot		c0.15	0.37			0.16						
v/s Ratio Perm		c0.29							0.21			
v/c Ratio		0.82	0.69			0.59			0.80			
Uniform Delay, d1		9.7	10.3			19.2			20.8			
Progression Factor		1.59	0.78			1.00			1.00			
Incremental Delay, d2		10.0	2.6			3.0			8.2			
Delay (s)		25.5	10.6			22.1			29.0			
Level of Service		C	B			C			C			
Approach Delay (s)			16.2			22.1			29.0			0.0
Approach LOS			B			C			C			A

Intersection Summary			
HCM Average Control Delay	21.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	71.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBR
Lane Configurations	
Volume (vph)	0
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.95
Adj. Flow (vph)	0
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	879	420	0	808	0	0	0	0	306	0	715
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0					5.0		2.0
Lane Util. Factor		0.95			0.95					1.00		0.88
Frt		0.95			1.00					1.00		0.85
Flt Protected		1.00			1.00					0.95		1.00
Satd. Flow (prot)		3210			3374					1687		2656
Flt Permitted		1.00			1.00					0.95		1.00
Satd. Flow (perm)		3210			3374					1687		2656
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	925	442	0	851	0	0	0	0	322	0	753
RTOR Reduction (vph)	0	96	0	0	0	0	0	0	0	0	0	112
Lane Group Flow (vph)	0	1271	0	0	851	0	0	0	0	322	0	641
Turn Type				Perm						Prot		custom
Protected Phases		4			8					1		
Permitted Phases				8								6
Actuated Green, G (s)		29.0			29.0					21.0		24.0
Effective Green, g (s)		29.0			29.0					21.0		24.0
Actuated g/C Ratio		0.48			0.48					0.35		0.40
Clearance Time (s)		5.0			5.0					5.0		2.0
Lane Grp Cap (vph)		1552			1631					590		1062
v/s Ratio Prot		c0.40			0.25					0.19		
v/s Ratio Perm												c0.24
v/c Ratio		0.82			0.52					0.55		0.60
Uniform Delay, d1		13.3			10.7					15.7		14.2
Progression Factor		1.07			1.09					1.00		1.00
Incremental Delay, d2		4.9			0.8					3.6		2.5
Delay (s)		19.1			12.5					19.3		16.8
Level of Service		B			B					B		B
Approach Delay (s)		19.1			12.5			0.0			17.5	
Approach LOS		B			B			A			B	

Intersection Summary			
HCM Average Control Delay	16.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	71.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

APPENDIX B: ROADWAY GEOMETRY

B1.0 DESIGN CRITERIA for 92ND AVE

Project: 92nd Avenue (92nd Avenue to Academy)

X New Construction / Reconstruction □ Rehabilitation □ Other

Design Functional Classification: Major Urban Collector
Traffic Analysis

Design Year: 2034
Traffic Analysis

Present AADT (& year): 1,500 vehicles/day (2011)
Traffic Analysis

Design Year AADT (& year): 12,992 vehicles/day (2034)
Traffic Analysis

Mid Design Period AADT (& year): 12,900 (2024)
Traffic Analysis

DHV: 1430 vehicles/hour
Traffic Analysis

Directional Split (%D): 60/40
Traffic Analysis

Trucks (PTT): 6.6% Total (4.8% Commercial Truck, 1.8% Recreational Vehicle)
Traffic Analysis

Equivalent Single Axle Load (ESAL): 206491
Traffic Analysis

Pavement Design Year (Construction Year + n*): 2015
Pavement Design

Design Vehicle: Passenger: FHWA Class 1-3 Commercial: FHWA Class 4-13
Traffic Analysis

Design Speed: 35 mph
2004 PGDHS, p. 430

Stopping Sight Distance: 250 ft 2004 PGDHS, Exhibit 6-2

Passing Sight Distance: 1280 ft 2004 PGDHS, Exhibit 6-3

Maximum Allowable Grade: 9% (level) 2004 PGDHS, Exhibit 6-8

Minimum Allowable Grade: 0.5%
2004 PGDHS, p. 431

Minimum K-value for Vertical Curves: Sag: 49 Crest: 29 2004 PGDHS, Exhibit 6-2

Superelevation: ≤6% 2004 PGDHS, p. 431
Number of Roadways: 6 lanes (West) to 2 lanes (East) Traffic Analysis
Width of Traveled Way: 72 ft (West) to 24 ft (East)
2004 PGDHS, Exhibit 6-5
Width of Shoulders: Outside: 8ft Inside: 8ft 2004 PGDHS, Exhibit 6-5
Surface Treatment: T/W: Asphalt Concrete Shoulders: Asphalt Concrete
Pavement Design
Side Slope Ratios: Foreslopes: 4H:1V Backslopes: 4H:1V
2004 PGDHS, p. 326 & 2005 PCM, 1130.3.2
Cross Slope: 0.02 (ft/ft) 2005 PCM, Figure 1130-1
Median Treatment: 2005 PCM, Table 1150-2

1. Separation for opposing traffic streams 4 ft
2. Provide for U-turns, inside land to outside lane 18 ft

Sidewalk: 6 ft (under NSH bridge) & 10 ft 2004 PGDHS, p. 436
Curb Usage and Type: 2 ft curb and gutter Match West Proposed
Bicycle Provisions: ≥4ft minimum lane (with 1-2 ft gutter pan)
FHWA COBAPT, p. 2

1. Design for Class A riders, minimum 2005 PCM, 1210-1
2. Bike lanes end 100 ft of roundabout yield line FHWA GD, 6.3.12

Pedestrian Provisions: ≤ 5% Grade for ADAAG
2004 PGDHS, p. 431

B2.0 DESIGN CRITERIA for EXISTING NSH

Project: 92nd Avenue (New Seward Highway)

X New Construction / Reconstruction □ Rehabilitation □ Other____________________________

Design Functional Classification: Interstate 2005 PCM 1100 & 2004 PGDHS, Ch. 8

Design Year: 2035 CH2MHILL PER

Present AADT (& year): 37,975 vehicles/day (2002) CH2MHILL PER, Table 2-1

Design Year AADT (& year): 60,000 vehicles/day (2035) CH2MHILL PER, Table 2-3

Mid Design Period AADT (& year): NB 21300 & SB 25930 (2024) Traffic Analysis

DHV: NB 2960 & SB 2480 Traffic Analysis

Directional Split (%D):N/A Traffic Analysis

Trucks (PTT): 6.6% Traffic Analysis

Equivalent Single Axle Load (ESAL): NB 8,791,000 & SB 7,220,000 Traffic Analysis

Pavement Design Year (Construction Year + n*):2014 Pavement Design

Design Vehicle: WB-109D CH2MHILL PER APP B & 2004 PGDHS, Exhibit 2-2

Design Speed: 70 mph CH2MHILL PER APP B & 2004 PGDHS, Ch. 8

Stopping Sight Distance: 730 ft CH2MHILL PER APP B & 2004 PGDHS, Exhibit 7-1

Passing Sight Distance: Not Applicable CH2MHILL PER APP B Maximum Allowable Grade: 4% CH2MHILL PER APP B & 2004 PGDHS, Exhibit 8-1

Minimum Allowable Grade: 0.5% CH2MHILL PER APP B

Minimum Allowable Radius: 2050 ft CH2MHILL PER APP B & 2004 PGDHS, Eq. 3-10 (f_{max}=0.10)

Minimum K-value for Vertical Curves: Sag: 181 Crest: 247 CH2MHILL PER APP B & 2004 PGDHS, Exhibits 3-72 & 3-75

Superelevation: 6% 2004 PGDHS, p. 505
Number of Roadways: 4 lanes (Match existing) 2004 PGDHS, pg. 454
Width of Traveled Way: 48 ft (Match existing) 2005 PCM 1120.2.3 & 2004 PGDHS, Exhibit 7-3
Width of Shoulders: Outside: 10 ft (8 ft existing) Inside: 4 ft (existing) 2004 PGDHS, pg. 505
Surface Treatment: T/W: Asphalt Concrete Shoulders: Asphalt Concrete CH2MHILL PER APP B
Side Slope Ratios: Foreslopes: 1:2 (w/ barrier) Backslopes: 1:5 (Match Existing) 2011 RDG,3.2
Existing: Foreslopes: 1:6 Backslopes: 1:5 CH2MHILL PER, Figure 3-3
Cross Slope: 0.02 (ft/ft) from median 2005 PCM 1130.1.2
Degree of Access Control: Controlled Access Existing
Median Treatment: Depressed open median or median barrier (Min. 4 ft) 2005 PCM, Table 1150-2
Illumination: Continuous low level and high mast CH2MHILL PER APP B

B3.0 TECHNICAL REFERENCES

1. 2004 AASHTO Policy on Geometric Design of Highways and Streets 5th Edition
2. 2011 AASHTO Roadside Design Guide 4th Edition
3. 2005 AK DOT&PF Preconstruction Manual
4. FHWA Course on Bicycle and Pedestrian Transportation, Lesson 19
   http://safety.fhwa.dot.gov/ped_bike/univcourse/pdf/swless19.pdf

B4.0 TYPICAL SECTIONS

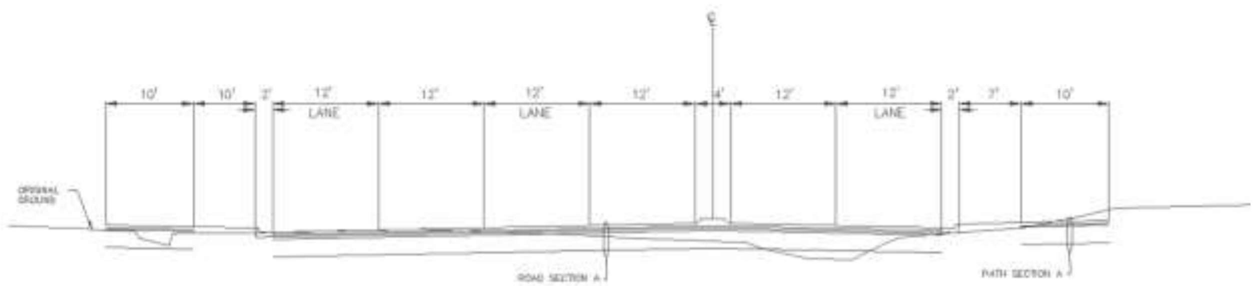


Figure B. 1: West 92nd Avenue (STA. 3+50 TO STA. 12+00)

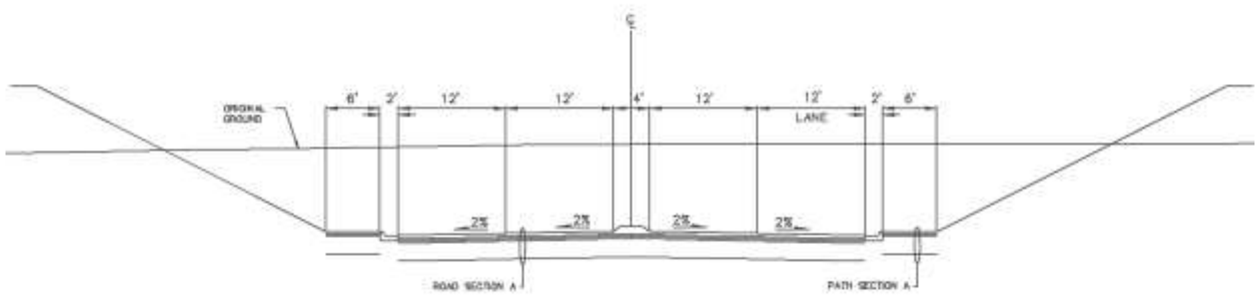


Figure B. 2: 92nd Avenue Bridge Area (STA. 13+50 TO STA. 17+50)

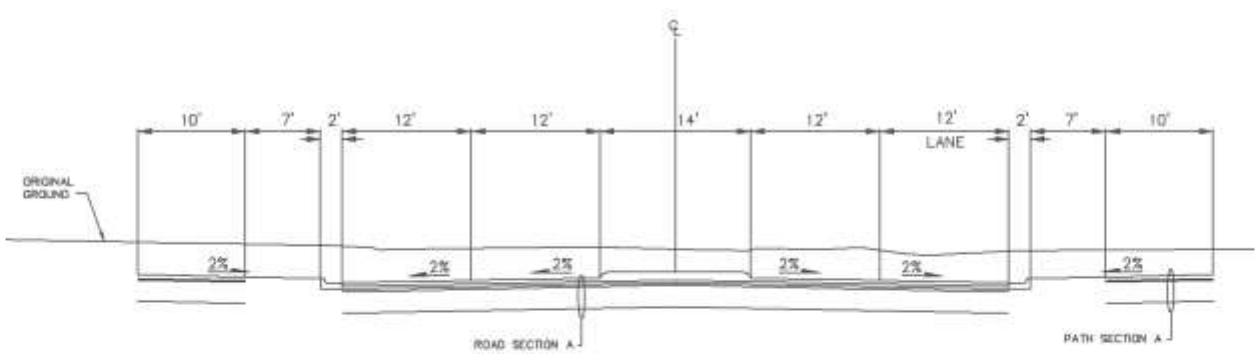


Figure B. 3: East 92nd Avenue (STA. 18+50 TO STA. 27+00)

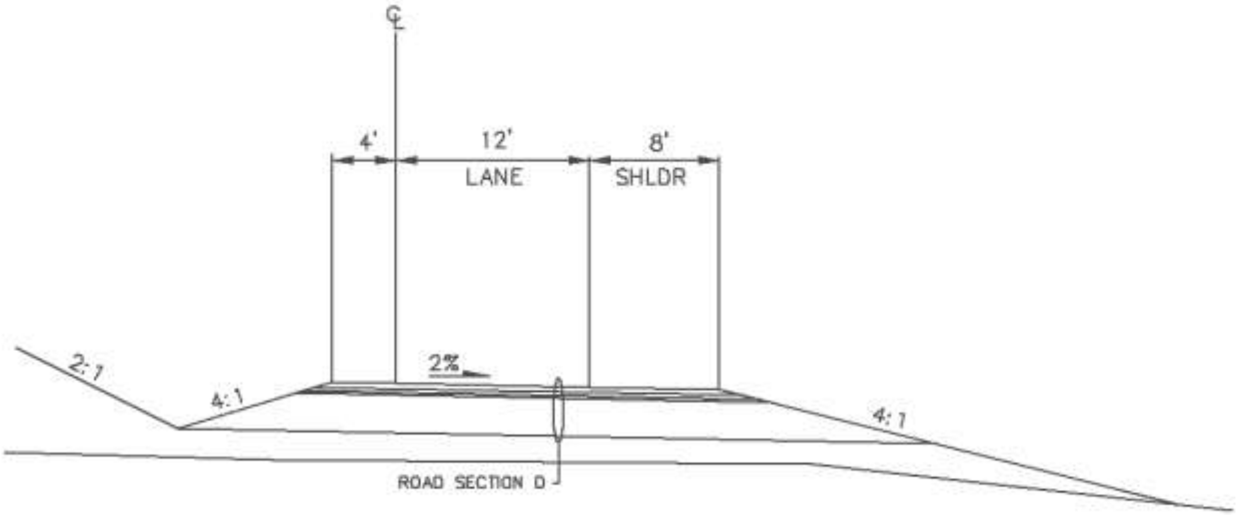


Figure B. 4: NSH N.B. Off Ramp (STA. 3+00 TO STA. 14+00)

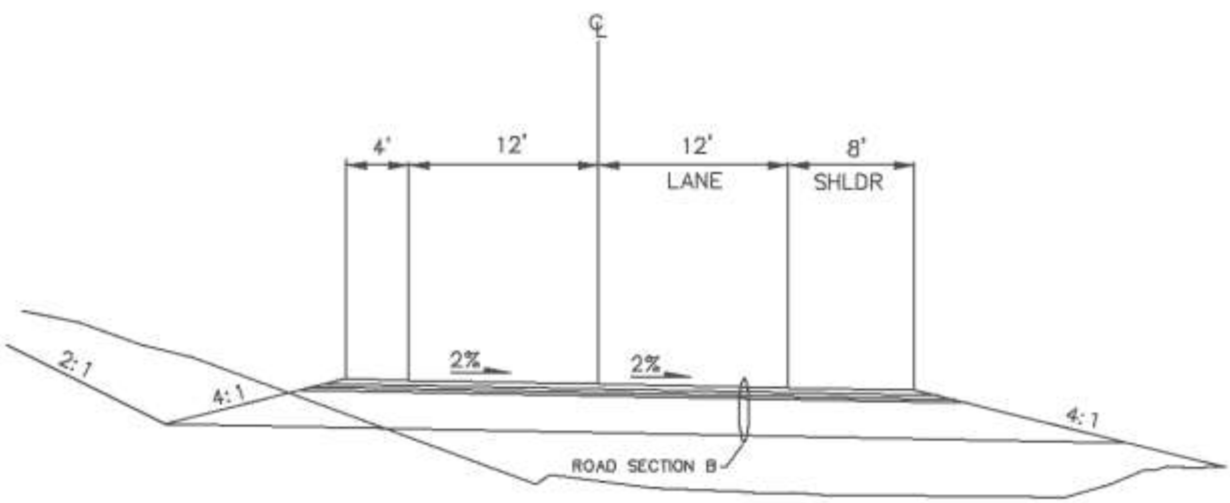


Figure B. 5: NSH S.B. Off Ramp (STA. 4+00 TO STA. 15+00)

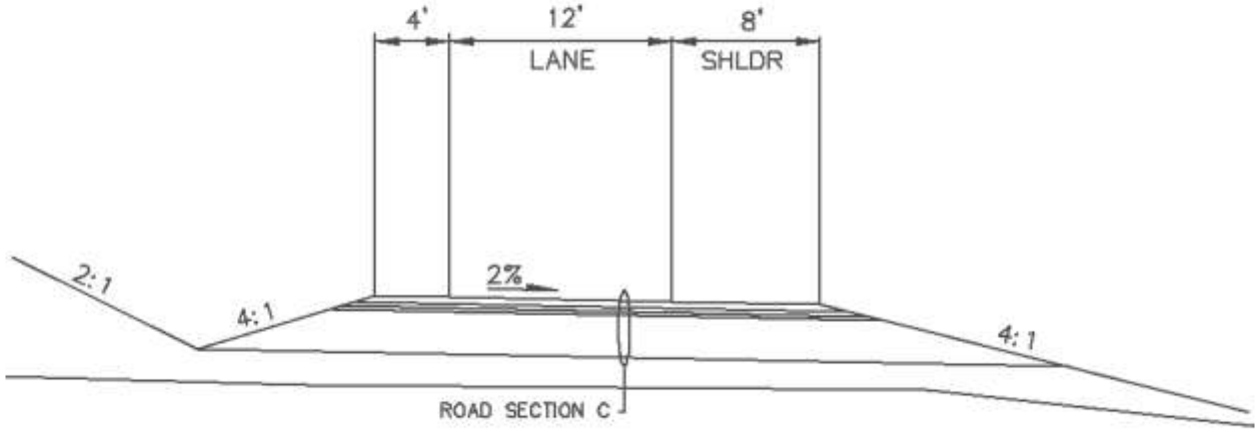


Figure B. 6: NSH S.B. On Ramp (STA. 1+00 TO STA. 14+00)

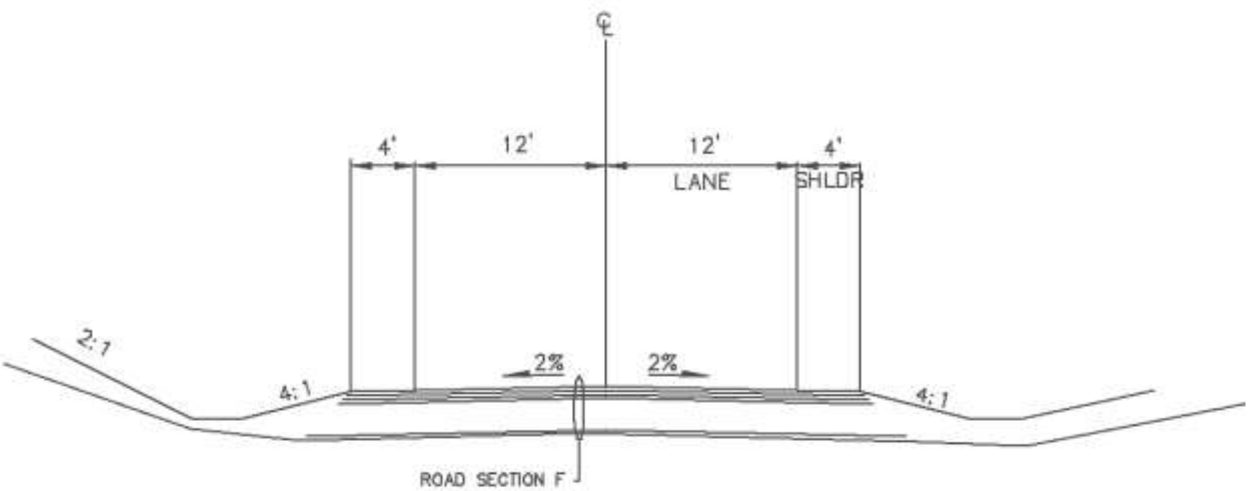


Figure B. 7: Brayton Drive (STA. 00+00 TO STA. 22+50)

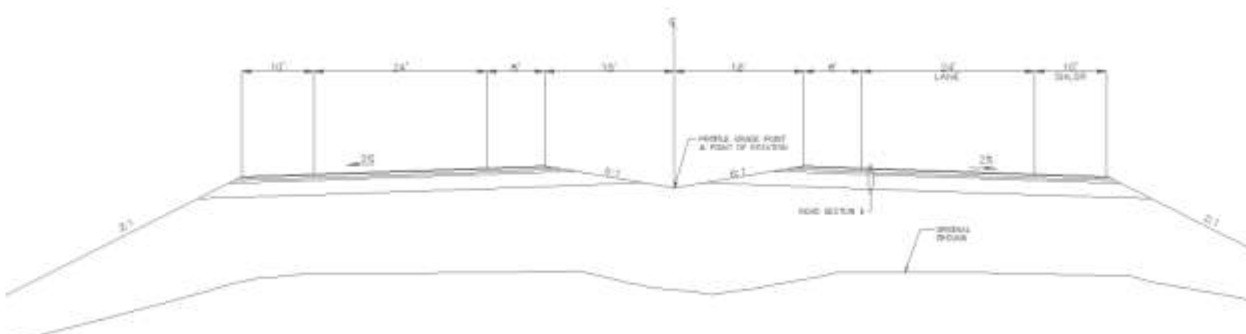


Figure B. 8: NSH (STA. 10+00 TO STA. 42+40)

APPENDIX C: PAVEMENT DESIGN

C1.0: ESAL CALCULATIONS

Table C1.1: ESAL for 92nd Ave

Truck Type	FHWA Class	Percent (%)	AADT	Truck Factor	Design Lane Factor	Growth Factor	ESAL
Single Unit, 2-axle	4,5	4.45	11700	0.5	0.70	22.02	1464617
Single Unit, 3&4-axle	6,7	0.38	11700	0.85	0.70	22.02	212616
Multi Unit, 3&4-axle	8	0.06	11700	1.2	0.70	22.02	47394
Multi Unit, 5-axle	9, 11	0.28	11700	1.55	0.70	22.02	285683
Multi Unit, 6&7-axle	10, 12, 13	0.15	11700	2.24	0.70	22.02	221174
							2,230,000

Table C1.2: ESAL for SB NSH On-Ramp

Truck Type	FHWA Class	Percent (%)	AADT	Truck Factor	Design Lane Factor	Growth Factor	ESAL
Single Unit, 2-axle	4,5	6.16	1200	0.5	1.00	22.02	297059
Single Unit, 3&4-axle	6,7	0.45	1200	0.85	1.00	22.02	36891
Multi Unit, 3&4-axle	8	0.06	1200	1.2	1.00	22.02	6944
Multi Unit, 5-axle	9, 11	0.39	1200	1.55	1.00	22.02	58303
Multi Unit, 6&7-axle	10, 12, 13	0.23	1200	2.24	1.00	22.02	49690
							450,000

Table C1.3: ESAL for SB NSH Off-Ramp

Truck Type	FHWA Class	Percent (%)	AADT	Truck Factor	Design Lane Factor	Growth Factor	ESAL
Single Unit, 2-axle	4,5	6.16	8100	0.5	1.00	22.02	2005146
Single Unit, 3&4-axle	6,7	0.45	8100	0.85	1.00	22.02	249016
Multi Unit, 3&4-axle	8	0.06	8100	1.2	1.00	22.02	46874
Multi Unit, 5-axle	9, 11	0.39	8100	1.55	1.00	22.02	393542
Multi Unit, 6&7-axle	10, 12, 13	0.23	8100	2.24	1.00	22.02	335406
							3,030,000

Table C1.4: ESAL for NB NSH Off-Ramp

Truck Type	FHWA Class	Percent (%)	AADT	Truck Factor	Design Lane Factor	Growth Factor	ESAL
Single Unit, 2-axle	4,5	6.16	2500	0.5	1.00	22.02	618872
Single Unit, 3&4-axle	6,7	0.45	2500	0.85	1.00	22.02	76857
Multi Unit, 3&4-axle	8	0.06	2500	1.2	1.00	22.02	14467
Multi Unit, 5-axle	9, 11	0.39	2500	1.55	1.00	22.02	121464
Multi Unit, 6&7-axle	10, 12, 13	0.23	2500	2.24	1.00	22.02	103520
							940,000

Table C1.5: ESAL for Brayton Dr

Truck Type	FHWA Class	Percent (%)	AADT	Truck Factor	Design Lane Factor	Growth Factor	ESAL
Single Unit, 2-axle	4,5	4.45	4800	0.5	1.00	22.02	858384
Single Unit, 3&4-axle	6,7	0.38	4800	0.85	1.00	22.02	124610
Multi Unit, 3&4-axle	8	0.06	4800	1.2	1.00	22.02	27777
Multi Unit, 5-axle	9, 11	0.28	4800	1.55	1.00	22.02	167433
Multi Unit, 6&7-axle	10, 12, 13	0.15	4800	2.24	1.00	22.02	129626
							1,310,000

C2.0: STRUCTURAL CALCULATIONS

Table C2.1: 92nd Avenue Structural Calculations

Layer No.	Description	Layer Coefficient, ai	Drainage Coefficient, mi	Elastic Modulus, psi	Thickness, D, inches	Associated SN
Layer 1	AC Layer	0.36	1.00	300,000	4.00	1.44
Layer 2	Treated Base	0.34	1.00	200,000	3.00	1.02
Layer 3	BASE - D-1	0.12	0.60	26,000	3.00	0.22
Layer 4	SUBBASE - A	0.08	0.60	10,000	24.00	1.15
					Calculated SN	3.83
					SN to Match	3.77

Table C2.2: Brayton Drive Structural Calculations

Layer No.	Description	Layer Coefficient, ai	Drainage Coefficient, mi	Elastic Modulus, psi	Thickness, D, inches	Associated SN
Layer 1	AC Layer	0.36	1.00	300,000	3.00	1.08
Layer 2	Treated Base	0.34	1.00	200,000	3.00	1.02
Layer 3	BASE - D-1	0.12	0.60	26,000	3.00	0.22
Layer 4	SUBBASE - A	0.08	0.60	10,000	24.00	1.15
					Calculated SN	3.47
					SN to Match	3.47

Table C2.3: New Seward Highway SB On Ramp Structural Calculations

Layer No.	Description	Layer Coefficient, ai	Drainage Coefficient, mi	Elastic Modulus, psi	Thickness, D, inches	Associated SN
Layer 1	AC Layer	0.36	1.00	300,000	3.00	1.08
Layer 2	Treated Base	0.34	1.00	200,000	2.00	0.68
Layer 3	BASE - D-1	0.12	0.60	26,000	2.00	0.14
Layer 4	SUBBASE - A	0.08	0.60	10,000	22.00	1.06
					Calculated SN	2.96
					SN to Match	2.94

Table C2.4: New Seward Highway SB Off Ramp Structural Calculations

Layer No.	Description	Layer Coefficient, ai	Drainage Coefficient, mi	Elastic Modulus, psi	Thickness, D, inches	Associated SN
Layer 1	AC Layer	0.36	1.00	300,000	4.00	1.44
Layer 2	Treated Base	0.34	1.00	200,000	3.00	1.02
Layer 3	BASE - D-1	0.12	0.60	26,000	3.00	0.22
Layer 4	SUBBASE - A	0.08	0.60	10,000	28.00	1.34
					Calculated SN	4.02
					SN to Match	3.95

Table C2.5: NSH NB Off Ramp Structural Calculations

Layer No.	Description	Layer Coefficient, ai	Drainage Coefficient, mi	Elastic Modulus, psi	Thickness, D, inches	Associated SN
Layer 1	AC Layer	0.36	1.00	300,000	3.00	1.35
Layer 2	Treated Base	0.34	1.00	200,000	2.00	0.28
Layer 3	BASE - D-1	0.12	0.60	26,000	2.00	0.16
Layer 4	SUBBASE - A	0.08	0.60	10,000	22.00	1.58
					Calculated SN	3.37
					SN to Match	3.28

APPENDIX D: OVERPASS DESIGN

D.1.0 DRAWINGS

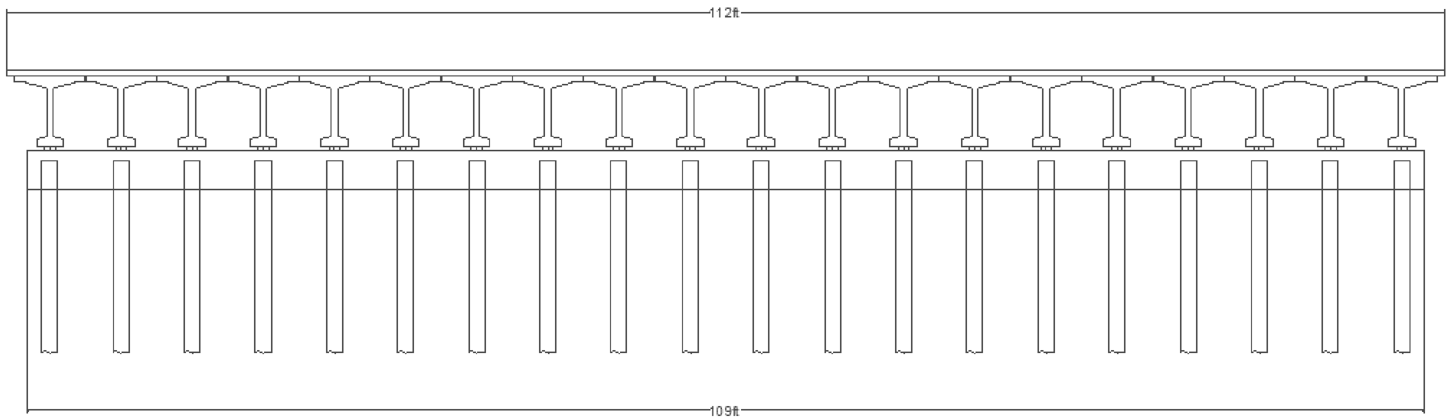


Figure D.1.1a. Bridge Typical Section

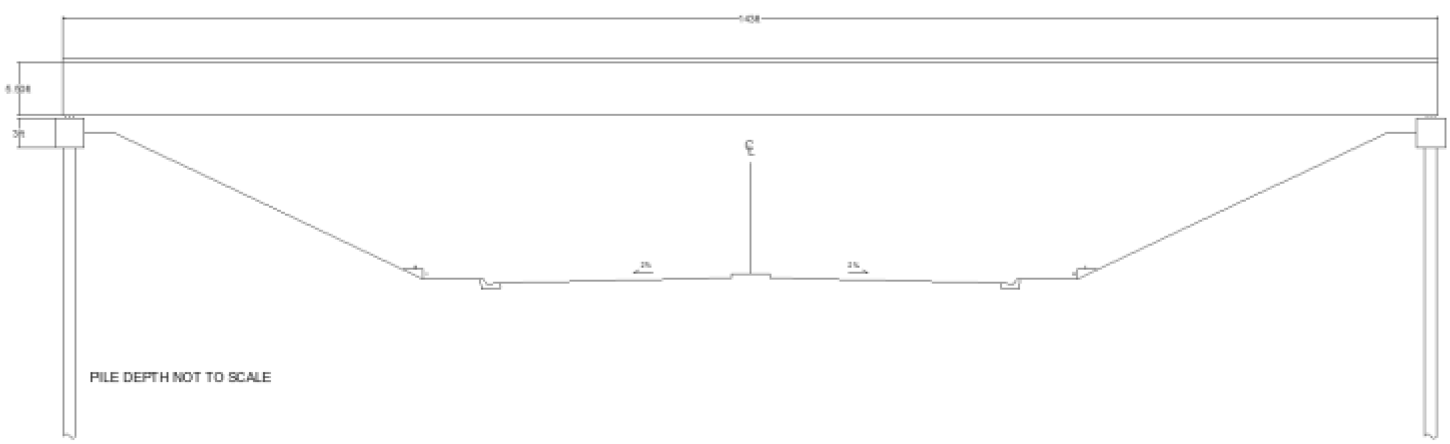


Figure D.1.1b. Bridge Elevation View

D.2.0 CALCULATIONS

D.2.1 Dead Load Calculation

Dead Load Calculation					
	Total Area (ft^2)	Unit Weight (pcf)		Dead Load (plf)	
		Max	Min	Max	Min
Railings	--	--	--	740	714
F-Shape Barriers	3.24	160.00	145.00	519.03	470.37
Girders	7.02	4.00	--	28.09	--
Misc.				25.0	25.0
			Total DL:	***1312.12***	**1209.37**

Figure D.2.1. Dead Load Used in Program

D.2.2 Shear and Moment Diagrams

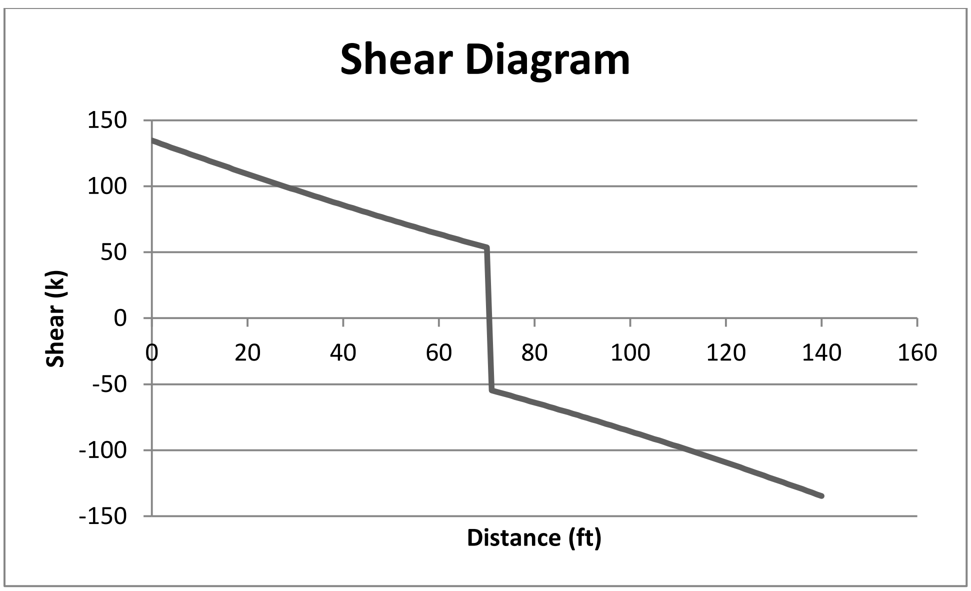


Figure D.2.2a. Bridge Shear Diagram

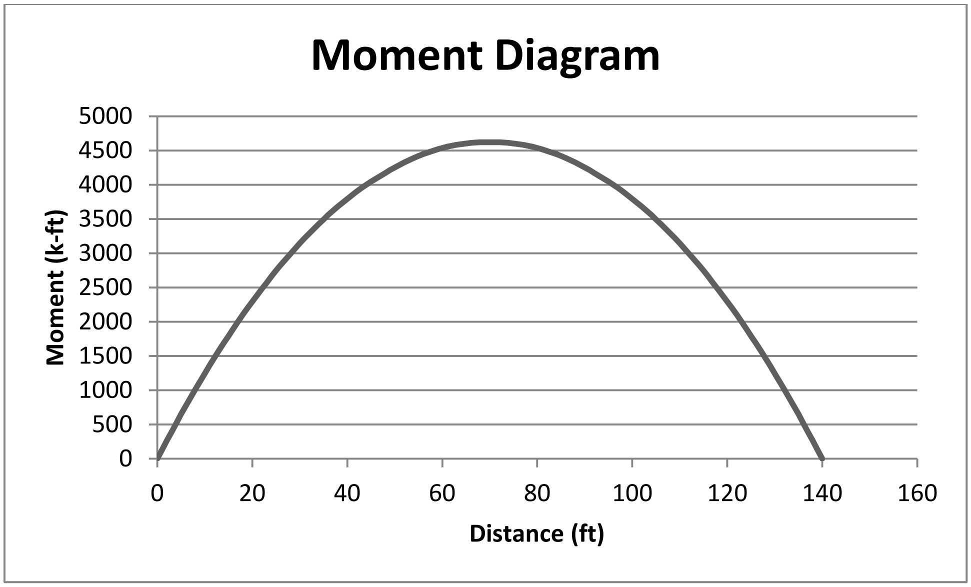


Figure D.2.2b. Bridge Moment Diagram

D.3.0 REFERENCES

1. 2007 AASHTO LRFD Bridge Design Specifications
2. 2004 AASHTO Policy on Geometric Design and Specifications
3. 2005 Preconstruction Manual
4. *Decked Bulb-Tee Girder Design 2007 LRFD*, AK DOT&PF
5. Travis Arndt, Bridge Engineer, AK DOT&PF

APPENDIX E: UTILITY CONFLICT REPORT

Table of Contents

LIST OF FIGURES

No figures in this document.

LIST OF TABLES

LIST OF ACRONYMS

ACS- Alaska Communications
AKDOT&PF – Alaska Department of Transportation & Public Facilities
AWWU – Anchorage Water and Wastewater Utility
CEA – Chugach Electric Association
ENSTAR – ENSTAR Natural Gas Company
GCI – General Communication, Inc.

E.1.0 INTRODUCTION

The primary objective of 92nd Avenue Phase II project is to connect the existing Academy Drive to the existing 92nd Avenue Phase I project. This connection will be an underpass below the New Seward Highway. One of the main goals of this project is to relieve the traffic congestion on the New Seward Highway & Dimond Boulevard by providing a new connection for southbound New Seward Highway traffic headed east towards Abbott Road and the Hillside area. This project will include an underpass below the Seward Highway, improvements to east 92nd Avenue (now called Academy Drive), southbound on and off ramps, as well as two new signalized intersections at Brayton Drive & 92nd Avenue, and the New Seward Highway ramps & 92nd Avenue.

E.1.1 Purpose

The purpose of this report is to:

1. Identify existing utilities within the project area.
2. Investigate relocation conflicts and provide recommendations.
3. Provide a preliminary relocation cost estimate.

E.1.2 Scope

The utilities covered in this report will include:

1. Water and sewer mainlines owned and operated by Anchorage Water and Wastewater Utility (AWWU).
2. Natural gas lines owned and operated by ENSTAR Natural Gas Company.
3. Communications lines (including fiber optic) owned and operated by both Alaska Communications (ACS) and General Communication, Inc. (GCI).
4. Electrical distribution and transmission lines owned and operated by Chugach Electric Association (CEA).

E.2.0 FINDINGS BY UTILITY

E.2.1 Anchorage Water and Wastewater Utility (AWWU), Water

AWWU operates the following water facilities within the project area:

1. A 36" water main runs along 92nd Avenue from station 3+00 to 14+50 and then turns north on the New Seward Highway.
2. A 12" water main exists on 92nd Avenue between station 17+50 to 27+00.
3. Several service connections, fire hydrants, and water valves throughout the project area.

E.2.2 Anchorage Water and Wastewater Utility (AWWU), Sewer

AWWU operates the following sanitary sewer facilities within the project area:

1. An 8" sanitary sewer line runs along 92nd Avenue between 3+00 to 8+00.
2. An 8" sanitary sewer line runs along 92nd Avenue between 17+50 to 25+20.
3. Several manholes exist throughout the project area.

E.2.3 ENSTAR, Natural Gas

ENSTAR operates a natural gas distribution and transmission system within the project area. The following facilities exists within the project area:

1. A gas line exists on 92nd Avenue between stations 21+70 to 27+00. This gas line will not be affected.

E.2.4 Alaska Communications (ACS), Telephone

ACS owns and operates telephone communication facilities within the project area. The following is a list of key facilities that will be impacted by the proposed construction:

1. An overhead telecommunications line on 92nd Avenue station 3+00 to 14+20.
2. An underground telecommunications line on 92nd Avenue station 17+50 to 26+50.
3. An underground telecommunications line on 92nd Avenue station 17+80 to 27+00.
4. A pedestal on 92nd Avenue station 17+80.

E.2.5 General Communications, Inc. (GCI), Cable Television

GCI owns and operates communication facilities within the proposed project area that consist of a combination of fiber optic and coaxial cable. The following is a list of key facilities that will be impacted by the proposed activities:

1. 0.500 Coaxial overhead CATV on 92nd Avenue station 3+00 to 14+20.
2. 0.500 Coaxial underground CATV on 92nd Avenue station 17+50 to 27+00.
3. 0.750 Coaxial underground CATV on 92nd Avenue station 17+50 to 27+50.
4. Fiber optic line on 92nd Avenue station 17+50 to 24+70.
5. Fiber Optic vault on 92nd Avenue at station 24+70
6. Several CATV vaults along the project area.

E.2.6 Chugach Electric Association (CEA), Electric

CEA owns and operates electric facilities in project area. Transmission, distribution, and service facilities will be impacted by the proposed construction activities. The following is a list of key impacted facilities:

7. 1 Phase overhead electric line with 9 poles that runs on 92nd Avenue between stations 3+00 to 14+20.
8. 1 Phase underground electric line on 92nd Avenue station 17+50 to 26+50.
9. An electric box on Brayton Drive.

E.3.0 SUMMARY of UTILITY CONFLICTS & PROPOSED RESOLUTIONS

E.3.1 Anchorage Water and Wastewater Utility (AWWU), Water

Table E.1 – Potential AWWU water facilities that may be impacted

Station	Offset	Conflict Description	Recommended Resolution
14+60	50 L	Fire hydrant	Relocate to station 13+60
17+50 to 27+00	5 R	12" Water line	Adjust in place
17+60	10 R	Water valve box and gate valve	Adjust to grade
17+70	20 R	Fire hydrant	Relocate 20' south
18+50	5 R	Water valve box and gate valve	Adjust to grade
19+20	5 L	Water valve box and gate valve	Adjust to grade
20+30	5 L	Water valve box and gate valve	Adjust to grade
21+61	5 L	Water valve box and gate valve	Adjust to grade
22+75	20 R	Fire hydrant	Relocate 25' south
22+75	5 R	Water valve box and gate valve	Adjust to grade
24+35	5 L	Water valve box and gate valve	Adjust to grade
26+40	20 R	Water valve box and gate valve	Adjust to grade
26+50	20 R	Water valve box and gate valve	Adjust to grade
26+55	5 L	Water valve box and gate valve	Adjust to grade

E.3.2 Anchorage Water and Wastewater Utility (AWWU), Sewer

Table E.2 – Potential AWWU sewer facilities that may be impacted

Station	Offset	Conflict Description	Recommended Resolution
03+20	40 L	Sanitary sewer manhole	Adjust to grade
06+20	40 L	Sanitary sewer manhole	Adjust to grade
08+10	35 L	Sanitary sewer manhole	Adjust to grade
17+50	25 L	Sanitary sewer manhole	Adjust to grade
17+50 to 25+20	25 L	8" Sanitary sewer line	Adjust in place
19+30	30 L	Sanitary sewer manhole	Adjust to grade
19+60	60 R	Sanitary sewer manhole	Adjust to grade
21+00	20 L	Sanitary sewer manhole	Adjust to grade
25+20	15 L	Sanitary sewer manhole	Adjust to grade

E.3.3 ENSTAR, Natural Gas

No ENSTAR facilities will be affected by this project.

E.3.4 Alaska Communications (ACS), Telephone

Table E.3 – Potential ACS communications facilities that may be impacted

Station	Offset	Conflict Description	Recommended Resolution
03+00 to 14+20	10 R	50-Count overhead telephone line	Relocate to 5' south of sidewalk
17+50 to 26+50	60 R	26-Count underground telephone line	Adjust in place
17+80	25 R	Pedestal	Relocate 50' southeast
17+80 to 27+00	25 R	26-Count underground telecommunications line	Relocate 40' south

E.3.5 General Communications, Inc. (GCI), Cable Television

Table E.4 – Potential GCI communications facilities that may be impacted

Station	Offset	Conflict Description	Recommended Resolution
03+00 to 14+20	3 R	0.500 Coax overhead CATV	Relocate 60' south
04+90	3 R	CATV Vault	Relocate 60' south
07+30	3 R	CATV Vault	Relocate 60' south
08+55	3 R	CATV Vault	Relocate 60' south
09+60	3 R	CATV Vault	Relocate 60' south
10+75	3 R	CATV Vault	Relocate 60' south
12+80	3 R	CATV Vault	Relocate 60' south
17+50 to 24+70	30 L	Fiber optic line	Relocate 30' north
17+50 to 27+00	35 R	0.500 Coax underground CATV	Relocate 25' south
17+50 to 27+00	50 R	0.750 Coax underground CATV	Relocate 15' south
24+70	30 L	Fiber optic vault	Relocate 30' north

E.3.6 Chugach Electric Association (CEA), Electric

Table E.5 – Potential CEA electric facilities that may be impacted

Station	Offset	Conflict Description	Recommended Resolution
03+00 to 14+20	10 R	1 Phase overhead electric line (9 poles)	Relocate to 5' south of sidewalk
17+50 to 26+50	60 R	1 Phase underground electric line	Adjust in place

E.4.0 PRELIMINARY UTILITY RELCOATION COST ESTIMATES

The total utility cost estimate is $1,479,000. The following tables show the cost break down per item and per utility company.

Table E.6 – Cost Estimate Per Item

Item	Quantity	Unit Price	Per	Price
1 Phase Overhead Electric	9	$15,000.00	Pole	$135,000.00
50 Count Overhead Telephone	1120	$40.00	Ft	$44,800.00
0.500 Coax Overhead CATV	1120	$20.00	Ft	$22,400.00
CATV Vault	6	$7,200.00	Ea.	$43,200.00
Pedestal	1	$10,000.00	Ea.	$10,000.00
26 Count Underground Telecom.	1900	$40.00	Ft.	$76,000.00
Underground Fiber Optic Line	720	$50.00	Ft.	$36,000.00
Fiber Optic Vault	1	$4,800.00	Ea.	$4,800.00
Water VB & GV	10	$5,000.00	Ea.	$50,000.00
Fire Hydrant	3	$5,000.00	Ea.	$15,000.00
Sanitary Sewer Manhole	8	$8,000.00	Ea.	$64,000.00
1 Phase Underground Electric	900	$100.00	Ft.	$90,000.00
0.500 Coax Underground CATV	950	$40.00	Ft.	$38,000.00
0.750 Coax Underground CATV	950	$70.00	Ft.	$66,500.00
8" Sanitary Sewer	900	$225.00	Ft.	$202,500.00
12" Water	950	$300.00	Ft.	$285,000.00
			Sum	$1,183,200.00
			Contingency (25%)	$295,800.00
			TOTAL	**$1,479,000.00**

Table E.7 – Cost Estimate Per Utility Company

Utility Company	Relocation Costs
ACS	$130,800.00
AWWU	$616,500.00
CEA	$225,000.00
GCI	$210,900.00
ENSTAR	$0.00
Sum	$1,183,200.00
Contingency (25%)	$295,800.00
TOTAL	**$1,479,000.00**

E.5.0 REFERENCES

Alaska, S. o. (n.d.). *Alaska Administrative Code.* Retrieved April 6, 2013, from The Alaska State Legislature: http://www.legis.state.ak.us/basis/folioproxy.asp?url=http://wwwjnu01.legis.state.ak.us/cgi-bin/folioisa.dll/aac/query=[JUMP:'17+aac+15!2E201']/doc/{@1}?firsthit

Barshire, B. (2013, March 29). Engineer. (A. Abaza, Interviewer)

APPENDIX F: STORM WATER CONTROL

F1.0 TABLES

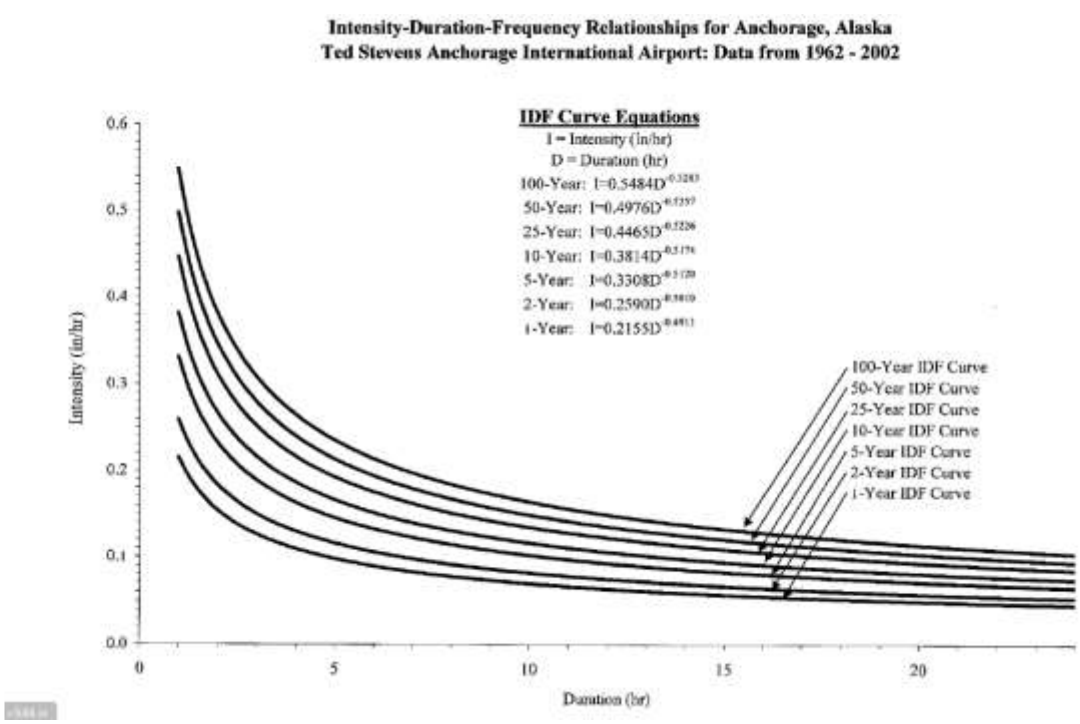
F 1.1 Inlet Spacing Computation Sheet

INLET SPACING COMPUTATION SHEET SI- Units												Date 1/16/01 SP ____ ROUTE ____ Computed By: JLM Checked By: AAW Sheet 1 of 1						
INLET		GUTTER DISCHARGE Design Frequency 10-yr.					GUTTER DISCHARGE Allowable Spread 2.0 m								INLET DISCHARGE			RMK
No. (1)	Stat. (2)	Drain. Area A (ha) (3)	Run-off Coeff. C (4)	Time of Conc. t_c (min) (5)	Rain. Inten. I (mm/hr) (6)	Q = CIA/K_c (m^3/s) (7)	Long. Slope S_L (m/m) (8)	Cross Slope S_x or S_w (m/m) (9)	Prev. By-pass Flow (m^3/s) (10)	Total Gutter Flow (m^3/s) (11)	Depth d (m) (12)	Grate or Gutter Width W (m) (13)	Spread T (m) (14)	W/T (15)	Inlet Type (16)	Inter-cept Flow Q_i (m^3/s) (17)	By-pass Flow Q_b (m^3/s) (18)	(19)
40	20+00	0.26	0.73	5	180	0.095	0.03	0.04	0	0.095	0.073	0.6	1.83	0.33	P50x100	0.068	0.027	Curb height 0.15 m
41	18+80	0.14	0.73	5	180	0.051	0.03	0.04	0.027	0.078	0.060	0.6	1.50	0.40	P50x100	0.057	0.021	Curb height 0.15 m

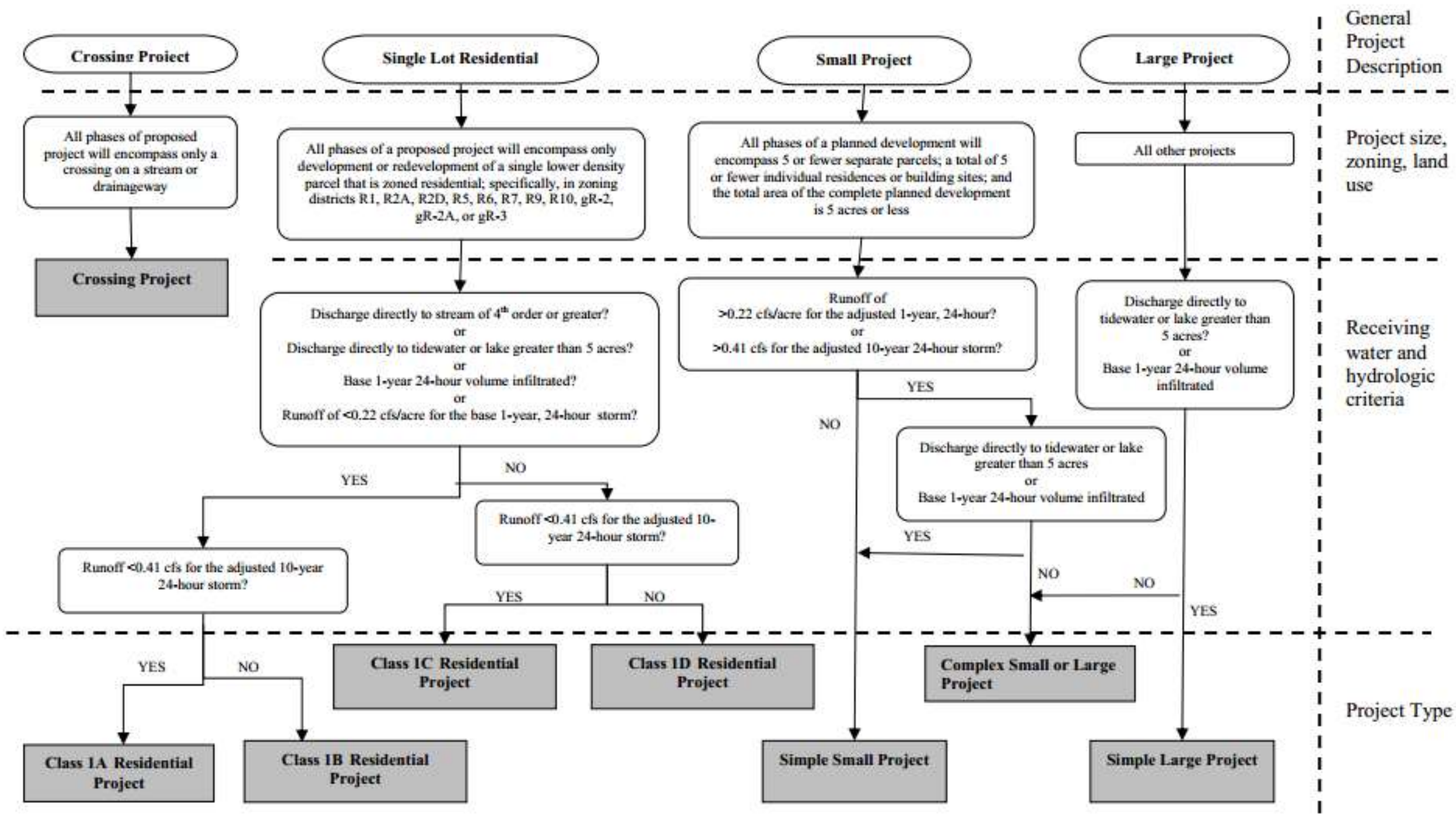
F2.0 FIGURES

F 2.1: Drainage Area Considered

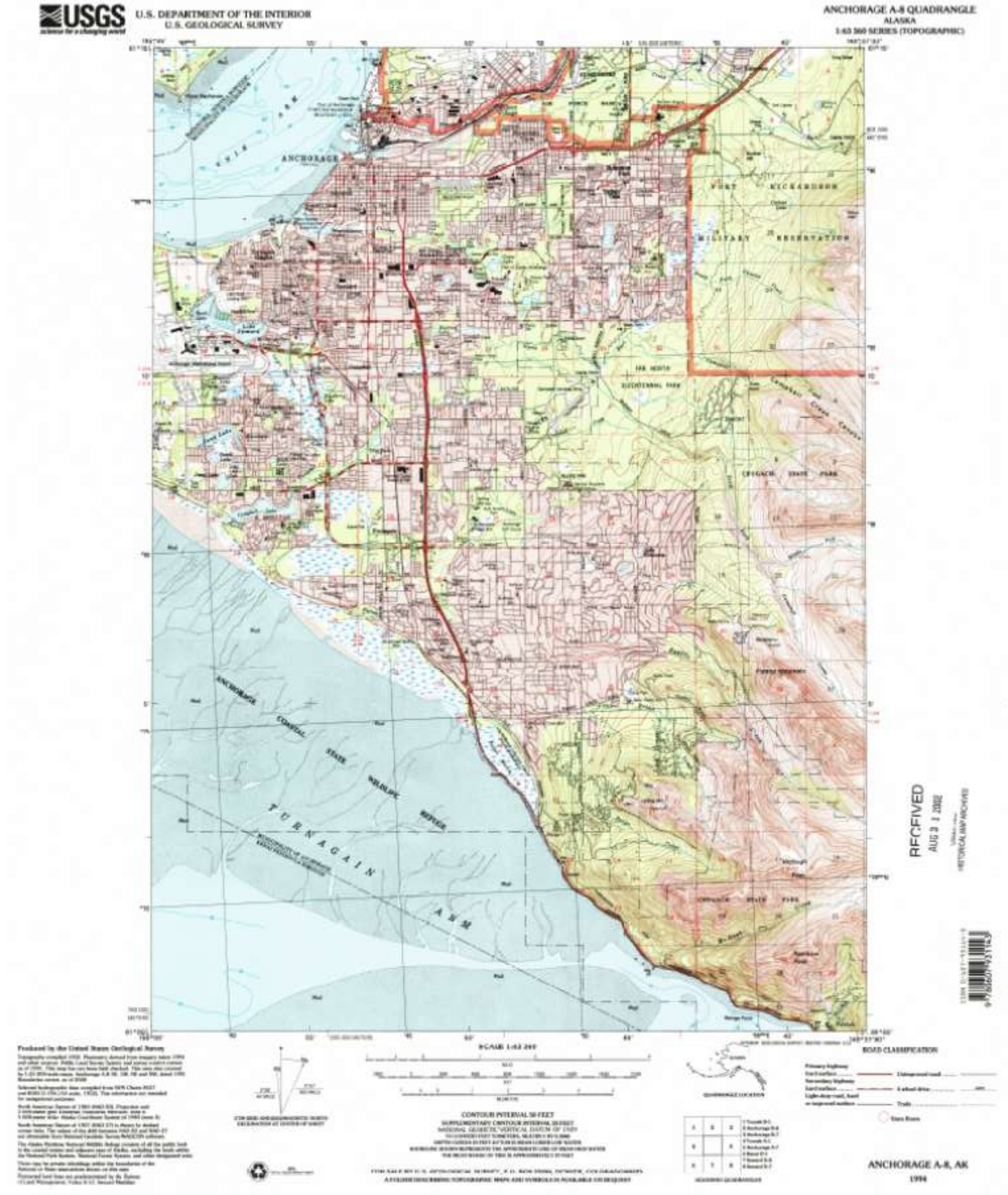
F 2.2: IDF Curve



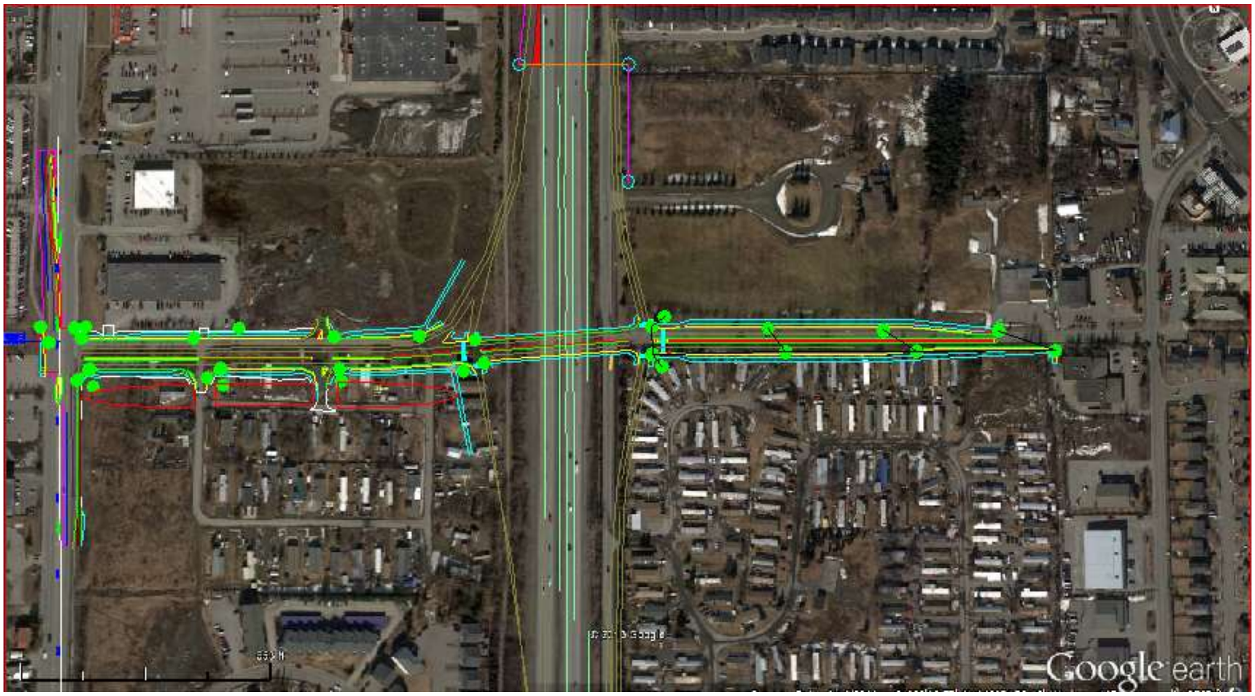
F 2.3 Project Flow Type



F 2.4 USGS Map

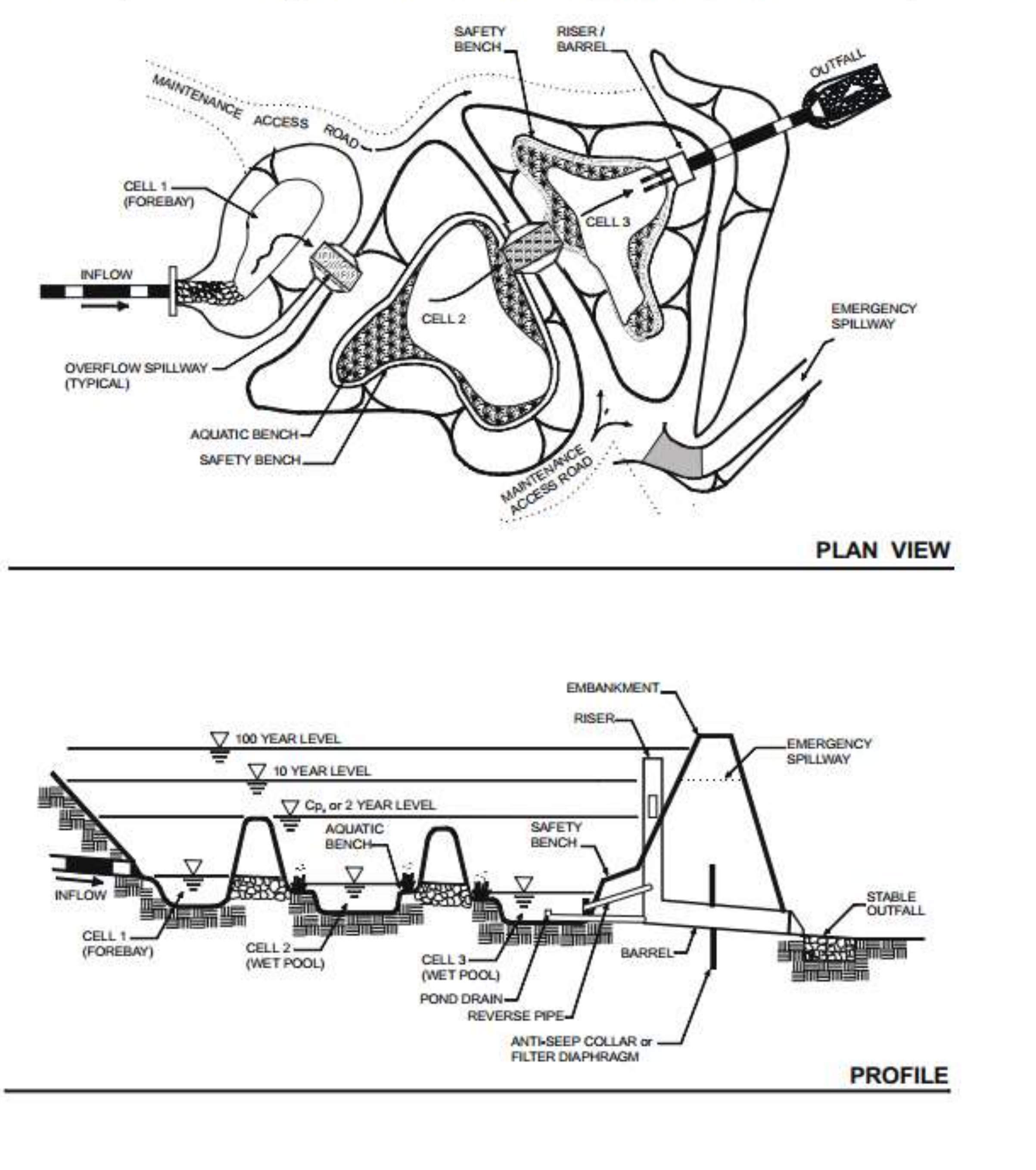

USGS
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY
ANCHORAGE A-8 QUADRANGLE
ALASKA
1:63 360 SERIES (TOPOGRAPHIC)
ANCHORAGE
TURNAGAIN ARM
ANCHORAGE A-8, AK
1994
RECEIVED

F 2.4: Storm Water Design



F 2.5: LID Concept from Maryland Storm Water Design Manual

P-4	**Figure 3.4** Example of Multiple Pond System	P-4



Multiple pond systems provide WQ_v storage in two or more cells that create longer pollutant removal pathways.

APPENDIX G: ENVIRONMENTAL

Figure G.1 - Bore Log Map (92nd Ave)

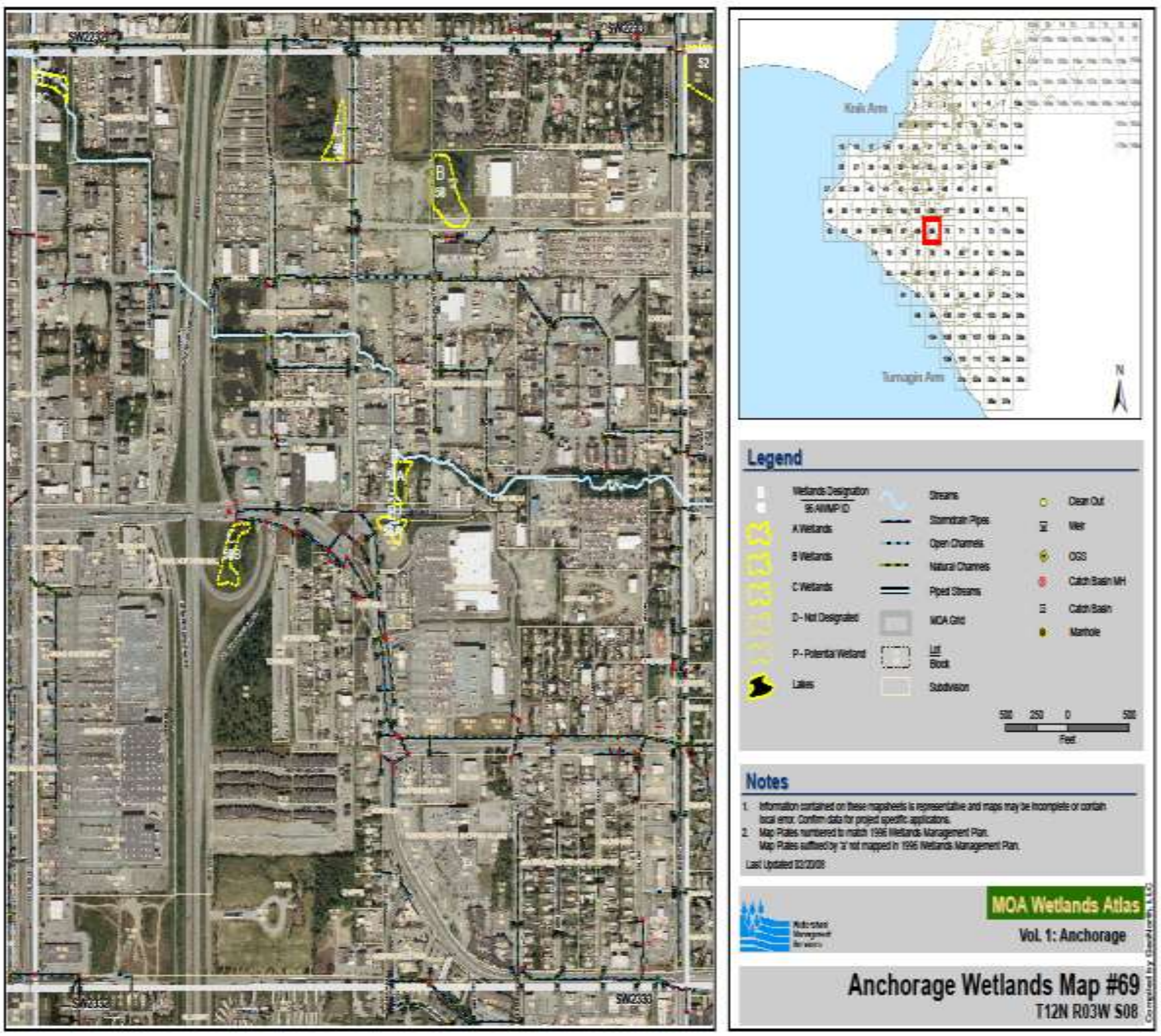


Figure G.2 - Anchorage Wetlands Map (Area 69)

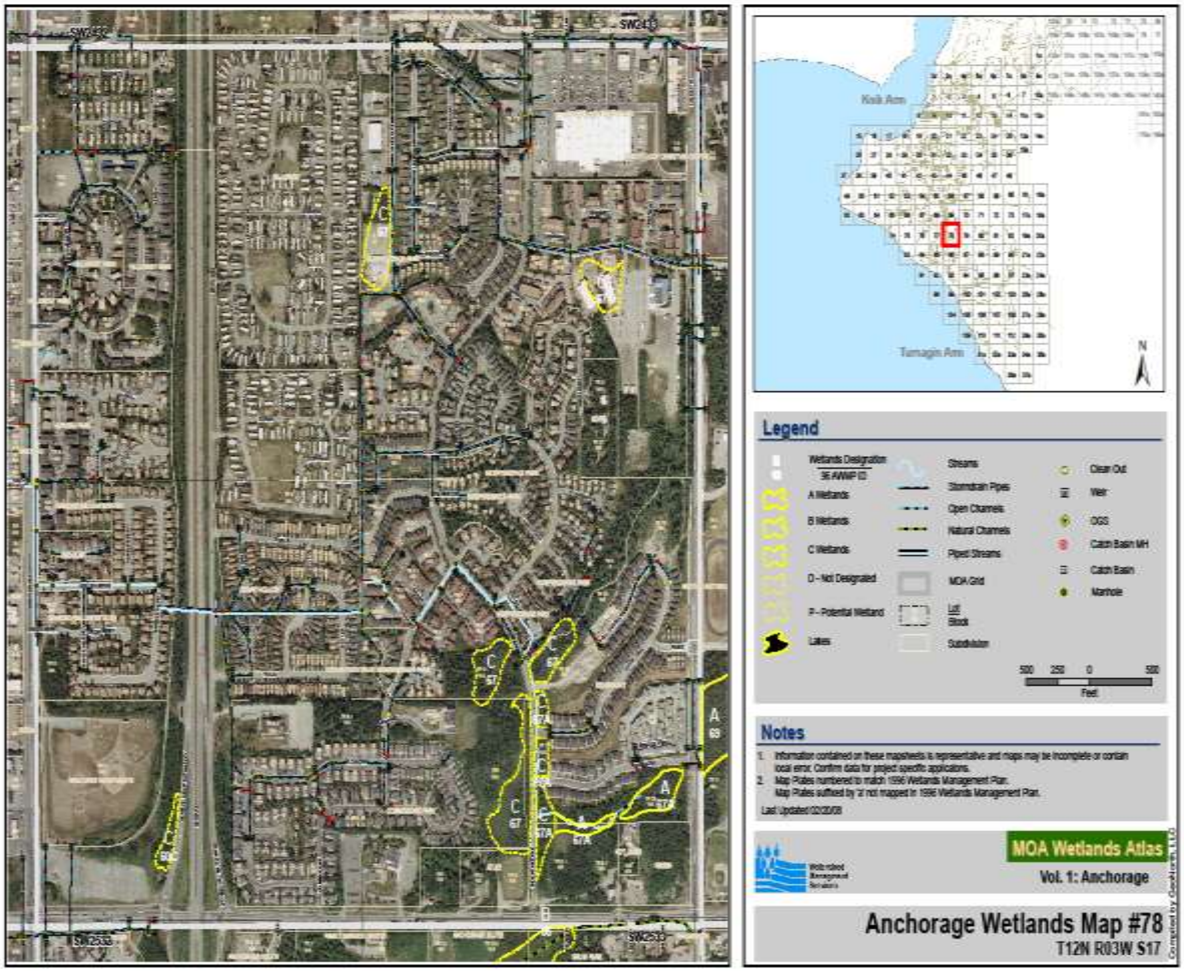


Figure G.3- Anchorage Wetlands Map (Area 78)

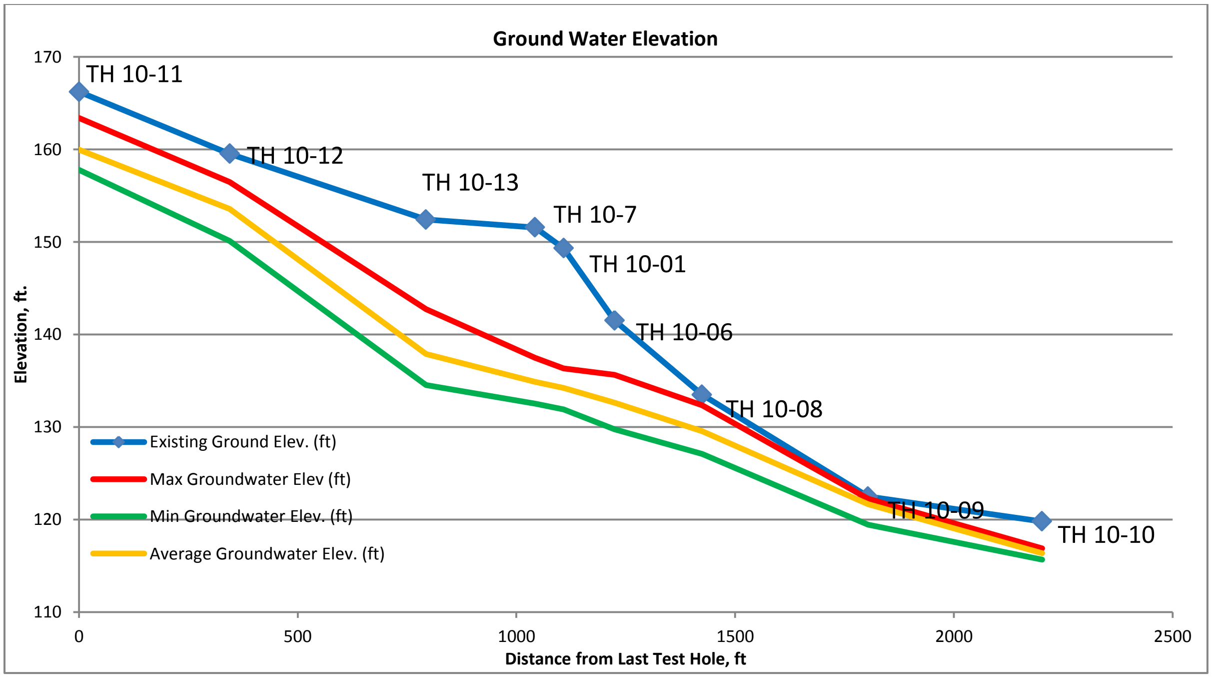


Figure G.4 - Ground Water Elevation (92nd Ave)

G1.0 ARTIFICAL GROUND FREEZING

- A technique of freezing of pore water in soil which changes the thermal and mechanical p roperties.
- Each ground freezing project requires an evaluation to determine the appropriate spacing between the freezing pipes

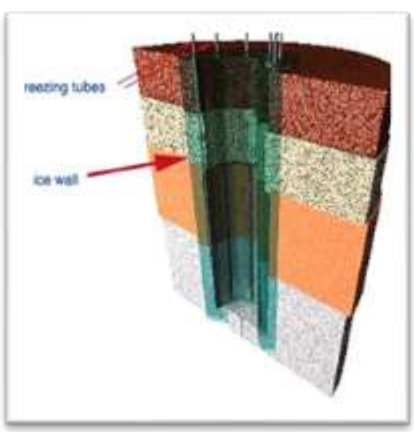


Figure G.5 – Artificial Ground Freezing Cross-Section

Ground Water Concern Based on Month

TH 10-11	Date	11-May-10	3-Oct-12	19-Jun-12	7-Aug-12	7-Sep-12		
	GWD, FT	2.84	4.64	5.16	5.85	6.16		
		29-Sep-10	14-Oct-10	12-Nov-10	30-Dec-11	21-Sep-11	23-Mar-11	
		6.8	6.8	6.97	7.71	7.8	8.21	

TH 10-12	Date	3-Oct-12	11-May-10	19-Jun-12	29-Dec-11	14-Oct-10		
	GWD, FT	3.06	3.34	4.74	5.79	6.44		
		12-Nov-10	7-Sep-12	29-Sep-10	21-Sep-11	23-Mar-11	7-Aug-12	
		6.47	6.47	6.59	7.49	9.04	9.42	

TH 10-13	Date	11-May-10	3-Oct-12	19-Jun-12	9-Apr-12	12-Nov-10	14-Oct-10	
	GWD, FT	9.67	10.58	12.42	14.32	14.43	14.61	
		29-Sep-10	29-Dec-11	7-Aug-12	7-Sep-12	21-Sep-11	23-Mar-11	
		15.16	15.87	16.25	16.35	16.77	17.89	

TH 10-7	Date	19-Jun-12	14-Oct-10	12-Nov-10	29-Sep-10	21-Sep-11	13-Jul-10	24-Mar-11
	GWD, FT	14.72	16.19	16.65	16.75	18.12	19.3	19.7

TH 10-1	Date	19-Jun-12	14-Oct-10	29-Sep-10	21-Sep-11	13-Jul-10
	GWD, FT	12.98	14.41	14.48	16.11	17.4

TH 10-6	Date	3-Oct-12	11-May-10	18-Jun-12	28-Dec-11	9-Apr-12	12-Nov-10	14-Oct-10
	GWD, FT	5.9	5.95	7.21	7.53	7.68	8.15	8.62
		29-Sep-10	10-Feb-12	21-Sep-11	7-Sep-12	7-Aug-12	7/13/2010	24-Mar-11
		8.98	9.38	10.25	10.73	10.91	11.52	11.79

TH 10-8	Date	11-May-10	9-Apr-12	3-Oct-12	27-Dec-11	19-Jun-12	12-Nov-10	14-Oct-10
	GWD, FT	0	0	1.13	2.22	2.26	2.52	4.09
		10-Feb-12	29-Sep-10	7-Aug-12	21-Sep-11	7-Sep-12	23-Mar-11	
		4.22	4.34	5.34	5.49	5.5	6.39	

TH 10-9	Date	11-May-10	9-Apr-12	12-Nov-10	29-Sep-10	14-Oct-10	19-Jun-12
	GWD, FT	0	0	0.23	0.33	0.33	0.48
		3-Oct-12	21-Sep-11	7-Sep-12	7-Aug-12	27-Dec-11	
		0.57	0.63	0.87	1.43	3.03	

TH 10-10	Date	3-Oct-12	12-Nov-10	11-May-10	19-Jun-12	14-Oct-10	28-Dec-11
	GWD, FT	2.9	3.09	3.09	3.14	3.24	3.39
		29-Sep-10	21-Sep-11	7-Sep-12	7-Aug-12		
		3.59	3.8	3.92	4.11		

Figure G.6 – Ground Water Concern

APPENDIX H: PERMITTING

H1.0 MITIGATION STATEMENT APPLICATION

U.S. ARMY CORPS OF ENGINEERS **APPLICATION FOR DEPARTMENT OF THE ARMY PERMIT** 33 CFR 325. The proponent agency is CECW-CO-R.	OMB APPROVAL NO. 0710-0003 EXPIRES: 28 FEBRUARY 2013

Public reporting for this collection of information is estimated to average 11 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of the collection of information, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters, Executive Services and Communications Directorate, Information Management Division and to the Office of Management and Budget, Paperwork Reduction Project (0710-0003). Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. Please DO NOT RETURN your form to either of those addresses. Completed applications must be submitted to the District Engineer having jurisdiction over the location of the proposed activity.

PRIVACY ACT STATEMENT

Authorities: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413; Regulatory Programs of the Corps of Engineers; Final Rule 33 CFR 320-332. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit. Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public and may be made available as part of a public notice as required by Federal law. Submission of requested information is voluntary, however, if information is not provided the permit application cannot be evaluated nor can a permit be issued. One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and/or instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned.

(ITEMS 1 THRU 4 TO BE FILLED BY THE CORPS)

1. APPLICATION NO.	2. FIELD OFFICE CODE	3. DATE RECEIVED	4. DATE APPLICATION COMPLETE

(ITEMS BELOW TO BE FILLED BY APPLICANT)

5. APPLICANT'S NAME	8. AUTHORIZED AGENT'S NAME AND TITLE (agent is not required)
First - Erik Middle - James Last - Jordt	First - Middle - Last -
Company - University of Alaska Anchorage	Company -
E-mail Address - ejjordt@alaska.edu	E-mail Address -
6. APPLICANT'S ADDRESS:	9. AGENT'S ADDRESS:
Address- 3700 Sharon Gagnon Lane	Address-
City - Anchorage State - Ak Zip - 99508 Country - USA	City - State - Zip - Country -
7. APPLICANT'S PHONE NOs. w/AREA CODE	10. AGENTS PHONE NOs. w/AREA CODE
a. Residence b. Business 907-854-2826 c. Fax	a. Residence b. Business c. Fax

STATEMENT OF AUTHORIZATION

11. I hereby authorize, ____________ to act in my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this permit application.

SIGNATURE OF APPLICANT ____________ DATE ____________

NAME, LOCATION, AND DESCRIPTION OF PROJECT OR ACTIVITY

12. PROJECT NAME OR TITLE (see instructions)

New Seward Highway -92nd Avenue

13. NAME OF WATERBODY, IF KNOWN (if applicable)	14. PROJECT STREET ADDRESS (if applicable)
	Address
15. LOCATION OF PROJECT Latitude: +N 64 081 4.89" Longitude: +W 149 51 30.63"	City - State- Zip-

16. OTHER LOCATION DESCRIPTIONS, IF KNOWN (see instructions)

State Tax Parcel ID Municipality

Section - 8 Township - 12 Range - 3

ENG FORM 4345, OCT 2012 PREVIOUS EDITIONS ARE OBSOLETE. Page 1 of 3

17. DIRECTIONS TO THE SITE

Follow Old Seward south to Abbott Road. Head east on Abbott Road to end. North of the end of Abott Road is area for potential wetlands.

18. Nature of Activity (Description of project, include all features)

Extending Abbott Road to Academy drive will require an extension of the ROW into potential wetlands, on the West side of the New Seward Highway. The proposed project involves a discharge of fill material in the suggested area of wetland.

19. Project Purpose (Describe the reason or purpose of the project, see instructions)

The 2006 EA/FONSI stated that the purpose of the proposed project is to construct improvements to the NSH corridor between Rabbit Creek Road and 36th Avenue that will provide additional capacity, connectivity, and safety enhancements. Since approval of the 2006 EA/FONSI, the purpose and needs have not changed.

USE BLOCKS 20-23 IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED

20. Reason(s) for Discharge

Proposed design alternatives include providing on and off ramps from the NSH onto Abbott Road, as well as the widening of the Abbott Road. Both provisions will potentially affect the proposed wetland area on the West Side of the NSH. These fills will be minor sliver fills that are abutting the project to construct the off ramp from the New Seward Highway.

21. Type(s) of Material Being Discharged and the Amount of Each Type in Cubic Yards:

Type Amount in Cubic Yards	Type Amount in Cubic Yards	Type Amount in Cubic Yards

22. Surface Area in Acres of Wetlands or Other Waters Filled (see instructions)

Acres
or
Linear Feet .96 Acres

23. Description of Avoidance, Minimization, and Compensation (see instructions)

Design is planned to minimize, and avoid impacting wetlands to fullest exent by designing offramp as close as possible to proposed NSH, as well as using steepest allowable side slopes on offramp to minize daylight.

24. Is Any Portion of the Work Already Complete? ☐ Yes ☒ No IF YES, DESCRIBE THE COMPLETED WORK

25. Addresses of Adjoining Property Owners, Lessees, Etc., Whose Property Adjoins the Waterbody (If more than can be entered here, please attach a supplemental list).

a. Address-

City - State - Zip -

b. Address-

City - State - Zip -

c. Address-

City - State - Zip -

d. Address-

City - State - Zip -

e. Address-

City - State - Zip -

26. List of Other Certificates or Approvals/Denials received from other Federal, State, or Local Agencies for Work Described in This Application.

AGENCY	TYPE APPROVAL*	IDENTIFICATION NUMBER	DATE APPLIED	DATE APPROVED	DATE DENIED

* Would include but is not restricted to zoning, building, and flood plain permits

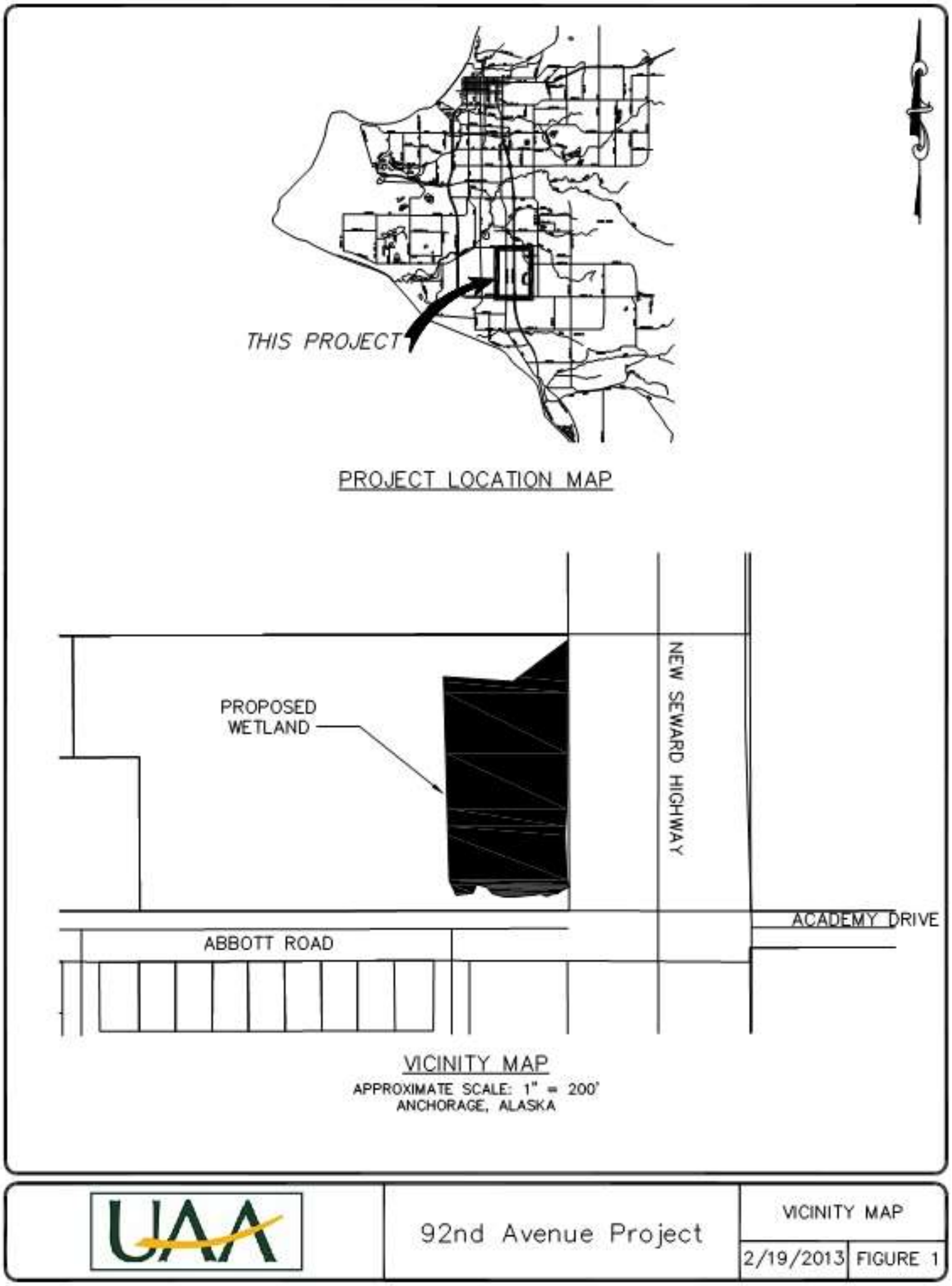
27. Application is hereby made for permit or permits to authorize the work described in this application. I certify that this information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent of the applicant.

SIGNATURE OF APPLICANT DATE SIGNATURE OF AGENT DATE

The Application must be signed by the person who desires to undertake the proposed activity (applicant) or it may be signed by a duly authorized agent if the statement in block 11 has been filled out and signed.

18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than $10,000 or imprisoned not more than five years or both.

H.20 VICINITY MAP



H3.0 APPLICANT PROPOSED MITIGATION STATEMENTS

Applicant Proposed Mitigation Statements

Background:

The U.S. Army Corps of Engineers (Corps) and the Environmental Protection Agency issued regulations that govern national compensatory mitigation policy for activities in waters of the U.S., including wetlands, authorized by Corps permits. The final mitigation rule was published in the federal register on April 10, 2008, and became effective on June 9, 2008. The final rule establishes standards and criteria for the use of appropriate and practicable compensatory mitigation for unavoidable functional losses of aquatic resources authorized by Corps permits (33 CFR Part 332). Additionally, the rule requires new information to be included in Corps permit applications and public notices to enable meaningful comments on applicant proposed mitigation. In accordance with 33 CFR Part 325.1(d)(7), "For activities involving discharges of dredged or fill material into waters of the U.S., the application must include a statement describing how impacts to waters of the United States are to be avoided and minimized. The application must also include either a statement describing how impacts to waters of the United States are to be compensated for or a statement explaining why compensatory mitigation should not be required for the proposed impacts." For additional information, the final mitigation rule can be viewed at: http://www.usace.army.mil/cw/cecwo/reg/news/final_mitig_rule.pdf

Mitigation is a sequential process of avoidance, minimization, and compensation. Compensatory mitigation is not considered until after all appropriate and practicable steps have been taken to first avoid and then minimize adverse impacts to the aquatic ecosystem. Please provide your proposed avoidance, minimization, and compensatory mitigation below:

Applicant's Proposed Mitigation (attach additional sheets as necessary):

1. Avoidance of impacts to waters of the U.S., including wetlands:

Please describe how, in your project planning process, you avoided impacts to waters of the U.S., including wetlands, to the maximum extent practicable. Examples of avoidance measures include site selection, routes, design configurations, etc...

- Based on site selection, we chose the most appropriate route that will least affect the wetlands area, by hugging as close as we could to the side slopes of the proposed New Seward Highway.
- We chose the most suitable side slopes (2:1) that will adequately support the stability of the highway while also minimizing wetland impact.

"ADOT will mitigate impacts to aquatic resource with a payment calculated according to the credit and debit methodology and remitted to the mitigation bank and land trust

Applicant Proposed Mitigation Statements

2. Minimization of unavoidable impacts to waters of the U.S., including wetlands: *Please describe how your project design incorporates measures that minimize the unavoidable impacts to waters of the U.S., including wetlands, by limiting fill discharges to the minimum amount/size necessary to achieve the project purpose.*

- The off ramp, from the New Seward Highway, is placed in design as close as possible to the proposed New Seward Highway daylights, which will maximize the least amount of damage possible to proposed wetlands.

- A side slope of 2:1 for the off ramp will be used which is the steepest slope that can be chosen to still efficiently support ramps structure.

3. Compensation for unavoidable impacts to waters of the U.S., including wetlands: *Please describe your proposed compensatory mitigation to offset unavoidable impacts to waters of the U.S., or, alternatively, why compensatory mitigation is not appropriate or practicable for your project. Compensatory mitigation involves actions taken to offset unavoidable adverse impacts to waters of the U.S., including wetlands, streams and other aquatic resources (aquatic sites) authorized by Corps permits. Compensatory mitigation may involve the restoration, enhancement, establishment (creation), and/or the preservation of aquatic sites. The three mechanisms for providing compensatory mitigation are mitigation banks, in-lieu fee of mitigation, and permittee-responsible mitigation. Please see the attached definitions for additional information.*

-ADOT will mitigate impacts to aquatic resource with a payment calculated according to the credit and debit methodology and remitted to the mitigation bank and land trust

Applicant Proposed Mitigation Statements

Definitions:

Enhancement: the manipulation of the physical, chemical, or biological characteristics of an aquatic resource to heighten, intensify, or improve a specific aquatic resource function(s). Enhancement results in the gain of selected aquatic resource function(s), but may also lead to a decline in other aquatic resource function(s). Enhancement does not result in a gain in aquatic resource area.

Establishment (creation): the manipulation of the physical, chemical, or biological characteristics present to develop an aquatic resource that did not previously exist at an upland site. Establishment results in a gain in aquatic resource area and functions.

In-lieu fee program: a program involving the restoration, establishment, enhancement, and/or preservation of aquatic resources through funds paid to a governmental or non-profit natural resources management entity to satisfy compensatory mitigation requirements for DA permits. Similar to a mitigation bank, an in-lieu fee program sells compensatory mitigation credits to permittees whose obligation to provide compensatory mitigation is then transferred to the in-lieu program sponsor. However, the rules governing the operation and use of in-lieu fee programs are somewhat different from the rules governing operation and use of mitigation banks. The operation and use of an in-lieu fee program are governed by an in-lieu fee program instrument.

Mitigation bank: a site, or suite of sites, where resources (e.g., wetlands, streams, riparian areas) are restored, established, enhanced, and/or preserved for the purpose of providing compensatory mitigation for impacts authorized by DA permits. In general, a mitigation bank sells compensatory mitigation credits to permittees whose obligation to provide compensatory mitigation is then transferred to the mitigation bank sponsor. The operation and use of a mitigation bank are governed by a mitigation banking instrument.

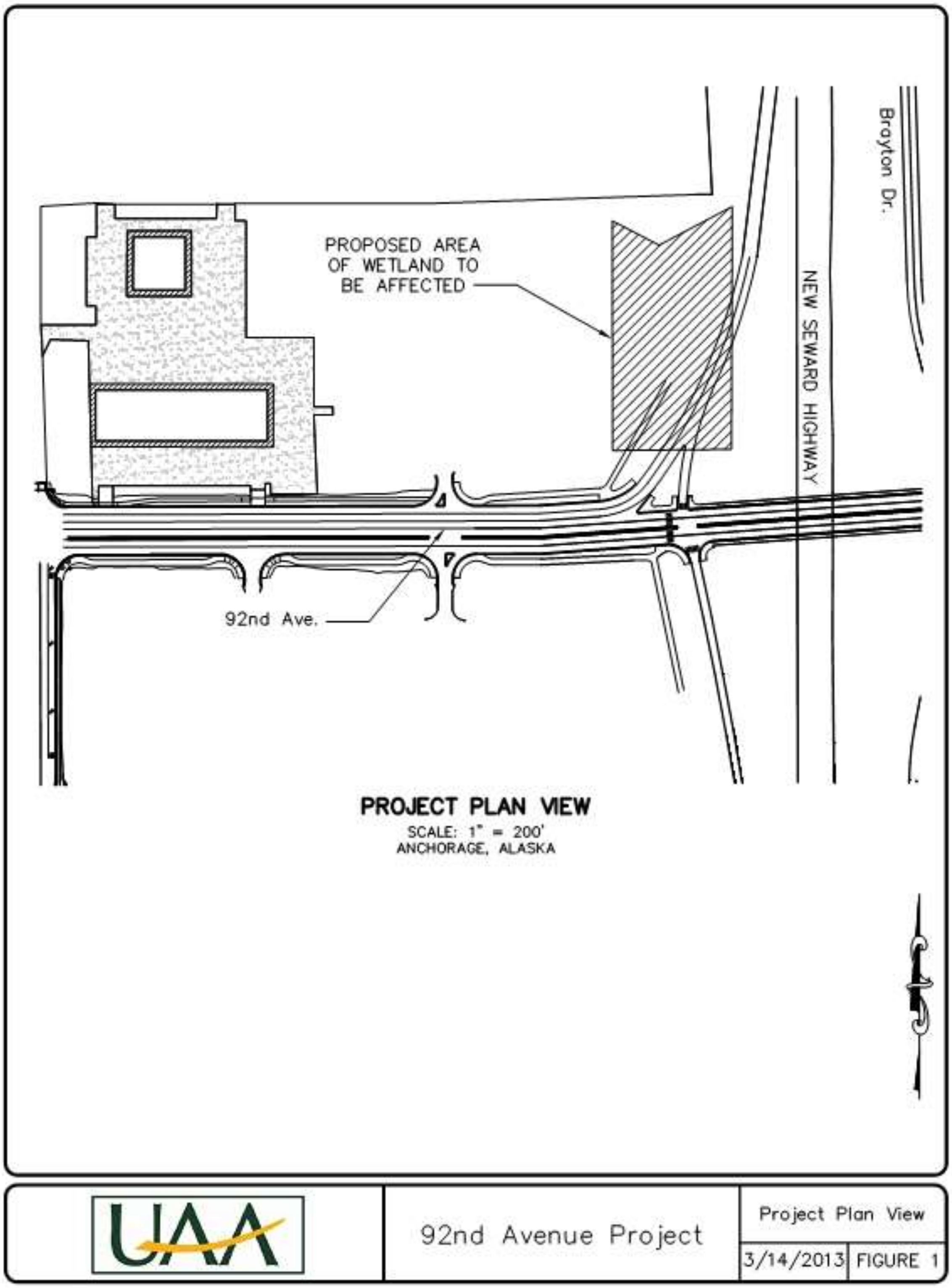
Permittee-responsible mitigation: an aquatic resource restoration, establishment, enhancement, and/or preservation activity undertaken by the permittee (or an authorized agent or contractor) to provide compensatory mitigation for which the permittee retains full responsibility.

Practicable: available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes.

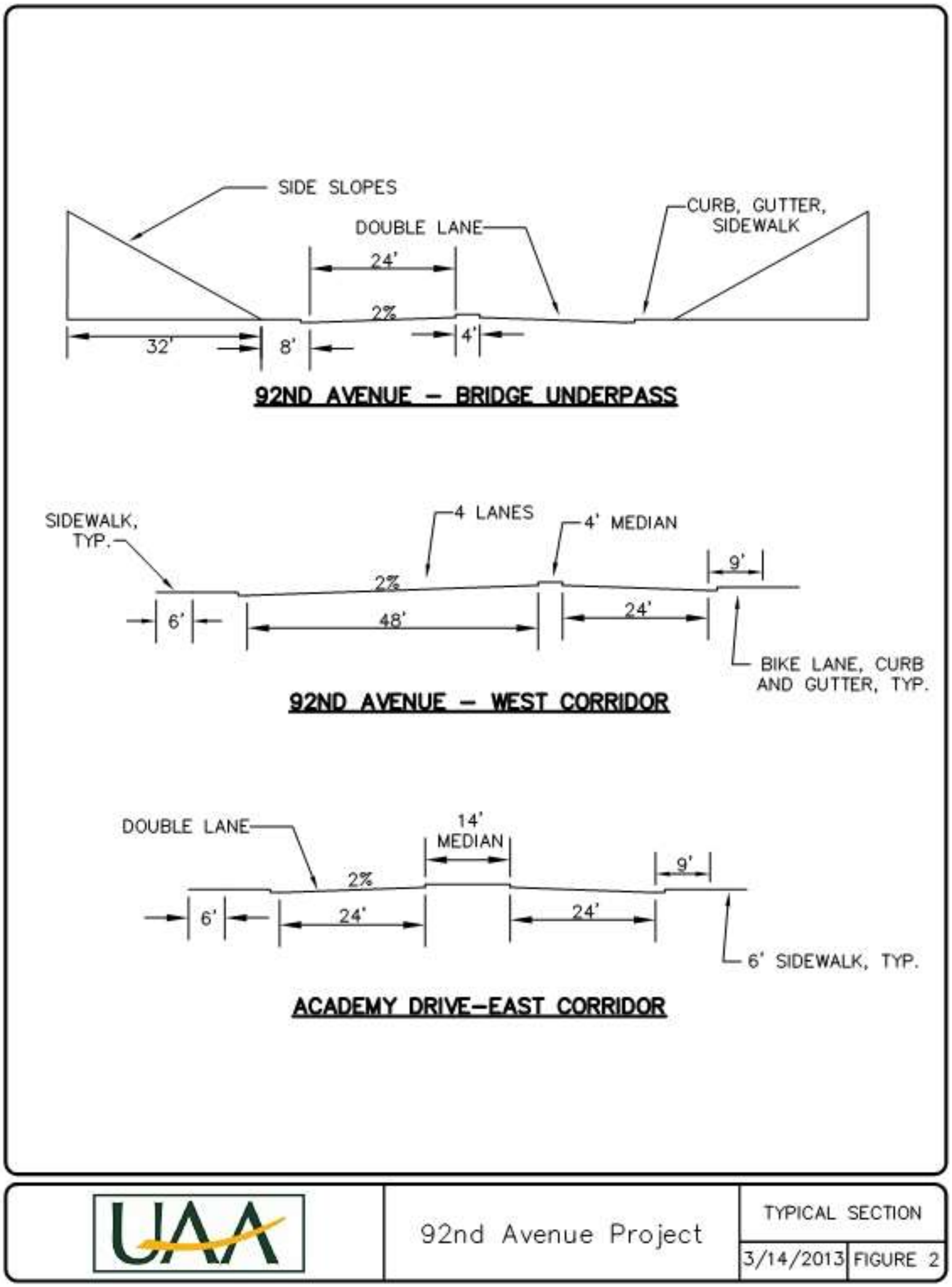
Preservation: the removal of a threat to, or preventing the decline of, aquatic resources by an action in or near those aquatic resources. This term includes activities commonly associated with the protection and maintenance of aquatic resources through the implementation of appropriate legal and physical mechanisms. Preservation does not result in a gain of aquatic resource area or functions.

Restoration: the manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former or degraded aquatic resource. For the purpose of tracking net gains in aquatic resource area, restoration is divided into two categories: re-establishment and rehabilitation.

H4.0 PLAN VIEW DRAWING



H5.0 TYPICAL CROSS SECTION



APPENDIX I: RIGHT-OF-WAY

I.1.0 ACQUISITION PROPERTIES

Table I.1.1. Projected ROW Property Costs

Land Acquisitions

Parcel ID#	Total Property Value	Total Area (ft^2)	Area of Land to Take (ft^2)	Fraction of Land to Take	Total Cost per Property ($)
014-281-01-000	$2,224,140	222,414	7514.2	0.033785	$75,142
014-281-05-000	$5,601,960	560,196	42673.8	0.076177	$426,738
016-262-02-000	$4,867,400	3242775	65424.4	0.020175	$98,202

Mobile Homes

Number of Homes	Average Cost Per Home	Total Cost of Homes
23	$28,000	$644,000

Σ	$1,244,083
Adjusted Total	**$1,741,716**

Table I.1.2. Summary of acquisition costs

SUMMARY	
Land Acquisition Value	$600,083
Mobile Homes Value	$644,000
Factor	1.4
Total	**$1,741,716**

I.2.0 References

Municipality of Anchorage Parcel Viewer.
http://munimaps.muni.org/website/anchorage/application/map.htm. 2013

APPENDIX J: PUBLIC INVOLVEMENT

J.1.0 MEETING NOTES

Below is a summary of the public meeting from March 14, 2013.

Seward Highway/
92nd Avenue
Grade Separation

Meeting Notes

SUBJECT:	New Seward Highway: 92nd Avenue Grade Connector
PROJECT NO.:	DOT Project No: 59770; B&A Project No: 3926.07
GROUP:	Public
DATE:	March 14, 2013
TIME:	7 – 8:15 pm
LOCATION:	Campbell Elementary School, Multipurpose Room 7206 Rovenna Street
MEETING OUTREACH:	Email notice of meeting and reminder to project contacts, email notice of venue change
MEETING ATTENDANCE:	24 individuals attended the meeting
MEETING MATERIALS:	Comment sheet, Aerial photo overlays with current and future project
STAFF PRESENT:	*Seawolf Engineering*: McKenzie Moss, David Darrington, Kristine Zajac, Jonathan Tymick, Erik Jordt, Charles Bang, Alma Abaza, Walter Graham *DOT & PF*: Jim Amundsen, Anne Brooks
MEETING INFORMATION:	

Attendees were greeted at the door and asked to sign-in and briefed on the open house format, location of materials, and availability of project staff to answer their questions. Information was available on the current and future projects. Staff members were on hand to answer questions.

District 4 assembly members Dick Traini and Elvi Gray-Jackson attended the meeting. Also in attendance were three firefighters from fire station 12, which is located in the Dimond area.

The following is a summary of the comments the project team received at the meeting in one-to-one conversations with project team members and the transcribed comment sheets received at the meeting:

One gentleman asked if a website was available for the project. It was explained that no media was used for this project due to the lack of actual public involvement. He then suggested a website be created to keep the public informed.

The firefighters voiced their support for this project, seeing that it provides them with an alternative route to get to their destination in 4 minutes or less.

The following comments were submitted in writing at the meeting:

> "Project seems to be a good, needed project. I look forward to future programs and funding."

> "Good class project; …"

> "Great presentation and great work! Glad to see this effort from students. I would like to see what impacts roundabouts would have and whether of not they would be a possibility. It would also be nice to see how the muni project at Academy/Vanguard/Abbott will affect this project."

Related documents on file:

Meeting graphics

Comments

J.2.0 REFERENCES

Brooks and Associates Public Involvement Notes. http://www.brooks-alaska.com/92ndAvenueDesign/public_involvement.html. 2013

APPENDIX K: COST ESTIMATION

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ACRONYMS

AKDOT…………………………………………… Alaska Department of Transportation
CS……………………………………………..……………….... Contingent Sum
CY……………………………………………………………..………… Cubic Yard
LF…………………………………………………………….............................Linear Foot
SF……………………………………………………………........................... Square Foot
ROW……………………………………………………………………... Right of Way
SY…………………………………………………………………….….... Square Yard
LS………………………………………………………………………….... Lump Sum

K 1.0 COST ESTIMATE

The overall project cost will include estimates from each of the technical teams.

Different cost estimating techniques were used to calculate the costs for parts of the project. Most items were calculated by the number amount or quantity of the item. This quantity would then be multiplied by a unit price. Other items were calculated by determining the length, area, or volume of the quantity and then multiplied by its unit cost. Some items will be listed as lump sum items. Lump sum items are composed of multiple smaller items added together.

K 2.0 RIGHT OF WAY ACQUISITION

This project requires purchasing parts of the surrounding lots and several mobile homes. Table 2 shows an estimated cost to acquire the land. These costs represent fair market prices for the year 2013.

Table K.1: ROW Costs	
LAND ACQUISITIONS	$840,116
MOBILE HOMES	$901,600
TOTAL ROW COST	**$1,741,716**

K 3.0 ENGINEER’S ESTIMATE

The engineer’s estimate is shown on Table 1. This estimate includes item numbers based on the numbering system in the State of Alaska Standard Specification for Highway Construction, pay item name, quantity, unit price, and total amount. An accurate estimate cannot be compiled until the project design and plan set have been finalized. All of the unit prices are accurate to 40% design; these prices are subject to change.

Table K.2: Engineer's Estimate

ESTIMATE OF QUANTITIES			
ITEM NO	ITEM DESCRIPTION	PAY UNIT	QUANTITY
201 (3B)	CLEARING & GRUBBING	AC	9
202 (2)	REMOVAL OF PAVEMENT	SY	40,944
202 (3)	REMOVAL OF SIDEWALK	SY	4,800
202 (9)	REMOVAL OF CURB AND GUTTER	LF	1,406
202 (17A)	REMOVE AND REINSTALL SIGN	EA	15
203 (3)	UNCLASSIFIED EXCAVATION	CY	17,240
203 (3A)	UNCLASSIFIED EXCAVATION (RETENTION POND)	CY	4,370
203 (6A)	BORROW, TYPE A	TON	286,322
205(1)	EXCAVATION FOR STRUCTURES	CY	500
205(3)	STRUCTURAL FILL	CY	1,500
301 (1)	AGGREGATE BASE COURSE, GRADING D-1	TON	9,887
306 (1)	ATB (ASPHALT TREATED BASE)	TON	9,909
401 (1A)	HOT MIX ASPHALT, TYPE V	TON	8,492
401 (2)	ASPHALT CEMENT, GRADE PC 52-28	TON	467
401 (6)	ASPHALT PRICE ADJUSTMENT	CS	1
410 (1)	TEMPORARY PAVEMENT (DETOURS)	TON	1,723
501 (1)	CLASS A CONCRETE	CY	73
501 (7)	PRECAST CONCRETE MEMBER (66' DECKED BULB TEE)	EA	20
505 (5A)	FURNISH STRUCTURAL STEEL PILES (HP 14X117)	LF	2,800
505 (6A)	DRIVE STRUCTURAL STEEL PILES (HP 14X117)	EA	40
507 (2)	PEDESTRIAN RAILING	LF	584
507 (4)	CONCRETE BARRIER	LF	1,700
507 (6)	PRECAST CONCRETE BARRIER	LF	143
508 (1)	WATERPROOFING MEMBRANE	SF	15,587
601 (1)	W-BEAM GUARDRAIL	LF	3,200
604 (1D)	OIL GRIT SEPERATOR	EA	1
604 (5)	INTEL, TYPE A	EA	14
605 (1A)	18" CORRUGATED STEEL PIPE	LF	493
605 (1B)	24" CORRUGATED STEEL PIPE	LF	1,545
605 (1C)	36" CORRUGATED STEEL PIPE	LF	200
606 (6)	REMOVING AND DISPOSING OF GUARDRAIL	LF	870
606 (9)	CONTROLLED RELEASE TERMINAL	EA	4

ESTIMATE OF QUANTITIES			
ITEM NO	ITEM DESCRIPTION	PAY UNIT	QUANTITY
606 (12)	GUARDRAIL TO BRIDGE RAIL CONNECTION	EA	4
608 (1A)	CONCRETE SIDEWALK, 4 INCHES THICK	SY	4,763
608 (6)	CURB RAMP	EA	22
609 (2)	CURB AND GUTTER, TYPE I	LF	5,191
611(1)	RIPRAP, CLASS I	CY	3,823
611 (1A)	RIPRAP, CLASS I (LID MATERIAL)	CY	3,600
615 (1)	STANDARD SIGN	SF	818
618 (1A)	SEEDING, SCHEDULE A	SY	40,000
619 (1)	NATIVE PLANTS	LS	1
620 (1)	TOPSOIL	SY	40,000
621 (1)	IMPERVIOUS SOIL	CY	3,823
630 (1)	GEOTEXTILE SEPARATION	SY	16,667
639 (6)	APPROACH	EA	5
640 (1)	MOBILIZATION AND DEMOBILIZATION	LS	1
641(1)	EROSION, SEDIMENT AND POLLUTION CONTROL ADMINISTRATION	LS	1
641(2)	TEMPORARY EROSION, SEDIMENT AND POLLUTION AMENDMENTS	CS	1
641 (6)	SWPPP PRICE ADJUSTMENT	CS	1
641 (7)	SWPPP MANAGER	CS	1
642 (1)	CONSTRUCTION SURVEYING	LS	1
643 (2)	TRAFFIC MAINTENANCE	LS	1
643 (15)	FLAGGING	CS	1
643 (25)	TRAFFIC CONTROL	CS	1
644 (1)	FIELD OFFICE	LS	1
645 (1)	TRAINING PROGRAM	HR	1,250
660 (1)	TRAFFIC SIGNAL SYSTEM COMPLETE, 92ND AVE.	LS	1
660 (2)	TRAFFIC SIGNAL SYSTEM COMPLETE, PEDESTRIAN CROSSING	LS	1
660 (3)	HIGHWAY LIGHTING SYSTEM COMPLETE	LS	1
662 (1)	RELOCATION OF ELECTRIC UTILITIES	LS	1
663 (1)	RELOCATION OF WATER AND SANITARY SEWERS UTILITIES	LS	1
665 (1)	RELOCATION OF TELEPHONE UTILITIES	LS	1
670 (1)	PAINTED TRAFFIC MARKINGS	LS	1

Table K.3: Total Project Cost	
Estimate of Quantities Total	$19,278,648
ROW Acquisition	$1,741,716
Contingency (20%)	$4,204,131
Construction Engineering (15%)	$3,153,098
Design Engineering (10% CE)	$31,531
Subtotal:	**$28,409,412**
ICAP (4.79%)	$1,360,811
TOTAL PROJECT COST	**$29,770,223**
TOTAL PROJECT COST (Rounded)	~ **$30,000,000**

K 4.0 REFERENCES

Alaska Department of Transportation and Public Facilities (2005). *Alaska Highway Preconstruction Manual.* Anchorage, AK.

Alaska Department of Transportation and Public Facilities (2004). *State of Alaska Standard Specifications, Highway Construction Manual,* Anchorage, AK.

Alaska Department of Transportation and Public Facilities (2011). *State of Alaska Bid Prices; West Dowling Project,* Anchorage, AK.

Municipality of Anchorage (2012). *Project Management and Engineering Department; Average Bid Tabs,* Anchorage, AK.

APPENDIX L: CONSTRUCTION PHASING

L1.0 INTRODUCTION

This appendix provides detailed information about the different phases during construction. There are a total of 4 main phases for this project with several sub-phases. Each phase and was divided up in order to decrease construction time and maximize work efficiency. The sub-phases are closely related to each main phase to accomplish a larger portion of the work in a shorter amount of time. The information below is general and may be specified by the general contractor.

L2.0 CONSTRUCTION PHASING

During construction, the traffic will be re-routed to different roads while maintaining the accessibility of all neighborhoods and businesses. Construction during night times will reduce delays and congestion. Traffic signs will be placed in construction areas to reduce confusion and reduce accidents. Aside from the Seward Highway off-ramp closure in phase 4, all other roads will stay open for traffic access.

L3.0 TRAFFIC CONTROL PLAN

The traffic control plan will include detour routes, temporary lane closures, and public notices to residents and businesses in the construction area. Proper construction signs will be utilized to increase traffic flow and decrease confusion. In addition to adequate signage, flaggers may be employed to reduce congestion during high traffic times. Refer to the construction phasing plan set for more information.