

COOPER LANDING BYPASS WILDLIFE BRIDGE

Project No.: STP-F-021-2(15)/Z530140000

DESIGN STUDY REPORT

ALASKA
DEPARTMENT OF TRANSPORTATION
AND PUBLIC FACILITIES



PREPARED BY: Arkenstone Group
3211 Providence Drive
Anchorage, Alaska 99508

May, 2019

ALASKA

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

DESIGN STUDY REPORT

For

Cooper Landing Bypass Wildlife Bridge

Project No.: STP-F-021-2(15)/Z530140000

Written by: Arkenstone Group

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ACRONYMS

1.0 PROJECT DESCRIPTION

1.1 Project Location and Description

1.2 Existing Facilities and Land Use

1.3 Purpose and Need

2.0 DESIGN STANDARDS AND GUIDELINES

3.0 DISCUSSION OF ALTERNATIVES

3.1 First Alternative

3.2 Second Alternative

3.3 Third Alternative

3.4 Fourth Alternative

4.0 PREFERRED ALTERNATIVE

5.0 TYPICAL SECTIONS

6.0 HORIZONTAL AND VERTICAL ALIGNMENT

6.1 Horizontal Alignment

6.2 Vertical Alignment

7.0 EROSION AND SEDIMENT CONTROL

8.0 DRAINAGE

9.0 SOIL CONDITIONS

10.0 TRAFFIC ANALYSIS

11.0 SAFETY IMPROVEMENTS

12.0 RIGHT-OF-WAY REQUIREMENTS

13.0 PEDESTRIAN AND BICYCLE FACILITIES

14.0 STRUCTURAL SECTION AND PAVEMENT DESIGN

15.0 COST ESTIMATE

16.0 ENVIRONMENTAL COMMITMENTS AND CONSIDERATIONS

17.0 BRIDGES

18.0 EXCEPTIONS TO DESIGN STANDARDS

19.0 MAINTENANCE CONSIDERATIONS

APPENDIX A Design Criteria and Design Designation

APPENDIX B Type, Size, and Location Memo

APPENDIX C Typical Section

APPENDIX D Approved Environmental Document

APPENDIX E Design Memos

LIST OF FIGURES

Figure 1 Location & Vicinity Maps

LIST OF ACRONYMS

AADT	Annual Average Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
CGP	Alaska Construction General Permit
ADEC	Alaska Department of Environmental Conservation
APDES	Alaska Pollutant Discharge Elimination System
ARRC	Alaska Railroad Corporation
ATM	Alaska Traffic Manual
BMP	Best Management Practice
CFR	Code of Federal Regulations
DOT&PF	Alaska Department of Transportation and Public Facilities
ESCP	Erosion and Sediment Control Plan
EPA	Environmental Protection Agency
FHWA	Federal Highway Administration
HPCM	Alaska Highway Preconstruction Manual
HMCP	Hazardous Material Control Plan
HSIP	Highway Safety Improvement Program
LOS	Level of Service
MADT	Monthly Average Daily Traffic
MOA	Municipality of Anchorage
MP	Milepost
MPH	Miles per Hour
MUTCD	Manual on Uniform Traffic Control Devices
NPDES	National Pollutant Discharge Elimination System
PGDHS	A Policy on Geometric Design of Highways and Streets
PIP	Public Information Plan
ROW	Right-of-Way
SWMM	Storm Water Management Model
SWPPP	Storm Water Pollution Prevention Plan
TCP	Traffic Control Plan
TMP	Traffic Management Plan
USGS	United States Geological Survey

Figure 1 Location and Vicinity Map



Figure 2 Location



1.0 PROJECT DESCRIPTION

1.1 PROJECT LOCATION AND DESCRIPTION

The Arkenstone Group, on behalf of the Alaska Department of Transportation and Public Facilities (DOT&PF) and Federal Highway Administration (FHWA), proposes to add a wildlife overpass crossing on the approved Sterling Highway Juneau Creek Alternative. The project is located near historical MP 54 of the Sterling Highway. The overpass will be located on the north side of the Kenai River and is roughly at 60.49898 latitude and -149.96843 longitude.

The proposed wildlife overpass project includes: a buried arch structure overpass that will span 102 feet and a new Sterling Highway typical section consisting of three 12 foot lanes (2 East bound and 1 West bound) and 8 foot shoulders. Work also includes drainage on both sides of the bridge, and fencing to direct animals to the overpass.

1.2 Existing Facilities and Land Use

The existing facility, Sterling Highway, currently passes through Cooper Landing along Kenai Lake and follows the Kenai River. The Sterling Highway is the only highway to serve Kenai Peninsula, Russian River, the many close hiking trails, campgrounds, and many smaller towns. Due to being the only highway in the area, it facilitates a lot of summertime traffic for the fishing, hiking, camping and tourism in the surrounding area. The Sterling Highway has no wildlife crossings currently and has a high number of wildlife-vehicle collisions. See the Traffic Analysis section for more details.

1.3 Purpose and Need

The project purpose is to bring the Sterling Highway up to current rural principal arterial standards and mitigate the large number of wildlife collisions within the project corridor. The project need is to improve highway safety, reduce highway congestion, and meet current highway design standards. The designated area for the wildlife crossing bridge has been identified as a high density traffic area for wildlife through extensive wildlife tagging and tracking. This proposed overpass would provide a safe crossing for the wildlife and reduce vehicle-wildlife conflicts.

2.0 DESIGN STANDARDS AND GUIDELINES

Design standards and guidelines that apply to the Cooper Landing Wildlife Bypass Bridge Project are contained in the following publications:

Standards:

- A Policy on Geometric Design of Highways and Streets (PGDHS), 6th Edition, American Association of State Highway and Transportation Officials (AASHTO), 2011.
- Roadside Design Guide (RDG), 4th Edition, AASHTO, 2011.
- Alaska Highway Preconstruction Manual (HPCM), State of Alaska, DOT&PF, 2005 as amended.

- Alaska Highway Drainage Manual (AHDM), State of Alaska, DOT&PF, 2006.
- The Alaska Traffic Manual (ATM), consisting of the Manual on Uniform Traffic Control Devices (MUTCD), 2009 as amended, U.S. DOT, Federal Highway Administration (FHWA) and the Alaska Traffic Manual Supplement (ATMS), State of Alaska, DOT&PF, 2016.
- Highway Capacity Manual (HCM), 5th Edition, Transportation Research Board, 2010.

Appendix A contains the project Design Criteria.

3.0 DISCUSSION OF ALTERNATIVES

Five alternatives were considered for this project, a no build alternative and four different animal crossing structures. The four build options were evaluated for their safety, cost, aesthetics, seismic and efficiency/maintenance. All necessary equipment and parts necessary for the discussed alternatives are available in Alaska or can be shipped to Alaska, therefore readily available. For further evaluation of the alternatives see Type, Size, and Location (TS&L) memo in Appendix B.

3.1 First Alternative: No Build Alternative

This option was the no build alternative. There was extensive animal tagging and tracking in this area that proved an animal crossing is necessary to reduce animal and car collisions. The no build alternative does not meet the necessary safety regulations and therefore is eliminated from the viable options.

3.2 Second Alternative: Conventional Steel Bridge

This option is the conventional steel bridge. This bridge would consist of large beams running the span of the road way. This type of bridge has concrete and steel supports running the span of the road way.

Pros:

- Large overhead clearance potential
- Long span
- Readily sourced materials

Cons:

- Not aesthetically pleasing
- Higher cost due to concrete and long, heavy steel beams
- Longer erection time, bolting and welding steel beams and cast-in place concrete
- Not seismically reliable
- Small load capacity due to dead load of bridge and fill
- More maintenance

See Appendix B for drawing.

3.3 Third Alternative: Under Truss Bridge

The third alternative is the under truss bridge. This bridge would be much like regular under trusses, with the top of the bridge being backfilled and graded to a slope that is accessible for the animals to cross over top.

Pros:

- Pre-fabricated, quicker assembly
- No span restrictions
- Economical, due to strength vs. material required

Cons:

- Loads are too large, low weight capacity/heavy design
- More maintenance
- Not aesthetically pleasing

See Appendix B for drawing.

3.4 Fourth Alternative: Bulb-Tee Bridge

The fourth alternative is the bulb-tee bridge. The bulb-tee bridge is the common bridge found in Alaska for its roadways. The bulb-tee has a larger column towards the center of the span splitting the span. It is comprised of both steel and concrete as its main construction material

Pros:

- Economical for short and medium spans
- Commonly used statewide
- Bridge parts are more readily available than other alternatives

Cons:

- Not aesthetically pleasing
- Materials might be more available but are pre-fabricated so not immediately available
- Split lanes necessary which would widen the total road width and therefore the crossing
- Longer erection time

See Appendix B for drawing.

3.5 Fifth Alternative: Buried Arch Bridge

The fifth alternative is the buried arch bridge. The buried arch bridge is a concrete arch that is built into a tunnel with ground filling in around the arch to create the bridge. At the faces of the tunnel there will be retaining wall to keep material from moving.

Pros:

- Curve design gives it increased strength
- An arch bridge's half circle shape is purposely designed to ensure that no damage or distortion would occur to the bridge. This quality is a very beneficial in a way that it cuts down the cost that would be needed for maintenance.
- Quick installation, comes in pieces to be assembled on site.
- Aesthetically pleasing, will be easy to maintain a more natural looking environment compared to other bridge options.
- Because of the natural strength of the arch design, maintenance costs for the bridge will be naturally lowered compared to other bridge designs.
- Surface treatments are minimal

Cons:

- Less flexible in span and vertical clearance
- High shipping costs, large lead times
- Differential Fill

4.0 PREFERRED ALTERNATIVE: Buried Arch Bridge

The preferred alternative is the buried arch bridge. The buried arch bridge is commonly used in overhead animal crossing design and has good features for the area. Some of the features include good seismic response, aesthetically pleasing, and can support the span needed. This type of structure is typical in overhead animal crossings because it the most comfortable for the animals to cross. This structure ability to place natural vegetation on top of the surface and to keep the bridge wide enough to make it comfortable for larger animals to cross. Another reason this structure was selected as the preferred alternative was because of its low maintenance requirement. This is due in part because much of the bridge is natural and the concrete arches have a long service life. It also allows for the reuse of most of the material removed to create the corridor as fill above the arch which will aid in reducing the overall cost of this alternative. For additional information see the TS&L memo.

See Appendix B for the drawing.

5.0 TYPICAL SECTIONS

The road will have one 12 foot lane for West bound traffic, and two 12 foot lanes for East Bound traffic. It will have 8 foot shoulders and a total clear distance of 30 feet. The embankment slopes are 4:1 with a ditch width of 8 feet.

The typical sections are provided in Appendix C.

6.0 HORIZONTAL AND VERTICAL ALIGNMENT

6.1 Horizontal Alignment

The horizontal alignment of the roadway matches the final EIS and no changes will be made. The bridge horizontal alignment will be perpendicular to the roadway to reduce the overall span of the structure.

6.2 Vertical Alignment

Moose, caribou, and bear are capable of traversing steep slopes, however to make the crossing more appealing to these animals the grade will be no steeper than existing conditions.

7.0 EROSION AND SEDIMENT CONTROL

This project will include temporary and permanent measures to control and prevent erosion and sedimentation during and after the construction of the animal crossing. The contractor will submit to the Construction Project Engineer for approval a Storm Water Pollution Prevention Plan (SWPPP) that conforms to the DOT&PF Best Management Practices (BMPs) for Erosion and Sediment Control in accordance with the DOT&PF contract specifications and follows the guidelines of the Erosion and Sediment Control Plan (ESCP) provided to the contractor. All construction activities will be done in accordance with the submitted and approved SWPPP. All temporary erosion and sediment control measures will be installed prior to construction and will remain installed and maintained until construction completion and permanent stabilization is achieved.

8.0 DRAINAGE

The drainage for the project will consist of ditches on either side of the road way along the structure with a 2% cross-slope from centerline to the edge of road to move water from the traveled area to the shoulder. The slope from the shoulder to the ditch is 4:1 and from here the water will drain down through the buried arch.

9.0 SOIL CONDITIONS

A recon geotechnical report was done for the larger project of Sterling Highway Juneau Creek Alternative. The geotechnical data suggested that the soil in the surrounding area was mostly comprised of unconsolidated glacial deposits that include gravelly sand, sand and silt. This surface material is highly susceptible to erosion. The underlain is primarily slate and greywacke. The report also recommends to avoid large steep cuts because some areas have fine grain soils which are susceptible to failure.

10.0 TRAFFIC ANALYSIS

The present annual average daily traffic, AADT(2014), is 2,915 vehicles, while the design AADT(2043) is 3,969. The Design Hourly Volume is 20 percent. The design speed will be 60 mph. The total number of crashes that happened from January 2000 to December 2009 was 302. Of those 302 crashes, roughly 15% of them were wildlife-vehicle collisions and approximately 12% of the wildlife-vehicle collisions were with moose.

11.0 SAFETY IMPROVEMENTS

The new highway improves on the overall safety of the original highway from MP 45-60 by bringing it up to current standards. The proposed animal overpass will provide a safe path for the animals to traverse the highway without having to cross the road. The wildlife overpass was selected because of a study done on big game in the area and the proposed station of the crossing is where they most frequently cross along the new proposed highway. By directing the higher volume of animals across the highway the number of

animal car collisions will be greatly decreased. Directing the animals to the crossing through fencing will help make sure they use the crossing.

12.0 RIGHT-OF-WAY REQUIREMENTS

The right-of-way corridor is 300 feet wide, with 150 feet on either side of the proposed centerline of the roadway. No additional right-of-way is needed.

13.0 PEDESTRIAN AND BICYCLE FACILITIES

The roadway shoulders will be eight feet wide and can be utilized by pedestrians and bicyclists.

14.0 STRUCTURAL SECTION AND PAVEMENT DESIGN

The proposed wildlife overpass will be spanning over a portion of the realigned Sterling Highway. The wildlife crossing itself will have no pavement, however the realigned Sterling Highway pavement surface under it will consist of 2” hot mix asphalt (HMA), 2” asphalt treated base (ATB), 6” aggregate base course (grading D-1), and 36” selected material (type A).

Pavement and structural section typicals are provided in Appendix B.

15.0 COST ESTIMATE

Span (Feet)	102
Width (Feet)	300
Square Feet (SF)	30,600
Price/SF	\$500
Bridge Cost	\$ 15,300,000
Moose Fencing (\$20/FT)	\$ 16,080
Subtotal	\$ 15,316,080
Contingencies (25%)	\$ 3,829,020
Subtotal	\$ 19,145,100
Mob and Demob (11%)	\$ 2,105,961
Subtotal	\$ 21,251,061
Design Engineering	\$ 42,486,042
Subtotal	\$ 24,000,000
Construction Engineering	\$ 3,600,000
Subtotal	\$ 27,600,000
ICAP (5.64%)	\$ 1,556,640

Total	\$ 29,156,640
--------------	----------------------

16.0 ENVIRONMENTAL COMMITMENTS AND CONSIDERATIONS

The proposed animal crossing does not involve any significant environmental impacts. There are however, archaeological concerns which means there will need to be constant monitoring throughout the entire construction project.

The contractor will be required to prepare and implement a SWPPP in accordance with Section 7.

17.0 BRIDGES

The only bridge within the proposed wildlife crossing limits will be the proposed overpass. For further discussion see Section 4.0.

18.0 EXCEPTIONS TO DESIGN STANDARDS

There are no exceptions to design standards for this project.

19.0 MAINTENANCE CONSIDERATIONS

Maintenance will remain the responsibility of the State of Alaska and the local DOT&PF Maintenance and Operations Station located at Quartz Creek. Maintenance costs will increase as no bridge currently exists and Federal Law mandates that any bridge open to the public needs to be inspected every two years by DOT & PF personnel.

APPENDIX A

Design Criteria and Design Designation

APPENDIX B

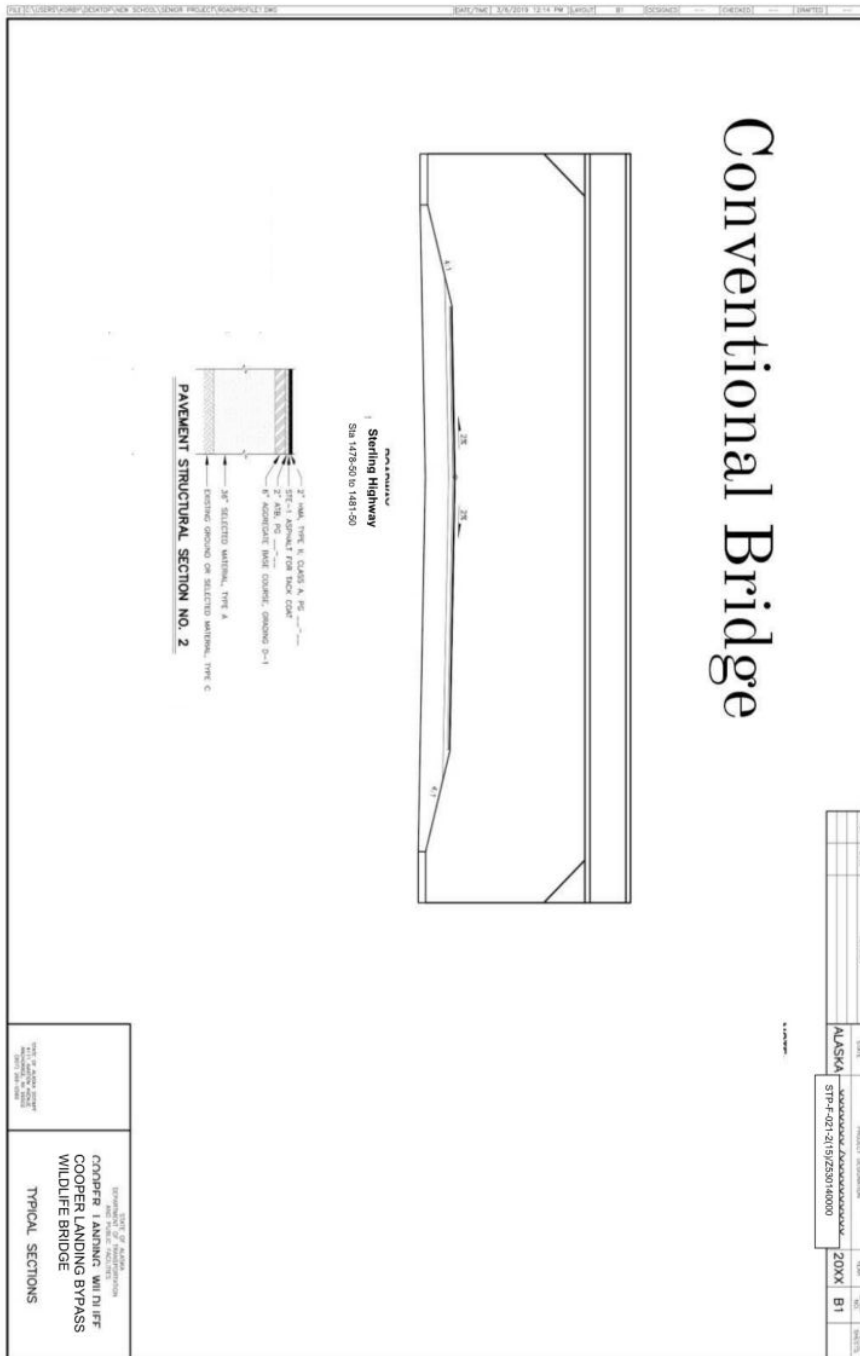
Type, Size, and Location Memo

APPENDIX C

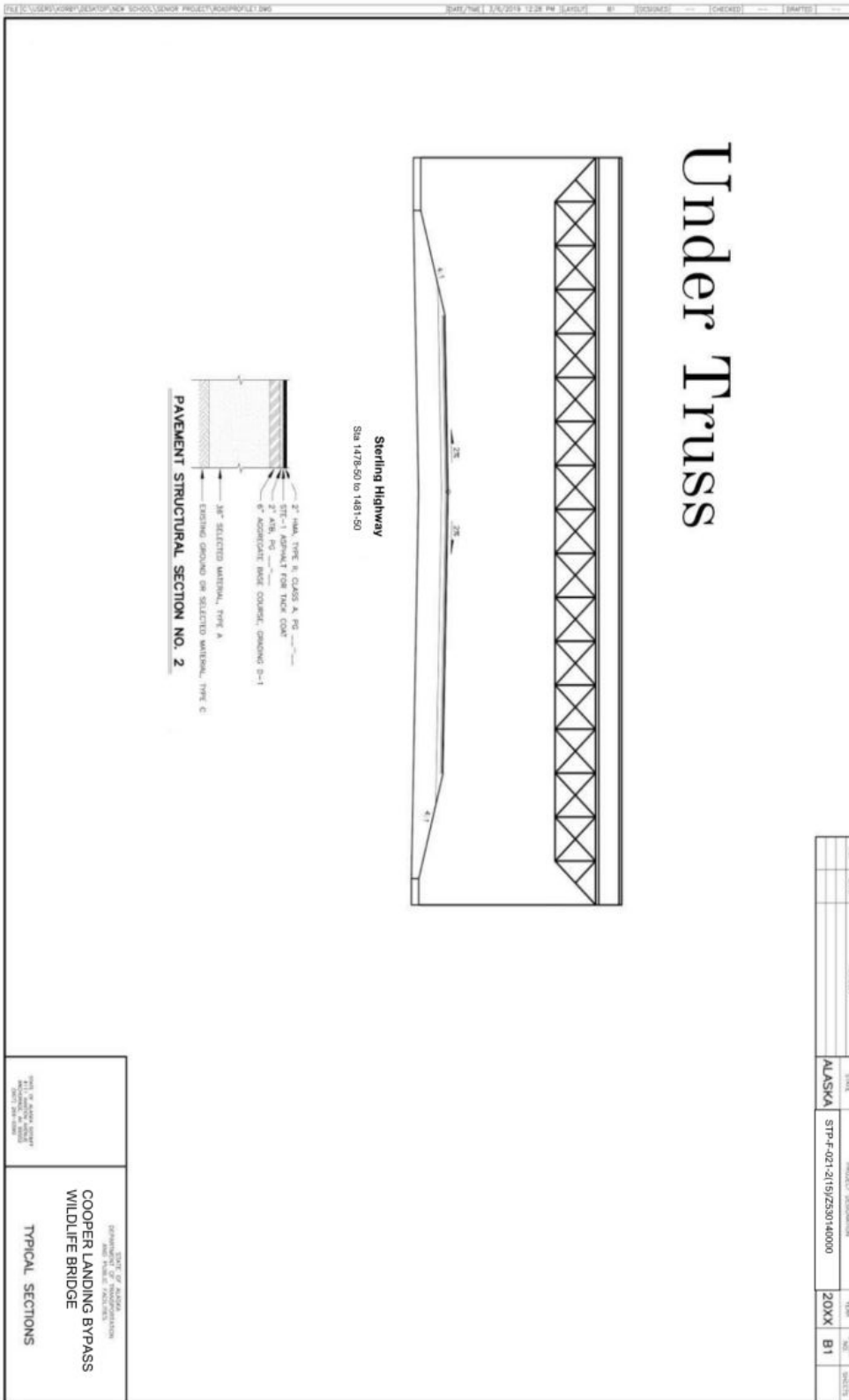
Typical Sections

C.1 Alternatives

C.1.A Alternative #2 Conventional Bridge.



C.1.B Alternative #3 Under Truss Bridge.

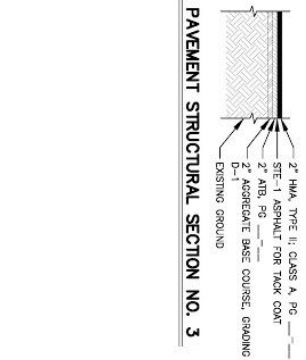
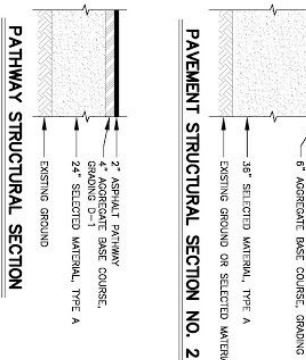
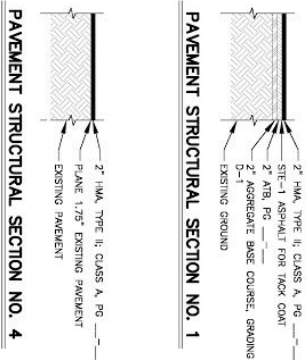
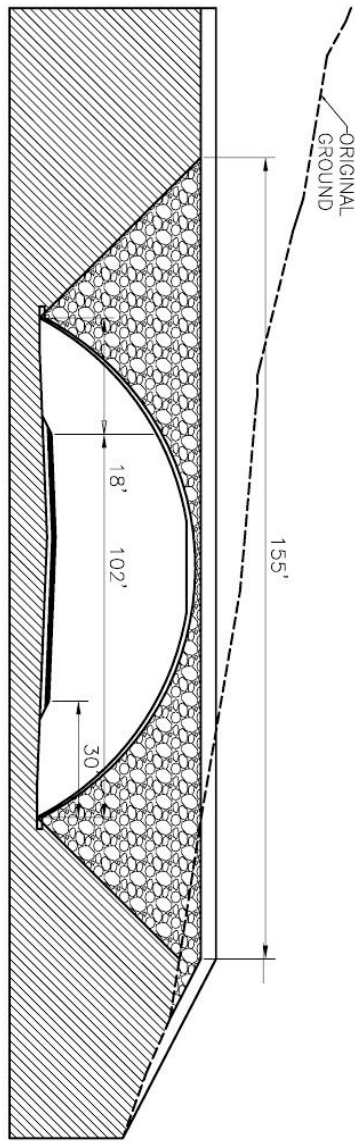


C.2.B Profile 1

PRODUCED BY AN AUTODESK STUDENT VERSION

FILE: C:\USERS\WORRY\DESKTOP\NEW SCHOOL\SENIOR PROJECT\WDR\PROFILE_1_UNDERTRUSS.DWG DATE/TIME: 4/3/2019 1:31 PM LAYOUT: B1 DESIGNED: CHECKED: DRAFTED:

PRODUCED BY AN AUTODESK STUDENT VERSION



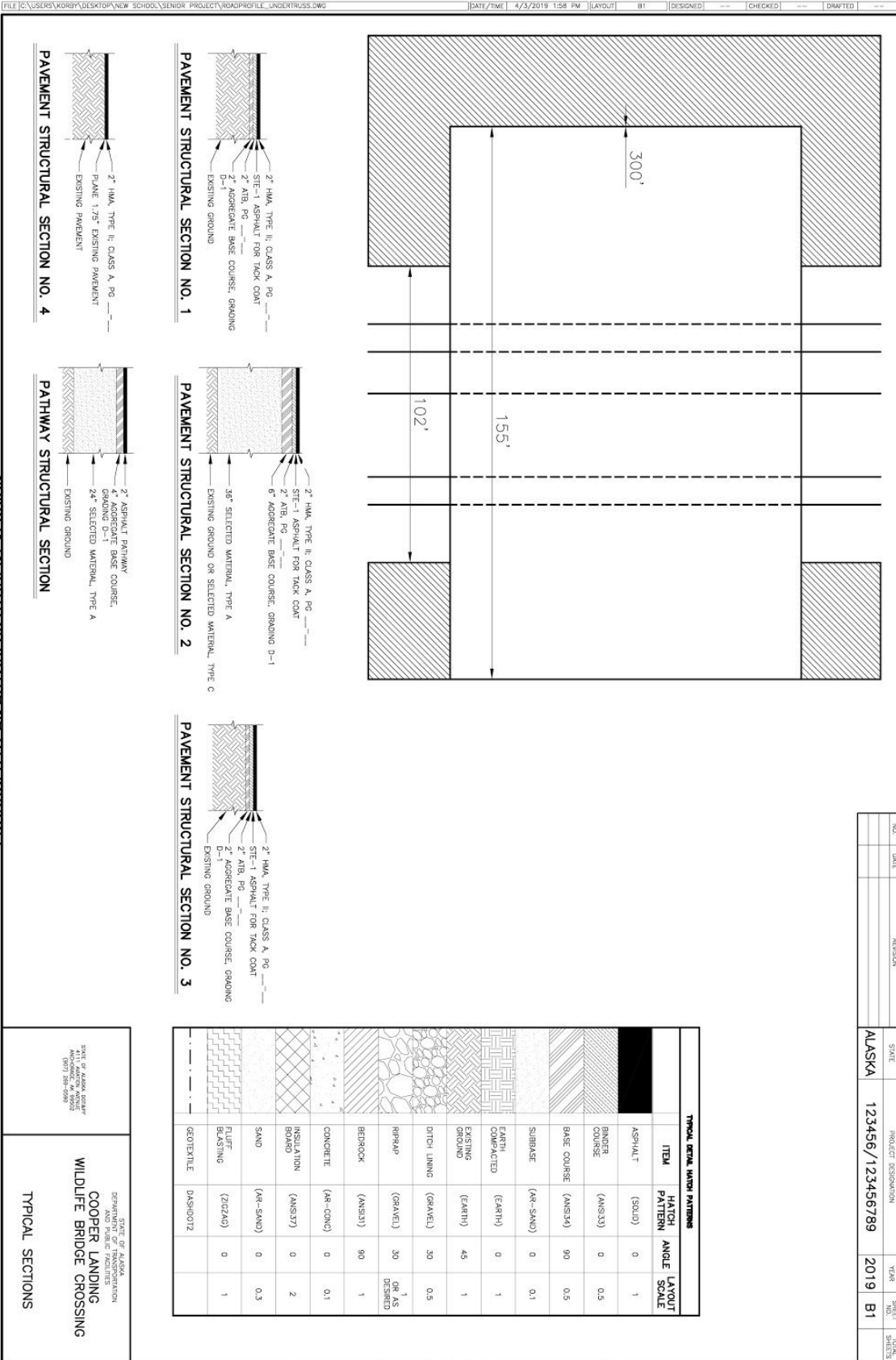
ITEM	HATCH PATTERN	ANGLE	LAYOUT SCALE
ASPHALT (SOLID)		0	1
BINDER COURSE (ANS33)		0	0.5
BASE COURSE (ANS34)		90	0.5
SUBBASE (AR-SAND)		0	0.1
FACED COMPACTED (EARTH)		0	1
EXISTING GROUND (EARTH)		45	1
DITCH LINING (GRAVEL)		30	0.5
RIPRAP (GRAVEL)		30	OR AS DESIGNED
BEDROCK (ANS37)		90	1
CONCRETE (AR-CONC)		0	0.1
INSULATION SAND (ANS37)		0	2
SAND (AR-SAND)		0	0.3
FLUFFING (ZIGZAG)		0	1
TEXTILE			

PRODUCED BY AN AUTODESK STUDENT VERSION

STATE OF ALASKA
 DEPARTMENT OF TRANSPORTATION
 111 ALASKA CENTER
 475 W. BRIDGE BLVD
 ANCHORAGE, ALASKA 99501
 (907) 266-6000

STATE OF ALASKA
 DEPARTMENT OF TRANSPORTATION
 WILDLIFE BRIDGE CROSSING
 TYPICAL SECTIONS

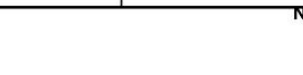
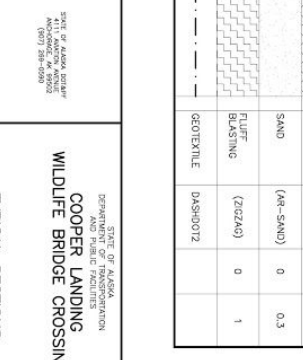
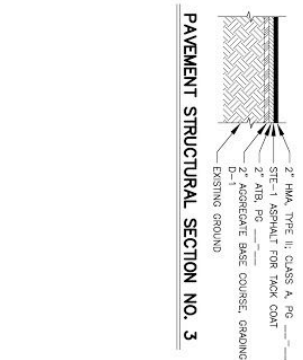
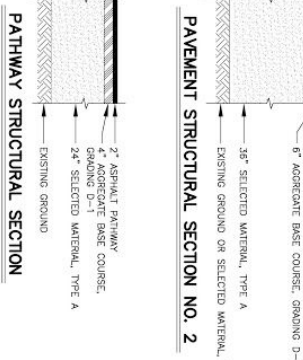
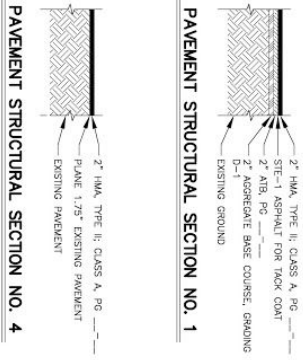
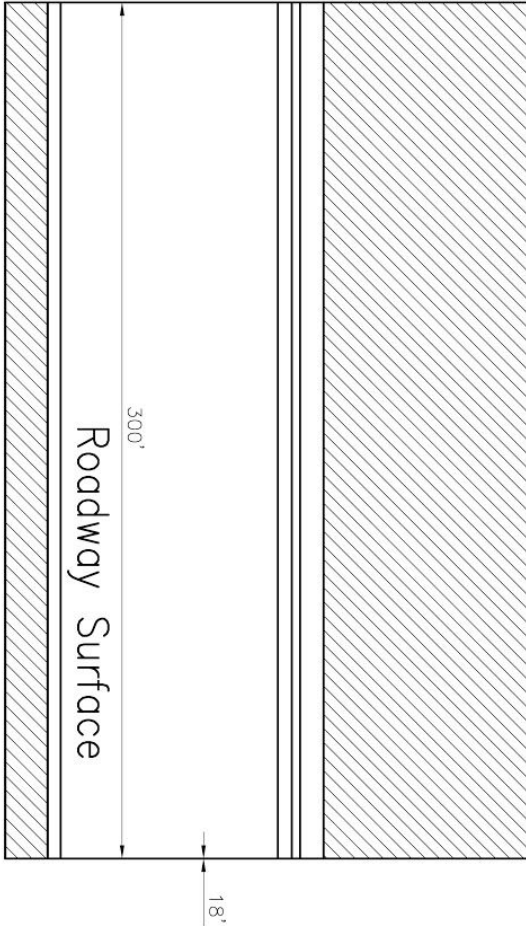
PRODUCED BY AN AUTODESK STUDENT VERSION



PRODUCED BY AN AUTODESK STUDENT VERSION

C.2.D Profile 3

PRODUCED BY AN AUTODESK STUDENT VERSION



PRODUCED BY AN AUTODESK STUDENT VERSION

NO.	DATE	REVISION	SHEET NO.	PROJECT DESCRIPTION	YEAR	SHEET TOTAL
			ALASKA	123456/123456789	2019	B2

ITEM	HATCH PATTERN	ANGLE	LAYOUT SCALE
ASPHALT	(ASPH)	0	1
BINDER COURSE	(ANS33)	0	0.5
BASE COURSE	(ANS34)	90	0.5
SUBBASE	(AS-SAND)	0	0.1
EARTH COMPACTED	(EARTH)	0	1
EXISTING GROUND	(EARTH)	45	1
DITCH LINING	(DAMEL)	30	0.5
RIEPAE	(DAMEL)	30	OR AS DESIRED
BETROCK	(ANS31)	90	1
CONCRETE	(AR-CONG)	0	0.1
INSULATION SAND	(ANS37)	0	2
SAND	(AR-SAND)	0	0.3
FLUFLING BLASTING	(ZGZ4)	0	1
GEOTEXTILE	DASHDOT2		

PRODUCED BY AN AUTODESK STUDENT VERSION

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
WILDLIFE BRIDGE CROSSING
TYPICAL SECTIONS

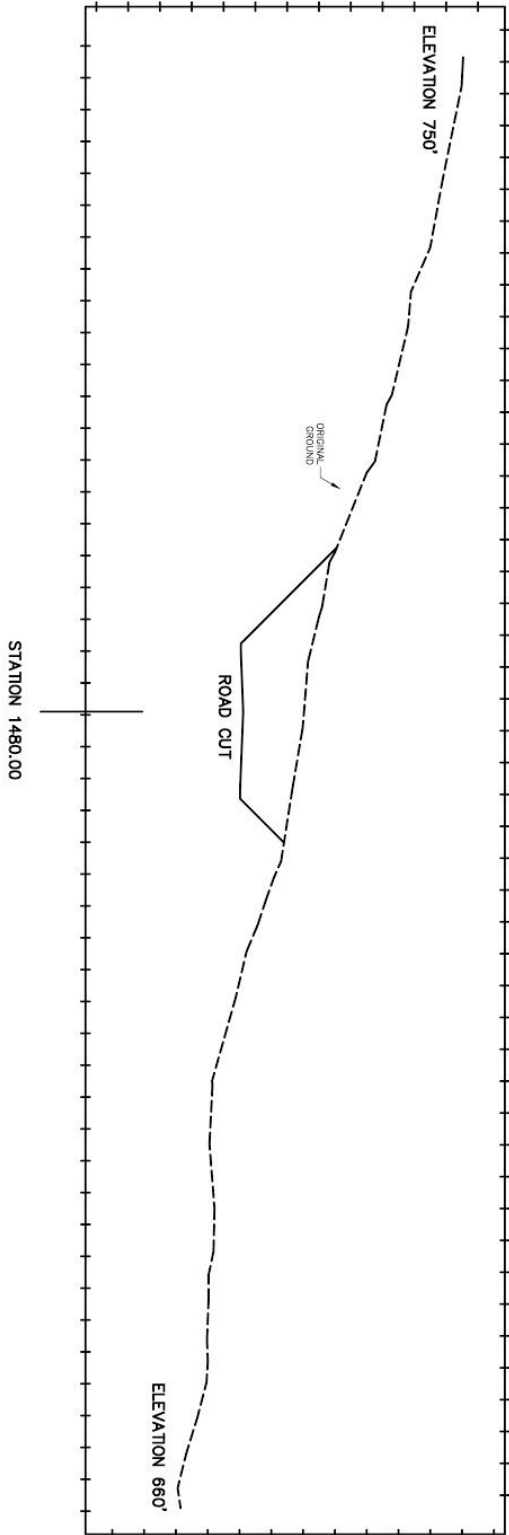
PRODUCED BY AN AUTODESK STUDENT VERSION

C.2.E Location 1

PRODUCED BY AN AUTODESK STUDENT VERSION

FILE: C:\USERS\KORBY\DESKTOP\NEW SCHOOL\SENIOR PROJECT\ROADPROFILE_UNDERTRUSS.DWG [DATE/TIME: 4/3/2019 3:01 PM] [LAYOUT] BT [DESIGNED] [CHECKED] [DRAFTED]

SELECTED TYPICAL SECTION AT STATION 1480.00 ON STERLING HIGHWAY



PRODUCED BY AN AUTODESK STUDENT VERSION

NO.	DATE	REVISION	STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
			ALASKA	123456/123456789	2019	B2	

PRODUCED BY AN AUTODESK STUDENT VERSION

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION COOPER LANDING WILDLIFE BRIDGE CROSSING TYPICAL SECTIONS	STATE OF ALASKA DEPARTMENT OF TRANSPORTATION COOPER LANDING WILDLIFE BRIDGE CROSSING TYPICAL SECTIONS
---	---

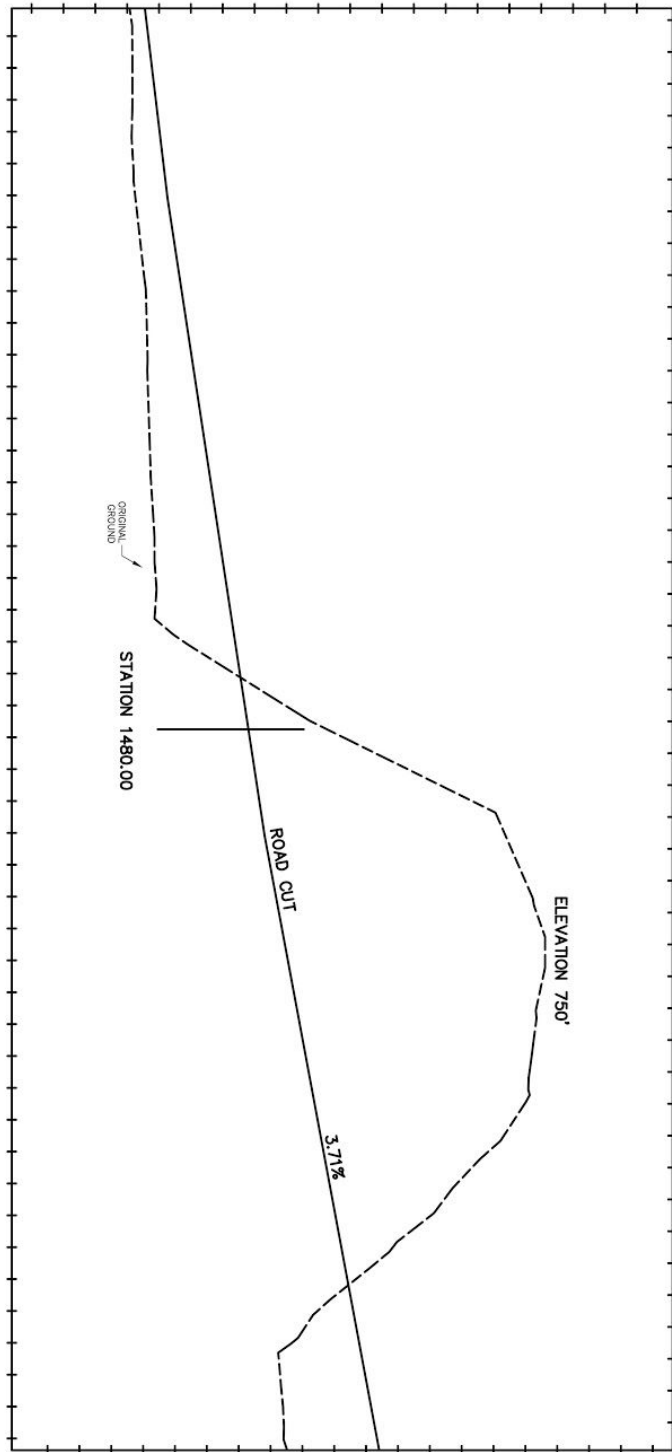
PRODUCED BY AN AUTODESK STUDENT VERSION

C.2.F Location 2

PRODUCED BY AN AUTODESK STUDENT VERSION

FILE: C:\USERS\WORBP\DESKTOP\NEW SCHOOL\SENIOR PROJECT\ROADPROFILE_UNDERTRUSS.DWG DATE/TIME: 4/3/2019 4:07 PM LAYOUT: B1 DESIGNED: --- CHECKED: --- DRAFTED: ---

SELECTED TYPICAL SECTION AT STATION 1480.00 ON STERLING HIGHWAY



PRODUCED BY AN AUTODESK STUDENT VERSION

NO.	DATE	REVISION	STATE	PROJECT IDENTIFICATION	YEAR	SHEET NO.	TOTAL SHEETS
			ALASKA	123456/123456789	2019	B2	

PRODUCED BY AN AUTODESK STUDENT VERSION

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES 411 W. WARDEN AVENUE ANCHORAGE, ALASKA 99574-0001	STATE OF ALASKA DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES COOPER LANDING WILDLIFE BRIDGE CROSSING TYPICAL SECTIONS
---	--

PRODUCED BY AN AUTODESK STUDENT VERSION

APPENDIX D

Approved Environmental Document

http://sterlinghighway.net/SHWFinalEIS_New.html

APPENDIX E

Design Memos