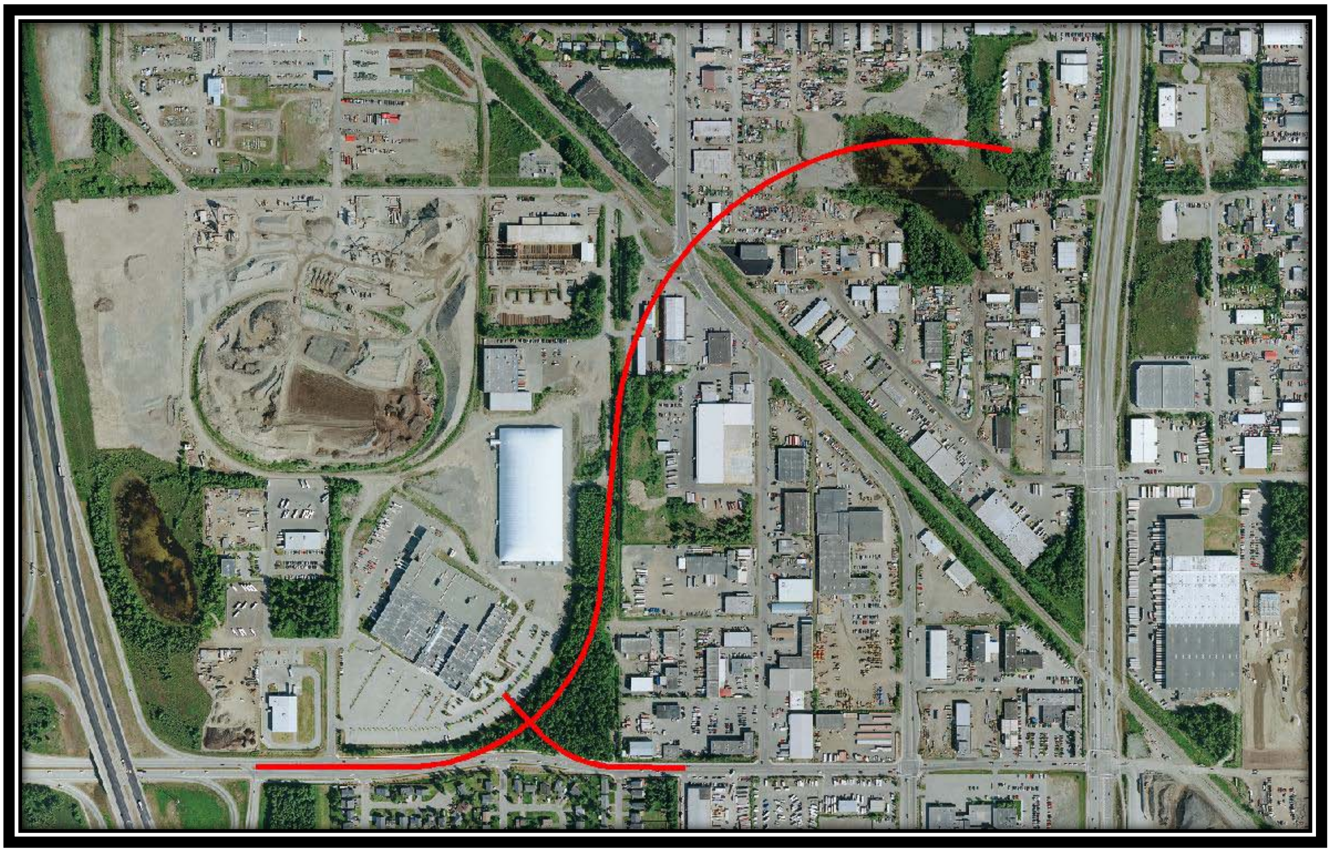
West Dowling Road
Phase II
Design Study Report



Seawolf Engineering Transportation Branch

UAA UNIVERSITY of ALASKA ANCHORAGE

DESIGN STUDY REPORT

WEST DOWLING ROAD EXTENSION: PHASE II
C STREET TO RASPBERRY ROAD

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April 2010

NOTICE TO USERS

This report reflects the student engineer's opinions and design decisions as of March 2010. As this project proceeds and details are discovered later in the design process, changes may need to be made to suit the required conditions. Persons intending to use this document for planning purposes should be aware that changes may have occurred in the project since publication. Additionally, it should be noted that this design has been conducted by engineering students at the University of Alaska, Anchorage, and the design has not been certified by a registered professional engineer.

PLANNING CONSISTENCY

Seawolf 2010 Engineering prepared this report in accordance with currently accepted design standards and Federal Regulations, and with input offered by the state, municipal government, the Alaska Railroad Corporation, 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 Highway and Transportation Officials
ACI……………………………………………………..…American Concrete Institute
ACS........ Alaska Communications Systems
AISC……………………………………………..…American Institute of Steel Construction
ARRC........ Alaska Railroad Corporation
CATV........ Cable Television
CEA........ Chugach Electric Association
CMP .... Corrugated Metal Pipe
DI .... Ductile iron
DOT&PF........ Alaska Department of Transportation and Public Facilities
F/O .... Fiber Optics
GCI........ General Communications Incorporated
MOA .... Municipality of Anchorage
MSE .... Mechanically Stabilized Earth
OH........ Overhead
OSHP .... Official Streets and Highways Plan
ROW .... Right Of Way
UG........ Underground
USACE .... United States Army Corps of Engineers
WDR .... West Dowling Road

1.0 INTRODUCTION

1.1 Objective

This Design Study Report (DSR) was prepared in conjunction with Phase II of the West Dowling Road (WDR) extension from the termination of Phase I at C street, southwest through to Raspberry Road. The design for Phase I is complete, which extends Dowling Road from Old Seward Highway to C Street.

The Phase II project area extends west from the intersection of Dowling Road and C Street, curves to the south around Tina Lake, and returns to a west route, ultimately travelling west on Raspberry Road. The objective of this project is to create a new four-lane east to west high speed corridor to relieve traffic from the surrounding major East-West routes. Features of this major objective include constructing a bridge over Arctic Boulevard and the railroad, creating an alignment that will minimize environmental impacts on Tina Lake, and designing channelized intersections with Raspberry Road and Seafood Drive to encourage the flow of traffic. In addition to the road construction, storm water systems will be put in place to ensure the ecological succession and restoration of the Tina Lake area, as well as a sewer mainline extension to supply future development of a Chugach Electric power plant. The main goals of the design process were to meet current design standards and to meet the needs of the public through the year 2035. The purpose of this report is to show the engineering thought process and methodology that was applied to meet our desired needs, goals and objectives.

1.2 Project Need

The major east-west corridors in Anchorage are Tudor Road and Dimond Boulevard. These roads currently suffer from congestion and low levels of service. The most effective way to alleviate the congestion is to provide an alternative high mobility arterial. The completion of the West Dowling Road Phase II project will complete a new east to west arterial that will substantially decrease congestion on the other major east-west routes. Additionally, the project will improve the bicycle and pedestrian facilities in the area, providing access to nearby existing trails.

2.0 EXISTING CONDITIONS

2.1 Roadway Facilities Raspberry Road Segment

The portion of Raspberry Road that lies in the project area is the recently completed Raspberry Road extension. At the beginning of the proposed project, Raspberry Road transitions from a divided arterial highway with two lanes of traffic in both direction and a 45 mph posted speed in the west to a minor collector highway with one lane of traffic in each direction with a center turn lane and 35 mph posted speed in the easterly direction.

The eastern section features curb and gutter throughout, with 12 foot wide travelled lanes, a 12 foot wide central turn lane, and 6 foot wide outer shoulders that also serve as bike lanes. Both the north and south sides of the roads have sidewalks.

3.0 DESIGN STANDARDS

3.1 Sources

The standard design guidelines used for WDR Phase II were based on various sources, including the following publications and documents (preliminary project design criteria is attached in Appendix C):

- A Policy on Geometric Design of Highway and Streets, AASHTO , 2004
- Guide for Development of Bicycle Facilities, AASHTO , 1999
- Highway Preconstruction Manual; DOT&PF, January 2005
- Roadside Design Guide, AASHTO, 2004
- LRFD Bridge Design Specifications, AASHTO, 2007
- Building Code Requirements for Structural Concrete, ACI, 2008
- Steel Construction Manual, AISC, 2005

3.2 Design Speeds

Based upon the roadway classification, accessibility, topography, and expected traffic volumes, the recommended design speed is 50 mph.

The design speed is used for establishing minimum geometric standards to ensure driver safety on the highway and is not the same as the speed limit. The recommended speed limit for West Dowling Road Phase II is 45 mph, but the speed limit for the completed roadway should be determined in accordance with DOT&PF Policy No. 05.05.020 – Establishment of Speed Limits and Zones.

4.0 DESIGN ALTERNATIVES

4.1 Alternative 1 -No-Build Alternative

Under the No-Build Alternative the West Dowling Road Phase II project would not be constructed. No transportation improvements would be made, and West Dowling Road would terminate at C Street. Existing levels of service on Dowling Road and surrounding arterials would remain the same or become congested as traffic volumes increase under the expected growth rates.

4.2 Alternative 2-Preferred Alternative

Under the Preferred Alternative, West Dowling Road would be extended from its Phase I terminus at C Street. Extending westward, West Dowling will skirt the northern edge of Tina Lake, curve southward through an industrial zone, and cross Arctic Boulevard and the existing Alaska Railroad tracks via a new bridge. Dowling will continue south through the existing Rovenna Street Right-Of-Way corridor and connect with Raspberry Road, near the Minnesota-Raspberry interchange. Alternative 2 has the following components:

- Four traveled lanes, two in each direction with directions of flow separated by medians
- A new bridge spanning Arctic Boulevard and the Alaska Railroad
- A new channelized intersection with Raspberry Road
- Two separated multi-use pathways for cyclists and pedestrians

5.0 TYPICAL SECTIONS

The typical cross section is 118 feet wide with a narrow section for the bridge that will cross Arctic Boulevard. There is a shared use path on each side of the road. The road has four 12-foot lanes, two in each direction, with a 6 foot level center median. The shared use paths are 10 feet wide. There is a 10 foot wide buffer between the road and the shared use path. The buffer will be used for snow storage. The bridge section will have railings between the roadway and the shared use paths. On the outside of the shared use paths there will be pedestrian railings. The section across the bridge will maintain the four 12 foot lanes and the two 10 foot shared use paths. The median will be a Jersey Barrier along the center line of the bridge. The bridge spans 275 feet with a clearance of 23 feet for the rail road.

6.0 HORIZONTAL AND VERTICAL ALIGNMENTS

The horizontal and vertical alignments for the preferred alternatives were developed to meet the following objectives:

- Requisite design criteria
- Minimize Right-of-Way impacts
- Minimize earthwork quantities
- Minimize wetlands impacts
- Avoid disturbing existing access to adjacent land
- Provide required railroad clearance at bridge crossing
- Minimize project costs

7.0 MAJOR STRUCTURES

The following section details the design of the bridge structure at the above-grade crossing of Arctic Boulevard. To accomplish the project objectives, a grade separated roadway at Arctic Boulevard has been determined to be the most suitable alternative. Specific bridge information is provided in Appendix E.

7.1 Superstructure

The preferred alternative is a 2-span bridge; approximately 275 feet in overall length. The bridge girders would be pre-cast, pre-stressed concrete bulb-tees. Girder cast length would be approximately 136'-6". The bridge girders would bear on a traditionally reinforced concrete pile cap. Integral cast-in-place end diaphragms would be constructed at mid-span as well as at pier and abutment bents.

7.2 Substructure

The substructure would likely consist of driven structural pipe pile at both pier and abutment bents. Abutment pile would be 42"Ø X 7/8", Grade 50 steel pipe. Pier pile would be 48"Ø X 1", Grade 50 steel pipe. Each bent requires eight driven pile. Structural loading and geotechnical conditions require estimated tip elevations to be 80 feet and 110 feet below existing ground at the abutment and pier respectively. All pile should be filled with a reinforced concrete core after driving to a depth of 40 feet below existing ground. Pile reinforcing should extend into each pile cap to insure integrity between the foundation and pile cap.

7.3 Retaining Structure

It is recommended that the approach embankments be retained at each abutment with a mechanically stabilized earth (MSE) wall. Based on ARRC overhead clearance requirements, the finished MSE wall height would be approximately 20 feet above existing ground. The MSE wall is to be designed by the supplier in accordance with AASHTO standards.

7.4 Embankment Settlement

Boring logs show silt and clay layers beginning at approximately 10 feet below existing ground with a peat layer above varying from 5 to 10 feet. It is possible that similar silt and clay layers exist at greater depths. To accommodate anticipated settlement due to approximately 30 feet of approach fill, it is recommended that all peat be removed prior to embankment construction. Excavation should extend to a maximum depth of 10 feet. After excavation and backfill, a 20 foot surcharge of engineered fill should be placed, compacted, and left in place for the season prior to initial roadway construction. This surcharge should be expected to initiate soil settlement of the silt and clay layers.

8.0 STORMWATER CONTROL

Drainage along Phase II of the West Dowling Road will be controlled and routed using three different methods including: traditional piping and sustainable "green" technologies. Stormwater runoff from the project will be contained in bioswales, or routed via Stormceptor filtration to Tina Lake, in an effort to minimize the flow entering existing storm systems. This will help maintain a sustainable and ecologically flourishing area surrounding the project.

Bio-swales provide treatment of chemicals, and utilize storm runoff areas for planting of trees and tall grass. Stormceptor filtration devices filter oil and grit from the stormwater, which will flow directly into the wetlands surrounding Tina Lake. In the areas where containment of stormwater is not feasible, the runoff will be routed via catch basins and piping into existing storm sewer networks along Raspberry Road and C Street.

Recommendations from this report include:

- Installation of catch basins and piping networks in the zones adjacent to C Street and along the curve near Changepoint church and the Raspberry Road curve.
- Creation of bioswale containment zones in all other areas, to reduce runoff into existing storm systems, as well as create sustainable vegetated zones.
- Utilization of culverts to transport stormwater to the Stormceptor filtration devices, and transport the subsequently clean water into the wetlands surrounding Tina Lake.

9.0 PAVEMENT DESIGN

9.1 Roadway

The following pavement design has been determined in accordance with the American Association of State Highway and Transportation Officials' (AASHTO) Guide for Design of Pavement Structures (See Appendix D). Noise level reduction was also considered in surface course selection. The following is the recommended roadway pavement structure:

- Two (2) inches of Hot Mix Asphalt, Type R, over
- Three (3) inches of Hot Mix Asphalt, Type II; Class A, over
- Two (2) inches of Aggregate Base Course, D1, over
- Sixty-six (66) inches minimum of Selected Material, Type A

9.2 Pathway

The following pathway pavement design has been determined in accordance with local paving practices and frost penetration considerations:

- Two (2) inches of Hot Mix Asphalt, Type III; Class A, over
- Four (4) inches of Aggregate Base Course, D1, over
- Forty-two (42) inches minimum of Selected Material, Type A

9.3 Intersection

Providing direct and seamless traffic flow is one of the objectives of this project. To ensure this quality, an analysis was performed on intersection design alternatives based on projected annual daily traffic (AADT) charts pertaining to Phase II of the project. Comparative alternative analyses and reasoning can be found in Appendix B. At the intersection of Raspberry Road and West Dowling Road, a unique channelized intersection (Fig. 1) resulted in an overall level of service A. Providing a signalized intersection causes delay and prevents direct traffic flow, which in turn reduces the level of service. Further, a roundabout would be insufficient because it functions more efficiently when the level of traffic is nearly equal from both approaches. The same concept and results apply at the intersection of Seafood Drive and Raspberry. Thus, it is recommended to construct uncontrolled and channelized intersections in Phase II.

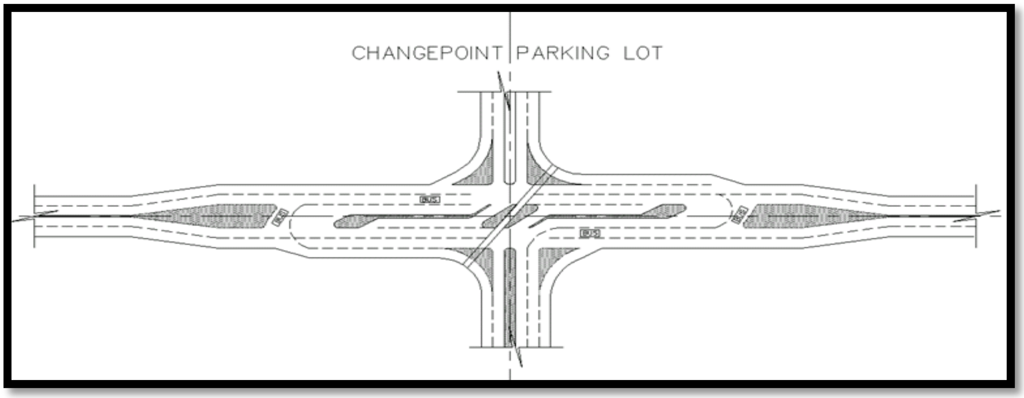

Figure 1: Proposed Channelized Intersection

10.0 UTILITY RELOCATION AND COORDINATION

The Utility Conflict Report is included in Appendix F. The key existing utilities and primary conflicts that require coordination are summarized below.

10.1 Existing Utilities

The following is a list of the primary utilities and their major segments that are located within the project corridor.

10.1.1 Water (AWWU)

AWWU operates the following water facilities within the project boundaries:

- A 10 inch ductile iron (DI) water main that runs north-south along Arctic Boulevard will require relocation
- Service lines that are connected to existing structures within the project boundaries
- 4 main line valves that will need adjusting to final grade

10.1.2 Sanitary Sewer (AWWU)

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

- A 78 inch concrete tunnel/main that runs east-west along Raspberry Road
- Service lines that are connected to existing structures within the project boundaries

- Approximately 9 manhole lids will need adjusted to match final grade

<u>10.1.3 Storm Drain (MOA)</u>

The MOA operates a storm water collection system within the project area. The following facilities will be affected:

- A 42 inch corrugated metal pipe (CMP) that runs north-south along Arctic Boulevard
- Existing facilities along Raspberry Road that will be intercepted with new storm water features

<u>10.1.4 Natural Gas (ENSTAR)</u>

Enstar operates a natural gas distribution and transmission system within the project boundaries. The following facilities will be impacted by proposed activities:

- A 4-inch plastic main that crosses the existing Rovenna Street at approximate STA 28 + 30
- An 8-inch steel transmission main that runs along Rovenna Street from approximately Raspberry Road to West Dowling Road that is in a current Enstar 10 foot easement located on the east side of Rovenna Street
- A 4-inch steel main that crosses Arctic Boulevard at West Dowling Road (STA 45 + 60)
- A 3-inch steel main that runs from east from Arctic Boulevard along the West Dowling Road right-of-way
- A 4-inch plastic main that runs along the south side of Raspberry Road
- Service lines that are connected to existing structures within the project boundaries

<u>10.1.5 Telephone (ACS)</u>

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

- Manhole C925 is located in the median of a right hand turnout at the intersection of Arctic Boulevard and Rovenna Street (at STA 45 + 20) is located approximately 51 feet south-southwest of the proposed placement of the central bridge pier.
- A variety of distribution and service facilities that are both UG and OH along the existing Rovenna Street ROW.
- OH and UG cables along and crossing Arctic Boulevard at the West Dowling Road intersection.
- Service lines that are connected to existing structures within the project boundaries.

10.1.6 Television (GCI)

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

- A variety of distribution and service facilities that are both UG and OH along the existing Rovenna Street ROW.
- A fiber optic cable that crosses Rovenna Street at approximate STA 30 + 13.
- Service lines that are connected to existing structures within the project boundaries.

10.1.7 Electrical (CEA)

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

- The University Transmission line (138 kV) that runs east-west and crosses Arctic Boulevard perpendicularly at the intersection with the West Dowling Road corridor.
- The Retherford Transmission line (138 kV) that runs along the ARR ROW.
- OH and UG distribution and service facilities that run along the existing Rovenna Street ROW.
- OH and UG distribution and service lines that run east-west between Arctic Boulevard and C Street.

- Service lines that are connected to existing structures within the project boundaries.

10.2 Utility Conflicts

The most significant utility conflicts and their proposed resolutions are summarized below. A complete listing of possible conflicts and proposed resolutions for all existing utility conflicts can be found in Appendix F of this report.

10.2.1 Utility Conflicts – West Dowling Road, from C Street to Arctic Boulevard

- From STA 27 + 00 to STA 42 + 00 OH electric, CATV, and telephone facilities will need to be relocated to underground.
- At Arctic Boulevard, the University Transmission line (CEA) needs to be raised to provide adequate clearance for the proposed bridge structure. This will be accomplished by removing several existing poles and placing two new steel poles that will provide the required OH clearance and span needs. This relocation will result in the removal of two poles that are currently located within the proposed West Dowling roadway.
- Removal of an on-site sewer service for 5921 and 5941 Arctic Boulevard
- Demolished structures (856 Bonanza Avenue, 5921 Arctic Boulevard, 5941 Arctic Boulevard, and 6031 Arctic Boulevard) will require all existing utilities to be disconnected per respective utility specification.
- Relocation of an existing 42-inch CMP storm drain that runs north-south along Arctic Boulevard that is within the proximity of the eastern abutment.
- Relocation of an existing 10 inch DI water main that runs north-south along Arctic Boulevard that is within the proximity of the eastern abutment.
- Relocation of an existing 4 inch steel gas main at STA 45 + 60 that is currently located at the site of proposed pile driving operations.

10.2.2 Utility Conflicts – West Dowling Road, from Arctic Boulevard to Raspberry Road

- From STA 27 + 00 to STA 42 + 00 OH electric, CATV, and telephone facilities will need to be relocated to an offset UG location.

- Demolished structures (6031 Arctic Boulevard and 6141 Rovenna Street) will require all existing utilities to be disconnected per respective utility specification.
- At approximate STA 30 + 13 GCI has both F/O and coaxial cables that cross the proposed roadway. These facilities will need to be located and worked around. Coordination with GCI is recommended to avoid impacting any critical facilities.
- Enstar has a 3 inch plastic main that runs along the existing Rovenna Street ROW, which then transitions to a 4 inch plastic main near the entrance to the Change Point Church.
- Enstar has an 8 inch transmission main that runs along the east side of the existing Rovenna Street corridor. The location of this main will need to be verified and any excavation in the immediate vicinity of this line will require coordination with Enstar engineering staff. It is possible that this main will need to be relocated depending on the depth of excavation required to remove unsuitable soils.
- From STA 39 + 34 to STA 40 + 50, a 10 inch water main transects and then parallels the proposed West Dowling Road alignment. This main is a service extension that crosses Rovenna Street and provides service to the NAPA distribution warehouse and multiple fire hydrants.

10.2.3 Utility Conflicts – Raspberry Road

- From STA 10 + 00 to STA 20 + 50 along Raspberry Road Enstar operates a 6 inch main that may present a conflict for the proposed noise wall. The extent of the conflict will be determined once the exact location of the main is known after surveying operations commence. The noise wall posts call for minimum of 10 feet embedment. An encroachment into Enstar ROW may be required and construction considerations may be required to place the fence posts within this ROW.
- At STA 13 + 00, Enstar operates a 2-inch plastic main that crosses Raspberry Road toward the ChangePoint Church.

10.3 Utility Extensions

Chugach Electric Association is planning to construct a new 183 MW combined cycle power plant on property that they own adjacent to this project. The new plant, the South central Power

Project, will require water and sanitary sewer main line extensions to existing AWWU facilities. CEA and AWWU are currently in discussion over the exact sizes and intercept points of these facilities. These facilities will be constructed on a reimbursable basis. This report includes the proposed facility extensions that will occur within the project limits. It is assumed at this time that these facilities will be constructed as a part of this project. These extensions are summarized below.

10.3.1 Sewer Service Extension for CEA – West Dowling Road

CEA is considering a 24-inch main line sewer extension to property that they own near the intersection of Rovenna Street and West Dowling Road. This main will be constructed within the limits of the project area to limit disturbances to any newly placed asphalt surfaces. The proposed alignment runs north-south along the West Dowling Road extension through the existing Rovenna Road ROW and connects to an existing manhole at Cheryl Street.

The mainline extension will place approximately 2,070 feet of 24 inch DI sewer main and seven new Type A sanitary sewer manholes. The mainline extension will connect to an existing 78 inch concrete tunnel (main) that runs east-west along Raspberry Road. The extension will terminate at a new manhole at approximate STA 42 + 00. This extension is estimated to cost $1,333,000.00 and will be paid for by CEA.

10.3.2 Water Service Extension for CEA – Arctic Boulevard

CEA is considering an 8 inch main line extension to the new power plant. AWWU has not identified the potential connection to their existing water facilities. It is believed at this time that this main line extension will be from Arctic Boulevard and will not be within the project limits. Any portion of the main that is found to be located within the project limits will be constructed as a part of this project provided the design can be finalized in time.

10.4 Utility Disconnects

Several operating commercial properties will be acquired as a part of this project. All existing facilities that are to be demolished will have their utilities disconnected. Water, sanitary sewer, and natural gas services are to be disconnected at the main. All electrical and communication services will be disconnected at their respective service terminals.

The following is a table of properties and associated services that will require disconnections.

Address	**Plat Ref No.**	**Utilities**
5921 Arctic Blvd	14	Water, Sewer, Tel, CATV, Natural Gas, Electric
5941 Arctic Blvd	7	Water, Sewer, Tel, CATV, Natural Gas, Electric
6031 Arctic Blvd	6	Water, Sewer, Tel, CATV, Natural Gas, Electric
6330 Arctic Blvd	5	Water, Sewer, Tel, CATV, Natural Gas, Electric
6141 Rovenna St	4	Water, Sewer, Tel, CATV, Natural Gas, Electric
856 Bonanza Ave	12	Water, Sewer, Tel, CATV, Natural Gas, Electric

Table 1: Service Disconnections

10.5 Illumination

West Dowling Road is to be a mixed use arterial with paved pedestrian facilities. The design illumination must provide adequate illumination for pedestrian and automotive users. Properly lighted roadways improve pedestrian and vehicular safety and reduce the number of collisions between automobiles, pedestrians, and wildlife.

10.5.1 Existing Conditions and Design Criteria

West Dowling Road from C Street to Raspberry Road will be owned and maintained by the Municipality of Anchorage after completion of the project, so all lighting designs must conform to MOA specifications. West Dowling Road is classified as a Class III Major Arterial in the Anchorage Official Streets and Highways Plan (OSHP). The required design criteria for a Class III Major Arterial is provided by the MOA Design Criteria Manual (DCM), chapter 5.

The following table presents the required design criteria per the DCM:

Category	Limit	Units	Value
Illuminance	Minimum	Lux/Footcandles	13.0/1.3
Uniformity Ratio	Maximum	(Average/Minimum)	3.0
Uniformity Ratio	Maximum	(Maximum/Minimum)	5.0
Average Luminance	Minimum	Candela/square meter	0.9
Average Horizontal Illuminance	Minimum	Lux/Footcandles	20.0/2.0
Vertical Illuminance	Minimum	Lux/Footcandles	10.0/1.0
Uniformity Ratio	Maximum	(Average/Minimum)	4.0

Table 2: The MOA prescribed design criteria for roadway lighting from the MOA DCM,.

Specified illumination levels will be achieved by installing high pressure sodium electroliers on each side of the roadway with a maximum longitudinal spacing of 220 feet. The lamps shall provide a minimum of 45,000 lumens with a bulb rated at 400 watts or less. The 54 luminaires shall be GE M-400A cobra head lights mounted on poles ranging from 30 to 50 feet in height.

11.0 RIGHT-OF-WAY

The West Dowling Road Phase II extension primarily transects industrial property through the anticipated corridor. ROW acquisition is intended to create the corridor while minimizing project cost. Property acquisition for the project is required in two categories:

- Acquisition to satisfy the anticipated project footprint
- Acquisition for the preferred wetlands mitigation alternative through Tina Lake

11.1 Existing ROW

Two existing DOT ROW corridors lay within the project limits. The historical Dowling Road ROW to the east of Arctic Boulevard, and the Rovenna Street corridor to the west.

11.2 ROW Acquisition

It is recommended that acquisition is enacted to varying degrees on a total of 14 parcels lying within the project boundaries. This acquisition should include both full and partial takes on the affected properties. Figure 2 shows the extent of the recommended acquisition and existing DOT ROW. Table 2 details the anticipated acquisition cost breakdown. The cost estimate was performed using available 2010 MOA property data and factored to account for relocation and discrepancies between assessed and appraised property values.

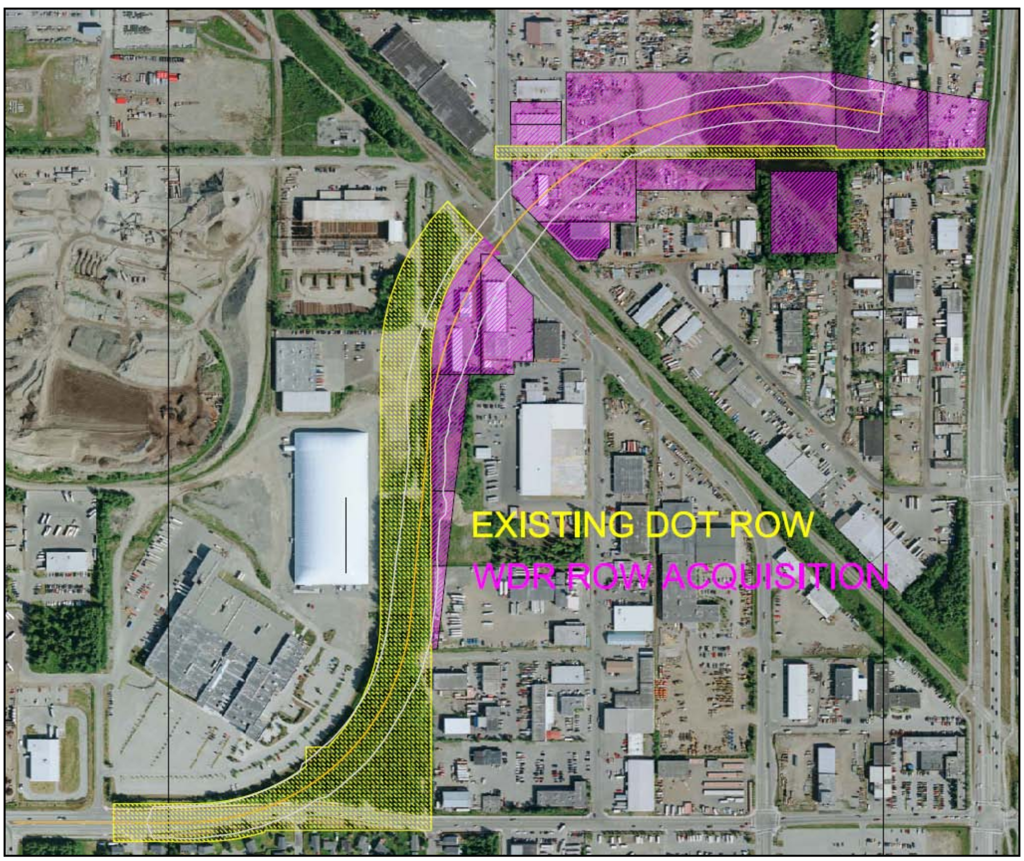

Figure 2: Right-of-Way Considerations

Acquisition Sub Total	$11,731,861.33
Adjustment Factor	1.5
Factored Total	**$17,597,791.99**

Table 3: Anticipated ROW Acquisition Estimate

12.0 COST ESTIMATE

The following summarizes the current project cost estimate:

Estimate	
Design Engineering	$1,500,000
Right-of-Way and Property Acquisition	$17,597,792
Construction Costs and Engineering	$18,620,471
Utilities	$5,130,400
Environmental Mitigation	$429,000
Construction Materials	$26,875,140
4.66% ICAP	$3,400,000
Total	$74,077,803

Table 4: Summary costs for the West Dowling Road Phase II project.

An itemized detail of the project costs and right of way acquisition is available in the engineer's estimate which can be found in Appendix J of this report.

13.0 PERMITTING

This report identifies the permits required at the 65% design level for the West Dowling Road Extension Phase II. The physical environment within the ROW for this project contains wetland and flood plain. The wetland is classified as navigable waters of the U.S.

13.1 Required Permits

The primary design level permits required for this project are summarized in the table below:

Permit:	Permitting Agency:
Section 401 Permit	US Army Corps of Engineers
Section 404 Permit	US Army Corps of Engineers
Flood Hazard Permit	Municipality of Anchorage

Table 5: Permits and Agencies

13.2 Recommendations

The USACE section 404 permit requires mitigation for fill in wetland areas to a quantity determined by the Anchorage Debit-Credit method of determining relative ecological value.

Area 11 (shown in Figure A.1 of Appendix A), South of Tina Lake is a parcel of privately owned wetland in jeopardy of being developed. It is recommended that this area be purchased and preserved as a wetland for mitigation credit to the project.

Areas 13 and 6 (shown in Figure A.1 of Appendix A) are parcels of light industrial business use and storage. It is recommended that this area be purchased and rehabilitated as wetland. This action would bring mitigation credits to the project, and enhance the aesthetic value of the area.

The method used to create wetland in areas 6 and 13 of Figure A.1 in appendix A will be to excavate the existing soil to an elevation of 10 to 12 inches below existing wetland elevations.

This excavated area will then be backfilled using soil from other portions of the project which will create native vegetation.

14.0 PUBLIC INVOLVEMENT

The objective of public involvement is to identify stakeholder concerns generated by construction of the proposed road alignment, and incorporate public feedback in project design.

14.1 Stakeholder Participation

A representative of the UAA Senior Design Transportation Project team attended a Public Information meeting hosted for the West Dowling Road Extension project hosted by the Taku Community Council on February 11th, 2010.

Stakeholders were allowed to voice concerns regarding potential future effects of the completed project. In particular, residents owning homes near the Raspberry Road area were concerned with road noise negatively affecting their comfort and property value.

The Alaska Department of Transportation and Public Facilities Noise Abatement Policy is used to determine whether or not a noise wall will be justified as part of the construction of this project.

14.2 Recommendation

Public involvement activities have shown that residents within the affected neighborhoods are in favor of building a noise abatement wall. A noise study completed by HDR Alaska Inc., predicted future noise levels to be above acceptable criteria. Current noise barrier cost estimates anticipate the barrier design alternative to be approximately $1 million. Based on the following factors, a noise barrier is recommended at the south side of the existing Raspberry Road. The recommended wall is a continuous, 1685 foot long, 13 foot high barrier constructed of cedar with steel posts.

15.0 CONSTRUCTION PHASING

This project will require multiple construction seasons to complete. In order to best accommodate the needs of utility relocation, native material excavation and replacement, and bridge construction, this project is slated to take place over three seasons and will be accomplished over three distinct phases.

15.1 Phase I

Phase one of the project will commence when the purchase of all affected parcels within the proposed ROW are acquired. With the completion of property purchases, demolition, grubbing and clearing, soil remediation, and utility relocation can begin.

The project area is currently a conglomerate of forest, industrial usage, and wetlands. In order to provide an area suitable for construction, the project area shall require demolition of all buildings, paved areas, and flora. Existing structures need to be vacated, have their utilities disconnected, and be disposed of. Wooded, saturated, and vegetated portions of the project will need cleared and prepared for soil remediation.

Soil in the project area is composed mainly of peat. This material will not meet compaction requirements, is unsuitable for construction, and will need to be removed. Excavation of peat material will be required to fifteen feet below existing grade in multiple sections to ensure complete removal. The area shall then be filled to the required elevation with a suitable soil. The new soil needs to be thoroughly compacted.

A surcharge placed on the backfilled material is recommended for approximately eight months to allow for adequate compaction of the borrow material. This period will ensure that differential settlement will be minimal during and after construction of the pavement and bridge.

Utility relocation work will proceed during this first season. The affected utilities include: GCI, AWWU, ACS, CEA, MOA, and Enstar. Coordination between the utilities will be required to ensure that all relocations can be completed in a timely fashion due to the extent of conflicts associated with this project.

15.2 Phase II

Phase II of the project will primarily consist of construction of the bridge superstructure, bridge embankments, preparation of the roadway, and installation of the noise wall along Raspberry Road.

Construction of the retaining structures shall commence after the surcharge has properly compacted the soil at the beginning of the second season. The construction of the MSE wing walls on the embankments can be completed.

Abutment piles shall be installed during the second season. Each abutment shall be properly installed in accordance with the plan drawings accompanying this Design Study Report. Backfill shall then be installed to the proposed vertical alignment height.

Following completion of the abutments and the center pier, the bridge pile caps can be completed. While bridge construction is underway, roadway preparation can be completed. This will entail the removal of all remaining surcharge material, excavation to the required depths for the placement of select materials, and construction of medians and curbs.

Construction on the noise wall can begin any time during the season that the contractor believes will provide adequate time to finish within the season. Coordination with nearby utilities will be required and construction should proceed in a manner that minimizes additional traffic stresses.

15.3 Phase III

The last season of construction shall encompass the finished construction of the bridge, installation of asphalt, roadway striping, and all associated landscaping. Following the opening of the new roadway the existing westbound lanes of Raspberry Road will be demolished and the area re-vegetated.

Completion of the bridge decking and structure shall proceed at the beginning of the season. At this time the bridge slab, approach slabs, and the final sub-base shall be laid. Afterwards the bridge will be ready for asphalt paving.

The entire roadway will be paved during this season. Following completion of paving, striping operations can commence. Pedestrian facilities will be completed at this time. Signage, protective barriers, and luminaries will be installed as well.

With the completion of the roadway and safety requirements, the contractor may open the new corridor to traffic. Once the new westbound Raspberry Road lanes are in operation, the contractor can proceed with demolition of the existing westbound Raspberry Road lanes.

All landscaping and final cleanup will occur during this final season.

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Appendix

TABLE OF APPENDICES

DESIGN STUDY REPORT

APPENDIX A
PERMITTING

WEST DOWLING ROAD EXTENSION: PHASE II
C STREET TO RASPBERRY ROAD

Prepared for:

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April 2010

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LIST OF ACRONYMS

MOA……………………………………..…………………………….Municipality of Anchorage
MS4…………………………………………………..Municipal Separate Storm Sewer System
REV……………………………………………………………….Relative Ecological Value
ROW………………………………………………………………………….....Right of Way
U.S……………………………………………………………………………....United States
USACE…………………………………………………………United States Corps of Engineers
WDR……………………………………………………………………..West Dowling Road

A.1.0 INTRODUCTION

The objective of this report is to identify the permits required at the design level for the Department of Transportation West Dowling Road Extension Phase II. This report provides an overview of the permit requirements and mitigation aspects of the project.

A.2.0 PROJECT DESCRIPTION

The West Dowling Road extension will connect C Street to Raspberry Road, in the central region of Anchorage Alaska. At present, no road exists to connect these two corridors, and all traffic is routed through surrounding streets.

This new corridor is proposed to provide greater east - west mobility and reduce congestion on surrounding routes. The proposed design is a four lane urban minor arterial passing through light industrial areas, neighborhoods, and undeveloped parcels of land. The design utilizes a variable cross section of four lanes and two ten foot paths on either side.

A.3.0 DESIGN LEVEL PERMIT REQUIREMENTS

Construction of the proposed route of the West Dowling Road extension requires work within portions of the wetland located in and around Tina Lake. Construction within a wetland area and areas which are determined to be navigable waters of the U.S. falls under the jurisdiction of the USACE.

The proposed construction will also require work within the existing 100 year flood plain, as determined by the Federal Emergency Management Agency elevations. Fill within this region reduces floodplain volume, which may elevate the flood levels in surrounding neighborhoods in an extreme flood event. The management of the flood plain requirements is under the jurisdiction of the MOA.

A.4.0 REQUIRED PERMITS

The primary design level permits required for this project are:

- USACE Section 401 Permit
- USACE Section 404 Permit
- MOA Flood Hazard Permit
- MS4 permit

Tina Lake has no fish population and is not part of a coastal area. It is connected to Campbell Creek via a buried culvert which drains surplus water from the lake.

A.5.0 DESIGN FACTORS

The proposed road alignment for this project has an objective design which is a compromise between cost and wetland avoidance. Complete avoidance of the Tina Lake wetland is impossible within the design parameters.

Effects within the wetland areas are reduced by curving the alignment around the wetlands, and reducing the area of the cross section within the wetland portion. A road alignment curvature which avoids Tina Lake completely creates unsafe curves and displaces a greater quantity of residents and businesses by placing the ROW in populated areas. By contrast, a straight road alignment causes unneeded disruption to the Lake, as well as greater expense to construct.

A.6.0 MITIGATION

Wetland area removed during construction (see Fig. A.1) will be compensated through a combination of preservation of existing threatened wetlands, and creation of new wetlands within the project ROW.

The area of land subject to compensatory mitigation is to be determined using the Anchorage Municipal Relative Ecological Value system. The area of wetland affected by the proposed design has a relative ecological value of 2.2 debits. Compensatory mitigation will be conducted to achieve 2.2 credits, providing a project which has an ecologically neutral effect on the surrounding area.

Preserving existing wetlands within the project boundaries would help offset a portion of the debits accrued on project. The amount of credits gained by preserving existing wetlands is a function of the wetlands classification and the threat of future development to the area. The wetlands adjacent to the project boundaries that could be preserved cannot be considered threatened as they primarily consist of Tina Lake. This status effectively reduces the credit basis for preservation.

The method used to create wetland in areas will be to excavate the existing soil to an elevation of 10 to 12 inches below existing wetland elevations. This excavated area will then be backfilled using soil from other portions of the project consisting of approximately 80% soil and 20% vegetative matter. Fill will be to a level equal to adjacent wetlands, and should require no fertilizer or seed. A preliminary cost estimate for wetlands recreation through the area shown in Fig. 1 was $429,000.

As an alternative to mitigation, REV credit may be purchased at a cost of $160,190.00 per credit. If this alternative is selected the funds are directed to The Great Land Trust of Alaska, where it is utilized to preserve and create wetlands in other areas of the State of Alaska. The total cost of this alternative is $352,500.00.

A.7.0 RECOMMENDATIONS

It is recommended that the six parcels resting on Tina Lake be purchased and protected as threatened wetlands. While preserving this area does not directly balance debits accrued, the parcels shown are undeveloped and have a low current assessed value. Preserving these areas will help to offset the remainder of debits not balanced by wetlands creation.

The areas shown in Fig. 1 for wetlands creation are parcels of light industrial business use and storage. It is recommended that this area be purchased, excavated to original or suitable elevations for wetland growth, and planted with vegetation. This action would bring REV credits to the project, and enhance the aesthetic value of the area.

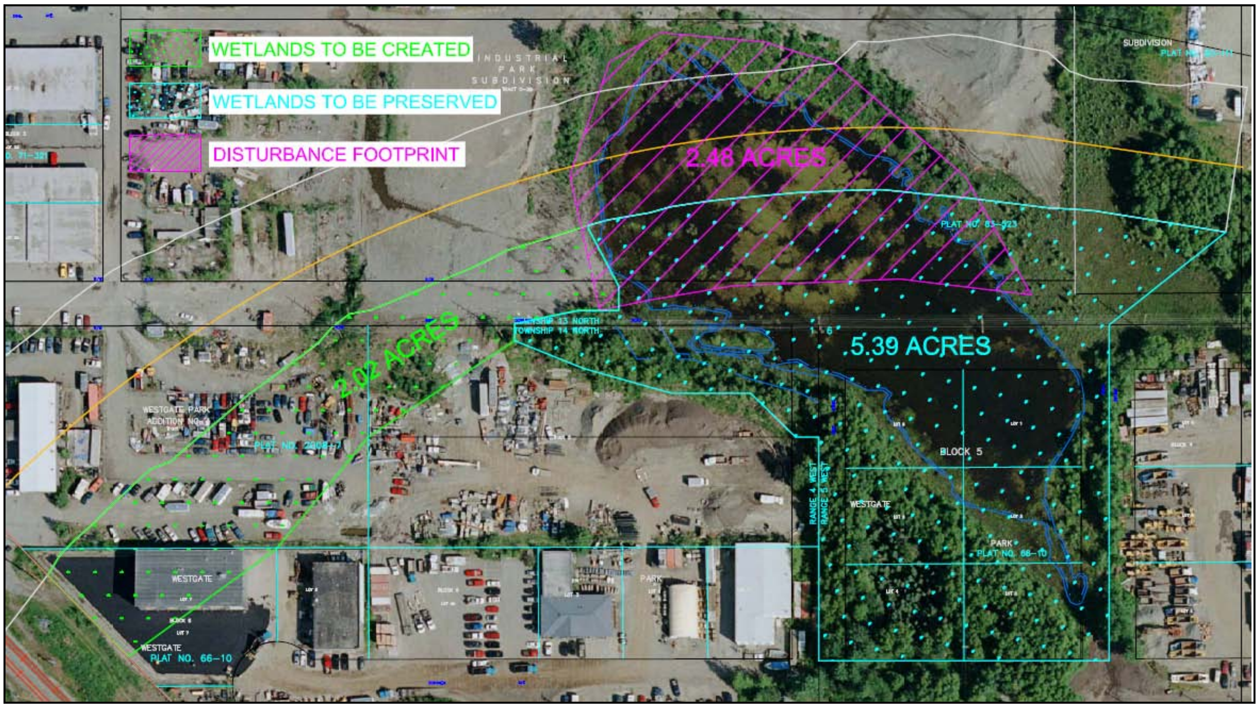

Figure A.1: Wetlands Mitigation Recommendations

A.7.1 Considerations

It is possible, if not likely, that contaminated soils exist where wetlands creation has been specified. If so, these soils would be part of the volume to be excavated and present a considerable health hazard to the surrounding area and project labor. Safely excavating contaminated soils drastically increases the excavation and containment costs. Given contaminated soils, it may be cost effective and environmentally prudent to not disturb the ground beyond the existing developed surfaces (pavements and engineered fills).

Actual soil contamination levels must be determined before a sound decision can be made. Evaluation and selection of mitigation alternatives will be dependent on the outcome of said environmental investigations.

DESIGN STUDY REPORT

APPENDIX B
TRAFFIC ANALYSIS

WEST DOWLING ROAD EXTENSION: PHASE II
C STREET TO RASPBERRY

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LIST OF ACRONYMS

AADT .... Annual Average Daily Traffic
LOS .... Level of Service
v/c .... Volume to Capacity Ratio
WDR .... West Dowling Road

B.1.0 ABSTRACT

The ADOT&PF is proposing highway projects to help mitigate traffic flow. Among these projects is the West Dowling Extension project. This project will improve east to west traffic flow. In turn, urban arterials operating near or at full capacity will be reduced as a benefit from this project.

A direct and seamless traffic flow is one of many prospects of this project. To ensure this quality, an analysis was performed on intersection design alternatives based on projected annual daily traffic (AADT) charts pertaining to Phase II of the project (See Fig B.1). On the intersection of Raspberry and Dowling, a unique channelized intersection resulted in an overall level of service A. Providing a signalized intersection causes delay and prevents direct traffic flow, which in turn reduces the level of service. The same concept and results apply at the intersection of Seafood Drive and Raspberry Road. Thus, it is recommended to construct uncontrolled and channelized intersections in Phase II.

B.2.0 INTRODUCTION

It is evident that the population of Anchorage, Alaska is increasing (U.S. Census). In turn, traffic flow within the Anchorage Bowl is often congested and causing delay for drivers.

The ADOT&PF is continuing its advancement in the construction of the West Dowling Road Extension. This project depicts an east to west corridor in the Anchorage Bowl. This extension will help mitigate traffic congestion and delay during the critical hours of the day; primarily morning and afternoon peak hours. Furthermore, the extension will improve east to west travel. This design is considered under two phases. Phase I includes the connection between Old Seward Highway and C Street and Phase II continues from C Street to Minnesota Drive.

B.3.0 PROBLEM DEFINITION

Design of intersections on Raspberry Road, West Dowling Road, Seafood Drive, and Raspberry Road, to provide seamless traffic flow on the intersections. Channelized intersection design, roundabout, and signalized intersection are compared and analyzed to meet the goal.

B.4.0 METHODOLOGY

HCS2000 software is used to determine the LOS on two intersections with anticipated traffic data for 2035. On the Seafood Drive and Raspberry Road intersection, semi-actuated signal; simple two phase signal, is applied due to the light traffic volume (thirty-six left turning vehicle and four right turning movements) on minor road (Seafood Drive). For the Raspberry Road and West Dowling Road, pre-time signal is applied.

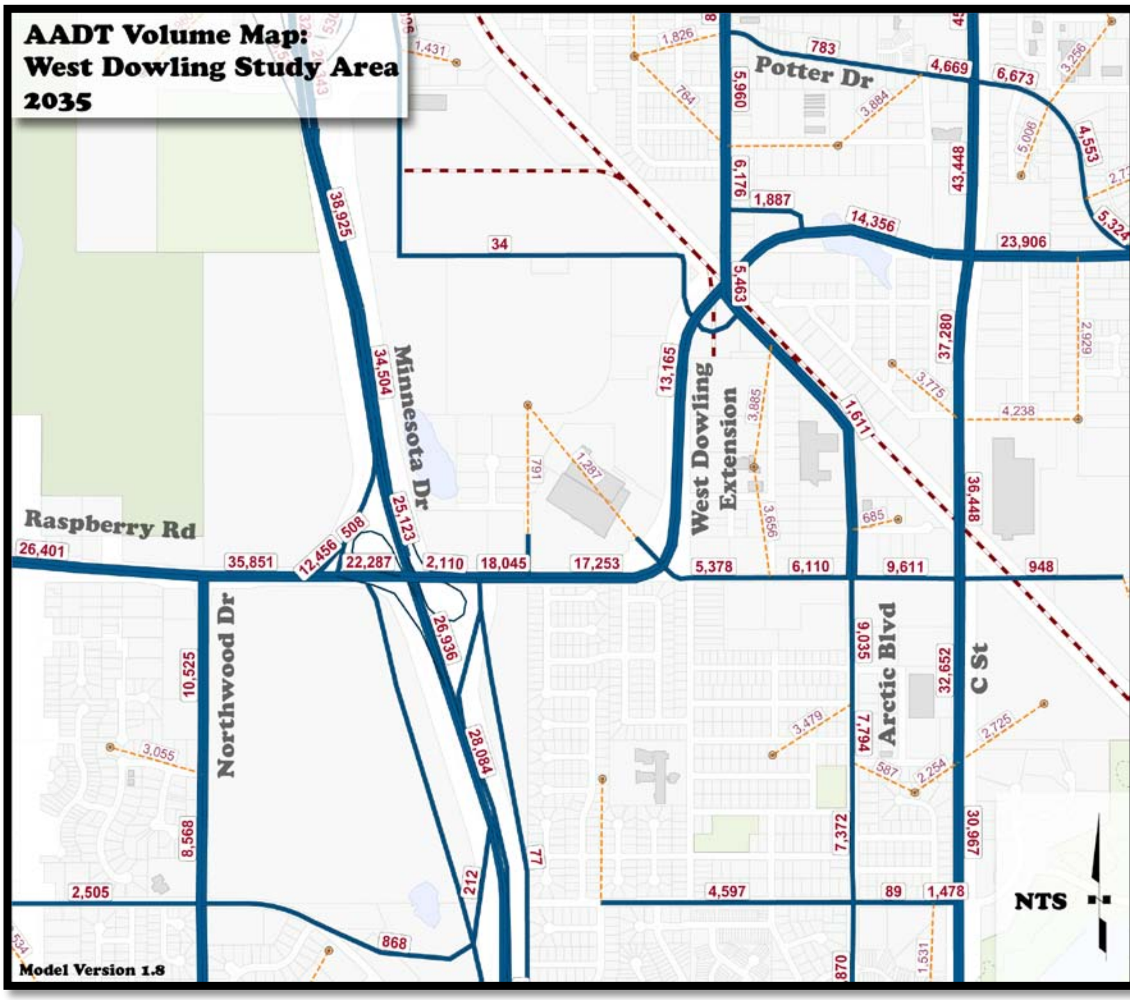

Figure B.1: AADT Volume Map for WDR 2035 Traffic Analysis (ADOT&PF, 2010)

B.5.0 DISCUSSION

For the two intersections of concern, three alternatives were analyzed:

1. Channelized Intersection
2. Signalized Intersection
3. Roundabout Intersection

Each of these three alternatives will be independently analyzed for their particular method of use.

B5.1 Dowling Road & Raspberry Road

The particular aspects of this intersection do not allow for a simple solution. The major approach has heavily occurring traffic during the weekday peak, and the minor approach has heavy traffic only on Sundays due to the presence of Changepoint Church.

- Alternative 1. A channelized intersection modified to fit (see Fig B.2) is easily adaptable. The main approach has no interruption of flow, save for instances where an on-demand pedestrian "walk" signal stops major approaches and allows for safe traversing of pedestrians.
  - The minor approaches will accumulate traffic during periods of heavy flow on the major, but according to data provided by the ADOT&DF, the minor approach's heavy flow will not occur simultaneously with that of the major's. In fact, due to the minor only experiencing heavy flow on Sundays, when major approach traffic is minimal, traffic will not be hindered. This allows for seamless flow.
- Alternative 2. A signalized intersection is the second alternative, and is not an insufficient one. A 2035 AADT analysis of the design seen in Fig B.` provides a level of service of B. Due to a design level of C, this is a positive aspect.
  - However, an objective of the traffic analysis is to provide seamless flow for the major approach. A signal will interrupt flow for the major approach if it will provide any service to the minor approach. This negative aspect is compounded by the fact that minor traffic will be minimal during the most vital time of service being provided to the major approach.
- Alternative 3. A roundabout intersection is best fit for an intersection that has a roughly equal amount of traffic approaching from both directions. According to the statistics

provided by the ADOT&PF, the amount of major traffic is roughly three times that of the minor. Thus, a roundabout would be unnecessarily interrupting major flow.

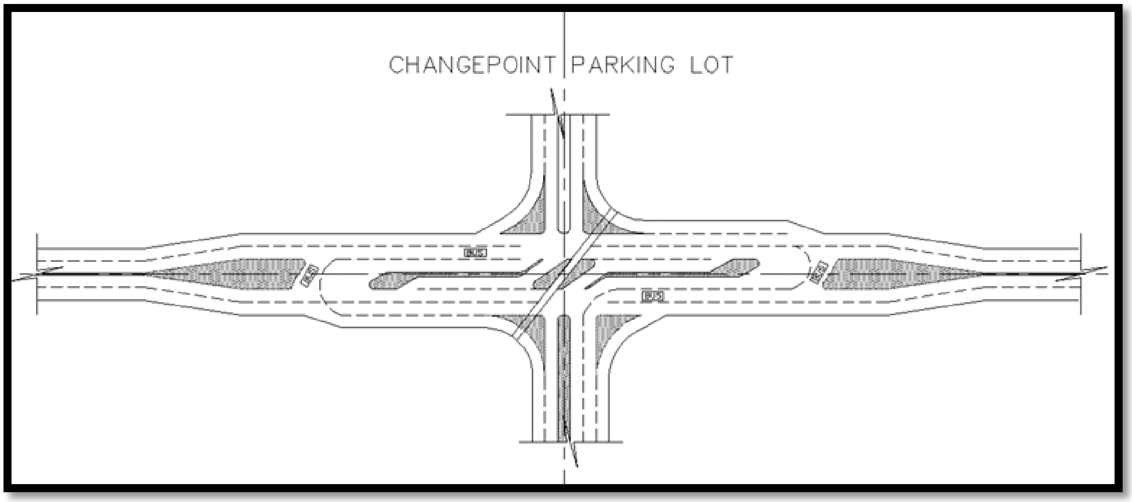

Figure B.2: Proposed Channelized Intersection

B5.2 Raspberry Road & Seafood Drive

- Alternative 1. The first alternative is a right-turn only exit from the ChangePoint Church parking lot. This alternative would allow for no interruption of the major approach. Traffic on the major road wishing to make a left-turn onto Seafood Drive would be routed to the Dowling Road & Raspberry Road intersection.
- Alternative 2. A signal would be a fair solution for this intersection, as it would allow major traffic to make a left turn onto Seafood Drive, however the major road through traffic would be unnecessarily interrupted on weekday peak-hour periods.
- Alternative 3. For the same reasons stated in the Dowling Road and Raspberry Road intersection, a roundabout would be an insufficient choice for this intersection.

B.6.0 DATA COLLECTION

The data collected for the traffic analysis are current and projected traffic flow volumes and turning movements within the afternoon peak hour. This data was collected and based on HDR's traffic research. Furthermore, roadway geometry variables, such as turning radius of design vehicles and width of traveled way have been validated throughout the analysis. These variables were obtained from AASHTO Highway Construction Manual.

B.7.0 DATA ANALYSIS

For the purpose of this study, the analysis measured of level-of-service on each intersection and compared three different cases which provide comparative traffic flow.

First, signalized intersection is designed and analyzed.

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Num. Lanes	1	2	0	0	2	0	0	0	0	1	0	1
Volume	36	655	0	0	1091	0				4		36
Parking		N			N						N	
Coord.		N			N						N	
LT Treat.	U			P						P		

Peak hour factor: 0.90 Area Type: All other areas

Table B.1: Seafood Drive and Raspberry Road Intersection

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	2	0	0	2	0	0	0	0	1	0	1
LGConfig	L	T			T					L		R
Volume	36	655			1091					4		36
Lane Width	12.0	12.0			12.0					12.0		12.0
RTOR Vol												0

Table B.2: West Dowling Road and Raspberry Road Intersection

Table B.1 shows traffic data during PM peak hour and lane-usages on intersection of Seafood Drive and Raspberry Road. Table B.2 shows traffic flow data during PM peak hour and lane-usages on West Dowling Road and Raspberry Road intersection.

The input volume data used above is adjusted traffic volume. For both cases, peak hour factor, which is the relationship between the hourly volume and the maximum rate of flow within the hour, is assumed to be 0.90 and v/c ratio, which is the ratio of current or projected demand flow to the capacity of the highway, is also assumed to be 0.9.

With the calculated green-time and signal phasing plan on two intersections, level-of-service is determined. Table B.3 below shows the level-of-service on each lane and overall level-of-service A on the Seafood Drive and Raspberry Road intersection. Table B.44 shows level-of-service on each lane and overall level-of-service B on the West Dowling Road and Raspberry Road. In Tables B.3 and table B.4 below, lane group capacity is the converted traffic volume to equivalent through vehicle units, Adjust saturation flow rate is the adjusted traffic vehicles per hour of green per lane, and g/c is the ratio of green time to total cycle signal length.)

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	289	389	0.14	0.74	3.2	A		
T	2629	3539	0.28	0.74	2.8	A	2.8	A
Westbound								
T	2629	3539	0.46	0.74	3.6	A	3.6	A
Northbound								
Southbound								
L	10	1770	0.40	0.01	119.7	F		
							34.5	C
R	196	1583	0.20	0.12	26.0	C		
	Intersection Delay = 4.0			(sec/veh)	Intersection LOS = A			

Table B.3: Performance Summary on Raspberry Road and Seafood Road Intersection

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	139	327	0.19	0.43	14.1	B		
T	1505	3539	0.52	0.43	14.5	B	14.5	B
Westbound								
L	211	496	0.60	0.43	25.9	C		
T	1505	3539	0.66	0.43	16.5	B	17.5	B
Northbound								
L	597	1770	0.40	0.45	13.1	B		
T	831	1863	0.22	0.45	11.1	B	12.3	B
Southbound								
L	249	1199	0.25	0.21	23.0	C		
T	387	1863	0.04	0.21	19.9	B	22.4	C

Intersection Delay = 15.8 (sec/veh) Intersection LOS = B

Table 4: Performance Summary on West Dowling Road and Raspberry Road Intersection

For the channelized intersection, unsignalized intersection calculations were made by hand using the methods prescribed in *Traffic Engineering* (Roess, *et al*., 2004).

Opposing Flow Volumes Vcx = 853 + 114 = 967 veh/h

Potential Capacity Cpx = $Vcx[e^{(-VcxTcx/3600)}/(1- e^{(-VcxTfx/3600)})]$

Tcx = 4.1 s

Tfx = 2.2 s

Cpx = 720.5 veh/h

Movement Capacity = Cmx = CpxPviPpj

Pvi = 0.9

Ppj = 1

Cmx = 648 veh/h

$$ControlDelay = Dx = \frac{3600}{Cmx} + 900T\left[\left(\frac{Vx}{Cmx} - 1\right) + \sqrt{\left(\frac{Vx}{Cmx} - 1\right)^2 + \frac{\left(\frac{3600}{Cmx}\right)\left(\frac{Vx}{Cmx}\right)}{450T}}\right]$$

Vx = 213 + 23 = 236 veh/h

T = 1.0 hr

Dx = 8.7 sec/veh (LOS = A)

B.8.0 CONCLUSION

The construction of a pre-timed signalized intersection on the Raspberry Road and Dowling Road intersection produces a LOS B. On the same intersection, constructing a roundabout would be insufficient because of the heavy percentage of intersection traffic on the major and traffic flow would be interrupted. A channelized intersection will provide level of service A. Therefore, Alternative 1, the channelized intersection is recommended.

On the T-intersection of Seafood Drive and Dowling Road, the construction of either a semi-actuated intersection or a channelized intersection will both provide level of service A. It is evident based on level of service and operation of the design alternative that using a channelized design is effective for direct and uninterrupted traffic flow. Thus, it is recommended to utilize a right-turn only channelized intersection for the intersections considered in Phase II of the project.

B.9.0 REFERENCES

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Highway Capacity Manual 2000, Transportation Research Board

DESIGN STUDY REPORT

APPENDIX C
ROADWAY GEOMETRY

WEST DOWLING ROAD EXTENSION: PHASE II
C STREET TO RASPBERRY ROAD

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LIST OF ACRONYMS

AASHTO…………………American Association of State Highway and Transportation Officials
ADOT&PF…………………...………Alaska Department of Transportation and Public Facilities
FHWA……………………………………………………...Federal Highway Administration
PCM………………………………………...……………………..Preconstruction Manual
PGDHS………………………………...….A Policy on Geometric Design of Highway & Street

C.1.0 DESIGN STANDARDS AND GUIDELINES

As a state funded project, West Dowling Road Phase II must be designed in accordance with Federal Highway Administration (FHWA) guidelines. FHWA guidelines require that federal aid projects be designed in accordance with State laws and design standards.

The State of Alaska uses the Alaska Department of Transportation and Public Facilities (ADOT&PF) *Preconstruction Manual* (PCM) to establish design standards. The PCM references the American Association of State Highway and Transportation Official's (AASHTO's) *A Policy on Geometric Design of Highways and* Streets (PGDHS), the AASHTO *Roadside Design Guide* and the AASHTO *Bike Guide*.

These documents were used to determine the most applicable design standards for this project.

C.2.0 ROADWAY CLASSIFICATION

West Dowling Road is designated as an Urban Major Arterial.

C.3.0 DESIGN CONTROLS AND CRITERIA

C.3.1 Design Vehicle

The selected Design Vehicle selected is the WB-67 Interstate Semi-Truck. Although semis are a relatively small fraction of the overall traffic, West Dowling Road Phase II features exceptionally low accessibility, with the only approaches in the project area occurring at Seafood Drive and Raspberry Road. Therefore, the use of a large design vehicle is not a major limiting factor in the design of the highway.

C.3.2 Design Speed

Based upon the roadway classification, accessibility, topography, and expected traffic volumes, the recommended design speed is 50 miles per hour (mph).

The design speed is used for establishing minimum geometric standards to ensure driver safety on the highway and is not the same as the speed limit. The recommended speed limit for West Dowling Road Phase II is 45 mph, but the speed limit for the completed roadway should be determined in accordance with DOT&PF Policy No. 05.05.020 – Establishment of Speed Limits and Zones.

C.4.0 DESIGN ELEMENTS

A summary of all project design criteria is includes as Figure C.3.

C.4.1 Horizontal Alignment

Based upon the design speed of 50 mph, the PGDHS recommends a minimum horizontal curve radius of 835 feet. This value is for a maximum superelevation rate, e_{max}, of 6%. For the recommended alignment, horizontal curve radii were maximized within the right-of-way, bridge, and topological constraints.

C4.2 Vertical Alignment

For an Urban Major Arterial over level terrain with a design speed of 50 mph, the PGDHS recommends a maximum grade of 6%. The PGDHS further recommends that for a 50 mph design speed, the ratio of the length of vertical curve to the algebraic difference in grade into and out of the curve, the "K" value, not exceed:

- 84, for crest vertical curves
- 96, for sag vertical curves

For the recommended alignment, the grade reaches the maximum of equal 6% on the fill on the west side of the bridge over Arctic Boulevard and the Alaska Railroad. This is to minimize fill quantities and reduce earthwork costs. On the east side of the bridge, the maximum grade is 5%, due to topological constraints. The recommended alignment attempts to provide the flattest vertical curves that are economically feasible, with all K values exceeding PGDHS recommendations.

C4.3 Intersections

The proposed project features two intersections: West Dowling Road and Seafood Drive, and West Dowling Road and Raspberry Road. For both intersections, channelization was chosen as the primary means of traffic control. The channelized intersections on Raspberry Road and Seafood Drive would provide seamless traffic flow.

C.4.3.1 West Dowling Road and Seafood Drive Intersection

This intersection will provide access to Raspberry Road and ChangePoint Church allowing free flowing traffic on Raspberry Road. The right turn only lane width from the AASHTO with a radius of 60 feet and an offset of 4.5 feet. The interaction has the following elements.

- Merging lane of 200 feet long.
- No left turns allowed from Seafood Drive and Raspberry Road.
- No left turns from Raspberry Road on to Seafood Drive.

C.4.3.2 West Dowling Road and Raspberry Road Intersection

This intersection would provide free flowing traffic on Dowling. ChangePoint Church would gain a second drive that would provide access to Dowling and Raspberry Roads. The intersection of Dowling Road and Raspberry Road has the following elements.

- 200 foot U-Turn lane with 50 feet for deceleration and 150 feet for capacity.
- 64-foot curve radius for U-Turn lane.
- 60-foot radius right turn only lane with a 4.5-foot offset.

The U-Turn radius of 64 feet would allow the design vehicle to perform the maneuver with comfort, as the minimum turning radius according to the PGDHS is 45 feet.

C.5.0 CROSS SECTIONAL ELEMENTS

The typical cross section design in Figure C.1 has the following elements and a total width of 118 feet.

- Two multi use paths, 10 feet wide, with a 2-foot unpaved shoulder.
- Two buffers for the multi use paths, 10 feet wide with a 5:1 slope.
- Two outside shoulders, 8 feet wide.
- Four travel lanes, 12 feet wide, two lanes in each direction.
- Two interior shoulders, 4 feet wide.
- Center median, 6 feet wide.

Figure C.1: West Dowling Road Typical Section

To minimize bridge width and cost, the multi-use pathways have a reduced separation distance from the traveled way on and in the vicinity of the bridge. Further, the outer shoulders and median have reduced width on and near the bridge. Consequently, the overall bridge cross-section width is 90 feet. Figure C.2 has the following elements for the cross section of the bridge:

- Jersey Barrier median with a width of 32 inches.
- 4 foot inside shoulders.
- Four 12 foot lanes, two in each direction.
- 5-foot wide outside shoulders.
- TL-5 bridge railing at the edge of the outer shoulder, mounted on concrete stem walls.
- Two 10-foot multi-use pathways.
- Pedestrian railing mounted on concrete stem walls at the outer edges of the multi-use pathway.

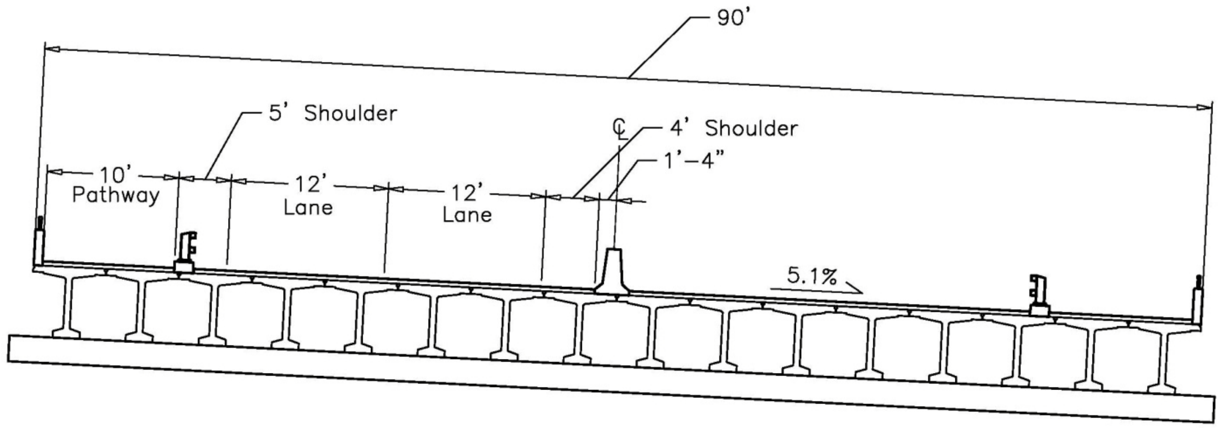

Figure C.2: West Dowling Road Bridge Typical Section

C.6.0 BARRIERS

The required clear-zone on Phase II of the West Dowling Extension is 22 feet. Based on foreslopes that are parallel to the through travel way and the design speed of 50 mph. Barriers are warranted at the bridge approach and bridge sections; in Figure C.2, an embankment of 2H:1V exists on both of the roadsides within the clear-zone. From ADOT&PF requirements, a slope of 3H:1V or steeper within the clear-zone shall require shielding. The barriers for the embankment and the approach to the bridge will have:

- TL-3 wood post W-beam barrier with a length of 180 feet with an offset from the edge of travelled way of 4 feet.
- TL-3 Extruder Terminal (ET-2000) end treatments for the W-beam guardrail
- For the Jersey Barrier on the bridge a crash cushion is required.

The barriers for the approach to the bridge will terminate within the clear zones, therefore an end treatment is required by AASHTO. The end treatments will gradually dissipate the crash energy absorbed by the head sliding along the rail element while flattening it. A crash cushion will shield the end of the Jersey Barrier from impacts.

C.7.0 DESIGN ALTERNATIVES

C.7 .1 Alternative 1: Construct West Dowling Road Phase II

Alternative 1 would construct West Dowling Road from Raspberry Road to C Street. The proposed alignment follows the existing Dowling right-of-way as much as possible, but diverges in the vicinity of the bridge to avoid altering access to adjacent land. No access is provided between the Raspberry Road and C Street intersections, allowing maximum mobility. Alternative 1 provides two 12 foot wide lanes in each direction and two 10 foot wide multi-use pathways along the entirety of the project. West Dowling Road Phase II would have an approximate length of 5,300 feet.

PROJECT DESIGN CRITERIA
(Figure 1100-2 of the Highway Preconstruction Manual)

Project	**West Dowling Road Extension Phase II, Raspberry Road to C Street**
☒ New Construction/Reconstruction	☐ Rehabilitation (3R) Other
Design Functional Classification	**Urban Minor Arterial**
Design Year (Usually 5-year increment at least 20 years after construction)	**2031** [ADOT&PF Design Designation]
Present ADT (2010)	**15,500** [ADOT & PF Design Designation]
Design Year ADT (2035)	**19,000** [ADOT & PF Design Designation]
Mid Design Period ADT (2021)	**,17,040** [ADOT & PF Design Designation]
DHV (%)	**5,850** [ADOT & PF Design Designation]
Directional Split (%D)	**N/A** [ADOT & PF Design Designation]
Trucks (PTT)	**2%** [ADOT & PF Design Designation]
Equivalent Single Axle Load (ESAL)	**9,000** [ADOT & PF Pavement Recommendations]
Pavement Design Year (Construction Year + **15**)	**2026** [PCM 1180.3.2, ADOT Pavement Design is 20 years]
Design Vehicle	**WB-67D**
Design Speed	**50 mph** [GB, Pg. 474]
Stopping Sight Distance	**425 Feet** [GB Exhibit 7-1, Pg. 449]
Passing Sight Distance (operational)	**1835 Feet** [GB Exhibit 7-1, Pg. 449]
Maximum Allowable Grade	**6 %** [GB, Exhibit 7-10, Pg. 476]
Minimum Allowable Grade	**0.5 %** [GB, Pg. 242]
Minimum Allowable Radius of Curve	**835 Feet** [GB, Exhibit 3-22, Pg. 159]
Minimum K-value for Vertical Curves	Sag **96** [GB, Exhibit 3-79, Pg. 280] Crest **84** [GB, Exhibit 3-76, Pg. 274]
Number of Roadways	**One**
Width of Traveled Way	**78 feet (four 12' lanes)** [PCM 1160.3.2 and 3R analysis]
Width of Shoulders: Outside	**8 feet** Inside **4 feet**
Surface Treatment: T/W	**Asphalt Pavement** Shoulders **Asphalt Pavement**
Side Slope Ratios (H:V): Foreslopes	**1V:2H** Backslopes **2V:1H**
Degree of Access Control	**Driveway/Entrance Regulations** [GB, Pg. 88]
Median Treatment (If applicable)	**6 ft level median** [GB]
Illumination	**N/A**
Curb Usage & Type	**Type I**
Bicycle Provisions	**10 ft Separated Multi use Pathway**
Pedestrian Provisions	**10 ft Separated Multi use Pathway**
Miscellaneous Criteria	**N/A**

Proposed by ______________ Date:________ Recommended by ______________ Date:________
Engineering Manager

Accepted by ______________________________
Regional Preconstruction Engineer

Figure C.3: West Dowling Road Preliminary Design Criteria

C.8.0 REFERENCES

American Association of State and Highway Officials (2004). *A Policy on Geometric Design of Highway and Streets*, American Association of State and Highway Officials

American Association of State and Highway Officials (1999). *Guide for the Development of Bicycle Facilities,* American Association of State and Highway Officials

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

American Association of State and Highway Officials (2004). *Roadside Barriers*, American Association of State and Highway Officials

National Cooperative Highway Research Program Report 492. *Roadside Safety Analysis Program (RSAP),* http://144.171.11.107/Main/Blurbs/Roadside_Safety_Analysis_ProgramEngineers_Manual_152743.aspx. (March, 12,2010)

DESIGN STUDY REPORT

APPENDIX D
PAVEMENT DESIGN

WEST DOWLING ROAD EXTENSION: PHASE II
C STREET TO RASPBERRY ROAD

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April 2010

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LIST OF ACRONYMS

CBR ……………..……………………………………………..………...California Bearing Ratio
SN…………………………………………………………...………………..Structural Number
M_R…………………….………………………………...………………...Modulus of Resilience
ESAL.…………………………………………………………..…….Equivalent Single Axle Load
ADOT&PF……….…………….…….Alaska Department of Transportation and Public Facilities
AASHTO…….….….…. American Association of State Highway and Transportation Officials

D.1.0 INTRODUCTION

This report documents and summarizes the Pavement Design Plan recommendations for the roadway and non-motorized pathways through the West Dowling Road corridor.

D.2.0 FLEXIBLE PAVEMENT STRUCTURE

The pavement structure has several layers that must be designed concurrently. The layers include:

- Surface course
- Binder course
- Base course
- Subbase
- Natural subgrade.

D.2.1 Surface Course

The surface material consists of the wearing course and the binder course. The top most layer of the pavement structure is the wearing course, which provides resistance to abrasion, thermal cracking, fatigue, and water penetration. Below the wearing course is the binder course and provides support to the wearing course. The binder course has the same properties as the wearing course.

D.2.2 Binder Course

The binder course is an asphalt base course. A second layer is required when the pavement is too thick to be placed in a single layer and compacted properly. The binder course is typically lower quality asphalt because the layer is not exposed to the same harsh conditions as the surface course.

D.2.3 Tack Coat

A tack coat is used as a bonding agent between paved layers. It is recommended to use a very thin tack coat between the surface course and binder course.

D.2.4 Base Course

The base course is the layer immediately under the binder course and has a high bearing capacity.

D.2.5 Subbase

The subbase material is the lower pavement structure and can consist of select material or borrow, which has much lower bearing capacity than base course. Thick layers of subbase are often used because the material is much more economical than base course.

D.3.0 DESIGN METHODS

D.3.1 Roadway

The flexible pavement structures were designed using the recommended procedures by the American Association of State Highway and Transportation Officials (AASHTO). The procedure consists of empirical performance equations based on results of an extensive road test.

D.3.2 Pathways

The flexible pavement structures were designed using the recommended procedures by the AASHTO Guide for Development of Bicycle Facilities and the State of Alaska Department of Transportation Flexible Pavement Design Guide.

D.4.0 DESIGN CRITERIA

The AASHTO Method encompasses several design variables including: analysis period, traffic, reliability, environmental effects, serviceability, effective roadbed soil resilient modulus, the structural number, and pavement performance.

D.4.1 Analysis Period

The analysis period is the design period for the pavement structure. The analysis period is taken as 20-years, a typical design period. The analysis period is also chosen in conjunction with the traffic analysis reports, which are also projected to a 20-year period.

D.4.2 Traffic

The traffic is based on cumulative expected 18,000 pound equivalent single-axle load (ESAL) as seen on Table D.1 Traffic volumes were taken from a traffic study projecting volumes to 2035 (Figure D.5). The typical vehicle usage was estimated based on traffic studies of the surrounding roads. The typical vehicle usage includes:

- Eighty-five percent passenger vehicles
- Eight percent two axle trucks
- Five percent three axle trucks
- One percent buses
- One percent semi-trailer trucks.

The growth factor was taken as 2.5 percent, the standard Municipality of Anchorage value. The calculated ESAL value was 2,700,000; intermediate values can be seen on Table D.1.

D.4.3 Reliability

Reliability is the degree of certainty the design will last the analysis period. Reliability factors are determined from the road classifications and volume. The reliability degree was conservatively taken as eighty-five percent.

D.4.4 Environmental Effects

The project has a high water table in several areas and is at risk of frost heaving. The AASHTO equations were modified with recommended drainage coefficient to reflect subgrade and environmental conditions. The subbase drainage pattern is not precisely known and the coefficient was taken as 0.40, the most conservative value. The base course allows more drainage and the coefficient was taken as 1.15 (Huang, 2004).

D.4.5 Serviceability

Serviceability indexes are established to equate change in serviceability. The typical initial value from the road test is 4.2 for flexible pavement. The terminal serviceability index is the lowest index before rehabilitation, resurfacing, and reconstruction. An index of 2.5 is suggested for design of major highway (Huang, 2004).

D.4.6 Effective Roadbed Modulus

Alaska Department of Transportation (ADOT & PF) standard Typical California Bearing Ratios (CBR) values were used for both base course and subbase, 80 and 20 respectively. The geotechnical report provided did not contain CBR values, a value of 10 was assumed based on the soil classification. The CBR values were converted into the effective roadbed soil resilient modulus (M_R) as required by the AASHTO Method. The M_R values for the base course, subbase and natural soil were 40,000, 11,000, 9,500 pounds per square inch.

D.4.7 Structural Number

The structural number (SN) is a function of the design variables and uses the AASTO Method for determining the minimum layer thicknesses. The SN does not provide a unique solution, but a varying one. The base course material thickness was decreased and the subbase material was increased to provide an optimum economical design, due to the high cost of base course.

D.4.8 Pavement Performance

The functional and structural variables are the two primary factors considered when looking at pavement performance. The functional performance of the road refers to the riding comfort of the roadway. Structural performance is the ability of pavement to withstand negative factors like cracking, rutting, and frost heaving while being able to withstand the traffic load. To increase the structural integrity, performance grade polymer modified asphalt cement is recommended. The polymer modified asphalt has several advantages including: greater ductility, greater elastic recovery, high viscosity, greater cohesive strength, and reduced thermal cracking. Based on the climate of the project area, PG 64-34 Polymer modified asphalt cement is recommended.

D.5.0 ROADWAY

Three alternatives for the pavement design were researched and compared. Alternative 1 is the recommended alternative.

D.5.1 Alternative 1- Rubberized Asphalt

The alternative 1 surface course is Hot Mix Asphalt, Type R. Type R is an asphalt mix containing crumb rubber as one of the aggregates. This is the recommended asphalt due to its many benefits, which include reduced road noise, reduced maintenance, and a long life span. Local residents have expressed concern about the increased road noise in the Raspberry Road area. Rubberized asphalt is known to decrease the road noise an average of seven to nine decibels, which will decrease the effects of the noise on the local residents. Anchorage roads are highly susceptible to thermal cracking and rutting. Studies have shown a decrease in rutting and thermal cracking in rubberized asphalt, which will decrease maintenance cost during the life of the road. Rubberized asphalt has been used on local roads and results show an unusually long life span of up to 25 years on some roads (ADOT & PF). The rubberized asphalt has a higher initial cost than standard asphalt mixes, but the long life span and decreased maintenance will result in a lower lifetime cost.

Alternative 1 uses Hot Mix Asphalt, Type II, Class A as the binder course. The total recommended asphalt thickness is five inches and to get adequate compaction lifts should be no more than three inches thick. Due to these requirements a binder course is required. It is recommend using Hot Asphalt Mix, Type II, Class A be used to reduce the project cost. Compared to the surface course, thermal cracking is not as great as a concern; the asphalt is not exposed directly to varying weather conditions. Noise reduction is not a design criterion for the binder course because the traffic is not in direct contact with the surface. Also because the traffic is not in direct contact with the pavement, road wear is not a concern. Tack coat should be used in between the binder course and surface course to insure proper bonding between the layers. The standard ADOT specified material is recommended, STE-1.

It is recommended to use Aggregate Base Course, Grading D-1 for the base course material. The material is crushed stone of sound, tough and durable rock of uniform quality. The material compacts well and is easily graded to obtain desired road surface grades. Due to the high local cost of the material a thin layer is recommended.

It is recommended to use Selected Material, Type A as the subbase. A thick layer is recommended as an economical solution to obtain the required bearing capacity not provided by the asphalt and base course. Once the required bearing capacity is obtained by meeting the calculated SN values the remaining subgrade is recommended to be Selected Material, Type C. The depth of the Selected Material, Type C shall be decided by the depth of suitable natural subgrade.

The following is the recommended pavement structure and Figure D.1 shows a typical detail:

- Two (2) inches of Hot Mix Asphalt, Type R, over
- Three (3) inches of Hot Mix Asphalt, Type II; Class A, over
- Two (2) inches of Aggregate Base Course, D1, over
- Sixty-six (66) inches minimum of Selected Material, Type A

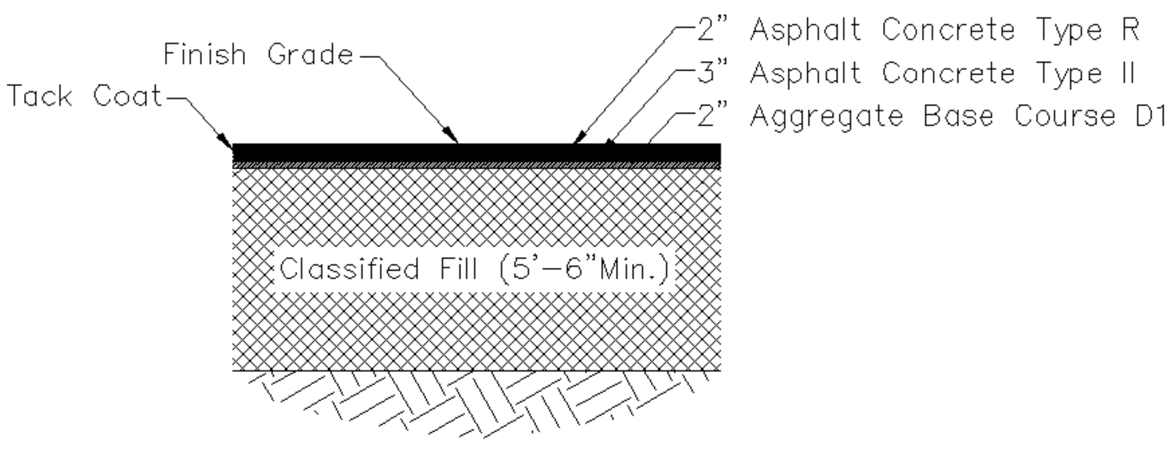

Figure D.1: Alternative 1 Detail

D.5.2 Alternative 2- Superpave Asphalt

Alternative 2 for the surface course and binder course is Hot Mix Asphalt, Type V. Type V is the ADOT nomenclature for superpave asphalts. Superpave is a region based mixed design for pavement that requires the use of hard, dense, elongated, and flat aggregate. Typical hard aggregates used in superpave asphalts are not available locally. Superpave asphalts typically last longer, have reduced thermal cracking and reduced rutting compared with standard asphalts. The superpave mix design does not reduce road noise. The required pavement structure design has three asphalt layers, a surface course and two binder courses. The maximum nominal aggregate size increases with each layer.

Alternative 2 base course, subbase and tack coat are identical to the recommended roadway design. The base course is not required by the bearing capacity calculated by the SN values, but is necessary for drainage and grading.

Alternative 2 is not the recommended pavement structure due to the high cost to import hard aggregates, the complicated mixes and involved construction practices necessary. Alternative 2 also does not address the increased noise concern.

The following is the Alternative 2 pavement structure and Figure D.2 shows a typical detail:

- One and a half (1.5) inches of Hot Mix Asphalt, Type V; 1/2", over
- Two (2) inches of Hot Mix Asphalt, Type V; 3/4", over
- Two and half (2.5) inches of Hot Mix Asphalt, Type V; 1", over
- Two (2) inches of Aggregate Base Course, D1, over
- Sixty-six (66) inches minimum of Selected Material, Type A

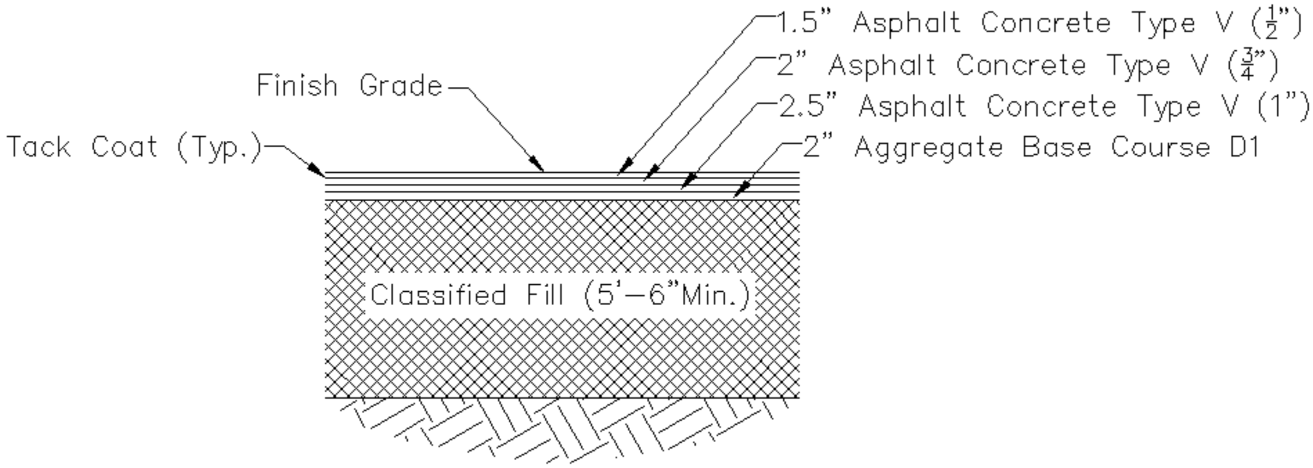

Figure D.2: Alternative 2 Detail

D.5.3 Alternative 3- Standard Asphalt

Alternative 3 for the surface course and binder course is Hot Mix Asphalt, Type II, Class A. Type II is the typical standard hot asphalt mix used locally and has a low initial cost.

Alternative 3 base course, subbase and tack coat are identical to the recommended roadway design.

Alternative 3 does not address thermal cracking, rutting, and noise concerns. Alternative 2 also has a relatively low usable life. Alternative 2 is not the preferred alternative.

The following is the Alternative 3 pavement structure and Figure D.3 shows a typical detail:

- Two (2) inches of Hot Mix Asphalt, Type II; Class A, over
- Three (3) inches of Hot Mix Asphalt, Type II; Class A, over
- Two (2) inches of Aggregate Base Course, D1, over
- Sixty-six (66) inches minimum of Selected Material, Type A

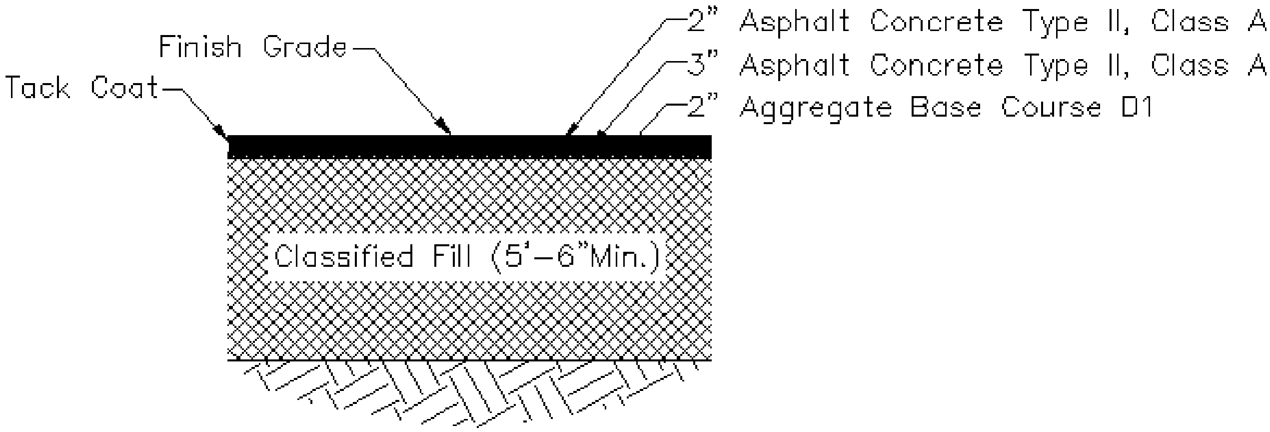

Figure D.3: Alternative 3 Detail

D.6.0 NON-MOTORIZED

It is recommended to use Hot Mix Asphalt, Type III, Class A. The State of Alaska Department of Transportation Flexible Pavement Design Guide recommends a minimum of two inches for all paved surfaces. The minimum asphalt thickness is recommended as a result of the traffic type. Pathways are highly susceptible to frost heaving in the area and a thick base course is recommended as opposed to a thicker asphalt layer. For ease of construction the subbase should end at the same depth of the roadway subbase.

The following is the recommended pathway structure and Figure D.4 shows a typical detail:

- Two (2) inches of Hot Mix Asphalt, Type III; Class A, over
- Four (4) inches of Aggregate Base Course, D1, over
- Forty-two (42) inches minimum of Selected Material, Type A

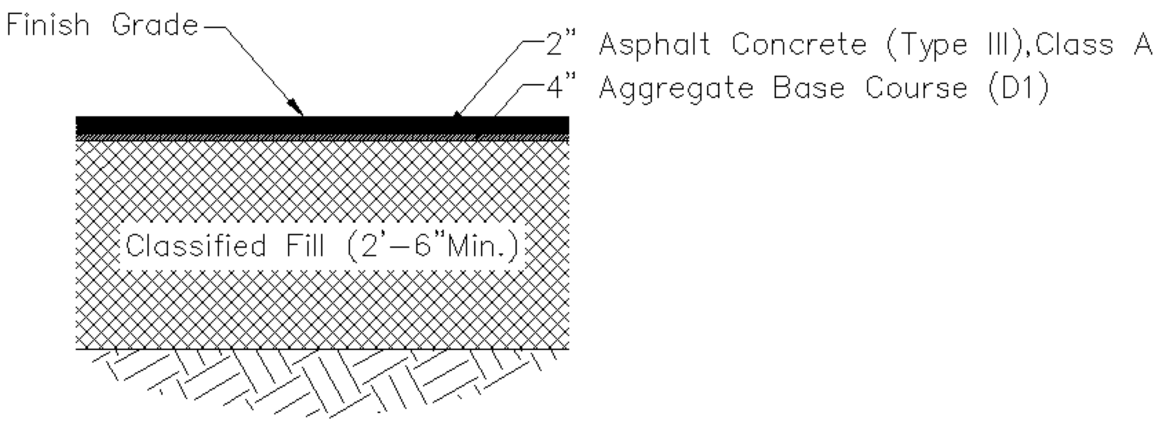

Figure D.4: Non-Motorized Paths Detail

D.7.0 PAVEMENT LAYER INSTALLATION RECOMMENDATIONS

According to the AASHTO guide and the Alaska Preconstruction manual the following installation procedures should be followed during pavement construction:

The aggregates should be moisture conditioned to near optimum moisture content, placed in uniform lifts not to exceed nine inches in thickness, and then be compacted to at least ninety-five percent of the maximum dry density as determined by AASHTO T-99. Asphalt concrete should be placed in equal lifts, and compacted to at least ninety-seven percent of the maximum density as determined by AASHTO T-245.

Topsoil, sod, organics, existing pavement, bound base material, and any other deleterious material should be excavated and removed from beneath all areas to be paved. The top eight inches of subgrade material should be scarified, moisture conditioned to near optimum moisture content, and then compacted to ninety-five of the maximum dry density as determined by AASHTO T-99 before placement of the subbase material.

Granular fill for backfill should be moisture conditioned to near optimum moisture content, placed in uniform lifts, not exceeding nine inches in thickness, and then compacted to at least ninety-five percent of the maximum dry density by AASHTO T-99.

Thin bituminous liquid asphalt, such as tack coat should be applied between HMA pavement lifts to promote bonding (University of Washington 2003).

D.8.0 REFERENCES

University of Washington (2003). "Tack Coats", http://training.ce.washington.edu/WSDOT/Modules/07_construction/tack_coats.htm, March 2010

Huang Y.H. (2004). Pavement Analysis and Design. Pearson Education, Upper Saddle River, NJ

Alaska Department of Transportation and Public Facilities, Standards and Specification for Highway Construction, 2004

First Year Estimated AADT	9,000
Percent Growth Rate of 2.5% for 20 years	28.41
Design Lane Factor	0.5

Type of Vehicle	**Department of Transportation Classifications**	**Percent Trucks**	**Number of Vehicles**	**Truck Factor**	**Growth Factor**	**ESAL**
Passenger Car	1,2,3	85	1,396,125.00	0.00	28.41	793.28
2 Axle Single Unit Truck	5	8	131,400.00	0.02	28.41	55,996.11
3 Axle Single Unit Truck	6	5	82,125.00	0.74	28.41	1,726,546.73
Bus	4	1	16,425.00	0.74	28.41	345,309.35
Semi Trailer Trucks	8	1	16,425.00	1.17	28.41	545,962.07
					Total =	**2,674,608**

Table D.1: The ESAL Calculations

ESAL	2,700,000
Reliability (%)	85
Standard Deviation	0.49
Initial Serviceability Index	4.2
Terminal Serviceability Index	2.5
Change in Serviceability Index	1.7

Table D.2: Pavement Structure Variable

Layer	CBR	M_R (psi)	Drainage Coefficient	Layer Coefficient	Structural Number
Asphalt	N/A	N/A	N/A	0.42	2.4
Base Course	80	40000	1.15	0.14	3.9
Subbase	20	11000	0.4	0.08	4.4
Natural Subgrade	10	9500	N/A	N/A	N/A

Table D3: Structural Numbers

Layer	Initial Layer Thickness (in)	Fixed Layer Thickness (in)	Calculated Layer Thickness (in)	Recommended Layer Thickness (in)
Asphalt	6	5	5	5
Base Course	9	N/A	1.2	2
Subbase	16	66	66	66
Natural Subgrade	N/A	N/A	N/A	N/A

Table D.4: Layer Thicknesses

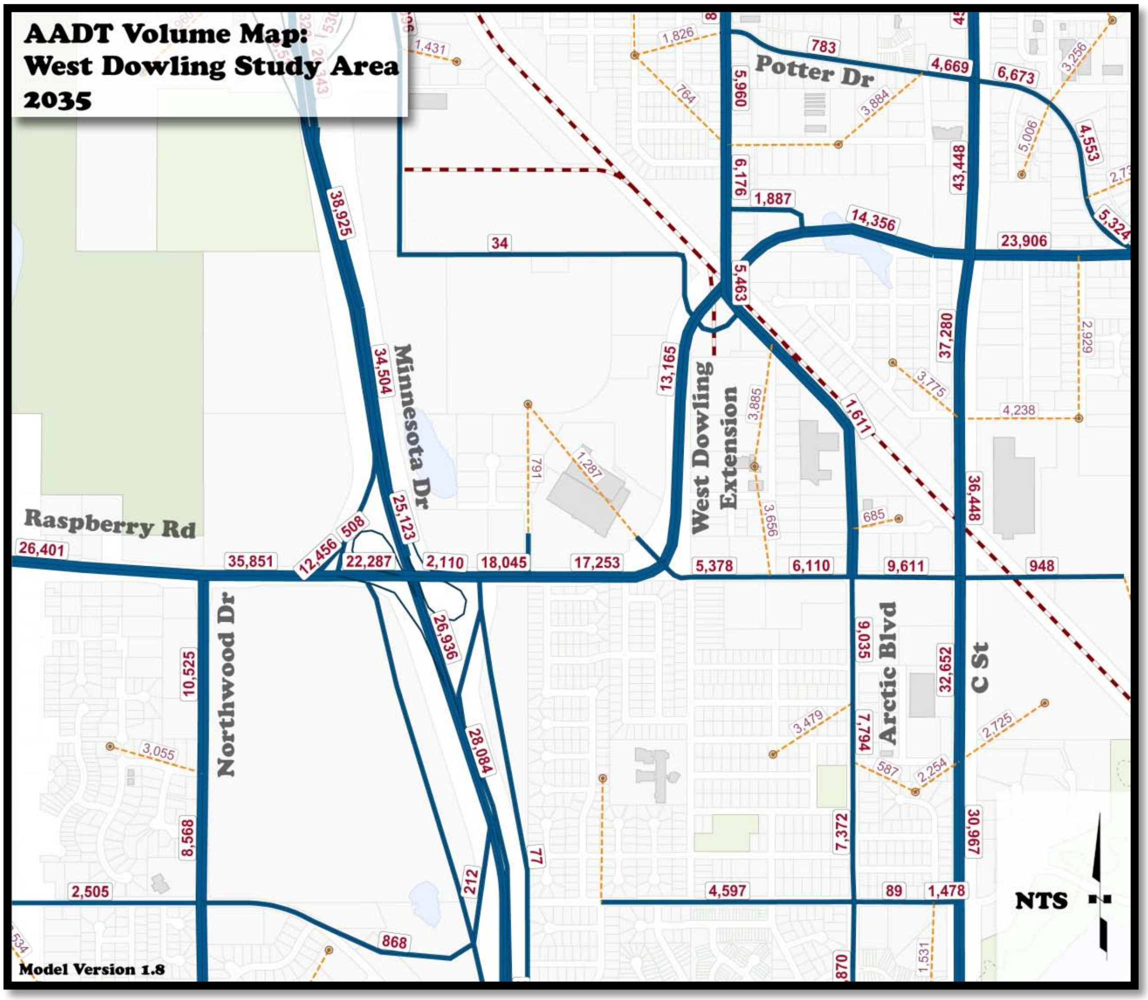

Figure D.5: AADT Volume Map for WDR 2035 Traffic Analysis (ADOT&PF, 2010)

DESIGN STUDY REPORT

APPENDIX E
BRIDGE STRUCTURAL DESIGN STUDY REPORT

WEST DOWLING ROAD EXTENSION: PHASE II
C STREET TO RASPBERRY ROAD

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April 2010

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LIST OF ACRONYMS

AKDOT……………………………………………………..Alaska Department of Transportation
ARRC………………………………………………..………Alaska Railroad Corporation
BDS………………………………………………AASHTO LRFD Bridge Design Specifications
CMP………………………………………………………………….Corrugated Metal Pipe
IM……………………………..………………………………………...Vehicular Impact Load
LL……………………………………………………………………………Vehicular Live Load
MSE…………………………………………………………...Mechanically Stabilized Earth
PCF…………………………………………………………………………Pounds per Cubic Foot
ROW…………………………………………………………………………..…..Right-of-Way
SCM……………………………………………………………………Steel Construction Manual
WA…………………………………………………...……Water Load (considered as snow load)

E.1.0 INTRODUCTION

The following section details the design of the bridge structure at the above-grade crossing of Arctic Boulevard. A primary goal of the West Dowling extension is to create a high-speed east-west corridor through Anchorage. To accomplish this through Arctic Boulevard, a grade separated roadway has been determined to be the most suitable alternative to allow free traffic flow from C Street to Minnesota Avenue.

E.2.0 DESIGN CRITERIA

The criteria used to design the Arctic Boulevard crossing was organized into two categories:

- General bridge design specifications
- Site-specific requirements

E.2.1 Design Specifications

The AASHTO LRFD Bridge Design Specification (BDS) was the primary specification used to determine the bridge superstructure and substructure requirements. The BDS includes the relevant loading conditions, design vehicles, limit states, modifiers, and design factors used for the current bridge analysis and design.

E.2.2 Site-Specific Criteria

Multiple factors influence the placement and geometry of the Arctic Boulevard bridge. Placement was constrained based on existing AKDOT ROW, ARRC ROW clearance requirements, and roadway alignment. The bridge geometry was determined based on the previous requirements, to include: roadway vertical alignment including necessary super-elevation and run-off.

E.3.0 STRUCTURAL ALTERNATIVES

The following bridge alternatives and preferred alternative are presented for consideration. Engineer's cost estimates presented herein include a 30% contingency factor for various unknowns inherent in preliminary design.

E.3.1 Alternative I – Single-span

The single-span alternative shown in Figure E.1 represents the lowest overall bridge cost of all alternatives. The span length is defined by a minimum ARRC structure offset of 25 feet at the northwest abutment and Arctic Boulevard to the southwest. This alternative would require reroutes for existing traffic patterns both onto and off of Arctic Boulevard that could require a tunnelized section underneath the new West Dowling Road extension south of the Arctic Boulevard crossing. The estimated cost of Alternative I is $4,100,000.00

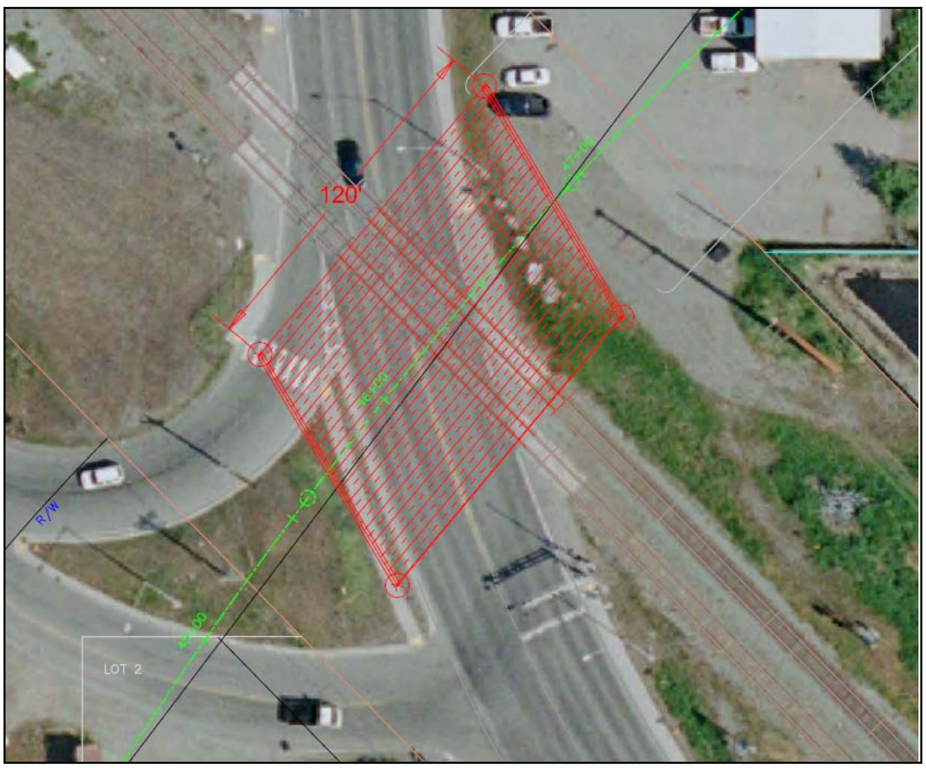


Figure E.1: Single-Span Alternative

E.3.2 Alternative II – Two-span (Option I)

The first of the two span options attempts to minimize the DOT encroachment into ARRC ROW at the northeast abutment while maintaining the frontage access onto Arctic Boulevard (Fig E.2). Rovenna Road access from Arctic Boulevard would likely require a reroute for this option. The bent placement would require significant realignment of Arctic Boulevard underneath the bridge itself. The placement of column bents at the Arctic Boulevard median would represent both an impact hazard to the bridge structure and possibly a driving sight hazard for motorists. Alternative II warrants consideration as it seeks to eliminate a conflict with both an existing 10 inch water main and 42 inch CMP storm drain running parallel to the east side of Arctic Boulevard.

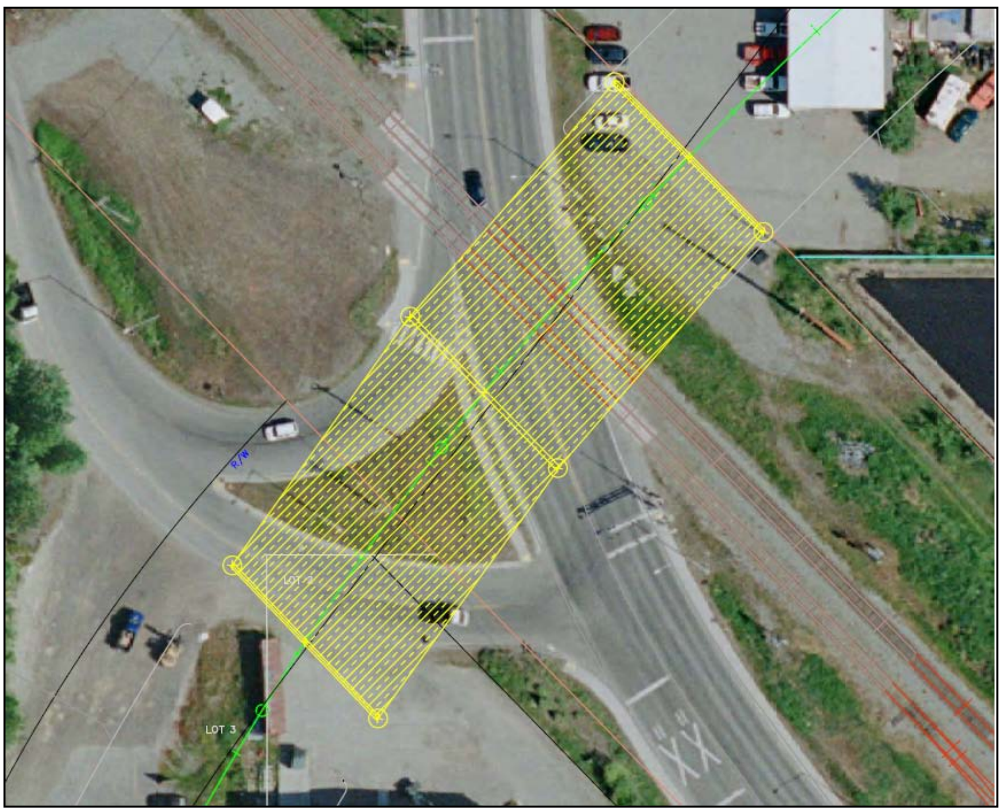


Figure E.2: Two-Span Alternative (Option I)

E.3.3 Alternative III – Two-span (Option II) – Preferred

The preferred option is a two-span bridge similar to Option I in geometry and span length. This alternative shifts the northeast abutment approximately 40 feet southwest along the alignment (Fig E.3). Shifting the pier to this location is preferred as it significantly relieves the vehicular impact hazard and requires the least amount of realignment for access onto Rovenna Road from Arctic Boulevard. Due to relevant span lengths, availability, and constructability, prestressed concrete bulb-tee girders will define the primary bridge structural elements. Both Alternatives II and III are estimated at $7,000,000.00.

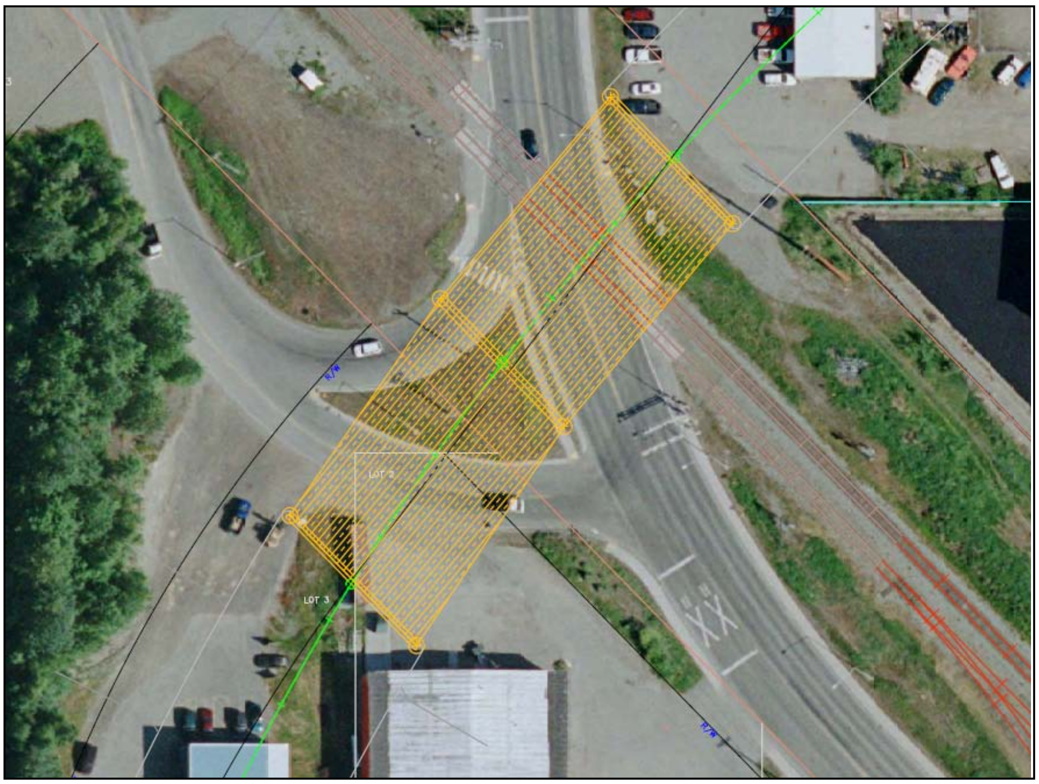


Figure E.3: Two-Span Preferred Alternative

E.3.4 Additional Alternatives

Single span options spanning the ARRC ROW may be developed upon request. A built-up steel plate girder or a cast-in-place post-tensioned concrete box girder could achieve this span. Initial design indicates each girder section would likely require section depths between 8.5 and 9 feet for a clear span of 200 feet. These section depths correspond to an increase of 3 to 3.5 vertical feet of fill required at each embankment in comparison to Alternatives I-III. Cost estimates of these alternatives have not been developed at this time, but future estimates should include an account of the increased earthwork quantities for comparison with Alternatives I-III.

E.4.0 SUPERSTRUCTURE DESIGN

The bridge superstructure consists of all structural elements necessary to support the roadway surface including, but not limited to:

- Bridge girders
- Girder diaphragms

E.4.1 Design Loads

The primary loads used for the girder design were dead load, vehicular live load, and snow load. (DL, LL, WA). Unfactored envelopes for these conditions are shown in Figs. E.4-9. Girder design was accomplished using the AKDOT Decked Bulb-Tee Girder Design software discussed in E.4.2. Force effects calculated due to imposed loading conditions were directly used for preliminary design of the pile cap and substructure elements.

E.4.2 Girders

Design of the primary bridge structural elements was done with the AKDOT Decked Bulb-Tee Girder Design software. The primary design variables to be input were:

- Bearing length
- Girder depth
- Top flange width
- Concrete strength at release
- Concrete strength at 28-days
- Straight and harped tendon strand patterns

Based on a 90-foot wide typical roadway section and common top flange spacing of 1/2", an iterative process was employed to determine an economical girder size, spacing, and strand pattern.

The Bulb-Tee program calculates six design stress and capacity checks relevant to the AASHTO code requirements. These are:

- Service limit state stresses
- Release stress
- Transport stress
- Moment demand and capacity at the Strength limit state
- Shear demand and capacity at the Strength limit state
- Camber given extended pre-stressing and dead load

Figures E.10-15 detail the program outputs and limit states.

Girder dimensions and reinforcing schedule can be found in the Bridge Plan sheets.

E.4.3 Diaphragms

Girder diaphragms will be cast-in-place concrete sections at each girder mid-span, pier, and abutment to provide lateral support, anchorage, and structural continuity.

E.5.0 SUBSTRUCTURE

The bridge substructure consists of the necessary elements to support the superstructure. The substructure forms the foundation support for the superstructure and is designed based on the loads imparted by the superstructure and all loading conditions relevant to the bridge criteria.

E.5.1 General

The primary substructure will consist of driven pipe pile at each abutment and pier. Pile caps will be cast-in-place at each bent. To accommodate the cap, piles will include reinforcing and concrete to insure integrity between the pile bent and cap. Reinforced concrete at the pier bent will extend below existing ground depth to increase pile capacity and structural rigidity.

E.5.2 Pile Cap

The designed pile cap is a doubly-reinforced concrete beam poured integrally with the supports. The pile cap will be tilted at a 5.1% slope to accommodate roadway superelevation. The bridge girders will rest on elastomeric bearing pads to allow for horizontal expansion and contraction

E.5.3 Soil Characteristics

The subsurface characteristics of the proposed bridge foundation site consist of a ten-foot upper layer of peat followed by a silt layer extending to twenty feet below ground surface. The preliminary site geotechnical investigation included boreholes and corresponding soil characteristics to a maximum depth of 20 feet below existing ground. Until further soil investigation is conducted, the deeper soil characteristics cannot be determined. For the purpose of analysis, boring logs for the Dowling Campbell Creek Bridge were used to generalize soil parameters and foundation requirements.

The water table is approximately ten feet below grade at the Dowling Road-Arctic Boulevard Bridge.

E.5.4 Design Loads

The loading used for the foundation design comprises the factored dead and live loads transferred from the superstructure plus the factored dead load of the substructure (Table E.4). For seismic analysis, a simplified force-based approach was used to place an equivalent seismic force on the superstructure to determine the substructure response using the design seismic response spectra for this site.

E.5.5 Foundation Design

Both shallow and deep foundations were considered in the design. Because of the subsurface characteristics, shallow foundations would settle excessively. The preferred bridge alternative is a two-span bridge, with the center pier founded on piles. Deep foundations were selected for the abutments as well as the center pier because of the differential settlement that would result between shallow and deep foundations.

Structural steel H-piles and pipe piles were analyzed in the design. Both could provide the necessary bearing capacity; however, using pipe pile reduces the weight of required steel by about 20% (Table E.1) because of its greater surface area-to-weight ratio. The pile bearing capacity (Table E.3) was calculated using the alpha method of stress analysis.

Driven structural steel pipe pile foundations were selected for both the abutments and the pier to eliminate differential settlement. Each abutment has eight vertical 42”Ø X 7/8” piles driven to a minimum depth of 80 feet below grade, and the center pier has eight vertical 48”Ø X 1” piles driven to a minimum depth of 115 feet below grade. All piles will extend approximately 20 feet above grade. The upper 60 feet of the piles will be contain a reinforced concrete core to insure integrity between the pile bent and cap.

The structure’s seismic response is calculated upon selection of the primary substructure elements. An iterative process was employed for final selection of the bent sections. Table E.5 contains the relevant seismic criteria for the bent column design.

E.6.0 ABUTMENT RETAINING WALL

Local parameters and costs associated with a longer bridge prohibit the use of a sloped embankment with the current girder design. An MSE wall is the recommended retaining solution at each abutment to accommodate current traffic conditions. Local stability of the MSE wall is to be determined by the supplier. Global MSE wall stability is a function of the local soil conditions and the applied surcharge due to the approach embankments. Appendix E.6.1 contains recommendations to deal with the anticipated settlement at each embankment.

E.6.1 Settlement Criteria and Recommendations

Anticipated settlement at the abutments was determined by placing a 30 foot surcharge of engineered soils. Soils data for this analysis also assumed conditions similar to those at the Dowling Campbell Creek site. Total long-term embankment settlement was calculated to be 9.3 inches (Table E.2). Of this total, 4.2 inches is attributed to settlement of a silt and clay layer extending from 7 to 20 feet below existing grade. The remaining 5.1 inches can be attributed to initial settlement and should occur during the embankment construction. The following recommendations address the issue of time-dependent settlement of low-conductivity soils at the bridge abutments.

Leaving silts and clays as they are will likely result in excessive roadway settlement. This would be most pronounced at the embankment-to-bridge connection as the finished pile elevation would not be susceptible to settlement issues. It is recommended that silts and clays be removed where possible in the first construction season. A practical limit of 10 feet of excavation is determined, upon which a 20-foot engineered fill surcharge should be placed prior to the primary construction season to expedite primary settlement. Figure E.16 shows the recommended limits of excavation and surcharge. A 10-foot excavation at this extent would amount to approximately 30,000 cubic yards of required excavation. The surcharge fill should be Select Material, Type A per Section 205 of Standard Specifications.

If there are significant layers of saturated silts and clays present at the site it will take years for the water to escape due to low hydraulic conductivity of silts and clays. To this end, wick drains may be installed in addition to the placement of the surcharge. Wick drains are used to provide a pathway for excess water to escape and will help to speed the long-term settlement of these problematic soil layers.

A proper geotechnical investigation must be conducted at the side to a greater depth to effectively anticipate long-term settlement at the abutments. The extent and depth of silts and clays has to be determined for the possibility of excavation or placement of wick drains prior to surcharge placement.

E.7.0 REFERENCES

AASHTO, (2007). AASHTO LRFD Bridge Design Specifications: Customary U.S. units. (4th ed.). Washington D.C.

AK DOT&PF, (2009). Final Structural Foundation Report, Dowling Campbell Creek Bridge. Anchorage, AK.

AK DOT&PF, (2009). West Dowling Road Phase II Geotechnical Report. Anchorage, AK

Coduto, D. P. (2000). Foundation Design: Principles and Practices. Upper Saddle River: Prentice Hall.

E.8.0 CALCULATIONS

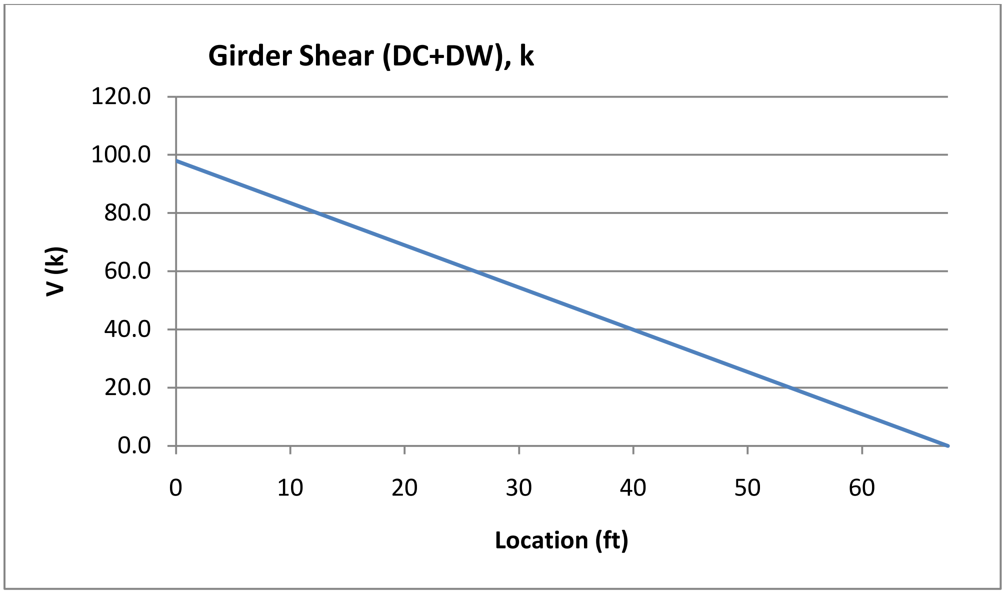


Figure E.4: Unfactored Shear (DC + DW)

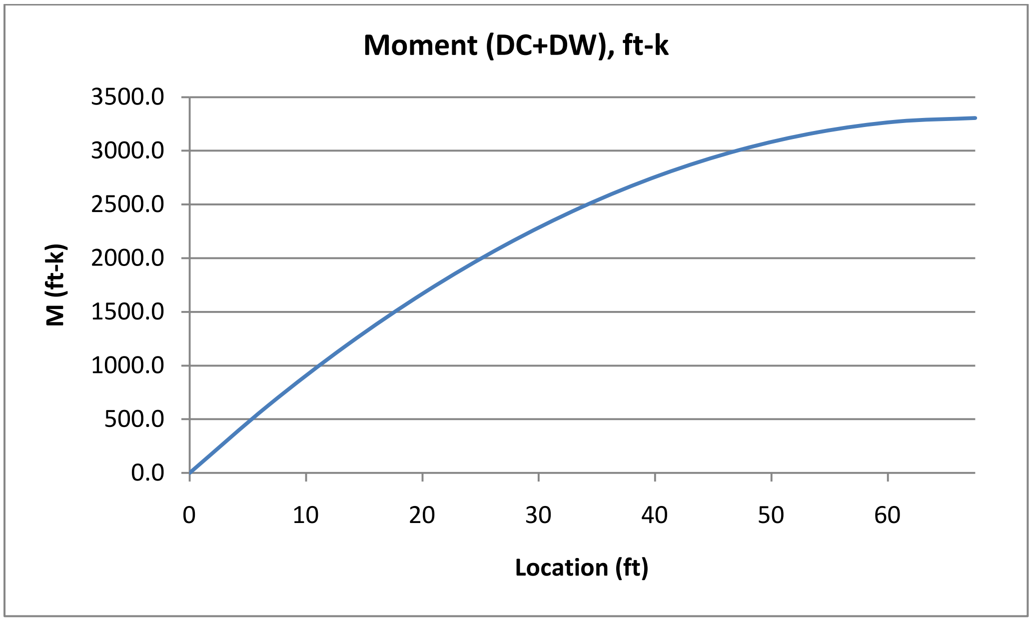


Figure E.5: Unfactored Moment (DC + DW)

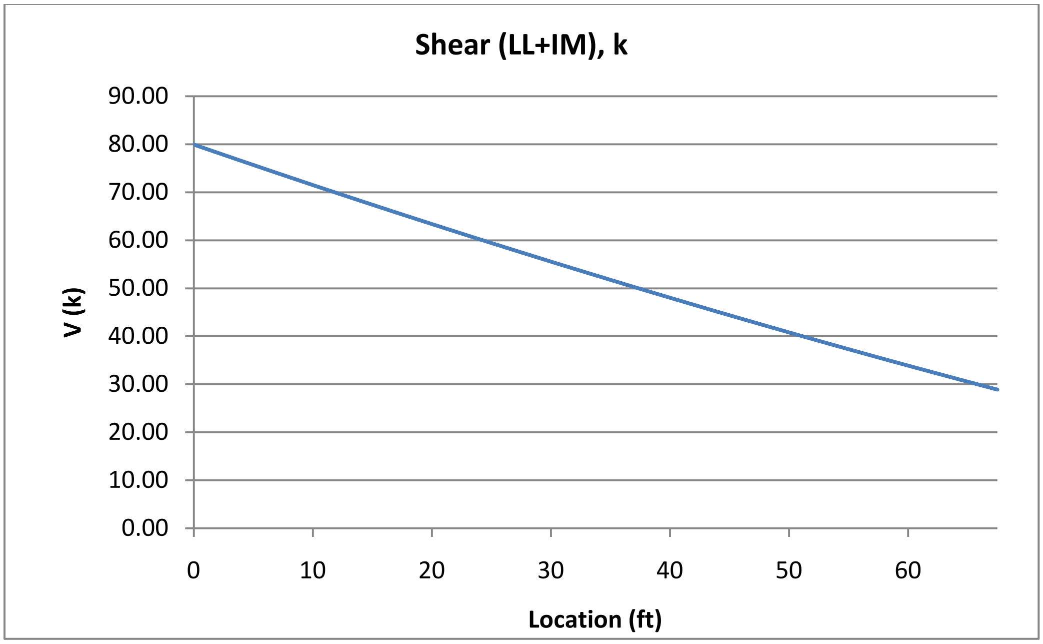


Figure E.6: Unfactored Shear (LL + IM)

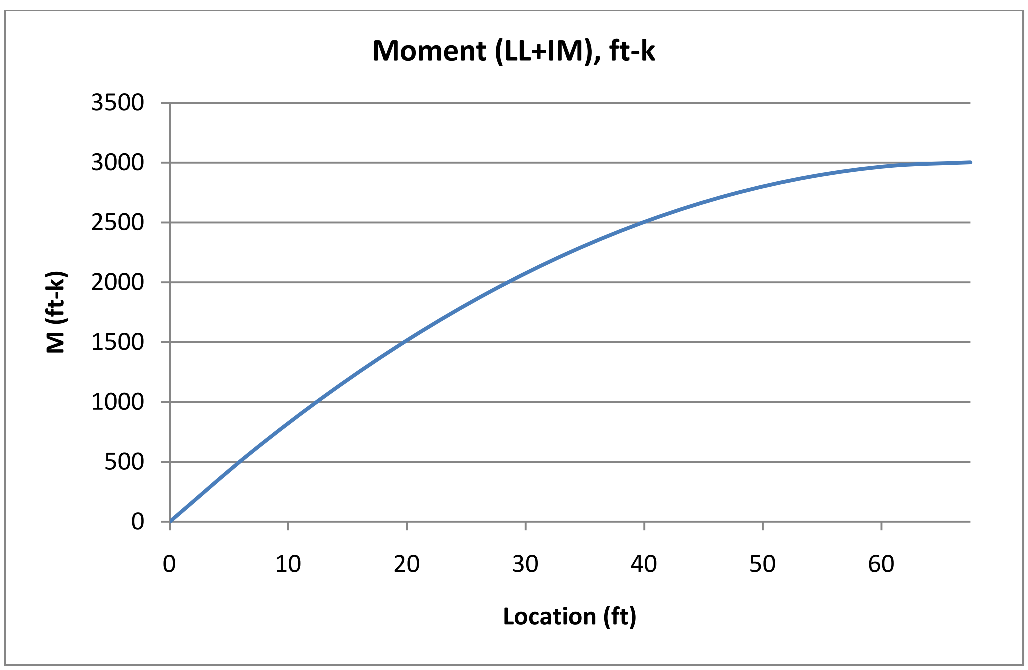


Figure E.7: Unfactored Moment (LL + IM)

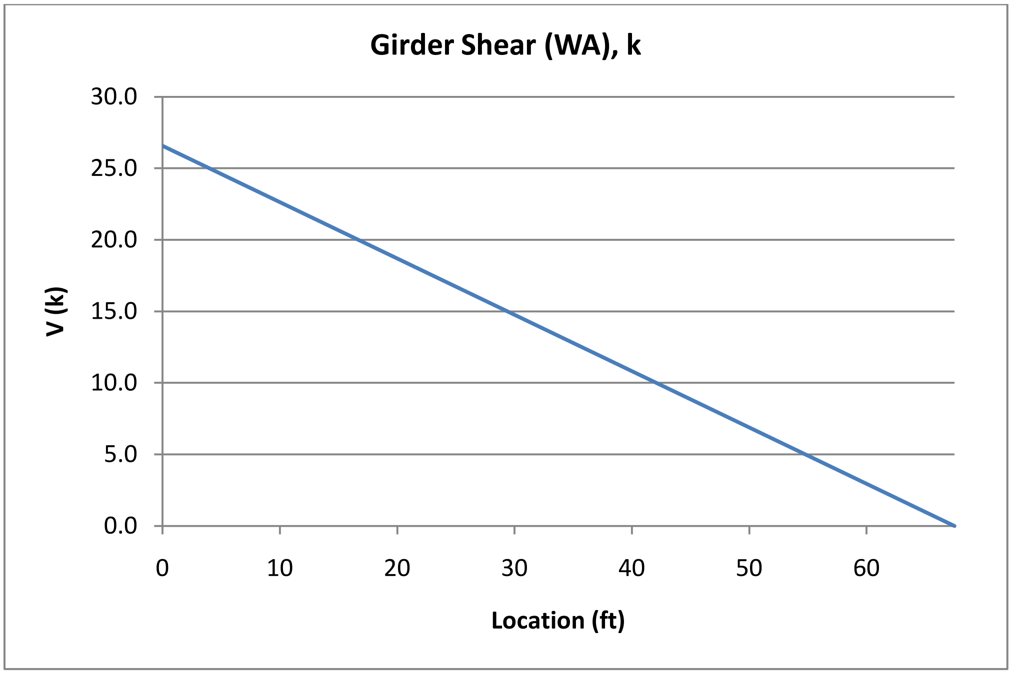


Figure E.8: Unfactored Shear (WA)

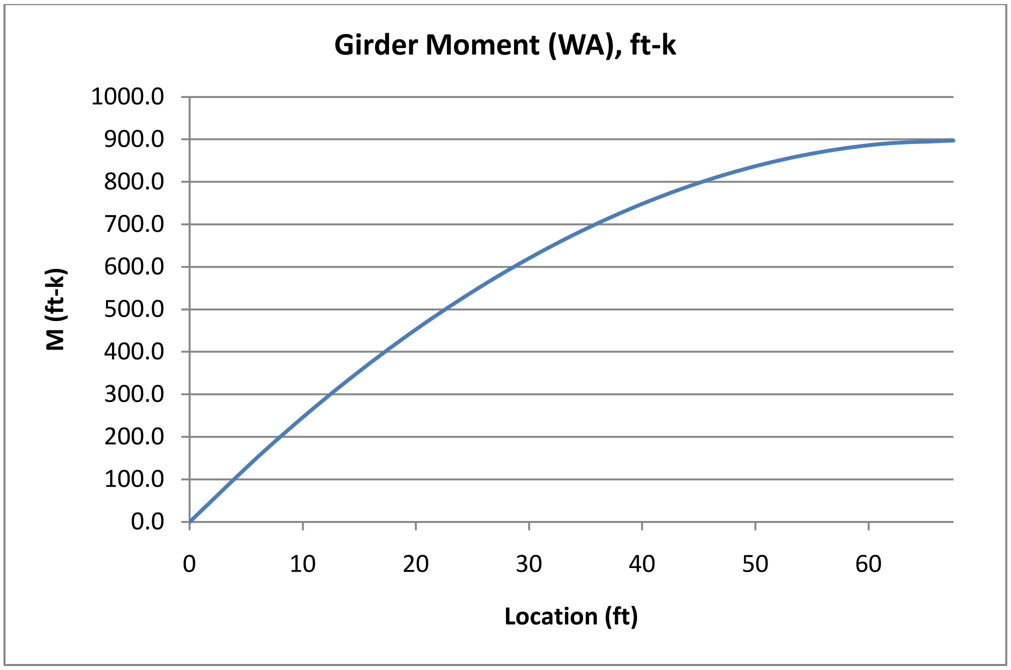
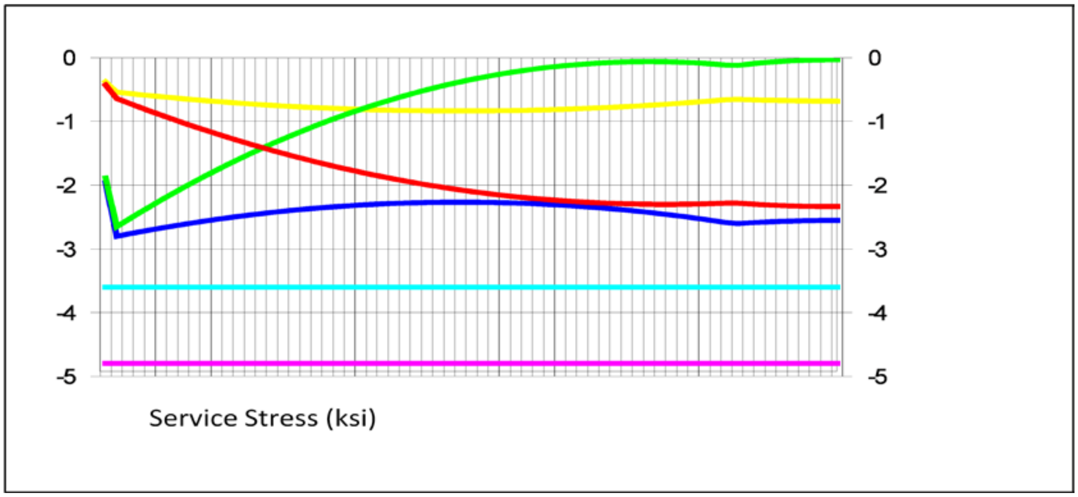
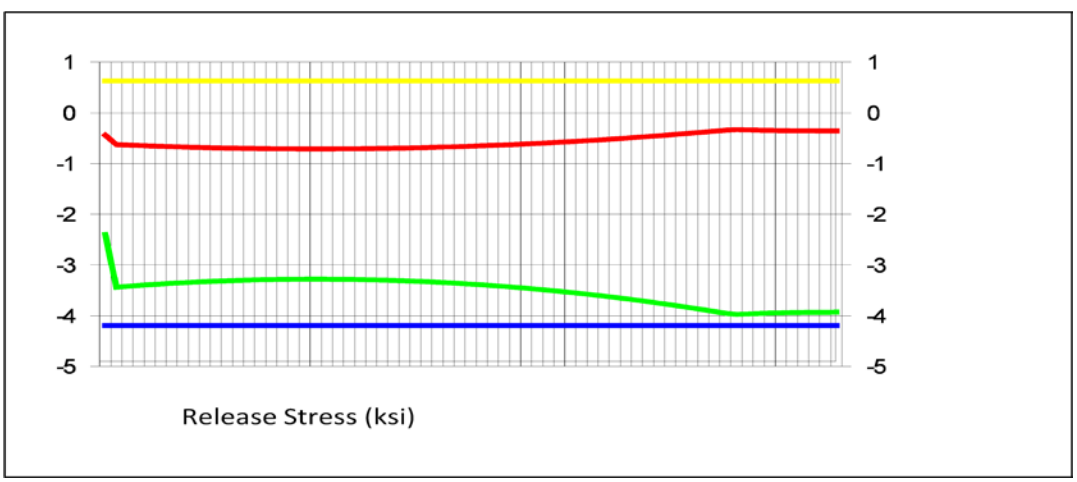


Figure E.9: Unfactored Moment (WA)



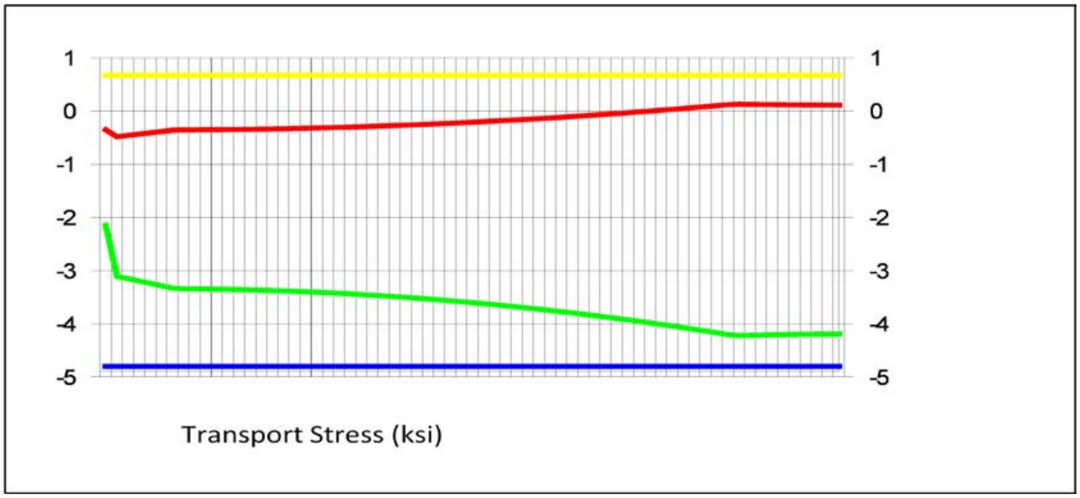
Color	Location	Components
	Bottom Flange	DC+DW+.8(LL+IM)
	Bottom Flange	DC
	Top Flange	DC
	Top Flange	DL+DW+LL+IM
	Compression limit for DL	<.45f'c
	Compression limit for DL+LL	<.6f'c

Figure E.10: Girder Analysis of Service Stress to Allowable Stress at Top and Bottom Flange



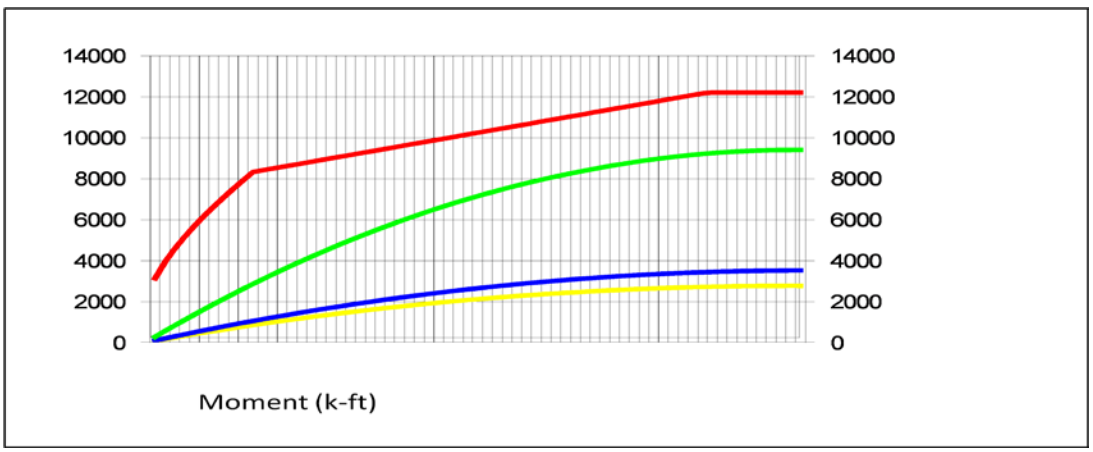
Color	Location	Components
	Bottom Flange	DC+DW+PS
	Top Flange	DC+DW+PS
	Compression limit	<.45f'c
	Tension limit	<7.5(f'c)^.5

Figure E.11: Girder Analysis of Release Stress to Allowable Stress at Top and Bottom Flange



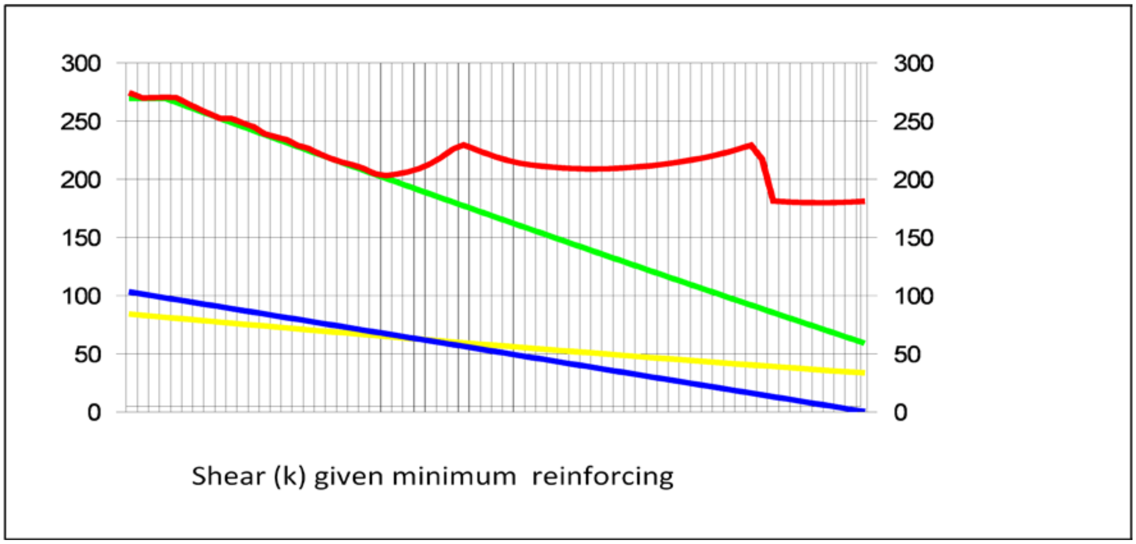
Color	Location	Components
	Bottom Flange	DC/bounce factor
	Top Flange	DC/bounce factor
	Compression limit	<.45f'c
	Tension limit	<7.5(f'c)^.5

Figure E.12: Girder Analysis of Transport Stress to Allowable Stress



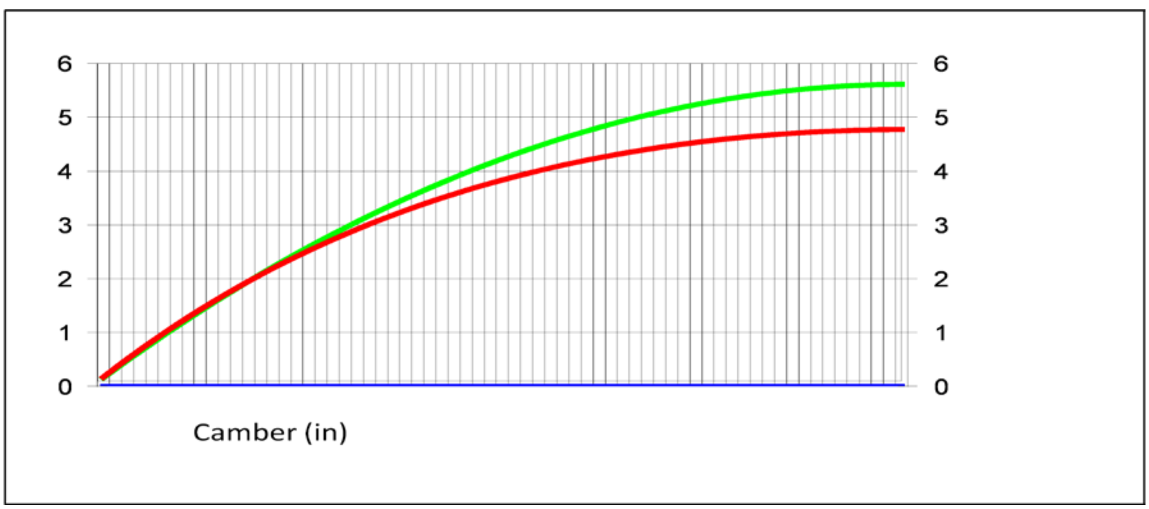
Color	Description	Components
	Moment capacity	ϕMn
	Strength I	1.25DC+1.25DW+1.75LL
	Unfactored DL	DC+DW
	Unfactored LL	LL

Figure E.13: Girder Analysis of Moment Capicity to Demand



Color	Description	Components
	Shear capacity	ϕVn
	Strength I	1.25DC+1.25DW+1.75LL
	Unfactored DL	DC+DW
	Unfactored LL	LL

Figure E.14: Girder Analysis of Shear Capacity to Demand



Color	Description	Components
	DL+Prestress deflection	2*Prestress+2.2*SW+DC+DW
	Prestress deflection	Prestress

Figure E.15: Anticipated Long-Term Camber Due to DL and Pre-Stress

	H-PILE				PIPE PILE			
	Type	Number	Length (ft)	Weight (k)	Type	Number	Length (ft)	Weight (k)
ABUTMENT	HP14x117	14	90	147.4	42"x0.375"	8	80	120.8
PIER	HP14x117	14	135	221.1	48"x0.375"	8	115	175.5

Table E.1: Analysis of H-Pile vs. Pipe Pile for Foundation Support

Layer	Type	Name of Layer	H [ft]	Typical Unit Weight [lb/ft^3]	Unit Weight Assumed [lb/ft^3]	At midpoint of layer			δc ult. [ft]
						σ_{z0}' [psf]	σ_{zf}' [psf]	Cc/(1=e$_0$)	
1	ML	Silt with Gravel	7.0	75-110	75	262.5	4612.5	0.013	0.11
2	MH	**Silt with Clay**	7.0	75-110/75-130	75	306.6	4656.6	0.028	0.23
3	MH	**Silt with Clay**	6.0	75-130	75	344.4	4694.4	0.018	0.12
4	SP	Sand with Gravel	4.0	120-135	120	459.6	4809.6	0.006	0.02
5	GP	Gravel with Sand	5.5	125-140	125	631.75	4981.75	0.006	0.03
6	ML	Silt with Gravel	7.5	80-130	80	697.75	5047.75	0.012	0.08
7	GM	Silty Gravel	5.0	125-140	125	854.25	5204.25	0.009	0.04
8	ML	Silt with Gravel	5.0	80-130	80	898.25	5248.25	0.005	0.02
9	GM	Silty Gravel	32.5	125-140	125	1915.5	6265.5	0.006	0.10
								Total:	**0.75**

Table E.2: Soil Settlement Analysis at Abutment

		48"x0.375" Pipe Pile		**42"x0.375" Pipe Pile**		**HP14x117**	
Depth Below Surface (ft)	Total Length of Pile (ft)	Weight of 8 Piles (k)	Net Bearing for 8 Piles (k)	Weight of 8 Piles (k)	Net Bearing for 8 Piles (k)	Weight of 14 Piles (k)	Net Bearing for 14 Piles (k)
15	35	23	341	23	295	25	246
20	40	31	685	30	595	33	475
25	45	38	1030	38	896	41	704
30	50	46	1381	45	1203	49	940
30	50	46	1577	45	1373	49	1151
35	55	53	1722	53	1499	57	1274
40	60	61	1897	60	1652	66	1420
40	60	61	2337	60	2036	66	1778
45	65	69	2773	68	2417	74	2095
50	70	76	3239	75	2825	82	2435
50	70	76	3435	75	2995	82	2535
55	75	84	3699	83	3225	90	2743
60	80	92	3990	91	3479	98	2969
65	85	99	4309	98	3757	106	3213
70	90	107	4656	106	4060	115	3476
75	95	114	5031	113	4387	123	3758
80	100	122	5433	121	4738	131	4059
85	105	130	5863	128	5113	139	4378
90	110	137	6321	136	5513	147	4716
95	115	145	6859	143	5988	156	5136
100	120	153	7374	151	6438	164	5514
105	125	160	7917	159	6913	172	5911
110	130	168	8488	166	7412	180	6326
115	135	175	9087	174	7935	188	6760
120	140	183	9713	181	8482	197	7213
125	145	191	10367	189	9054	205	7685
130	150	198	11049	196	9650	213	8175
135	155	206	11759	204	10270	221	8683
140	160	214	12496	211	10914	229	9210
145	165	221	13410	219	11733	238	9906

Color	Description
(blue)	42 X 0.375 Abutment Pipe Pile
(green)	HP14 X 117 Abutment Pile
(yellow)	48 X 0.75 Pier Pipe Pile

Table E.3: Bearing Capacity Analysis for Foundation

	Foundation Loading (k)
Abutments	4510
Center Pier	8800

Table E.4: Factored Reactions for Foundation Design

WEIGHT OF STRUCTURE	6632	kips
$T_{M, LONGITUDINAL}$	1.36	seconds
$T_{M, TRANSVERSE}$	0.68	seconds
$EQ_{, LONGITUDINAL}$	3891	kips
$EQ_{, TRANSVERSE}$	6176	kips
$M_{EQ (DESIGN)}$	4490	ft-k
$V_{EQ (DESIGN)}$	224	kips

Table E.5: Seismic Criteria for Column Bent Design

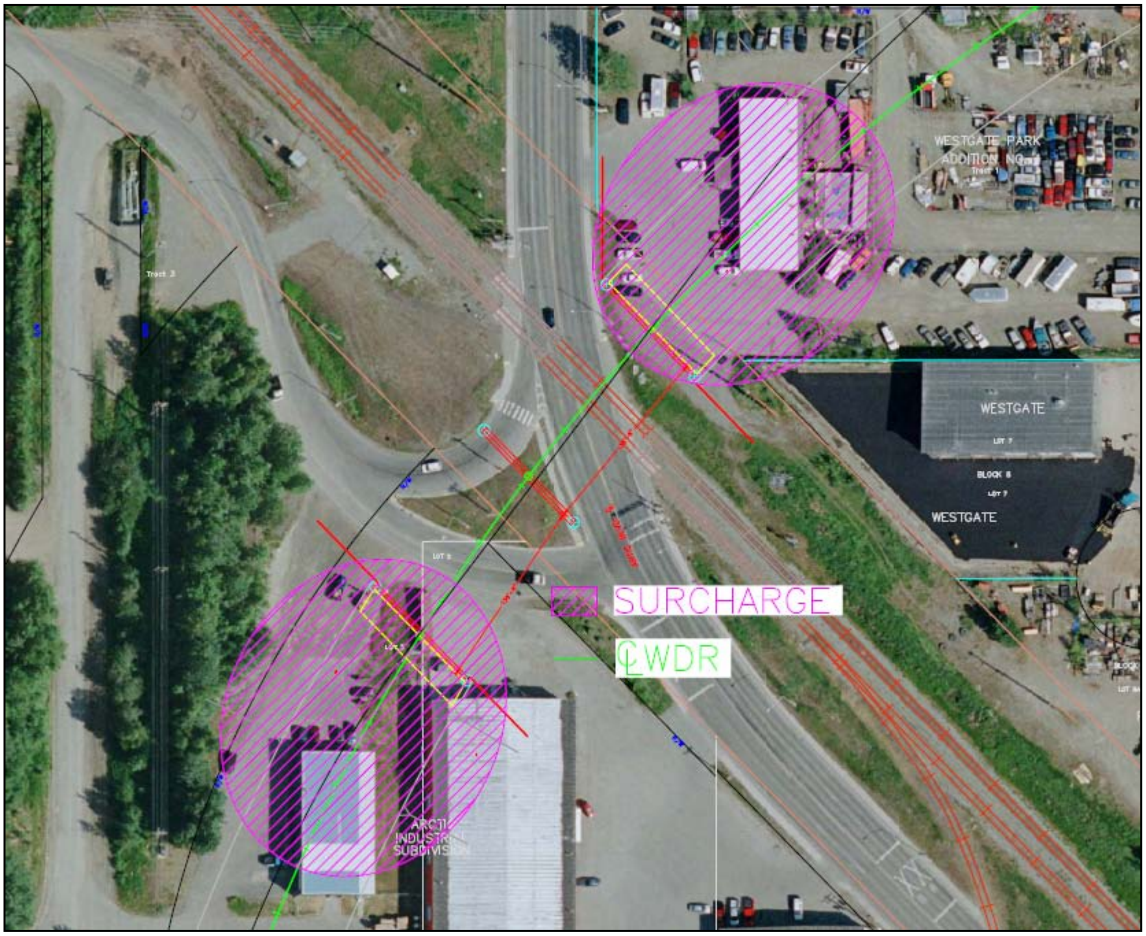


Figure E.16: Limits of Excavation and Surcharge at Bridge Embankments

DESIGN STUDY REPORT

APPENDIX F
UTILITY CONFLICT REPORT

WEST DOWLING ROAD EXTENSION: PHASE II
C STREET TO RASPBERRY ROAD

Prepared for:

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Department of Transportation and Public Facilities
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April 2010

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LIST OF ACRONYMS

ACS…………………………………….……………………Alaska Communication Systems
ARR……………………………….………………………………Alaska Rail Road
AWWU…………………………………….………….....Anchorage Water and Wastewater Utility
CB……………………………….…………………………………………catch basin
CEA…………………………….……………………………Chugach Electric Association
CMP………………………………………………………………………..corrugated metal pipe
DI……………………………………………………………………………...ductile iron
DOT&PF……………………...State of Alaska Department of Transportation and Public Facilities
F/O……………………………………………………………………………..fiber optic
GCI.……………………………………………………………General Communications, Inc.
LT………………………………………………………………………………………. left
MASS…………………………………..Municipality of Anchorage Standards and Specifications
MOA…………………………………………………………………Municipality of Anchorage
MSE…………………………………………………………………..mechanically stabilized earth
NESC……………………………………………………………….. National Electrical Safety Code
OH………………………………………………………………………………...…. overhead
ROW…………………………………………………………………………….. right-of-way
RT……………………………………………………………………………………right
SD……………………………………………………………………………….storm drain
SDMH…………………………………………………………………storm drain manhole
SS………………………………………………………………………………sanitary sewer
SSMH…………………………………………………………………sanitary sewer manhole
STA……………………………………………………………………………………. station
UG……………………………………………………………………………… underground
X-ING………………………………………………………………………………crossing

F.1.0 INTRODUCTION

The primary objective of the West Dowling Road Extension (Phase II) project is to provide additional road connectivity and relieve traffic congestion in east Anchorage. The project area includes extending the West Dowling corridor between C Street and Raspberry Road. Construction of this corridor will provide connectivity from East Anchorage to Minnesota Drive and ultimately Kinkaid Park. This will reduce the amount of traffic congestion in the midtown area of Anchorage by providing an alternative route from East Anchorage to South Anchorage.

This project includes building approximately one mile of new roadway, the construction of a new overpass for West Dowling Road at Arctic Boulevard, and a new intersection with a redesigned portion of Raspberry Road. The new roadway will be constructed by Alaska Department of Transportation and Public Facilities (DOT&PF) and owned by the Municipality of Anchorage (MOA). The project must be cost effective, comply with current design standards, and meet the needs of the traveling public through the design year of 2035.

F.1.1 Purpose

This report presents conflicts identified between the proposed improvements and existing utilities within the project corridor and discusses recommendations for resolution that resulted from coordination with utility companies and the DOT&PF. Local review level plan and profile drawings of the corridor are available for use in viewing existing utilities, proposed improvements, and resulting conflicts. The plan sheets show proposed improvements over a base map compiled from field survey and as-built data. These drawings have been shared with individual utility companies for their use in evaluating the accuracy of the base map and completing utility relocation designs, if any are required. The utilities have completed the utility questionnaire and have assisted in identifying all existing facilities.

Design of the proposed water, sanitary sewer, and storm drain improvements have been drafted by Seawolf Engineering. All other relocations are to be designed by their respective owners with Seawolf Engineering submitting suggested corridors, routes, and possible conflict resolutions.

F.1.2 Scope

Utilities covered in this report include:

- Water and sanitary sewer lines owned by Anchorage Water and Waste Water Utility (AWWU),
- Storm sewer facilities located within the project ROW and owned by the Municipality of Anchorage (MOA),
- Electrical distribution and transmission lines owned by Chugach Electric Association (CEA),
- Telecommunication lines (including fiber optic) owned by both Alaska Communication Systems (ACS) and General Communications Inc. (GCI),
- Natural gas lines owned by ENSTAR.

Utility appurtenances that may remain because no major conflicts result from proposed improvements will be adjusted to final grade. Such appurtenances include, but are not limited to, manholes (sanitary sewer and storm sewer), valve boxes, junction boxes, and telephone pedestals.

F.2.0 FINDINGS BY UTILITY

The existing utility infrastructure, presented by respective utility is presented here. The conflicts found between existing utilities and proposed improvements are presented in section F.3. The information below was synthesized using as-built (record) drawings, utility facility grid maps, aerial photography data, meetings with utility representatives, and site visit information. All utility locations are approximate and additional survey work and potholing should be utilized to determine exact locations of critical facilities prior to the commencement of construction activities.

Minimum Standards utilized for this study include the following:

- Depth of Bury
    - Within ROW 36 inches 17 AAC 15.211(d)

  - Within road structure 48 inches 17 AAC 15.211(d)
- Vertical Clearance
  - Existing 18 feet 17 AAC 15.201
  - New or relocated 20 feet 17 AAC 15.201
  - Power >22kV 18+0.4*(V-22kV)/12 feet NESC
- Horizontal Clearance
  - Toe of Fill/Top of Cut 10 feet 17 AAC 15.211
  - From face of curb 2 feet 17 AAC 15.171(e)
  - Overhead Power 10 feet AS 18.60.670
- Facility crossings that must be installed by boring, coring, or jacking 17 AAC 15.211(b)
- Longitudinal facilities shall be installed as near to the ROW line as practicable 17 AAC 15.181

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

AWWU owns and operates a water system within the project limits that provides for local distribution and transmission of water. The primary features of the water system within the affected project limits include:

- At STA 39+34, a 10 inch ductile iron (DI) main crosses an area of proposed excavation.
- 6 developed parcels will be purchased as a part of this project. Each of these buildings will have to have their water services disconnected at the main per MASS specifications.
- At STA 47 + 15, a 10 inch DI main is located at the site of a proposed abutment and will require relocation.
- From STA 39 + 30 to STA 41 + 00, a 10 inch water main transects and then parallels the proposed West Dowling Road alignment.
- Approximately 4 Valve boxes will require adjustment to final grade throughout the project.
- 1 fire hydrant will need removed.

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

AWWU owns and operates a sanitary sewer system within the project limits that includes local collection and a primary transmission trunk line. The primary features of the sewer system within the project limits include:

- A 78 inch concrete tunnel (main) runs along the south side of Raspberry Road within the project limits. A proposed sewer main line extension for Chugach Electric Association (CEA) will connect to this system.
- 6 developed parcels will be purchased as a part of this project. Each of these buildings will have to have their sewer service lines disconnected at the main per MASS specification.
- 2 on property manholes and 140 feet of 8 inch DI main will need to be removed and 1 manhole will need installed for developed parcels that are to be purchased as a part of this project.
- Approximately 9 manhole lids will need to be adjusted to match final grade.

F.2.3 Municipality of Anchorage (MOA), Storm Water

The MOA owns and operates a storm water collection system within the project boundaries. Portions of the system are open graded swales and culverts, while other portions consist of catch basins, manholes, and corrugated metal pipe (CMP) mains.

This project will require the rerouting of a portion of the storm drain system along Arctic Boulevard near the site of the planned bridge construction. At this location the existing main is in conflict with the proposed abutment and wing wall.

Additional affected MOA storm drain facilities within the project area include:

- At 47 + 03 the storm drain near the proposed eastern abutment will need to be relocated to provide adequate clearance around the proposed wing wall.
- Along the Raspberry Road and West Dowling Road intersection, the existing storm water system will be exposed as a part of native soil excavation.

- Near Raspberry Road the existing storm water system will be intercepted to tie in new features.
- Approximately 2 existing catch basins will need to be adjusted to match final grade.

F.2.4 Chugach Electric Association (CEA), Electric

Electrical transmission and distribution lines within the corridor are owned and operated by CEA.

There are two 138 kV overhead transmission lines that intersect and cross the project at Arctic Boulevard and West Dowling Road. The University Transmission line runs due east-west and the Retherford Transmission line runs along the Alaska Rail Road (ARR) ROW (northwest-southeast). These lines are located at the site of the proposed bridge structure.

There are a variety of local transmission, distribution, and service lines within the project corridor, including both overhead and underground facilities. The majority of these facilities located within the project corridor are currently overhead on joint use poles. This project calls for the undergrounding of all existing facilities less than 28 kV. CEA will be proposing exact utility relocations for their facilities.

Some of the additional impacted electrical facilities include:

- The 6 developed properties that are to be purchased for the development of this project will need to have their power services disconnected per CEA specifications.
- From STA 27 + 00 to STA 42 + 00, aerial facilities currently exist on a near parallel path with the proposed roadway. These facilities will need to be relocated underground and offset from their existing locations to provide adequate roadway clearance. This will include the removal of associated transformers, poles, guy wires, and anchors.
- Underground facilities exist in the areas of proposed excavation of native soils at approximate stations: STA 30 + 13, STA 39 + 80.
- Existing poles are located in the proposed roadway alignments at stations STA 35 + 10 and STA 37 + 85.

- From STA 45 + 00 to STA 45 + 30, existing OH distribution does not have sufficient clearance for the proposed bridge structure.
- From STA 45 + 20 to STA 45 + 80, existing OH transmission does not have sufficient clearance for the proposed bridge structure.
- At STA 47 + 22 clearance of the existing OH transmission line needs verified.
- At STA 47 + 26 there is insufficient clearance for OH facilities.
- From STA 49 + 00 to STA 52 + 20 the OH transmission lines have insufficient clearance and 2 poles are located within the proposed roadway.

F.2.5 Alaska Communication Systems (ACS), Telephone

ACS owns and operates existing telephone communications facilities within the project limits. These facilities include both copper and fiber optic cables. These lines are for both transmission and local distribution. ACS facilities within the project corridor include pedestals, repeaters, manholes, and aerial appurtenances.

The following is a summary of the affected facilities within the project area:

- From STA 27 + 00 to STA 42 + 00, ACS operates OH and UG facilities, with many on joint use poles owned by CEA. These facilities are being moved to strictly UG. The final design for relocation of these facilities will be presented by ACS in coordination with CEA.
- 6 developed properties that are being purchased and demolished for the construction of this project will need to have their existing communication facilities disconnected per ACS standards.
- From STA 45 + 00 to STA 45 + 30 OH facilities have inadequate clearance for the proposed bridge.
- At approximate STA 46 + 50 a pole that transitions UG to OH and has a repeater attached will need to be removed and the facilities will need to be relocated underground.
- At STA 47 + 26 there is insufficient clearance for the existing OH lines.
- At approximate STA 45 + 17 there is an existing manhole that may need to be relocated to make clearance for the proposed center bridge pier.

- From STA 49 + 00 to STA 50 + 00 an UG cable exists in the area of proposed embankment construction that will require relocation to avoid extraneous depth of cover.

F.2.6 General Communications, Inc (GCI), Cable Television

GCI owns and operates cable television facilities within the project limits. These facilities include both overhead and underground coaxial and fiber optic cable. The majority of the GCI facilities are strung on joint use poles that are owned by CEA from STA 27 + 00 to STA 42 + 00.

Additional GCI facilities within the project limits include:

- From STA 27 + 00 to STA 42 + 00, GCI operates OH and UG facilities, with many on joint use poles owned by CEA. These facilities are being relocated to strictly UG. The final design for these facilities will be designed and presented by GCI in coordination with CEA.
- At STA 30 + 13 UG fiber optic facilities exist in an area of proposed excavation of native material.
- From STA 45 + 00 to STA 46 + 30 OH coaxial and fiber optic cable on joint use poles has insufficient clearance at location of proposed bridge.

F.2.7 Enstar, Natural Gas

Enstar owns and operates natural gas transmission and distribution lines within the project limits. Enstar currently owns a 10 foot gas easement along the east side of Rovenna Street that contains two mains. All Enstar facilities within the project bounds are underground mains ranging from 3 to 8 inches.

The Enstar facilities within the project area that present potential conflicts include:

- 6 developed parcels with natural gas connections will need to have their services disconnected in accordance with Enstar standards and practices.
- At approximate STA 13 + 10, a 2 inch plastic main crosses the existing roadway.
- At STA 28 + 30, a 4 inch plastic main transverses an area of proposed native soil excavation.

- From STA 29 + 00 to 41 + 00, an 8 inch steel transmission main is present in the proposed roadway. This main is in the current easement that Enstar owns along the east side of Rovenna Street. In this area, soil excavation for roadway preparation is expected to range from ten to fifteen feet. This excavation will undermine and expose the main for approximately 1200 feet. This main will need to be relocated to a new easement along the western side of the existing Rovenna Street corridor. Enstar engineers will be required on site at all times that this main is exposed per Enstar policy.
- At STA 45 + 10 a 4 inch plastic main exists in an area of minimal excavation.
- At approximate STA 45 + 60, a 4 inch steel main is located in an area of proposed pile driving operations and will require relocation.
- From STA 49 + 00 to 51 + 50, an existing 3 inch steel main is located under the proposed embankment.
- From STA 10 + 00 to STA 20 + 00, and from STA 106 + 00 to STA 103 + 50, an existing 6 inch transmission pipe parallels the location of the proposed noise wall.

F.2.8 Municipality of Anchorage (MOA), Illumination

The municipality of Anchorage owns and operates an illumination system within the corridor. The current lighting system is inconsistent and incomplete within the project corridor. Several existing electroliers will require removal due to their existing locations and the proposed roadway alignment.

Electrolier relocations or removal will be required at the following approximate stations:

- STA 16 + 90, STA 18 + 50, STA 45 + 10, and STA 46 + 80

F.2.9 Municipality of Anchorage (MOA), Traffic Signalization

Traffic signalization is not a part of this project.

F.3.0 SUMMARY OF UTILITY CONFLICTS AND PROPOSED RESOLUTIONS

Existing monuments, traffic control junction boxes, valve boxes, key boxes, manhole lids, and cleanouts which are to remain in their present location will be adjusted to match final grade. All impacted utilities which will require relocation are cited in the following subsections by utility owner.

The following tables are a summary of the impacted utilities, location description, and recommended actions for resolving the conflicts, presented in order of project stationing.

Conflicts along the West Dowling Road alignment from Raspberry Road to C Street are presented below in Table 1.

Station	**Offset**	**Utility**	**Conflict Description**	**Recommended Resolution**
28+30	Transverse	Enstar	4” Plastic pipe in area where native soil will be excavated and replaced with borrow	Locate and work around
27+00 to 42+00	160 RT 100LT	CEA/ACS /GCI	Overhead on joint-use poles. Nearly parallel to road	Bury utilities/ Remove poles
29+00 to 41+00	60 RT 100 LT	Enstar	8” Transmission Pipe parallel to and crossing proposed the roadway and site of native soil excavation	Relocate to west side of ROW
30+13	Transverse	CEA	UG in area where native soil will be excavated and replaced with borrow	Locate and work around
30+13	Transverse	GCI	UG in area where native soil will be excavated and replaced with borrow	Locate and work around
35+10	20 RT	CEA	Pole in roadway.	Remove pole. Bury from new North/South line to new pole at 120 LT

Station	Offset	Utility	Conflict Description	Recommended Resolution
37+85	65 RT	CEA	Pole in roadway	Remove pole. Install new pole at edge of ROW. Bury from new North/South line to new pole.
39+25	70 LT	AWWU	Valves in roadway	Raise
39+34	Transverse	AWWU	Water line in area where native soil will be excavated and replaced with borrow	Locate and work around
39+75	--	CEA/ACS	Services to building being removed (6141 Rovenna Street)	Abandon/remove
41+75 to 42+75	--	Enstar	Service to building being removed (6141 Rovenna Street)	Abandon/remove
42+00 to 42+25	--	AWWU	Service to building being removed (6141 Rovenna Street) and hydrant	Remove hydrant and line. Cap at main.
44+50	100 RT	Enstar	Service to building being removed (6330 Arctic Boulevard)	Abandon/remove
44+50	100 RT	CEA	Service to building being removed (6330 Arctic Boulevard)	Abandon/remove
45+00 to 45+30	100 RT 100LT	CEA/ACS /GCI	OH on joint-use poles. Insufficient clearance for bridge.	Bury utilities/ Remove poles
45+20 to 46+80	10 RT 125 LT	CEA	OH power line have insufficient clearance for bridge	Bury lines. Bore under railroad tracks.

Station	Offset	Utility	Conflict Description	Recommended Resolution
45+60	15 LT	Enstar	4" steel pipe located where piles will be driven	Relocate segment around pile location
47+03	Transverse	MOA	Storm drain near abutment piles	Relocate-construct new segment with four manholes and reconstruct existing segment and manhole
47+15	Transverse	AWWU	Under bridge approach embankment. (18 ft from nearest pile)	Case pipe.
47+22	Transverse	CEA	OH transmission	Should be sufficient clearance
47+26 to 47+26	60 RT 67 LT	CEA/ACS	OH lines. Insufficient clearance.	Remove poles and bury
47+75 to 48+25	90 RT 55 RT	AWWU	Service to building being removed (6031 Arctic Boulevard)	Remove manholes and sewer
48+00	--	AWWU/ACS /Enstar/CEA	Service to building being removed (6031 Arctic Boulevard)	Abandon or remove
48+00	165 RT	AWWU/ACS /Enstar/CEA	Service to building being removed (856 Bonanza Avenue)	Abandon or remove
50+00	125 LT	AWWU/ACS /Enstar/CEA	Service to building being removed (5941 Arctic Boulevard)	Abandon or remove

Station	Offset	Utility	Conflict Description	Recommended Resolution
49+00 to 51+50	100 LT 100 RT	Enstar	3" steel pipe under approach embankment	Case pipe
49+00 to 50+00	100 LT 100 RT	ACS	Cable under embankment	Relocate parallel to toe
49+00 to 52+20	100 LT 100 RT	CEA	OH transmission lines have insufficient clearance. 2 poles in roadway.	Remove 2 transmission poles, Replace 2 with taller poles to raise lines

Table 1: Utility conflicts and proposed resolutions presented in order of project stationing for the West Dowling Road alignment.

Conflicts along the Raspberry Road Alignment are presented below in table 2.

Station	Offset	Utility	Conflict Description	Recommended Resolution
103+40	Transverse	Enstar	Possible conflict depending on where Raspberry starts curving to the North	Locate and work around
108+75	Transverse	Enstar	4" Plastic pipe in area where native soil will be excavated and replaced with borrow	Locate and work around
108+75	Transverse	MOA	Storm Drain in area where native soil will be excavated and replaced with borrow	Locate and work around

Table 2: Utility conflicts and proposed resolutions presented in order of project stationing for the Raspberry Road alignment.

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

The following table summarizes AWWU water facilities that will be impacted by the proposed construction activities and presents proposed conflict resolutions.

Station	Offset	Conflict Description	Recommended Resolution
39 + 34	Transverse	10” DI main located in area of native soil excavation	Locate and work around
42 + 10	100 LT	Valve box located in proposed roadway	Adjust to match final grade
42 + 20	90 LT	Valve box located in proposed roadway	Adjust to match final grade
42 + 00 to 42 + 25	--	Demolish existing structure (6141 Rovenna Street)	Disconnect service at main; Relocate existing hydrant
44 + 50	100 RT	Demolish existing structure (6330 Arctic Boulevard)	Disconnect service at main
47 + 00	100 RT	Demolish existing structure (856 Bonanza Avenue)	Disconnect service at main
47 + 15	Transverse	10” DI main located at proposed embankment location and pile driving operations	Relocate
48 + 00	100 LT	Demolish existing structure (5921 Arctic Boulevard)	Disconnect service at main
48 + 00	50 LT	Demolish existing structure (5941 Arctic Boulevard)	Disconnect Service at main
48 + 00	--	Demolish existing structure (6031)	Disconnect service at main

Table 3: AWWU water facilities that will be potentially impacted by construction activities.

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

The following table summarizes AWWU sanitary sewer facilities that will be impacted by the proposed construction activities and presents proposed conflict resolutions.

Station	Offset	Conflict Description	Recommended Resolution
42 + 00 to 42 + 25	--	Demolish existing structure (6141 Rovenna Street)	Disconnect service at main
44 + 50	100 RT	Demolish existing structure (6330 Arctic Boulevard)	Disconnect service at main
47 + 00	100 RT	Demolish existing structure (856 Bonanza Avenue)	Disconnect service at main
48 + 00	100 LT	Demolish existing structure (5921 Arctic Boulevard)	Disconnect service at main
48 + 00	50 LT	Demolish existing structure (5941 Arctic Boulevard)	Disconnect service at main
48 + 00	--	Demolish existing structure (6031 Arctic Boulevard)	Disconnect service at main; remove 2 on property manholes and approx. 300 feet of pipe; install 1 new manhole at end of main

Table 4: AWWU sanitary sewer facilities that will be potentially impacted by construction activities.

F.4.3 Municipality of Anchorage (MOA), Storm Water

The following table summarizes MOA storm water facilities that will be impacted by the proposed construction activities.

Station	Offset	Conflict Description	Recommended Resolution
47 + 03	Transverse	Storm drain main located near abutment piles and eastern wing wall	Relocate main—Construct new pipe segment, 2 new manholes, 2 intercept manholes, reconstruct 1 existing manhole, and reconstruct 1 existing pipe segment.
108 + 75	Transverse	Storm drain main located in area of native soil excavation	Locate and work around

Table 5: MOA storm sewer facilities that will be potentially impacted by construction activities.

F.3.4 Chugach Electric Association (CEA), Electric

CEA has transmission, distribution, and service facilities located within the project limits that consist of combinations of OH and UG lines and associated appurtenances. Many of these facilities will need to be relocated as a part of this project. CEA will design and present final plans detailing relocation efforts.

The following table summarizes CEA facilities that are located within the project limits that will be impacted by proposed by construction activities.

Station	Offset	Conflict Description	Recommended Resolution
27 + 00 to 42 + 00	160 RT 100 LT	Overhead on joint use poles that are near parallel to the proposed roadway	Relocate exisisting OH facilites to new UG facilities that are offset from proposed roadway
30 + 13	Transverse	UG in area of native soil excavation	Locate and work around
35 + 10	20 RT	Pole in proposed roadway	Remove pole; bury any associated facilities

Station	Offset	Conflict Description	Recommended Resolution
37 + 85	65 RT	Pole in proposed roadway	Remove pole; install new pole at edge of ROW. UG facilities from new north/south line to new pole.
42 + 00 to 42 + 25	--	Demolish existing structure (6141 Rovenna Street)	Disconnect service
44 + 50	100 RT	Demolish existing structure (6330 Arctic Boulevard)	Disconnect service
45 + 00 to 45 + 30	100 RT 100 LT	OH on joint use poles with insufficient clearance for proposed bridge	UG exisisting facilites; remove poles
45 + 20 to 46 + 80	10 RT 125 LT	OH lines have insufficient clearance for proposed bridge	UG existing facilities; horizontal bore under railroad tracks
47 + 00	100 RT	Demolish existing structure (856 Bonanza Avenue)	Disconnect service
47 + 22	Transverse	OH transmission (138 kV) at site of proposed bridge	Verify clearance requirements are met
47 + 26	60 RT 67 LT	OH lines with insufficient clearance	UG facilities and remove poles
48 + 00	100 LT	Demolish existing structure (5921 Arctic Boulevard)	Disconnect service
48 + 00	50 LT	Demolish existing structure (5941 Arctic Boulevard)	Disconnect service
48 + 00	100 RT	Demolish existing structure (6031 Arctic Boulevard)	Disconnect service

Station	Offset	Conflict Description	Recommended Resolution
49 + 00 to 52 + 20	100 LT 100 RT	OH transmission lines have insufficient clearance; 2 poles in proposed roadway	Remove 4 existing transmission poles and replace with two taller steel poles to raise lines and increase span

Table 6: CEA electric facilities that will be potentially impacted by proposed construction activities.

F.3.5 Alaska Communications Systems (ACS), Telephone

The primary conflicts associated with ACS facilities includes existing OH lines that will need to be relocated to an offset UG location and disconnection of facilities to structures that are to be demolished. ACS will design and submit specific relocation plans.

The following table summarizes ACS facilities that are located within the project limits that will be impacted by proposed construction activities.

Station	Offset	Conflict Description	Recommended Resolution
27 + 00 to 42 + 00	160 RT 100 LT	Overhead on joint use poles that are near parallel to the proposed roadway	Relocate exisisting OH facilites to new UG facilities that are offset from proposed roadway
42 + 00 to 42 + 25	--	Demolish existing structure (6141 Rovenna Street)	Disconnect service
44 + 50	100 RT	Demolish existing structure (6330 Arctic Boulevard)	Disconnect service
45 + 00 to 45 + 30	100 RT 100 LT	OH on joint use poles with insufficient clearance for proposed bridge	UG exisisting facilites; remove poles

Station	Offset	Conflict Description	Recommended Resolution
47 + 00	100 RT	Demolish existing structure (856 Bonanza Avenue)	Disconnect service
47 + 26	60 RT 67 LT	OH lines with insufficient clearance	UG facilities and remove poles
48 + 00	100 LT	Demolish existing structure (5921 Arctic Boulevard)	Disconnect service
48 + 00	50 LT	Demolish existing structure (5941 Arctic Boulevard)	Disconnect service
48 + 00	--	Demolish existing structure (6031 Arctic Boulevard)	Disconnect service
49 + 00 to 50 + 00	100 LT 100 RT	Cable under embankment	Relocate parallel to toe

Table 7: ACS communications facilities that will be potentially impacted by proposed construction activities.

F.3.6 General Communications, Inc (GCI), Cable Television

The primary conflicts associated with GCI facilities include existing OH lines that will need to be relocated to an offset UG location and disconnection of facilities to structures that are to be demolished. GCI will design and submit specific relocation plans.

The following table summarizes GCI facilities that are located within the project limits that will be impacted by proposed construction activities.

Station	Offset	Conflict Description	Recommended Resolution
27 + 00 to 42 + 00	160 RT 100 LT	Overhead on joint use poles that are near parallel to the proposed roadway	Relocate exisisting OH facilites to new UG facilities that are offset from proposed roadway
30 + 13	Transverse	UG in area of native soil excavation	Locate and work around
45 + 00 to 45 + 30	100 RT 100 LT	OH on joint use poles with insufficient clearance for proposed bridge	UG exisisting facilites; remove poles

Table 8: GCI communications facilities that will be potentially impacted by proposed construction activities.

F.3.7 Enstar, Natural Gas

The conflicts with the existing natural gas facilities include: the disconnection of services from existing buildings that are to be demolished; relocation of mains that conflict with pile driving operations; and, the relocation of mains that will have excessive amounts of cover with the proposed finished grades. Enstar will submit specific relocation and disconnection plans.

The following table summarizes Enstar facilities that are located within the project limits that will be impacted by proposed construction activities.

Station	Offset	Conflict Description	Recommended Resolution
28 + 30	Transverse	4” plastic pipe located in area of native soil excavation	Locate and work around main
29 + 00 to 41 + 00	60 RT 100 LT	8” transmission pipe located within roadway	Relocate to the west side of the roadway
42 + 00 to 42 + 25	--	Existing building to be demolished (6141 Rovenna Street)	Disconnect service at main

Station	Offset	Conflict Description	Recommended Resolution
44 + 50	100 RT	Existing building to be demolished (6330 Arctic Boulevard)	Disconnect service at main
45 + 60	15 LT	4” steel main at location of proposed pile driving operations	Relocate segement around pile location
47 + 00	100 RT	Existing building to be demolished (856 Bonanza Avenue)	Disconnect service at main
48 + 00	100 LT	Existing building to be demolished (5921 Arctic Boulevard)	Disconnect service at main
48 + 00	50 LT	Existing building to be demolished (5941 Arctic Boulevard)	Disconnect service at main
48 + 00	--	Existing building to be demolished (6031 Arctic Boulevard)	Disconnect service at main
49 + 00 to 51 + 50	100 LT 100 RT	3” steel pipe at location of proposed embankment	Place casing around existing main
103 + 40	Transverse	Possible conflict with buried transmission main	Locate and work around
108 + 75	Transverse	4” plastic main located in area of native soil excavation	Locate and work around

Table 9: Enstar natural gas facilities that will be potentially impacted by proposed construction activities.

F.4.0 PRELIMANARY COST ESTIMATES FOR RECOMMENDED UTILITY RELOCATIONS

The following table presents preliminary cost estimates for utility relocations that have been proposed for this report. Factors that could increase the associated costs include dewatering, traffic control, construction phasing, and any requirement to extend muck excavation limits. Factors that may result in costs savings include joint trenching (not already considered), modification of slope limits which may remove potential conflicts, and reduced excavation or boring requirements. As the design work continues with each individual utility, conflict resolutions will be negotiated, and more detailed costs estimates will be available. The following table presents the current estimated costs for utility conflict resolution by utility. Reimbursable costs are those that will be paid to DOT and non-reimbursable costs are those that DOT will have responsibility to compensate the respective utility.

Utility	Reimbursable Costs	Non-reimbursable Costs
AWWU, Water	$0	$150,000
AWWU, Sanitary Sewer	$1,333,000	$15,000
MOA, Storm Water	$0	$365,400
CEA, Electric	$0	$3,500,000
ACS, Telephone	$0	$300,000
GCI, Cable Television	$0	$200,000
Enstar, Natural Gas	$0	$600,000
Total	$1,333,000	$5,130,400

Table 10: Utility relocation cost estimate where non-reimbursable costs are borne by the DOT&PF.

F.5.0 REFERENCES

Enstar Natrual Gas Company, Safety Requirements for Excavation Adjacent to Natural Gas Pipelines, March 2007

Green, Ellen; Green Engineering; Meeting on February 26, 2010

Municipality of Anchorage Design Criteria Manual, Chapter 5 Lighting; Project Management and Engineering Department and Traffic Department; January 2007

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Parker, Kathy; KBP Consulting; Meeting on February 26, 2010

Tullius, Mike; Chugach Electric Association, Distribution Engineer; Meeting on April 1, 2010.

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DESIGN STUDY REPORT

APPENDIX G
CONSTRUCTION PHASING

WEST DOWLING ROAD EXTENSION: PHASE II
C STREET TO RASPBERRY

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LIST OF ACRONYMS

ACS ..... Alaska Communication Services
ARR ..... Alaska Railroad
AWWU ..... Anchorage Water & Wastewater Utility
CEA ..... Chugach Electric Association
MOA ..... Municipality of Anchorage
MSE ..... Mechanically Stabilized Earth
ROW ..... Right of Way

G.1.0 CONSTRUCTION PHASING AND TRAFFIC CONTROL PLAN

This appendix provides recommendations and guidelines for construction that achieve the objectives in an efficient manner. These recommendations and guidelines are broad in their scope, leaving the more specific details to the general contractor.

G.2.0 CONSTRUCTION PHASING

This project will require a multiple construction seasons to complete. In order to best accommodate the needs of utility relocation, native material excavation and replacement, and bridge construction, this project is slated to take three seasons to complete and will be accomplished over three distinct phases.

G.2.1 Phase I

Phase I of the project will commence when the purchase of all affected parcels within the proposed ROW are acquired. With the completion of property purchases, demolition, grubbing and clearing, soil remediation, and utility relocation can begin.

The project area is currently a conglomerate of forest, industrial usage, retail, and wetlands. In order to provide an area suitable for construction, the project area shall require demolition of all buildings, paved areas, and flora. Existing structures need to be vacated, have their utilities disconnected, and be disposed of. Wooded, saturated, and vegetated portions of the project will need cleared and prepared for soil remediation.

Soil in the project area is composed mainly of peat. This material will not meet compaction requirements, is unsuitable for construction, and will need to be removed. Excavation of peat material will be required ten to fifteen feet below existing grade in multiple sections to ensure complete removal. The area shall then be filled to the required elevation with a suitable soil. The new soil needs to be thoroughly compacted.

A surcharge placed on the backfilled material beneath the bridge footprint is recommended for approximately eight months to allow for adequate compaction of the borrow material. This period will ensure that differential settlement will be minimal during and after construction of the bridge. Standard compaction procedures are sufficient for the remainder of the roadway.

Utility relocation work will proceed during this first season. The affected utilities include: GCI, AWWU, ACS, CEA, MOA, and Enstar. Coordination between the utilities will be required to ensure that all relocations can be completed in a timely fashion due to the extent of conflicts associated with this project. CEA relocation work along Rovenna Street will need to be coordinated with GCI and ACS due to shared facilities and easements. Storm drain and water main relocation along Arctic Boulevard can be completed after the demolition of the existing parcels located on the east side of Arctic Boulevard.

G.2.2 Phase II

Phase II of the project will primarily consist of construction of the bridge superstructure, bridge embankments, preparation of the roadway, and installation of the noise wall along Raspberry Road.

Construction of the retaining structures shall commence after the surcharge has properly compacted the bridge soil at the beginning of the second season. The construction of the MSE wing walls on the embankments can be completed.

Abutment piles shall be installed during the second season. Each abutment shall be properly installed in accordance with the plan drawings accompanying this Design Study Report. Backfill shall then be installed to the proposed vertical alignment height.

Following completion of the abutments and the center pier, the bridge pile caps can be completed. While bridge construction is underway, roadway preparation can be completed. This will entail the removal of all remaining surcharge material, excavation to the required depths for the placement of select materials, and construction of the medians and curbs.

Construction on the noise wall can begin any time during the season that the contractor believes will provide adequate time to finish within the season. Coordination with nearby utilities will be required and construction should proceed in a manner that minimizes additional traffic stresses.

G.2.3 Phase III

The last season of construction shall encompass the finished construction of the bridge, installation of asphalt, roadway striping, and all associated landscaping. Following the opening of the new roadway the existing westbound lanes of Raspberry Road will be demolished and the area re-vegetated.

Completion of the bridge structure shall proceed at the beginning of the season. At this time, the bridge girders, stringers, decking, railing, slab, approach slabs, and the final sub-base shall be laid. Afterwards, the bridge will be ready for asphalt paving.

The entire roadway will be paved during this season. Following completion of paving, striping operations can commence. Pedestrian facilities will be completed at this time. Signage, protective barriers, and luminaries can be installed at this time.

With the completion of the roadway and safety requirements, the contractor may open the new corridor to traffic. Once the new westbound Raspberry Road lanes are in operation, the contractor can proceed with demolition of the existing westbound Raspberry Road lanes.

All landscaping and final cleanup will occur during this final season.

G.3.0 TRAFFIC CONTROL PLAN

Traffic control shall be accomplished through detoured routing, flow routing, and restricting access. By detouring traffic to major thoroughfares, most of the anticipated traffic will be mitigated. For the volume of traffic that cannot be detoured, the flow shall be hand-controlled and may include phased one-directional flow by the general contractor. Some access points will be restricted, though only in the case of non-publicly accessible roads.

Pedestrian access throughout the corridor will need to be maintained by the contractor at all times, with additional consideration given to the businesses that have frontage along Arctic Boulevard and the residential communities along Raspberry Road.

The Alaska Rail Road (ARR) requires constant clearance requirements overhead their rail road tracks. Closure of the rail line, or restrictions on operations, must be negotiated directly with ARR. At this time, it should be assumed that ARR will not accept any restricted access to their affected rail line.

Public notice of road closures will be completed by a combination of local signage, advertisements in the Anchorage Daily News, and updates to the project web site, www.dowlingroad.com.

G.3.1 Available Detour Routes

The main traffic approach that will be impeded by construction is the daily traffic travelling to and from the NAPA warehouse on Rovenna Street. The general contractor will be required to maintain access to the NAPA facility during normal business hours. Any disruptions to existing business access will require negotiation and acceptance by the affected operation.

Business facilities directly south of the bridge location will be relocated upon purchase of the right-of-way, so there are no access issues to consider.

During the period in which the historic Raspberry Road will be connected to the new corridor, traffic travelling to and from the fish processing plant will be required to access the area using Raspberry Road and Minnesota Drive.

G.3.2 Impact to Surrounding Area

During the construction phase, a sizeable staging area will be essential. There will be ample room for this area primarily because the project constructs a new road rather than expanding an existing one with a limited right-of-way.

Construction of the bridge will impact access to Rovenna Street and historic West Dowling Road, especially during construction of the pier which will be installed near the center of the intersection of Arctic Boulevard and West Dowling Road. Because this is a central business district, much progress can be made by severely limiting access to West Dowling Road and

Rovenna Street after normal business hours. Installation of the central pier and construction of the MSE wing walls may result in lane restrictions along Arctic Boulevard.

Access to Changepoint Church from the north will be prohibited during construction. This prohibition may impact a small amount of traffic, but this is currently not a legal public thoroughfare. Access to the church will have to be routed to the legal entrances located south of the building along Raspberry Road.

G.3.3 Pedestrian Traffic

Pedestrian traffic is currently minimal in the area, but maintaining accommodations will still be required. During construction pedestrian traffic along Arctic Boulevard will be restricted to one side of the street or the other, depending on which side will be used for construction purposes.

The other area where pedestrians may be significantly impacted is along Raspberry Road. There is an existing neighborhood to the south of Raspberry Road from Minnesota Drive to the eastern edge of the proposed corridor. Pedestrian traffic will have to be isolated to the south side of Raspberry Road, restricted from the north. This will allow for pedestrians, yet still allow for construction as well. During construction of the noise wall along Raspberry Road, the contractor will have to provide adequate and properly signed access to maintain accessibility in this area.

G.3.4 Alaska Rail Road

The ARR operates two lines that cross the project area at the intersection of Arctic and West Dowling. The ARR has strict requirements on maintaining access to its lines. Any possible disruptions to their service will need to be coordinated and agreed to by the ARR.

G.3.5 Road Closures

There will only be select periods of construction that will require road closures: closure of Arctic Boulevard while overhead construction of the bridge is taking place, restrictions along Arctic Boulevard while the utility relocation is underway, and closure of Raspberry Road while connecting the new road system to existing Raspberry. Additionally, during utility relocation, traffic along Arctic Boulevard and Rovenna Street may face intermittent lane restrictions and flagging operations.

While girders are being installed, traffic shall be prohibited from traversing underneath due safety concerns. This installation shall take place ultimately at the behest of the general contractor, but is recommended to install the girders during occasional night-time operations.

Connecting the existing Raspberry Road to the new road system would be impossible to construct during a single night-time operation, thus traffic will be limited and routed to one lane, each approach, while this connection is being completed.

G.4.0 UTILITY RELOCATION

The majority of the utility relocation will occur along the undeveloped section of Rovenna Street and will have a minimal impact on local businesses. Some utility relocation will occur along Arctic Boulevard and will require varying lane restrictions and flagging operations to accommodate the proposed excavations.

The general contractor and the project manager will have the responsibility to coordinate with all affected utilities to see that relocation proceeds efficiently and minimizes conflicts between relocation operations.

The majority of the relocation work involves moving overhead electrical and communication facilities to underground. This work is being designed by the respective facility owners to minimize impact on their existing customers. The overhead relocation also includes the raising of a 138kV electric transmission line that is owned and operated by CEA. This relocation includes the installation of two new steel friction poles to raise the line to the required clearances over the new bridge. This line crosses Arctic Boulevard and during operations to raise the cable, traffic flows may be restricted.

Along Arctic Boulevard, north and south of the West Dowling Road intersection, multiple underground utilities will need to be relocated or reconstructed to accommodate the new bridge structure. During this time traffic along Arctic Boulevard will likely be restricted.

G.5.0 BRIDGE CONSTRUCTION

Bridge construction will proceed over multiple seasons.

G.5.1 Initial Preparation

As with any project, initial preparation is essential. The bridge requires a strong, compacted base: this will be accomplished with the excavation of substandard native material and backfilling with specified borrow materials, and the placement of the surcharge during the first season of construction.

Demolition of any buildings or roadways in the area of the proposed road will be required as will removal of peat and contaminated soil ranging from ten to fifteen feet below existing grade. Proper borrow fill will be placed and compacted with an ample surcharge during the first construction season. This surcharge will remain in place for eight to twelve months over the winter between the first and second construction seasons.

G.5.2 Abutment and Pier Pile Installation

The abutment piles, center piers, and pile caps shall be installed during the second season.

Retaining structures shall be required at each end of the bridge where vertical soil lifts are installed to reach the required vertical alignment. After the structures are finished, piles shall be installed at each abutment to provide structural support for the bridge.

The piles required for the pier support shall also be installed during the second season. These piles shall be driven and poured at bridge center, near the center of the intersection of Arctic Boulevard and historic West Dowling Road.

Proper vertical alignment shall be achieved through vertical soil lifts. The required clear distance from finished grade to bottom chord of the bridge is twenty three feet.

G.5.3 Girder Installation

Installation of the girders will require use of cranes and other heavy equipment. All traffic on Arctic Boulevard shall be stopped while equipment is being placed, thus girder installation is required to occur during night-time operations. According to the schedule of this particular project, girder installation will be accomplished during the third season.

G.5.4 Sub-base and Asphalt Placement

The sub-base is scheduled to occur during the third season, after the installation of the girders, stringers, and decking. Approach slabs on each side of the bridge shall be installed after the sub-base is laid. On top of the sub-base, the asphalt shall be laid.

All guardrails and associated safety appurtenances shall be installed during the final season.

G.6.0 ROADWAY CONSTRUCTION

Roadway construction along the length of the project corridor will be completed in phases occurring over three construction seasons.

G.6.1 Roadway Preparation

Roadway preparation will primarily be completed during the first season with the soil remediation operations. This will entail the excavation of native material, primarily peat, and the placement of an unclassified backfill suitable for roadway construction.

G.6.2 Sub-base Placement

Sub-base material can be placed during the second season. At this time, the contractor can construct medians and curbs.

G.6.3 Asphalt Placement

Asphalt placement is expected to take place during the final season. After placement of the asphalt, striping operations can commence.

DESIGN STUDY REPORT

APPENDIX H
PUBLIC INVOLVEMENT

WEST DOWLING ROAD EXTENSION: PHASE II
C STREET TO RASPBERRY ROAD

Prepared for:

State of Alaska
Department of Transportation and Public Facilities
Central Region
411 Aviation Ave.
Anchorage, Alaska 99502

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Seawolf Engineering
3211 Providence Drive
Anchorage, AK 99503

Authors:

Brice Conklin
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April 2010

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LIST OF ACRONYMS

UAA..University of Alaska Anchorage
dBA…………………………………………………………………………….....Decibel
HDR…………………………………………………………………...…HDR Engineering Inc.
NAC………………………………………………………………….….Noise Abatement Criteria
AKDOT&PF…………………………Alaska Department of Transportation and Public Facilities
FHWA.. Federal Highway Administration

H.1.0 INTRODUCTION

The objective of this report is to identify stakeholder concerns generated by construction of the proposed road alignment, and incorporate public feedback in project design. This report also provides an overview of the design environment, requirements, environmental factors, and methods used to develop the recommended noise wall.

H.2.0 PROJECT DESCRIPTION

The Department of Transportation West Dowling Road Extension will connect C Street to Raspberry Road, in the central region of Anchorage Alaska.

This new corridor is proposed to provide greater east - west mobility and reduce congestion on surrounding routes. The proposed design is a four lane urban minor arterial passing through light industrial areas, neighborhoods, and undeveloped parcels of land. The design utilizes a variable cross section of four lanes and two ten foot paths on either side. A channelized intersection is planned to preserve traffic flow and service level, without the use of a signalized intersection.

H.3.0 STAKEHOLDER PARTICIPATION

A representative of the UAA Senior Design Transportation Project team attended a Public Information meeting hosted for the West Dowling Road Extension project hosted by the Alaska Department of Transportation on February 11th, 2010.

H.3.1 Stakeholder Concerns

During the meeting the public was made aware of project progress and objectives. Stakeholders were allowed to voice concerns regarding potential future effects of the completed project. In particular, residents owning homes near the Raspberry Road area were concerned with road noise negatively affecting their comfort and property value.

H.4.0 EXISTING CONDITIONS

The residential area located near the project adjacent to Raspberry Road as shown in Figure H.5 is the region where noise levels may be detrimental to the comfort of homeowners.

Existing sources of noise in the project area are:

- Traffic on existing corridors
- Railroad traffic and crossing alarms
- Industrial business operations
- Aircraft
- Aggregate processing operations

H.5.0 METHODOLOGY

The Alaska Department of Transportation and Public Facilities Noise Abatement Policy was used to determine whether or not a noise wall will be justified as part of the construction of this project. The noise abatement policy calls for build versus no build determination to be based on noise study results. Noise studies have been conducted for this project by HDR Alaska Inc. in October 2006. It was determined that "Predicted future traffic noise levels meet or exceed the NAC at all modeled receptors and Build noise levels substantially exceed the noise levels at most modeled receptors." To include a noise barrier in a project, the barrier must be considered both feasible and reasonable. Appendices H.5.1 and H.5.1 discuss these criteria in detail.

H.5.1 Feasibility

The following criteria are used to determine when construction of a noise wall is a justifiable project:

- Predicted future noise levels must be greater than FHWA Noise Abatement Criteria (Figure H.2) or 15 dBA greater than existing noise levels.
- Noise abatement will not be provided for undeveloped lands or industrial use areas.
- A minimum noise reduction of 5 dBA must be achieved.
- The noise wall must not generate a safety hazard to the driving public or the residents.

H.5.2 Reasonableness

- Cost per benefited receiver must not exceed $32,000 at the design engineering level, except in cases of severe noise.
- Residents in the vicinity of the noise wall must reach a general consensus supporting construction.
- Homes of the benefited receivers must have been constructed prior to the highway concerned, and at least 50% must have existed for over 10 years.
- The future predicted noise levels are greater than 66 dBA, 10 dBA greater than existing, and 5 dBA greater than the no-build alternative.
- Emergency vehicle access to residential areas must be considered.

H.6.0 FINDINGS

A noise abatement study was completed in November 2007 by HDR Alaska Inc., determined that a noise wall would be warranted at the north side of Raspberry Road. Figure H.1 shows the determination of existing and future noise levels at Chad Street., adjacent to Raspberry Road, based on a project no build option and with or without a noise barrier.

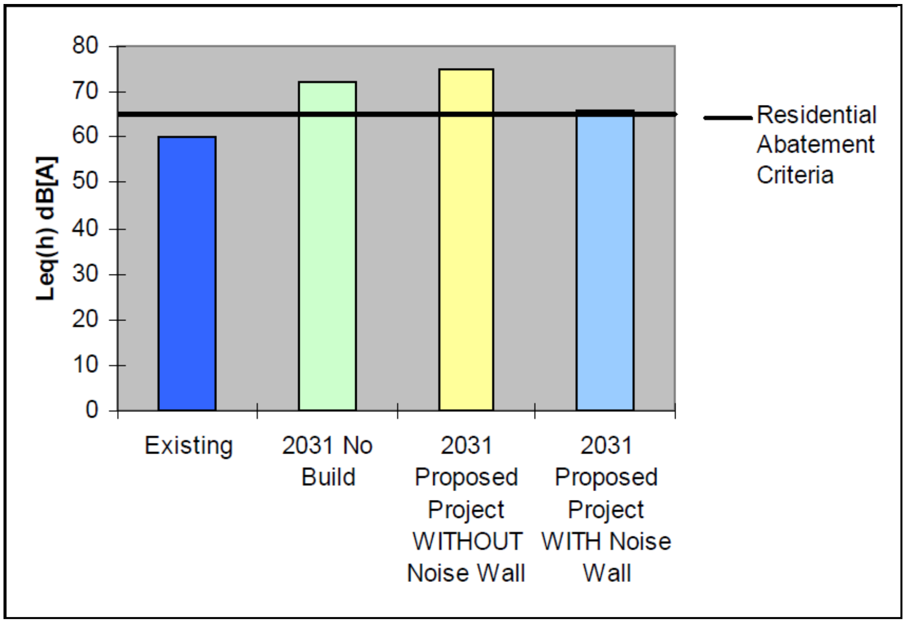

Figure H.1: Existing & Future Noise Levels at Chad Street

HDR Alaska Inc. is currently (Spring 2010) conduction a noise study to more accurately determine the affects of the West Dowling Road Phase II extension given more determined roadway geometry. The findings of this report should ultimately aid in determining the feasibility of a noise wall.

H.7.0 ALTERNATIVES

1. No-Action
2. Insulation of homes
3. Noise reducing pavement only
4. Reduced speed limits
5. Extend right of way
6. Noise Wall Construction

H.8.0 RECOMMENDATIONS

The recommended wall is a continuous 13 foot high barrier. Approximately 1600 feet long, it will be constructed of cedar dimensional lumber, with steel posts. A typical section of noise abatement wall is detailed in Figure H.4 as a possible design.

Public involvement activities have shown that residents within the affected neighborhoods are in favor of building a noise abatement wall. The current noise study (November 2007) dictates that a noise wall would be a feasible inclusion as well. The estimated cost of constructing a 1700 foot long, 13 foot tall noise wall is $1,001,500.00. This amounts to $45.30 per square foot of noise wall constructed. Given the construction specifications and the existence of utility conflicts in the area, this estimate may be considered conservative.

H.8.0 REFERENCES

HDR Alaska Inc. 2006. *West Dowling Road Connection Project, Roadway Traffic Noise Assessment.*

AKDOT&PF 2009. *Traffic Noise Abatement Guidance*

ALASKA DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
NOISE ABATEMENT RECOMMENDATION WORKSHEET

Project Name: ______________________________ Project No: _________________________

State-Funded ☐ or Federal-Aid ☐

Preparer's Name: ____________________________________ Date: ____________________

Receiver Name/Description: ____

		YES	NO
	Feasibility Factors		
1.	Does a noise impact exist or is one predicted to occur in the Design Year?	☐	☐
	If no, then noise abatement is not recommended. Proceed to the decision segment of this form.		
2.	Is the receiver a use typically defined within Activity Category A, B, C, or E in the FHWA noise abatement criteria?	☐	☐
	If no, then noise abatement is not recommended. Proceed to the decision segment of this form.		
3.	Is the receiver located within an Industrial or Commercial zoned area?	☐	☐
	If yes, then noise abatement is not recommended. Proceed to the decision segment of this form.		
4.	Can effective noise abatement measures be constructed which provide a minimum 5 dBA reduction in noise levels?	☐	☐
	If no, abatement measures are not feasible and are not recommended at this site. Proceed to the decision segment of this form.		
5.	Can effective noise abatement measures be constructed without creating a safety hazard to users, residents and maintenance personnel?	☐	☐

If no, abatement measures are not feasible and are not recommended at this site. Proceed to the decision segment of this form.

Reasonableness Factors (Numbering system matches numeric numbers in Section VII. B. of the Policy paper.)	YES	NO
1. Cost Per Benefited Receiver		
Engineer's estimate for the abatement measure divided by number of benefited receivers > $ 32,000 (adjusted from 2006 dollars, if more recent annual construction price index calculations are available)	☐	☐
1a. Severe Noise Impact		
i. Predicted noise level is 75 dBA or higher	☐	☐
ii. Predicted noise levels are 30 dBA or more over existing noise levels.	☐	☐
2. Residents' desires	☐	☐
3. Development vs. highway timing	☐	☐
4. Development existence	☐	☐
5. Build level greater than or equal to 66 dBA	☐	☐
6. Build level 10 dBA greater than existing	☐	☐
7. Build level 5 dBA greater than No-Build	☐	☐
8a. Land use is not changing	☐	☐
8b. Local ordinances or zoning is in place to control new development of noise sensitive land uses adjacent to transportation corridors	☐	☐
9. ADDITIONAL FACTORS		

If an abatement measure is determined not reasonable, then go to the decision segment of this form (a feasibility determination is not necessary).

		YES	NO	NA
	Decision			
1.	Are abatement measures feasible?	☐	☐	
2.	Are abatement measures considered reasonable?	☐	☐	☐

REASONS FOR DECISION

Signatures

Recommend ☐: or Not Recommend ☐: Noise Abatement Measure

____ ________

DOT&PF Regional Environmental Manager Date

Concurrence:

____ ________

DOT&PF Regional Preconstruction Engineer Date

For projects with severe impacts:

Approved:

____ ________

DOT&PF Regional Director Date

Concurrence:

____ ________

FHWA Alaska Division Administrator Date

DOT&PF Noise Abatement Recommendation Worksheet
Receiver Name/Description: ________________ Page 3

Figure H.2: AKDOT Noise Abatement Recommendation Worksheet

FHWA NOISE ABATEMENT CRITERIA

Activity Category	$L_{eq}(h)$	Description of Activity Category
A	57 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C	72 (Exterior)	Developed lands, properties, or activities not included in Categories A or B above.
D	--	Undeveloped lands.
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

NOTES:

1. The Alaska DOT&PF definition of a noise impact is 1 dBA less than the FHWA Noise Abatement Criteria in every Activity Category.
2. While not specifically mentioned in Activity Category B a cemetery, campground/RV park, trail or trail crossings should be included in Activity Category B.

Figure H.3: FHWA Noise Abatement Criteria

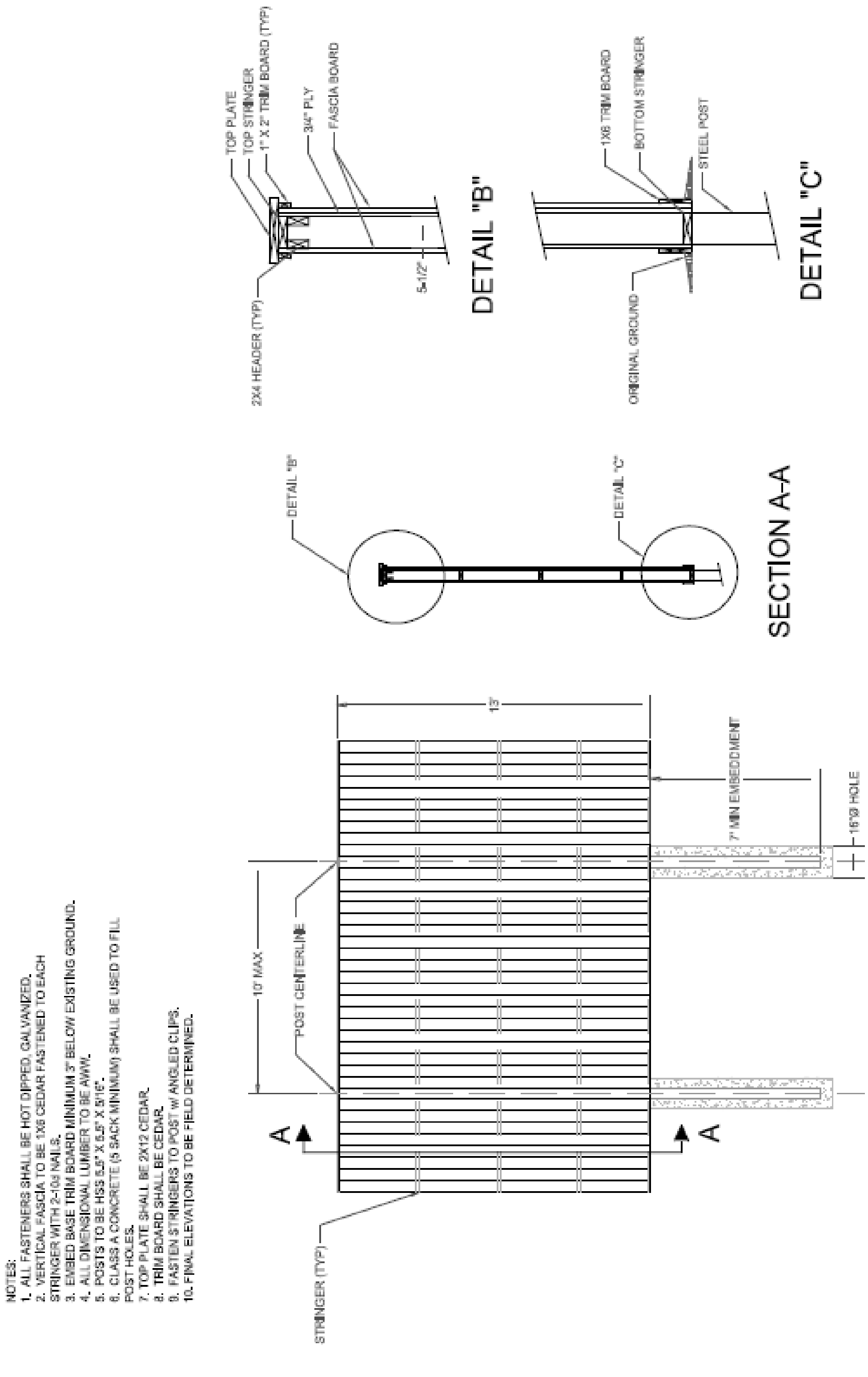

Figure H.4: Noise Wall Potential Design

Figure H.5: Noise Wall Location

DESIGN STUDY REPORT

APPENDIX I
RIGHT-OF-WAY

WEST DOWLING ROAD EXTENSION: PHASE II
C STREET TO RASPBERRY ROAD

Prepared for:

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April 2010

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LIST OF ACRONYMS

CEA……………………………………………………………………Chugach Electric Association
MOA……………………………………………………………...……Municipality of Anchorage
ROW……………...……………………...…………………………………………..Right-of-Way

I.1.0 INTRODUCTION

The West Dowling Phase II extension primarily transects industrial property through the anticipated corridor. ROW acquisition is intended tro create the corridor while minimizing project cost.

I.2.0 METHODOLOGY

Property acquisition for the project is required in 2 categories:

- Acquisition to satisfy the anticipated project footprint
- Acquisition for wetlands mitigation

I.3.0 EXISTING ROW

I.3.1 East of Arctic Boulevard

An existing 50 foot corridor extends from C Street to Arctic Boulevard as shown in Fig. 1. This corridor alleviates a small percentage of anticipated ROW acquisition for the project. In its current form, the Dowling Road ROW accommodates a CEA easement.

I.3.2 West of Arctic Boulevard

The proposed alignment connects with the existing 200 foot Rovenna ROW corridor as shown in Fig. 2.

I.4.0 ROW ACQUISTION

I.4.1 East of Arctic Boulevard

A total of 14 parcels will be affected by the project between Arctic Boulevard and C Street. Acquisition will include full takes of 10 parcels. The remaining will involve partial property takes. The preferred wetlands compensation alternative surrounding Tina Lake calls for the full acquisition of seven additional parcels. Six of these seven are set both in and directly adjacent to

Tina Lake. As future development is functionally impossible on these properties, their acquisition will not constitute a significant portion of the total cost.

I.4.2 West of Arctic Boulevard

Five parcels will be affected to the west of Arctic Boulevard, two involving full property takes (see Fig. I.2).

I.5.0 ACQUISITION COST

Parcel costs were taken from the MOA property tax data. These values reflect the assessed land and building values, which may not be accurate with respect to current appraised values. To account for this discrepancy and the possible cost of relocation, assessed values were multiplied by a factor of 1.5 for estimate purposes. Tables I.1-I.3 detail the required property acquisition and estimated cost.

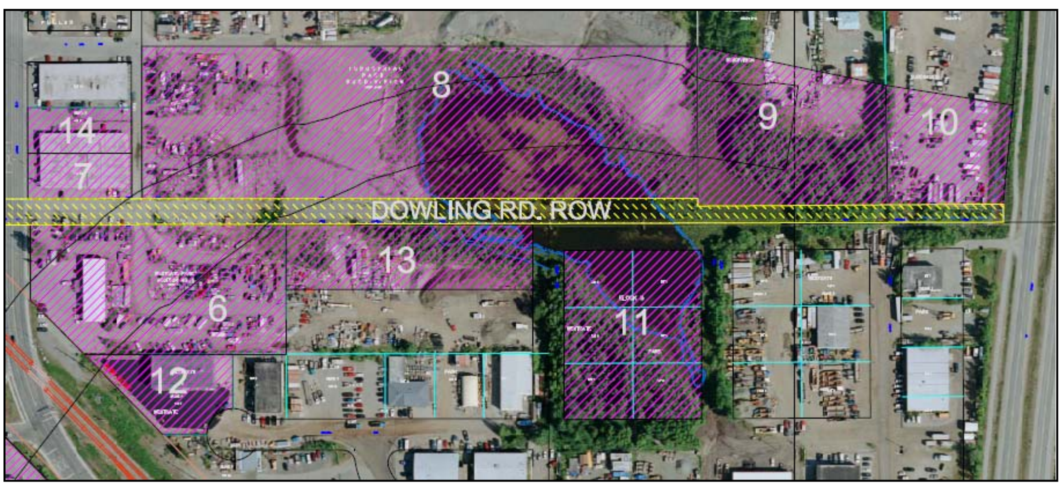

Figure I.1: Existing ROW and Proposed Property Acquisition East of Arctic Blvd.

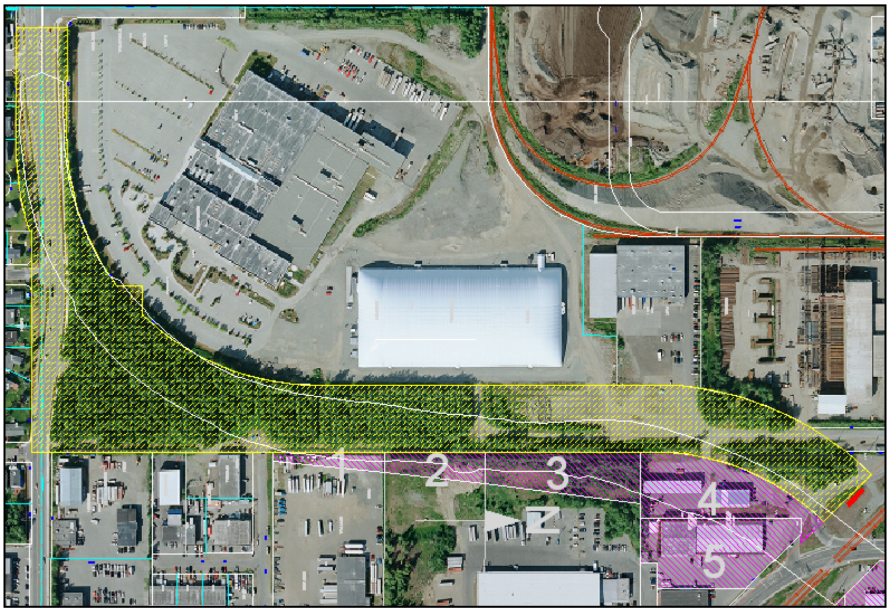

Figure I.2: Existing ROW and Proposed Acquisition West of Arctic Blvd.

Platt	Address	Existing ft^2	Taken ft^2	Parcel Value	Building Value	Total Value	Amount
1	6510 ARCTIC SPUR RD	207999	14266.66	$1,904,800	$1,657,800	$3,562,600	$130,650
2	6510 ARCTIC SPUR RD	189000	23318.43	$1,765,800	$0	$1,765,800	$217,861
3	6308 ARCTIC SPUR RD	321300	57690.76	$2,645,100	$3,316,200	$5,961,300	$474,939
4	6141 ROVENNA ST	77031	*ALL*	$452,400	$451,700	$904,100	$904,100
5	6330 ARCTIC BLVD	84562	*ALL*	$954,300	$1,554,100	$2,508,400	$2,508,400

Table I.1: ROW Acquisition West of Arctic Blvd.

Platt	Address	Existing ft^2	Taken ft^2	Parcel Value	Building Value	Total Value	Amount
6	6031 ARCTIC BLVD	239028	*ALL*	$951,800.00	$263,100	$1,214,900	$1,214,900
7	5941 ARCTIC BLVD	17592	*ALL*	$293,700.00	$1,071,400	$1,365,100	$1,365,100
8a	700 W 59th AVE	64770	*ALL*	$695,000.00	$0	$695,000	$695,000
8b	700 W 59th AVE	66067	*ALL*	$702,800.00	$0	$702,800	$702,800
8c	700 W DOWLING RD	71767	*ALL*	$756,700.00	$0	$756,700	$756,700
8d	700 W 59th AVE	80263	*ALL*	$831,500.00	$0	$831,500	$831,500
8e	700 W 59th AVE	247632	*0*	$981,300.00	$0	$981,300	$0
9	NONE	237957	97922.92	$1,295,400.00	$0	$1,295,400	$533,077
10	5801 SILVERADO WAY	165528	49329.69	$1,714,800.00	$1,226,400	$2,941,200	$511,035
11a	NONE	14388	*ALL*	$100.00	$0	$100	$100
11b	NONE	14256	*ALL*	$100.00	$0	$100	$100
11c	NONE	14256	*ALL*	$100.00	$0	$100	$100
11d	NONE	14256	*ALL*	$100.00	$0	$100	$100
11e	NONE	14256	*ALL*	$100.00	$0	$100	$100
11f	NONE	14388	*ALL*	$100.00	$0	$100	$100
12	856 BONANZA AVE	27591	*ALL*	$265,400.00	$619,800	$885,200	$885,200
13	None	118502	59251	$884,900.00	$0	$884,900	$442,450
14	5921 ARCTIC BLVD	17600	*ALL*	$293,800.00	$13,600	$307,400	$307,400

Table I.2: ROW Acquisition East of Arctic Blvd.

Acquisition Sub Total	$9,895,700.00
Adjustment Factor	1.5
Factored Total	**$14,843,550.00**

Table I.3: Anticipated ROW Acquisition Estimate

DESIGN STUDY REPORT

APPENDIX J
COST ESTIMATE

WEST DOWLING ROAD EXTENSION: PHASE II
C STREET TO RASPBERRY

Prepared for:

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April 2010

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LIST OF ACRONYMS

C.Y. .... Cubic Yard
L.F. .... Linear Foot
MSE .... Mechanically Stabilized Earth
ROW .... Right of Way
S.Y. .... Square Yard

J.1.0 COST ESTIMATE

The cost summary included in this appendix does not reflect the complete cost projections for this project. These estimates include the purchase of key properties and materials. The overall expected costs for the project are available in the main body of this report, section 13.0.

J.2.0 ENGINEERS ESTIMATE

The engineers estimate for project costs can be seen below in table 1. The table provides reference section numbers, item description, quantities, and the engineers estimated cost.

Item No.	Item Description	Pay Unit	Quantity	Cost/unit	Estimate
201 (3A)	Clearing and Grubbing	Acre	11	$10,000.00	$110,000.00
202 (1)	Removal of Structures	Each	6	41666.66667	$250,000.00
202 (2)	Removal of Pavement	SY	90000	$6.00	$540,000.00
202 (3A)	Removal of Concrete Sidewalk	SY	558	$15.00	$8,370.00
202 (6)	Removal of Manhole	Each	2	$2,000.00	$4,000.00
202 (9)	Removal of Curb and Gutter	LF	4470	$8.25	$36,877.50
202 (20)	Removal of Water Pipe	LF	400	$30.00	$12,000.00
203 (3)	Unclassified Excavation	CY	86551	$10.00	$865,510.00
203 (3A)	Wetlands Excavation	CY	10000	$10.00	$100,000.00
203 (6A)	Borrow; Type A	Ton	201111.9	$29.50	$5,932,800.46

Item No.	Item Description	Pay Unit	Quantity	Cost/unit	Estimate
203 (6C)	Borrow; Type C	Ton	175000	$13.00	$2,275,000.00
301 (1)	Aggregate Base Course, Grading D-1	Ton	5421.85	$27.50	$149,100.88
401 (1A)	Hot Mix Asphalt, Type II; Class A	Ton	6098.33	$75.00	$457,374.75
401 (2B)	Asphalt Cement; PG 64-28	Ton	77.59	$300.00	$23,277.00
402 (1)	STE-1 Asphalt for Tack Coat	Ton	15.14	$800.00	$12,112.00
409 (1)	Hot Mix Asphalt, Type R	Ton	3828.44	$60.00	$229,706.40
409 (2)	Asphalt Cement; PG 64-34	Ton	645.24	$600.00	$387,144.00
501(15b)	Stub Wall (Aestetic)	L.F.	540	$400.00	$216,000.00
507(1)	Steel Bridge Railing	L.F.	540	$175.00	$94,500.00
507(2)	Pedestrian Railing	L.F.	540	$150.00	$81,000.00
5XX(X)	Wetlands Creation	S.Y.	10000	$10.00	$100,000.00
603 (1-18)	18" CSP	L.F.	730	$85.00	$62,050.00
603 (3-18)	End Section for 18"CSP	Each	8	$550.00	$4,400.00
603 (21-12)	Pipe 12" Corrugated Polyethylene	L.F.	2490	$75.00	$186,750.00
603 (1-42)	42" Corrugated Steel Pipe	L.F.	360	$275.00	$99,000.00

Item No.	Item Description	Pay Unit	Quantity	Cost/unit	Estimate
604 (1A)	Storm Sewer Manole, Type IA	Each	14	$6,500.00	$91,000.00
604 (2A)	Sanitary Sewer Manhole, Type A	Each	1	$6,000.00	$6,000.00
604 (3)	Reconstruct Existing Manhole	Each	1	$3,000.00	$3,000.00
604 (4)	Adjust Existing Manhole	Each	9	$500.00	$4,500.00
604 (5)	Inlet	Each	23	$2,400.00	$55,200.00
604 (14X)	Oil and Grit Separator, Stormceptor	Each	2	$50,000.00	$100,000.00
605 (7)	8" Perforated PVC Pipe	L.F.	3550	$25.00	$88,750.00
606 (1)	W-Beam Guardrail	L.F.	2000	$25.00	$50,000.00
606 (11)	Extruder Terminal (ET-2000)	Each	4	$815.00	$3,260.00
606 (12)	Guardrail/Bridge Rail Connection	Each	4	$400.00	$1,600.00
606 (15)	Crash Cushion	Each	4	$4,000.00	$16,000.00
608 (2)	Asphalt Sidewalk	Ton	1410.74	$23.00	$32,447.02
609 (2)	Curb and Gutter, Type I	L.F.	540	$25.00	$13,500.00

Item No.	Item Description	Pay Unit	Quantity	Cost/unit	Estimate
610 (2)	Ditch Lining	Ton	5500	$60.00	$330,000.00
614 (1)	Concrete Barrier	L.F.	270	$125.00	$33,750.00
615 (1)	Standard Sign	S.F.	300	$50.00	$15,000.00
618 (1A)	Seeding, Type A	Acre	1.15	$7,000.00	$8,050.00
619 (2)	Matting	S.Y.	50000	$4.18	$209,000.00
620 (1A)	Topsoil, 4" Depth	S.Y.	50000	$5.50	$275,000.00
627 (1-10)	10" Ductile Iron Water Conduit, Class 52	L.F.	380	$135.00	$51,300.00
627 (3)	Install Valve Box	Each	3	$700.00	$2,100.00
627 (7)	Fire Hydrant Removal	Each	1	$2,500.00	$2,500.00
627 (9-10)	Install 10" Gate Valve	Each	3	$2,200.00	$6,600.00
627 (10)	Adjustment of Valve Box	Each	4	$700.00	$2,800.00
627 (12B)	Install Magnesium Bag Anode	Each	3	$400.00	$1,200.00
631 (1)	Geotextile, Drainage	S.Y.	41400	$3.75	$155,250.00
633 (1)	Silt Fence	L.F.	4300	$5.50	$23,650.00
642 (3)	3-Person Survey Party	Hr	100	$400.00	$40,000.00
660 (15)	Electrolier and Foundation	Each	55	$5,000.00	$275,000.00

Item No.	Item Description	Pay Unit	Quantity	Cost/unit	Estimate
670 (10A)	Methyl Methacrylate Pavement Markings Longitudinal Surface Applied	L.F.	27000	$1.70	$45,900.00
670 (10G)	Methyl Methacrylate Pavement Markings Only and Arrow Inlaid	Each	24	$560.00	$13,440.00
670 (10H1)	Methyl Methacrylate Pavement Markings Transverse Inlaid	Each	1	$450.00	$450.00
--	Noise Wall, Furnish and Install	Each	1	$1,001,487.46	$1,001,487.46
--	Bridge Construction and Materials	Each	1	$7,000,000.00	$7,000,000.00
--	MSE Wall	Each	1	$500,000.00	$500,000.00
				Total	$22,694,707.47

Table J.1: The engineer's estimate for West Dowling Road Phase II.

J.3.0 RIGHT OF WAY ACQUISITION

This project requires the purchase of several properties, including the purchase of developed and active parcels, partial takes of parcels, and the purchase of several undeveloped properties. Property acquisition costs were determined utilizing 2010 assessed values and by assuming a purchase factor of 1.5. Table 2 below presents a summary of property acquisition costs and figure 1 provides a reference of the purchased parcels.

Plat	Address	Sq. Ft. Existing	Sq. Ft. Taken	Parcel Value	Building Value	Total Value	Amount
1	6510 ARCTIC SPUR RD	207999	14266.66	$1,904,800	$1,657,800	$3,562,600	$130,650
2	6510 ARCTIC SPUR RD	189000	23318.43	$1,765,800	$0	$1,765,800	$217,861
3	6308 ARCTIC SPUR RD	321300	57690.76	$2,645,100	$3,316,200	$5,961,300	$474,939
4	6141 ROVENNA ST	77031	*ALL*	$452,400	$451,700	$904,100	$904,100
5	6330 ARCTIC BLVD	84562	*ALL*	$954,300	$1,554,100	$2,508,400	$2,508,400
6	6031 ARCTIC BLVD	239028	*ALL*	$951,800	$263,100	$1,214,900	$1,214,900
7	5941 ARCTIC BLVD	17592	*ALL*	$293,700	$1,071,400	$1,365,100	$1,365,100
8a	700 W 59th AVE	64770	*ALL*	$695,000	$0	$695,000	$695,000
8b	700 W 59th AVE	66067	*ALL*	$702,800	$0	$702,800	$702,800
8c	700 W DOWLING RD	71767	*ALL*	$756,700	$0	$756,700	$756,700
8d	700 W 59th AVE	80263	*ALL*	$831,500	$0	$831,500	$831,500
8e	700 W 59th AVE	247632	*0*	$981,300	$0	$981,300	$0
9	NONE	237957	97922.92	$1,295,400	$0	$1,295,400	$533,077
10	5801 SILVERADO WAY	165528	49329.69	$1,714,800	$1,226,400	$2,941,200	$511,035
11a	NONE	14388	*ALL*	$100	$0	$100	$100
11b	NONE	14256	*ALL*	$100	$0	$100	$100
11c	NONE	14256	*ALL*	$100	$0	$100	$100
11d	NONE	14256	*ALL*	$100	$0	$100	$100
11e	NONE	14256	*ALL*	$100	$0	$100	$100
11f	NONE	14388	*ALL*	$100	$0	$100	$100
12	856 BONANZA AVE	27591	*ALL*	$265,400	$619,800	$885,200	$885,200
13	None	118502	59251	$884,900	$0	$884,900	$442,450
14	5921 ARCTIC BLVD	17600	*ALL*	$293,800	$13,600	$307,400	$307,400
					Sub-Total		$11,731,861
					Factor Adjustment		1.5
					Factored Total		$17,597,792

Table J.2: Cost summary table for ROW acquisition.

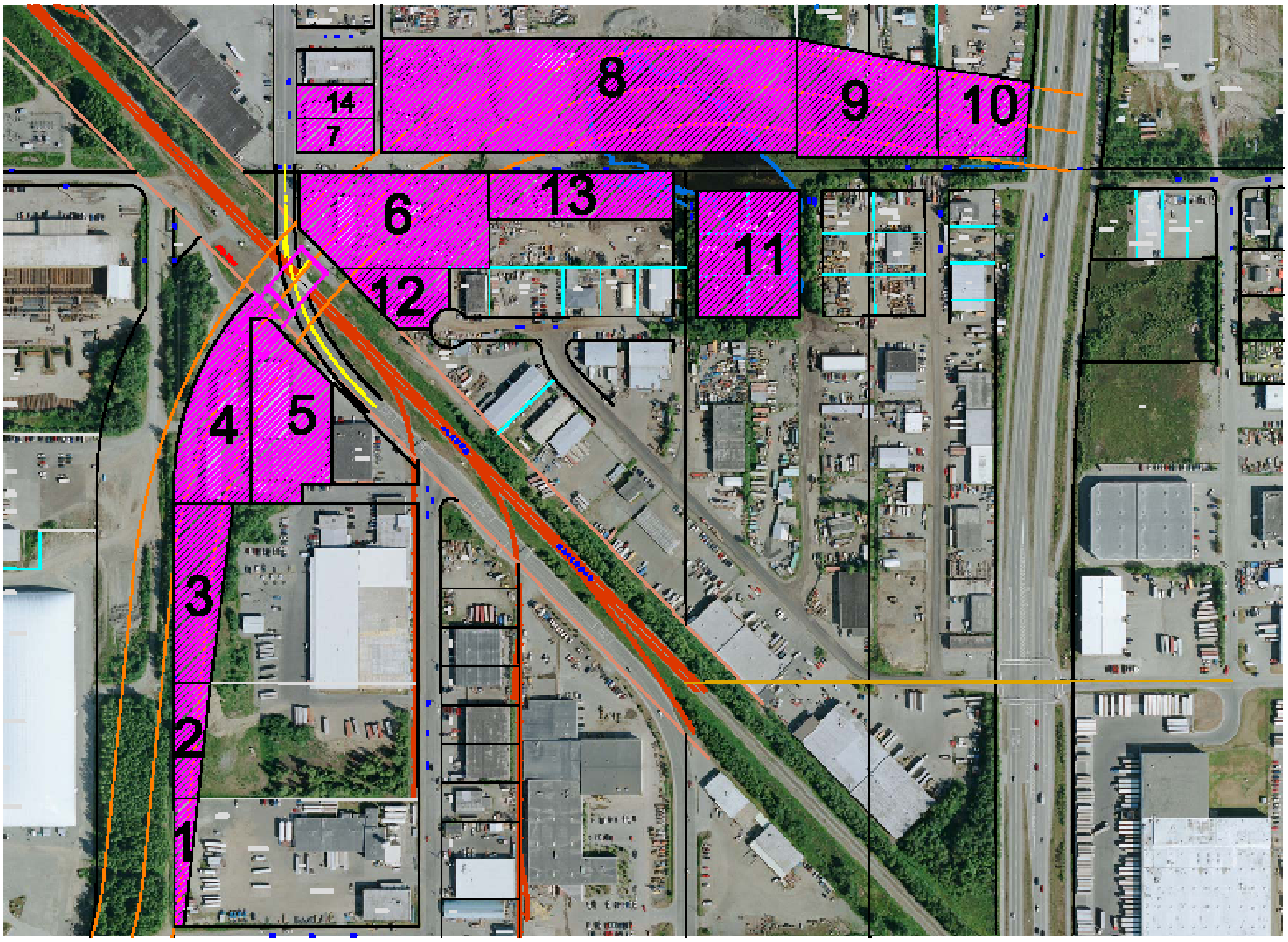

Figure J.1: Plat reference map for ROW purchases.

J.4.0 REFERENCES

Alaska Department of Transportation and Public Facilities, Bid Tabulation Summaries, Central Region Highways, 2007

Alaska Department of Transportation and Public Facilities, Standards and Specification for Highway Construction, 2004

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DESIGN STUDY REPORT

APPENDIX K
HYDROLOGIC REPORT

WEST DOWLING ROAD EXTENSION: PHASE II
C STREET TO RASPBERRY ROAD

Prepared for:

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April 2010

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LIST OF ACRONYMS

SCS……………………………………………………………………...Soil Conservation Service
WDR……………………………………………………………………..West Dowling Road
MOA………………………………..…………………………….Municipality of Anchorage
IDF…………………………………………………………………..Intensity Duration Frequency

K.1.0 INTRODUCTION

K.1.1 Objective

The objective of this study is to identify and propose specific solutions to stormwater runoff generated by construction of the proposed road alignment. The solution will require design of adequate drainage systems to control the runoff, while protecting the surrounding environment by treatment of water runoff. The stormwater design must also incorporate management of stormwater in all basins affected by the proposed project.

This study provides an overview of the design requirements, environmental factors, and methods used to develop the recommended drainage solutions. All design measures have been conducted to satisfy the guidelines set out in the Municipality of Anchorage Drainage Design Guidelines.

K.1.2 Project Description

This Hydrologic Report was prepared in support of the West Dowling Road Phase II project. The proposed extension will connect Dowling Road from its Phase I termination at C Street, through to Raspberry Road. At present, no road exists to connect these two corridors, and all traffic is routed through surrounding streets.

This new corridor is proposed to provide greater east - west mobility and reduce congestion on surrounding routes. The proposed design is a four lane urban major arterial passing through light industrial areas, neighborhoods, and wetlands. The design utilizes a variable cross-section of four lanes and two ten foot paths on either side. A bridge overpass of the Alaska Railroad mainline is proposed near the at-grade crossing of Arctic Boulevard and West Dowling Road. The west end of the proposed project passes near residential areas, and will employ rubberized, low-noise pavement and a noise wall.

At the location where the existing course of Raspberry Road Intersects the new road alignment, a channelized intersection will be used to preserve traffic flow and service level, without the use of a signalized intersection.

K.2.0 HYDROLOGIC ANALYSIS

K.2.1 Flood Risk

The Federal Emergency Management Agency classifies the project area at Tina Lake as within the flood zone for a 100-year event. This project holds low risk in the event of a flood, due to the fact that no vertical structures are proposed for construction.

K.2.2 Drainage Area Characteristics

In general, as the proposed project passes from east to west it crosses existing road right of way in residential areas, through wooded areas, over the railroad grade and Arctic Boulevard, and around Tina Lake to connect to C street.

Existing storm water facilities in the project area utilized by this design consist of a forty-eight inch storm drain pipe under Raspberry Road.

The areas affected by the design have been divided into different drainage basins based on the topographic profile of the existing and proposed grade. Runoff calculations are based on cumulative flows for each drainage basin.

K.2.3 Methodology

Stormwater was analyzed at varying peak flow interval to design a system as required by the Municipality of Anchorage Drainage Design Guidelines. Intervals were calculated over 24 hour periods and include: 2-year, 10-year, 25-year, 50-year, and 100-year storm events. The Municipality of Anchorage Drainage Design Guidelines require basins under forty acres to be designed to contain 10-year, 24 hour storm events. Basins that are over forty acres are to be designed to contain 25-year, 24 hour storm events. The 50-year, 24 hour storm events were used to sized culverts. The 100-year, 24 hour runoff was used solely for comparison.

The rational method was used to calculate the peak flow in the project, using Municipality of Anchorage Drainage Design Guidelines. The SCS is another typical method for peak flow calculations, but could not be calculated due to insufficient soil data.

K.2.4 Rational Method

The rational method for calculation of peak runoff flow is used as follows;

$$Q=CiA$$

where:

Q = peak flow (cubic feet per second)

C = runoff coefficient

A = drainage area (acres)

I = rainfall intensity (inches per hour)

Runoff coefficients used were determined by the Municipality of Anchorage Drainage Design Guidelines based on slope, soil, and land cover.

Rainfall Intensity was calculated as required by the Municipality of Anchorage Drainage Design Guidelines, based on the drainage basin acreage.

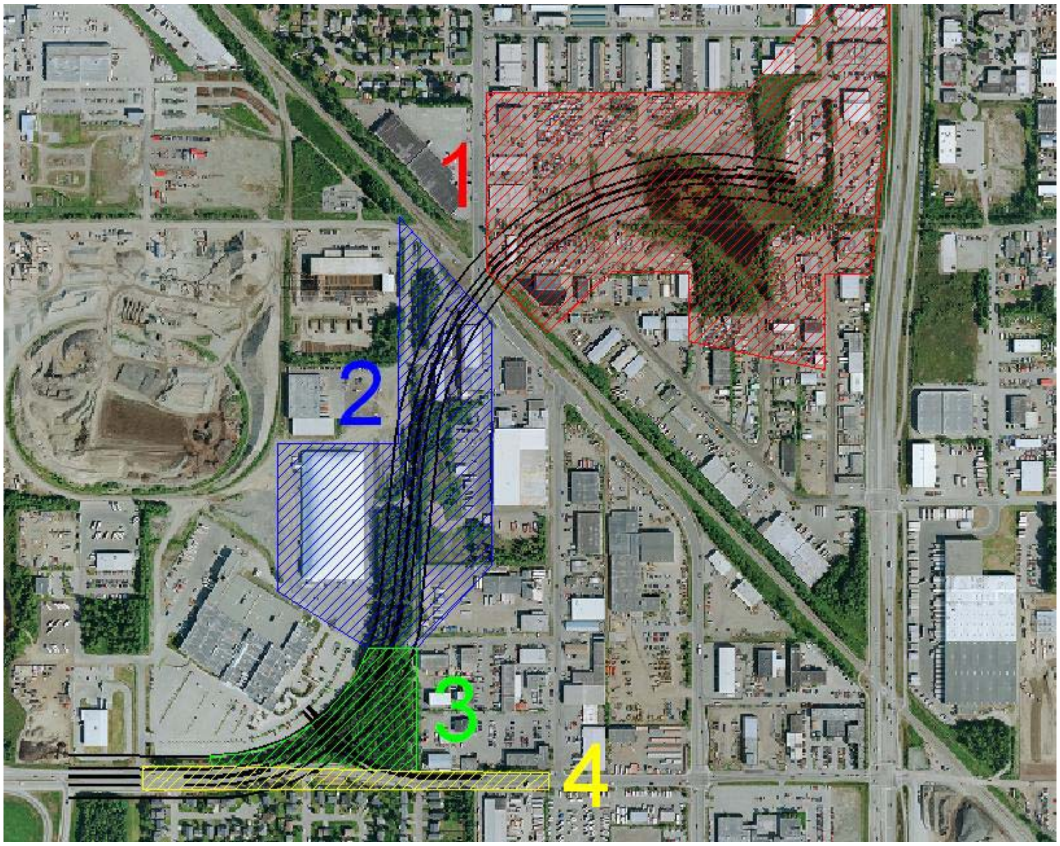

Figure K.1: Basin Delineation

K.3.0 HYDRAULIC ANALYSIS AND WATER TREATMENT

Surface water hydrology along Phase II of the West Dowling Road (WDR) will be controlled and routed using three different methods, a sustainable "green" technology, a traditional piping method and an onsite treatment method. Calculated peak flow values are in Table K.1.

Basin Discharge (ft^3/s)					
Basin	2 yr	10 yr	25 yr	50 yr	100 yr
1	1.63	2.27	2.83	3.12	3.41
2	0.99	1.38	1.74	1.92	2.10
3	0.15	0.21	0.27	0.30	0.32
4	0.16	0.23	0.29	0.32	0.35

Table K.1: Discharge Rates

K.3.1 Bioswales

The "green" method will cause storm runoff from the project to be contained in bio-swales, in an effort to restrict the flow from entering existing storm systems, as well as maintain a sustainable and ecologically flourishing area surrounding the project. Bioswales provide treatment from chemicals, and utilize storm runoff areas for the planting of trees and tall grass. The bioswales are constructed with an eight inch layer of topsoil over a geotextile drainage fabric. The topsoil and geotextile fabric filter the sediment and prevent sediment infiltration into groundwater. Below the geotextile fabric are large retention ditches that contain the peak flows. The retention ditches are filled with open graded materials that provide structural integrity to the surface layers. From the retention ditch, water infiltrates into the ground and enters the water table. A perforated pipe is also placed in the retention ditch for storm events that exceed the bioswale design. Bioswales require little maintenance, which consist mainly of trash and debris removal.

K.3.2 Existing Municipality Storm System Tie-In

The areas where containment of storm water is not feasible, the runoff will be routed via curb, gutter and piping into existing stormwater networks along Raspberry Road and C Street. The stormwater design will have little effect on the existing forty-eight inch pipe storm system. Change in peak flows can be seen on Table K.2. Once the water enters the existing system it is treated and discharged into Campbell Creek. Drain inlets will have oil and grit separators. Within the separator, oil and grit are removed from the runoff flow and stored for later removal.

Change in Discharge to Existing Storm (ft^3/s)				
2 year	10 year	25 year	50 year	100 year
0.08	0.11	0.15	0.16	0.18

Table K.2: Additional Discharge to Existing MOA Storm System

K.3.3 Onsite Treatment

The main concern for storm runoff in the project is to keep Tina Lake free from contaminated water, so that it may remain a wetland, and continue to be a clean habitat for its inhabitants. Stormwater that contains sediment and oil from the roadway will be routed into water treatment systems before being discharged into Tina Lake. The type of oil and sediment separator recommended for this project is manufactured by Rinker Materials under the Stormceptor product line. The Stormceptor is a fixture which is placed in-line with the storm water pipe. Stormceptors remove ninety-eight percent of hydrocarbons and ninety-five percent of total suspended solids during the filtration process. The water quality meets federal requirements for wetland discharge. The stormceptors have a minimum life span of fifty years.

K.3.4 Drainage Basin 1

Drainage basin one is adjacent to Tina Lake and covers 49.5 acres. The basin encompasses the existing Tina Lake wetlands from north to south. East and west borders of the basin are formed by the Alaska Railroad and C Street, respectively. The drainage in this area is generally directed toward Tina Lake. An independent stormwater system will be constructed using ditches and stormceptors.

Drainage of water from the east slope of the bridge surface will flow into the ditches which lead to a Stormceptor. After treatment, the water will discharge into the surrounding wetlands. Due to the size of this basin, it is classified as a major drainageway and Municipality of Anchorage Drainage Design Guidelines require the design for a 25-year, 24-hour storm event.

K.3.5 Drainage Basin 2

The area of drainage basin two covers from the Alaska Railroad right of way to the northeast corner of the Change Point Church parking area. The area of drainage basin two is 28 acres. Most of the adjacent properties to the east and west drain into the project right of way, including the sports arena. The west slope of the bridge surface will also drain into basin 2.

Bioswales will be constructed along both sides of the new road. The bioswale width ranges from 7.5 to 11.5 feet and are 2 feet deep throughout the corridor located in basin 2. Any runoff water which does not infiltrate will flow toward drainage basin 3 and the pond facility located there. Basin 2 is classified as a minor drainage way and uses a 10-year, 24-hour base design storm.

K.3.6 Drainage Basin 3

Drainage basin 3 covers most of the curve and corner of the right of way adjacent to Raspberry Road. The area of basin 3 is 6.25 acres. This region is mostly wooded low lying ground; drainage here will use bioswales, and an infiltration pond. The stormwater in the intersections will be captured in curb and gutter and tie into the existing stormwater system on Raspberry Road. Basin 3 is classified as a minor drainageway and uses a 10-year, 24-hour base design storm.

K.3.7 Drainage Basin 4

Drainage basin 4 covers the area currently covered by Raspberry Road. The drainage basin is 4.37 acres in area. Drainage in this area will be accomplished by standard storm drain methods which will connect to the existing storm sewer under Raspberry Road. Basin four is classified as a minor drainageway and uses a 10-year, 24-hour base design storm.

K.4.0 RECOMMENDATIONS

Recommendations from this report include:

- Installation of catch basins and piping networks in the zones adjacent to C Street and along the intersection near the Raspberry Road curve.
- Creation of bioswale containment zones in all other areas, to reduce runoff into existing storm systems, as well as create sustainable vegetative zones.
- Utilization of Stormceptors to filter stormwater and discharge into Tina Lake and surrounding wetland.

K.5.0 REFERENCES

Municipality of Anchorage (2008). Drainage Design Guidelines. Anchorage, Alaska.

Rinker Materials (2008). "Stormceptor." http://www.rinkerstormceptor.com (April 8, 2010)

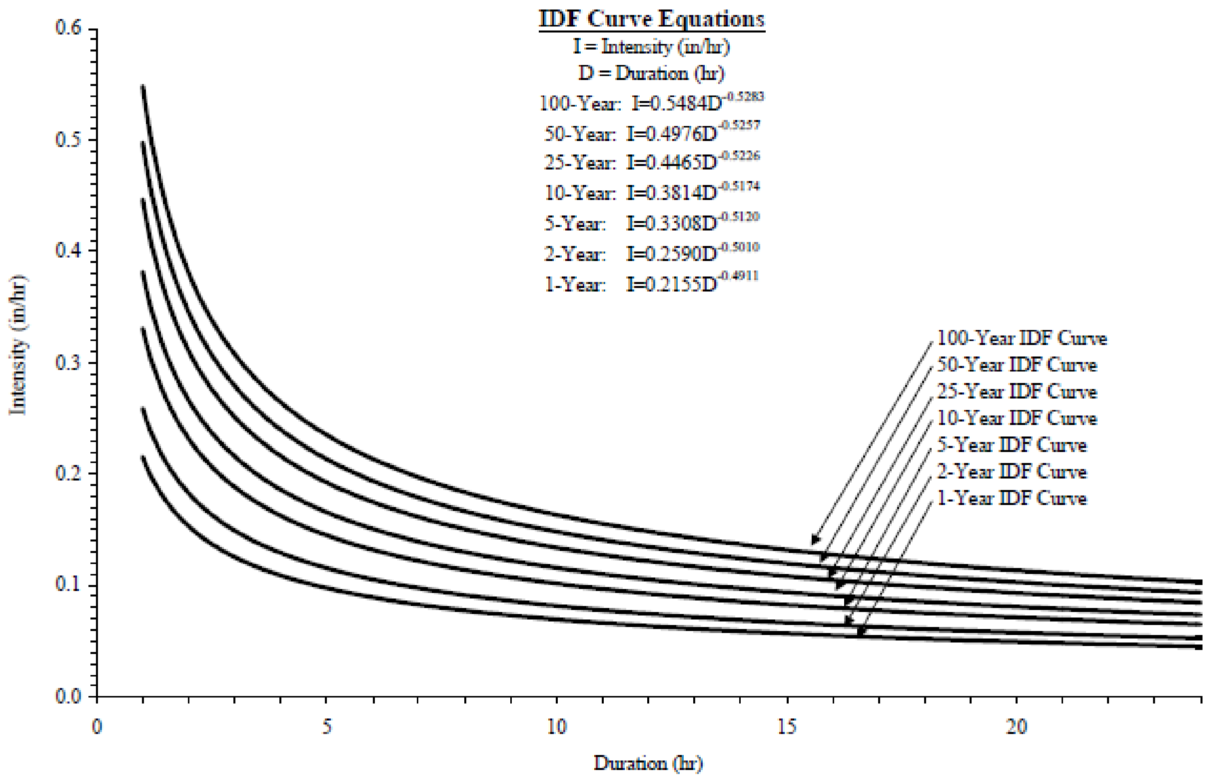

Figure K.2: MOA IDF Curves

		HYDROLOGIC SOILS GROUP											
		A Soil			B Soil			C Soil			D Soil		
Slope		0-2%	2-6%	+6%	0-2%	2-6%	+6%	0-2%	2-6%	+6%	0-2%	2-6%	+6%
Landcover													
Forest, brush	a*	0.05	0.08	0.11	0.08	0.11	0.14	0.10	0.13	0.16	0.12	0.16	0.20
	b*	0.08	0.11	0.14	0.10	0.14	0.18	0.12	0.16	0.20	0.15	0.20	0.25
Wetland	a							0.12	0.16	0.20	0.12	0.16	0.20
Parkland	a	0.05	0.10	0.14	0.08	0.13	0.19	0.12	0.17	0.24	0.16	0.21	0.28
	b	0.11	0.16	0.20	0.14	0.19	0.26	0.18	0.23	0.32	0.22	0.27	0.39
Cultivated	a	0.08	0.13	0.16	0.11	0.15	0.21	0.14	0.19	0.26	0.18	0.23	0.31
	b	0.08	0.14	0.22	0.16	0.21	0.28	0.20	0.25	0.34	0.24	0.29	0.41
Pasture	a	0.12	0.20	0.30	0.18	0.28	0.37	0.24	0.34	0.44	0.30	0.40	0.50
	b	0.15	0.25	0.37	0.23	0.34	0.45	0.30	0.42	0.52	0.37	0.50	0.62
Lawn	a	0.17	0.22	0.35	0.17	0.22	0.35	0.17	0.22	0.35	0.17	0.22	0.35
Barren	a	0.25	0.30	0.35	0.25	0.30	0.35	0.50	0.55	0.60	0.50	0.55	0.60
Graded slope													
Gravel	a	0.25	0.30	0.35	0.25	0.30	0.35	0.50	0.55	0.60	0.50	0.55	0.60
Earthen	a	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
Drives, walks	a	0.75	0.80	0.85	0.75	0.80	0.85	0.75	0.80	0.85	0.75	0.80	0.85
Streets													
Gravel	a	0.50	0.55	0.60	0.50	0.55	0.60	0.50	0.55	0.60	0.50	0.55	0.60
Paved	a	0.85	0.86	0.87	0.85	0.86	0.87	0.85	0.86	0.87	0.85	0.86	0.87
	b	0.95	0.96	0.97	0.95	0.96	0.97	0.95	0.96	0.97	0.95	0.96	0.97
Impervious	a	0.85	0.86	0.87	0.85	0.86	0.87	0.85	0.86	0.87	0.85	0.86	0.87
	b	0.95	0.96	0.97	0.95	0.96	0.97	0.95	0.96	0.97	0.95	0.96	0.97

* - a, ≤25-year, 24-hour event; b, >25-year, 24-hour event
Modified from: Rawls et al., 1981; WaDOT, March 2005.

Table K.3: Rational Equation Runoff coefficients