Northern Access to U-Med Design Study Report

Prepared for:

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NOTICE TO USERS

This report reflects the ideas and design of Civil Engineering Student of the University of Alaska, Anchorage participating in CE 438 Design of Civil Engineering Systems for spring semester 2014. Changes may occur as the project proceeds due to the design requirements. If contents of this report would like to be used, please contact the Department of Transportation and Public Facilities for the most current design. This report is a 35% submittal and may be missing information due to the time constraint for preparing this document.

PLANNING CONSISTENCY

The 2014 Seawolf Engineering Team prepared this report in accordance with currently accepted design standards and Federal Regulations, and with input offered by the state, municipal government, the affected public utilities and the public.

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LIST OF ACRONYMS

AWWU .... Anchorage Water and Wastewater Utility
AASHTO………………… American Association of State and Highway Transportation Officials
ACI…………………………………………………………..…American Concrete Institute
ACS..Alaska Communications Systems
APU ....Alaska Pacific University
CATV... Cable Television
CEA... Chugach Electric Association
DOT .... Alaska Department of Transportation and Public Facilities
GCI.. General Communications Incorporated
LOS..Level of Service
MOA .... Municipality of Anchorage
ROW .... Right Of Way
UAA……………………………………………………………...University Of Alaska, Anchorage
USACE ....United States Army Corps of Engineers

1.0 INTRODUCTION

The U-MED district is located in northeast Anchorage, Alaska. It has been identified as one of the largest growing employment centers in Anchorage and is expected to continue to grow over the next 20 years. From DOT's 2011 reconnaissance report, approximately 43% of the people traveling into this district make their trip from the north or east. With the current surrounding arterial roads, connectivity, safety, and congestion are major concerns. Figure 1.1 shows the U-MED district in the north-eastern portion of Anchorage Alaska.

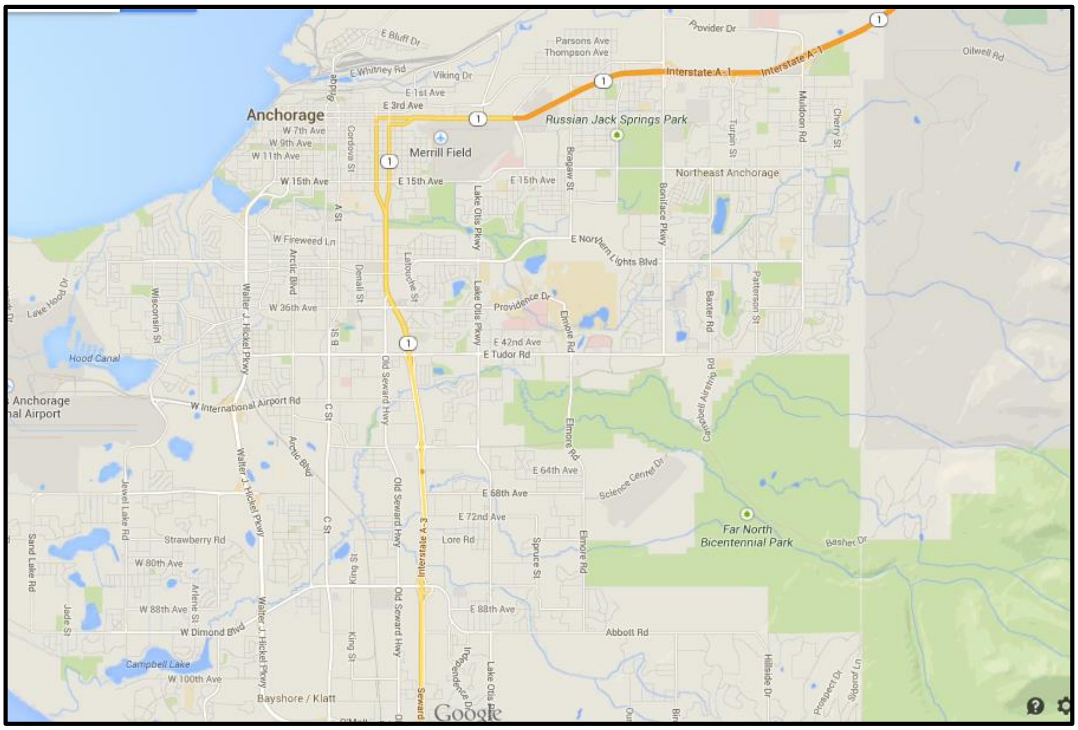

Figure 1. 1 Image of Anchorage Alaska from Google Maps

1.1 Objective

The purpose of this project is to provide better access to the U-MED district. With the addition of a road in the area, out-of-direction travel will be reduced; meaning faster travel times, less congestion, less air emissions, and safer surrounding intersections.

1.2 Project Need

DOT has recognized three very specific needs for this project. There is no direct access from the north or east. The arterial roads around the district are over capacity. The roads operate at poor levels of service during peak hours and the intersections have elevated crash rates. With the addition of a road through this area DOT believes that these issues can be fixed making this district ready for the projected growth of the seven stakeholders in this area. Figure 1.2 shows the stakeholders involved in this project. They include: UAA, APU, Providence Hospital, Alaska Native Tribal Health Consortium, MOA, South Central Foundation, and DOT.

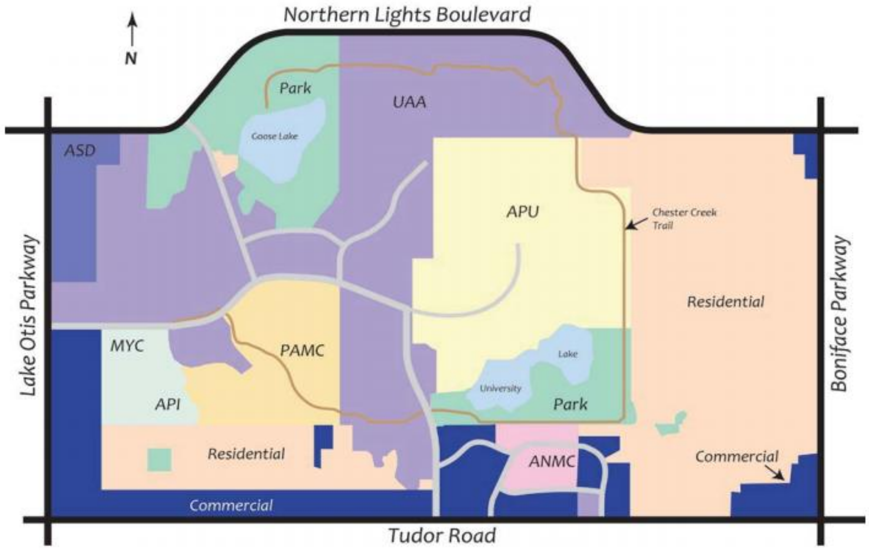

Figure 1. 2 U-Med District and Stakeholders from DOT's 2011 Reconnaissance Report[1]

2.0 EXISTING CONDITIONS

In the 2011 Reconnaissance report by DOT, there are 12 intersections that were reviewed for their LOS. Morning peak hours are from 7:30-8:30am. and evening peak hours are from 4:30-5:30pm. During each timeframe approximately half of the intersections are operating at LOS of E or F.

[1] Image from DOWL-HKM 2011 Reconnaissance Report prepared for DOT & PF

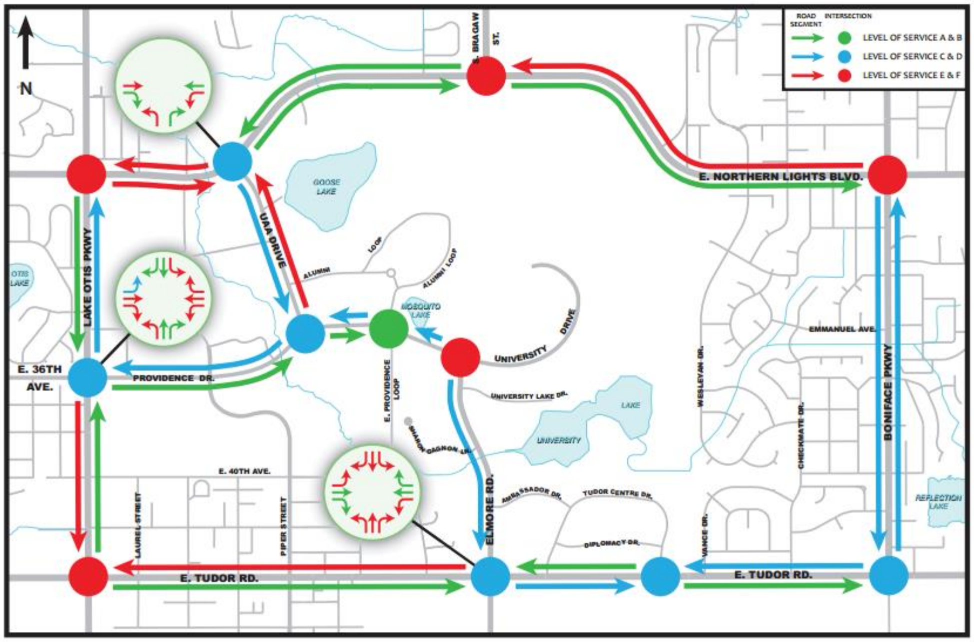

Figure 2. 1 Weekday Street and Intersection LOS for Morning Peak Hour[2]

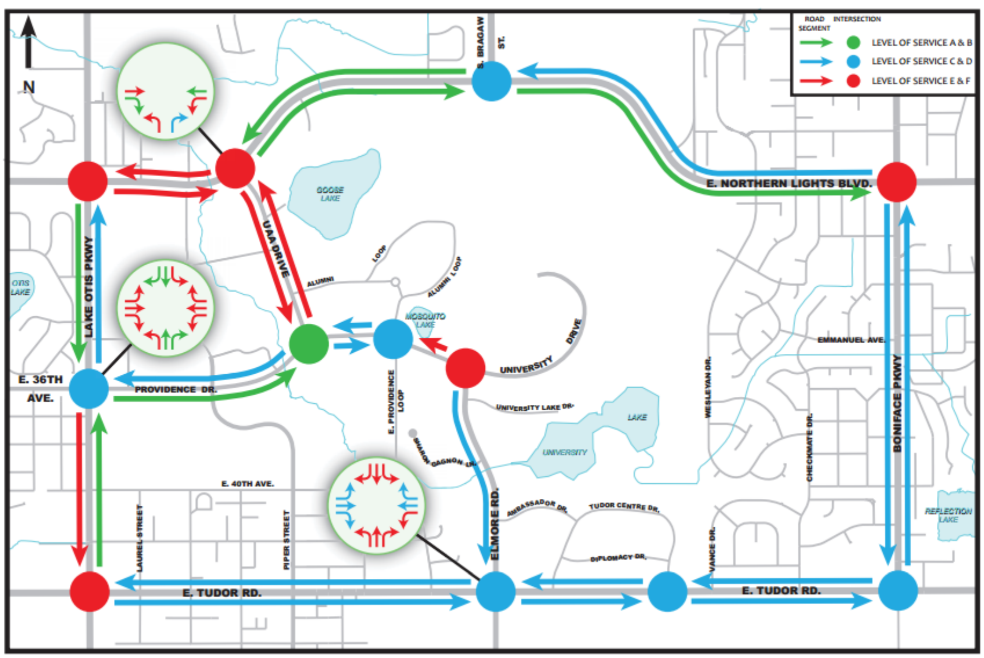

Figure 2. 2 Weekday Street and Intersection LOS for Evening Peak Hour[3]

As shown in figures 2.1 and 2.2, there is only one intersection at a time that is operating at a LOS of A or B. With growth in this district, more trips will be taking place which will decrease the LOS in each of these intersections. With the LOS being low at many of these intersections, safety for non-

[2] Image from DOWL-HKM 2011 Reconnaissance Report prepared for DOT & PF
[3] Image from DOWL-HKM 2011 Reconnaissance Report prepared for DOT & PF

motorized traffic is a concern. Many people in this district appreciate that there is a large green space in between the two universities. This invites many people who use other modes of transportation to the area. Runners, cyclists, and skiers use this area not only for employment or education, but also recreational activities.

The public transit system has eight routes that travel through and around the U-MED district. People Mover offers a U-Pass program for students, staff, and faculty of UAA, APU, and Charter College. This program gives the rider a free ride with school ID. This helps cut down on congestion and costly time delays that everyone in the area has to endure. With more people using the bus or non-motorized methods of transportation, the demand for parking is reduced. As the number of commuters grows, the strain on parking areas will become even more of a difficulty than it already is. Currently there are a limited number of parking areas and with the district growing, space that would otherwise be allocated for parking will be needed for buildings.

3.0 DESIGN STANDARDS

3.1 Sources

The standards used were based on several sources including the following publications and documents:

- A Policy on Geometric Design of Highways and Streets; American Association of State Highway and Transportation Officials (AASHTO), 2011
- Alaska Preconstruction Manual, AKDOT&PF, 2005
- Alaska Flexible Pavement Design Manual, AKDOT&PF, 2004
- Alaska Department of Transportation and Public Facilities. (2004). Standards and Specifications for Highway Construction.
- American Association of State and Highway Transportation Officials. (2009). LRFD Guide Specifications for Design of Pedestrian Bridges, 2nd Edition. Washington D.C.

Table 3. 1 Design Criteria

Project B. Northern Access to U-Med District		
New Construction		Sources/Comments
Design Functional Classification	Minor Arterial	
Design Year	2035	
Present ADT (& year)	14,602 (2013)	Traffic Analysis Report
Directional Split (%D)	50%	
Trucks (PPT)	4%	
Equivalent Single Axle Load (ESAL)	1,375,754	
Pavement Design Year	2035	
Design Vehicle	WB-50	
Design Speed	35 mph (posted at 30 mph)	
Stopping Sight Distance	250 ft.	2011 AASHTO GB table 7-1
Passing Sight Distance	550 ft.	2011 AASHTO GB table 7-1
Maximum Allowable Grade	N/A	PCM Fig 1120-1
Minimum Allowable Grade	.3%	PCM Fig 1120-1
Maximum Allowable Superelevation	6%	PCM Fig 1120-1
Minimum Allowable Radius of Curvature	340 ft.	2011 AASHTO GB table 3-7
Minimum K-value for Vertical Curves	Sag: 49 Crest: 29	2011 AASHTO GB table 3-34 2011 AASHTO GB table 3-36
Number of Roadways	1	
Number of Lanes	2	
Width of Traveled Way	24 ft.	
Width of Shoulders	5 ft	
Surface Treatment	HMA	PCM 1180-1
Cross Slope	-2%	PCM Fig 1130-1
Side Slope Ratios	Foreslope 4:1 Backslope 3:1	2011 AASHTO GB sec 4.8.4
Clear Zone	Fill: 16-18 ft. Cut: 14-16 ft.	
Degree of Access Control	None	
Median Treatment if Applicable	N/A	
Illumination		
Curb Usage and Type		
Bicycle Provisions	5 ft. bike lane, shared use path on E side	
Pedestrian Provisions	Shared use path on E side, sidewalk on W side	
Miscellaneous Criteria	Minimum Vertical Clearance: 17.5 ft. (ped bridge)	PCM table 1130-1

4.0 DESIGN ALTERNATIVES

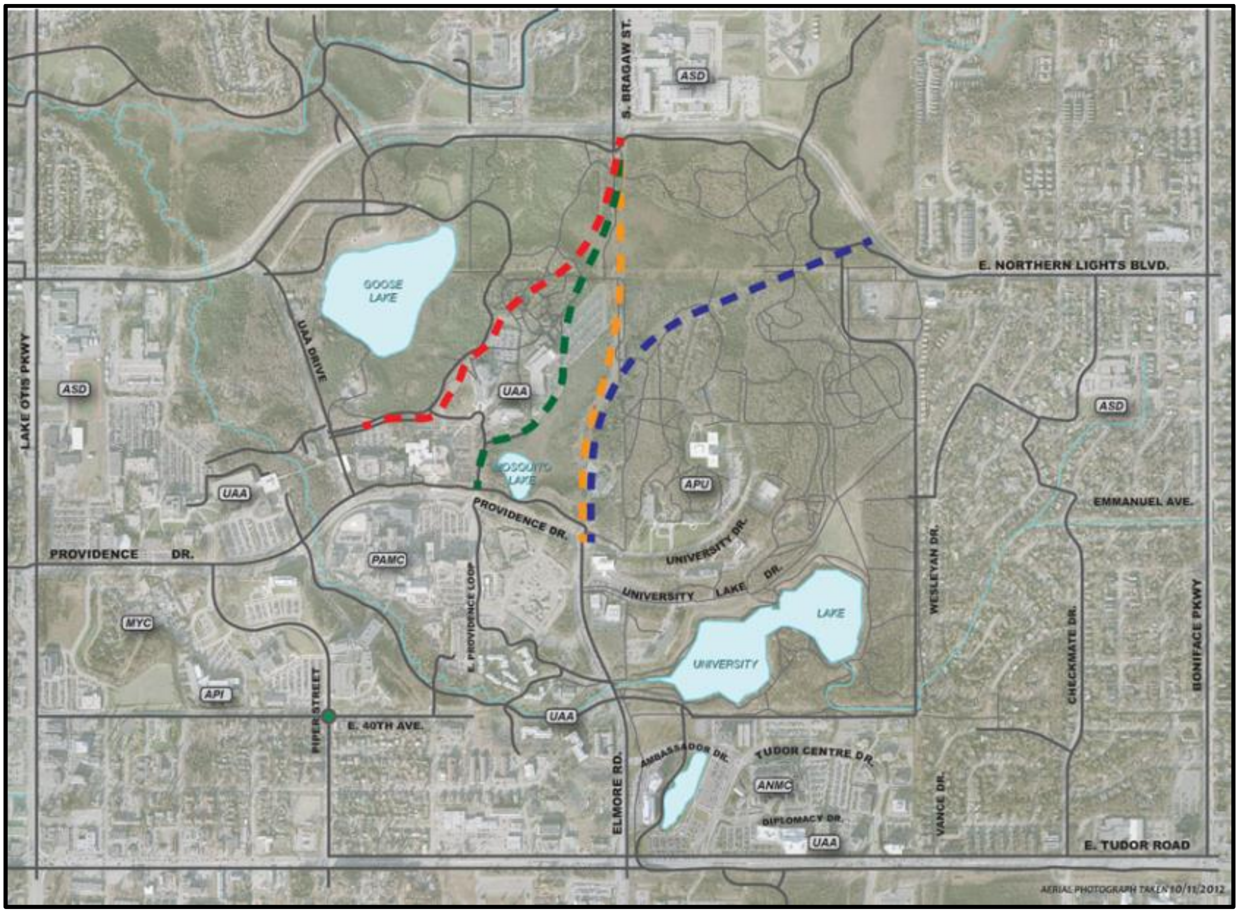

Figure 4. 1 Four Alternatives Chosen by DOT and DOWL-HKM[4]

4.1 Alternative I – No-Build Alternative

The no build option was rejected fairly quickly by DOT. This option does not meet the purpose and objective of the project. No build alternative would leave the intersections at low LOS and would be detrimental to the expected growth of the area.

4.2 Alternative II – Red

This red route uses part of UAA's existing road infrastructure. This would connect UAA Drive through Alumni Loop with Northern Lights Blvd.

4.3 Alternative III – Green

This option would connect Northern Lights Boulevard and Bragaw Street with Providence Drive. This option would also use UAA's existing road, Alumni Loop.

[4] Image from DOWL-HKM 2011 Reconnaissance Report prepared for DOT & PF

4.4 Alternative IV – Orange

This alternative would mostly follow the existing utility corridor connecting Bragaw St. and Providence Drive with a more direct route.

4.5 Alternative V – Purple

The purple route would start at Providence Drive and curve around APU through their land and connect with Northern Lights Blvd. at the S curve.

4.6 Overall Alternative Selection

The route that was chosen for Seawolf Engineering to design was the orange route. This route was selected based on the previous engineering education and stakeholder concerns.

The red route connected to UAA Drive. This alternative did not meet the need for lowering the LOS of the intersections. UAA Drive is already over capacity and with student crossing the road throughout the day this route was not the best option.

The green route was also rejected due to the fact that it uses Alumni Loop. This road can become very crowded throughout the day with student traveling to and from class. This is a small two lane road with a very low speed. There are students who choose to bike or walk around campus and adding more traffic in this area causes a major safety concern for the pedestrians and the motorized traffic.

The purple route was initially rejected by the group because of the concern of the public and stakeholders about APU land. The purple route cuts through APU which could hinder their future expansion and also take away a majority of their trail system. APU has an extensive Skiing program that send students to the Olympics. Keeping the trails in this district is a very important aspect of this project.

The orange route was selected because it has a direct route through the area. This became very important when considering the Providence Hospital and their emergency responders. University of Alaska has also decided that if the design had UAA in mind and it fit with the Master Plan, then they would take the ROW money and return it to the project in order to help pay for items that would benefit the university.

5.0 ROADWAY GEOMETRY

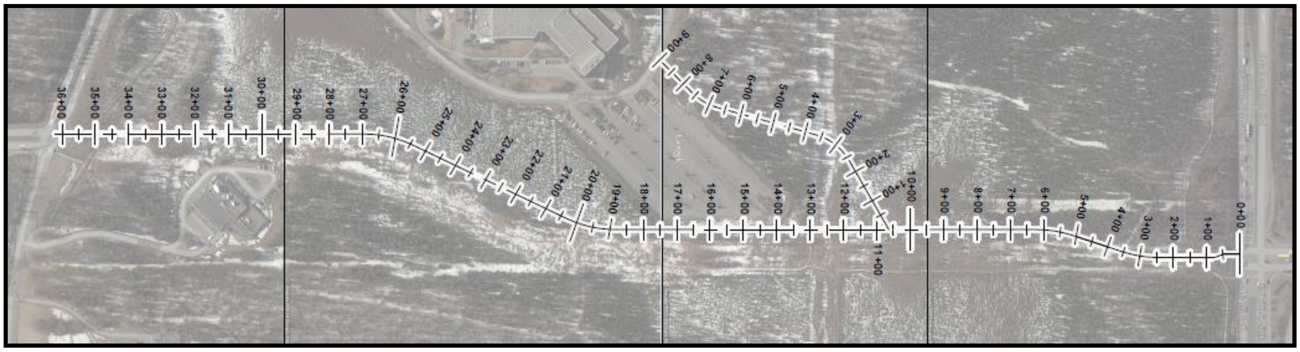

Figure 5. 1 Road Alignment with Stationing

The above figure, Figure 5.1, shows the main road alignment with the East Campus Access road, and stationing for both. The main road is 3620 feet long running from Northern Lights Boulevard, Station 0+00, to Providence Drive, station 36+19.9. The design speed for this alignment is 35mph, with a posted speed of 30mph.There is an access road for the East end of the University of Alaska campus that stems off of the main alignment. The design speed and posted speed for the campus access road are 25mph and 20 mph respectively.

5.1 Main Alignment

Along the main alignment there is a round-about which offers traffic calming for the road way as well as a connection point for the East campus access road. There are also four curves along main alignment.

- Roundabout : Center Stationing: 10+64.1

- First Curve: Beginning Station: 2+45.2
  End Station: 3+51.6
  Curve Length: 106.4 feet
  Radius: R = 340 feet

- Second Curve: Beginning Station: 5+11.1
  End Station: 6+19.4
  Curve Length: 108.3 feet
  Radius: R = 340 feet

- Third Curve: Beginning Station: 18+83.4
  End Station: 20+30.1
  Curve Length: 146.7 feet
  Radius: R = 340 feet

- Fourth Curve: Beginning Station: 25+42.7
  End Station: 26+95.3
  Curve Length: 152.6 feet
  Radius: R = 340 feet

5.2 East Campus Access Alignment

The east campus access road connects the main alignment to Alumni Drive on the East end of the University of Alaska campus. This alignment has 2 curves in it and connects to Alumni Drive on the West side of the Fine Arts Building Parking Lot. This alignment begins at station 10+64.1 of the main road alignment, and is 902.8 feet long.

- First Curve: Beginning Station: 2+38.6
  End Station: 3+66.8
  Curve Length: 128.2 feet
  Radius: 165 feet

- Second Curve: Beginning Station: 6+75.5
  End Station: 7+60.5
  Curve Length: 85 feet
  Radius: 165 feet

The curves on both alignments were designed in accordance with the 2011 AASHTO Green Book, table 3-7. And the traffic calming roundabout meets the Federal Highway Administrations design criteria.

6.0 PAVEMENT DESIGN

Pavement Design was conducted using the 1993 American Association of State Highway and Transportation Officials (AASHTO) Flexible Pavement Structural Design Method along with the Alaska Flexible Pavement Design Manual and the Alaska Highway Preconstruction Manual.

6.1 Main Line

The chosen alternative for the pavement type for the main line consists of rubberized hot mix asphalt and an asphalt treated base course. The following is recommended for the roadway pavement structure:

- Two and a half (2.5) inches of Hot Mix Asphalt Type R, over
- Three (3) inches of Asphalt Treated Base, over
- Three (3) inches of Crushed Aggregate Base Course, over
- Forty (40) inches minimum of Selected Material, Type A

6.2 Pedestrian Facilities

The pavement structure for the sidewalk and the shared use pathway were found using standard thicknesses provided in the Alaska Highway Preconstruction Manual.

6.2.1 Sidewalk

The following is recommended for the sidewalk pavement structure:

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

6.2.2 Shared Use Path

The following is recommended for the shared use path pavement structure:

- Two (2) inches of Hot Mix Asphalt, over
- Four (4) inches of Crushed Aggregate Base Course, over
- Twenty-four (24) minimum of Selected Material, Type A

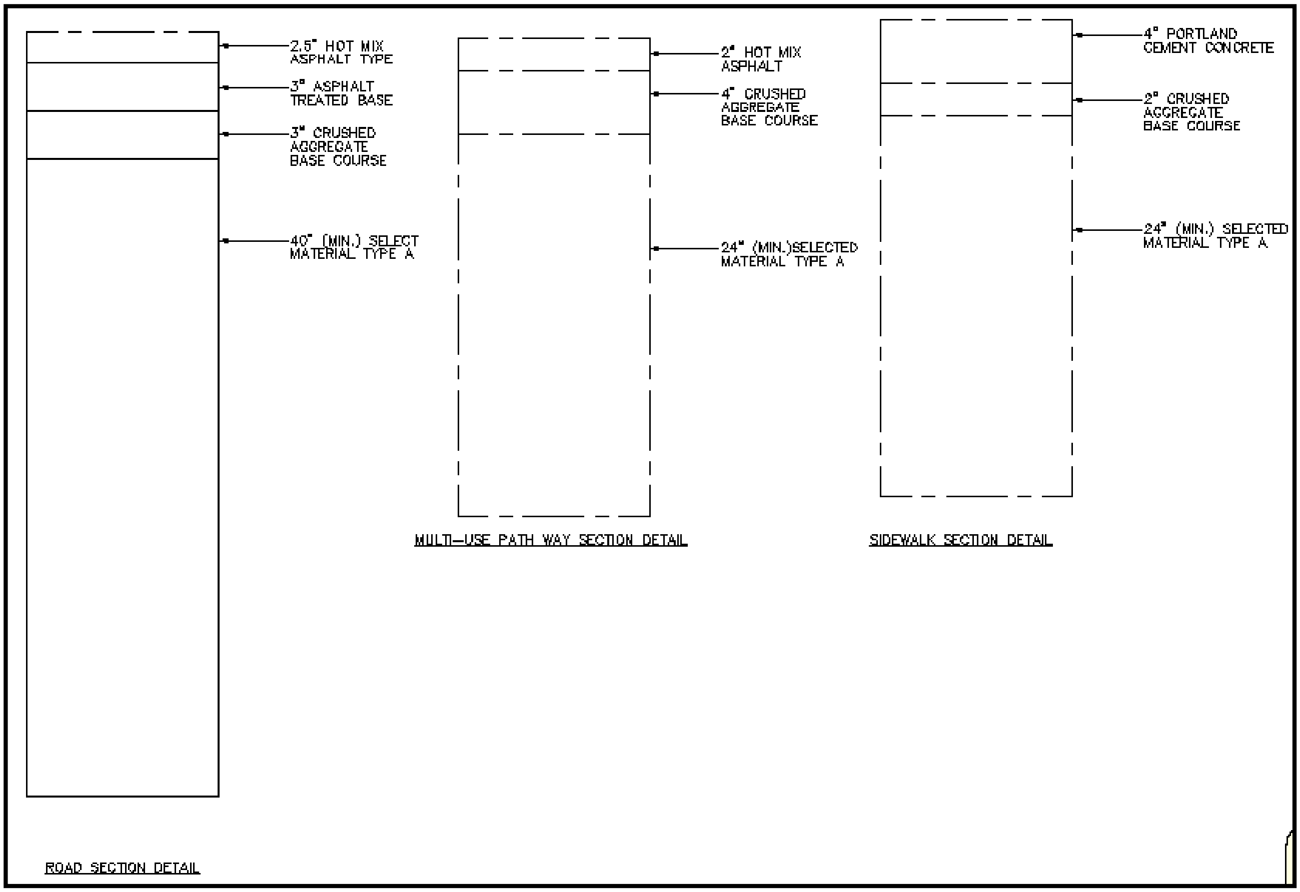

Figure 6. 1 Pavement Design Drawings

7.0 PEDESTRIAN BRIDGE STRUCTURES

This section provides an outline of the pedestrian bridge crossing the roadway. A more detailed description can be found in Appendix B. The objective of this project is to mitigate the influence the new roadway will have on the local trails and pathways. This was accomplished by creating a grade-separated intersection just south of the intersection of Northern Lights and the new roadway.

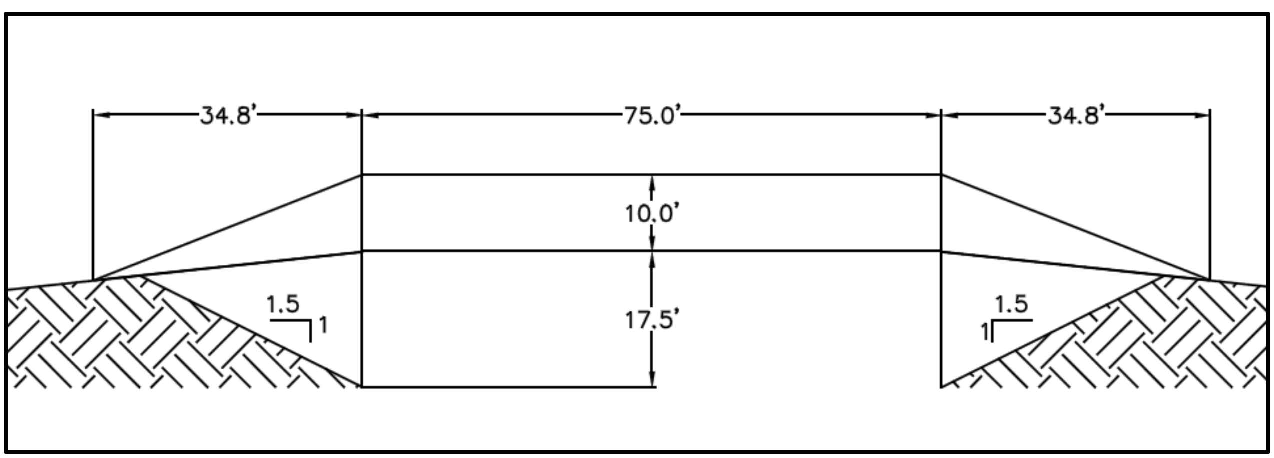

Figure 7. 1 Pedestrian Bridge

7.1 Project Description

The U-Med Bridge will cross the new roadway just south of the Northern Lights and Bragaw intersection. All structures meet Federal Highway Administration (FHWA) and Americans with Disabilities Act (ADA) handicap accessibility requirements. Construction shall be performed adhering to Alaska DOT Standards and Specifications for Highway Construction 2004.

7.2 Recommendations

Primary building material:

- Glued-laminated timber members constructed of Douglas Fir laminated using adhesives rated for use in wet conditions and treated with pressure preservatives

Connections:

- Galvanized bolts, screws and drive spikes conforming to ASTM A 307

Bridge supports:

- Cast-in-place concrete piers (primary span)
- Shallow concrete footings within soil embankments (secondary spans)

Bridge specifications:

- Deck width – 10 feet
- Total span – 144.6 feet
- Minimum height – 17.5 feet

Embankment Slopes:

- Trail approach and departure – 8% as specified by FHWA regulations
- Side slopes – rise to run of 1 to 2
- Back slopes – rise to run of 1 to 2

8.0 ENVIRONMENTAL

8.1 Analysis of Existing Conditions

The area of study's existing environmental conditions were determined through review of pertinent documents prepared by DOWL HKM. Those documents included the 2009 Preliminary Wetlands Reconnaissance and Functions and Values Assessment, 2010 Hydrology Reconnaissance Report, and the 2010 Abbreviated Phase I Environmental Site Assessment. From the document review, it was found that the selected alignment would affect various wetlands and, therefore, would require specialized wetlands permitting.

The project area contains Class A, B, and C Wetlands (Fig. 8.1) as classified by the Municipality of Anchorage. Wetlands are ranked in terms of determined value with Class A being of the highest value. Class A Wetlands are recommended to be preserved. Class B Wetlands are of moderate to high value and are suggested to be conserved. Finally, Class C Wetlands are developable, low-value wetlands. Wetlands serve many important functions including providing flood control, purifying groundwater and surface water flows, offering breeding and nesting grounds for various species of animals and insects, as well as supporting complete, viable ecosystems. Alteration of high valued wetlands, such as what will be encountered for this project, requires responsible documentation and mitigation. Since the chosen alignment alternative will disturb Class A, B, and C Wetlands, it will be necessary to obtain a Section 404 Permit from the U.S. Army Corps of Engineers (USACE) along with a 401 Certificate of Reasonable Assurance from the Alaska Department of Environmental Conservation (AKDEC).

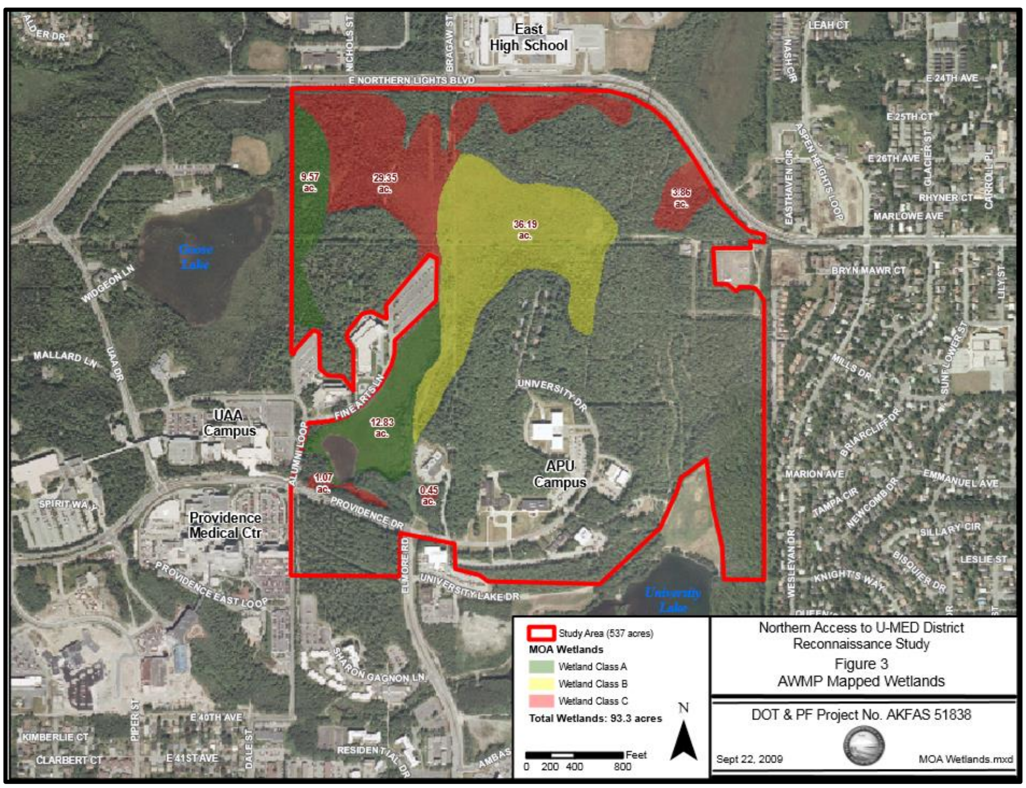

Figure 8. 1 U-Med District Wetlands[5]

[5] Municipality of Anchorage Reconnaissance Study

9.0 STORM WATER CONTROL

9.1 Objective

In the design, the selected alternative will properly route roadway precipitation and snowmelt, as well as maintain the naturally occurring drainage of the area. Considering the impacts of urbanization to the naturally occurring wetlands drainage is also an important part of the selected design.

9.2 Existing Conditions

Within our project area, most of the land cover is classified as wetlands. The wetlands surrounding the proposed project can provide storage and runoff-volume reduction from the expected roadway storm water. The hydrologic analysis provided that the volume of expected runoff from a storm event is relatively small in comparison with the drainage basin of the project area. Knowing that runoff can be treated without the need for a large storm drain system, the use of bioswales and rain gardens were given large consideration.

9.3 Recommendations

On the west side of the roadway, the edge of pavement will meet with a curbed sidewalk. Here it will be necessary to install storm drains. The storm drains will drain back into the wetlands via outfalls. On the east side of the road the edge of pavement will meet with a bioswale or rain garden so that half the expected runoff can infiltrate directly into the ground. It is suggested that the vertical alignment of the road be adjusted such to create positive drainage to approved outfall areas.

Culverts will also be necessary as the existing ground water is at or near ground level. Our recommendation is concurrent with that of DOWL HKMs preliminary geotechnical report in placing equilibrium culverts throughout the roadway base to maintain the current drainage patterns of the area.

10.0 GEOTECHNICAL

Existing conditions for this project corridor were researched through hundreds of borehole logs collected over a span of more than 20 years by multiple consulting firms. Using logs that outlined our project corridor we found that the existing material was mainly peat along with silt and sandy silt materials. Peat deposits are in the range of 1’ to 18’ deep throughout the proposed project corridor. This along with seasonal high ground water levels anywhere between 1’ to 8’ below the existing ground make this a challenging project but not unlike many other areas in Anchorage. Though the existing material does vary somewhat with less peat and lower ground water levels seen at the northern most section of the project near the intersection of Bragaw Street and Nothern Lights Boulevard, the majority of existing material is unusable as a roadway foundation. Large quantities of excavation and fill material will likely be required. It is recommended at this time that the unsuitable soils be excavated and trucked to an offsite disposal facility. This material is to be replaced by type A borrow.

10.1 Recommendations

Large quantities of excavation and fill material will be required. It is recommended at this time that the unsuitable soils be excavated and trucked to an offsite disposal facility. This material is to be replaced by type A borrow. Dewatering during construction will also be necessary using a wellpoint system to draw water out during excavation.

11.0 UTILITY RELOCATION AND COORDINATION

This section summarizes the existing utilities within the project area, as well as the utility conflicts and proposed relocations. The Utility Conflict Report is included in *Appendix F*.

11.1 Existing Utilities

The following is a list of the existing utilities within the project area.

11.1.1 Wastewater - Anchorage Water and Wastewater Utilities (AWWU)

AWWU operates the following water utilities within the project area:

- Northern Lights to Providence Drive
  - 48 inch Ductile Iron Pipe – Reinforced concrete
- Southeast edge of UAA Fine Arts Parking Lot
  - 8 inch Ductile Iron Pipe – ties into 48 inch Main Line

11.1.2 Natural Gas - ENSTAR

ENSTAR operates the following natural gas utilities within the project area:

- Northern Lights to Providence Drive
  - 12 inch Transmission Line

11.1.3 Electric – Anchorage Municipal Light & Power (ML&P)

ML&P operates the following electric utilities within the project area:

- Northern Lights to north of UAA Fine Arts Parking Lot
  - Overhead 34.5 kV Electric Line
- Crosses Proposed Project north of UAA Fine Arts Parking Lot
  - Two overhead 34.5 kV Electric Lines

11.1.4 Electric – Chugach Electric Association, Inc. (CEA)

CEA operates the following electric utilities within the project area:

- Northern Lights to north of UAA Fine Arts Parking Lot
  - Overhead 34.5 kV Electric Line
- Crosses Proposed Project north of UAA Fine Arts Parking Lot
  - Overhead 34.5 kV Electric Line

11.1.5 Communication – GCI Cable, Inc.

GCI owns and operates the following communication facilities within the proposed project area:

- South end of new route
  - A 30 strand Fiber Optic cable
  - A .750 inch coaxial cable
  - A .875 inch coaxial cable

11.2 Utility Conflicts and Proposed Relocations

11.2.1 AWWU

- The 48 inch wastewater pipe will need to be replaced at the north end of new route if not buried 10 feet or more under road.
- The 48 inch wastewater pipe will need to be replaced at the south end of new route if not buried 10 feet or more under road.
- The 8 inch ductile iron wastewater pipe connecting UAA Fine Arts Building to Main Line will need to be removed and replaced if not buried 10 feet or more under road.

11.2.2 ENSTAR

- The 12 inch Transmission Pipeline at the north end of new route will need to be worked around and protected.

- The 12 inch Transmission Pipeline at the south end of new route will need to be worked around and protected.

11.2.3 ML&P

- Poles 91A, 91C, 91B, 99A, and 99B will need to be removed and overhead lines will need to be placed underground using trenches or boring.

11.2.4 CEA

- Poles T79 (ML&P 91C) and T80 (ML&P 91A) will need to be removed and overhead lines will need to be placed underground using trenches or boring.

11.2.5 GCI Cable, Inc.

- A 30 strand Fiber Optic cable located at the intersection of Providence Drive/University Drive and Bragaw Street will need to be relocated for Alaska Public Media building.
- A .750 inch coaxial cable that crosses the south end of the new route will need to be relocated.
- A .875 inch coaxial cable that crosses the south end of the new route will need to be relocated.

11.3 Utility Extensions

This new road will require street lighting, which will require power that will be provided by either ML&P or CEA and maintained by MOA. Relocation of existing street lights at the intersections of Bragaw Street and Northern Lights Boulevard and at Elmore Road and Providence Drive may be necessary. It is recommended to use energy-saving LED street lights throughout the project. Using LED street lights will also require lower maintenance costs.

12.0 RIGHT-OF-WAY

12.1 Existing Right-of-Way

Right now, there is no existing right-of-way along the proposed route. The land between Northern Lights Boulevard and Elmore Road is owned by the University of Alaska or Alaska Pacific University.

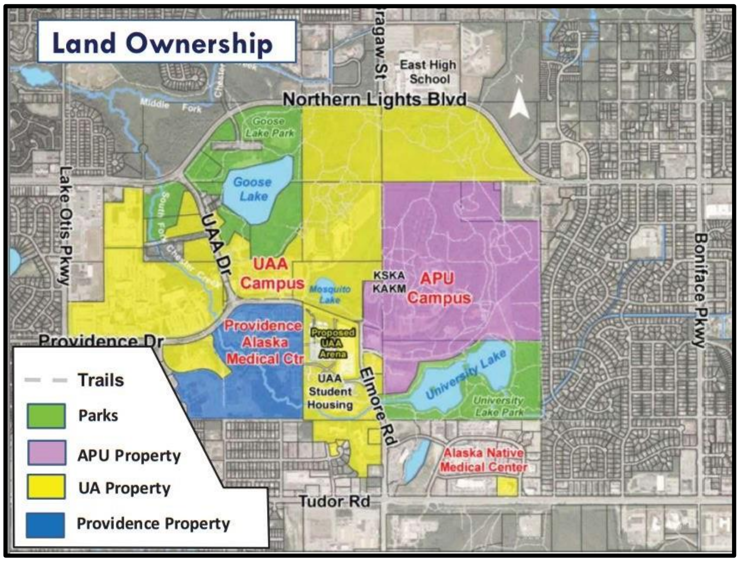

Figure 12. 1 U-Med Land Ownership[6]

12.2 Right-of-Way Acquisition

The proposed ROW is located on property owned by UA. If the SOA was to purchase the land needed, the amount would be minimum $6.7 million at $18 per square foot (information provided by DOWL/DOT). UA has offered to reinvest the ROW money back into the project with stipulations. The orange route that directly connects Elmore Road and Bragaw Street corresponds to the University's Master Plan. The money that would be used to purchase the land will be instead used for upgrades that will enhance UAA's property for future development. UA has asked for an additional roundabout on the north portion of the road and additional trail crossings. At the time of this report, other items on the agenda are unknown to this project group.

It has been determined that the ROW width will vary between 80 feet and 120 feet. The larger width allows for the need of roundabouts and bus pullouts throughout the project. For this project, the CE 438 class is working parallel with DOWL-HKM on this project. DOT & PF has given the class specific directions to not create the same design. With that in mind, the Engineers Estimate might not directly reflect the entire cost of the project.

Table 12. 1 Engineer's Estimate for ROW

Land Area	374,616 ft
Price per square foot	$18/ft^2
Calculated Cost	$6,743,088
Estimated Cost	$7,000,000

[6] Image from DOWL-HKM 2011 Reconnaissance Report prepared for DOT & PF

13.0 COST ESTIMATE

Table 13. 1 Cost Estimate

Cost Estimate	
Engineers Design	$1,500,000
Right-of-Way and Land Acquisition	$7,000,000
Utilities	$360,000
Environmental	$700,000
Geotechnical	$2,400,000
Pedestrian Structure	$240,000
Pavement	$2,200,000
4.79% ICAP	$661,020
Total	$15,100,000

14.0 PERMITTING

14.1 Required Permits

The necessary environmental permits for the Northern U-Med Access Project are summarized below in Table 14.1.

Table 14. 1 Required Environmental Permits and Agencies

Permit	Permitting Agency
Section 404 Permit	U.S. Army Corps of Engineers (USACE)
Section 401 Permit	Alaska Department of Environmental Conservation (AKDEC)

14.2 Recommendations

It is recommended that the Sections 401 and 404 Permits be applied for and obtained due to the foreseeable environmental impacts of this project.

The USACE-issued Section 404 Permit is required since the construction of this project will involve the discharge of dredged or fill material into valuable wetlands. The permit arose as a condition of the 1972 Clean Water Act (CWA) in order to protect the nation's navigable waters and to aid in the mitigation of any damage accrued through disturbance of said waters. A completed Section 404 Permit Application as pertaining to this project is included in Appendix C.

A required piece of the 404 Permit process is to provide a mitigation statement. As outlined in USACE 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." Since the project takes place within the Municipality of Anchorage, the Anchorage Debit-Credit Method (ADCM) and In-Lieu-Fee Program will be utilized to meet the mitigation requirements. The mitigation statement and fee calculations can be found in Appendix C.

In conjunction with the Section 404 Permit, it is necessary to comply with the AKDEC regulations and obtain a Section 401 Certificate of Reasonable Assurance. The 401 Certificate was defined in the CWA to "…provide an opportunity for such certifying State, or, if appropriate, the interstate agency or the Administrator to review the manner in which the facility or activity shall be operated or conducted for the purposes of assuring that applicable effluent limitations or other limitations or other applicable water quality requirements will not be violated." (Clean Water Act 1972).

15.0 PUBLIC INVOLVEMENT

The purpose of public involvement is to identify and coordinate with the stakeholders that will be involved throughout the project. With early preparation, the stakeholders and public might have input on the decisions that affect the outcome of the project. With constructive concerns and comments, the project is likely to benefit the public's needs and preferences.

15.1 Stakeholder Participation

The Elmore Extension Project includes seven stakeholders that are in the U-MED area. The stakeholders have attended meetings with DOWL-HKM and DOT since the beginning of the project. The comments and concerns from the stakeholders are reviewed continuously to ensure the best possible outcome.

15.2 Methods

There are a variety of ways that DOWL has allowed for public involvement. Public meetings, community council meetings, stakeholder meetings, project website, project email distribution, flyer/poster distribution, display boards, and campus meetings are all ways that have welcomed comments and concerns.

Over 200 comments and concerns have been collected since 2013 through the various methods of communication. DOWL and DOT continues to make serious efforts to work with the public to calm the nerves of the community. Through the stakeholders' efforts and cooperation, the community continues to see changes in the project that are beneficial to the people and the environment.

15.3 Public Concerns

Using the comments that DOWL received from the concerned public, the four main issues affecting this project are the noise, environment, trails and speeding. These issues have been addressed throughout the suggested design. Noise will be addressed through the selection of the pavement and keeping as much natural barrier as possible to make it seem like the noise is being reduced. For the environment, permitting will be done to minimize the lasting effects on the land. For the route that was chosen the alignment minimizes the impact to wetlands type A. There will be a pedestrian overpass located towards the northern end of the road to allow access for recreationalists to cross traffic unimpeded. The trails will be realigned to allow for the Tour of Anchorage pathway to cross over the road. The road will also have a sidewalk and a multi-use pathway to allow pedestrian users the ability to travel the length of the corridor. To address the speeding issue, the speed will be posted at 30mph and the roundabout will be posted at 15mph. The selected alignment has two S curves to also help cut down on the speeding.

16.0 TRAFFIC

From the UAA Master Plan, public concern, and Alaska DOT guidelines, the primary goals of the project with regard to traffic were developed and include the following:

- Avoid creating a cut-through corridor
- Improve pedestrian and bicycle facilities as part of the UAA Master Plan
- Decrease network delay for surrounding area

16.1 Traffic Calming

In order to lower the amount of cut-through traffic, the corridor must be undesirable to drivers looking for a quick path through the area. Therefore, the best method for lowering cut-through traffic is to calm traffic through the road by various methods to slow down traffic. Some of the methods considered include gateway treatments, roundabouts, narrowing lanes, and medians.

16.1.1 Gateway Treatments

A gateway treatment is a traffic calming installation designed to slow traffic entering a lower-speed environment. A gateway treatment may include special landscaping, raised crosswalks, or signage used at the entrance of a residential district, or simply some special lane markings on a rural highway as it enters a town center. In all applications, such treatments signal drivers that they are entering a lower speed street segment, where they should reduce their speed, exercise more caution, and expect slower traffic, cross-traffic, turning vehicles, bicyclists, and/or pedestrians.

16.1.2 Roundabouts

Roundabouts require traffic to circulate counterclockwise around a center island. Roundabouts are used on higher volume streets to allocate right-of-way between competing movements, and they can moderate traffic speeds on roads up to the size of an arterial. They are generally aesthetically pleasing if well landscaped.

16.1.3 Narrowing Lanes

Lane narrowing is a method of visual traffic calming. Visual traffic calming changes to roads have been shown to cause more attentive driving, reduced speeds, reduced crashes, and a greater tendency to yield to pedestrians. Narrowing traffic lanes differs from other road treatments by making slower speeds seem more natural to drivers and less of an artificial imposition as opposed to most other treatments, which physically force lower speeds or restrict route choice.

16.1.4 Medians

Raised medians are often used leading up to intersections and roundabouts. A median is a section of raised curb to separate the opposite directions of traffic. This has a similar effect to lane narrowing and is often used in conjunction with lane narrowing. The median can also serve as a pedestrian refuge while crossing the road, such as at roundabouts where all approaches are split by wide medians.

16.2 Pedestrian Facilities

The UAA Campus Facilities Master Plan Update (2009) identifies a design guideline for circulation: "Minimize the need for the use of automobiles on campus by increased transit and shuttle use, improvement of pedestrian circulation, provision of lockers, and other means." With this in mind, the pedestrian facilities were designed to allow ease of access to campus through multiple non-motorized transportation methods. They were also designed to conform to the guidelines presented in the *2004 AASHTO Policy on Geometric Design of Highways and Streets* and the *FHWA Course on Bicycle and Pedestrian Transportation.*

Pedestrian facilities will include:

- 6' pedestrian sidewalk
- 6' multi-purpose path
- Pedestrian overpass
- 6' bike lane on each side of roadway

16.2.1 Sidewalk

To conform to the University Master Plan referenced above, the project must accommodate pedestrian commuters to the university. A pedestrian sidewalk with a width of 6 feet will be constructed on west side of roadway to ease campus access for pedestrians. Standardized sidewalk pavement structure from AKDOT will be used.

The sidewalk structure consists of:

- 4" of Portland Cement Concrete, over
- 2" of Crushed Aggregate Base Course, over
- 24" of Select Material, Type A

16.2.2 Multi-Purpose Path

Much of the public concern about this project stems from the project area being popular for recreational uses such as skiing, jogging, and biking. To allow recreational use of the area, a multi-purpose path with a width of 6 feet will be constructed on the east side of the roadway, separated from the roadway by about 6 feet. This path can be utilized for transportation and recreation as it will connect to existing paths on the east side of the roadway. In the summer it will accommodate joggers and cyclists and during winter it can be used for skiing.

16.2.3 Pedestrian Overpass

To accommodate pedestrian access to campus by the trail system and maintain functionality of existing trails, a pedestrian overpass will be constructed. The overpass will be ramped to allow skiers to use it to cross to the trails on the opposite side. Details are discussed further in structural section.

16.2.4 Bike Lanes

Following the University Master Plan referenced above, a bike lane on each side of the road aids in the goal of reducing automobile use on campus. It also contributes to greater sustainability. The 2013 campus master plan states that "Over time, pedestrians and bicyclists will dominate the campus, with vehicular movement and parking elegantly accommodated on the periphery." Bike lanes on each side conform to the future goals stated in the master plan.

16.3 Traffic Analysis

This project is designed to alleviate traffic congestion in the U-Med district. The primary goal of this traffic analysis is to examine the effect of the new corridor on existing roadways in the immediate vicinity. Currently, vehicles coming from the northeast direction to the U-Med district must come in through the Northern Lights Blvd/UAA Drive intersection, which is currently very congested at peak hours. Providing an additional access route from the northeast side will improve network capacity and reduce congestion at the Northern Lights Blvd/UAA Drive intersection.

The alternatives that were analyzed include the no-build option and the proposed new route. Both alternatives were analyzed for a design year of 2030. This analysis is based on a 2011 Traffic Analysis Report prepared by DOWL HKM.

16.3.1 Data Collection

The traffic data collected for this analysis was obtained using data from the Alaska DOT&PF as well as data from traffic studies performed by DOWL HKM. Calculated growth rates were obtained for all routes in the U-Med district by analyzing traffic volumes for each route from 2000 to 2007 in the Alaska DOT&PF "2007 Central Region Annual Traffic Volume Report." With the calculated growth rates, the 2007 AADT volumes were converted to 2011 AADT volumes for existing traffic analysis. Peak hour turning movements were obtained from turning movement counts conducted by DOWL HKM in 2009 during morning and afternoon peak hours.

16.3.2 Methodology

This traffic analysis was performed to examine existing conditions in 2011 for the U-Med network to use as a comparison tool for the new project. The morning and afternoon peak hour level of service, delay, and volume-over-capacity (v/c) ratios were used as measurements to determine the overall condition of the network. Analysis was then performed on the 2030 traffic conditions of the U-Med network for two options. The two options are the network with and without the new road. This produced a measurable difference between the two options.

Level of Service is defined by the expected delay experienced by a vehicle at a signalized intersection or roundabout. A LOS of C is considered an appropriate level of service in accordance with AASHTO GDHS guidelines. According to the Highway Capacity Manual, a certain level of service corresponds to a specific amount of delay per vehicle, as shown in table 16.1.

Table 16. 1 Signalized Intersection LOS, HCM 2010

Level of Service	Delay (s/veh)
A	<10
B	>10-20
C	>20-35
D	>35-55
E	>55-80
F	>80

16.3.3 Existing Traffic Analysis

The morning and afternoon peak hour level of service, delay, and volume-over-capacity (v/c) ratios were computed for each intersection in the U-Med district using the Synchro 7.0 and SimTraffic software. The analysis used existing lane configurations, signal cycle lengths, phasing splits, offsets, peak hour factors, and traffic controls. The morning and afternoon peak hour levels of service, delays, and volume-over-capacity (v/c) ratios for the U-Med district are shown in table 16.2.

Table 16. 2 Existing Traffic Summary

Intersection	Morning Peak			Afternoon Peak		
	LOS	Delay(s)	V/C	LOS	Delay(s)	V/C
Northern Lights / Lake Otis	F	94.0	1.12	F	97.9	1.15
Northern Lights / UAA	D	45.8	1.06	E	60.0	1.07
Northern Lights / Bragaw	F	148.2	1.31	D	36.4	0.88
Northern Lights / Boniface	F	83.7	1.15	E	69.5	1.05
Providence / Lake Otis	D	38.9	0.89	D	44.6	0.88
Providence / UAA	C	21.1	0.52	B	19.2	0.74
Providence / Alumni	B	11.1	0.38	C	23.2	0.72
Providence / Elmore	E	35.5	-	F	214.0	-
Tudor / Lake Otis	F	105.3	1.09	F	110.5	1.25
Tudor / Elmore	C	34.3	0.67	D	49.5	0.94
Tudor / Tudor Center	C	24.0	0.70	C	29.5	0.76
Tudor / Boniface	D	43.3	0.55	D	50.4	0.94

Network performance for the U-Med district was also analyzed using SimTraffic. The performance indicators analyzed include total network delay, vehicle demand, turning movement demand, and average vehicle delay in the network. The data presented in table 16.3 presents an existing baseline to demonstrate the differences in the future traffic analysis.

Table 16. 3 Existing Network Performance

Network Perfomance Indicator	AM Peak Hour	PM Peak Hour
Total Vehicle Demand(veh/hr)	13,916	14,521
Unserved Vehicle Demand(veh/hr)	514	698
Total Turning Movement Demand(mvmnt/hr)	42,670	49,070
Unserved Turning Movement Demand(mvmnt/hr)	2,088	1,579
Total System Delay(hr)	806.0	886.0
Average Delay(secs/veh)	216.5	230.7

16.3.4 Future Traffic Analysis

For the future traffic analysis, growth rates were estimated from existing data. Calculated growth rates were obtained for all routes in the U-Med district by analyzing traffic volumes for each route from 2000 to 2007 in the Alaska DOT&PF *2007 Central Region Annual Traffic Volume Report*. These calculated growth rates were used to estimate a conservative future growth rate estimate for use in the traffic analysis, as shown in table 16.4.

Table 16. 4 Growth Rates for U-Med Network

Roadway	Calculated Growth Rates	Growth Rate Used In The Analysis
East Tudor Road	-0.70%	1.00%
Elmore Road-South Bragaw Street	2.20%	1.00%
Boniface Parkway	0.71%	1.00%
Lake Otis Parkway	-0.60%	1.00%
East Northern Lights Boulevard	0.80%	1.00%
Providence Drive - 36th Avenue	-1.40%	1.00%
UAA Drive	3.10%	1.00%

For the future traffic analysis, two options were considered. The first was the no-build option, which was used to analyze the condition of the network if nothing is changed. The numbers from the no-build option were then used to compare the relative delay reduction produced by the new link. The second option analyzed was the new link option. The network was analyzed with the new link between Elmore Rd. and Bragaw St. Each intersection in the U-Med network was analyzed for level of service, average delay, and volume-over-capacity ratio at 2030 traffic volumes using Synchro. This data is shown in table 16.5.

Table 16. 5 2030 Traffic Summary

Intersection	No-Build			W/ New Link		
	LOS	Delay(s)	V/C	LOS	Delay(s)	V/C
Northern Lights / Lake Otis	F	118.8	1.24	F	116.2	1.19
Northern Lights / UAA	C	21.9	0.88	C	20.0	0.84
Northern Lights / Bragaw	B	17.8	0.65	D	46.7	0.95
Northern Lights / Boniface	F	83.4	1.15	F	99.9	1.35
Providence / Lake Otis	E	58.2	1.05	D	50.4	0.99
Providence / UAA	D	35.1	0.76	B	13.9	0.44
Providence / Alumni	C	22.6	0.74	C	24.5	0.66
Providence / Elmore	A	8.2	0.61	B	12.9	0.76
Tudor / Lake Otis	F	152.2	1.42	F	131.2	1.35
Tudor / Elmore	E	63.0	1.04	D	54.8	1.03
Tudor / Tudor Center	D	54.3	0.92	C	21.9	0.85
Tudor / Boniface	F	114.6	1.34	F	90.2	1.24

Network performance for 2030 was also analyzed using SimTraffic. The performance indicators analyzed include total network delay, vehicle demand, turning movement demand, and average vehicle delay in the network for morning and afternoon peak hours on each build option. This data is shown in Table 16.6. The percent reduction in average delay for morning and afternoon peak hours from the new link option was computed by comparing the average delays from the new link and no-build options. For the new link traffic model in 2030, the morning peak hour had a 25.9% reduction in average delay and the afternoon peak hour had an 11.5% reduction in delay compared to the no-build option.

Table 16. 6 2030 Network Performance

	No-Build		W/ New Link	
Network Performance Indicator	**AM Peak Hour**	**PM Peak Hour**	**AM Peak Hour**	**PM Peak Hour**
Total Vehicle Demand(veh/hr)	16,729	15,842	16,737	15840
Unserved Vehicle Demand(veh/hr)	1,714	1,347	1,108	1134
Total Turning Movement Demand(mvmnt/hr)	50,482	50,473	49,201	49447
Unserved Turning Movement Demand(mvmnt/hr)	4,435	2,854	3,081	2317
Total System Delay(hr)	1,305.0	1,020.0	1,006.0	916.0
Average Delay(secs/veh)	312.9	253.3	231.7	224.2
Reduction In Average Delay(%) Compared to No-Build Option	N/A	N/A	25.9%	11.5%

Appendix

TABLE OF APPENDICES

NORTHERN ACCESS TO U-MED
DESIGN STUDY REPORT

APPENDIX A
PAVEMENT DESIGN

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LIST OF ACRONYMS

AASHTO………………….. American Association of State Highway & Transportation Officials

AADT………………………………………………………... Average Annual Daily Traffic

AKDOT ………………………………..……………. Alaska Department of Transportation

ATB…………………………………………….....……………..… Asphalt Treated Base

a_i………………………………………………………………………….Layer Coefficient

ESAL……………………..……………………………………… Equivalent Single-Axle Load

HMA…………………………………………………..………………… Hot Mix Asphalt

M_R……………………………………………....………….…...…… Resilient Modulus

PSI….………………………………………………………... Present Serviceability Index

SN……………………..………………………….....…………………….... Structural Number

A.1 INTRODUCTION

This document summarizes the pavement design recommendations for the Northern Access to U-Med District.

A.2 DESIGN METHODS

Roadway pavement structures were developed using the 1993 American Association of State Highway and Transportation Officials (AASHTO) Flexible Pavement Structural Design Method which uses empirical performance equations obtained from the AASHO Road Test. References are also made to the Alaska Flexible Pavement Design Manual and the Alaska Highway Preconstruction Manual.

A.3 DESIGN CRITERIA

The AASHTO design procedure includes several design variables including analysis period, traffic loading, reliability, environmental effects, serviceability, and subgrade support.

A.3.1 Analysis Period

The analysis period is the period of time the pavement structure is designed to perform. An analysis period of 20 years was chosen, a typical design life for a road of this classification.

A.3.2 Traffic Loading

The traffic loading design variable is calculated as a cumulative expected 18-kip equivalent single-axle load (ESAL). ESAL calculations are a factor of several variables including Average Annual Daily Traffic (AADT), truck factor, growth factor, directional distribution factor, and lane distribution factor. ESALs were calculated using the ESAL Calculator provided in the Alaska Flexible Pavement Design Manual, this can be seen in Figure 1. Factors used are included in Table 1.

A.3.2.1 AADT

Average Annual Daily Traffic (AADT) of 14,602 was used in the ESAL calculations. This value can be found in Part 2 of the 2011 Traffic Analysis Report provided by DOWL HKM.

A.3.2.2 Truck Factor

A typical distribution of truck classes based on highway classification can be found in Table 6.9 of *Pavement Analysis and Design*. This distribution was then applied to a heavy vehicle percentage of 4% found in Appendices Part 5a of the 2011 Traffic Analysis Report.

A.3.2.3 Growth Factor

A growth factor is used to project ESALs over the analysis period of the design, factors include a yearly rate of traffic growth and the design life of the project. The 2035 Metropolitan Transportation Plan (MTP) included in the Anchorage Metropolitan Area Transportation Solutions (AMATS) gives values between 1 and 1.5% growth rate for the anchorage area, an AKDOT recommended value of 1.2% was used.

A.3.2.4 Directional Distribution

Traffic in each direction was assumed equal and therefore a directional distribution of .5 is applicable.

A.3.2.5 Lane Distribution Factor

For a two-lane highway there is only one lane in each direction and therefore is the design lane and the lane distribution factor is 100%.

Table 1. ESAL Factors

ADT	14602
Growth rate %	1.2
% Trucks	4
Truck Factor	0.07
Growth Factor	22.45
Directional	1
Lane Factor	0.5
Design Period	20

Design Data Input

Design Construction Year:	2015
Design Length in Years:	20
Base Year:	2015
Base Year Total AADT:	14600
Growth Rate % per Year:	1.2

% of Base Year AADT for Each Lane

Lane	%
1	50
2	50
3	0
4	0
5	0
6	0

Truck Category	Load Factor (ESALs per Truck)	% AADT in Truck Category
2-Axle	0.5	3.72
3-Axle	0.85	0.08
4-Axle	1.2	0.08
5-Axle	1.55	0.12
>=6-Axle	2.24	0.04

TOTAL DESIGN ESALs:

1,375,754

Figure 1. ESAL Calculator

A.3.3 Reliability

Based on the classification of the highway the suggested level of reliability is 80-99 percent. A conservative value of 95% was chosen. A typical standard error for flexible pavements of .45 was used.

A.3.4 Environmental Effects

Long term effects of temperature and moisture were not addressed in the reduction of serviceability. These concerns were instead considered in the selection of materials and analysis of native soils.

A.3.5 Serviceability

Another design variable in the AASHTO flexible design method is the change in serviceability. An initial serviceability index value of 4.2 is typical for flexible pavements while a terminal serviceability index of 2.5 is acceptable for major highway.

A.3.6 Subgrade Support

The effective roadbed soil resilient modulus (M_R) is an equivalent modulus that is representative of the same damage that would result if seasonal modulus values were actually used. Typical values for subgrade, base courses, and surface courses were found in the Alaska Preconstruction Manual. The lowest values based on season were used to be conservative.

A.3.7 Structural Number

The structural number is a numerical characterization of the structural strength of a given pavement. The structural number is a function of layer thicknesses, layer coefficients and drainage coefficients.

A.3.7.1 Layer Coefficient

The layer coefficient a_i is a measure of the relative ability of a unit thickness of a given material to function as a structural component of the pavement. Later coefficients were found using the typical M_R found in the Alaska Preconstruction Manual and charts in the AASHTO Guide for Design of Pavement Structures that relate M_R and layer coefficient. These charts can be seen in Figures 2 and 3.

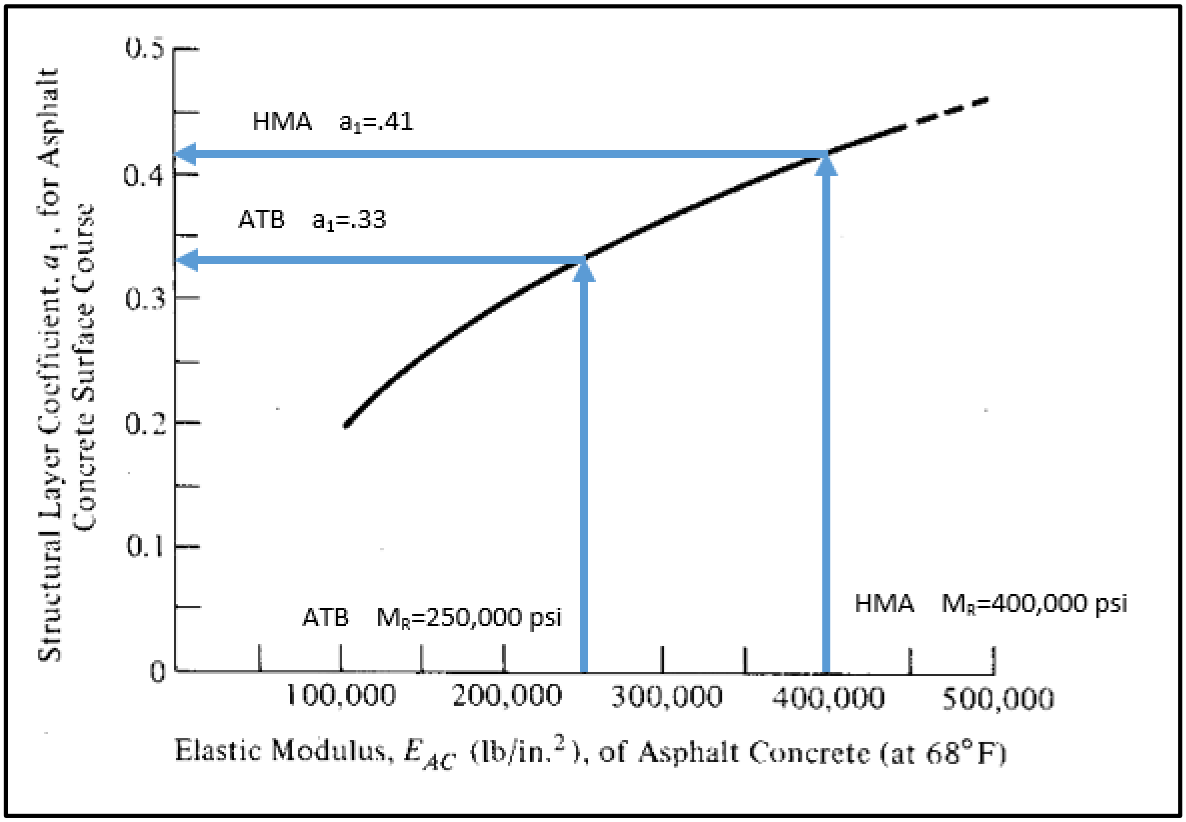

Figure 2. Structural Layer Coefficient (HMA/ATB)

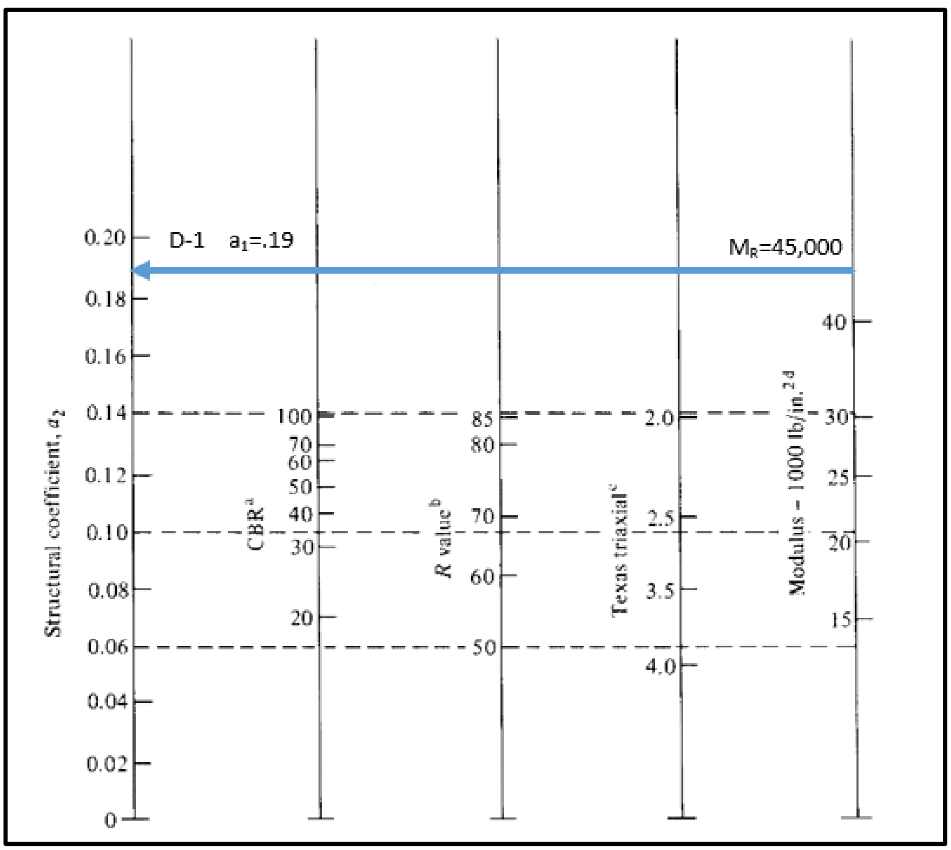

Figure 3. Structural Layer Coefficient (D-1)

A.3.7.2 Drainage Coefficient

Depending on quality of drainage and presence of moisture drainage coefficients can be applied to modify layer coefficients. Drainage coefficients were assumed to 1.0.

A.3.7.3 Layer Thickness

A set of layer thicknesses was determined based on the required structural number using the 1993 AASHTO Flexible Pavement Design empirical equation. Assumptions and variables used to determine the required structural number can be seen in Table 2. Calculated thicknesses and structural numbers for each layer are included in Table 3. As recommended by DOWL HKM the entire pavement structure will be four feet to avoid heaving of frost-susceptible subgrade. Once thicknesses were calculated for surface and base courses Selected Material A was used to obtain the full four foot depth.

Table 2. Structural Number Variables

ESAL	1375754
Analysis Period	20 years
Reliability	95%
Standard Error	0.45
ΔPSI	1.7

Table 3. Structural Numbers and Depths

	Mr (ksi)	a	SN calculated	Depth calculated	Depth used	SN used
Hot Mix Asphalt	400,000	0.41	0.94	2.29	2.5	1.03
Asphalt Treated Base	250,000	0.33	1.99	2.92	3	2.02
Aggregate Base Course	45,000	0.19	2.49	2.53	3	2.59
Selected Material	25,000	-	-	-	-	-

The following is recommended for the roadway pavement structure:

- Two and a half (2.5) inches of Hot Mix Asphalt Type, over
- Three (3) inches of Asphalt Treated Base, over
- Three (3) inches of Crushed Aggregate Base Course, over
- Forty (40) inches minimum of Selected Material, Type A

A.4 ROADWAY ALTERNATIVES

A.4.1 Alternative I

Alternative I consists of Hot Mix Asphalt (HMA) Type II, Class A over crushed aggregate base course over Selected Material type A. This is a typical pavement structure used on most project in Anchorage and throughout Alaska because it uses locally available materials and has a relatively low costs.

HMA consists of a mixture of asphalt cement and well-graded aggregate. According to the Alaska Flexible Pavement Design Manual HMA is recommended for use in all stable embankment areas with AADTs greater than 1,000 or significant truck volumes. The class of the HMA is determined by the gradation of aggregate, mix design, and compaction during construction. Class A, the strongest class of HMA, is specified by AKDOT for roadways with design ESALs of greater than 1,000,000.

The base course will consist of typical crushed aggregate D-1. To provide support for the base Selected Material Type A is recommended for the subbase layer. Due to the high water table a geotextile below the subbase is recommended to reduce clogging of the drainage layers and maintain structural support of the base layers.

A.4.2 Alternative II

Alternative II will utilize Hot Mix Asphalt Type V, Class A for the surface course. HMA Type V is a Superpave mix design that requires the use of hard aggregates. Hard aggregate is aggregate that is more resistant to abrasion, determined in the Los Angeles abrasion test, typically resulting in about 10 percent abrasion lost during testing. Hard aggregates result in a pavement that maintains skid resistance and resists fatigue and surface deterioration more than typical pavement structures with lower quality aggregate. These aggregates tend to be igneous rocks and are only available in select locations in Alaska. Most aggregate produced in Alaska is sedimentary rock of much lower quality.

Alternative II will also use crushed aggregate D-1 as a base course and Selected Material A as the subbase with a geotextile fabric below.

A.4.3 Alternative III

Alternative III consists of Hot Mix Asphalt Type R, Class A over Asphalt Treated Base (ATB) over crushed aggregate base course over Selected Material Type A.HMA Type R, or rubberized hot mix asphalt, is a mix design that incorporates crumb rubber as an aggregate. Crumb rubber is made from recycled tires.

The use of crumb rubber in the mix design has many advantages, especially in cold climates. Rubberized HMA helps to resist thermal cracking during freeze-thaw cycles and large temperature changes and also minimizes deformation due to rutting, both of which are prevalent issues in Alaska. Rubber has been shown to increase skid resistance and minimize friction problem due to surface deterioration. Adding rubber to the mix design can also help with noise reduction, absorbing more traffic noise than traditional pavement. The incorporation of crumb rubber increases the cost of materials but has a longer life span requiring less maintenance costs.

The addition of crumb rubber to the mix design results in a lower resilient modulus than traditional HMA. To account for the decrease in structural strength an Asphalt Treated Base (ATB) is recommended as the base course for Alternative III. ATB is a stabilized base course with the addition of an asphalt binder additive.

Alternative III will also use crushed aggregate D-1 as a base course and Selected Material A as the subbase with a geotextile fabric below.

A.5 RECOMMENDATIONS

The recommended pavement structure is Alternative III, Hot Mix Asphalt Type R over Asphalt Treated Base over Crushed Aggregate over Selected Material A. This alternative was chosen due to its many advantages that align very well with the project location and environment.

Rubberized HMA performs better than traditional HMA in cold environments resisting thermal cracking and rutting, which are the primary concern for pavement failure throughout Anchorage. The increased skid resistance that results from the addition of rubber helps with safety, an important aspect of a highway located in on a university campus surrounded by a heavily used trail network.

Rubberized HMA has greater noise reducing qualities than traditional HMA, this will help address public concerns about disruption to the existing trails and surrounding neighborhoods due to traffic. HMA Type R uses recycled materials for crumb rubber which reduces environmental impacts and contributes to the UAA Master Plan, which lists Sustainability as one of its key themes.

The use of an Asphalt Treated Base provides structural support to compensate for the lower resilient modulus of the rubberized HMA. The ATB also acts as an extra waterproof layer in the pavement structure that reduces infiltration through the pavement and helps prevent the loss of fines and clogging of the drainage layers.

A.6 PEDESTRIAN FACILITIES

The pavement structure for the sidewalk and the shared use pathway were found using standard thicknesses provided in the Alaska Highway Preconstruction Manual.

A.6.2Sidewalk

The following is recommended for the sidewalk pavement structure:

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

A.6.2Shared Use Path

The following is recommended for the shared use path pavement structure:

- Two (2) inches of Hot Mix Asphalt, over
- Four (4) inches of Crushed Aggregate Base Course, over
- Twenty-four (24) minimum of Selected Material, Type A

A.7 COST ESTIMATE

Cost estimations for the pavement structure was completed using layer thickness and dimensions. Unit prices were found using AKDOT&PF BidTab Program. A summarization of calculations can be found below in Table 4.

Table 4. Pavement Cost Estimate

Main Line	Area (ft^2)	Thickness (in.)	Density (lb/ft^3)	Pay Unit	Unit Price	Quantity	Cost ($)
HMA Type R	156869	2.5	150	ton	150	2451	367662
ATB	156869	3	152	ton	120	2981	357661
D1	156869	3	104	ton	25	2039	50982
Select A	156869	40	145	ton	10	37910	379100
	156869						
Side Walk							
PCC	26615	4	-	sq yd	70	2957	207006
D1	26615	2	104	ton	25	231	5767
Select A	26615	24	145	ton	10	3859	38592
Curb/gutter	-	-	-	linear ft	18	6388	114984
Pathway							
HMA	44283	2	1580	ton	100	5831	583060
D1	44283	4	104	ton	25	768	19189
Select A	44283	24	145	ton	10	6421	64210
						Total Cost	$2,200,000

A.8 REFERENCES

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Northern Access to U-MED
Design Study Report

Appendix B
Pedestrian Bridge Structures

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Joseph Horazdovsky

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LIST OF ACRONYMS

AASHTO………….……. American Association of State and Highway Transportation Officials

ADA ……………………………………………………………………American Disabilities Act

ASTM ……………………………….…………………American Society for Testing and Materials

DOT …………………………………Alaska Department of Transportation and Public Facilities

FHWA ………………………………………………………..Federal Highway Administration

LRFD …………………………………………………………Load and Resistance Factor Design

MOA ………………………………………………………………….Municipality of Anchorage

UAA……………………………………………………………University Of Alaska, Anchorage

B.1 OBJECTIVE

The objective of this project is to mitigate the influence the new roadway will have on the local trails and pathways. It is important that there are ample opportunities for pedestrians and bicycles to safely and quickly pass over the roadway. All structures meet FHWA and ADA handicap accessibility requirements.

B.2 EXISTING TRAILS

Illustrated in Figure1 are the major pedestrian pathways and ski trails that currently exist on the project site. These pathways serve several vital purposes including the necessary non-motorized transportation needs of the surrounding community as well as recreational use by the general public. Local campuses also use some of the trails for athletic training purposes such as skiing and cross-country running. It is important that upon conclusion of this project traffic on the surrounding trail network continues to flow as it did before the roadway was in place.

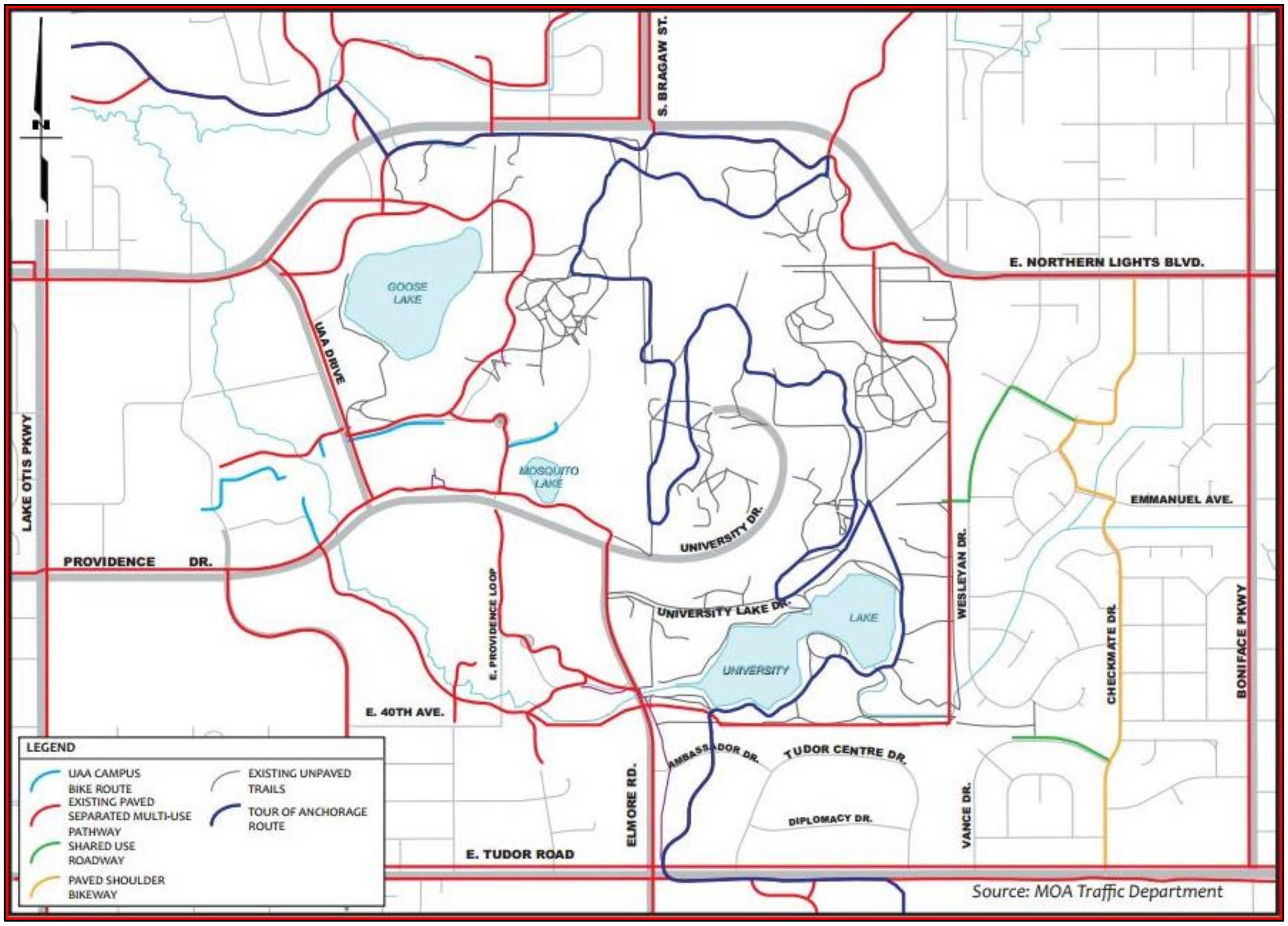

Figure 4: Existing Pedestrian Trails and Pathways[7]

B.3 STRUCTURE SELECTION

To allow for the free flow of pedestrian traffic safely across the new roadway, there is a need for a grade-separated intersection. This could be accomplished by either an overpass or underpass. Due to existing landscape and public preference, an overpassing bridge was selected to carry foot traffic across the road. To complete the project within budget, there will be only one bridge built. This will require some minor pathway relocation to ensure that access to the new bridge or some other safe means of road crossing is accessible from all trails within the area.

B.4 STRUCTURE LOCATION

The majority of intersections between existing trails and the new roadway are found in the northern portion of the U-Med District just south of Northern Lights Boulevard. The bridge will be placed at the center of the major trail crossings northeast of Goose Lake which will maintain the best flow of

[7] Image from DOWL-HKM 2011 Reconnaissance Report prepared for DOT & PF

pedestrian traffic while causing the least amount of necessary trail relocation. The pathways found in the southern portion of the site will be rerouted slightly to allow signaled crossing of the road at the intersection of Elmore Road and Providence Drive.

B.5 MATERIAL SELECTION

B.5.1 Concrete

Concrete is a fairly inexpensive building material that achieves high strength in compression and, when used in conjunction with steel for tensile strength, it can span large gaps with minimal deflection. Prefabricated bulb tee girders are the conventional method for using concrete in bridges. With the use of cranes to lift the girders into place, construction time is relatively minimal. Concrete bulb tee beams are susceptible to cracking when bending loads are applied, but with the use of post tensioning this can be minimized or even eliminated. Concrete was ultimately ruled out as a building material because of its relatively unattractive appearance. This bridge runs through a somewhat undeveloped natural setting and will serve as an entry way to both the UAA and APU campuses. For these reasons, the aesthetic appeal of the bridge is of more importance than if it were being built elsewhere.

B.5.2 Steel

Steel was considered as a building material because when spanning the same gap, a much smaller steel member can be used than would be required of concrete; this causes steel structures to be much lighter than equivalent concrete ones. Steel bridges are also reasonably easy to erect when using bolted and welded connections. Although steel is susceptible to weathering, there are many treatments that can be applied to mitigate this problem. Like concrete, steel was ruled out because it did not meet the aesthetic requirements of the project.

B.5.3 Timber

In most bridge construction, utilizing timber glulam beams are used in place of solid timbers. Glulam beams can be fabricated to almost any length, size, or shape which makes them ideal for use in long spans where unbroken members provide the most strength. Since glulam beams are created from smaller boards glued together, much higher quality boards can be used which will be free from imperfections such as knots and cracks. This is simply not possible when using large timbers cut from a single tree. When treated properly, wood can be very resilient to weathering.

Timber was ultimately chosen as the primary bridge material because of its pleasant appearance. A timber structure will be much less intrusive to the surrounding park environment that currently exists. After much research into public opinion, aesthetics were deemed to be highly important and second only to structural feasibility.

B.6 STRUCTURE SPECIFICATIONS

Shown in Figure 2 is an elevation view of the proposed bridge. To keep all of the support stuctures out of the right-of-way of both the driving lanes and the pedestrian pathways, the main span will be 75 feet long. At either end of this 75 foot span there will be support piles that start at the base of the 1.5:1 backslope. Over the driving lanes there will be a 17.5 foot minimum clearance to the bottom of the bridge that will allow for the unobstructed passage of most semi-trailer trucks and their cargo. The traversable bridge deck will be 10 feet wide which will accommodate one lane of pedestrian traffic in either direction. Since the surrounding topography is relatively flat, there will be an 8% approach and depatrure grade that will bring pedestrians up to bridge deck level. This complies with FHwA and ADA requirements which state that pedestrain facilities must be designed with ramps which do not exceed a rise over run ratio of 1:12 or 8.3%. Including bridge span and the approach grades the total length of the crossing from ground level back to ground level will be 403 feet.

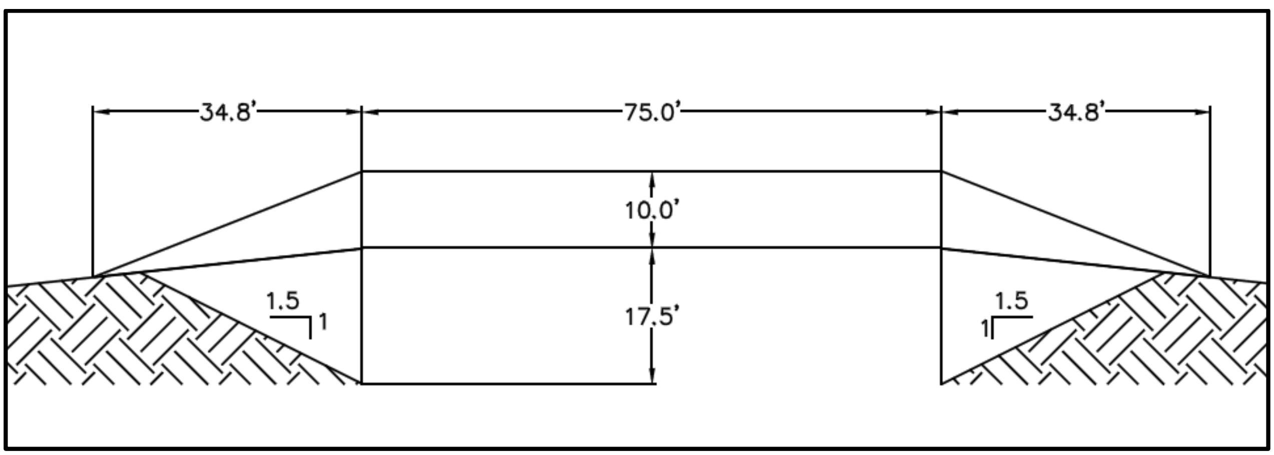

Figure 5: Pedestrian Bridge

B.7 APPLIED LOADS

With a width of 10 feet and a total span of 145 feet, the bridge will have a loading area of 1,450 square feet. Since this structure is used to connect several major ski trails, it will be covered in snow for much of the season. According to MOA building safety codes, structures within the Anchorage area will have an applied ground snow load of 50 pounds per square foot (psf). AASHTO LRFD

Guide Specifications for the Design of Pedestrian Bridges states that the pedestrian live load shall be 90 psf. Bridges with a clear deck width of between 6 and 10 feet shall include a vehicle live load from an AASHTO standard (H-5 Truck) of 10,000 pounds as shown in Figure 3.

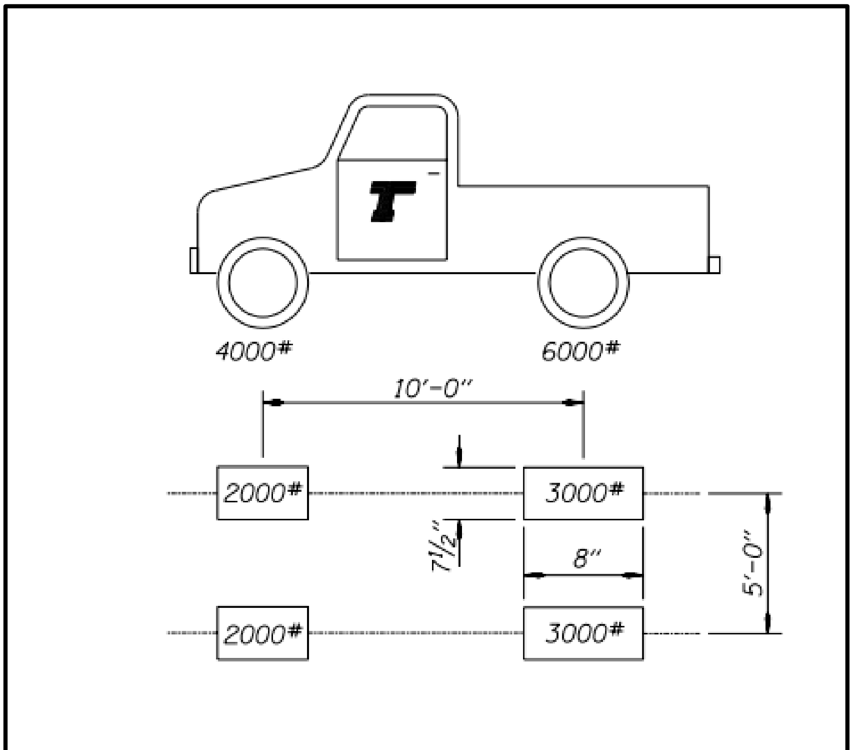

Figure 6: AASHTO (H-5 Truck)

B.8 COST ANALYSIS

The bridge analysis performed was for type selection and feasibility. No structural analysis was performed to find specific member sizing, so the cost analysis was done on a per square foot basis. In 2006, a similar timber pedestrian bridge was constructed across town in Kincaid Park. It serves the same purpose of connecting a pedestrian pathway across a two lane roadway with a similar span.

Table 5: Cost Estimation

	Length (ft)	Width (ft)	Area (ft2)	Total cost	Cost Adjusted for inflation
Kincaid Bridge	136.3	21.3	2903.2	$377,000	$477,572
U-Med Bridge	144.6	10.0	1446.0	$187,773	$241,263

B.9 RECOMMENDATIONS

Construction shall be performed adhering to Alaska DOT Standards and Specifications for Highway Construction 2004.

Primary Building Material:

- Glued-laminated timber members constructed of Douglas Fir laminated using adhesives rated for use in wet conditions and treated with pressure preservatives

Connections:

- Galvanized bolts, screws and drive spikes conforming to ASTM A 307

Bridge Supports:

- Cast-in-place concrete piers (primary span)
- Shallow concrete footings within soil embankments (secondary spans)

Bridge Specifications:

- Deck width – 10 feet
- Total span – 144.6 feet
- Minimum height – 17.5 feet

Embankment Slopes:

- Trail approach and departure – 8% as specified by FHWA regulations
- Side slopes – rise to run of 1 to 2
- Back slopes – rise to run of 1 to 2

B.10 REFERENCES

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Design Study Report

Appendix C
Environmental

Northern Access to U-Med

Prepared for:

State of Alaska
Department of Transportation and Public Facilities
Central Region
4111 Aviation Drive
Anchorage, AK 99519

Prepared by:

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3211 Providence Drive
Anchorage, AK 99503

Author:

Jamie Gorman

April 2014

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LIST OF ACRONYMS

ADCM.. Anchorage Debit-Credit Method

AKDEC.. Alaska Department of Environmental Conservation

CWA ....Clean Water Act

ILF.. In-Lieu-Fee

LOS .... Level-of-Service

MOA ....Municipality of Anchorage

REV...Relative Ecological Value

USACE ....U.S. Army Corps of Engineers

C.1 INTRODUCTION

The U-Med District is located in northeast Anchorage, Alaska and is one of the city's fastest growing employment hubs. The district supports several universities, hospitals, and recreational areas which draw large numbers of commuters each day. With the area expected to experience continued growth over the next 20 years, it is imperative that safe, effective modes of transportation be provided for funneling individuals into and out of the district.

C.2 PROJECT DESCRIPTION

This project will involve the connection of Bragaw Street and Elmore Road between Providence Drive and Northern Lights Boulevard. Currently, the selected design alignment runs through a tract of undeveloped land. The added connection will improve the mobility and LOS of the roadways in the district and provide better access from the northeast. The proposed design is a two-lane minor arterial that will disturb several acres of high-class wetlands.

C.3 REQUIRED PERMITS

A list of the necessary environmental permits are listed below in Table C.3.1.

Table C.3. 1 Required Permits

Permit	Permitting Agency
Section 404 Permit	U.S. Army Corps of Engineers (USACE)
Section 401 Permit	Alaska Department of Environmental Conservation (AKDEC)

The Section 404 Permit and Section 401 Permit are required due to the fact that the chosen road alignment runs through about six acres of high-quality wetlands. The USACE, as designated by the CWA, regulates the general permitting process (Section 404) for disturbance to the waterways of the U.S., including wetlands. The State of Alaska requires, and is provided the right by the CWA, that 404 permit applicants also apply for a Section 401 Permit through AKDEC. This application is usually processed by and forwarded to the state by the USACE at the time of the Section 404 Permit review. A completed Section 404 Permit application is shown for this project in Figure C.3.1.

U.S. ARMY CORPS OF ENGINEERS **APPLICATION FOR DEPARTMENT OF THE ARMY PERMIT** 33 CFR 325. The proponent agency is CECW-CO-R.	***Form Approved -*** ***OMB No. 0710-0003*** ***Expires: 31-AUGUST-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 - Jamie Middle - S Last - Gorman	First - Middle - Last -
Company - Seawolf Engineering	Company -
E-mail Address - jgorman4@alaska.edu	E-mail Address -
6. APPLICANT'S ADDRESS:	9. AGENT'S ADDRESS:
Address- 3211 Providence Drive	Address-
City - Anchorage State - AK Zip - 99503 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 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)
Northern Access to U-Med District

13. NAME OF WATERBODY, IF KNOWN (if applicable)	14. PROJECT STREET ADDRESS (if applicable) Address
15. LOCATION OF PROJECT Latitude: •N 61.189055 Longitude: •W 149.810236	City - State- Zip-

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

State Tax Parcel ID Municipality Anchorage

Section - 21, 22, 27, 28 Township - 13N Range - 3W

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17. DIRECTIONS TO THE SITE

This site is located in northeast Anchorage, Alaska in the U-Med District. It is part of a mostly undeveloped area of land starting at the T-intersection of Elmore Road, Providence Drive, and University Drive. The site continues north to connect with Bragaw Street at its intersection with Northern Lights Boulevard. The area to be developed is about 0.3 miles east of Providence Hospital.

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

The nature of the project will involve the creation of approximately 0.70 miles of roadway through a primarily undeveloped section of wetlands. Since the in-situ soils are not adequate to support a roadway structure, the area will need to be dewatered and all of the undesirable soil will need to be excavated and replaced with more appropriate material. In total, approximately 120,000 cubic yards of material will be removed and replaced and about 6.2 acres of wetlands will be disturbed.

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

The U-Med district is located in northeast Anchorage, Alaska. It has been identified as one of the largest growing employment centers in Anchorage and is expected to continue to grow over the next 20 years. From DOT's 2011 reconnaissance report, approximately 43% of the people traveling into this district make their trip from the north or east. With the current surrounding arterial roads, connectivity, safety, and congestion are major concerns. The purpose of this project is to provide better access to the U-Med district. With the addition of a road in the area, out-of-direction travel will be reduced meaning faster travel times, less congestion, less air emissions, and safer surrounding intersections.

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

20. Reason(s) for Discharge

The discharge of fill material into classified wetlands will be necessary for the completion of this project since the majority of existing material is unusable as a roadway foundation. There are hundreds of borehole logs collected over the span of more than 20 years that support the necessity for this new fill material.

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
120000		

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

Acres 6.2

or

Linear Feet

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

The discharge of fill material into classified wetlands will be necessary for the completion of this project since the majority of existing material is unusable as a roadway foundation. There are hundreds of borehole logs collected over the span of more than 20 years that support the necessity for this new fill material.

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- 3211 Providence Drive

City - Anchorage State - AK Zip - 99508

b. Address- 4101 University Drive

City - Anchorage State - AK Zip - 99508

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
AKDEC	Section 401 Permit				

* 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.

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Figure C.3. 1 USACE 404 Permit Application

C.4 MITIGATION

Mitigation efforts are needed in order to comply with the Section 404 Permit requirements. For this project, a mitigation statement (Fig. C.4.2) was drafted and debit/credit calculations were performed in accordance with the ADCM.

The compensation method selected for this project was the ILF program as determined by the ADCM. This method was chosen since it is the preferred method for assessing and mitigating wetlands within the MOA. The fees associated with ILF are outlined and managed by the Great Land Trust and are based upon the REV system.

It was determined that a total of 4.13 debits will be accrued due to the proposed construction. This was calculated using DOWL HKM's 2009 Preliminary Wetlands Assessment REV Map shown in Figure C.4.3. From the map, it can be seen that the proposed alignment will only affect REV 2 wetlands (yellow shading). The total debits were calculated assuming 6.2 acres of REV 2 wetland disturbance. Following the ADCM for projects in 'Still Waters, Intertidal Areas and Ditches', it was assumed that there would be no temporary impacts or disturbance shadows. Therefore, the total debit was the quotient of the affected wetland area and the appropriate REV 2 debit ratio. The spreadsheet used to accomplish these calculations is shown below (Fig. C.4.1). Finally, using the 2011 Great Land Trust ILF credit rates, the REV 2 debit of $163,891/db was multiplied by the total debits to determine the total cost required in monetary credits. It was found that $677,420.27 will be paid to the Great Land Trust to mitigate these debits.

Applicant's Proposed Mitigation

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...*

When the roadway design alignment was selected, impact to wetlands was a key factor under consideration. The route chosen was placed, whenever possible, outside of the highest ranking wetlands, particularly Class A wetlands.

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.*

In order to minimize unavoidable impacts to wetlands during construction, certain measures will be taken. The first measure will be to minimize dredge and fill activities; only the minimum amount of soils will be removed and replaced for the foundation of the roadway. Also, sustainable construction practices will be implemented in order to prevent disturbance to wetlands outside of the proposed project right-of-way.

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.*

The proposed compensatory mitigation selected for this project is the In-Lieu-Fee program (ILF) associated with the Municipality of Anchorage Debit-Credit Method (ADCM). This program, in partnership with the Great Land Trust, uses a Relative Ecological Value system (REV) to account for debits accrued during wetland disturbance. From these calculations, the necessary credit payment is determined.

Figure C.4. 1 Mitigation Statement

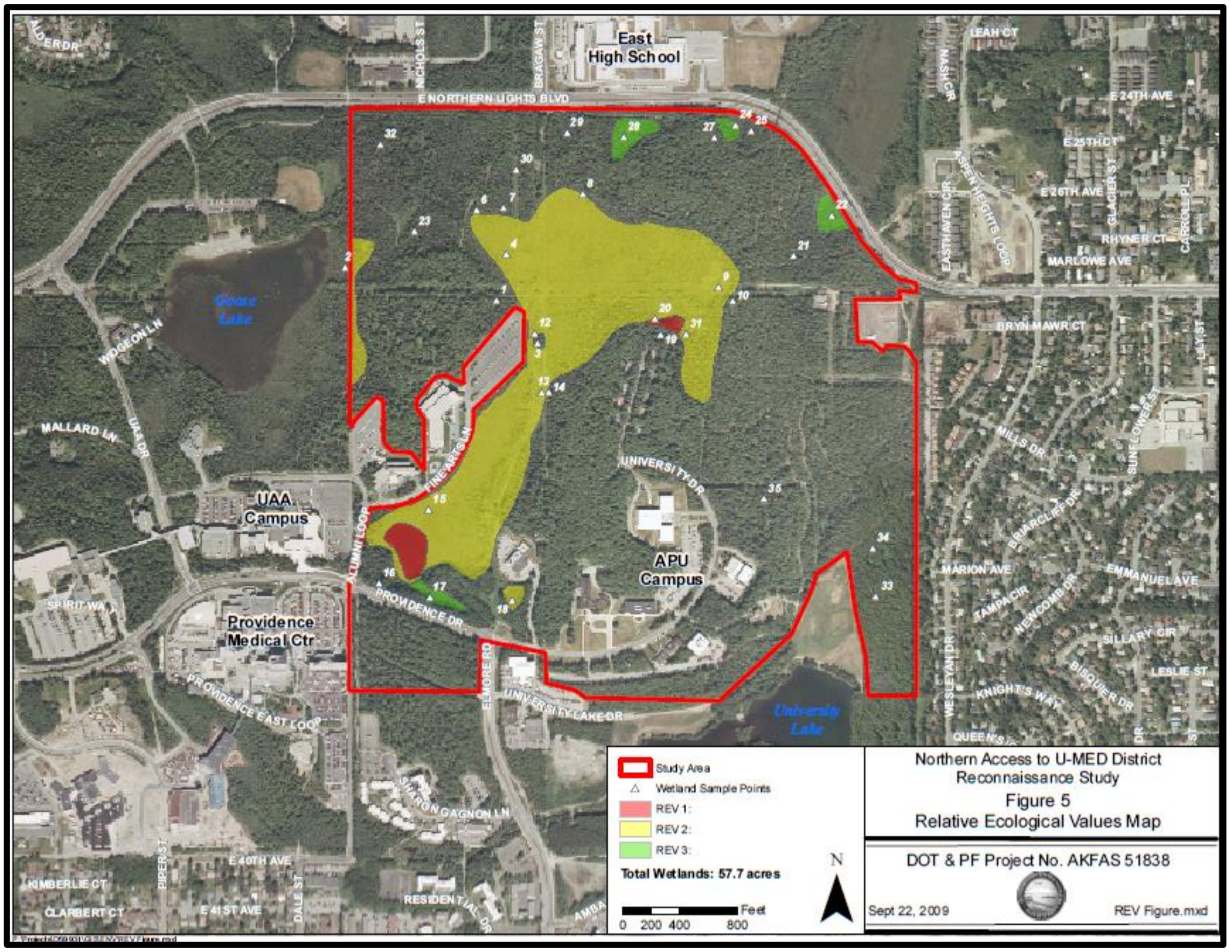

Figure C.4. 2 U-Med Wetlands REV Map[8]

Table C.4. 1 ADCM Debit/Credit Calculations

A. REV	B. Debit Ratio	C. Shadow Factor	D. Size (acres)	E. Debits [(D./B.)*C]	F. Cost per Debit	G. Total Cost [E.*F.]
2	1.5	1	6.2	4.13	$ 163,892.00	$ 677,420.27
*Calculation process determined in adherence to Anchorage Debit-Credit Method						
**Assumed no temporary impacts or disturbance shadow						
***Cost per debit given by Great Land Trust, 2011						

C.5 COST ESTIMATE

The cost estimate associated with environmental permitting and impacts is shown below in Table C.5.1. The cost estimate sums the determined required credits and the AKDEC 401 Permit Application fee. In total, the environmental costs associated with this project are estimated to be $678,500.

[8] Municipality of Anchorage Reconnaissance Study

Table C.5. 1 Environmental Cost Estimate

Environmental Costs		
Source	**Amount**	
401 Permit Application	$	1,120
404 ILF Credits	$	677,420
Total	**$**	**678,540**

C.6 REFERENCES

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DESIGN STUDY REPORT

APPENDIX D
HYDROLOGY AND HYDRAULICS

NORTHERN ACCESS TO U-MED DISTRICT

Prepared for:

State of Alaska
Department of Transportation and Public Facilities
Central Region
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Anchorage, Alaska 99502

Prepared by:

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Anchorage, AK 99503

Authors:

Meghanne Faulise
Sophia Huff

April 2014

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LIST OF ACRONYMS

MOA....................Municipality of Anchorage

IDF ....Intensity Duration Frequency

BMP .... Best Management Practice

DCM.................... Design Criteria Manual

WMS .... Watershed Management Section

FEMA....................Federal Emergency Management Agency

LIST OF FIGURES

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D.1 INTRODUCTION

D.1.1 Objective

All roadway construction projects need storm water control. In this project, there are special hydrologic and hydraulic considerations due to the wetlands, soil type and ground water level. In the design, the selected alternative will properly route roadway precipitation and snowmelt as well as maintain the naturally occurring drainage of the area.

D.1.2 Existing Conditions

In the project, most of the area consists of wetlands. The soil conditions consist of deep peat deposits with a ground water level at or near the ground surface. The project area lies within the Chester Creek watershed drainage basin which consists of approximately 19,361.8 acres. Water bodies existing near the project corridor consist of Goose Lake to the North and Mosquito Lake and Chester Creek to the South. Mosquito Lake is the closest water body to the project and is of particular concern especially during construction as it may be fed by an underground aquifer. Our proposed roadway will be 335 feet from Mosquito Lake. Dewatering will likely be needed during construction in this area.

D.2 HYDROLOGIC ANALYSIS

D.2.1 Flood Risk

According to the DOWL Hydrology Reconnaissance Report, the FEMA Flood Insurance Rate Map for the project area shows flood levels confined to the floodplain in the immediate proximity of Chester Creek. The risk of flooding in other areas appears minimal." Since this project is not in the immediate vicinity of Chester Creek, the risk of flooding is minimal.

D.2.2 Drainage Area Characteristics

The project is found within the South Fork of the Chester Creek Watershed. This sub watershed is part of the Chester Creek Watershed that encompasses most of the north and northeast part of Anchorage. (Figures D.1 and D.2). The Chester Creek Watershed drains west through Anchorage, into the Westchester Lagoon, and then into the Knik Arm. As seen in Table D.1, the total acreage of the South Fork of Chester Creek drainage basin is 6,563.2 acres. The proposed roadway has an estimated acreage of 3.0 acres and is surrounded by 57.7 acres of wetland of the total project area of 316 acres.

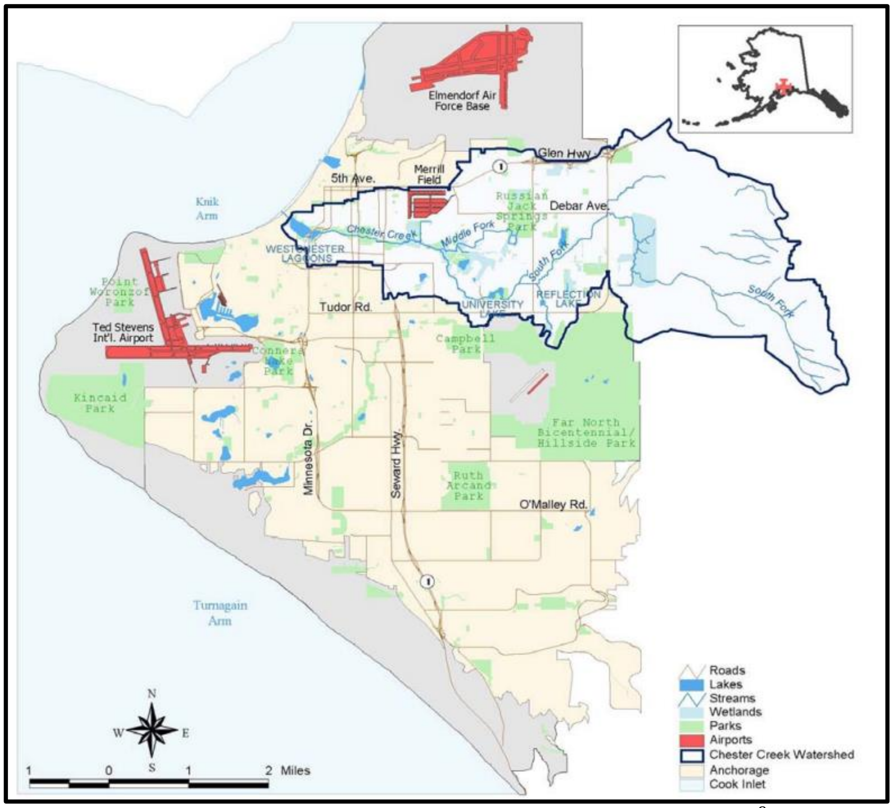

Figure D. 1 Location of the Chester Creek Watershed[9]

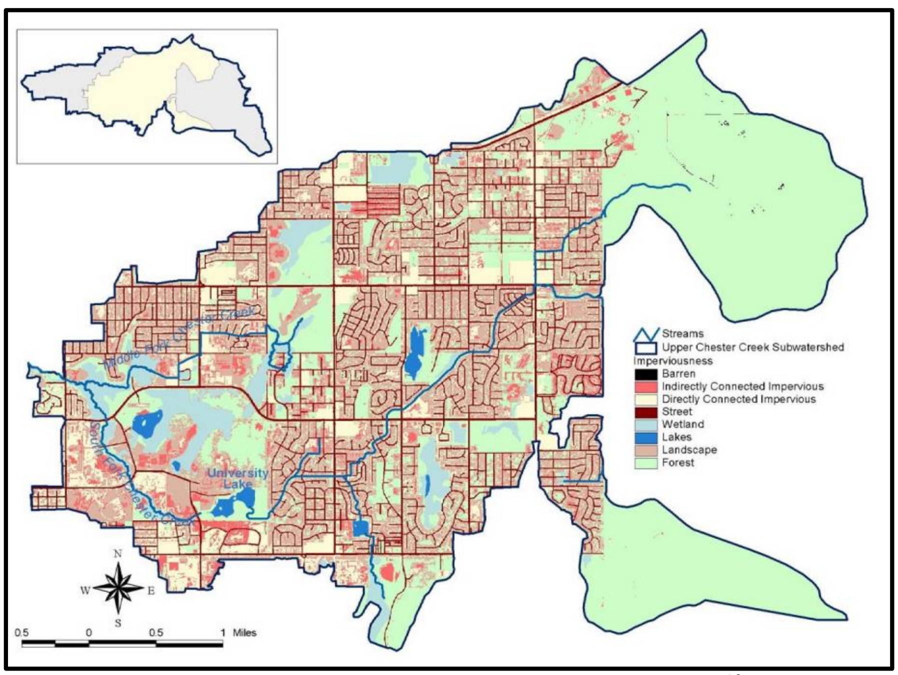

Figure D. 2 Upper Chester Creek Subwatershed[10]

[9] Municipality of Anchorage
[10] Municipality of Anchorage

Table D. 1 Major Subwatersheds and Drainages Within the Chester Creek Watershed

Subwatershed Name	Acres	Area Square Miles
Lower Chester Creek	**3,838.6**	**6.0**
• Westchester drainage	2,703.9	4.2
• North Fork of Chester Creek drainage	1,134.7	1.8
Upper Chester Creek	**9,297.0**	**14.5**
• Middle Fork of Chester Creek drainage	2,354.3	3.6
• South Fork of Chester Creek drainage	6,563.2	10.3
• Reflection Lake drainage	379.5	0.6
Headwaters	**6,226.2**	**9.7**
Total Watershed Area	**19,361.8**	**30.2**

D.2.3 Wetland Characteristics

Within our project area, most of the land cover is classified as wetlands. Wetlands are very significant from a storm water perspective due to the fact that they "provide storage, peak attenuation, runoff-volume reduction, and pollutant removal through sedimentation and biological processes." (Design of Urban Storm water Controls) In order to protect wetlands it is suggested to avoid disturbance in the area as much as possible.

D.2.4 Methodology

According to the Municipality of Anchorage Drainage Design Guidelines, storm water systems are designed by analyzing storm water at varying peak flows. Peak flows were calculated using the rational method as show below. The values are shown in Table 2. According to the Alaska Storm Water Guide, the corresponding infiltration rates for wetland soil groups range from 0.02 to 0.11 inch per hour. Soils in the project area are mainly considered to be low infiltration soils, where infiltration rates are less than 0.1 inch per hour. Due to the crowned cross section of the road half of the rainfall can fall to each side of the road. Thus, 1.5 acres of total rainfall will be drained to each side of the roadway. According to a study done by MHW Americas Inc. for the Anchorage Watershed Management Program, models for tested Anchorage wetlands suggest that wetlands have a capacity to store 60 to 90 percent of the MOA 2-year 6-hour water quality design storm. Those wetlands tested include those in the proposed project area.

D.2.5 Rational Method

To determine the peak flow runoff values in the drainage design, the Rational Method was used:

$$Q = C\ i\ A$$

where:

Q = Peak Flow (cubic feet per second)

C = Runoff Coefficient

i = Rainfall Intensity (inches/hour)

A = drainage area (acres)

The runoff coefficient was determined to be 1.0 inch/hour for the impervious roadway surface. Rainfall intensity was calculated using the IDF Curve (Figure D.3) from MOA for the following durations: 2-year, 5-year, 10-year, 25-year, 50-year, and 100-year.

Significant surface runoff will not occur if rainfall intensity is less than the soil infiltration capacity. In the project area, a conservative value of 0.1 inch/hour was chosen for the infiltration rate for the soil in the wetlands. This infiltration rate value is less than or equal to all the calculated intensities (Table D.2), thus all rainfall should fully infiltrate through the soil.

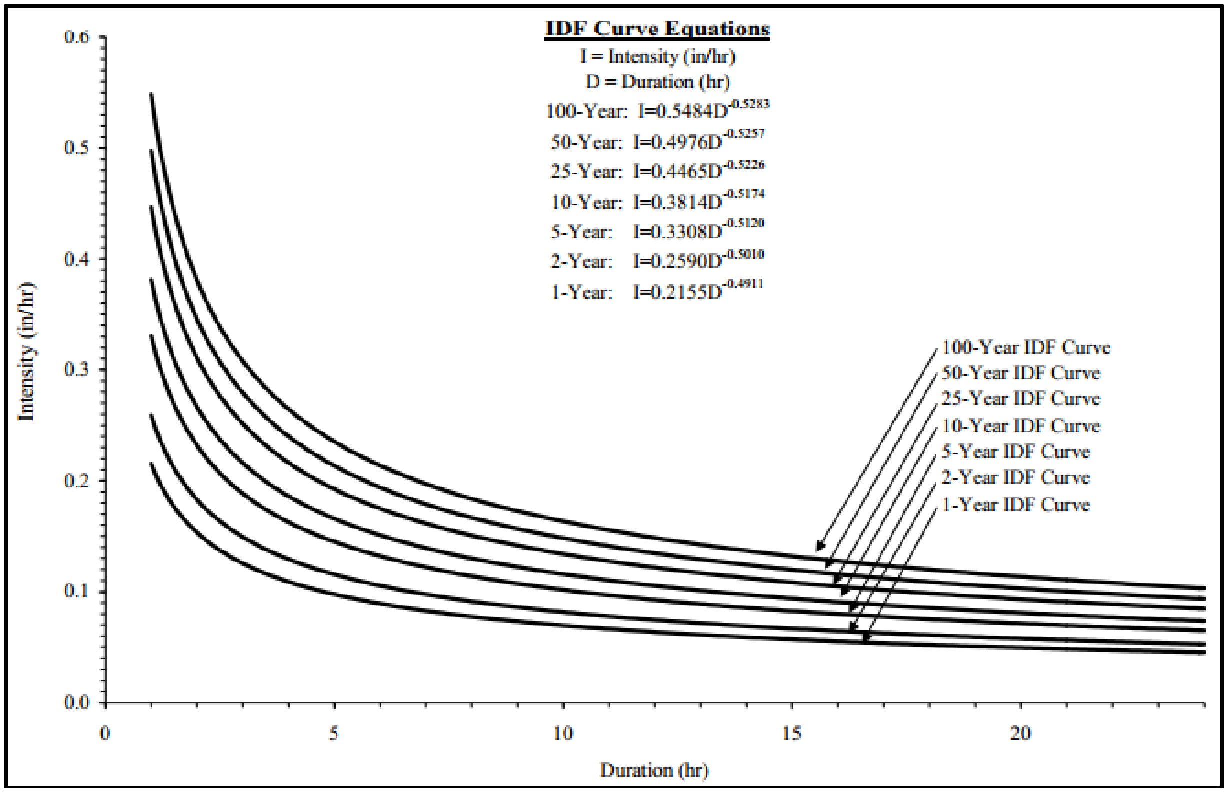

Figure D. 3 IDF Relationships for Anchorage, Alaska

Table D. 2 Peak Flow Runoff Values

IDF Curve	Duration (hr)	Intensity i (in/hr)	Roadway Discharge Q (cfs)
2-year	24	0.05	0.08
10-year	24	0.07	0.11
25-year	24	0.08	0.13
50-year	24	0.09	0.14
100-year	24	0.10	0.15

D.3 HYDRAULIC ANALYSIS AND WATER TREATMENT

The hydrologic analysis provided that the volume of expected runoff from a storm event is relatively small in comparison with the drainage basin of the project area. Knowing that the expected runoff will be treated without the need for a large storm drain system, the use of swales and rain gardens were given large consideration. It is suggested that the vertical alignment of the road be adjusted such to create positive drainage to approved outfall areas.

D.3.1 Storm Drain System

There are few existing storm drain facilities in the project corridor. As shown in Figure K.F.4 and K.F.3 on the MOA Wetlands Map #33 and #22, the closest existing storm drain connections are those at the intersection of Northern Lights Boulevard and Bragaw Street and at Elmore Road and Providence Drive.

On the west side of the proposed road a curb will separate the sidewalk and roadway surface. The roadway surface will be crowned with a 2% slope with half of the surface runoff draining to the west side of the road and half of the runoff draining to the east side of the road. Thus, a storm drain system will need to be introduced on the west side to release runoff from the roadway surface. Runoff channeled into the storm drains will lead into outfalls that discharge back into the wetlands. Filtration of the storm water can be provided by placing a riprap apron with geotextile or rock outfall at the storm drain outlet. This acts as both a velocity dissipater and sediment filter for the runoff. Therefore the proposed conveyance design described will allow the runoff to discharge back into the wetlands, not requiring any new storm drain construction or connections. This allows for the recharging of wetlands which can be lost with increasing urbanization and collection of storm water.

D.3.2 Culverts

It is important to ensure that the natural drainage patterns of the wetlands are retained after the proposed roadway has been constructed. In order to do this, it is suggested culverts be placed throughout the roadway base to maintain natural drainage patterns. The culverts will also require rip rap outfalls to protect against erosion. Necessary location and size of culverts can be determined through a field investigation.

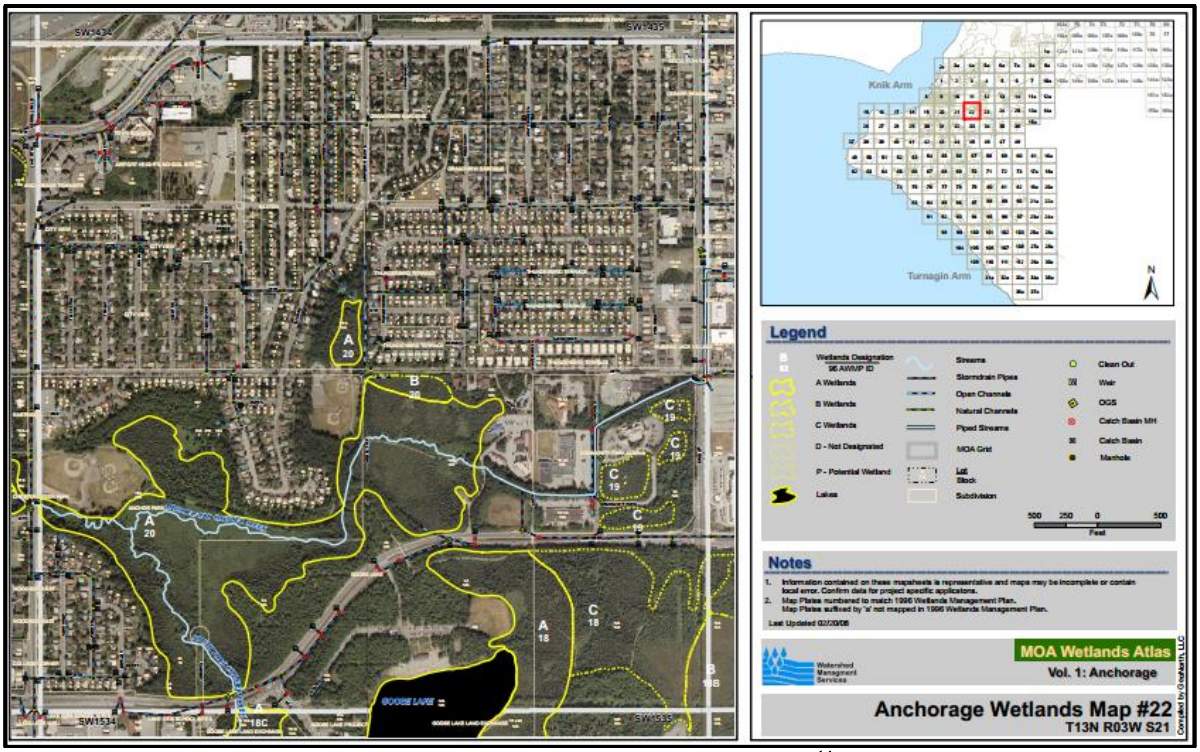

Figure D. 4 MOA Wetlands Map #22[11]

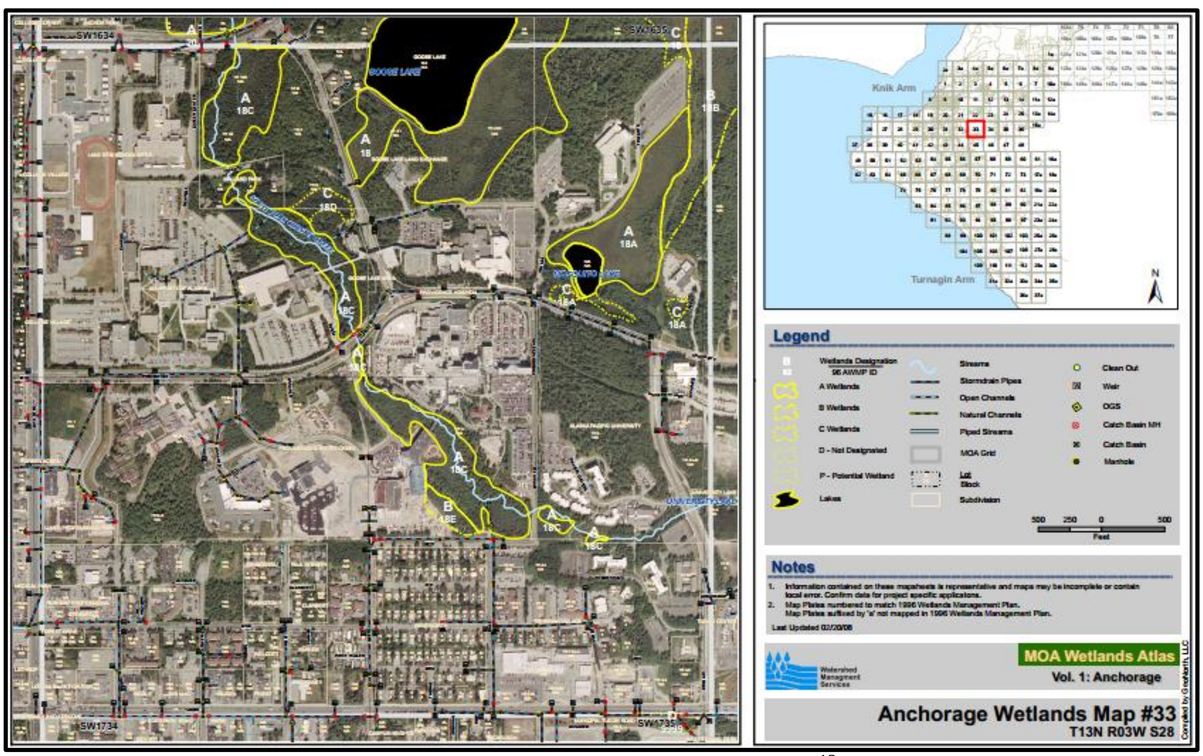

Figure D. 5 MOA Wetlands Map #33[12]

[11] Municipality of Anchorage
[12] Municipality of Anchorage

D.3.2 Low Impact Development

Throughout the project, runoff from the road will be introduced back into the native soil for water quality enhancement. As stated in the Alaska Storm Water Guide "currently, wetlands are used for discharge of storm water in Anchorage and this practice is helping to preserve remnant wetland areas that have been isolated from their historic water sources".

D.3.2.1 Bio Filtration and Rain Gardens

On the east side of the road, there will be no curbing which will allow for direct infiltration into the ground. Swales or rain gardens placed between the edge of the roadway and multi-use pathway will allow for storm water infiltration. As the total impervious area draining to a single system should not be more than one acre (Cahill, 2012), it is recommended that a minimum of three rain gardens be constructed within the project. This would allow for half an acre for each rain garden.

D.3.3 Detention Pond

A detention pond will not be needed for this project due to the characteristics of the existing wetland soils around the roadway. The peat will work as a retention facility and will naturally infiltrate the drainage. The bio filtration design criteria can be found in the MOA Design Guide. Extra consideration may be required in Maintenance for any filtration structures.

D.4 ENVIRONMENTAL CONCERNS AND PERMITTING

Due to the high value of wetlands surrounding the project area mitigation measures must be put in place to ensure the quality and functionality of the surrounding wetlands is retained. Along with permits as mentioned in the environmental section, one permit program, the National Pollutant Discharge Elimination System (NPDES) incorporates regulations for three types of water discharges. These are: storm water from certain municipal separate storm sewer systems (MS4s), discharges of storm water associated with industrial activity and storm water from construction sites disturbing one or more acres. As stated in the Alaska Storm Water Guide only MS4s serving communities of a specific size are required to obtain NPDES permits. An MS4 NPDES permit will not be required with our recommended design as the MS4 permit is required only for discharging into a municipal storm water system. It is likely that dewatering will be needed for the Mosquito Lake area and other areas of the project during excavation. This will require an Excavation Dewatering permit per DEC requirements.

D.5 RECOMMENDATIONS

Recommendations for the conveyance of storm water for the proposed project include a system of both traditional storm drains and low impact development swales and rain gardens. The goal of this conveyance system is to properly drain the roadway while also recharging the wetlands and lessening the impact of urbanization. As the existing water table is at or near the ground surface culverts will be necessary throughout the roadway base.

- Storm drains with riprap outfalls placed accordingly to treat storm water before being released into wetlands
- Implementation of swale ditches and rain gardens to provide treatment for runoff infiltration on the east side of the road
- Equilibrium culverts for maintaining the existing wetlands drainage

D.6 REFERENCES

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Design Study Report

Appendix E
Geotechnical Study

Northern Access to U-MED

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LIST OF ACRONYMS

AS&G ……………………………………………………………………Alaska Sand and Gravel
CY ………………………………………………………………………………..Cubic Yard
DOT …………………………………Alaska Department of Transportation and Public Facilities
EPS ……………………………………………………….……….Expanded Polystyrene Foam

E.1.0 OBJECTIVE

The objective of this portion of the report is to analyze the surface and subsurface soil conditions that exist on the project site and if necessary remove or otherwise treat unsuitable materials. All excavation shall be done as specified by Alaska DOT Standards and Specifications for Highway Construction.

E.2.0 EXISTING CONDITIONS

Existing conditions for this project corridor were researched through hundreds of borehole logs collected over a span of more than 20 years by multiple consulting firms. Shown in Figures 10.1 and 10.2 are the boreholes that were selected to represent the in situ soils found beneath the selected roadway alignment. Reading the graph left to right follows the road north to south starting with boreholes found closest to Northern Lights Boulevard on the left and boreholes closest to Providence Drive on the right. Not all of the boreholes had surface elevations but it can be seen from the ones that did that the ground is relatively flat. The layer found between the blue line and the orange line is peat which varies in depth from almost none near Northern Lights all the way to a depth of 24 feet near Providence Drive. The next layer found between the orange and grey lines is primarily silty sands and silty gravely sands. This layer will not likely need to be removed or consolidated.

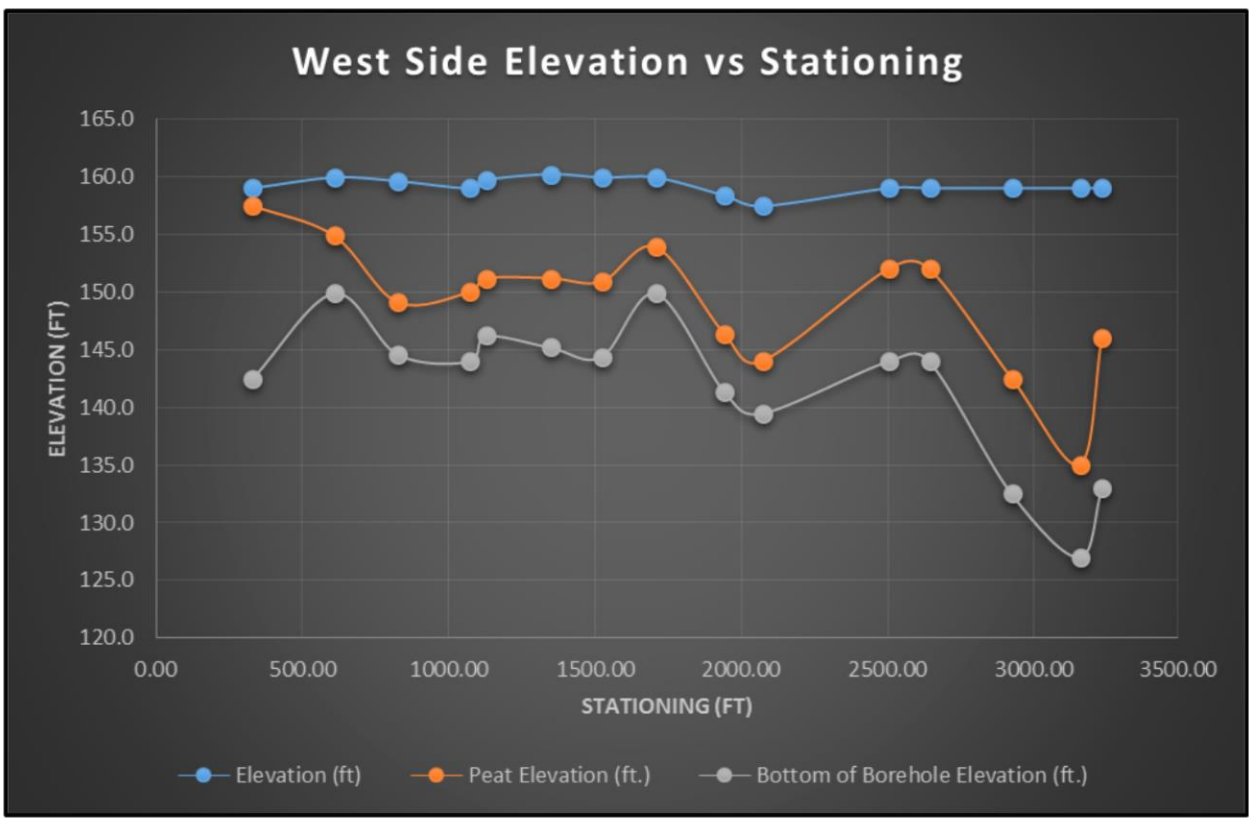

Figure 7: Boreholes along west side of alignment

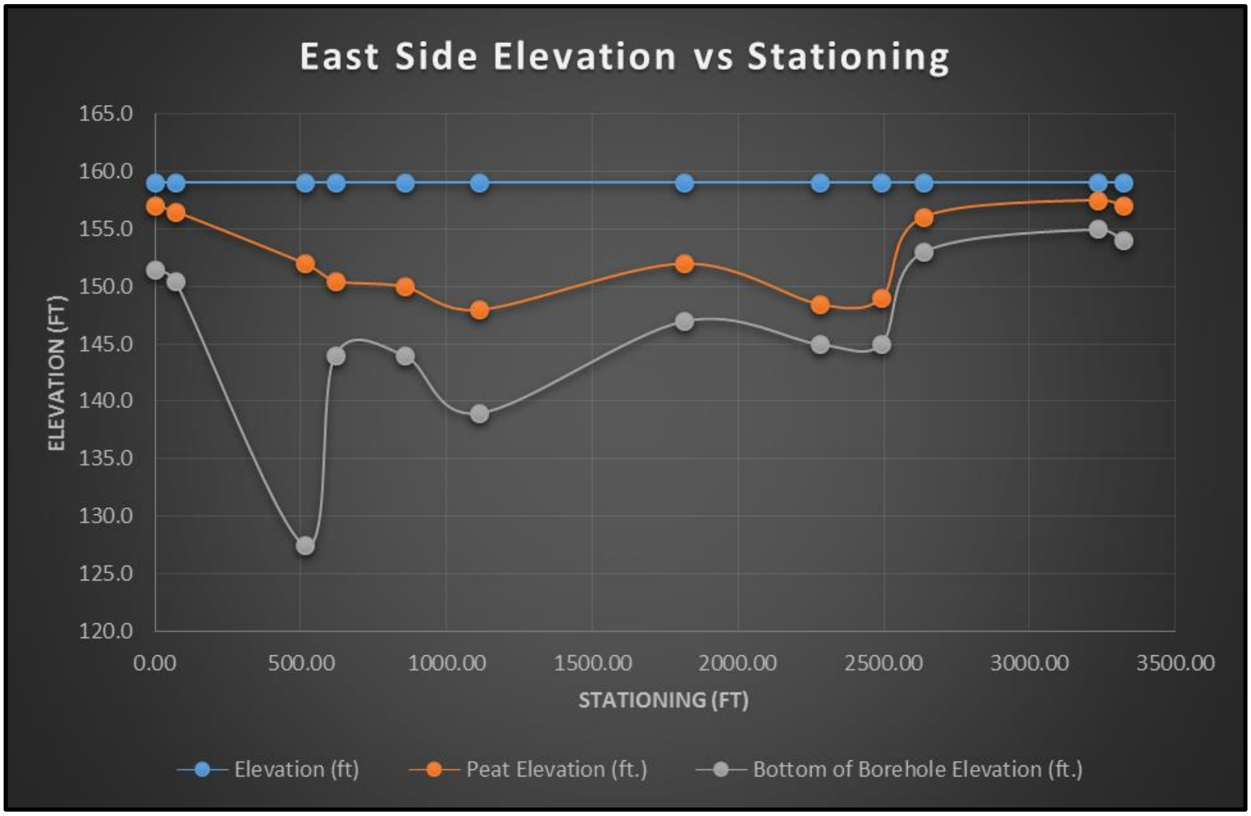

Figure 8: Boreholes along east side of alignment

E.3.0 SOIL PREPARATION

The in situ soil currently is unacceptable as a road base and will need some form of treatment before construction of the roadway embankment may begin. The thick layer of peat found throughout the project site will need to be either compacted or removed. Peat makes a poor base material because of its very low bearing capacity as well as being prone to large amounts of settlement.

E.3.1 Excavation

One plausible method for creating a suitable base layer would be to excavate down through the problematic peat layer and remove it from below the proposed roadway base. This excavated area would be filled back in with type A borrow hauled in from an offsite gravel pit. To allow for stable construction of street lighting and pedestrian pathways excavation down to either solid soil or 10 feet should be done across the entire right of way. Under the road surface where the majority of loads will be applied, it is recommended excavation be done based on the profile of peat depth across the road length.

E.3.2 Expanded Polystyrene Foam

A different approach that would drastically cut down on the amount of necessary excavation would be to put down a layer of geofoam beneath the roadway. The problem with the current soil is its inability to support the loads developed from traffic on the new road. EPS geofoam is put down in between the road surface and the questionable soils and stabilizes the ground by dispersing the weight of the vehicles, pavement, and subsequent base layers in such a way that the soils beneath it do not succumb to excessive settlement or localized failures. EPS is also only about 1% of the weights of an equivalent soil fill material which greatly reduced the loads applied to underlying soils.

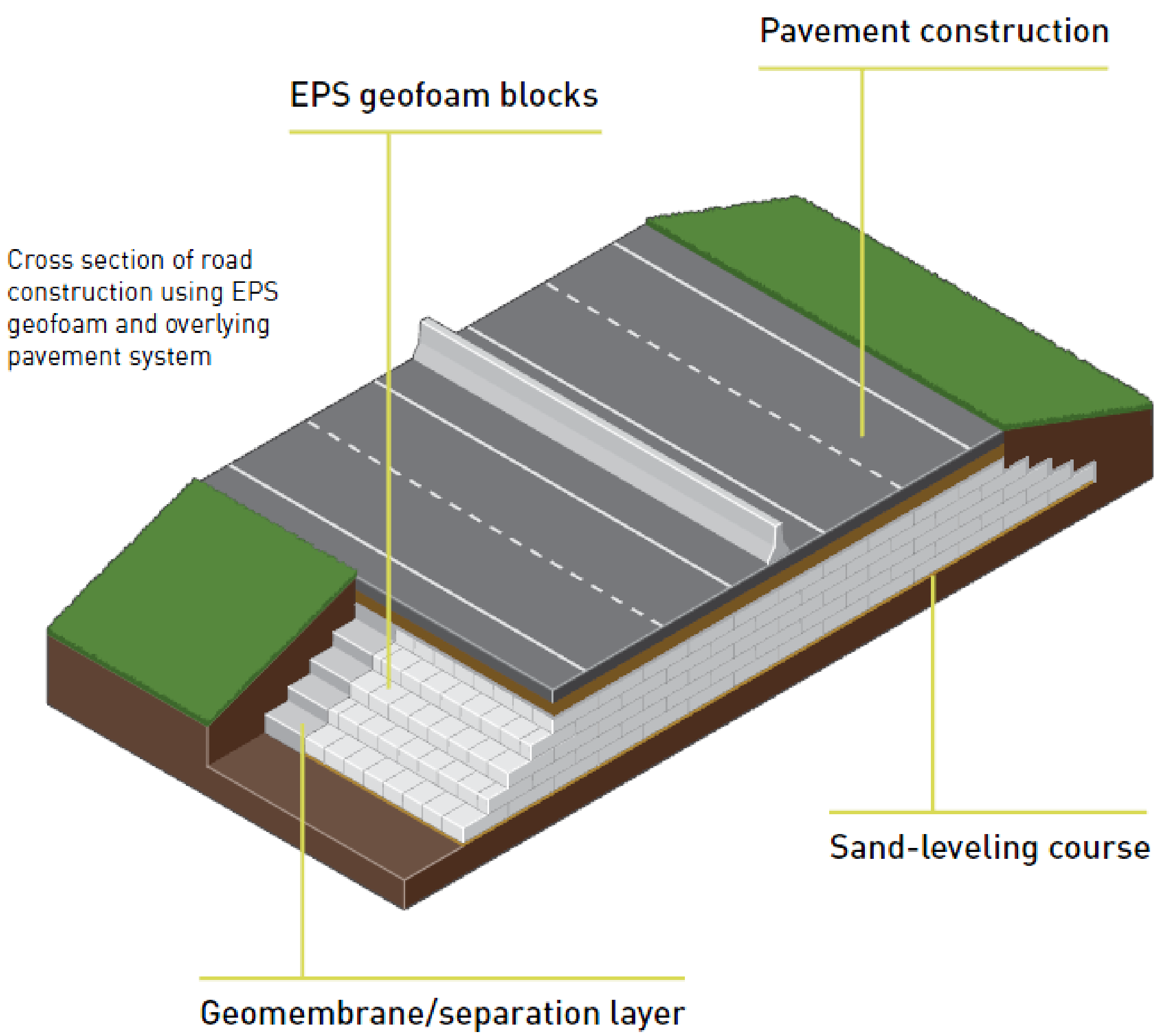

Figure 9 : EPS Geofoam cross section

E.4.0 EXCAVATED SOIL DISPOSAL

The final decision of what to do with the excess soils is left to the discretion of the general contractor. This section will discuss the possible solution that may be available at the time of excavation. Any combination of these alternatives can be used based on project need.

E.4.1 Material Dump Site

One option would be to haul the excavated soil offsite to a material disposal facility. The most common option for anchorage is the Lucy Pit Disposal Site which is run by AS&G. Material would be hauled 8.5 miles from the dig site to the disposal site located near sand lake. This would be done using either standard dump trucks which can haul 10 cubic yards or side dump semi-trailers which hold 20 cubic yards. In addition to the cost of trucking there is a cost per cubic yard for disposal as well.

E.4.2 Other Projects

There may be an opportunity for collaboration with other projects would be mutually beneficial. Peat excavated from this site could be used as top soil for embankments or any other nonstructural use. Negotiation regarding responsibility of trucking costs will be discussed between project managers.

E.4.2 Leave onsite

The alternative to removing the excavated material would be to leave it onsite and use it for current and future landscaping purposes. This alternative costs nothing and allows for the creation of topographical features along the roadway and surrounding lands.

E.5.0 DEWATERING

Borehole analysis has indicated that the water table is between surface level and 7 feet down. This will very likely interfere with excavation. Ground water seeping into the dig site will cause slope stability problems as well as standing water in the bottom of the trench which causes a safety hazard to personnel and equipment.

E.5.1 Sump Pumping

One possible method of mitigating the water table problem would be to create a low spot within the dig site from which open water can be pumped out. Water trapped within the soil that is higher that the elevation of the sump will naturally flow to the lower elevation of the pumping area. This strategy might not be sufficient since the ground water table is so much higher than depth of excavation required.

E.5.2 Wellpoints

A more plausible dewatering procedure would be to use a wellpoints system as shown in Figure 4. This consists of multiple wellpoint shafts all connected to a common header pipe. This system allows for all of the individual well shafts to be powered by one centralized pump which provides vacuum suction for the system. Two rows of wellpoints are inserted into the ground just outside of the planned excavation site. They draw the water level between the two suction points down below the desired excavation depth. This system is capable of drawing the water level down up to 20 feet which should be enough to fill the project needs. Water removed from this system can be place into a dewatering tank before being released back into the wetlands. This serves as both a holding tank and treatment stage for the discharged water to remove any oils, grease or unwanted sediments.

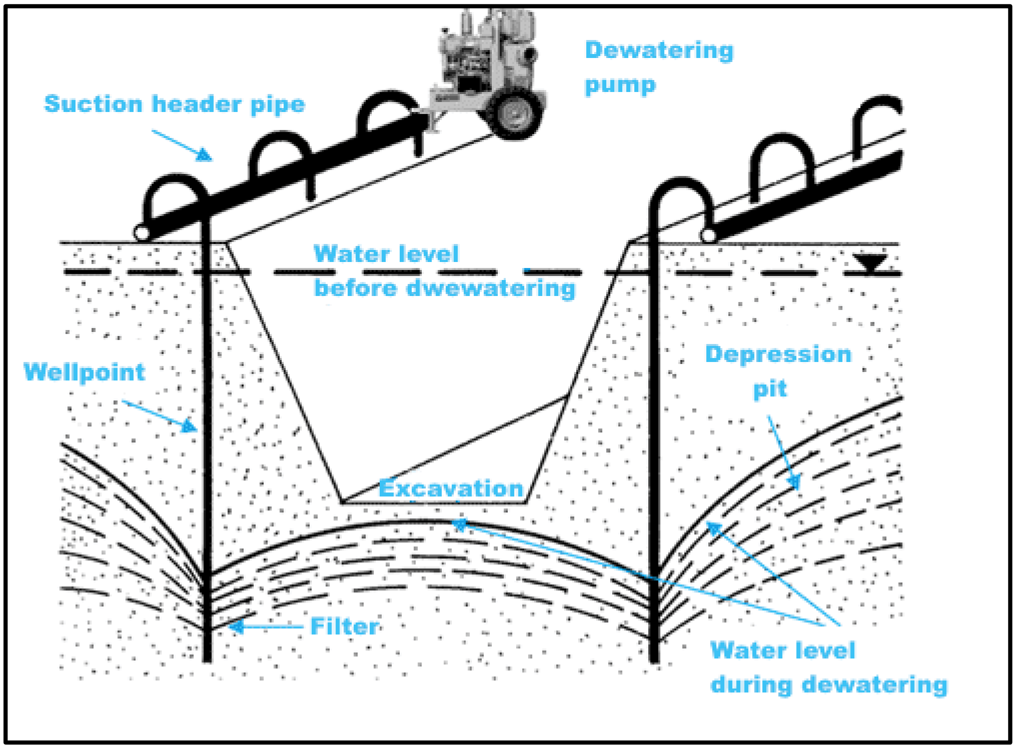

Figure 10 : Well Points Dewatering System

E.6.0 COST ANALYSIS

EPS Geofoam

- The cost savings and structural benefits that EPS geofoam provides are outweighed by its formidable cost of $65 per cubic yard.

Trucking soils offsite

- Full load round trip – 1 hour
- 10 CY dump truck at $90 per hour - $1,080,000
- 20 CY side dump semi-trailer at $130 per hour - $780,000
- Disposal of 120,000 cubic yards of peat at $5.00 per CY - $600,000

Leave soil on site

- Free

Table 6: Cost Estimation

	Unit price	Units	Quantity	Total cost
Excavation	$6.00	CY	120,000	$720,000.00
Type A Borrow	$10.00	ton	168,000	$1,680,000.00
Total				$2,400,000.00

E.7.0 RECOMMENDATIONS

The recommended procedures for stabilization of the roadway base is to excavate the unusable material and replace it with borrow type A. The placement of the excavated soil will be left to the discretion of the contractor. Using the wellpoint system for dewatering during construction will be necessary to keep the excavation area free of standing water. The following is an outline of excavation volumes used for cost estimation calculations.

Excavation volume

- Main Right of way
    - Width – entire right of way which will vary along the alignment due to roundabouts and bus stops
    - Depth – until suitable soil layer is reached or 10 feet, whichever comes first
- Road Surface
    - Width – 40 feet
    - Depth – following peat soil depth as laid out in borehole chart or until suitable soil layer is reached
- Bridge Embankments
    - Width – 162 feet beyond either side of the right of way
    - Depth – following peat soil depth as laid out in borehole chart or until suitable soil layer is reached

E.8.0 REFERENCES

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Design Study Report

Appendix F
Utilities

NORTHERN ACCESS TO U-MED DISTRICT

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LIST OF ACRONYMS

AWWU .... Anchorage Water and Wastewater Utilities
CEA.. Chugach Electric Association, Inc.
DI .... Ductile Iron
GCI.. GCI Cable, Inc.
ML&P .... Anchorage Municipal Light & Power
RC .... Reinforced concrete
ROW .... Right-of-way
UAA.. University of Alaska Anchorage

F.1 UTILITY RELOCATION AND COORDINATION

F.1.1 Existing Utilities

The following is a list of the existing utilities within the project area.

F.1.1.1 Wastewater - AWWU

F.1.1.2 Natural Gas - ENSTAR

Enstar operates one of the major utilities running through the project area:

Northern Lights to Providence Drive

- 12 inch Transmission Line

F.1.1.3 Electric – ML&P

ML&P operates one of the major utilities running through the project area:

Northern Lights to north of UAA Fine Arts Parking Lot

- Overhead 34.5 kV Electric Line

Crosses Proposed Project north of UAA Fine Arts Parking Lot

- Overhead 34.5 kV Electric Line

F.1.1.4 Electric – CEA

CEA operates one of the major utilities running through the project area:

Northern Lights to north of UAA Fine Arts Parking Lot

- Overhead 34.5 kV Electric Line

Crosses Proposed Project north of UAA Fine Arts Parking Lot

- Overhead 34.5 kV Electric Line

F.1.1.5 Communication – GCI

South end of new route

- A 30 strand Fiber Optic cable
- A .750 inch coaxial cable
- A .875 inch coaxial cable

F.2 UTILITY CONFLICTS AND PROPOSED RELOCATIONS

For accuracy, it is recommended to perform utility locates in the project area. The Minimum Standards for Utility Location/Relocation are:

- Depth of Bury

Within ROW	36 inches	17 AAC 15.211(d)
Within Road Structure	48 inches	17 AAC 15.211(d)
Water/Wastewater Pipes	10 feet	

- Vertical Clearance

Existing	18 feet	17 AAC 15.201
New or relocated	20 feet	17 AAC 15.201

- Facility crossings that must be installed by boring, coring, or jacking 17 AAC 15.211(b)

F.2.1 AWWU

- The 48 inch wastewater pipe will need to be replaced at the north end of new route if not buried 10 feet or more under road.
- The 48 inch wastewater pipe will need to be replaced at the south end of new route if not buried 10 feet or more under road.
- The 8 inch ductile iron wastewater pipe connecting UAA Fine Arts Building to Main Line will need to be removed and replaced if not buried 10 feet or more under road.

F.2.2 Enstar

- The 12 inch Transmission Pipeline at the north end of new route will need to be worked around and protected.
- The 12 inch Transmission Pipeline at the south end of new route will need to be worked around and protected.

F.2.3 ML&P

- Poles 91A, 91C, 91B, 99A, and 99B will need to be removed and overhead lines will need to be placed underground using trenches or boring.

F.2.4 Chugach

- Poles T79 (ML&P 91C) and T80 (ML&P 91A) will need to be removed and overhead lines will need to be placed underground using trenches or boring.

F.2.5 GCI

- A 30 strand Fiber Optic cable located at the intersection of Providence Drive/University Drive and Bragaw Street will need to be relocated for Alaska Public Media building.
- A .750 inch coaxial cable that crosses the south end of the new route will need to be relocated.
- A .875 inch coaxial cable that crosses the south end of the new route will need to be relocated.

F.3 UTILITY EXTENSIONS

This new road will require street lighting, which will require power that will be provided by either ML&P or CEA and maintained by MOA. Relocation of existing street lights at the intersections of Bragaw Street and Northern Lights Boulevard and at Elmore Road and Providence Drive may be necessary. It is recommended to use energy-saving LED street lights throughout the project. Using LED street lights will also require lower maintenance costs.

F.4 UTILITY CONFLICT REPORT

Stationing was determined from *Figure F.1*.

Table F. 1 Utility Conflict Report

Station	Offset	Utility	Description	Recommended Resolution
0+00 to 36+00	0 to 80 RT	AWWU	48" RC DI Wastewater Main Line	Locate, work around and protect
17+00	LT	AWWU	8" DI Service Line	Locate, work around and protect
0+00 to 36+00	0 to 80 RT	ENSTAR	12" Transmission Line	Locate, work around and protect
0+00 to 7+75	Longitudinal 160 LT to 75 LT	ML&P	34.5 kV	Leave as is
10+00	75 LT	ML&P/CEA	Pole 91A/T79	Remove
12+25	75 LT	ML&P/CEA	Pole 91C/T80	Remove pole, add switch cabinet to connect longitudinal and crossing electrical lines
12+35	75 LT	ML&P	Pole 91B	Remove
12+90	75 LT	ML&P	Pole 99A	Remove
13+00	75 LT	ML&P	Pole 99B	Remove
7+75 to 13+00	75 LT	ML&P	34.5 kV	From pole 92A to pole 91C and pole 99B, bury utilities
7+75 to 13+00	75 LT	CEA	34.5 kV	From pole T78 to pole T80 and pole 99B, bury utilities
31+50 to 36+00	0 to 150 RT	GCI	30 Strand Fiber Optic Service Line	Relocate
35+50	0 to 350 RT	ENSTAR	4" Plastic Service Line	Locate, work around and protect
35+60	Crossing	GCI	.750 Coaxial Cable	Upgrade and relocate
35+75	Crossing	GCI	.875 Coaxial Cable	Upgrade and relocate

F.5 COST ESTIMATE

Table F. 2 Utility Cost Estimate

Description	Unit Cost	# of Units	Total Cost
Removal of pole	$25,000	5	$125,000
Replace Aerial with Conduit Underground 3 phase Urban	$180/ft	1150	$94,500
Relocate Fiber Optic	$20/ft	550	$11,000
Replace Coax with Fiber Optic in Conduit	$50/ft	100	$5,000
		Total	$236,000

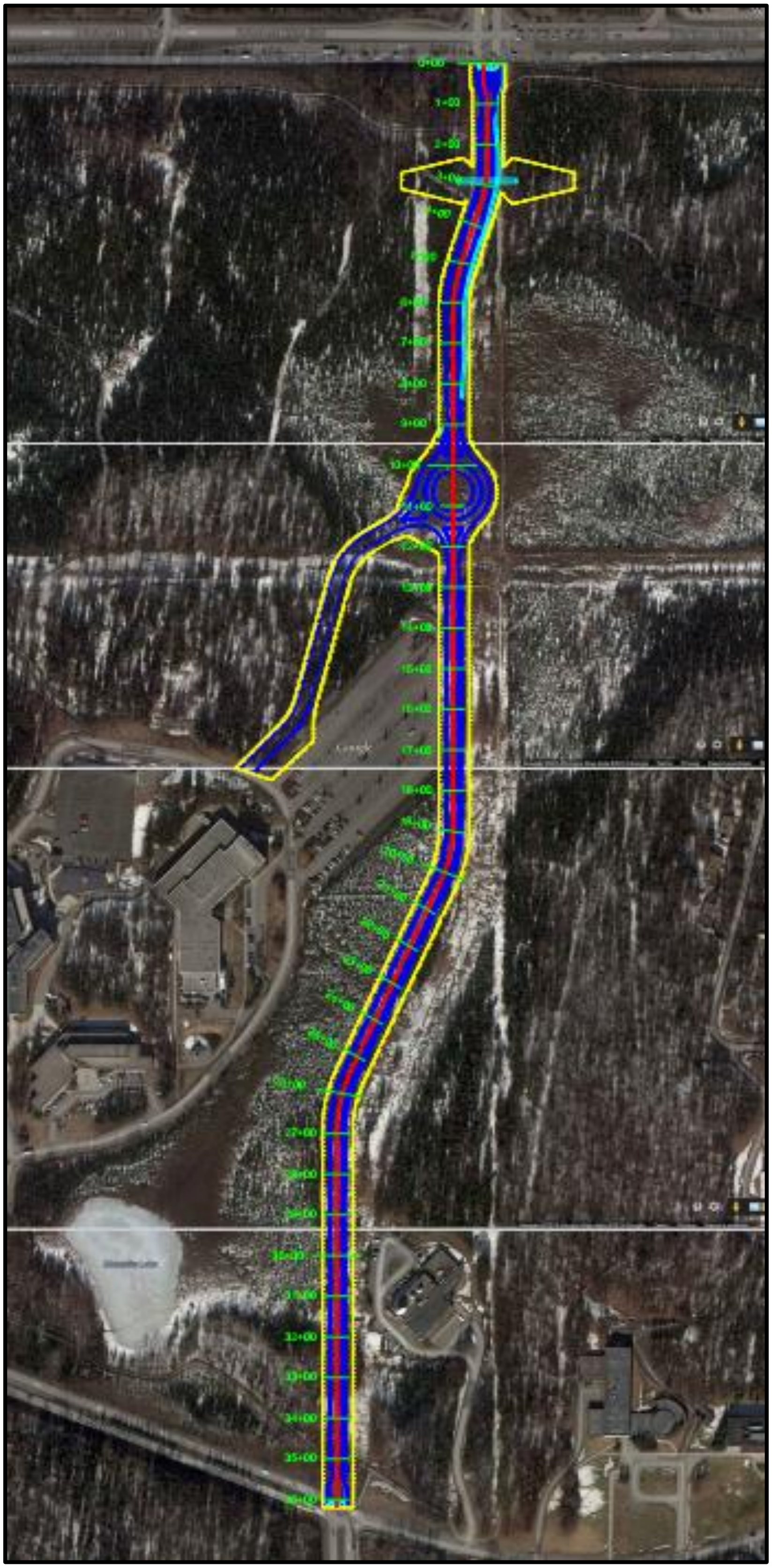

Figure F.11: Roadway With Stationing

F.6 REFERENCES

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