State of Alaska
Department of Transportation
&
Public Facilities

Northern Region

Bid Forms, Contract, Bond, Standard Modifications, and Special Provisions for:

Old Steese Highway Reconstruction

Project No. Z624870000

Preliminary PS&E: October 24, 2022

To be used in conjunction with State of Alaska Standard Specifications for Highway Construction dated 2020, and the Plans for the above referenced project.

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STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES

INVITATION TO BID

for Construction Contract

Date _____

Old Steese Highway Reconstruction, PENDING/Z624870000

Project Name and Number

The Department invites bidders to submit bids for furnishing all labor, equipment, and materials and performing all work for the project described below. The Department will only consider bids received **before 2:00 PM local time (per the Department's time source) on the _____ day of _____ 2022**. On that date, the Department will assemble, open, and then publicly announce the timely-received bids at **Engineering Services Building, Room 4, 2301 Peger Road, Fairbanks, Alaska** at **2:00 PM**, or as soon thereafter as practicable.

Location of Project: Fairbanks, Alaska
Contracting Officer: Joseph P. Kemp, P.E., Acting Regional Director
Issuing Office: Northern Region DOT&PF

State Funded ☐ Federal Aid ☒

Description of Work:

Reconstruct the Old Steese Highway from 3rd Street to, and including, the intersection at Johansen Expressway.

Project DBE Utilization Goal: ☒ Race-Neutral, Goal is N/A ☐ Race-Conscious, Goal is XX.X%

The Engineer's Estimate is between $10,000,000 and $20,000,000

All work shall be completed in N/A Calendar Days, or by **October 15, 2024**.
The Department will identify interim completion dates, if any, in the Special Provisions.

The apparent successful bidder must furnish a payment bond in the amount of 100% of the contract and a performance bond in the amount of 100% of the contract as security conditioned for the full, complete and faithful performance of the contract. The apparent successful bidder must execute the said contract and bonds within fifteen calendar days, or such further time as may be allowed in writing by the Contracting Officer, after receiving notification of the acceptance of their bid.

Submission of Bidding Documents

Bidders may submit bidding documents electronically via the Department's approved online bidding service, through the mail or hand delivered. For mailed or hand delivered bids and for electronically submitted bids with a paper bid guaranty, documents shall be submitted in a sealed envelope marked as follows:

Bidding Documents for Project: **PENDING/Z624870000** **Old Steese Highway Reconstruction**	ATTN: Chief of Contracts State of Alaska Department of Transportation & Public Facilities 2301 Peger Road Fairbanks, Alaska 99709

It is incumbent upon the bidder to ensure its bid, any amendments, and/or withdrawal arrive, in its entirety, at the location and before the deadline stated above. A bidder sending a bid amendment or withdrawal via email or fax must transmit its documentation to the Department at this email address: nrdotpfcontracts@alaska.gov or fax number: (907) 451-5390.

To be responsive, a bid must include a bid guaranty equal to 5% of the amount bid. (*When calculating the bid amount for purposes of determining the 5% value of the bid guaranty, a bidder shall include its base bid amount, plus the amount bid for alternate and supplemental bid items, if any.)*

The Department hereby notifies all bidders that it will affirmatively ensure that in any contract entered into pursuant to this Invitation, Disadvantaged Business Enterprises will be afforded full opportunity to submit bids and will not be discriminated against on the grounds of race, color, national origin, or sex in consideration for an award.

NOTICE TO BIDDERS

Bidders must have a Vendor ID or your bid may not be accepted. More information can be obtained at the following website: http://dot.alaska.gov/aashtoware/docs/AWP-Vendor-List-Guidance.pdf

The following data may assist a bidder in preparing its bid:

- Quantity Calculations
- Cross Sections
- Geotechnical Report
- As Builts
- Other applicable information

All supplemental information can be found under the letting for this project which may be selected using the following link: https://www.bidx.com/ak/lettings

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A bidder may obtain hard copy project plans and specifications for the price of $100, from:
Engineering Services Building, Room 3
2301 Peger Road
Fairbanks, Alaska 99709
Phone: (907) 451-2247 TDD (for Hearing Impaired, requires special equipment): 711 or 1-800-770-8973

If a bidder has a question relating to design features, constructability, quantities, or other technical aspects of the project, it may direct its inquiry to the questions and answers area of the Bid Express proposal page: https://www.bidx.com/ak/lettings

A bidder requesting assistance in viewing the project site must make arrangements at least 48 hours in advance.

The point of contact for inquiries for this project is **Kyungyun Chi, P.E., Construction Manager**.
Email: kyungyun.chi@alaska.gov Phone: (907) 374-3709

For questions relating to electronic bidding or for assistance with your Bid Express account, contact Bid Express customer support at customer.support@bidx.com or call toll free (888)352-BIDX(2439) Monday through Friday 7:00am to 8:00pm (Eastern).

A bidder may direct questions concerning bidding procedures and requirements to:
Construction Contracts Coordinator

Email: stacy.mcsorley@alaska.gov Phone: (907) 451-2219

Other Information:

To report bid rigging activities call: 1-800-424-9071

The U.S. Department of Transportation (DOT) operates the above toll-free “hotline” Monday thru Friday. 8:00 a.m. to 5:00 p.m., Eastern Time. Anyone with knowledge of possible bid rigging, bidder collusion, or other fraudulent activities should use the “hotline” to report such activities.

The “hotline” is part of the DOT’s continuing effort to identify and investigate highway construction contract fraud and abuse and is operated under the direction of the DOT Inspector General. All information will be treated confidentially and caller anonymity will be respected.

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
AND PUBLIC FACILITIES

Bid Schedule - Preliminary Review

Section 1 - Basic Bid

Prop Line #	Item Number	Item Description	Quantity	Unit	Unit Bid Price	Amount Bid
10	201.0008.0000	Grubbing	All Required	Lump Sum	Lump Sum	
20	202.0001.0000	Removal of Structures and Obstructions	All Required	Lump Sum	Lump Sum	
30	202.0013.0000	Removal of Structures and Obstructions	All Required	Contingent Sum	Contingent Sum	$59,000.00
40	203.0003.0000	Unclassified Excavation	14,600	Cubic Yard		
50	203.0009.0000	Obliteration of Roadway	127	Square Yard		
60	203.2008.0000	Special Ditch	790	Linear Foot		
70	203.2037.0000	Drainage Basin	3	Each		
80	301.0001.00D1	Aggregate Base Course, Grading D-1	1,900	Ton		
90	304.0001.000F	Subbase, Grading F	21,200	Ton		
100	308.0001.0000	Crushed Asphalt Base Course	17,100	Square Yard		
110	401.0001.002A	HMA, Type II; Class A	4,600	Ton		
120	401.0001.002B	HMA, Type II; Class B	7,500	Ton		
130	401.0004.0000	Asphalt Binder, Grade PG 52E-40	800	Ton		
140	401.0009.0000	Longitudinal Joint Density Price Adjustment	All Required	Contingent Sum	Contingent Sum	$30,000.00
150	401.0013.0000	Job Mix Design	1	Each		
160	401.0015.0000	Asphalt Material Price Adjustment	All Required	Contingent Sum	Contingent Sum	$0.00
170	401.2010.0000	HMA, Sidewalks and Paths	314	Ton		
180	402.0001.STE1	STE-1 Asphalt for Tack Coat	9.3	Ton		
190	603.0001.0018	CSP 18 Inch	70	Linear Foot		
200	603.0022.0048	End Section for Corrugated Polyethylene Pipe 48 Inch	1	Each		
210	603.2032.0008	Corrugated HDPE Pipe 8 Inch	49	Linear Foot		
220	603.2032.0012	Corrugated HDPE Pipe 12 Inch	1,650	Linear Foot		
230	603.2032.0018	Corrugated HDPE Pipe 18 Inch	303	Linear Foot		
240	603.2032.0024	Corrugated HDPE Pipe 24 Inch	540	Linear Foot		
250	603.2032.0036	Corrugated HDPE Pipe 36 Inch	1,100	Linear Foot		
260	603.2032.0048	Corrugated HDPE Pipe 48 Inch	520	Linear Foot		
270	604.0001.0002	Storm Sewer Manhole, Type II	12	Each		

Section 1 - Basic Bid

Prop Line #	Item Number	Item Description	Quantity	Unit	Unit Bid Price	Amount Bid
280	604.0002.0000	Sanitary Sewer Manhole	1	Each		
290	604.0004.0000	Adjust Existing Manhole	32	Each		
300	604.0005.000A	Inlet, Type A	44	Each		
310	604.0009.0000	Reconstruct Manhole Top Section	4	Each		
320	604.0012.0000	Replace Inlet Frame and Grate	4	Each		
330	604.0016.0000	Adjust Inlet Frame and Grate	28	Each		
340	607.0003.0000	Chain Link Fence	54	Linear Foot		
350	608.0001.0006	Concrete Sidewalk, 6 inches thick	6,250	Square Yard		
360	608.0006.0000	Curb Ramp	68	Each		
370	609.0002.0001	Curb and Gutter, Type 1	10,300	Linear Foot		
380	609.0003.0000	Backing Curb	385	Linear Foot		
390	615.0001.0000	Standard Sign	1,085	Square Foot		
400	615.0006.0000	Salvage Sign	117	Each		
410	618.0003.0000	Water for Seeding	78	Mega Gallon		
420	618.0004.0000	Seeding	8,700	Square Yard		
430	620.0001.0000	Topsoil	8,700	Square Yard		
440	621.0001.0000	Tree, Betula papyrifera, 2" caliper	16	Each		
450	621.0001.0000	Tree, Malus, 2" caliper	5	Each		
460	621.0001.0000	Tree, Picea glauca, 6' height	3	Each		
470	621.2018.0000	Rock Mulch	41	Square Yard		
480	626.0001.0008	Sanitary Sewer Conduit, 8 Inch	87	Linear Foot		
490	626.0002.0000	Sanitary Sewer Service Connection	2	Each		
500	626.2013.0000	Adjust Sanitary Sewer Cleanout	9	Each		
510	627.0010.0000	Adjustment of Valve Box	18	Each		
520	627.2033.0000	Water System Complete	All Required	Lump Sum	Lump Sum	
530	630.0001.0003	Geotextile, Separation, Class 3	24,500	Square Yard		
540	630.2000.0000	Geotextile, Separation by Directive	All Required	Contingent Sum	Contingent Sum	$9,800.00
550	639.2000.0000	Approach	39	Each		

Section 1 - Basic Bid

Prop Line #	Item Number	Item Description	Quantity	Unit	Unit Bid Price	Amount Bid
560	640.0001.0000	Mobilization and Demobilization	All Required	Lump Sum	Lump Sum	
570	641.0001.0000	Erosion, Sediment and Pollution Control Administration	All Required	Lump Sum	Lump Sum	
580	641.0003.0000	Temporary Erosion, Sediment and Pollution Control	All Required	Lump Sum	Lump Sum	
590	641.0005.0000	Temporary Erosion, Sediment and Pollution Control by Directive	All Required	Contingent Sum	Contingent Sum	$65,000.00
600	641.0006.0000	Withholding	All Required	Contingent Sum	Contingent Sum	$0.00
610	641.0007.0000	SWPPP Manager	All Required	Lump Sum	Lump Sum	
620	642.0001.0000	Construction Surveying	All Required	Lump Sum	Lump Sum	
630	642.0013.0000	Three Person Survey Party	All Required	Contingent Sum	Contingent Sum	$40,000.00
640	643.0002.0000	Traffic Maintenance	All Required	Lump Sum	Lump Sum	
650	643.0023.0000	Traffic Price Adjustment	All Required	Contingent Sum	Contingent Sum	$0.00
660	643.0025.0000	Traffic Control	All Required	Contingent Sum	Contingent Sum	$1,000,000.00
670	643.0033.0000	Detour	All Required	Lump Sum	Lump Sum	
680	643.2005.0000	Public Information Program	All Required	Lump Sum	Lump Sum	
690	644.0001.0000	Field Office	All Required	Lump Sum	Lump Sum	
700	644.0006.0000	Vehicle	All Required	Lump Sum	Lump Sum	
710	645.0001.0000	Training Program, 2 Trainees/Apprentices	500	Labor Hour		
720	646.0001.0000	CPM Scheduling	All Required	Lump Sum	Lump Sum	
730	660.0001.0000	Traffic Signal System Complete, Blair/Fred Meyer	All Required	Lump Sum	Lump Sum	
740	660.0001.0000	Traffic Signal System Complete, Helmericks Avenue	All Required	Lump Sum	Lump Sum	
750	660.0003.0000	Highway Lighting System Complete, COF	All Required	Lump Sum	Lump Sum	
760	660.2003.0000	Traffic Signal System Modifications - Bentley Trust Road	All Required	Lump Sum	Lump Sum	
770	660.2003.0000	Traffic Signal System Modifications - College Road	All Required	Lump Sum	Lump Sum	
780	660.2003.0000	Traffic Signal System Modifications - Johansen Expressway	All Required	Lump Sum	Lump Sum	
790	660.2018.0000	Traffic Signal System	All Required	Contingent Sum	Contingent Sum	$20,000.00
800	660.2025.0000	Pan Tilt Zoom (PTZ) Camera	3	Each		
810	661.0002.0000	Load Center, Type 1A	3	Each		
820	661.2002.0000	Remove Existing Load Center	2	Each		
830	662.2004.0000	Fiber Optic Manhole - Adjustment	1	Each		

Section 1 - Basic Bid

Prop Line #	Item Number	Item Description	Quantity	Unit	Unit Bid Price	Amount Bid
840	662.2005.0000	Fiber Optic Interconnect	All Required	Lump Sum	Lump Sum	
850	669.2000.0000	Traffic Data - Site 01	All Required	Lump Sum	Lump Sum	
860	669.2000.0000	Traffic Data - Site 02	All Required	Lump Sum	Lump Sum	
870	669.2000.0000	Traffic Data - Site 03	All Required	Lump Sum	Lump Sum	
880	669.2000.0000	Traffic Data - Site 04	All Required	Lump Sum	Lump Sum	
890	669.2000.0000	Traffic Data - Site 05	All Required	Lump Sum	Lump Sum	
900	670.0010.0000	Methyl Methacrylate Pavement Markings	All Required	Lump Sum	Lump Sum	
910	670.0013.0000	Painted Traffic Markings	122	Linear Foot		
920	670.2002.0000	MMA Pavement Markings, Inlaid	All Required	Lump Sum	Lump Sum	
930	670.2014.0000	MMA Pavement Markings Inlaid	All Required	Contingent Sum	Contingent Sum	$10,000.00
940	680.2000.0000	Telecommunications Utility Relocation , GCI	All Required	Lump Sum	Lump Sum	
950	687.2000.0000	Power Utility Relocation , GVEA	All Required	Lump Sum	Lump Sum	
960	802.2000.0000	Contaminant Soil Removal and Disposal, Petroleum	All Required	Contingent Sum	Contingent Sum	$624,200.00
970	802.2000.0000	Contaminant Soil Removal and Disposal, RCRA	All Required	Contingent Sum	Contingent Sum	$346,700.00
980	802.2000.0000	Contaminant Soil Removal and Disposal, Unrestricted	All Required	Contingent Sum	Contingent Sum	$105,600.00
990	802.2000.0000	Contaminant Soil Removal and Disposal, Upland Location	All Required	Contingent Sum	Contingent Sum	$2,034,000.00
1000	802.2001.0000	Laboratory Testing, Petroleum and VOCs	200	Each		
1010	802.2001.0000	Laboratory Testing, TCLP VOCs	2	Each		
1020	802.2002.0000	Media Specialist	All Required	Lump Sum	Lump Sum	

State of Alaska, Standard Specifications
for Highway Construction, Dated 2020 are
modified as follows:

STANDARD MODIFICATIONS

SECTION 102
BIDDING REQUIREMENTS AND CONDITIONS

04/30/22 (HSM20-42)

102-1.05 PREPARATION OF BID. *In the third paragraph, replace the fourth sentence with the following:* If the bidder is a joint venture, the bid must be signed by an officer or agent with authority to bind the joint venture.

SECTION 104
SCOPE OF WORK

11/30/2020 (HSM20-2)

104-1.06 VALUE ENGINEERING CHANGE PROPOSALS BY CONTRACTOR. *Delete item 3.e of this subsection and substitute the following:* The Contractor may submit VECPs for an approved subcontractor. If the Contractor elects to submit a VECP for an approved subcontractor and it is subsequently accepted by the Department, the Department will reimburse the Contractor per 104-1.06.5.

SECTION 106
CONTROL OF MATERIAL

12/31/21 (HSM20-20)

106-1.01 SOURCE OF SUPPLY AND QUALITY REQUIREMENTS. *Add the following:*

PROHIBITION ON CERTAIN TELECOMMUNICATION AND VIDEO SURVEILLANCE SERVICES OR EQUIPMENT. On projects using federal funds, the Contractor shall comply with the requirements of 2 CFR 200.216, Prohibition on certain telecommunication and video surveillance services or equipment, including any future amends thereto that are applicable to the project**.**

By submitting a bid or by execution of the contract, the Contractor certifies that it has not entered into a contract nor extended or renewed a contract to procure or obtain equipment, services, or systems that uses covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system produced by:

- Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities).
- Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities).
- Any entity that the Secretary of Defense, in consultation with the Director of the National Intelligence or the Director of the Federal Bureau of Investigation, reasonably believes to be an entity owned or controlled by, or otherwise connected to, the government of a covered foreign country.

The Contractor further certifies that it has complied with the requirements of 2 CFR 200.216 and that it will continue to do so throughout the term of the Contract.

SECTION 108
PROSECTUTION AND PROGRESS

01/01/22 (HSM20-41)

108-1.01 SUBCONTRACTING OF CONTRACT. *In item 1.g delete* “AS 45.45.101(a)” *and substitute the following:* AS 45.45.010(a).

In item 2.f delete “AS 45.45.101(a)” *and substitute the following:* AS 45.45.010(a).

07/01/22 (HSM20-43)

108-1.07 FAILURE TO COMPLETE ON TIME. *Replace Table 108-1 with the following:*

TABLE 108-1
DAILY CHARGE FOR LIQUIDATED DAMAGES
FOR EACH CALENDAR DAY OF DELAY

Original Contract Amount		Daily Charge
From More Than	To and Including	
$ 0	500,000	$1,400
500,000	1,000,000	1,700
1,000,000	5,000,000	2,600
5,000,000	10,000,000	3,800
10,000,000	25,000,000	4,500
25,000,000	----------	6,600

SECTION 109
MEASUREMENT AND PAYMENT

11/30/2020 (HSM20-3)

109-1.08 FINAL PAYMENT. *Add the following after the fifth paragraph of this subsection:* On federally funded projects, if DOLWD Wage and Hour Administration notifies the Department of a pending prevailing wage investigation, and that the investigation is preventing the closing out of the project, the Contractor may place the notified amount in escrow under Wage and Hour for the exclusive purpose of satisfying unpaid prevailing wages. Upon receipt of notice from Wage and Hour that the contractor has satisfactorily transferred the necessary funds into escrow, the Department will proceed to issue final payment.

SECTION 120
DISADVANTAGED BUSINESS ENTERPRISE PROGRAM

12/31/21 (HSM20-21)

120-1.01 DESCRIPTION. *In the first sentence of the second paragraph, delete* "8.83 percent" *and substitute the following:* 8.28 percent.

120-3.01 DETERMINATION OF COMPLIANCE. *Delete the statement in 2.a. Written DBE Commitment and substitute the following:* Complete Form 25A-326 for each DBE to be used on the project.

SECTION 202
REMOVAL OF STRUCTURES AND OBSTRUCTIONS

11/30/2020 (HSM20-4)

202-5.01 BASIS OF PAYMENT. *In the first paragraph, delete the words "*and 22.0013.____." *and substitute the following:* and 202.0013.____.

*In the fourth paragraph, delete the words "*Items 020.0014.____" *and substitute the following:* Items 202.0014.____

SECTION 203
EXCAVATION AND EMBANKMENT

11/30/2020 (HSM20-5)

203-3.04 COMPACTION WITH MOISTURE AND DENSITY CONTROL. *In the second paragraph of this subsection, delete the words "*and ATM 214".

SECTION 205
EXCAVATION AND FILL FOR MAJOR STRUCTURES

11/30/2020 (HSM20-5)

205-3.05 COMPACTION. *In the second paragraph of numbered paragraph 1. Compaction With Moisture and Density Control, delete the words "*and ATM 214".

SECTION 301
AGGREGATE BASE AND SURFACE COURSE

11/30/2020 (HSM20-5)

301-3.03 SHAPING AND COMPACTION. *In the second paragraph of this subsection, delete the words "*and ATM 214".

SECTION 402
TACK COAT

11/30/2020 (HSM20-6)

402-3.02 EQUIPMENT. *Delete this subsection in its entirety and substitute the following:* Furnish, maintain, and operate asphalt distributor to apply asphalt material uniformly at even heat on variable widths of surface up to 15 feet at readily determined and controlled flow rates. Provide an asphalt distributor capable of application rates from 0.01 to 0.11 gallon per square yard. Equip with a heater, tachometer, flow rate gauge, operable mechanical tank gauge, thermometer for measuring temperatures of tank contents, power unit for the pump and full circulation spray bars adjustable laterally and vertically.

402-3.04 APPLICATION OF ASPHALT MATERIAL. *Add the following at the end of the first paragraph:* Control deviation from any specified application rate to within 0.02 gallon per square yard.

Add the following after the second paragraph this subsection: After application of the tack coat, the surface shall be allowed to cure without being disturbed for the period of time necessary to permit drying and setting of the tack coat. If necessary, the Engineer will determine when the tack has cured.

SECTION 501
CONCRETE FOR STRUCTURES

12/31/21 (HSM20-23)

501-2.02 COMPOSITION OF MIXTURE - JOB MIX DESIGN. *Delete Table 501-4 and substitute the following:*

TABLE 501-4
AIR CONTENT REQUIREMENTS

Class of Concrete	Air Content
A	6.0% ±0.5%
A-A	6.0% ±0.5%
P	3.50% minimum[1] and Super Air Meter (SAM) number ≤0.20[1]
DS	Not required

[1]*Not required for web and bottom flange of precast, prestressed decked bulb-tee girders.*

SECTION 511
MECHANICALLY STABILIZED EARTH (MSE) WALL

11/30/2020 (HSM20-7)

511-2.01 MATERIALS. Meet the following: *Delete the sixth and seventh items in the Materials reference list in this subsection and substitute the following:*

Geotextile for Drainage	Subsection 729-2.01
Geogrid	Subsection 729-2.04

SECTION 550
COMMERCIAL CONCRETE

12/31/21 (HSM20-25)

550-2.02 COMPOSITION OF MIXTURE – JOB MIX DESIGN.

1. Submittals. *Add the following to the first paragraph:* Submit the JMD on Form 25D-203.

SECTION 608
SIDEWALKS

11/30/2020 (HSM20-10)

608-3.01 CONCRETE SIDEWALKS. *Add the following new paragraph after the ninth paragraph of this subsection:* The Engineer will test the finished surface with a 10-foot straightedge. Variations of more than 1/4-inch from the edge of the straightedge across or along the sidewalk surface, except at grade changes, are unacceptable. Portions of the sidewalk surface and pedestrian ramps less than 10 feet in width or length may be tested using a shorter straightedge.

SECTION 615
STANDARD SIGNS

12/31/21 (HSM20-29)

615-2.01 MATERIALS.

1. Shop Drawings. *Delete the first sentence and substitute the following:* Submit shop drawings for all signs that must meet the ASDS letter width and spacing charts for variable width legends (such as D-series and I-3 signs), and which require custom shop drawings specific to the project.

SECTION 633
SILT FENCE

11/30/2020 (HSM20-13)

633-2.01 MATERIALS. Use materials that conform to the following: *Delete the second item in the Materials reference list and substitute the following:*

Silt Fence	Subsection 729-2.02

633-3.01 CONSTRUCTION REQUIREMENTS. *Delete the first sentence of this subsection and substitute the following:* Install silt fence according to the SWPPP, Appendix B.

SECTION 643
TRAFFIC MAINTENANCE

12/31/21 (HSM20-30)

643-2.02 CRASHWORTHINESS. *Delete Table 643-2 and substitute the following:*

TABLE 643-2
WORK ZONE TRAFFIC CONTROL DEVICE AND BARRIER CRASH TESTING COMPLIANCE

Category	Devices	Devices Manufactured Before Dec. 31, 2019 [1]	Devices Manufactured After Dec. 31, 2019 [1]	Method of Documentation
1	Low-mass single-piece devices w/o attachments: traffic cones, tubular markers, single piece drums, delineators	NCHRP 350, MASH 2009, or MASH 2016	MASH 2016	Manufacturer's Certification for devices exceeding height and weight limits
2	Category 1 devices with attachments, barricades, portable sign supports, drums w/lights, other devices weighing less than 100 pounds but not included in category 1	NCHRP 350, MASH 2009, or MASH 2016	MASH 2016	FHWA eligibility letter, at Test Level 3 [2]
3	Fixed sign supports, truck mounted attenuators, temporary crash cushions, bridge railing, bridge and guardrail transitions, and guardrail and barrier end treatments.	NCHRP 350, MASH 2009, or MASH 2016	MASH 2016	FHWA eligibility letter, at Test Level 3 [2]
	Portable concrete and steel barriers	NCHRP 350, MASH 2009, or MASH 2016	MASH 2016	FHWA eligibility letter, at Test Level 3, unless otherwise required in the contract.

[1] The Engineer will determine whether a device is in serviceable condition. Serviceable means the device will function equivalent to a new device of the same manufacture.
[2] When no test level is specified in an FHWA Eligibility letter; it is implied that the tests were run for Test Level 3.

02/01/2022 (HSM20-39)

643-3.06 TRAFFIC PRICE ADJUSTMENT. *Delete Table 643-3 Adjustment Rates in its entirety and substitute the following:*

TABLE 643-3
ADJUSTMENT RATES

Published ADT	Dollars/Minute of Unauthorized Lane Reduction or Closure
Less than 1,000	$6
1,000-4,999	$25
5,000-9,999	$75
10,000-29,999	$105
30,000+	$150

SECTION 660
SIGNALS AND LIGHTING

11/30/2020 (HSM20-16)

660-3.04 JUNCTION BOXES. *Delete item 1. of the seventh paragraph of this subsection and substitute the following:*

1. 300 feet maximum for any conduit run containing either:

    a. One single cable, plus one bare or insulated equipment grounding conductor (EGC); or
    b. 2 or fewer single pair No. 12 AWG (or smaller) loop lead-in cables, plus one bare or insulated EGC.

SECTION 661
ELECTRICAL LOAD CENTERS

12/31/21 (HSM20-31)

661-2.01 MATERIALS.

Load Center. *In the second sentence of the second paragraph delete* "FSS No. 5950" *and substitute the following:* AMS STD 595.

SECTION 708
PAINTS

12/31/21 (HSM20-31)

708-2.01 PAINT FOR STEEL STRUCTURES.

3. Top Coat. *In the second sentence of the first paragraph, delete* "FSS FED-STD-595B" *and substitute the following:* AMS-STD-595.

SECTION 702
ASPHALT MATERIALS

12/31/21 (HSM20-32)

702-2.03 EMULSIFIED ASPHALT.

1. Cationic Emulsified Asphalt. *Delete the sentence and substitute the following:* Meet AASHTO M 208, except CRS-2P meet AASHTO M 316.

SECTION 703
AGGREGATES

05/01/22 (HSM20-40)

703-2.03 AGGREGATE FOR BASE AND SURFACE COURSE. *In Table 703-1 replace the line for Degradation Value with the following:*

TABLE 703-1
AGGREGATE QUALITY PROPERTIES FOR BASE AND SURFACE COURSE

PROPERTY	BASE COURSE	SURFACE COURSE	TEST METHOD
Micro-Deval	15%, max.	15%, max.	AASHTO T 327

703-2.04 AGGREGATE FOR HOT MIX ASPHALT. *In Table 703-3 replace the line for Degradation Value with the following:*

TABLE 703-3
COARSE AGGREGATE QUALITY FOR HMA

Description	Specification	Type II, Class A	Type I, Type II Class B, Type III	Type IV	Type V	Type SP
Micro-Deval, max.	AASHTO T 327	18%	18%	18%	18%	18%

703-2.05 AGGREGATE FOR COVER COAT AND SURFACE TREATMENT. *In Table 703-5 replace the line for Degradation Value with the following:*

TABLE 703-5
QUALITY PROPERTIES FOR COVER COAT AND SURFACE TREATMENT

Micro-Deval	AASHTO T 327	15%, max.

703-2.09 SUBBASE. *In Table 703-8 replace the line for Degradation Value with the following:*

TABLE 703-8
QUALITY PROPERTIES FOR SUBBASE

Micro-Deval	AASHTO T 327	25%, max.

12/31/21 (HSM20-33)

703-2.10 POROUS BACKFILL MATERIAL. *Add the following to the end of the paragraph:* Use Gradation A unless otherwise specified.

SECTION 712
MISCELLANEOUS

12/31/21 (HSM20-35)

712-2.08 GLASS BEADS. *In the second sentence, delete EPA Testing Method* "3062" *and substitute the following:* 3052.

SECTION 740
SIGNALS AND LIGHTING MATERIALS

12/31/21 (HSM20-31)

740-2.14 VEHICULAR SIGNAL HEADS.

1. Signal Heads. *In the last sentence of the third paragraph, delete* "Federal Standard 595b-37038" *and substitute the following:* AMS-STD-595 color number 37038.

3. Backplates. *In the last sentence of the fourth paragraph, delete* "Federal Standard 595b-37038" *and substitute the following:* AMS-STD-595 color number 37038.

740-2.15 PEDESTRIAN SIGNALS.

8. Finish. *In the last sentence, delete* "Federal Standard 595b-37038" *and substitute the following:* AMS-STD-595 color number 37038.

SPECIAL PROVISIONS

SECTION 104
SCOPE OF WORK

11/30/12 (H5)
Add the following subsection:

104-1.07 FROZEN GROUND. Frozen areas, ice lenses, and saturated soils may be encountered on this project and related material sources. Specific locations and specific content of frozen areas, ice lenses, and saturated soils are not defined. Any such area that may be encountered by the Contractor in the performance of the contract work will not be considered unforeseeable within the terms of the contract such as to entitle the Contractor to any adjustment in contract price or contract time. Reference is made to Subsection 203-3.03 of these Specifications.

SECTION 105
CONTROL OF WORK

01/20/15 (N1)
105-1.06 UTILITIES.

1. Bid Considerations. *Add the following to the first paragraph:*

    f. Alaska Railroad Corporation (ARRC) flag protection will be provided by the ARRC at the Department's expense.

3. Utility Work. *Add the following:*

    t. Contact Alaska Railroad Signal Construction Manager, _____ at (907) ___-____ a minimum of 3 working days before work begins within any Railroad ROW or before any planned shut-off of a traffic signal that includes railroad preemption.

SECTION 107
LEGAL RELATIONS AND RESPONSIBILITY TO PUBLIC

04/30/17 (N4)
107-1.02 PERMITS, LICENSES, AND TAXES. *Add the following subparagraph after "The Contractor Shall:"*

10. The Department has included a draft Temporary Construction Permit (TCP) from the Alaska Railroad Corporation (ARRC) in Appendix A. The Contractor must contact ARRC, provide required documents, and pay permit fees to obtain the final permit. Approved ARRC TCP must be provided to the Engineer prior to any work within ARRC ROW.

01/20/15 (N5)
Add the following subsection:

107-1.22 NOISE ABATEMENT. The Contractor will not disturb the peace in contravention of any applicable local Ordinance. Within the City of Fairbanks, the applicable ordinance is FGC Section 46-42. Any noise within the City of Fairbanks as described in FGC Section 46-42(A)(3) will be limited to the hours of 7 a.m. to 11 p.m. unless exempted by FGC Section 46-42(E).

SECTION 201
CLEARING AND GRUBBING

03/02/20 (N79)
201-3.01 GENERAL. *Add the following*: Do not perform mechanized vegetation clearing between (begin date – end date).

SECTION 202
REMOVAL OF STRUCTURES AND OBSTRUCITONS

202-3.01 GENERAL. *Add the following:* Remove and dispose of any existing utilities that are in conflict with the construction of new utilities, including but not limited to storm drain, sanitary sewer, and drinking water systems. Existing utilities are not to be removed until temporary services have been provided, or the new utilities have been installed, tested, and approved by the Engineer.

All existing structures that are to be abandoned within right-of-way, easements (temporary or permanent), or project limits shall have all penetrations plugged by an approved method, be saw-cut to a minimum of 4 feet below finish grade, and be filled with clean backfill material.

All existing pipe or conduit that are to be abandoned within right-of-way, easements (temporary or permanent), or project limits shall have all open ends plugged by 12" of sprayed urethane, 4" of concrete, or filled with slurry, as shown on Plans or directed by the Engineer.

Delete Subsection 202-3.04 REMOVAL OF PIPE in its entirety and substitute the following:

202-3.04 REMOVAL OF PIPE AND CONDUIT. Contractor is to remove any pipe that is in conflict with construction of new facilities. All removed storm drain pipe, sanitary sewer conduit or water conduit is to become the property of the Contractor. Any pipe or conduit that is not in conflict with the construction of new facilities shall be abandoned in place in accordance with Subsection 202-3.01 and the Plans.

202-5.01 BASIS OF PAYMENT. *Delete the first paragraph and substitute the following*:

Item 202.0001.0000. Payment includes all work and resources to remove, plug, salvage, dispose and/or relocate all structures and obstructions, abandonment of existing structures, pipe, or conduit, and everything described in the above subsections, encountered within the right-of-way, easements (temporary and permanent), and project limits, under the provisions of this subsection, that are not to be paid for under separate bid items within the bid schedule.

SECTION 203
EXCAVATION AND EMBANKMENT

203-1.01 DESCRIPTION. *Add the following:* Construct special ditches as shown on the Plans.

01/20/15 (N8)
203-3.01 GENERAL. *Add the following to the eighth paragraph:* Disposal in wetlands is prohibited, except as described in Subsection 107-1.11.

Add the following after the eighth paragraph: The Contractor shall certify in writing to the Engineer that all permits and clearances relating to all waste disposal sites selected by the Contractor have been obtained prior to any clearing or ground disturbance in the disposal site.

Add the following:

Do not compact bottom of drainage basins (subgrade) where porous backfill material is to be placed as shown on the Plans. When excavating for and grading drainage basins, limit operation of equipment in the bottom of the basins to minimize compaction of existing subgrade soils from equipment. Place Riprap, Class I, Porous Backfill Material, Grading A, and Aggregate Base Course, Grading D-1 as shown on the Plans or as directed by the Engineer.

Add the following subsection:

203-3.06 COMPACTION BY PROOF ROLLING. Proof-roll the base of excavations and where the embankment crosses previously undisturbed ground, prior to placing new embankment material, to the extent that ensures the first lift of material placed upon it can be compacted to the specified density. Omit proof rolling only as approved by the Engineer and as necessary to prevent liquefaction of surface soils.

203-4.01 METHOD OF MEASURMENT. *Add the following*:

9. Item 203.2008.0000. By the length measured along the center of the ditch for each special ditch constructed and accepted by the Engineer.

10. Item 203.2037.0000. By each drainage basin installed, including excavation for and grading of drainage basins as shown on the Plans, installation of riprap aprons at culvert ends, excavation for and placement of Porous Backfill Material at the bottom of drainage basins, and grading for and placement of Aggregate Base Course, Grading D-1 for maintenance access.

01/20/15 (N12)
Borrow will not be weighed or used while free moisture is observed draining from the haul vehicle at the scale location.

02/01/20 (N13)
203-5.01 BASIS OF PAYMENT. *Add the following:* Ten percent (10%) of the value earned in the progress period shall be withheld on progress payments for all Section 203 items of work. Five percent (5%) will be released by work area, as defined in the SWPPP, when final stabilization is initiated. The last five percent (5%) will be released by work area, as defined in the SWPPP, when final stabilization as defined by the *Construction General Permit* has been obtained and accepted by the Engineer. Withholding will be made under Item 641.0006.____ Withholding.

Item 203.2008.0000. Payment includes full compensation for furnishing equipment, labor, tools, an incidentals to provide the preparation, excavation, and shaping necessary to complete the work.

Item 203.2037.0000. The contract price includes all work and resources required to construct the drainage basins as shown on the Plans. Payment includes all excavation, hauling, stockpiling, disposing of unsuitable and surplus material, grading, Porous Backfill Material, Riprap, and Filter Blanket are subsidiary. Aggregate Base Course, Grading D-1 is paid under Section 301. Seeding and Water for Seeding is paid under Section 618 series pay items.

Add the following pay items:

PAY ITEM		
Item Number	**Item Description**	**Unit**
203.2008.0000	Special Ditch	LF
203.2037.0000	Drainage Basin	EACH

SECTION 304
SUBBASE

02/01/20 (N15)

304-5.01 BASIS OF PAYMENT. *Add the following:* Ten percent (10%) of the value earned in the progress period shall be withheld on progress payments for all Section 304 items of work. Five percent (5%) will be released by work area, as defined in the SWPPP, when final stabilization is initiated. The last five percent (5%) will be released by work area, as defined in the SWPPP, when final stabilization as defined by the *Construction General Permit* has been obtained and accepted by the Engineer. Withholding will be made under Item 641.0006.____ Withholding.

Delete Section 306 in its entirety and substitute the following:

02/01/20 (N17)

SECTION 306
ASPHALT TREATED BASE COURSE

306-1.01 DESCRIPTION. Construct a plant-mixed asphalt treated base (ATB) course on an approved foundation to the lines, grades, and depths shown on the Plans.

306-2.01 MATERIALS. Use materials that conform to the following:

Aggregate	Subsection 703-2.03, Grading D-1, except change the minimum Degradation Value to 30, and change the percent passing the No. 200 sieve to 0-7.
Asphalt Binder	Subsection 702-2.01, for the Grade shown on the bid schedule.
Anti-Strip	As required to meet Subsection 306-3.01.
Recycled Asphalt Pavement	Subsection 703-2.16.

CONSTRUCTION REQUIREMENTS

306-3.01 COMPOSITION OF MIXES. The ATB shall contain 4.5% Asphalt Binder, Grade PG . Do not place ATB until authorized to do so by the Engineer. ATB with an Asphalt Binder content less than 4.0% will be considered unacceptable according to Subsection 105-1.11.

Use Liquid Anti-Strip Additive in the proportions determined by ATM 414. At least 70% of the aggregate must remain coated when tested according to ATM 414. The minimum required amount of Liquid Anti-Strip Additive is as specified in Subsection 401-2.02.

A maximum of 35 percent RAP, by total weight of ATB, is allowed to be added to the composition at the time of mixing. The combined gradation of all aggregates, virgin and recycled, shall meet the requirements of Table 703-2, except that the percent passing the No. 200 sieve is 0-7. If RAP will be used in the ATB, then submit the following to the Engineer at least fourteen days prior to producing ATB:

1. The target gradation.
2. The gradation of all materials to be used in the ATB.
3. The blend ratio of all materials to be used in the ATB.
4. The combined virgin aggregate gradation.
5. The asphalt binder content of the RAP by the extraction method.
6. Representative samples of all materials to be used in the ATB.

306-3.02 WEATHER LIMITATIONS. Do not place ATB on a wet or frozen surface, or when weather conditions will prevent proper handling, compacting, or finishing of the mixture. Do not place ATB unless the air temperature is above 40°F, as measured in the shade and away from any heat sources.

306-3.03 STOCKPILING. Store virgin aggregates and RAP in separate stockpiles. Prevent segregation and contamination.

306-3.04 EQUIPMENT.

1. Mixing Plant. Conform to Subsection 401-3.05.
2. Hauling Equipment. Conform to Subsection 401-3.06.
3. Spreading Equipment. Conform to Subsection 401-3.07.
4. Rollers. Conform to Subsections 401-3.08 and 306-3.09.

306-3.05 PREPARATION OF ASPHALT. Provide a continuous supply of asphalt binder to the mixer at a uniform temperature, within the allowable mixing temperature range.

306-3.06 PREPARATION OF AGGREGATE. Heat and dry the aggregate to a temperature compatible with the manufacturer's recommended mixing temperature for the asphalt binder used. Adjust dryer flames to avoid damage to aggregate and to avoid soot on the aggregate.

306-3.07 MIXING. Combine aggregate, asphalt binder, anti-strip additive, and RAP (if used) in the mixer in the proportions required by the contract. Mix to obtain 98% coated particles when tested according to AASHTO T 195. For batch plants, put the dry aggregate in motion before addition of the asphalt binder. Mix the ATB mixture within the manufacturer's recommended mixing temperature range for the asphalt binder used.

306-3.08 SPREADING AND FINISHING. Deposit and spread ATB mixture on an approved surface in layers not exceeding 3 inches in compacted depth. Use hand tools to spread, rake, and lute the ATB in areas where irregularities or unavoidable obstacles make mechanical spreading and finishing equipment impracticable. Place a tack coat between successive layers of ATB and on all vertical surfaces the ATB abuts.

306-3.09 COMPACTION. Compact the ATB using vibratory rollers, applying a minimum dynamic force of 50,000 pounds per vibration at a minimum frequency of 1,000 vibrations per minute. Adjust working speed in order to apply 8 to 12 impacts per foot. Do not crush or fracture aggregate. In areas inaccessible to rollers, use mechanical tampers until thoroughly compacted.

306-3.10 SURFACE TEST. After rolling has been completed, the surface will be tested for smoothness and accuracy of grade, crown, superelevation, and width. Limit surface deviations to 3/8 inch, as measured from the testing edge of a 10-foot straightedge between two contacts with the surface parallel with, and at right angles to, the centerline.

306-3.11 THICKNESS REQUIREMENTS. Meet Plan thickness ± 1/2 inch, compacted.

306-3.12 JOINTS. Offset both transverse and longitudinal joints such that ATB joints in the layer immediately below, and Hot Mix Asphalt Pavement joints in the layer immediately above, are offset by at least 6 inches from the ATB layer being placed.

306-3.13 ACCEPTANCE SAMPLING AND TESTING.

1. Asphalt Binder Content.

    a. If RAP is used and there is a windrow, asphalt binder will be sampled from the windrow by the Engineer according to ATM 403. If there is not a windrow, asphalt binder will be sampled using the plate method by the Contractor in the presence of the Engineer according to ATM 402 or ATM 403. Asphalt binder content will be determined according to ATM 406.

    b. If RAP is not used, asphalt binder content will be measured by supplier's invoice quantity minus waste, diversion and remnant, as confirmed by tank stickings taken at the beginning and end of each shift. Perform tank stickings in the presence of the Engineer. Provide tank volume charts to

the Engineer. Tank stickings will be adjusted for temperature. Provide the supplier's asphalt binder temperature-density relationship to the Engineer. At the Engineer's discretion, asphalt binder content may instead be determined according to ATM 405.

2. Aggregate Gradation.

   a. If RAP is used, aggregate gradation will be accepted based on the same samples taken for asphalt binder content, tested according to ATM 408 from the aggregate remaining after the ignition oven (ATM 406) has burned off the asphalt binder.

   b. If RAP is not used, aggregate gradation will be accepted based on samples taken from the combined cold feed conveyor according to ATM 301 and tested according to ATM 304.

3. Density. The Engineer will use ATM 412 to determine the density standard. Make each control strip at least 12 feet by 300 feet. Compact the remainder of the project to not less than 98% of the density standard, in accordance with ATM 411. The Engineer will designate the location of test strips.

4. Asphalt Binder Grade. Sample asphalt binder at the plant from the supply line in the presence of the Engineer according to ATM 401. The Engineer will take immediate possession of the samples. Meet Subsection 702 requirements for asphalt binder quality.

306-4.01 METHOD OF MEASUREMENT. Section 109 and the following:

1. ATB. By weight. No deduction will be made for the weight of asphalt binder or anti-strip additive in the mixture.

2. Asphalt Binder. By weight. No payment will be made for asphalt binder in excess of 0.5% above the percentage specified in 306-3.01. If ATM 406 or ATM 405 are used to determine asphalt binder content, the quantity used for payment will be the percent asphalt from ATM 406 or ATM 405 multiplied by the weight of ATB represented by that test. If invoices and tank stickings are used to determine asphalt binder content, the quantity for payment will be calculated from supplier's invoice quantity minus waste, diversion, and remnant, as confirmed by tank stickings adjusted for temperature.

306-5.01 BASIS OF PAYMENT. Anti-strip additive is subsidiary to Asphalt Binder.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
306.0001.____	ATB	TON
306.0002.____	Asphalt Binder, Grade PG ___	TON

SECTION 308
CRUSHED ASPHALT BASE COURSE

308-3.01 PULVERIZING AND MIXING. *Delete the first paragraph and substitute the following:* Crush or process the existing asphalt pavement in place to the depths shown on the Plans so that 100% by weight passes the 2-inch sieve and 95-100% by weight passes the 1-inch sieve.

Add the following subsection:

308-3.06 EXCESS CABC. Salvage, deliver and stockpile excess Crushed Asphalt Base Course at the Department's M&O yard located at 2301 Peger Road, Fairbanks Alaska. Coordinate delivery with the Engineer and get approval for final stockpile location(s).

Create stockpiles by depositing material in uniform layers or lifts. Work in a manner that does not contaminate the crushed asphalt base course with foreign materials and avoids segregation of the various sizes of pulverized material. Make the completed stockpile(s) neat and regular in form having side slopes 1.5H:1V or steeper.

308-5.01 BASIS OF PAYMENT. *Add the following*: The contract price includes all work and resources required to pulverize, crush, process, haul, deliver, stockpile, double handle, place, shape, grade and compact Crushed Asphalt Base Course.

Removal of existing non-operable inductive loops and conduits at signalized intersection approaches is subsidiary

Existing HMA removal at unsignalized approaches will be paid for by Item 202.0002.0000 Removal of Pavement. Excavation of existing base course at these locations is subsidiary to the work in this Section.

SECTION 401
HOT MIX ASPHALT PAVEMENT

08/04/22 (N76)
401-2.01 ASPHALT BINDER. *Add the following:* Provide the grade of Asphalt Binder shown in the Bid Schedule, except PG 52-28 may be used for Items 401.0011.____ and 401.0012.____, HMA Driveway.

401-2.08 RECYCLED ASPHALT PAVEMENT. *Add the following:* The maximum amount of RAP in the HMA is limited to 10%.

401-2.09 JOB MIX DESIGN. *Delete the last two rows of Table 401-1 HMA MARSHALL DESIGN REQUIREMENTS.*

(04/08/21) N85
Add the following: For HMA placed under Item 401.2010.0000 HMA, Sidewalks and Paths:

1. JMD shall be Type II or Type III, Class B.

2. Asphalt Binder shall be PG 52-28 or PG 52E-40.

3. The maximum amount of RAP in the HMA is limited to 10%.

401-3.18 SURFACE REQUIREMENTS AND TOLERANCES. *Add the following:* When Item 401.0010.___ appears in the Bid Schedule, profiler measurements will be taken on through lanes and passing lanes.

401-4.02 ACCEPTANCE SAMPLING AND TESTING. *Add the following:* The bid quantity for Item 401.2010.0000 HMA, Sidewalks and Path will be considered 1 lot. The lot will be divided into sublots of 500 tons. HMA for Sidewalks and Paths will be accepted for payment based on:

1. The Engineer's approval of the JMD.

2. Placement and compaction of the HMA to the specified depth, finished surface requirements, and tolerances.

3. Conformance to the Upper Specification Limit (USL) and Lower Specification Limit (LSL) shown in Table 401-2. The TV is the specification value shown in the approved Job Mix Design.

4. Mat Density will be sampled and tested according to Subsection 401-4.02.3. Density test results will be based on the MSG from the approved JMD.

5. At the discretion of the Engineer, Asphalt Binder Content may be tested according to Subsection 401-4.02.1, Aggregate Gradation may be tested according to Subsection 401-4.02.2, and Asphalt Binder Grade may be tested according to Subsection 401-4.02.5.

The Engineer reserves the right to perform any testing required in order to determine acceptance.

401-5.01 BASIS OF PAYMENT. *Add the following:* HMA placed on driveways, turnouts, and pullouts will be paid under Item 401.0012.____ HMA, Driveway, Type ___; Class ___.

The use of a transferred HMA Job Mix Design from another project is subsidiary and will not be paid for under 401.0013.

Asphalt binder, liquid anti-strip additives and tack coat are subsidiary to Item 401.2010.0000 HMA, Sidewalks and Paths.

Item 401.0008.____ HMA Price Adjustment does not apply to Item 401.2010.0000 HMA, Sidewalks and Paths.

Add the following pay item:

PAY ITEM		
Item Number	**Item Description**	**Unit**
401.2010.0000	HMA, Sidewalks and Paths	TON

SECTION 501
CONCRETE FOR STRUCTURES

09/10/21 (N89)

501-2.02 COMPOSITION OF MIXTURE – JOB MIX DESIGN.

1. Water-Cement Ratio and Cementitious Materials: *Add the following after Table 501-1:*

TABLE 501-1.1
MINIMUM CEMENTITIOUS MATERIAL CONTENT

Class of Concrete	Minimum Cementitious Material Content
A	564 lbs/yd^3
A-A	658 lbs/yd^3

SECTION 550
COMMERCIAL CONCRETE

09/10/21 (N90)

550-2.02 COMPOSITION OF MIXTURE – JOB MIX DESIGN. *Delete Table 550-1 and substitute the following:*

TABLE 550-1
COMMERCIAL CONCRETE DESIGN REQUIREMENTS

Class	B-B	B	W
Cementitious Material Content, minimum	658 lbs/yd^3	564 lbs/yd^3	n/a
Water-Cement Ratio, lbs/lbs, maximum	0.40	0.45	0.50
Total Air Content, %	5.5 – 6.5	5.5 – 6.5	4.0 – 6.5
Coarse Aggregate Gradation, AASHTO M 43	No. 57 or 67	No. 57 or 67	No. 7, 8, 57, or 67
Compressive Strength, psi, minimum	5,000	4,000	3,000

Alternative sizes of coarse aggregate, as shown in AASHTO M 43, may be used when approved in writing.

550-5.01 BASIS OF PAYMENT. *Delete the first sentence and substitute the following:* If Items 550.0001.____, 550.0002.____, 550.0003.____, 550.0004.____, 550.0005.____, or 550.0006.____ do not appear in the Bid Schedule concrete is subsidiary to other items.

Add the following pay items:

PAY ITEM		
Item Number	**Item Description**	**Unit**
550.0005.____	Class B-B Concrete	LS
550.0006.____	Class B-B Concrete	CY

Delete Section 603 in its entirety and substitute the following:

SECTION 603
CULVERTS AND STORM DRAINS

603-1.01 DESCRIPTION. Construct or reconstruct culvert and storm drain pipe. Install culvert marker posts, and strap plastic culvert ends.

603-1.02 REFERENCES.

ASTM D3953	Standard Specification for Strapping, Flat Steel and Seals
ASTM D4675	Standard Guide for Selection and Use of Flat Strapping Materials

603-2.01 MATERIALS. Use materials that conform to the following:

Bedding and Backfill	Subsection 204-2.01
Grout	Subsection 701-2.03
Joint Mastic	ASTM C990
Joint Mortar	Subsection 705-2.04
Flexible Watertight Gaskets	Subsection 705-2.05
Non-reinforced Concrete Pipe	Subsection 706-2.01
Reinforced Concrete Pipe	Subsection 706-2.02

Corrugated High Density Polyethylene (HDPE) Pipe	Subsection 706-2.07
Corrugated Steel Pipe and Pipe Arches	Subsection 707-2.01
Corrugated Aluminum Pipe	Subsection 707-2.03
Galvanize	Subsection 716-2.07
Culvert Marker Posts (Flexible Delineator Posts)	Subsection 730-2.05

Item 603.0017.____, Pipe, listed in the bid schedule, furnish either Corrugated Steel Pipe (CSP), Corrugated Aluminum Pipe, Reinforced Concrete Pipe, or Corrugated Dual Wall HDPE (plastic) Pipe. Select pipe for each installation that meets or exceeds the requirements shown on the Plans for height of cover.

For steel and plastic pipe, use metal end sections with metal rings to aid in detection. End sections shall be compatible to join HDPE with metal end sections.

Separate dissimilar materials with an electrical insulating material. The insulating material must be at least 1/16 inch thick and approved by the Engineer.

Culvert marker post is 6-foot tall by 2.5 inches wide with reinforcing ribs, capable of a 9-inch minimum bending radius, and blue with no marking.

Culvert marker Strap and Seals according to ASTM D3953. .625 inch x .02 inch, dry Type 1 regular-duty (magnetic, ferritic), galvanized Finish B (hot-dipped Grade 2 moderate coating, .18 oz./ft^2 surface or .0002 inch thick minimum. Push type seals, Style III (overlap), regular duty, galvanized Finish B (hot-dipped coating) by 1.75-inch minimum length and matched to strapping width.

CONSTRUCTION REQUIREMENTS

603-3.01. GENERAL. Excavate, bed, and backfill according to the requirements of Subsections 204-2.01 and 204-3.01, and the Plans.

Dewater ground water from work areas; construct and maintain temporary water diversion when working in waterways, and for facilities or structures with active drainage according to Section 204.

603-3.02. LAYING PIPE. Begin the pipe laying at the downstream end of the pipe. Keep the lower segment of the pipe in contact with the bedding throughout its full length. Place bell or groove ends of rigid pipe and outside circumferential laps of flexible pipe facing upstream.

Lay paved or partially lined pipe so that the longitudinal centerline of the paved segment coincides with the flow line. Install elliptical conduit and circular conduit reinforced with other than a full circular cage or cages so the orientation of a vertical plane through the longitudinal axis of the conduit does not vary more than 5 degrees from the design orientation.

Repair damaged metallic coating on metal pipe according to AASHTO M36.

Where HDPE culverts are used, metal marker straps (rings) and metal end sections shall be used to aid in maintenance detection. Consult manufacture to ensure that metal ring is appropriately sized for use with double-walled HDPE culvert and end section, when required.

603-3.03 JOINING PIPE. Joints shall provide circumferential and longitudinal strength to preserve the pipe alignment, prevent separation of pipe sections, and provide a watertight joint between new sections of pipe and joints between new and existing sections of pipe of similar and dissimilar materials. Include a continuous gasket (seal) in all joints. Construct the watertight joint capable of passing a laboratory hydrostatic pressure and vacuum test of at least 4 psi for 10 minutes.

1. Rigid Pipe. Use either bell and spigot or tongue and groove joints. Join pipe sections with the ends fully entered and the inner surfaces reasonably flush and even.

Use one or more of the following joint materials, or any other if approved:

a. Portland cement mortar

b. Portland cement grout

c. Rubber gaskets

d. Coupling bands

e. Preformed plastic sealing compound

Make mortar joints using an excess of mortar to form a bead around the outside of the pipe.

For grouted joints, use molds or runners to retain the poured grout. Install rubber ring gaskets to form a flexible, watertight seal.

When using Portland cement mixtures, protect the completed joints against rapid drying using suitable covering material.

2. Metal Pipe. Join the metal pipe firmly using connecting bands conforming to ASTM B745 (Corrugated Aluminum Pipe) and ASTM A760 (Corrugated Steel Pipe) and as noted herein. Use bands that are no more than two nominal sheet thicknesses lighter than the pipe jointed, and in no case more than 0.052 inches lighter. Include a gasket each side of the gap.

   a. Primary Band. Furnish and install corrugated bands so that the band corrugations match and conform to the corrugations of the pipe. Conform to the following guidelines:

      (1) The gap between the pipes joined is in the center of the band and is no wider than one corrugation width.

      (2) Bands shall have a minimum width of 22 inches.

   b. Secondary Band. Use this band only where it is not physically possible to use primary bands, such as on field-cut pipe ends, joining new pipe to existing pipe, etc. Furnish and install deformed metal sheet bands (dimple bands) so that the projections match and are the same depth as the pipe corrugations. Form these projections in circumferential rows with one projection for each corrugation of the helical pipe.

      Conform to the following guidelines:

      (1) The gap between the pipes joined is in the center of the band and is no wider than 2 inches.

      (2) Bands shall have a minimum width of 22 inches and shall have two circumferential rows of projections for each pipe end being joined.

      (3) Furnish and install these bands with a gasket that resists infiltration and leakage.

3. Plastic Pipe. Use push-on or mechanical joints. Ensure that the plastic pipe couplings' corrugation matches the pipe corrugation and that their width is not less than one-half the nominal pipe diameter.

Furnish all bolted connections on coupling bands with cut washers placed between the nut and the angle bracket or use nuts with integral washers.

Take up any pipe that is out of alignment, unduly settled, or damaged and re-lay or replace it.

603-3.04 CULVERT MARKER.

a. Marker Post. Install a culvert marker on the approach side of storm drain outfalls 30 inches and smaller, field inlets not in paved parking lots, all end sections to cross culverts, or as directed. Drive to maintain forty-two inches of post above the ground after driving, and

b. Marker Strap. In addition to marker posts, install marker strap around the plastic pipe ends.

Position the strap in the valley of the first annular ring from the top end of the culvert. From the vertical centerline of the culvert, at the top, overlap the strap and extend the ends to approximately 30 degrees each side of the centerline. Place the strap loosely without twists in the valley, without compressing the pipe, and tight enough to keep the strap from moving out of the valley without deforming the pipe or pipe corrugation. Seal the strap at three locations, one at each of the ends, and one at the top of the culvert. Extend the strap ends beyond the end seals approximately ½-inch. Double crimp the seal, two pairs of crimps minimum each seal.

Repair the strap galvanizing where abraded and at cut ends according to ASTM A780. Prepare the surface with power tools per SSPC-SP11, hand tools per SSPC-SP2, and as required by the paint manufacturer. Apply paint, Type – paint containing zinc dust, to the prepared surfaces and allow enough time for curing as required by the manufacturer's printed instructions.

603-4.01 METHOD OF MEASUREMENT. Section 109, and as follows:

1. Culvert Pipe. The length of pipe, measured in place, along the invert.

2. Pipes for Storm Drains. The length of pipe, measured in place, along the invert, from center to center of structures. The length through the inlets, catch basins, and manholes is included in the measured length.

3. End Sections. The number of units installed.

603-5.01 BASIS OF PAYMENT. The following is subsidiary:

1. Coupling bands, seals (gaskets), and other items necessary for the proper joining of the sections.

2. Branch connections and elbows.

3. Culvert markers.

4. Temporary water diversion, dewatering, and re-watering.

5. Excavation, bedding, and backfill.

6. Extruded polystyrene insulation.

7. Working drawings, design, and load ratings.

Payment will be made under:

PAY ITEM		
Item No.	**Pay Item**	**Pay Unit**
603.0001.____	CSP ___ Inch	LF
603.0002.____	___ Inch CSP Arch	LF

PAY ITEM		
Item No.	**Pay Item**	**Pay Unit**
603.0003.____	End Section for CSP ___ Inch	EACH
603.0004.____	End Section for ___ Inch CSP Arch	EACH
603.0009.____	Corrugated Aluminum Pipe ___ Inch	LF
603.0010.____	___ Inch Corrugated Aluminum Pipe Arch	LF
603.0011.____	End Section for Corrugated Aluminum Pipe ___ Inch	EACH
603.0012.____	End Section for ___ Inch Corrugated Aluminum Pipe Arch	EACH
603.0013.____	Reinforced Concrete Pipe, ___ Inch, Class ___	LF
603.0014.____	Reinforced Concrete End Section, ___ Inch	EACH
603.0015.____	Elbow, (Type & Size)	EACH
603.0016.____	Branch Connection (Type & Size)	EACH
603.0017.____	Pipe ___ Inch	LF
603.0019.____	___ Inch Pipe Arch	LF
603.0020.____	End Section for Pipe ___ Inch	EACH
603.0022.____	End Section for Corrugated Polyethylene Pipe ___ Inch	EACH
603.2032.____	Corrugated HDPE Pipe ___	LF
603.2033.____	End Section for Corrugated HDPE Pipe ___	EACH

SECTION 604
MANHOLES AND INLETS

604-2.01 MATERIALS. *Add the following:* For sanitary sewer manholes, use materials, excluding concrete, that conform to GOLDEN HEART UTILITIES STANDARDS OF DESIGN AND CONSTRUCTION (most recent revision). Sanitary sewer and storm sewer manholes shall be constructed of Class B Concrete.

Insulation	Subsection 712-2.23
Waterproof Protective Coating	Subsection 712-2.24

Materials must comply with Buy America requirements outlined in Subsection 106-1.01.

604-3.01 CONSTRUCTION REQUIREMENTS. *Add the following*: Furnish and install the type of storm drain frame and grate specified or shown on the Plans at the locations specified.

Install curb box inlets consisting of a metal frame and grate as shown on the Plans. Insert pipe into inlet and ensure a watertight seal.

Add the following subsection:

604-3.02 INSULATION. All sanitary sewer manholes shall be completely insulated with a minimum of two (2) inches of urethane foam. Insulate storm drain manholes and inlets with urethane foam or insulation board at locations and thicknesses indicated on the Plans.

604-5.01 BASIS OF PAYMENT. *Delete the first paragraph and substitute the following*: Excavation, shoring, bedding, and backfill are subsidiary.

Add the following: Payment for insulating sanitary sewer and storm drain structures shall be subsidiary to respective pay items.

Removal of existing manholes and inlets is paid for under item 202.0001.0000 Removal of Structures and Obstructions.

Sanitary sewer manhole drop connections shall be subsidiary to item 604.0002.0000 Sanitary Sewer Manhole.

Abandonment of existing sanitary sewer manholes designated on the Plans is subsidiary to pay item 202.0001.0000 Removal of Structures and Obstructions.

Permit coverage for dewatering is required by ADEC for excavations located within 1,500 ft of a permit defined "DEC-identified contaminated site" or "contaminated groundwater plume" identified by Contaminated Sites. Localized sumps for trench water and washed rock required for installation of pipe and structures will be utilized with the approval of the Engineer. Payment for this work or any other extra work associated with trench water / ground water is subsidiary to respective 604 pay items.

SECTION 608
SIDEWALKS

05/06/21 (N87)
608-2.01 MATERIALS.

1. Concrete Sidewalk. *Delete the line beginning with* "Joint Sealer" *and substitute the following:*

Joint Sealer	Hot pour joint sealant in accordance with ASTM D6690, Type IV

05/06/21 (N80)
Add the following to list of materials under 1. Concrete Sidewalk:

Reinforcement	Subsection 709-2.01

608-3.01 CONCRETE SIDEWALKS. *Add the following after the second paragraph***:** Six inches thick sidewalks shall have 6x6 – W2.9xW2.9 Welded Wire Fabric (WWF) reinforcement placed 1.5 inches from the foundation for the entire width and length of the sidewalk unless shown on Plans otherwise. Four inches thick sidewalk shall have 6x6 – W1.4xW1.4 WWF reinforcement placed 1.5 inches from the foundation for the entire width and length of the sidewalk unless shown on Plans otherwise. Provide two inches of concrete clear cover between reinforcement and sidewalk edges.

Delete the fifth paragraph and substitute the following: Make expansion joints to the dimensions and spacing shown on the Plans, with maximum spacing of 50 feet between expansion joints, and fill with the type of preformed expansion joint filler specified. Top surface profile of the expansion point may not be recessed more than 1/4 inch from the finished sidewalk profile.

608-3.03 CURB RAMPS. *Add the following after the first paragraph:* Construct all curb ramp sections (ramp, upper and lower landings) of six inches thick concrete with 6x6 – W2.9xW2.9 WWF reinforcement placed 1.5 inches from the foundation for the entire width and length of the each section. Provide two inches of concrete clear cover between the reinforcement and the outside edges of the concrete.

04/08/21 (N84)
608-4.01 METHOD OF MEASUREMENT.

Concrete Sidewalk. *Add the following to the end of the sentence:* and curb ramps.

608-5.01 BASIS OF PAYMENT. *Add the following after the first paragraph:*

Curb Ramp. Materials to construct the curb ramps will be paid for separately under Concrete Sidewalk pay item(s).

Curb Ramp, Retrofit. Materials to construct the curb ramps will be paid for separately under Concrete Sidewalk pay item(s).

SECTION 609
CURBING

05/06/21 (N88)
609-2.01 MATERIALS. *Delete the line beginning with* "Joint Sealer" *and substitute the following:*

Joint Sealer	Hot pour joint sealant in accordance with ASTM D6690, Type IV

07/01/20 (N81)
Add the following to the list of materials in first paragraph:

Reinforcement	Subsection 709-2.01

609-3.02 CAST-IN-PLACE CONCRETE CURBING. *Add the following after the first paragraph:* Use two longitudinally placed #4 reinforcing steel bars for the entire length of concrete curb and gutter. Place the reinforcing steel 3 inches from the bottom and 4 inches from each outside edge. Provide continuing reinforcement by lap splicing the bars by minimum overlap of 1.75 feet.

609-5.01 BASIS OF PAYMENT. *Add the following before the first paragraph:* The contract price includes all work and materials to construct curbs and gutters. This includes excavation, reinforcement, expansion joint material, and other related miscellaneous materials.

Work and resources required for chording curbs are subsidiary to pay item 609.0002.0001.

Delete the first paragraph and substitute the following: Excavation, reinforcement, expansion joint material, and other related miscellaneous items are subsidiary. Payment will be made under:

SECTION 611
RIPRAP

01/20/15 (N23)
611-2.01 MATERIALS. *Add the following after the first sentence:* WAQTC FOP for AASHTO T 85 will determine apparent specific gravity.

SECTION 615
STANDARD SIGNS

01/20/15 (N27)
615-3.01 CONSTRUCTION REQUIREMENTS. *Delete numbered subparagraph 8 in its entirety and substitute the following:*

8. All materials and finished signs are subject to inspection and acceptance in place.

    a. Surfaces exposed to weathering must be free of defects in the coating.

    b. Finished signs must be clean and have no chatter marks, burrs, sharp edges, loose rivets, delaminated reflective sheeting, oxidation, corrosion, other blemishes, aluminum marks, or unapproved coatings. Do not make repairs to the face sheet.

    c. Replace any finished sign not meeting a. and b. with a replacement sign at no cost to the Department.

11/01/16 (N68)
615-5.01 BASIS OF PAYMENT. *Delete the first sentence and substitute the following:* Sign posts, bases, mounting hardware and all traffic control devices necessary for removal, installation, reconstruction, or maintenance of 615 Pay Items are subsidiary.

Delete Section 618 in its entirety and substitute the following:

SECTION 618
SEEDING

618-1.01 DESCRIPTION.
It is the intent of this work that a uniform living vegetative cover be established according to the Plans and Specifications. This work consists of soil preparation, seeding, fertilizing, mulching, and establishing, and maintaining vegetated areas.

618-2.01 MATERIALS. Use materials that conform to the following:

Seed	Section 724
Fertilizer	Section 725
Mulch	Subsection 727-2.01
Water	Subsection 712-2.01

CONSTRUCTION REQUIREMENTS

618-3.01 SOIL PREPARATION. Clear all areas to be seeded of stones 4” and larger in diameter and of all weeds, plant growth, sticks, stumps and other debris or irregularities which may interfere with the seeding, establishment, and maintenance of the vegetated areas.

Prior to the application of seed, prepare slopes using one or more of the following methods, or as approved by the Engineer:

1. Manual Raking – Requires manual labor with landscaping rakes to produce a uniform pattern of grooves perpendicular to the fall of the slope.
2. Mechanical Raking - Requires the use of a scarifying slope board to produce grooves with an approximate width and depth of 1”, and no more than 6” apart. The resultant indentations shall leave a uniform pattern of grooves perpendicular to the fall of the slope.
3. Mechanical Track Walking - Requires operating tracked equipment in such a manner as to leave a uniform pattern of grooves perpendicular to the fall of the slope.

618-3.02 SEEDING SEASON. Perform seeding after the ground is free of snow and no sooner than June 15th and no later than August 15th. Perform seeding when wind conditions, climatic conditions, and soil conditions will not hinder seeding and establishment.

618-3.03 APPLICATION METHOD. Use the Hydraulic Method. You must obtain the Engineer's permission to use the Mechanical Method.

Hydraulic Method:

1. Seeding by the hydraulic method consists of furnishing and placing a slurry of dye, seed, fertilizer, trace mulch, water, and a second application of mulch.
2. Do not place seed in the slurry prior to 30 minutes before application.
3. Add the proportionate amount of seed to the water slurry in the hydraulic seeder after the proportionate amounts of trace mulch and fertilizer have been added.
4. Apply the slurry mixture in a manner that results in an even distribution of all materials. Apply seed, fertilizer, and trace mulch together in one application.
5. Hydraulic seeding equipment must maintain continuous slurry agitation so that a homogeneous, uniform mixture is applied through a spray nozzle, for the complete tank load. The pump must be capable of producing sufficient pressure to maintain a continuous, nonfluctuating spray capable of reaching the extremities of the seeding area with the pump & nozzle unit located on the roadbed. Provide sufficient hose to reach areas not practical to seed from the pump & nozzle unit situated on the road bed.
6. A second application of mulch shall be applied within 24-hours after seeding. Mulch shall be furnished and evenly applied at the rates required for temporary stabilization per the manufacturer's recommendations and according to Subsection 727-2.01. Mulch sprayed on signs or sign structures shall be removed the same day.

Mechanical Method:

1. Use mechanical spreaders, seed drills or other approved mechanical seeding equipment when seed and fertilizer are to be applied in dry form.
2. Water seeding area both prior to and after the application of fertilizer.
3. Spread fertilizer separately from seed.
4. An application of mulch shall be applied within 24-hours after seeding. Mulch shall be furnished and evenly applied at the rates required for temporary stabilization per the manufacturer's recommendations and according to Subsection 727-2.01. Mulch sprayed on signs or sign structures shall be removed the same day.

618-3.04 APPLICATION RATE. Apply seed, fertilizer, and trace mulch at the rates specified in the table below:

MATERIALS	TYPE	APPLICATION RATE PER 1,000 SQUARE FEET
Seed*	Nortran – Tufted Hairgrass	0.60 lb
	Arctared – Red Fescue	0.40 lb
	Wainwright – Slender Wheatgrass	0.40 lb
	Annual Ryegrass	0.10 lb
	Total	1.50 lbs
Fertilizer	20-20-10	10 lbs
Trace mulch**	See Subsection 727-2.01	20 lbs

* Do not remove the required tags from the seed containers.

** Trace mulch application rate may be adjusted according to the manufacturer's recommendations when approved by the Engineer. Trace mulch is not required for mechanical seeding.

618-3.05 MAINTENANCE. Protect seeded areas against erosion and sedimentation. Protect seeded areas against traffic by approved warning signs or barricades. Water seeded areas, in a non-erosive manner, as required to establish a uniform living perennial vegetative cover. Be responsible for identifying, retracking, reseeding, refertilizing and remulching gullied or otherwise damaged areas. The second application of mulch shall be maintained so it properly performs its temporary stabilization function until final stabilization is achieved. Rescarify, reseed, refertilize and remulch unproductive areas as directed by the Engineer.

618-3.06 PERIOD OF ESTABLISHMENT. The establishment period extends until a uniform (e.g. evenly distributed, without large bare areas) perennial living vegetative cover with a density of 70 percent of the native background vegetative cover is established.

618-3.07 ACCEPTANCE. The Engineer will accept seeding when a uniform (e.g. evenly distributed, without large bare areas) perennial living vegetative cover with a density of 70 percent of the native background vegetative cover is established.

618-4.01 METHOD OF MEASUREMENT. Section 109 and as follows:

Watering seeded areas per Subsection 618-3.05 will not be measured directly for payment and is subsidiary, except when Pay Item 618.0003.____ is listed on the Bid Schedule.

Identifying, retracking, reseeding, refertilizing and remulching gullied or otherwise damaged areas will not be measured directly for payment and is subsidiary.

Seeding by the Acre. By the area of ground surface acceptably seeded and maintained. Soil preparation, seed, fertilizer, all mulch, dye, and water required for seed and fertilizer application will not be measured directly for payment and is subsidiary.

Seeding by the Pound. By the dry weight of seed acceptably seeded and maintained. Soil preparation, fertilizer, all mulch, dye, and water required for seed and fertilizer application will not be measured directly for payment and is subsidiary.

Water for Seeding. By the M Gal. (1,000 gallons) acceptably placed. Use a conversion factor of 8.34 pounds per gallon, if measured by weight.

Seeding by the Square Yard. By the area of ground surface acceptably seeded and maintained. Soil preparation, seed, fertilizer, all mulch, dye, and water required for seed and fertilizer application will not be measured directly for payment and is subsidiary.

618-5.01 BASIS OF PAYMENT. The accepted quantity will be paid for at the contract price, per unit of measurement, for the pay items listed below that appear on the bid schedule.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
618.0001.____	Seeding	ACRE
618.0002.____	Seeding	LB
618.0003.____	Water for Seeding	MGAL
618.0004.____	Seeding	SY

SECTION 621
PLANTING TREES AND SHRUBS

621-1.01 DESCRIPTION. *Add the following:* Furnish and place rock mulch in landscape areas as shown on the Plans.

Add the following subsections:

621-2.08 ROCK MULCH. Use a blend of 3-inch minus with 1 percent passing No. 4 sieve, round river gravel cleaned of foreign debris and washed.

Submit a rock mulch sample to the Engineer for their approval prior to delivering rock mulch on site.

621-3.08 ROCK MULCH. Place rock mulch as shown on the Plans.

621-4.01 METHOD OF MEASUREMENT. *Add the following:*

Item 621.2018.0000 Rock Mulch. By the square yard, six-inch depth, measured and accepted in place.

621-5.01 BASIS OF PAYMENT. *Add the following:*

Item 621.2018.0000 Rock Mulch. The contract price includes all work and resources required to provide and install rock mulch.

Add the following pay item:

PAY ITEM		
Item Number	**Item Description**	**Unit**
621.2018.0000	Rock Mulch	SY

Delete Section 626 in its entirety and substitute the following:

SECTION 626
SANITARY SEWER SYSTEMS

626-1.01 DESCRIPTION. Furnish and install all sanitary sewer pipe, fittings, manholes, and appurtenances for the sanitary sewer collection system.

The sanitary sewer system shall be constructed in accordance with the GOLDEN HEART UTILITIES STANDARDS OF DESIGN AND CONSTRUCTION (most recent revision) and GOLDEN HEART UTILITIES SERVICE LINE STANDARDS (most recent version).

626-2.01 MATERIALS. Use materials that conform to GOLDEN HEART UTILITIES STANDARDS OF DESIGN AND CONSTRUCTION (most recent revision) and GOLDEN HEART UTILITIES SERVICE LINE STANDARDS (most recent version). The Contractor shall supply all materials to complete the work.

Materials must comply with Buy America requirements outlined in Subsection 106-1.01.

626-2.02 POLYETHYLENE SHEETING. Provide and install, according to GHU Standard Drawings.

626-2.03 CONCRETE MANHOLE CHANNELS AND BENCHES. Factory or field formed from concrete.

Portland cement design mix, 4,000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

Include channels and benches in manholes. Benches shall be sloped to drain into channel.

626-2.04 TRANSITION FITTINGS. Ductile iron center ring and end rings, rubber gaskets, steel bolts and hex nuts. ROMAC style 501 transition coupling or approved equal.

626-2.05 DETECTABLE WARNING TAPE. Acid and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored green to represent sewer systems.

CONSTRUCTION REQUIREMENTS

626-3.01 GENERAL. All work will conform to GOLDEN HEART UTILITIES (GHU) STANDARDS OF DESIGN AND CONSTRUCTION (most recent revision) and GOLDEN HEART UTILITIES SERVICE LINE STANDARDS (most recent version).

Furnish and install all incidental parts not shown on the Plans or specified in this section that are necessary for a complete and functioning sewer system.

Comply with all requirements associated with the ADEC conditional construction approval.

Verify locations of all existing utilities prior to excavation. The Contractor is responsible to obtain, from all utility organizations, a locate of buried utilities within the project limits and give notice of proposed excavation in accordance with AS 42.30.

The existing facilities are to remain in service until the new facilities are in place, approved, and operational.

Contractor shall be responsible for public notification of sewer service disruption with approval from the Engineer.

Contractor is responsible for all damages resulting from interruptions in service.

626-3.02 INSTALLATION. Sanitary sewer systems shall be installed according to GOLDEN HEART UTILITIES STANDARDS OF DESIGN AND CONSTRUCTION (most recent revision) and GOLDEN HEART UTILITIES SERVICE LINE STANDARDS (most recent version).

626-3.03 BYPASS PUMPING. Provide a bypass for flow of sewage around the section of sewer lines designated for reconstruction, or replacement, as required. Plug the existing system at an upstream manhole and pump collected sewage to downstream manhole or adjacent sanitary sewer system. The pump(s) and bypass system shall be routed to a sanitary sewer system that has sufficient capacity to handle the peak flow and bypass flow combined.

The Contractor shall submit any bypass pumping plan, for sanitary sewer mains or services, to the Engineer for approval, prior to implementation.

626-3.04 TESTING. Acceptance testing includes pressure testing and remedy of any defects.

Contractor shall verify water-tightness of newly installed ductile iron conduit by air pressure testing at 4 psi. Pipe shall be tested for 2 minutes with no pressure loss.

Acceptance of pipe is contingent upon passing pressure testing.

626-3.05 VIDEO INSPECTION. The Contractor shall conduct video inspection of newly installed sanitary sewer conduit, as outlined in the GOLDEN HEART UTILITIES STANDARDS OF DESIGN AND CONSTRUCTION (most recent revision), and submit the video inspection report to the Engineer and the Golden Heart Utilities representative. The Contractor shall conduct a post-construction video inspection to ensure there are no damages during construction. Post-construction video inspection shall be submitted to the Engineer and the Golden Heart Utilities representative.

626-3.06 WARRANTY. Contractor warrants that Work performed on this facility shall conform to the GHU Standards for Design and Construction and be free of defects in material, designs/plans furnished by Contractor, or workmanship performed by Contractor or any subcontractor or material supplier for a period of one (1) year. The Contractor further warrants that all materials and equipment furnished will be new unless otherwise specified, of good quality, in conformance with specifications, and free from defective workmanship and materials. At the Department's request, the Contractor shall furnish satisfactory evidence of the quality and type of materials and equipment furnished.

The warranty shall begin on the date of acceptancy by GHU. GHU shall notify Contractor in writing of any warranty claims pertaining to facilities installed by the Contractor under the 3rd Street Widening contract.

Contractor shall make repairs, replacements and corrections promptly and at no expense to GHU. If Contractor fails to respond to a notice by GHU of a warranty claim within a reasonable time, GHU may make or cause to have made, the appropriate correction or repair at the expense of Contractor. If Contractor fails to correct defective work within a reasonable time after receipt of written notice from GHU prior to final payment, GHU may correct the work and issue an appropriate change order deducting the costs of correction from any payment(s) remaining due to Contractor. If payments then remaining due to Contractor are insufficient to cover such amounts, Contractor shall pay the difference to GHU within thirty (30) days of notice of such cost.

A new warranty period of one (1) year shall begin to run from completion of any repairs or replacements under the first or any successive warranty period.

Contractor shall furnish all warranties provided by any vendors and/or manufacturers of materials and equipment used to complete the Work.

626-4.01 METHOD OF MEASUREMENT.

1. Sanitary Sewer Conduit. Measured by the linear foot, along the overall horizontal length of pipe installed, from center to center of manholes.

2. Sanitary Sewer Service Connection. Measured by the number of units installed and accepted.

3. Adjust Sanitary Sewer Cleanout. Measured by the number of cleanouts adjusted and accepted.

626-5.01 BASIS OF PAYMENT. The contract price includes all work and resources required for each pay item shown in the bid schedule, complete in place and accepted. This includes all structural excavation, trench excavation, shoring, bedding, and backfill.

Payment for sanitary sewer conduit shall include all pipe, 2-inches insulation, gaskets and all materials, labor and supervision to provide a complete sewer construction or reconstruction as described on the Plans and Specifications.

Sewer service connection payment shall include all service piping, fittings (22.5, 45 or 90 degree bends), mission couplings and transitions from HDPE to WSP (except saddle and gasket) pipe, tapping, insulation, and any other materials, labor and supervision required to complete the service connection as described on the Plans and Specifications.

Acceptance testing including cleaning, pressure and leakage testing, and test for damaged and defective pipe with a video camera inspection is subsidiary. Use a swivel head camera with sufficient lighting to clearly see each pipe joint and provide a DVD and log to Engineer of the sewer main inspection. Remedy of any defects is subsidiary.

Any costs involving shoring, repair of damaged services, sewage by-passes, and providing temporary sewer services are subsidiary.

Costs to remove or abandon existing sewer piping or appurtenances are subsidiary to Pay Item 202.0001.0000.

Permit coverage for dewatering is required by ADEC for excavations located within 1,500 ft of a permit defined 'DEC-identified contaminated site' or 'contaminated groundwater plume' identified by Contaminated Sites. Localized sumps for trench water and washed rock required for installation of pipe and structures will be utilized with the approval of the Engineer. Payment for this work or any other extra work associated with dewatering shall be subsidiary to respective 626 pay items.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
626.0001.____	Sanitary Sewer Conduit, ___ Inch	LF
626.0002.____	Sanitary Sewer Service Connection	EACH
626.2013.0000	Adjust Sanitary Sewer Cleanout	EACH

Delete Section 627 in its entirety and substitute the following:

SECTION 627
WATER SYSTEMS

627-1.01 DESCRIPTION. Furnish and install all water conduit, fittings, valves, hydrants, and incidental parts to complete water main improvements and replacements, as shown on the Plans, or specified in this section. Remove, salvage, and reinstall, or abandon valve boxes, water conduit, and water meters as specified. Remove all existing fire hydrants as specified on Plans or as directed by the Engineer.

627-1.02 SUBMITTALS. Submit, in writing, plans outlining all procedures for temporary cap installations, service disruptions, temporary bypass, and tie-ins, for approval by the Engineer.

627-2.01 MATERIALS. The Contractor shall supply all materials to complete the work. Use materials that conform to GOLDEN HEART UTILITIES STANDARDS OF DESIGN AND CONSTRUCTION (most recent revision) and GOLDEN HEART UTILITIES SERVICE LINE STANDARDS (most recent revision), except for those materials specified in the Section.

Materials must comply with Buy American requirements outlined in Subsection 106-1.01.

Submit manufacturer's literature and affidavit of compliance with specified standards, for review by the Engineer. Procurement of materials shall not take place until approved.

Piping material shall bear label, stamp, or other markings of specified testing agency. All pipe, fittings, and valves shall be UL/FM listed for fire service.

All water conduit, water service piping, and incidental water system parts shall comply with NSF 61.

627-2.02 WATER CONDUIT PIPE AND FITTINGS. Push-on-Joint, Ductile Iron Pipe: Water conduit pipe shall be Thickness Class 50, with push-on-joints, having bell- and plain-spigot ends, unless flanged ends are indicated on the Plans, and shall conform to AWWA C151. Physical properties shall not be less than 60-42-10 iron. Ductile iron pipe shall be cement mortar lined in accordance with the applicable provisions of AWWA C104. All pipe and fittings shall be restrained joint.

1. Restrained Joint Gaskets: Restrained rubber gaskets shall be in accordance with AWWA C111. Contractor shall use U.S. Pipe Field Lok 350 gaskets, or approved equal.

2. Nitrile Restrained Joint Gaskets: Restrained nitrile gaskets shall be in accordance with AWWA C111 and shall be installed in areas containing petroleum and chlorinated contaminated soils, as outlined on the Plans. Contractor shall use U.S. Pipe Field Lok 350 gaskets, or approved equal.

3. FKM Joint Gaskets: FKM gaskets shall be in accordance with AWWA C111 and shall be installed in areas containing chlorinated contaminated soils and below an elevation of 433', as outlined on the Plans. Contractor shall use Viton gaskets, or approved equal.

Mechanical-Joint, Ductile-Iron Fittings: All fittings shall be standard pattern ductile iron conforming to AWWA C153. Fittings shall have a minimum working pressure rating equal to one hundred fifty (150) psi, but be capable of withstanding three (3) times the rated working pressure as per AWWA C110. Interior of fitting shall be cement mortar lined per AWWA C104.

1. Glands, Gaskets, and Bolts: Ductile-iron glands, rubber, nitrile, and FKM gaskets, and steel bolts shall conform to AWWA C111.

2. Restrained Joint: Mechanical joint fittings shall be field installed, wedge action, joint restraints conforming to AWWA C110. Contractor shall use MEGALUGs, by EBAA Iron, or approved equal.

3. Sleeve: Sleeve must provide a restrained joint designed for a maximum working pressure of two hundred fifty (250) psi.

627-2.03 RESTRAINED JOINTS. In lieu of concrete thrust blocks, components such as restraining glands and restraining gaskets may be used in accordance with the pipe/restraint manufacturer's instructions and the DIPRA Design Guide. Basis of design include US Pipe Field Lok 350 or Tyler Union SureStop 350 gasket systems, and EBAA Iron MegaLug or ROMAC Romagrip restraint systems, or approved equal.

627-2.04 GATE VALVES. Gate valves shall be non-rising stem, resilient-wedge-seated gate valves, conforming to AWWA C509. Valves shall be constructed of a ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, NDZ bronze stem, and stem nut. Valves shall open by turning the operation stem in a counter-clockwise direction. After the valves are assembled and tested, the manufacturer's name or symbol, the size of the valve, the year of manufacture, and the working water pressure shall be cast in the bonnet or body of the valve.

Gate valves shall be furnished with:

1. Minimum Working Pressure: 200 psig.

2. End Connections: Mechanical joint. (Gate valves on hydrants and tapping sleeve shall be flanged by mechanical joint.)

3. Interior and Exterior Coating: Epoxy in accordance with AWWA C550.

4. O-ring stem seal.

5. 2-inch square operating nut.

627-2.05 VALVE BOXES. Valve boxes shall be cast iron, two (2) piece, extension-type, with a plastic dust cap and cast iron cover, and shall conform to AWWA M44 for cast iron valve boxes.

Cast Iron Soil Pipe Riser: ASTM A74 Cast Iron Soil Pipe, Hub and Spigot, five (5) Inch, with hub at one or both ends.

Valve Box Bottom Section: Twenty-four (24) inch long, Heavy Duty Load Rating, Gray Iron ASTM A48 CL35; Basis of Design: East Jordan Iron Works, Product # 85556024 or approved equal.

Valve Box Top: Eighteen (18) inch long, Heavy Duty Load Rating, Gray Iron ASTM A48 CL35. Basis of design: East Jordan Iron Works, Product # 00366918 or approved equal.

Valve Box Cover: ASTM A48, CL35 Gray Iron, Heavy Duty Load Rating, one (1) inch raised flat face gothic lettering, six and three-quarters (6 ¾) inch diameter with two cast ears, two and three-quarter (2 ¾) inch depth, stamped with "Water" or "Sewer" as appropriate based on duty. Basis of design: East Jordan Iron Works, Product # 00366952 or approved equal.

627-2.06 FIRE HYDRANTS. All fire hydrants to be installed shall comply with FM's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products. Fire Hydrants shall comply with the latest edition of the Golden Heart Utilities Standards of Design and Construction.

Dry-Barrel Fire Hydrants: Hydrants shall conform to AWWA C502, include one NPS 4½-inch pumper nozzle and two NPS 2½-inch outlets, 5¼-inch main valve, drain valve, and NPS 6-inch flanged inlet. Include interior coating according to AWWA C550. Hydrants shall have ductile-iron body, compression-type valve opening against pressure and closing with pressure, and 200 psig minimum working pressure. Hydrant shall have a safety flange design to minimize traffic damage.

Gate valve shall conform to Paragraph 2.03 of this section except it shall be provided with mechanical joint by flanged ends.

1. Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains. Nozzle threads shall be National Safety Fire Hose Threads.

2. Operating and Cap Nuts: Pentagon, 1 1/2 inches point to flat.

3. Direction of Opening: Open hydrant valve by turning operating nut counterclockwise.

4. Exterior Finish: Two (2) coats of yellow alkyd-gloss enamel paint, unless otherwise indicated.

Hydrant Marker Flags will be furnished by the utility.

627-2.07 ELECTRONIC BALL MARKERS. Electronic Ball Marker shall contain a passive-tuned antenna, molded inside a plastic disk. Shell of marker must be impervious to minerals, chemicals and temperature extremes, and be colored blue to indicate water utilities. Contractor to utilize 3M Scotchmark 1403-XR Electronic Ball Marker for water utilities, compatible with 3M marker locator, or approved equal.

CONSTRUCTION REQUIREMENTS

627-3.01 GENERAL. All work will conform to GOLDEN HEART UTILITIES STANDARDS OF DESIGN AND CONSTRUCTION (most recent revision) and GOLDEN HEART UTILITIES SERVICE LINE STANDARDS (most recent revision).

Furnish and install all incidental parts not shown on the Plans or specified in this section that are necessary for a complete and functioning water system.

Verify locations of all existing utilities prior to excavation. The Contractor is responsible to give notice of proposed excavation in accordance with AS 42.30 to all utility companies and to obtain utility locates of buried utilities within the project limits.

Contractor will locate all water services as required using a contractor provided magnetic locator, other device designed for water service locates, or any means necessary to find the services. Golden Heart Utilities will not locate services.

All fire hydrants taken out of service will be reported to the City of Fairbanks Fire Department twenty-four hours before and a bag placed over the hydrant.

Maintain existing facilities in service until the new facilities are in place, approved, and operational. Provide public notification of water service disruption. Contractor is responsible for all damages resulting from interruptions in service.

627-3.02 INSTALLATION. Water systems shall be installed according to GOLDEN HEART UTILITIES STANDARDS OF DESIGN AND CONSTRUCTION (most recent revision) and GOLDEN HEART UTILITIES SERVICE LINE STANDARDS (most recent revision).

When a water main or water service (new or existing) crosses a storm drain or sanitary sewer conduit (new or existing), fully insulate the new or existing water pipe or conduit with an additional 2 inches of urethane foam for 7 feet on each side of the crossing (14 feet total). Install additional insulation to pipe or conduit as shown on Plans, and as directed by the Engineer in the field.

When a water main or water service (new or existing) is parallel with storm drain or sanitary sewer conduit (new or existing), and within 7 feet, insulate the entire new or existing water pipe or conduit with an additional 2 inches of urethane foam. Install additional insulation to pipe or conduit as shown on Plans, and as directed by the Engineer in the field.

Provide additional insulation to pipe or conduit where insufficient cover exists.

627-3.03 TESTING WATER SYSTEM. Testing shall be according to GOLDEN HEART UTILITIES STANDARDS OF DESIGN AND CONSTRUCTION (most recent revision). Water mains shall be verified as watertight by hydrostatically testing in accordance with AWWA Standard C600 to comply with the Alaska Department of Environmental Conservation conditional Approval to Construct.

627-3.04 WARRANTY. Contractor warrants that Work performed on this facility shall conform to the GHU Standards for Design and Construction and be free of defects in material, designs/plans furnished by Contractor, or workmanship performed by Contractor or any subcontractor or material supplier for a period of one (1) year. The Contractor further warrants that all materials and equipment furnished will be new unless otherwise specified, of good quality, in conformance with specifications, and free from defective workmanship and materials. At the Department's request, the Contractor shall furnish satisfactory evidence of the quality and type of materials and equipment furnished.

The warranty shall begin on the date of acceptancy by GHU. GHU shall notify Contractor in writing of any warranty claims pertaining to facilities installed by the Contractor under the 3rd Street Widening Upgrade contract.

Contractor shall make repairs, replacements and corrections promptly and at no expense to GHU. If Contractor fails to respond to a notice by GHU of a warranty claim within a reasonable time, GHU may make or cause to have made, the appropriate correction or repair at the expense of Contractor. If Contractor fails to correct defective work within a reasonable time after receipt of written notice from GHU prior to final payment, GHU may correct the work and issue an appropriate change order deducting the costs of correction from any payment(s) remaining due to Contractor. If payments then remaining due to Contractor are insufficient to cover such amounts, Contractor shall pay the difference to GHU within thirty (30) days of notice of such cost.

A new warranty period of one (1) year shall begin to run from completion of any repairs or replacements under the first or any successive warranty period.

Contractor shall furnish all warranties provided by any vendors and/or manufacturers of materials and equipment used to complete the Work.

627-4.01 METHOD OF MEASUREMENT.

Water System Complete. No measurement of quantities shall be made. Water System Complete shall be lump sum.

627-5.01 BASIS OF PAYMENT. Structural excavation, trench excavation, shoring, bedding, backfill, trench backfill are subsidiary.

Leakage tests, flushing, disinfection, hydrant flow testing, operation of installation, biological purity test, labor, materials and supervision required to complete the task as described on the Plans and Specifications are subsidiary. Remedy of any defects is subsidiary.

Any costs involving shoring, repair of damaged services, and providing temporary water caps and service are subsidiary.

Costs to remove or abandon existing water piping, hydrants, or appurtenances are subsidiary to Pay Item 202.0001.0000.

Water System Complete shall include all supervision, labor, materials, equipment, appurtenances, and incidentals to install a complete and functioning water system as shown on the Plans. The contract unit price includes pipe, insulation, gate valves, valve boxes, fire hydrant, fittings, corrugated plastic pipe sleeve, gaskets, specialized gaskets, pipe restraint followers, and all appurtenances and incidentals specified or required on the Plans, see Sheet U1 for estimated lump sum quantities. This work includes flushing, disinfection, leakage testing, biological purity tests, and connection to the existing system. Structural excavation, trench excavation, shoring, bedding, backfill, and trench backfill are subsidiary.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
627.2033.0000	Water System Complete	LS

SECTION 630
GEOTEXTILE FOR EMBANKMENT AND ROADWAY SEPARATION, STABILIZATION AND REINFORCEMENT

630-5.01 BASIS OF PAYMENT. *Add the following*: See Section 109.

Add the following pay item:

PAY ITEM		
Item Number	**Item Description**	**Unit**
630.2000.0000	Geotextile, Separation by Directive	CS

Delete Section 639 in its entirety and substitute the following:

SECTION 639
DRIVEWAYS

639-1.01 DESCRIPTION. Construct approaches and driveways at the locations shown on the Plans.

639-2.01 MATERIALS. Use materials that conform to the Plans.

639-3.01 CONSTRUCTION. Regrade approaches, driveways, including grading to meet ADA standards at the locations shown on the Plans.

639-4.01 METHOD OF MEASUREMENT. By the number of approaches as shown on the Plans or as directed.

639-5.01 BASIS OF PAYMENT. Excavation required beyond the limits of the adjacent mainline is subsidiary.

Materials required to construct approaches will be paid for separately under the respective pay items listed in the bid schedule.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
639.2000.0000	Approach	Each

Delete Section 641 in its entirety and substitute the following:

SECTION 641
EROSION, SEDIMENT, AND POLLUTION CONTROL

2/14/22 (N91)

641-1.01 DESCRIPTION. Provide project administration and work relating to control of erosion, sedimentation, and discharge of pollutants, according to this Section and applicable local, state, and federal requirements, including the Alaska Pollution Discharge Elimination System (APDES) Construction General Permit (CGP). The state APDES program is administered by the Department of Environmental Conservation (DEC). Section 301(a) of the Clean Water Act (CWA) and 18 AAC 83.015 provide that the discharge of pollutants to water of the U.S. is unlawful except as allowed by the CGP.

641-1.02 DEFINITIONS. These definitions apply only to Section 641.

ACTIVE TREATMENT SYSTEM (ATS) OPERATOR. See CGP Appendix C.

ALASKA CERTIFIED EROSION AND SEDIMENT CONTROL LEAD (AK-CESCL). A person who has completed training, testing, and other requirements of, and is currently certified as, an AK-CESCL from an AK-CESCL Training Program (a program developed under a Memorandum of Understanding between the Department and others). The Department recognizes AK-CESCLs as “qualified personnel” required by the CGP. An AK-CESCL must be recertified every three years. (See Qualified Person).

ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION (DEC). The state agency authorized by EPA to administer the Clean Water Act’s National Pollutant Discharge Elimination System.

ALASKA GENERAL PERMIT FOR EXCAVATION, DEWATERING (Excavation Dewatering Permit). The permit authorizing excavation dewatering discharges from Construction Activities.

ALASKA MULTI-SECTOR GENERAL PERMIT (MSGP). The permit authorizing stormwater discharges associated with Industrial Activity.

ALASKA POLLUTANT DISCHARGE ELIMINATION SYSTEM (APDES). A system administered by DEC that issues and tracks permits for stormwater discharges.

BEST MANAGEMENT PRACTICES (BMPS). See CGP Appendix C.

CLEAN WATER ACT (CWA). Federal Water Pollution Control Amendments of 1972, as amended (33 U.S.C. 1251 et seq.).

CONSTRUCTION ACTIVITY. Ground disturbing activity by the Contractor, subcontractor or utility company; that may result in erosion, sedimentation, or a discharge of pollutants into stormwater. See CGP Appendix C.

CONSTRUCTION GENERAL PERMIT (CGP). The permit authorizing stormwater discharges from Construction Activities, issued and enforced by Alaska DEC. It authorizes stormwater discharges providing permit conditions and water quality standards are met.

U.S. ARMY CORPS OF ENGINEERS PERMIT (COE PERMIT). A COE permit for construction in waters of the U.S. May be issued under Section 10 of the Rivers and Harbors Act of 1899, or Section 404 of the Clean Water Act.

ELECTRONIC NOTICE OF INTENT (ENOI). See CGP Appendix C.

ELECTRONIC NOTICE OF TERMINATION (ENOT). See CGP Appendix C.

ENVIRONMENTAL PROTECTION AGENCY (EPA). The federal agency charged to protect human health and the environment.

ERODIBLE STOCKPILE. Any material storage area or stockpile consisting of mineral aggregate, organic material, or a combination thereof, with greater than 5 percent passing the #200 sieve, and any material storage where wind or water transports sediments or other pollutants from the stockpile. Erodible Stockpile also includes any material storage area or stockpile, where the Engineer determines there is potential for wind or water transport, of sediments or other pollutants away from the stockpile.

EROSION AND SEDIMENT CONTROL PLAN (ESCP). The Department's project specific document that illustrates measures to control erosion and sediment on the project. The ESCP provides bidders with the basis for cost estimating and guidance for developing an acceptable Storm Water Pollutant Prevention Plan (SWPPP).

FINAL STABILIZATION. See CGP, Appendix C, "Stabilization."

HAZARDOUS MATERIAL CONTROL PLAN (HMCP). The Contractor's detailed project specific plan for prevention of pollution from storage, use, transfer, containment, cleanup, and disposal of hazardous material (including, but are not limited to, petroleum products related to construction activities and equipment). The HMCP is included as an appendix to the SWPPP.

MUNICIPAL SEPARATE STORM SEWER SYSTEM (MS4) PERMIT. A DEC stormwater discharge permit issued to certain local governments and other public bodies, for operation of stormwater conveyances and drainage systems. See CGP Appendix C.

OPERATOR(S). The party(s) responsible to obtain CGP permit coverage. CGP, Appendix C.

1. Contractor – the Contractor is an Operator inside and outside the Project Zone.

2. Department – the Department is an Operator inside the Project Zone.

POLLUTANT. Any substance or item meeting the definition of pollutant contained in 40 CFR § 122.2. A partial listing from this definition includes: dredged spoil, solid waste, sediment, sewage, garbage, sewage sludge, chemical wastes, biological materials, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial or municipal waste.

PROJECT ZONE. The physical area provided by the Department for Construction. The Project Zone includes the area of highway or facility under construction, project staging and equipment areas, and material and disposal sites; when those areas, routes and sites, are provided by the Contract.

Material sites, material processing sites, disposal sites, haul routes, staging and equipment storage areas; that are furnished by the Contractor or a commercial operator, are not included in the Project Zone.

QUALIFIED PERSON. See CGP Appendix C and Subsection 641-1.04.

SPILL PREVENTION, CONTROL AND COUNTERMEASURE PLAN (SPCC PLAN). The Contractor's detailed plan for petroleum spill prevention and control measures that meet the requirements of 40 CFR 112.

SPILL RESPONSE FIELD REPRESENTATIVE. The Contractor's representative with authority and responsibility for managing, implementing, and executing the HMCP and SPCC Plan.

STORM EVENT. See CGP Appendix C.

STORM WATER POLLUTION PREVENTION PLAN TWO (SWPPP2). The Contractor's plan for compliance with both the CGP and MSGP construction activities outside the Project Zone.

SUPERINTENDENT. The Contractor's duly authorized representative with authority and responsibility for the overall operation of the Project, and Contractor furnished sites and facilities.

SWPPP AMENDMENT. A modification to the SWPPP. CGP Part 5.0.

SWPPP MANAGER. The Contractor's Qualified Person with authority and responsibility. CGP Appendix C.

SWPPP PREPARER. The Contractor's Qualified Person with authority and responsibility. CGP Appendix C.

SWPPPTRACK. Software subscription service version SWPPPTrack LTIS AK developed and provided by Storm Water Simplified Ltd, for use on construction projects that require coverage under the APDES CGP.

TEMPORARY STABILIZATION. See CGP Appendix C. See "Stabilization."

641-1.02.01 REFERENCE. A complete list of websites and documents referenced herein can be found at the DOT&PF Statewide Design and Engineering Services Stormwater webpage.

DEC Permit information can be found at the DEC Division of Water webpage. SWPPP preparation documents can be found at the DOT&PF Design and Engineering Services Stormwater webpage. Construction forms are found at the DOT&PF Design and Engineering Services Construction Forms webpage.

641-1.03 PLAN AND PERMIT SUBMITTALS.

For plans listed in Subsection 108-1.03.5 (SWPPP, HMCP, and SPCC), use the Contractor submission and Department review deadlines identified in this Subsection.

Partial and incomplete submittals will not be accepted for review. Any submittal that is re-submitted or revised after submission, but before the review is completed, will restart the submittal review timeline. No additional Contract time or additional compensation will be allowed due to delays caused by partial or incomplete submittals, or required re-submittals.

1. Storm Water Pollution Prevention Plan. Submit an electronic copy of the SWPPP to the Engineer for approval. Deliver these documents to the Engineer at least 21 days before beginning Construction Activity. Organize the SWPPP and related documents for submittal according to the requirements of Subsection 641-2.01.2.

   The Department will review the SWPPP submittals within 14 days after they are received. Submittals will be returned to the Contractor, and marked as either “rejected” with reasons listed or as “approved” by the Department. When the submittal is rejected, the Contractor must revise and resubmit the SWPPP. The 14 day review period will restart when the Contractor submits an electronic copy of the revised SWPPP to the Engineer for approval.

   After the SWPPP is approved and certified by the Department using Form 25D-109, the Contractor must certify the approved SWPPP using Form 25D-111. See Subsection 641-1.03.4 for further SWPPP submittal requirements.

2. Hazardous Material Control Plan. The HMCP Template can be found at the DOT&PF Construction Forms webpage. The HMCP submittal and review timeline, and signature requirements are the same as the SWPPP.

3. Spill Prevention, Control and Countermeasure Plan. When a SPCC Plan is required under Subsection 641-2.03, submit an electronic copy of the SPCC Plan to the Engineer. Deliver these documents to the Engineer at least 21 days before beginning Construction Activity. The Department reserves the right to review the SPCC Plan and require modifications.

4. CGP Coverage. The Contractor is responsible for permitting of Contractor and subcontractor Construction Activities related to the Project. Do not use the SWPPP for Construction Activities outside the Project Zone where the Department is not an operator. For Construction Activities outside the Project Zone, the Contractor must use a SWPPP2. Department approval is not needed for a SWPPP2.

   After the Department certifies the SWPPP and prior to beginning Construction Activity, submit an eNOI with the required fee to DEC for coverage under the CGP. Submit a copy of the signed eNOI and DEC’s written acknowledgement (by letter or other document), to the Engineer as soon as practicable and no later than three days after filing eNOI or receiving a written response.

   Do not begin Construction Activity until the conditions listed in Subsection 641-3.01.1 are completed.

   The Department will submit an eNOI to DEC for Construction Activities inside the Project Zone. The Engineer will provide the Contractor with a copy of the Department’s eNOI and DEC’s written acknowledgment (by letter or other document), for inclusion in the SWPPP.

   Before Construction Activities occur, transmit to the Engineer an electronic copy of the approved and certified SWPPP, with signed Delegations of Signature Authorities on Forms 25D-107 and 25D-108, SWPPP Certifications on Forms 25D-111 and 25D-109, both permittee’s signed eNOIs and DEC’s written acknowledgement.

5. DEC SWPPP Review. When CGP Part 2.1.3 or 2.1.4, requires DEC SWPPP review:

   a. Transmit a copy of the Department-approved SWPPP to DEC using delivery receipt confirmation;

   b. Transmit a copy of the delivery receipt confirmation to the Engineer within seven (7) days of receiving the confirmation; and

   c. Retain a copy of delivery receipt confirmation in the SWPPP.

6. Local Government SWPPP Review. When local government or the CGP Part 2.1.4, requires local government review:

   a. Transmit a copy of the Department-approved SWPPP and other information as required to local government, with the required fee. Use delivery receipt confirmation;

   b. Transmit a copy of the delivery receipt confirmation to the Engineer within seven days of receiving the confirmation;

   c. Transmit a copy of any comments by the local government to the Engineer within seven days of receipt;

   d. Amend the SWPPP as necessary to address local government comments and transmit SWPPP Amendments to the Engineer within seven days of receipt of the comments;

   e. Include a copy of local government SWPPP review letter in the SWPPP; and

   f. File a notification with local government that the project is ending.

7. Modifying Contractor's eNOI. When required by the CGP Part 2.7, modify your eNOI to update or correct information within 30 calendar days of the change. Reasons for modification are found in the CGP Part 2.7.1. The Contractor must submit an eNOT instead of an eNOI modification when the operator has changed. The new operator must file an eNOI to obtain permit coverage.

641-1.04 PERSONNEL QUALIFICATIONS. Provide documentation in the SWPPP that the individuals serving in these positions meet the personnel qualifications. The Department accepts the following certificates as equivalent to AK-CESCL: CPESC, Certified Professional in Erosion and Sediment Control or CISEC, Certified Inspector in Sediment and Erosion Control, which are found in the CGP Appendix C and repeated below.

Table 641-1.04 Personnel Qualifications

Personnel Title	Required Qualifications
SWPPP Preparer	Current certification as a Certified Professional in Erosion and Sediment Control (CPESC); OR Current certification as AK-CESCL, and at least two years' experience in erosion and sediment control, as a SWPPP Manager or SWPPP writer, or equivalent. OR Professional Engineer registered in the State of Alaska with current certification as AK-CESCL.
Superintendent	Current AK-CESCL or substitute training from CGP Appendix C Qualified Person Table 4
SWPPP Manager	Current AK-CESCL or substitute training from CGP Appendix C Qualified Person Table 4

Personnel Title	Required Qualifications
Active Treatment System Operator	Current AK-CESCL or substitute training from CGP Appendix C Qualified Person Table 4. ATS operator should possess a recognized certification, or professional standing, or who by extensive knowledge, training, and experience has successfully demonstrated the ability to meet the ATS requirement.

641-1.05 SIGNATURE/CERTIFICATION REQUIREMENTS AND DELEGATIONS.

1. eNOI and eNOT. The eNOI, eNOT, and eNOI Modifications must be signed and certified by a responsible corporate officer according to CGP Appendix A, Part 1.12. Signature and certification authority for the eNOI and eNOT cannot be delegated.

2. Delegation of Signature Authority for Other SWPPP Documents and Reports. Use Form 25D-108 to delegate signature authority and certification authority to the Superintendent position, according to CGP Appendix A, Part 1.12.3, for the SWPPP, inspection reports and other reports required by the CGP. The Superintendent position is responsible for signing and certifying the SWPPP, inspection reports, and other reports required by the CGP, except the eNOI, eNOI Modifications, and eNOT.

   The Engineer will provide the Department's delegation on Form 25D-107, which the Contractor must include in the SWPPP.

3. Subcontractor Certification. Subcontractors must certify on Form 25D-105, that they have read and will abide by the CGP and the conditions of the project SWPPP.

4. Signatures and Initials. Where documents are completed in SWPPPTrack, utilize SWPPPTrack to sign and initial documents. When documents are not completed in SWPPPTrack (e.g. Form 25D-111 SWPPP Certification for Contractor), upload scanned copies after signing and initialing the documents into SWPPPTrack.

641-1.06 RESPONSIBILITY FOR STORM WATER PERMIT COVERAGE.

1. The Department and the Contractor are jointly responsible for permitting and permit compliance within the Project Zone.

2. The Contractor is responsible for permitting and permit compliance for all construction support activity in the Project Zone and outside the Project Zone. The Contractor has sole responsibility for compliance with DEC, COE and other applicable federal, state, and local requirements, and for securing all necessary clearances, rights, and permits. The Contractor shall be responsible for protection, care, and upkeep of all work, and all associated off-site zones. Subsection 107-1.02 describes the requirement to obtain permits, and to provide permit documents to the Engineer.

3. The Contractor is responsible for obtaining an Excavation Dewatering Permit (AKG002000) if construction activities are within 1,500 feet of a DEC-identified contaminated site or groundwater plume.

4. An entity that owns or operates, a commercial plant (as defined in Subsection 108-1.01.4) or material source or disposal site outside the Project Zone, is responsible for permitting and permit compliance. The Contractor has sole responsibility to verify that the entity has appropriate permit coverage. Subsection 107-1.02 describes the requirement to obtain permits, and to provide permit documents to the Engineer.

5. The Department is not responsible for permitting or permit compliance, and is not liable for fines resulting from noncompliance with permit conditions:

    a. For areas outside the Project Zone;
    b. For Construction Activity and Support Activities outside the Project Zone; and
    c. For commercial plants, commercial material sources, and commercial disposal sites.

641-1.07 UTILITY. (Reserved for Regions)

641-1.08 USE OF SWPPPTRACK. The Contractor is responsible for purchasing and contracting with Storm Water Simplified Ltd. for the use of the SWPPPTrack software application and services until final stabilization is achieved and the eNOT has been completed. Contact SWPPPTrack Alaska Support at (888) 401-1993 or AKSupport@SWPPPTrack.com for project fees, setup coordination, device requirements, and training.

Perform and document all inspections required by the CGP and the SWPPP with SWPPPTrack and populate all inspection fields accurately to represent current project conditions. Complete the following forms using SWPPPTrack:

1. SWPPP Construction Site Inspection Report (25D-100)

2. SWPPP Grading & Stabilization Activities Log (25D-110)

3. SWPPP Corrective Action Log (25D-112)

4. SWPPP Amendment Log (25D-114)

5. SWPPP Daily Record of Rainfall (25D-115)

6. SWPPP Training Log (25D-125)

7. SWPPP Project Staff Tracking (25D-127)

641-2.01 STORM WATER POLLUTION PREVENTION PLAN (SWPPP) REQUIREMENTS.

1. SWPPP Preparer and Pre-Construction Site Visit.

    Use a SWPPP Preparer to develop the SWPPP in accordance with the CGP, DEC and Department SWPPP templates. See Subsection 641-1.02.01 for guidance and templates. The SWPPP Preparer must conduct a pre-construction inspection at the Project Site before Construction Activity begins. If the SWPPP Preparer is not a Contractor employee, the SWPPP Preparer must visit the site accompanied by the Contractor. Give the Department at least seven days advance notice of the site visit, so that the Department may participate.

    Document the SWPPP Preparer's pre-construction inspection in the SWPPP on Form 25D-106, SWPPP Pre-Construction Site Visit, including the names of attendees and the date.

2. Developing the SWPPP.

    Use the Department's ESCP, Environmental commitments, and other Contract documents as a starting point for developing the SWPPP.

    Develop the SWPPP with sections and appendices, according to the DEC CGP SWPPP template and DOT&PF SWPPP template. Include information required by the Contract and described in the CGP Part 5.0. Use SWPPP forms found at the DOT&PF Construction Forms website.

Compile the SWPPP in three ring binders with tabbed and labeled dividers for each appendix. One electronic copy of the SWPPP must be submitted as a single PDF file.

3. SWPPP Considerations and Contents.

   a. The SWPPP must provide erosion and sediment control measures for all Construction Activity within the Project Zone. Construction Activity outside the Project Zone must have permit coverage and document permit compliance according to a SWPPP2.

   b. The SWPPP must consider the activities of the Contractor and all subcontractors and utility companies performing work in the Project Zone. The SWPPP must describe the roles and responsibilities of the Contractor, subcontractors, utility companies, and the Department with regard to implementation of the SWPPP. The SWPPP must identify all operators for the project, including utility companies performing Construction Activity, and identify the areas:

      (1) Over which each operator has operational control, and;

      (2) Where the Department and Contractor are co-operators.

   c. For work outside the Project Zone the SWPPP must identify the entity that has stormwater permit coverage, the operator, and the areas that are:

      (1) Dedicated to the project and where the Department is not an operator; and

      (2) Not dedicated to the project, but used for the project.

   d. The SWPPP must meet all CGP requirements. Utilize the DEC CGP SWPPP Template in conjunction with the DOT&PF SWPPP Template to develop the SWPPP.

   e. Comply with the CGP Part 1.4.3 Authorized Non-Storm Water Discharges.

   f. If the project discharges to a Tier III, Outstanding Natural Resource Water, comply with CGP Part 2.1.6. Submittal deadlines apply prior to filing an eNOI and beginning construction activities. As noted, none have been designated in the state of Alaska as of the issuance of the 2021 CGP.

   g. There are special requirements in the CGP Part 3.2, for stormwater discharges into an impaired water body, and they may include monitoring of stormwater discharges. The Contractor is responsible for monitoring and reporting outside the Project Zone.

   h. Describe the sequence and timing of activities that disturb soils and BMP implementation and removal. Phase earth disturbing activities to minimize unstabilized areas, and to achieve temporary or final stabilization. Whenever practicable incorporate final stabilization work into excavation, embankment and grading activities. Include drawings showing each phase of the project with the BMPs implemented in the phase.

   i. Delineate the site according to CGP Part 4.2.1.

   j. Minimize the amount of soil exposed and preserve natural topsoil on site, unless infeasible according to the CGP Part 4.2.2.

   k. Describe methods and time limits, to initiate temporary or final soil stabilization. Comply with stabilization requirements in the CGP Part 4.5.

   l. If construction will cease during winter months, describe all requirements for winter shutdown according to the CGP Part 4.12.

   m. Plans for ATS must meet with the requirements in the CGP Part 2.1.5 and 4.6.

n. Design all temporary BMPs to accommodate a two year 24-hour storm event. All installed control measures must be described and documented in the SWPPP, according to the CGP Part 5.3.6. All installed BMPs must include a citation from a published BMP Manual, publication, or manufacturers specification used as a source, or include a statement "No BMP Manual was used for this design." If using out of state BMPs follow the instructions in the SWPPP Guide, found at the DOT&PF Stormwater webpage.

o. Provide a legible site map or set of maps in the SWPPP, showing the entire site and identifying boundaries of the property where construction and earth-disturbing activities will occur. Include all the elements described in the CGP Part 5.3.5, and DEC CGP SWPPP Template Section 5.0.

p. Identify the inspection frequency in the SWPPP according to the CGP Part 6.1.

q. Linear Project Inspections, described in CGP Part 6.5, are not applicable to this contract.

r. The SWPPP must cite and incorporate applicable requirements of the project permits, environmental commitments, COE permit, and commitments related to historic preservation. Make additional consultations or obtain permits as necessary for Contractor specific activities that were not included in the Department's permitting and consultation.

s. The SWPPP is a dynamic document. Keep the SWPPP current by noting installation, modification, and removal of BMPs, and by using amendments, SWPPP amendment logs, inspection reports, corrective action logs, records of land disturbance and stabilization, and any other records necessary to document stormwater pollution prevention activities and to satisfy the requirements of the CGP and this specification. See Subsection 641-3.03 for more information.

4. Recording Personnel and Contact Information in the SWPPP.

Identify the SWPPP Manager as the Storm Water Lead and Stormwater Inspector positions in the SWPPP. Document the SWPPP Manager's responsibilities in Section 2.0 Stormwater Contacts, of the SWPPP template and:

a. Identify that the SWPPP Manager does not have authority to sign inspection reports (unless the SWPPP Manager is also the designated project Superintendent).

b. Identify that the SWPPP Manager cannot prepare the SWPPP unless the SWPPP Manager meets the Contract requirements for the SWPPP Preparer.

Include in the SWPPP proof of AK-CESCL or equivalent certifications for the Superintendent and SWPPP Manager, and for any acting Superintendent and acting SWPPP Managers. If the Superintendent or SWPPP Manager is replaced permanently or temporarily, by an acting Superintendent or acting SWPPP Manager; record in the SWPPP (use Form 25D-127) the names of the replacement personnel and date of replacement. For temporary personnel, record their beginning and ending dates.

Provide 24-hour contact information for the Superintendent and SWPPP Manager. The Superintendent and SWPPP Manager must have 24-hour contact information for all Subcontractor SWPPP Coordinators and Utility SWPPP Coordinators.

Include in the SWPPP proof of AK-CESCL or equivalent certifications of ATS operators. Record names of ATS operators and their beginning and ending dates, on Form 25D-127.

The Department will provide proof of AK-CESCL, or equivalent certifications for the Department's Project Engineer, Stormwater Inspectors, and Monitoring Person (if applicable), and names and dates they are acting in that position. Include the Department's staff certifications in Appendix E. Include Department's staff names, dates acting, and assignments in Section 2.0 of the SWPPP and Form 25D-127.

641-2.02 HAZARDOUS MATERIAL CONTROL PLAN (HMCP) REQUIREMENTS.

Prepare the HMCP using the Department template for the prevention of pollution from storage, use, containment, cleanup, and disposal of all hazardous material, including petroleum products related to construction activities and equipment. Include the HMCP as an appendix to the SWPPP. Compile Material Safety Data Sheets in one location and reference that location in the HMCP.

641-2.03 SPILL PREVENTION, CONTROL AND COUNTERMEASURE PLAN (SPCC Plan) REQUIREMENTS.

Prepare and implement an SPCC Plan when required by 40 CFR 112 when both of the following conditions are present on the project:

1. Oil or petroleum products from a spill may reach navigable waters (as defined in 40 CFR 112); and

2. Total above ground storage capacity for oil and any petroleum products is greater than 1,320 gallons (not including onboard tanks for fuel or hydraulic fluid used primarily to power the movement of a motor vehicle or ancillary onboard oil-filled operational equipment, and not including containers with a storage capacity of less than 55 gallons).

Reference the SPCC Plan in the HMCP and SWPPP.

641-2.04 RESPONSIBILITY AND AUTHORITY OF THE SUPERINTENDENT AND SWPPP MANAGER.

The Superintendent shall certify the SWPPP, inspection reports, and other reports required by the CGP, except the eNOI and eNOT. The Superintendent may not delegate the task or responsibility of signing and certifying these documents.

The Superintendent may assign certain duties to the SWPPP Manager.

1. Ensuring Contractor's and subcontractor's compliance with the SWPPP and CGP;

2. Ensuring the control of erosion, sedimentation, or discharge of pollutants;

3. Directing and overseeing installation, maintenance, and removal of BMPs;

4. Performing inspections; and

5. Updating the SWPPP including adding amendments and forms.

When Bid Item 641.0007.____ is part of the Contract, the SWPPP Manager must be a different person than the Superintendent and must be available at all times to administer SWPPP requirements, and be physically present within the Project Zone or the project office, when construction activities are occurring.

The Superintendent and SWPPP Manager shall be knowledgeable in the requirements of Section 641, the SWPPP, CGP, BMPs, HMCP, SPCC Plan, environmental permits, environmental commitments.

The Superintendent and SWPPP Manager shall have the Contractor's complete authority and be responsible for suspending construction activities that do not conform to the SWPPP or CGP.

641-2.05 MATERIALS.

Use materials suitable to withstand hydraulic, wind, and soil forces, and to control erosion and trap sediments according to the requirements of the CGP and the Specifications.

Use the seed mixture specified in the contract or as directed by the Engineer.

Use soil stabilization material as specified in Section 727.

Use silt fences as specified in Section 729.

Use straw and straw products certified weed free of prohibited and restricted noxious weed seed and quarantined pests, according to Alaska Administrative Code, Title 11, Chapter 34 (11 AAC 34). When straw or straw products certified according to 11 AAC 34 are not available, use non-certified products manufactured within Alaska before certified products manufactured in another state, country, or territory. Non-certified straw or straw products manufactured in another state, country, or territory shall not be used. Grass, legumes, or any other herbaceous plants produced as hay, shall not be substituted for straw or straw products.

641-3.01 CONSTRUCTION REQUIREMENTS.

Comply with the SWPPP and the requirements of the CGP Part 5.0.

1. Before Construction

   The following actions must be completed before Construction Activity begins:

   a. The SWPPP Preparer must visit the project, the visit must be documented in the SWPPP using Form 25D-106, and the SWPPP must be developed or amended with findings from the visit.

   b. The SWPPP must be approved by the Engineer on Form 25D-109.

   c. The Contractor must be authorized to begin work by the Engineer.

   d. The Project must have an eNOI for the Department and for the Contractor.

   e. The Department approved SWPPP must be submitted to DEC and Local Government per CGP Part 2.1.2, Part 2.1.4, and Part 2.4.1.

   f. The Contractor has transmitted to the Engineer an electronic copy of the approved SWPPP.

   g. The Delegation of Authority forms 25D-108 and 25D-107 for both the Contractor and Engineer are signed.

   h. Main entrance signage must meet requirements of CGP Part 5.10.2.

      Post notices on the outside wall of the Contractor's project office, and near the main entrances of the construction project. Protect postings from the weather. Locate postings so the public can safely read them without obstructing construction activities or the traveling public (for example, at an existing pullout). Do not use retroreflective signs for the SWPPP posting. Do not locate SWPPP signs in locations where the signs may be confused with traffic control signs or devices. Update the notices if the listed information changes.

   i. Track precipitation according to CGP Part 7.3.9. Submit the method to track precipitation to the Engineer for approval.

   j. Complete all setup and training required to implement SWPPPTrack.

   k. Complete the upload of the BMP inventory into SWPPPTrack.

2. During Construction.

   a. Delineate the site according to the CGP Part 4.2.1.

b. Install required BMPs according to the SWPPP prior to the initiation of ground disturbance.

c. Document subcontractors. Provide a copy of the SWPPP and the CGP to all subcontractors and utility companies before they begin soil disturbing activities, and verify they understand and comply the with SWPPP and CGP and:

(1) Document all subcontractors and utility companies that may work on the site, according to the CGP Part 5.3.1, and SWPPP Section 1.2.

(2) Require subcontractors and utility companies to sign the SWPPP Subcontractor Certification (Form 25D-105). Include in the signed Form in the SWPPP Appendix E.

(3) Inform subcontractors and utility companies in a timely manner of SWPPP amendments that affect them. Coordinate with subcontractors and utility companies to protect BMPs, including temporary and final stabilization from damage.

(4) Notify the Engineer immediately if the actions of any utility company or subcontractor do not comply with the SWPPP and the CGP.

d. Provide ongoing training to all employees, subcontractors and utility companies, in according to the CGP Part 4.14. Training must:

(1) Be given no less than once a month during construction activity;

(2) Be documented in the SWPPP Training Log using Form 25D-125. Include the training record in the SWPPP Appendix I.

e. Protection and Restoration. Comply with Subsection 107-1.11.

f. Good housekeeping measures to comply with the SWPPP and CGP 4.8.

g. Control measures. Comply with the SWPPP and CGP Part 5.3.6 including:

(1) Maintain BMPs.

(2) Comply with requirements of the HMCP and SPCC Plan, if applicable and all local, state and federal regulations that pertain to the handling, storage, containment, cleanup, and disposal of petroleum products or other hazardous materials.

(3) Keep the SWPPP and HMCP current (refer to Subsection 641-2.01.3, SWPPP Considerations and Contents).

3. Winter Construction

If winter construction activity occurs, the project must have appropriate BMPs in place CGP Part 4.12.2. Inspections can be reduced to once per month if the project meets the requirements in the CGP Part 6.2.4.

4. Storm Water Discharge Pollutant Reporting Requirements.

If an incident of non-compliance occurs that may endanger health or the environment a report must be made, CGP, Appendix A, Part 3.4.

A permit non-compliance is considered any type of pollutant, such as turbidity or petroleum that enters storm water runoff and flows into a receiving water body, MS4, or wetland that is connected to waters of the U.S.

a. Immediately report the incident to the Engineer verbally;

b. Report to DEC verbally within 24 hours after the permittee becomes aware of the incident, and;

c. Report to DEC in writing within five days after the permittee becomes aware of the circumstances. To report in writing, complete the written noncompliance report on Form 25D-143, and file the written report with DEC. Coordinate the report with the Engineer. Include in the report:

(1) A description of the noncompliance and its causes;

(2) The exact dates and times of noncompliance;

(3) If not yet corrected the anticipated time the project will be brought back into compliance, and;

(4) The corrective action taken or planned to reduce, eliminate and prevent reoccurrence.

d. Notify the Engineer immediately if there is incident of noncompliance with COE Permits. The Engineer will notify the COE.

5. Hazardous Materials Reporting Requirements.

Any release of a hazardous substance must be reported immediately to the Engineer as soon as the person has knowledge of the discharge.

Report spills of petroleum products or other hazardous materials to the Engineer and other agencies as required by law, and according to CGP Part 9.3.

a. To water; any amount released must be reported immediately to the Engineer, DEC, and the Coast Guard.

b. To land:

(1) Any release of a petroleum product in excess of 55 gallons must be reported as soon as the person has knowledge of the discharge CGP Part 9.3.2.

(2) Any release of a petroleum product in excess of 10 gallons but less than 55 gallons must be reported to the Engineer and must be reported to DEC within 48 hours after the person has knowledge of the discharge CGP Part 9.3.2.

(3) Any release of a petroleum product in excess of 1 gallon to 10 gallons must be recorded and logged and provided to DEC on a monthly basis.

c. Use the HMCP and SPCC Plan (if available) for contact information to report spills to regulatory agencies.

d. Implement measures to prevent the reoccurrence of and to respond to such releases.

e. Prior to disposal of contaminated material, submit a Contaminated Media Transport and Treatment Disposal Approval Form to DEC Spill Prevention and Response. Dispose as approved by DEC.

6. Corrective Action and Maintenance of BMPs.

Implement maintenance as required by the CGP Part 4.13 and Part 8.0, SWPPP, and manufacturer's specifications, whichever is more restrictive.

a. Implement corrective action to comply with the CGP Part 8.0 and the SWPPP.

b. Corrective action deadlines and documentation:

(1) Corrective actions must be completed according to CGP Part 8.2.

(2) Document corrective actions in the Corrective Action Log (25D-112) according to the SWPPP, CGP Part 8.3 and Part 5.9.2.

If a different BMP is installed to correct the condition leading to the corrective action a SWPPP Amendment must be completed.

(3) If a corrective action is not completed according to the CGP 8.2, document the conditions in the Corrective Action Log, notify the Engineer, and implement the corrective action as soon as possible.

The Engineer may assign a new complete-by date using a Delayed Action Item Report, Form 25D-113 (DAIR Form), if the Contractor is unable to complete the corrective action within the required timeframe. The DAIR Form can only be authorized and completed by the Engineer.

7. Stabilization.

a. All Soil Stabilization requirements must be met in accordance with CGP Part 4.5 and the SWPPP.

b. When temporary or permanent seeding is required, provide a working hydro seeding equipment located within 100 miles of the project by road; with 1,000 gallon or more tank capacity, paddle agitation of tank, and the capability to reach the seed areas with an uniform mixture of water, seed, mulch and tackifier. If the project is located in an isolated community, the hydro-seeder must be located at the project.

c. Apply temporary seed and stabilization measures after preparing the surface to reduce erosion potential and to facilitate germination and growth of vegetative cover according to Section 618.

d. Apply permanent seed and stabilization measures after land-disturbing activity has permanently ceased. Comply with the CGP, SWPPP, and the contract Sections 618, 724, and 727.

e. Incorporate final or temporary stabilization immediately after installing culverts or drainage structures to satisfy CGP Part 4.5, the SWPPP and the Engineer. Stabilize under any bridges, and in areas upstream and downstream of culverts, drainages and areas disturbed by related construction activities after installation, or before deactivating stream bypass or diversion.

f. Stabilization before Fall Freeze up and Spring Thaw.

Stabilize Construction Activities within the Project Zone with appropriate BMPs prior to the anticipated date of fall freeze up, in accordance with the SWPPP and CGP, Part 4.12.

Exceptions to stabilization prior to anticipated date of fall freeze up include:

(1) Where temporary stabilization activities are precluded by snow cover or frozen ground conditions prior to the anticipated date of fall freeze up, stabilization measures must be initiated as soon as practicable following the actual spring thaw.

(2) When winter construction activity is authorized by the Engineer and conducted according to the contract.

8. Ending CGP Coverage.

a. The Engineer will determine the date that all the following conditions for ending CGP coverage have been met within the Project Zone:

(1) Land disturbing activities have ceased;

(2) Final Stabilization has been achieved on all portions of the Project Zone, according to the CGP 4.5.2 (including at Department furnished material sources, disposal sites, staging areas, equipment areas, etc.), and;

(3) Temporary BMPs have been removed.

b. After the Engineer has determined the conditions have been met for submitting an NOT in accordance to CGP Part 10.2, the Department will:

(1) Send written notice to the Contractor with the date that the conditions were met;

(2) Submit an eNOT to DEC within 30 days, and;

(3) Provide a copy of the eNOT and DEC's acknowledgement letter to the Contractor.

c. If the Contractor's CGP eNOI acreage includes Support Activities and any other areas where the Department is not an Operator, the Contractor may not be able to file an eNOT at the same time as the Department.

d. The Contractor must submit a copy of each signed eNOT and DEC's acknowledgement letter to the Department within three days of filing the eNOT or receiving a written response. Insert the eNOT and DEC acknowledgement letter in SWPPP Appendix Q.

e. The Contractor is responsible for coordinating local government inspections of work and ending permit coverage with local government. See Subsection 641-1.03.6 for more information.

9. Ending BMP Maintenance in the Project Zone.

The Contractor is responsible for continuing inspections, BMP maintenance and SWPPP updates until permit coverage is ended.

10. Transmit final SWPPP.

Transmit one electronic copy of the final SWPPP, including all SWPPP documents, to the Engineer, when the Contractor's eNOT is filed, or within 30 days of the Department's eNOT being filed, whichever is sooner. Collate all documents into a single electronic file before transmittal.

641-3.02 SWPPP DOCUMENTS, LOCATION ON-SITE, AVAILABILITY, AND RECORD RETENTION.

The SWPPP and related documents maintained by the Contractor are the record for demonstrating compliance with the CGP. Copies of SWPPP documents transmitted to the Engineer under the requirements of this specification are informational and do not relieve the Contractor's responsibility to maintain complete records as required by the CGP and this specification.

Keep the SWPPP, HMCP and SPCC Plan if applicable at the on-site project office. If there is not an on-site project office, keep the documents at a locally available location that meets CGP requirements and is approved by the Engineer. Records may be moved to another office for record retention after the eNOTs are filed. Records may be moved to another office during winter shutdown. Update on-site postings if records are relocated during winter shutdown. Provide the Department with copies of all records.

Retain records and a copy of the SWPPP, for at least three years after the date of eNOT according to the CGP Part 9.4.

The SWPPP and related documents must be made available for review and copy, to the Department and other regulatory agencies that request them. See CGP Parts 5.10, 6.6 and 9.5.

641-3.03 SWPPP INSPECTIONS, AMENDMENTS, REPORTS, AND LOGS.

Perform inspections, prepare Inspection Reports, and prepare SWPPP Amendments in compliance with the SWPPP and the CGP using Department forms found at the DOT&PF Construction Forms website.

1. Inspection during Construction.

   Conduct Inspections according to the schedule and requirements of the SWPPP and CGP Part 6.0. When the project is on a 14 calendar day inspection frequency, conduct Post-Storm Event Inspections within 24 hours of the end of a storm event, as required, in addition to the 14 day predetermined inspection cycle.

   Inspections required by the CGP and SWPPP must be performed by the Contractor's SWPPP Manager and the Department's Stormwater Inspector jointly, unless approved by the Engineer, when:

   a. One of the inspectors is not on site, access is only by air, and weather delayed or canceled flights;

   b. One of the inspectors is sick;

   c. The project is on a reduced frequency inspection schedule with no staff on site, the only access to the site is by air, and it is economical to send only one inspector, or;

   d. When the Engineer determines a safety concern that makes joint inspection impracticable.

   When this is the case, the Operator who conducts the inspection must provide a copy of the Inspection Report to the other Operator within three days of the inspection date and document the date of the report transmittal in SWPPP Appendix K.

2. Inspection Reports.

   Use only the Department SWPPP Construction Site Inspection Report, Form 25D-100, to record inspections. Changes or revisions to Form 25D-100 are not permitted, except for adding or deleting data fields that list Location of Discharge Points and Site Specific BMPs. Complete all fields in the Inspection Report; do not leave any fields blank.

   Refer to the DOT&PF Construction Forms webpage for instruction to complete Form 25D-100.

   The Superintendent or SWPPP Manager must review and correct all errors within three days of the date of inspection.

   Inspection Reports must be signed by the person described in the CGP Appendix A, Part 1.12 or by a duly authorized representative of that person. Only the Superintendent can certify the Inspection Form.

   Insert a Complete-by-Date for each corrective action listed that complies CGP Part 8.2.

   Provide a copy of the completed, unsigned Inspection Report to the Engineer by the end of the next business day following the inspection.

   The Engineer may coordinate with the Superintendent to review and correct any errors or omissions before the Superintendent signs the report. Corrections are limited to adding missing information or correcting entries to match field notes and conditions present at the time the inspection was performed. The signed and certified Inspection Report must be provided to the Engineer on the same day the Superintendent signed the form.

   The Engineer will sign and certify the Inspection Report and will return the original to the Contractor within three working days if compliant with the CGP and SWPPP.

If the Inspection Report is not compliant with the CGP or SWPPP the Engineer may make corrections after the Superintendent has signed and certified the Inspection Report. The Engineer will initial and date each correction. If the Engineer makes corrections, the Superintendent must recertify the Inspection Report by entering a new signature and date in the white space below the original signature and date lines. Send a copy of the recertified Inspection Report to the Engineer on the day it is recertified.

When a correction is required to an Inspection Report that was already certified by both the Superintendent and Engineer, follow directions given below:

If subsequent corrections are required for a certified Inspection Report 25D-100, document the corrections in an addendum memo that addresses only the omitted or erroneous portions of the original Inspection Report. The Superintendent and the Engineer must both sign and certify the updated Inspection Report and addendum memo. File the corresponding Inspection Report and memo in the SWPPP Appendix K and update the amendment log. The issuance of an addendum memo does not relieve the Contractor of liquidated damages that may have been incurred as a result of the error on the original certified inspection report.

3. Items and Areas to Inspect.

Conduct inspections of all areas required by the CGP Part 6.4 and SWPPP.

4. Reduced Inspection Frequencies.

Conduct inspections according to the inspection schedule indicated in the approved SWPPP. Any change in inspection frequency must be approved by the Engineer, and beginning and ending dates documented as an amendment to the SWPPP.

If the Engineer approves and the entire site is stabilized, the frequency of inspections may be reduced in accordance to the CGP Part 6.2.1. At actively staffed sites, inspect within two business days of the end of a storm event that results in a discharge from the site.

5. Winter Shutdown Inspection.

Conduct winter shutdown inspection 14 calendar days after the anticipated fall freeze up date and conditions under the CGP Parts 4.12, 6.2.3, and the SWPPP are met. The Engineer may approve suspension of inspections and waive requirements for updating the Grading and Stabilization Activities Log and Daily Record of Rainfall Form during Winter Shutdown.

Inspections must resume on a regular frequency or reduced inspection frequency identified in the SWPPP, at least 21 days before anticipated spring thaw CGP Part 6.2.3. Resume updating the Daily Record of Rainfall Form at the start of the 21-day spring thaw inspection.

6. Inspection before Project Completion.

Conduct inspection to ensure Final Stabilization is complete throughout the Project, and temporary BMPs that are required to be removed are removed. Temporary BMPs that are biodegradable and are specifically designed and installed with the intent of remaining in place until they degrade, may remain in place after project completion if approved by the Project Engineer.

7. SWPPP Amendments and SWPPP Amendment Log.

The SWPPP Amendment Log Form 25D-114 must be filled out by an individual who holds a current AK-CESCL, or equivalent certification. The Superintendent or the SWPPP Manager must sign and date amendments to the SWPPP and updates to the SWPPP Amendment Log.

SWPPP Amendments must be approved by the Engineer.

Amendments must occur:

a. Whenever there is a change in design, construction operation, or maintenance at the construction site that has or could cause erosion, sedimentation or the discharge of pollutants that has not been previously addressed in the SWPPP;

b. If an inspection identifies that any portion of the SWPPP is ineffective in preventing erosion, sedimentation, or the discharge of pollutants;

c. Whenever an inspection identifies a problem that requires additional or modified BMPs or a BMP not shown in the original SWPPP is added;

d. If the inspection frequency is modified (note beginning and ending dates);

e. When there is a change in personnel who are named in the SWPPP, according to Subsection 641-2.01;

f. When an inspection is not conducted jointly;

g. When a NOI modification is filed;

h. When a Noncompliance Report is filed with DEC.

Place all correspondence with DEC, EPA or MS4s in Appendix Q.

Amend the SWPPP as soon as practicable after any change or modification, but in no case later than seven days following identification of the need for an amendment. All SWPPP Amendments must have an amendment number, be dated, and signed.

Keep the SWPPP Amendment Log current. Prior to a scheduled inspection or submittal of an inspection, submit to the Engineer a copy of the pages of the Amendment Log that contain new entries since the last submittal. Include copies of any documents amending the SWPPP.

Keep the SWPPP Amendment Log in Appendix M.

8. Site Maps.

Maintain site maps in accordance with CGP Part 5.3.5 and the SWPPP template 5.0. It is acceptable to have separate site maps for BMPs and grading and stabilization activities.

9. Corrective Action Log.

The Superintendent and SWPPP Manager are the only persons authorized to make entries on the SWPPP Corrective Action Log, Form 25D-112.

The Corrective Action Log must document corrective actions required by the conditions listed in the CGP Part 8.0. Document the need for corrective action within 24 hours of either:

a. Identification during an inspection, or;

b. Discovery by the Department’s or Contractor’s staff, a subcontractor, or a regulatory agency inspector;

c. If a corrective action is discovered outside of an inspection, update the log with the date of discovery, the proposed corrective action, and the date the corrective action was completed.

Keep the Corrective Action Log current and submit a copy to the Engineer prior to performing each scheduled SWPPP Inspection.

Keep the Corrective Action Log in Appendix J of the SWPPP.

10. Grading and Stabilization Activities Log.

    The Superintendent and SWPPP Manager are the only persons authorized to date and initial entries on the SWPPP Grading and Stabilization Activities Log, Form 25D-110. Use the SWPPP Grading and Stabilization Activities Log, to record land disturbance and stabilization activities.

    Keep the Grading and Stabilization Activities Log current and submit a copy to the Engineer prior to performing each scheduled SWPPP Inspection. Keep the Grading and Stabilization Activities Log organized and completed to demonstrate compliance with the CGP Part 4.5.

    Keep the Grading and Stabilization Activities Log in Appendix G of the SWPPP.

11. Daily Record of Rainfall.

    Use SWPPP Daily Record of Rainfall, Form 25D-115 to comply with CGP Part 7.3.9. Submit a copy to the Engineer with each completed Inspection Report. Keep the Daily Record of Rainfall current in Appendix N of the SWPPP.

    For projects on a 14-day inspection frequency or reduced inspection frequency, SWPPPTrack will generate a precipitation alert for storm events that produce more than 0.5 inch of rainfall in 24 hours. If a storm event does not produce a discharge from the project zone, submit an explanation in response to the SWPPPTrack precipitation alert.

12. Staff Tracking Log.

    Use the SWPPP Project Staff Tracking Form 25D-127, to identify project staff that are required to be AK-CESCL certified or hold an equivalent qualification CGP Appendix C. Complete this form to document the following positions; Superintendent, SWPPP Manager, Engineer, DOT&PF Stormwater Inspector, and when positions have changed in personnel, either permanent or temporary. Update the SWPPP Project Staff Tracking Form within 24-hours of any changes in personnel, qualifications, or other staffing items related to administration of the CGP or Section 641.

641-3.04 FAILURE TO PERFORM WORK.

The Engineer has authority to suspend work and withhold monies according to Subsections 105-1.01 and 108-1.06 for the reasons listed under Subsection 108-1.06 and for an incident of noncompliance with the CGP or SWPPP that may endanger health or the environment or for failure to perform work related to Section 641.

1. An incident of noncompliance includes, but is not limited to, the Contractor's failure to:

    a. Obtain appropriate permits before Construction Activities occur;

    b. Perform SWPPP administration;

    c. Perform timely inspections;

    d. Update the SWPPP;

    e. Transmit updated SWPPP, Inspection Reports, and other updated SWPPP forms to the Engineer;

f. Maintain effective BMPs to control erosion, sedimentation, and pollution in accordance with the SWPPP, the CGP, and applicable local, state, and federal requirements;

g. Perform duties according to the requirements of Section 641;

h. Meet requirements of the CGP, SWPPP, or other permits, laws, and regulations related to erosion, sediment, or pollution control, or;

i. Any other requirements established or included in the contract.

2. No additional Contract time or additional compensation will be allowed due to delays caused by the Engineer's suspension of work.

641-3.05 ACCESS TO WORK.

The Project, including any related off-site areas or support activities, must be made available for inspection, or sampling and monitoring, by the Department and other regulatory agencies. See CGP Part 6.6.

641-4.01 METHOD OF MEASUREMENT. See Section 109 and as follows:

Items 641.0001.____, 641.0003.____ and 641.0007.____, are lump sum.

Items 641.0002.____, 641.0004.____ and 641.0005.____, measured on a contingent sum basis as specified by the Directive authorizing the work.

Item 641.0006.____ measured on a contingent sum basis with withholding determined by the Department.

TABLE 641-1 BMP VALUES – RESERVED

Liquidated Damages assessed according to Table 641-2 are not an adjustment to the Contract amount. These damages charges are related to Contract performance but are billed by the Department to the Contractor, independent of the Contract amount. An amount equal to the Liquidated Damages may be withheld for unsatisfactory performance, from payment due under the Contract, until the Contractor remits payment for billed Liquidated Damages.

TABLE 641-2 - VERSION C
EROSION, SEDIMENT AND POLLUTION CONTROL – LIQUIDATED DAMAGES

Code	Specification Section Number and Description	Deductible Amount in Dollars	Cumulative Deductible Amounts in Dollars
A	641-1.05 Failure to have a qualified (AK-CESCL or equivalent) SWPPP Manager	Calculated in Code B or F	
B	Failure to meet SWPPP requirements of: (1) 641-2.01.1 Name of SWPPP Preparer (2) Not Applicable (3) 641-3.03.8 Sign and Date SWPPP amendments by qualified person (4) 641-3.02 Records maintained at project and made available for review	$750 per omission	
C	Not Applicable		
D	641-3.03.5 Failure to stabilize a Project prior to fall freeze up.	$5,000 per Project per year	
E	641-2.01.1 Failure to conduct pre-construction inspections before Construction Activities on all projects greater than 1 acre.	$2,000 per Project	
F*	641-3.03. Failure to conduct and record CGP Inspections 641-3.03.1 Personnel conducting Inspections and Frequency 641-3.03.2 Inspection Reports, use Form 25D-100, completed with all required information	$750 per Inspection	Additional $750 for every additional 7 day period without completing the required inspection.
G	641-3.01.4 Corrective action, failure to timely accomplish BMP maintenance and/or repairs. In effect until BMP maintenance and/or repairs is completed.	$500 per Project per day	
H	641-3.01.3 Failure to provide to the Engineer and DEC a timely oral noncompliance report of violations or for a deficient oral noncompliance report	$750 for the first day the report is late or deficient	Additional $750 for every 14 day period with- out the required information
I	641-3.01.3 Failure to provide to the Engineer and DEC a timely written noncompliance report, use Form 25D-143, of violations or for a deficient written noncompliance report	$750 for the first day the report is late or deficient	Additional $750 for every 14 day period without the required information
J	641-3.04 Failure to comply with the requirements of the CGP, approved SWPPP, and Section 641, except as listed above	$750 per occurrence for the first day of noncomplianc e	Additional $750 for every day the deficiency remains uncorrected

Code F* Liquidated Damages according to Code F will not be billed for typographic errors and minor data entry errors, except the liquidated damages will be assessed for these errors when:

a. the Contractor has previously been notified and subsequent inspection reports repeat the same or similar error,
b. multiple inspection reports are submitted after the submission due date and the same or similar errors are repeated on multiple overdue reports,
c. an error in recording the inspector's AK-CESCL certification date results in an inspector performing the inspection during a period when their certification was lapsed or was otherwise invalid.

641-5.01 BASIS OF PAYMENT.

See Subsection 641-3.04 Failure to Perform Work, for additional work and payment requirements.

Item 641.0001.____ Erosion, Sediment and Pollution Control Administration. At the Contract lump sum price for administration of all work under this Section. Includes, but is not limited to, SWPPP and HMCP and SPCC Plan preparation, agency fees for SWPPP reviews, SWPPP amendments, pre-construction inspections, inspections, monitoring, reporting, and recordkeeping or copying records related to the SWPPP and required by the CGP, and record retention.

Item 641.0002.____ Temporary Erosion, Sediment and Pollution Control. At the contingent sum prices specified for all labor, supervision, material, equipment, and incidentals to install, maintain, remove and dispose of approved temporary erosion, sedimentation, and pollution control BMPs required to implement the SWPPP and SPCC Plan.

Item 641.0003.____ Temporary Erosion, Sediment and Pollution Control. At the Contract lump sum price for all labor, supervision, material, equipment, and incidentals to install, maintain, remove and dispose of temporary erosion, sedimentation, and pollution control BMPs identified in the SWPPP and SPCC Plan.

Item 641.0004.____ Temporary Erosion Sediment and Pollution Control Additives. At the contingent sum prices specified in the Directive to authorize the work, for all labor, supervision, materials, equipment, and incidentals for extra, additional, or unanticipated work, to install, maintain, remove and dispose of temporary erosion, sedimentation, and pollution control BMPs not covered by Item 641.0003.____. All additional Erosion, Sediment, and Pollution Control Administration necessary due to this item will not be paid for separately but will be subsidiary to other bid items.

Item 641.0005.____ Temporary Erosion Sediment and Pollution Control by Directive. At the contingent sum prices specified in the Directive using time and materials to authorize the work, for all labor, supervision, materials, equipment, and incidentals to install, maintain, remove and dispose of temporary erosion, sedimentation, and pollution control BMPs. Prices for this item will be by time and materials according to Subsection 109-1.05, or by mutual agreement between the Engineer and Contractor. All additional Erosion, Sediment, and Pollution Control Administration necessary due to this item will not be paid for separately but will be subsidiary to other bid items.

Item 641.00006.___ Withholding. The Engineer may withhold an amount equal to Liquidated Damages, assessed according to Section 641, from payment due the Contractor. Liquidated Damages for violations of the Contract, CWA, CGP, are determined by the Engineer according to Table 641-2. The Engineer may withhold payment due the Contractors until the Contractor pays the Liquidated Damages to the Department.

The Department will not release performance bonds until Liquidated Damages assessed according to Section 641 are paid to the Department, and all requirements according to Subsection 103-1.05 are satisfied.

Item 641.0007.____ SWPPP Manager. At the Contract lump sum price for a SWPPP Manager that conforms to this specification. When Item 641.0007.____ appears in the Bid Schedule, the SWPPP Manager must be a different person than the superintendent, and must be physically present during construction activity with duties and authority as described in Subsection 641-2.04. When Item 641.0007.____ does not appear in the Bid Schedule, the SWPPP Manager is subsidiary to Item 641.0001.____.

Subsidiary Items. Temporary erosion, sediment and pollution control measures that are required outside the Project Zone are subsidiary. Work required by the HMCP and SPCC Plan including hazardous material storage, containment, removal, cleanup and disposal, are subsidiary to Item 641.0001._____Erosion, Sediment and Pollution Control Administration.

Work under other pay items. Work that is paid for directly or indirectly under other pay items will not be measured and paid for under Section 641. This work includes but is not limited to:

1. Dewatering;
2. Shoring;
3. Bailing;
4. Permanent seeding;
5. Installation and removal of temporary work pads;
6. Temporary accesses;
7. Temporary drainage pipes and structures;
8. Diversion channels;
9. Settling impoundment, and;
10. Filtration.

Permanent erosion, sediment and pollution control measures will be measured and paid for under other Contract items, when shown on the bid schedule.

Work at the Contractor's Expense. Temporary erosion, sediment and pollution control measures that are required due to carelessness, negligence, or failure to install temporary or permanent controls as scheduled or ordered by the Engineer, or for the Contractor's convenience, are at the Contractor's expense.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
641.0001.____	Erosion, Sediment and Pollution Control Administration	LS
641.0002.____	Temporary Erosion, Sediment and Pollution Control	CS
641.0003.____	Temporary Erosion, Sediment and Pollution Control	LS
641.0004.____	Temporary Erosion, Sediment and Pollution Control Additives	CS
641.0005.____	Temporary Erosion, Sediment and Pollution Control by Directive	CS
641.0006.____	Withholding	CS
641.0007.____	SWPPP Manager	LS

SECTION 642
CONSTRUCTION SURVEYING AND MONUMENTS

01/20/15 (N34)

642-3.01 GENERAL. *Delete the fifth paragraph and substitute the following:* Follow the Department's Construction Surveying Requirements, or if GPS survey is approved by the Engineer, use the Alaska Survey Manual GPS Surveys 2010 (rev. 8/15/10).

Add the following to the last sentence in the second to the last paragraph: or the Alaska Survey Manual GPS Surveys 2010 (rev. 8/15/10).

01/20/15 (N35)

Add the following: Stake all environmental permit boundaries, including but not limited to Corps of Engineers permit boundaries and temporary work zone boundaries, with green colored stakes. Stake according to the permit and frequently enough that you can construct the project without risk of violating the permit conditions, but in no case set stakes further apart than 200 feet or as deemed necessary by the Engineer.

642-3.02 CROSS-SECTION SURVEYS. *Add the following to the first paragraph:* or the Alaska Survey Manual GPS Surveys 2010 (rev. 8/15/10).

Delete numbered paragraph 4 of the second paragraph in its entirety and substitute the following: Department's Construction Surveying Requirements or the Alaska Survey Manual GPS Surveys 2010 (rev. 8/15/10).

642-4.01 METHOD OF MEASUREMENT. *Add the following:* All work and materials required to stake environmental permit boundaries will not be measured for payment, rather is subsidiary to other items of work.

SECTION 643
TRAFFIC MAINTENANCE

643-1.03 TRAFFIC CONTROL PLAN. *Add the following:* Incorporate portable changeable message board signs in the approved traffic control plan(s).

643-3.01 GENERAL CONSTRUCTION REQUIREMENTS. *Add the following:* At each cross street the Contractor shall provide and maintain at least one Americans with Disabilities Act (ADA) accessible pedestrian route that follows and connects to existing cross street sidewalks or other pedestrian routes (or similar).

Separate pedestrian routes from construction activities with the use of plastic safety fence. Provide adequate signing in accordance with the Alaska Traffic Manual and MUTCD, to accompany pedestrian routes.

Where businesses have only one accessible entrance, the Contractor shall provide an ADA accessible route from the nearest cross street to the business entrance.

A minimum of three (3) pedestrian flaggers shall be used to keep pedestrians out of the work zone and to ensure the safety of the pedestrians within the project limits.

On site construction activities are limited between 7 am to 11 pm in order to comply with Fairbanks General Code Section 46-42 Disturbing the Peace. Nighttime closures shall only be permitted if approved by the Engineer and in compliance with an approved TCP and a City of Fairbanks noise waiver. Noise waivers must be approved by the Fairbanks City Mayor. The Contractor shall submit to the Fairbanks City Engineer their work plan describing the details on why, when and how long the waiver is requested.

643-3.04 TRAFFIC CONTROL DEVICES. *Delete numbered item 8 and substitute the following:*

8. Portable Changeable Message Board Signs. Provide six (6) Portable Changeable Message Board Signs for the duration of the project, incorporating messages as directed by the Engineer and from approved Traffic Control Plans.

643-3.06 TRAFFIC PRICE ADJUSTMENT. *Add the following to the second paragraph of this subsection:* Exceeding any of the maximum allowable traffic restriction durations, or violating any of the criteria, listed in Subsection 643-3.08, is considered an unauthorized lane closure and are subject to a traffic price adjustment as directed by the Engineer.

643-3.08 CONSTRUCTION SEQUENCING. *Add the following after the third paragraph of this subsection:*
The construction sequencing must comply with all contract Specifications and the following additional criteria:

1. Temporary signalization may only be used with the approval of the Engineer and an approved Traffic Control Plan.

2. Except where otherwise approved, new signals shall be installed and fully operational before the old signals are removed.

3. The Old Steese Highway may be closed in accordance with the Plans.

643-3.10 LIGHTING FOR NIGHT WORK. *Add with the following after the first sentence:* Night work illumination will not be required from May 15 through August 15 or as directed by Engineer.

Add the following subsection:

643-3.12 PUBLIC INFORMATION. Provide a Public Information (PI) professional to accomplish the work outlined in this subsection. The PI professional shall be familiar with the construction schedule, progress and traffic control; be able to provide information to the general public and affected residents /businesses in the project area, closure duration and detour routes; to schedule required access to residences/businesses through areas of construction, etc. The PI professional shall participate at the Preconstruction Conference and is responsible for supplying up to date information.

The PI professional is responsible for the following for the PI Program:

1. In instances of emergencies, utility shutdowns, changes in traffic patterns or other unanticipated impacts to drivers, pedestrians, or residences/businesses within the project corridor, immediately coordinate with the Engineer and the DOT&PF Public Information Officer.

2. Public Open House. Attend up to three Public Open Houses scheduled by the Engineer. The Public Open House will be scheduled at the earliest possible date prior to commencement of work and may be scheduled twice during construction.

3. Weekly Progress Report. Submit to the Engineer, for review and use, information related to the progress of all work. Submit the Progress Report on a weekly basis, by Tuesday of each week, for the following two week's work in writing. This information will be used by the Engineer for weekly public outreach preparation, including a Friday email newsletter. Include the following information:

    a. A detailed description and map of the project (north to the top of the page, easily readable at 3" x 5") including the project name.

    b. Detailed traffic information such as delays, and lane or intersection closures and corresponding detours with effective dates of closures and detours.

    c. A listing of location where current project information may be obtained.

    d. The Contractor's 24-hour message number, contact name, and office telephone number.

    e. The Engineer's project office telephone number.

4. Business flyers, residential notices, and mail-outs. No less than two weeks prior to and again no less than three days prior to road closures or significant changes in traffic control, work with DOT&PF public information staff to notify affected businesses and residents adjacent to and around the project corridor of the upcoming closure or traffic change via door-to-door flyer, mail-out, and/or email.

The Contractor is responsible for developing a distribution list prior to the start of construction activities. Contractor is responsible for creating and distributing mail-outs, flyers, and emails based on templates provided by DOT&PF.

a. The two-week notice must contain estimated start date (or range of dates) closure or change will begin, expected duration, detour routes, contact information for Contractor and DOT&PF project engineer, work that will be completed during closure, link to Alaska Navigator.

b. The three-day notice must contain specific date closure or change will begin, expected duration, detour routes, contact information for Contractor and DOT&PF project engineer, work that will be completed during closure, link to Alaska Navigator.

5. Utility Outage Notifications. Prior to any utility outage, provide written notice to all affected property owners and tenants a minimum 24 hours notice.

6. Agency Notification. Notify the following Agencies at least 24 hours prior to starting any work which might inconvenience or endanger vehicular traffic. Information on project area duration and detour routes should be provided to the:

a. City and Borough Mayor's Offices
b. City Police Department
c. City Fire Department
d. State Troopers
e. MAC Borough Transit
f. School District
g. U.S. Postal Service
h. Emergency Services
i. Fort Wainwright
j. Alaska Trucking Association

7. Weekly Meetings. Representatives from the Contractor and all Subcontractors shall attend weekly meetings every Wednesday morning with the Engineer and designated Utility Coordinator. The Contractor and Subcontractors shall present and explain the information contained in the current Weekly Progress Report.

643-4.01 METHOD OF MEASUREMENT. *Add the following:*

17. Public Information. Attendance and participation at the Public Open House, Weekly Information submittals, and Support for Residential Mail Outs, Business Flier Information and Distribution will not be measured for payment directly. All work, materials, and costs associated with the Public Information task shall be considered subsidiary to Pay Item 643.2005.0000.

643-5.01 BASIS OF PAYMENT.

10 Traffic Maintenance. *Add the following*: The six (6) Portable Changeable Message Board signs required in 643-3.04 are subsidiary to item 643.0002.0000, Traffic Maintenance. If more than six Portable Changeable Message Board signs are required at any one time, additional message boards will be paid for under 643.0025.0000 Traffic Control.

11. Traffic Control. *Add the following:* Watering for dust control directed by the Engineer and traffic maintenance for concurrent utility relocations are subsidiary.

04/01/22 (N40)

Add the following schedule:

TRAFFIC CONTROL RATE SCHEDULE

TRAFFIC CONTROL DEVICE	PAY UNIT	UNIT RATE
Construction Signs	Each/Day	$6.50
Special Construction Signs	Square Foot	$31.00
Type II Barricade	Each/Day	$3.30
Type III Barricade	Each/Day	$11.00
Traffic Cone or Tubular Marker	Each/Day	$1.10
Drums	Each/Day	$3.30
Temporary Guardrail	Linear Foot	$25.00
Portable Concrete or Steel F Shape Barrier (12.5 foot standard length or$8/foot)	Each	$100.00
Temporary Crash Cushion/ non-redirective Water filled barrier (all required per end)	Each	$2,500.00
Temporary Crash Cushion / non-redirective Water filled Barrels (all required per end)	Each	$3,285.00
Temporary Crash Cushion / non-redirective Sand filled Barrels (all required per end)	Each	$4,325.00
Temporary Crash Cushion / Redirective	Each	$9,230.00
Plastic Safety Fence	Foot	$1.00
Temporary Sidewalk Surfacing	Square Foot	$2.00
Flexible Markers (Flat Whip, Reflective)	Each	$60.00
Flagging	Hour	$65.00
Electronic Boards, Panels and Signals		
Sequential Arrow Panel	Each/Day	$40.00
Portable Changeable Message Board Sign	Each/Day	$130.00
Portable Traffic Signals (Two)	Each/Day	$361.00
Cars and Trucks w/driver		
Pilot Car (4x2 ½ ton truck, or any car)	Hour	$77.00
Watering Truck – up to 4900 gallon capacity	M-Gallon	$28.00
Watering Truck – more than 4900 gallon	M-Gallon	$21.00
Street Sweeping (Regenerative Sweeper, Vacuum Sweeper, Mechanical or Power Broom with vacuum)	Hour	$214.00
40,000 GVW Truck with Crash Attenuator	Hour	$162.00
Interim Pavement Markings		
Painted Markings	Linear Foot	$0.30
Preformed Pavement Marking Tape (removable or non-removable)	Linear Foot	$1.75
Temporary Raised Pavement Markers	Each	$1.00
Word or Symbol Markings	Each	$55.00
Temporary Cover Markings	Linear Foot	$4.00
Removal of Pavement Markings	Linear Foot	$1.25

Add the following:

18. Public Information. The contract price includes all resources, labor, equipment, and material required to provide the Public Information Professional, attendance at all Public Open Houses, all required Weekly Progress Reports, Weekly Meetings, Mail-Outs, Utility Outage and Agency Notifications.

Add the following pay item:

PAY ITEM		
Item Number	**Item Description**	**Unit**
643.2005.0000	Public Information Program	LS

Delete Section 644 in its entirety and substitute the following:

SECTION 644
SERVICES TO BE FURNISHED BY THE CONTRACTOR

644-1.01 DESCRIPTION. Furnish and maintain facilities and services specified in the Contract for the Department's project administrative personnel to use during the project. Services include heat, electrical power (NEC compliant), water and any others required to operate the facilities. All furnished facilities remain the property of the Contractor when the work is completed.

The Engineer may delete any 644 Items, by Directive within five working days after the Preconstruction Conference. If any 644 Items are deleted within the specified period, Subsection 109-1.09, Eliminated Items, shall not apply to the deleted 644 Items.

644-2.01 FIELD OFFICE. Furnish and maintain a suitable office for the Engineer to use during construction. Make the Field Office available for occupancy 2 weeks before commencing work on the project through one week after Project Completion. The Field Office shall be within one half of one mile from the project.

1. Submit office proposal to the Engineer prior to procurement or transporting office to the project. The Engineer will approve the office general condition, location, access, features, and physical layout prior to beginning any office setup work. If this office is part of your building, completely partition it from the rest of the structure and provide a separate outside door equipped with a lock.

2. Provide at least the following minimum requirements, or as approved by the Engineer:

    a. Floor space of at least 500 ft^2
    b. Window area of at least 60 ft^2
    c. Lockable outside door(s)
    d. 4 each plastic folding tables, 8 ft. long
    e. Shelf space of at least 24 linear feet
    f. Adequate heating and cooling devices, and fuel or power to run the devices, to maintain an office temperature between 65° and 75°F.
    g. Adequate ventilation
    h. Continuous supply of drinking water from an approved source or commercial supplier
    i. A minimum of 1 sanitary facilities exclusively for Department use that include adequate sink with water supply, hand soap, hand sanitizer, toilet paper, and paper towels
    j. Janitorial services at least weekly
    k. Wet/dry vacuum with a minimum capacity of 5 gallons and a minimum of 4 horsepower. Provide filters and dust bags as needed.
    l. Provide electrical service as indicated in 644-2.09, #1 Field Office

m. Internet Service and Phone:

Furnish and install a high speed internet service and three telephones, with all necessary ancillary equipment.

The internet system shall have a send and receive capability supporting 1.0 Gbps download speed or higher and 50 Mbps upload speed at all times. The internet system shall have unlimited data. Include a wireless router and an appropriately sized battery backup for the internet system. The system shall be for the exclusive use of the Engineer.

The telephone system shall consist of commercially available telephones with the necessary equipment for each line. Provide one telephone that includes a built in digital answering machine.

Internet and telephone service shall be supplied and operational no more than two weeks after the field office has been set up on site. Service plans shall be provided and remain in effect for the duration of the use of the field office.

n. One multifunction Laser Color Printer/Scanner/Copier meeting the following requirements:
New or like-new condition
Printing/copying at least 32 ppm
Scan speed of 40 ppm at 400 DPI in color, at a minimum
Print/Scan/Copy 8.5” x 11” and 11” x 17” in color, at a minimum
Supports network scanning (FTP and SMB Support)
Supports network printing (PCL and Postscript)
Network card included
Automatic Document Feeder

Furnish toner and perform repairs and maintenance as necessary.

The Printer/Scanner/Copier remains property of the Contractor upon completion of the contract.

o. Make the field office accessible according to the requirements of *Americans with Disabilities Act Accessibility Guidelines* (ADAAG). Provide at least one designated handicap parking space.
p. One AED (Automated External Defibrillator), with carrying case and properly marked wall cabinet. Provide training on how to use the AED.
q. One combination Smoke and Carbon Monoxide Detector per structure, minimum. Provide combination Smoke and Carbon Monoxide Detectors in any location requested by the Engineer.
r. One 25 Person Trauma First Aid Kit. List of required contents available at http://dot.alaska.gov/nreg/files/25-Person-Trauma-Kit-Contents.pdf
s. 4 mobile hotspots with unlimited data plans and car charger.

3. Provide electrical power to the Department’s portable concrete compressive strength lab if there are any bridge items in the bid schedule as identified in 644-2.09, #9.

4. Provide electrical power to the Department’s portable nuclear storage trailer as identified in 644-2.09, #8.

5. Provide the following to the Department’s portable asphalt lab if there are any asphaltic materials in the bid schedule and item 644.0002.____ Field Laboratory does not appear in the bid schedule.

a. electrical service as identified in 644-2.09, #4 Asphalt Laboratory.
b. internet service as specified for the Field Laboratory.

All long distance calls made by State personnel will be paid by the State. Installation and maintenance fees, local calls, connection fees and internet service provider fees, and all other fees shall be paid by the Contractor. Paper used by the copier/scanner/printer will be provided by the State.

644-2.02 FIELD LABORATORY. Furnish and maintain a field laboratory for the Engineer to use exclusively throughout the contract. Provide a completely functional installation 2 weeks before commencing construction work through one week after Project Completion.

1. Grade and compact a site for the lab acceptable to the Engineer. Locate and level the structure on this site. If subsequent ground movement causes an unlevel or unstable condition, re-level or re-locate the facility as directed.

2. Provide a weatherproof structure suitable to field test construction materials, with the following minimum functional requirements:

    a. Floor space of 300 ft^2
    b. Two 10-ft^2 windows that open and lock
    c. Lockable door(s)
    d. Work bench(es), 2-1/2 x 16 feet total, 3 feet high
    e. Shelf space, 1 x 16 feet
    f. One 18-inch deep sink with attached industrial faucet with hand sprayer attachment and approved drain
    g. A gravity-fed 250-gallon tank or pressurized constant water supply of acceptable quality
    h. Electrical service as indicated in 644-2.09, #2 Field Laboratory
    i. A sanitary facility exclusively for Department use that includes adequate sink with water supply, hand soap, hand sanitizer, toilet paper, and paper towels
    j. Heating and cooling equipment suitable to maintain a uniform room temperature of 65° to 75°F
    k. Storage cabinet, 3 ft x 3 ft x 3 ft, lockable, securely fixed to an inside wall with a hinged door opening outward
    l. Office desk and 2 chairs
    m. One combination Smoke and Carbon Monoxide Detector per structure, minimum. Provide Combination Smoke and Carbon Monoxide Detectors at any location requested by the Engineer.
    n. One 25 person Trauma First Aid Kit. List of required contents available at http://dot.alaska.gov/nreg/files/25-Person-Trauma-Kit-Contents.pdf
    o. Internet Service and Phone:

        Furnish and install a high speed internet service and a telephone, with all necessary ancillary equipment.

        The internet system shall have a send and receive capability supporting 1.0 Gbps download speed or higher and 50 Mbps upload speed at all times. The internet system shall have unlimited data. Include a wireless router and an appropriately sized battery backup for the internet system. The system shall be for the exclusive use of the Engineer.

        The telephone system shall consist of commercially available telephones with the necessary equipment for each line. Provide one telephone that includes a built in digital answering machine.

        Internet and telephone service shall be supplied and operational no more than two weeks after the field laboratory has been set up on site. Service plans shall be provided and remain in effect for the duration of the use of the field laboratory.

3. If the lab is a mobile unit mounted on axles and wheels, block the structure under the frame so that the wheels do not touch the ground and the blocking rests firmly on the prepared site.

4. Provide a separate weatherproof shed within 20 feet of the main lab structure (Shaking Shed). Grade and compact a site for the Shaking Shed acceptable to the Engineer. Locate and level the structure on this site. If subsequent ground movement causes an unlevel or unstable condition, re-level or re-locate the facility as directed.

    a. The Shaking Shed shall have the following minimum functional requirements:

        (1) Floor 8 ft x 12 ft, ceiling height 8 ft
        (2) Door 4 ft wide and window 5 ft^2 that opens, both lockable
        (3) electrical service as identified in 644-2.09, #3 Field Laboratory Out Building
        (4) Work table 3 ft x 1-1/2 ft x 3 ft high, capable of supporting 250 pounds and affixed to an inside wall as directed
        (5) Concrete-slab floor, 8 ft x 8 ft x 4 inches thick, cast-in-place or pre-cast. Install anchor bolts in the floor to accommodate the mounting pattern of the Gilson sieving machine at a location as directed.

            Found the slab directly on the prepared site such that it is continuously supported.

5. Provide a weatherproof pole shed adjacent to the Shaking Shack. Grade and compact a site for the Splitting shed acceptable to the Engineer. Locate and level the structure on this site. If subsequent ground movement causes an unlevel or unstable condition, re-level or re-locate the facility as directed.

    a. The Splitting shed shall meet the following minimum requirements
        (1) 12’ x 24’ Pole shed structure with 8’ minimum ceiling height.
        (2) Pole spacing 4’ to 6’
        (3) Water proof roof
        (4) 2x4 construction, or manufactured structure approved by the Engineer.
        (5) 6 each 4’ T8 LED lighting fixtures with bulbs spaced evenly across the roof structure
        (6) Manufactured, industrial strength, welded-metal shelving with total 52 square feet of shelving
        (7) 2 walls
        (8) Smooth rigid floor as approved by the Engineer

6. For all types of installations, if the entryway is located higher than a single 7-inch rise, provide the following:

    a. Stairway, 3 feet wide x 11-inch tread x 7-inch rise
    b. Landing, 4 ft x 4 ft centered on the entryway
    c. Handrail(s) firmly affixed to the stairway

7. Provide the following lab equipment and services:

    a. Propane necessary for the lab operation, including two 100-lb tanks, regulators, hoses, fittings, and incidentals for a functional system
    b. Specialized sampling equipment such as belt templates or belt sampling devices as required
    c. Fuel and power necessary to continuously operate the facilities

8. Provide the following to the Department’s portable asphalt lab if there are any asphaltic materials in the bid schedule.

    a. electrical service as identified in 644-2.09, #4 Asphalt Laboratory.
    b. internet service as specified for the Field Laboratory.

644-2.03 CURING SHED. Furnish and maintain a suitable weather tight shed for curing concrete test cylinders, with a suitable tank(s) for curing concrete test cylinders.

Provide a tank(s) large enough to contain at least 6 each 4" x 8" test cylinders from each pour that you propose to make during any 28-day period. Use a tank(s) at least 18 inches high, insulated, and constructed of heavy duty plastic or non-corrosive metal. Construct a lid to provide access to the tank(s).

Provide suitable heating to maintain the temperature in the tank between 70° and 77°F at all times when curing the test cylinders. In addition, provide suitable thermometers in the shed and tank(s) to check the temperature.

Provide a supply of calcium hydroxide (high-calcium hydrated lime) sufficient to maintain a fully saturated water bath in the tank(s). Provide a source of potable water.

Provide one combination smoke alarm and carbon monoxide detector.

Provide electrical service as identified in 644-2.09, #5 Curing Shed

644-2.05 VEHICLES. Furnish and maintain vehicles in good condition that are less than six years old and with less than 100,000 miles on the odometer for the exclusive use of the Department throughout the project. Provide full-size four-wheel drive pickups or sport utility vehicles. The Special Provisions will state the required number and type of vehicles. Provide vehicles from two weeks before commencing work to one week after Project Completion. Maintain the vehicles in satisfactory running condition throughout the duration of the contract. Provide insurance, fuel, fluids, lubricants, tire repair/replacement, and windshield repair/replacements as needed. If a vehicle is down for more than 24 hours, provide a replacement Vehicle of the same type at no additional cost.

The State of Alaska is responsible for damage to any vehicle caused by its own negligent operation.

The Engineer will approve the vehicles prior to transporting them to the project site. In addition to use on the project, all of the vehicles will be allowed to make round trips to the Department's regional headquarters. Remove all vehicles from the project at the end of the Contract.

Number of Vehicles	Type
3	Extended Cab Pickup Truck

Equip each vehicle as follows:

1. Four wheel drive
2. Automatic transmission
3. Power steering
4. Air conditioning
5. Fire extinguisher & basic first aid kit
6. Jack and lug wrench
7. Load range E tires in good condition
8. Two full size load range E spare tires in good condition mounted on rims
9. 360-degree Permanent Beacon
10. 2 sets of keys
11. CB Radio with 48" Antenna for all projects more than 50 miles from Fairbanks.
12. 3 each AKDOT&PF magnetic stickers. Plans available at http://dot.alaska.gov/documents/DOT-SOA-Construction-Magnets-Specs.pdf

Materials Truck

Number of Vehicles

____

Meet the above requirements for a vehicle and the following:

1. 3/4 Ton Crew Cab Pickup
2. Minimum 500 lb hydraulic tailgate lift attached to the bed of the truck

644-2.06 NUCLEAR TESTING EQUIPMENT STORAGE SHED. Design, furnish and maintain a weatherproof, heated, and ventilated nuclear densometer/testing equipment storage shed for the Engineer to use exclusively throughout the contract. Install the building at least 15-feet from an occupied area at a location approved by the Engineer. Install the shed at least one week before the commencement of construction activities and maintain it until one week after Project Completion. Provide sufficient floor area for the nuclear testing equipment and a portable electric heater to maintain a minimum room temperature of 50°F. Design the building with enough floor area to provide sufficient clearance between the equipment, heater, and combustibles. Provide a commercial grade metal-clad exterior entrance door of 3'-0" min width by 6'-8" height with dead-bolt lockset. Hang the door so that hinge pins are not accessible from the exterior. Provide the Engineer with 2 keys to control access. Provide a 5/16" x 10 foot long welded steel security chain securely attached inside the structure with tamperproof hardware for the Engineer to secure the testing equipment. Provide electrical service as identified in 644-2.09, #7 Nuclear Testing Equipment Storage Shed. Secure the structure to the ground with tamperproof anchors to resist wind loads and prevent unauthorized movement of the building. The Nuclear Testing Equipment Storage Shed remains the property of the Contractor. Remove the shed from the site following project completion. The Nuclear Testing Equipment Storage Shed must be windowless.

644-2.07 STORAGE CONTAINER. Furnish, transport and maintain a weathertight, lockable, steel enclosed 20 foot long x 8 foot wide x 8 foot high wooden floored container for the storage of the Department's materials, supplies and testing equipment (but not nuclear equipment). Provide twenty equally spaced fastening points on the interior walls that are capable of securing the Department's contents. Door opening dimensions of the storage container shall be greater than 60 square feet. Supply necessary equipment to lift and move container with minimal disturbance to the Department's contents. The container shall not be moved by skidding or hook lift. The Contractor shall be listed as the shipper on all documents listing and acknowledging receipt of the Department's goods for shipment.

Deliver an empty and clean container to the Regional Materials Laboratory, or location acceptable to the Engineer, three weeks prior to transporting to the project site. Allow 7 days for the Department to load the container. Transport the loaded container to the project site. Set up container at a location approved by the Engineer at least one week before the commencement of construction activities and maintain it until one week after Project Completion.

1. Provide electrical service and other facilities as follows:

    a. Provide a stairway with railing, built to meet the International Building Code, if there is more than 12-inch difference in floor entry and existing ground elevation.
    b. Provide electrical service as identified in 644-2.09, #6 Storage Container.

Return the container to the Regional Materials Laboratory, or location acceptable to the Engineer, upon project completion. Allow 7 days for the Department to unload the container. The storage container remains your property after you complete the work.

644-2.08 FIELD COMMUNICATIONS. Provide internet and phone communication systems as directed by the Engineer.

644-2.09 ELECTRICAL POWER. Furnish and maintain a constant source of power to the facilities specified in the contract for the Department's use during the project. Provide a completely functional installation 2 weeks before commencing construction work through 2 weeks after Project Completion.

1. FIELD OFFICE. Provide electrical services as follows:

    a. Heating/Cooling adequate to maintain temperatures between 65° to 75°F
    b. Electrical current: 120/240 VAC, 60 cycle on 24 hour basis
    c. Wiring system to support a 40 amp user load demand with two 20-amp circuits
    d. Eight conveniently spaced outlets on the interior wall, consistent with local codes
    e. Eight 8ft LED minimum 5000 lumen lamps or sixteen 4ft LED minimum 2000 lumen lamps, between 2800K and 5000K color temperature

2. FIELD LABORATORY. Provide electrical services as follows:

    a. Heating/Cooling adequate to maintain temperatures between 65° to 75°F
    b. Electrical current: 120/240 VAC, 60 cycle on 24 hour basis
    c. Wiring system to support a 40 amp user load demand with two 20-amp circuits, GFI Protected
    d. Six conveniently spaced outlets on the interior wall, consistent with local codes
    e. Eight 8ft LED minimum 5000 lumen lamps or sixteen 4ft LED minimum 2000 lumen lamps, between 2800K and 5000K color temperature
    f. Exhaust fan: minimum 300 CFM

3. SHAKING SHED. Provide electrical services as follows:

    a. Heating/Cooling adequate to maintain temperatures between 65° to 75°F
    b. Electrical current: 120/240 VAC, 60 cycle on 24 hour basis
    c. Wiring system to support a 20-amp user load demand, GFI Protected
    d. Three conveniently spaced outlets on the interior wall, consistent with local codes
    e. Two 8ft LED minimum 5000 lumen lamps or four 4ft LED minimum 2000 lumen lamps, between 2800K and 5000K color temperature
    f. Exhaust fan: minimum 300 CFM

4. ASPHALT LABORATORY. Provide electrical services as follows:

    a. Electrical current: 120/240 VAC, 60 cycle on 24 hour basis
    b. 100-amp service

5. CURING SHED. Provide electrical services as follows:

    a. Heating/Cooling adequate to maintain temperatures between 70° to 77°F
    b. Two 100-watt incandescent or four 4ft LED minimum 2000 lumen lamps, between 2800K and 5000K color temperature

6. STORAGE CONTAINER. Provide electrical services as follows:

    a. Electrical current: 120/240 VAC, 60 cycle on 24 hour basis
    b. Wiring system to support a 20-amp user load demand, GFI Protected
    c. Two conveniently spaced outlets on the interior wall, consistent with local codes
    d. Four 100-watt incandescent or eight 4ft LED minimum 2000 lumen lamps, between 2800K and 5000K color temperature

7. NUCLEAR TESTING EQUIPMENT STORAGE SHED. Provide electrical services as follows:

    a. Heating/Cooling adequate to maintain minimum temperatures of 50°F
    b. Electrical current: 120/240 VAC, 60 cycle on 24 hour basis

c. Two 100-watt incandescent or four 4ft LED minimum 2000 lumen lamps, between 2800K and 5000K color temperature
d. Wiring system to support a 20-amp user load demand

8. NUCLEAR TESTING EQUIPMENT STORAGE SHED (STATE PROVIDED). Provide electrical services as follows:

a. Electrical current, 120/240 VAC, 60-cycle on 24-hour basis
b. Wiring system to support a 20-amp user load demand

9. PORTABLE CONCRETE COMPRESSIVE LABORATORY. Provide electrical services as follows:

a. Electrical current: 120/240 VAC, 60 cycle on 24 hour basis
b. Wiring system to support a 20-amp user load demand

If 644.0015____, Nuclear Testing Equipment Storage Shed is deleted the electrical power requirement are still required per 644-2.09, #8.

If the contract contains bridge items that require concrete or grout provide electrical power to the Department's Portable Concrete Compressive Laboratory per 644-2.09, #9.

644-3.01 METHOD OF MEASUREMENT. Section 109 and as follows:

Storage Container. By the number of storage containers specified, to include all components, installed and accepted as completed units and ready for materials and equipment storage.

644-4.01 BASIS OF PAYMENT.

Vehicles. Includes all resources, including fuel, oil, maintenance, and insurance to furnish the specified number of fully operational vehicles for the duration specified in the contract.

Lump Sum Items. Payment for lump sum items will be made as follows:

1. A percentage of the lump sum amount, to be determined by the Engineer, will be paid as full compensation for furnishing the facility at the site.

2. The balance of the lump sum amount will be prorated over the anticipated active construction period with a portion included as part of each interim payment, for maintenance, repairs, providing all utilities, and for removing it from the site. If anticipated construction period changes, the final increment will be held until final payment.

Storage Container. At the contract unit price to include all labor, materials, tools, equipment and supplies required to deliver the storage shed to the regional office for loading, to deliver it to the project office, to install it before commencement of construction, to maintain it for the duration of the project, to remove the shed and electrical service after project completion, to deliver it to the regional office for unloading, and to remove the storage shed. Electrical service and utility costs are subsidiary to this item.

Field Communications. Installation and maintenance of equipment and monthly invoice costs will be paid for by Contingent sum under Item 644.2002.0000, Field Communications. Provide invoices from vendor for installation, maintenance, and monthly subscription costs. When this bid item appears in the Bid Schedule, internet and phone service are not subsidiary to 644.0001.____ Field Office.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
644.0001.____	Field Office	LS
644.0002.____	Field Laboratory	LS
644.0003.____	Curing Shed	LS
644.0006.____	Vehicle	LS
644.0015.____	Nuclear Testing Equipment Storage Shed	EACH
644.0016.____	Storage Container	EACH
644.2002.0000	Field Communications	CS
644.2010.0000	Nuclear Testing Equipment Storage Shed	LS

Add the following section:

SECTION 645
TRAINING PROGRAM

11/30/20 (HSP20-2)

645-1.01 DESCRIPTION. This Statewide Special Provision for on-the-job training (OJT) implements 23 CFR 230, Subpart A, Appendix B.

As part of the Equal Employment Opportunity Affirmative Action Program, the Contractor shall provide on-the-job training aimed at developing full journey status in the type of trade or job classification involved. The number of individuals to be trained and the number of hours of training to be provided under this contract will be as shown on the bid schedule.

645-2.01 OBJECTIVE. Training and upgrading of minorities and women toward journey status is the primary objective of this program. The Contractor shall enroll minorities and/or women, where possible, and document good faith efforts prior to the hire of non-minority males in order to demonstrate compliance with this Training Special Provision. Specific good faith efforts required under this Section for the recruitment and employment of minorities and women are found in the Federal EEO Bid Conditions, Form 25A-301.

645-3.01 GENERAL. The Contractor shall determine the distribution of the required number of apprentices/trainees and the required number of hours of training among the various work classifications based upon the type of work to be performed, the size of the workforce in each trade or job classification, and the shortage of minority and female journey workers within a reasonable area of recruitment.

Training will be provided in the skilled construction crafts unless the Contractor can establish prior to contract award that training in the skilled classifications is not possible on a project; if so, the Department may then approve training either in lower level management positions such as office engineers, estimators, and timekeepers, where the training is oriented toward construction applications, or in the unskilled classifications, provided that significant and meaningful training can be provided. Some offsite training is permissible as long as the training is an integral part of an approved training program and does not comprise a significant part of the overall training.

Credit for offsite training hours indicated above may only be made to the Contractor where the apprentices/trainees are concurrently employed on the project and the Contractor does one or more of the following: contributes to the cost of the training, provides the instruction to the apprentice/trainee, or pays the apprentice's/trainee's wages during the offsite training period.

Where feasible, 25 percent of apprentices or trainees in each occupation shall be in their first year of apprenticeship or training.

Prior to award of the contract, the Contractor shall submit Form 25A-311, Training Utilization Report, indicating the training program to be used, the number of apprentices/trainees to be trained in each selected classification, the number of hours of training to be provided, and the anticipated starting time for training in each of the classifications.

Training must begin within 2 weeks of the anticipated start date(s); unless otherwise authorized by a Directive. Such authorization will be made only after submission of documentation by the Contractor, and approval by the Engineer, of efforts made in good faith which substantiate the necessity for a change.

Contractors may use a training program approved by the U.S. Department of Labor, Office of Apprenticeship (USDOL/OA); or one developed by the Contractor using Form 25A-310 and approved prior to contract award by the OJT Coordinator in the DOT&PF Civil Rights Office.

The minimum length and type of training for each classification will be established in the training program selected by the Contractor. Training program approval by the Department for use under this section is on a project by project basis.

It is expected that each apprentice/trainee will begin training on the project as soon as feasible after start of work utilizing the skill involved and remain on the project as long as training opportunities exist or until training has been completed. It is not required that apprentices/trainees be continuously employed for the duration of the contract.

If, in the judgment of the Contractor, an apprentice/trainee becomes proficient enough to qualify as a journey worker before the end of the prescribed training period and the Contractor employs that individual as a journey worker in that classification for as long as work in that area remains, the individual's training program will be considered completed and the balance of training hours required for that apprentice/trainee shall be waived.

The Contractor shall furnish each ADOT&PF training program trainee a copy of the program (Form 25A-310) to be followed during training on the project, and with a written certification showing the type and length of training completed on the project. Existing USDOL/OA apprentices should already have a copy of their program. No employee shall be employed for credit as an apprentice/trainee in a classification in which that employee has previously worked at journey status or has previously completed a training course leading to journey status.

The Contractor shall periodically review the training and promotion potential of minority and women employees and shall encourage eligible employees to apply for such training and promotion.

The Contractor shall provide for the maintenance of records and the furnishing of periodic reports documenting the progress of each apprentice/trainee. The Contractor must submit Form 25A-313 by the 15th of each month and provide each ADOT&PF trainee written evaluation reports for each unit of training provided as established on Form 25A-310.

645-3.02 WAGES. Trainees in ADOT&PF approved training programs will be paid prevailing Davis-Bacon fringe benefits plus at least 60 (but less than 100) percent of the appropriate minimum journey rate specified in the contract for the first half of the training period, at least 75 (but less than 100) percent for the third quarter of the training period, and at least 90 (but less than 100) percent for the last quarter of the training period. Trainee wages shall be identified on Form 25A-310. Apprentices in USDOL/OA training programs shall be paid in accordance with their approved program. Beginning wages of each trainee/apprentice enrolled in a Section 645 Training Program on the project shall be identified on Form 25A-312.

645-3.03 SUBCONTRACTS. In the event the Contractor subcontracts a portion of the work, he shall determine how many, if any, of the apprentices/trainees are to be trained by the subcontractor. Any such subcontracts shall include this Section 645, Form 25A-311 and Form 25A-310, where appropriate. However, the responsibility for meeting these training requirements remains with the Contractor; compliance or non-compliance with these provisions rests with the Contractor and sanctions and/or damages, if any, shall be applied to the Contractor in accordance with Subsection 645-5.01, Basis of Payment.

645-4.01 METHOD OF MEASUREMENT. The Contractor will be credited for each approved apprentice/trainee employed on the project and reimbursed on the basis of hours worked, as listed in the certified payrolls. There shall be no credit for training provided under this section prior to the Contractor's submittal and approval by the Engineer of Form 25A-312 for each apprentice/trainee trained under this Section. Upon completion of each individual training program, no further measurement for payment shall be made.

645-5.01 BASIS OF PAYMENT. Payment will be made at the contract unit price for each hour of training credited. Where a trainee or apprentice, at the discretion of the Contractor, graduates early and is employed as a journey worker in accordance with the provisions of Subsection 645-3.01, the Contractor will receive payment only for those hours of training actually provided.

This payment will be made regardless of any other training program funds the Contractor may receive, unless such other funding sources specifically prohibit the Contractor from receiving other reimbursement.

Payment for training in excess of the number of hours specified on the approved Form 25A-311 may be made only when approved by the Engineer through Change Order.

Non-compliance with these specifications shall result in the withholding of progress payments until good faith efforts documentation has been submitted and acceptable remedial action has been taken.

Payment will be at the end of the project following the completion of all training programs approved for the project. No payment or partial payment will be made to the Contractor if he fails to do any of the following and where such failure indicates a lack of good faith in meeting these requirements:

1. provide the required hours of training (as shown in the Bid Schedule and approved Form 25A-311),

2. train the required number of trainees/apprentices in each training program (as shown in the Bid Schedule and approved Form 25A-311), or

3. hire the apprentice/trainee as a journey worker in that classification upon completion of the training program for as long as work in that area remains.

Failure to provide the required training damages the effectiveness and integrity of this affirmative action program and thwarts the Department's federal mandate to bring women and minorities into the construction industry. Although precise damages to the program are impractical to calculate, they are at a minimum, equivalent to the loss to the individuals who were the intended beneficiaries of the program.

Therefore, where the Contractor has failed, by the end of the project, to provide the required number of hours of training and has failed to submit acceptable good faith efforts documentation which establishes why he was unable to do so, the Contractor will be assessed an amount equal to the following damages to be deducted from the final progress payment:

> Number of hours of training not provided, times the journey worker hourly scale plus benefits. The journey worker scale is that for the classification identified in the approved programs.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
645.0001.____	Training Program, ____ Trainees/Apprentices	LH

Delete Section 646 in its entirety and substitute the following:
02/01/20 (N42)

SECTION 646
CPM SCHEDULING

646-1.01 DESCRIPTION. Provide and maintain a Critical Path Method (CPM) progress schedule for the project. Use the schedule in coordinating and monitoring of all work under the Contract including activity of subcontractors, manufacturers, suppliers, and utility companies, and submittal review by the Department. Update the CPM as described in this specification.

Provide to the Engineer a legal copy of the software program to be utilized for the CPM Schedule item on the project. The software program shall have the full capacity to analyze and modify the CPM Schedule.

646-2.01 SUBMITTALS.

1. Submit a detailed initial CPM schedule at least 5 working days prior to the preconstruction conference, for the Engineer's approval. The construction schedule, for the entire project, may not exceed the specified contract time.

   Following the Engineer's review, if revisions to the proposed CPM schedule are required, do so promptly. The CPM schedule must be finalized within 15 days of the Notice to Proceed.

   No contract work may be pursued at the project site without an approved CPM schedule.

2. Weekly Work Plans. Submit a Weekly Work Plan in conjunction with Weekly Progress Meeting agenda. Detail your proposed operations for the upcoming week. This work plan shall reflect a true and accurate assessment by the Contractor concerning the actual progress on the project. Include:

   a. Tasks / work activities
   b. Work hours
   c. Subcontractors
   d. Location of the work to be performed

The approval by the Department of the initial CPM Schedule, subsequent CPM updated schedules, and the weekly Work Plans shall not relieve the Contractor as the responsible party for development and execution of the means, method, and timing of performance reflected in the schedule, nor completing the project within the specified contract time.

646-3.01 REQUIREMENTS AND USE OF SCHEDULE.

1. Schedule Requirements. Prepare the CPM schedule as a Precedence Diagram Network developed in the activity-on-node format which includes:

   a. Activity description
   b. Activity duration
   c. Critical Sequence of activities and Critical Path.

   Show on the activity-on-node diagram the sequence and interdependence of all activities required for complete performance of all items of work under this Contract, including shop drawing submittals and reviews and fabrication and delivery activities. The maximum review period allowed by the contract shall be shown where review functions by the Department are noted on the schedule

   The contract completion time will be adjusted only for causes specified in this Contract.

2. Weekly Progress Meetings. Hold Weekly job site progress meetings with the Engineer for the purpose of reviewing and updating the CPM schedule. Review progress and verify finish dates of completed activities, remaining duration of uncompleted activities, and any proposed time estimate revisions. At a minimum, the Contractor's Project Manager, Project Superintendent, Traffic Control Supervisor shall attend the weekly job site meetings.

   Provide an updated CPM schedule when the critical path on the CPM schedule has changed by 7 or more days.

646-4.01 METHOD OF MEASUREMENT. Section 109.

646-5.01 BASIS OF PAYMENT. If the requirements of Item 646 CPM Scheduling are not in full compliance, five percent (5%) of the total progress payment value earned during the progress period will be withheld until the requirements of Item 646 CPM Scheduling are in full compliance.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
646.0001.____	CPM Scheduling	LS

Add the following section:

SECTION 651
WORK BY OTHERS

651-1.01 DESCRIPTION. Coordinate construction schedule and phasing according to Section 105.

651-3.01 CONSTRUCTION REQUIREMENTS. Utilities (overhead and buried) to the extent they are known are shown on the plans. Before conducting any ground-disturbing activities, the Contractor shall verify utility locations by contacting the utility company(s). The Contractor is responsible for locating and protecting utilities in the project work areas.

Utilities in the project area subscribing to the dig-line include: ACS, GCI, GVEA, IGU, GHU and MTA

651-3.02 DESCRIPTION OF WORK AND SCHEDULE. Adjust your schedule and phasing as necessary to allow utility owners, their contractors, and other third party entities to complete their work on or before the completion date given in the utility relocation agreement.

Notify utility owners a minimum one week before beginning work requiring utility coordination.

Utility adjustments by others are shown on the Plans and are scheduled to be performed under relocation agreements, as follows:

Utility Type	Utility Company	Agreement #	Agreement Completion Date
Railroad	ARRC	TBD	TBD
Communications	ACS	TBD	TBD
Communications	MTA	TBD	TBD
Power	GVEA	TBD	TBD
Natural Gas	IGU	TBD	TBD
Communications	GCI	TBD	TBD
Water and Sewer	GHU	TBD	TBD

Utility relocation agreement plans are available for inspection by making arrangements with the contact for pre-bid information, as listed on the Invitation for Bids.

651-3.03 ADDITIONAL UTILITY REQUIREMENTS. The Contractor shall provide all Utility owners a copy of their construction schedule at the time of the Preconstruction Conference.

Prior to any ground disturbing activities, coordinate with ARRC and complete their Temporary Construction Permit included in Appendix A.

SECTION 660
SIGNALS AND LIGHTING

660-1.01 DESCRIPTION. *Add the following to the first paragraph*: This work shall include installing Wavetronix radar presence detection, Opticom detection, controller cabinet, controllers, and all additional work and materials as noted or detailed on the Plans, in the Specifications, and in these Special Provisions. Provide one spare per intersection of the hardware as described in the Basis of Payment.

660-1.02 DEFINITIONS.

2. Luminaire. *In the second sentence, delete* "including socket" *and substitute the following*: including socket, lamp, and ballast or LEDs and driver.

Add the following:

5. Interconnect. In Section 660, unless otherwise specified, interconnect refers to the use of twisted pair copper wires (telemetry cable) that is used to transmit and receive data between field devices and/or a Traffic Operations Center. See Section 662 for Fiber Optic Signal Interconnect System work and requirements.

09/16/22 (N92)
660-2.01 MATERIALS. *Add the following:*

Concrete for Junction Boxes	Section 550 (Class B)
Anchor Bolts:	Subsection 740-2.02

Submit certification from the suppliers for all steel products incorporated into the signal and lighting items indicating origin with the material catalog cuts or the shop drawings in accordance with Subsection 106-1.01, Source of Supply and Quality Requirements.

1. Equipment List(s) and Drawings. *In the first sentence, delete* "30 days" *and substitute the following*: 15 days.

   a. Materials on the *Qualified Products List*: *Delete in its entirety and substitute the following:* The Qualified Products List does not apply to the 660 items. Provide catalog cuts of materials to the Engineer for review and approval.

   d. Materials Not Requiring Certification: *Delete in its entirety and substitute the following:* Incidental materials incorporated into the work (such as nuts, ties, bolts, washers, etc.) must meet all applicable Specifications and be installed per all manufacturer's recommendations. Only submit these materials for review and approval if they are included on the Materials Certification List (MCL).

2. As-Built Plans. *Add the following*: Place one (1) copy of the controller cabinet diagram and the intersection and phase diagram as reviewed by the Engineer in a clear plastic envelope and attach to the inside of each controller cabinet.

660-3.01 GENERAL.

1. Scheduling of Work: *Add the following:* Contact the regional DOT&PF Traffic Section (telephone 907-451-2323) 24 hours in advance of any work on a signal or lighting system. Contact shall be made through the Engineer.

   After staking pole, cabinet or transformer foundations, verify there will be no overhead or underground utility conflicts with foundations or conduits. Locate and protect all existing underground and overhead utilities. The location of cables, conduits, J-boxes, foundations and poles that are shown on the plan sheets are approximate and it is your responsibility to verify the actual location when working in the area. See Subsection 105-1.06.

   State technicians will perform all necessary signal controller timing and programming changes. All other work shall be by the Contractor. Notify the Engineer five working days (Monday – Friday) prior to commencing signal modification work.

   Existing signing and traffic markings shall not be allowed to conflict with new signal modifications. New signing and traffic marking modifications shall not conflict with existing signals and shall be kept current with signal modifications.

   Conduct all work with the existing traffic signal systems remaining in operation unless authorized otherwise by the Engineer.

   The signal system may be turned off if necessary for signal modification work when authorized by Subsection 660-3.01. 7. f. (1) the Engineer. Signal outages may only be scheduled for Monday through Thursday, between the hours of 9:00 p.m. and 6:00 a.m. Signal outages may not occur on observed holidays. Prior to turning signal systems off, set the signal to flashing operation while R1-1 STOP signs (48"x 48") are posted for the approaches which flash red. After these approaches are

posted with STOP signs, the signal system may be turned off, and STOP signs posted for all remaining approaches. Two STOP signs are required for each approach. Mount each STOP sign with a high level warning device at a mounting height of 5 feet.

The Contractor must complete the signal and signing modifications for any one approach during one night's shift (9:00 p.m. to 6:00 a.m.) where signal systems are allowed to be turned off. Wiring modifications, including signal controller cabinet wiring, must be completed and ready for inspection and testing by State technicians at 6:00 a.m. of the same day. The Contractor must have an electrician present during the inspection and testing process. The State technician must place the signal system back into normal operation after the Contractor has corrected any deficiencies.

Remove all temporary STOP signs during flash operation. The Contractor shall return signal systems that have been turned off, to flashing operation before the work is completed, prior to the arrival of the State technician. At least one signal head per signal phase must flash, and only after the Engineer has inspected the work to insure correct flashing operation colors.

All incidental materials and other items which are not shown on the plans, assembly drawings, or specified herein, which are necessary to complete the system, must be furnished and installed as though such materials and other items were shown on the plans, assembly drawings, or specified herein.

Protect all metallic materials against corrosion. Hot-dip galvanize all ferrous metals such as bolts, braces, bodies, clamps, fittings, guards, nuts, pins, rods, shims, thimbles, washers, and miscellaneous parts not of corrosion-resistant steel, in accordance with ASTM A 123 or A 153, except where other equivalent protection treatment is specifically approved in writing by the Engineer.

2. Safety Precautions: *Add the following:* Existing circuits listed on the wiring diagrams and plan sheets were obtained from as-built information and must be verified prior to work involving those circuits.

Delete numbered paragraphs 3. through 8. in their entirety and substitute the following:

3. Excavating and Backfilling. Complete excavation and backfill required to install the signal and lighting components embedded in the roadway as shown on the Plans, including foundations, conduits, junction boxes, and loop detectors before final lift paving. Provide traffic control to complete this work according to the requirements of Section 643. Place excavated materials where it will not interfere with surface drainage.

   Support and protect conduits and utilities scheduled to remain in service when encountering them during excavation.

   Excavate trenches wide enough to install the number of conduits specified and to compact the bedding and backfill materials according to these specifications.

   To install conduits, excavate trenches deep enough to allow for 6 inches of bedding material, the depth of the largest conduit, and the minimum burial depth specified between the top of the conduit and finished grade of the ground above the conduit. Keep the longitudinal profile of trench bottoms free of irregularities that would prevent the assembled conduit run from continuously contacting the top of the bedding material.

   When conditions allow HDPE conduit to be installed by a plowed technique, restoring the area disturbed from the process, shall be accomplished according to Subsection 204-3.01. Density testing may be waived and compactive effort substituted at the discretion of the Engineer. This work is subsidiary to conduit installation. Use Selected Material, Type A for backfill.

Dispose of, according to Subsection 203-3.01, excavated materials that remain after completing backfill work and excavated material not meeting the requirements of Selected Material, Type C, as defined in Subsection 703-2.07. Disposal of this material is subsidiary to the 660 Pay Items.

Dewater foundation and conduit excavations immediately before and during embedding and backfilling operations. Backfill excavations with materials that meet the following requirements:

a. Backfill foundations with material that meets the requirements of Selected Material, Type A that passes through a 3 inch sieve.

b. Within the limits of the typical section, embed conduits and backfill trenches using material that meets the requirements of the lift where it is located, reusing excavated materials if it meets the requirements of the applicable lift.

c. In other locations, embed conduits and backfill trenches using material that meets the requirements of Selected Material, Type C, reusing excavated materials if it meets this requirement.

d. Import, when ordered, embedment and backfill materials that satisfy the preceding materials requirements.

Embed conduit(s) between two 6 inch lifts of material cleaned free of rocks exceeding a 1 inch maximum dimension. Grade and compact the first lift to provide a surface that continuously contacts the assembled conduit run.

Within 6 feet of paved surfaces and around foundations, backfill in uniform layers no more than 6 inches deep and compact each layer according to Subsection 203-3.04. In other locations, compaction may be as approved by the Engineer.

4. Welding. Complete welding according to Subsection 504-3.01.7. Welding and approved shop drawings.

Submit shop drawings of the proposed work with the welding plans for approval. The shop drawings shall include material specifications, component dimensions, the types of welds that will be made, and the proposed type and extent of weld inspection.

Repair the holes that were used to mount equipment, in reused poles and mast arms by welding in disks flush with the adjoining surface. For the disk material, use steel that matches the ASTM designation, grade, and thickness of the steel used to fabricate each pole. Cut disks that match the dimensions of the hole being repaired from pieces of steel plate bent to match the pole's radius at the hole. Grind the welds smooth and flush with the adjoining pole and disk surfaces. Repair the damaged finish according to Subsection 660-3.01.8.

5. Removing and Replacing Improvements. The Contractor shall complete the following work at the Contractor's expense.

a. Remove improvements that block completion of the work detailed on the Plans as specified herein.

b. Reconstruct with new materials the nonreusable improvements the Contractor removed to complete the work.

c. Replace with new materials the reusable items damaged by the Contractor, that are specified for reuse.

d. Reconstruct with new materials improvements damaged or removed by the Contractor not conflicting with the work and not scheduled for removal.

Nonreusable improvements consist of cast in place items, including: asphalt concrete pavement, sidewalks, curb and gutter, lawns, and traffic markings. Reusable improvements include the items that were made before installation. Excavated material may not be used as backfill in the base course if excavation depth exceeds the thickness of the base course.

Complete reconstruction work, including materials, according to the applicable sections of the Alaska SSHC, and leave the work in a satisfactory and serviceable condition. In completing the reconstruction work, match the alignments, widths, thicknesses, shapes, sizes, typical sections, cross sections, and finishes of the existing improvements.

If removing a portion of sidewalk or curb and gutter, remove an entire segment between the weakened plane contraction joints or between an expansion joint and a weakened plane contraction joint.

Before removing a segment of Portland or asphalt cement concrete material, cut completely through the material with a saw along the outline of the area to be removed. Make cuts neat and true and prevent shatter outside the area removed.

To replace lawns, leave the top of the backfilled excavation low enough to install 4 inches of compacted topsoil. Match the top of the topsoil with the bottom of the vegetative mat. Apply seed and keep the seeded areas watered according to Section 618.

Remove, keep alive, and replant trees, shrubs, and plants according to Section 621. Replace the trees, shrubs, and plants that do not survive with plants of like size and type.

6. Salvaging and Reusing Electrical Equipment. When the Plans include existing electrical equipment scheduled for removal or relocation, remove, and store the equipment listed in the following paragraph without damaging it. Deliver removed equipment not scheduled for reuse to the local District Maintenance Station, or place specified on the Plans or Special Provisions. Notify the district superintendent or person specified by telephone one week before planned delivery date.

   Salvage the controller assemblies, load centers, and video cameras. The Contractor shall replace at the Contractor's expense salvaged equipment damaged or destroyed before or during delivery or reinstallation.

   Controller assemblies and load centers include the cabinet and equipment contained in the cabinet (that is to be replaced) before Contract award.

   Remove from the highway right-of-way materials associated with the equipment removed or relocated and not scheduled for reuse, including conduits, junction boxes, conductors, and foundations. Raze the tops of foundations abandoned in place according to Subsection 660-3.02. Fill the holes left by removing junction boxes and foundations with Selected Material, Type A and compact as directed.

   Within 15 days of the Notice to Proceed, complete an inventory of the materials that will be salvaged in the presence of the Engineer. Note the location and condition of the materials. When material specified for reuse is found in an unserviceable condition, the Engineer will determine whether to repair it or replace it with new material that will be paid for as extra work under Subsection 109-1.05. Retain a copy of the inventory and give the original documents to the Engineer.

   When the Plans specify reinstalling existing equipment at new locations and installing State furnished equipment, complete the following work at the Contractor's expense.

   a. For poles, install new foundations, furnishing the new nuts, bolts, washers, and conduits needed to complete the installations.

   b. For lighting poles, install new illumination tap wires and fused disconnect kits.

c. For luminaires, clean the luminaires inside and out and install new lamps of the same wattage.

d. For signal heads, furnish and install the mounting brackets needed to complete the relocation, and clean the signal heads inside and out.

e. For poles and undisturbed poles from which the Plans specify removing equipment, repair the holes that were made to mount equipment according to Subsection 660-3.01.4 Welding and repair the finishes according to Subsection 660-3.01.8 Repairing Damaged Finishes.

When ordered, the Engineer will pay for repairing existing damaged finishes on existing equipment according to Subsection 660-3.01.8 as extra work.

If deciding to use new equipment rather than reusing the equipment specified, notify the Engineer of the change and include a submittal according to Subsection 660-2.01.1.

Deliver the salvaged materials undamaged to the local DOT & PF Maintenance and Operations Yard.

Coordinate with the State, M&O Signal Foreman, Eric Slay at (907) 451-5279, one week before planned delivery.

7. Field Tests. Electrical circuits must pass the following tests before the Engineer will accept the work for payment. Perform these tests in the presence of the Engineer, and document the results of each test on a per circuit basis. Retain a copy of test results and give the original documents to the Engineer. Furnish equipment needed to perform these tests.

Replace or repair at the Contractor's expense, and in an approved manner, faulty materials and work revealed by these tests. After making repairs, repeat tests on the repaired circuit and continue this process until circuits have passed required tests. The Department reserves the right to have the Contractor retest circuits, and to use the retest results to accept or reject individual circuits.

a. Grounds. Before completing the circuitry and functional tests, physically examine conduits ends, junction box lids, load centers, and the foundations for signal posts and poles, lighting poles, and controller cabinets to ensure the grounding system required by Subsections 660-3.06 and 661-3.01 has been installed and splices and connections are mechanically firm.

b. Continuity. Test each loop detector circuit for continuity at the roadside junction box before splicing the loop detector to the lead-in cable. Each loop detector must have a resistance less than 0.5 ohms.

After splicing the loop detectors to the lead-in cables, test each pair at the controller or detector cabinet. Each pair must have a value less than 5 ohms for single pair lead-in cables and 10 ohms for multipair lead-in cables. The continuity test ohm reading at the cabinet must be greater than the ohm reading measured for the loop detector at the junction box.

c. Insulation Resistance (megohm) Test. Complete this test to verify the integrity of each conductor's insulation after pulling the conductors and cables into position and before terminating the conductors. At 500 VDC, each conductor's insulation shall measure a minimum resistance of 100 megohms or the minimum specified by the manufacturer. With single conductors, complete the test between each conductor and ground. In each multiconductor cable, complete the test between conductors and between each conductor and ground.

After splicing the loops to the shielded pairs in the lead-in cables, measure each pair in the lead-in cables at the controller or detector cabinet between one conductor and the cabinet ground rod. Upon acceptance, document these tests in writing, for each circuit, and submit one (1) copy to the Engineer and one (1) copy to Traffic Signal Maintenance.

d. Inductance Test. Measure each detector loop and lead-in cable system at the controller or detector cabinet. The inductance must be in the range of 50 to 500 microhenries.

e. Circuit. Energize every signal indication circuit with lamps installed before installing the load switches.

f. Functional. Perform the following tests on each signal and lighting system after the component circuits have satisfactorily passed the tests for continuity, grounding, insulation integrity, and circuitry.

(1) For each new traffic signal system, complete at least 24 hours of flashing operation, followed by not less than 5 days of continuous, satisfactory operation. The Engineer may decide to omit the flashing portion of the test for modified signal systems and for new signals that replaced existing signals that remained in operation during the construction phase.

If the Engineer omits flashing operation and the system performs unsatisfactorily, correct the condition and repeat the test until the system runs for five days with continuous, satisfactory operation.

Begin the signal functional tests between 9:00 a.m. and 2:00 p.m. on any day, except a Saturday, Sunday, a legal holiday, or the day before the legal holiday.

Before each system turn on, aim signal faces according to Subsection 660-3.08 and ensure equipment specified on the Plans is installed and operable, including: pedestrian signals and push buttons; signal backplates and visors; vehicle detectors; highway lighting; and regulatory, warning, and guide signs.

(2) Perform the functional test for each highway lighting system and sign illumination system until the systems burn continuously 5 days without the photocell, followed by a 5 day operational test using the photocell.

(3) Perform the functional test for each flashing beacon system for not less than 5 days of continuous, satisfactory operation.

(4) Perform a continuous 5 day burning test on each pedestrian overpass and underpass lighting system before final acceptance.

A shut down of the electrical system due to a power interruption does not constitute discontinuity of the functional test if the system functions normally when power is returned.

8. Repairing Damaged Finishes. Examine new, reused, and State furnished equipment for damage to its finish before putting the equipment into service. Repair the damaged finishes found according to the following:

a. Galvanized. Repair damaged areas more than 12 inches away from welds and slip fit areas, by applying minimum 7.8 mils of zinc based alloy applied according to ASTM A780.

If the damaged areas are within 12 inches of welds and slip fit areas, make the repair by applying a minimum 7.8 mils of zinc rich paint applied according to ASTM A780.

b. Painted. Repair damage to painted finishes according to the following

(1) Wash the equipment with a stiff bristle brush using a solution containing two tablespoons of heavy duty detergent powder per gallon of water. After rinsing, wire brush surfaces to remove

poorly bonded paint, rust, scale, corrosion, grease, or dirt. Remove dust or residue remaining after wire brushing before priming.

(2) Factory or shop cleaning methods may be used for metals if equal to the methods specified herein.

(3) Immediately after cleaning, coat bare metal with pretreatment, vinyl wash primer, followed by 2 prime coats of zinc chromate primer for metal.

(4) Give signal equipment, excluding standards, a spot finishing coat on newly primed areas, followed by 1 finishing coat over the entire surface.

(5) Give nongalvanized standards 2 spot finish coats on newly primed areas.

Paint coats may be applied either by hand brushing or by approved spraying machines. Perform the work in a neat and workmanlike manner. The Engineer reserves the right to require the use of brushes for the application of paint, should the work done by the paint spraying machine prove unacceptable.

Add the following:

9. Regulation and Code. Complete work according to the standards of the NEC, the NESC, and local safety codes as adopted and amended by the Authority Having Jurisdiction.

660-3.02 FOUNDATIONS.

3. All Foundations. *Add the following:*

e. Protect foundation anchor bolts and conduit stub-ups poured into the foundation from damage before installing controller cabinets or poles.

The method of protection must be approved by the Engineer. This work does not relieve the Contractor of any responsibility specified under Subsection 107-1.15.

660-3.03 CONDUIT. *Delete this subsection in its entirety and substitute the following:* Electrical conductors shall be installed in conduit, except for overhead wiring, wiring inside poles, and when otherwise specified. Use rigid metal conduits (RMC) and fittings for raceways, including bored casings, except when the Plans specify using polyethylene conduits. Install conduits of the sizes specified along the routes detailed on the Plans. When routing is not shown, route conduits as directed by the Engineer.

1. Install conduits at least 30 inches below the finished grade of the ground above the conduit, except conduits that will be sealed under a minimum 4 inch thick Portland cement concrete sidewalk may be installed a minimum of 18 inches below the top back of curb or surface above the conduit, whichever is lower.

2. Install conduits that cross unpaved areas and paved roadways that will be overlaid in excavated trenches. Excavate, bed conduits, and backfill trenches according to Subsection 660-3.01.3, Excavating and Backfilling.

3. Install conduit(s) under paved roadways and approaches that will not be overlaid in excavated trenches. Jacking conduits into position is allowed. However, if subsurface conditions prevent the successful completion of the work, install the conduit(s) by boring or drilling methods without additional compensation.

4. If encountering obstructions during jacking or drilling operations obtain approval and cut small holes in the pavement to clear the obstruction. Locate the bottom inside face of the bore pit no closer than the

catch point of a 1.25:1 slope (a horizontal to vertical ratio) from the edge of pavement. Install approved means of protection around pits.

5. Sweep both rigid metal and polyethylene conduits through the open bottom of junction boxes by installing 90 degree rigid metal elbows on the ends of conduit runs. To each elbow, install a nipple that terminates 5 to 12 inches above the bottom edge of each junction box.

6. Install the tails of loop detectors without elbows through the walls of junction boxes at elevations that ensure the loops drain into the box. Extend the ends a minimum of 2 inches beyond the inside wall of the box.

7. Drill a 3/8 inch drain hole in the bottom of the lower straight section of elbows and in the bottom of conduits at the low points of conduit runs. Smooth the edges of the drilled holes on the inside of elbows to prevent scraping the conductors. Cover the holes with a wrap of approved filter cloth secured with 2 self-clinching nylon cable ties.

8. Keep conduits clean. Install grounding bushings and approved plastic insert type plugs on the ends of conduit runs before backfilling around the conduit ends.

9. At the low points of conduit runs, install sumps containing a minimum 2 cubic feet of washed porous backfill material that conforms to Subsection 703-2.10. Compact the aggregate sumps as directed to prevent settlement of the trench backfill.

10. Install conduits that must cross existing facilities such as storm drain pipes, duct systems, and other underground utilities at the minimum depths specified, going under the facilities if necessary. Install additional drains and aggregate sumps at the low spots, if any.

11. Position conduits in trenches, junction boxes, and foundations to provide clearances of at least 2-1/2 inches around 2 inch conduits and at least 2 inches around conduits larger than 2 inches.

12. Fabricate rigid metal conduits less than 10 feet long from standard lengths of conduit. Cut conduits squarely to ensure the threading die starts squarely on the conduit. Cut the same number of threads as found on the factory threaded ends. Ream the inside of conduit ends cut in the shop or field to remove burrs and sharp edges. Do not use slip joints or pieces of running thread pipe.

13. Coat drilled holes, shop and field cut threads, and the areas with damaged zinc coating with zinc rich paint.

14. When standard couplings cannot be used to join conduit components, use approved threaded unions.

15. Bury a continuous strip of 4 mils thick, 6 inch wide polyethylene marker tape above underground conduit runs. Install the tape 9 inches (± 3 inches) below finished grade, using two strips side by side to mark road crossings. Furnish tapes with a black legend on a red background.

16. When the Plans specify using polyethylene conduit, install RMC in structures and foundations, between load centers and the nearest junction box, and on the surfaces of poles and other structures.

17. In foundations, install 90 degree elbows and conduits of the size and quantity shown on the Plans. Extend the conduits a maximum of 3 inches above the top of the foundations for posts and poles with breakaway bases and 4 inches above the top of foundations for fixed base structures.

18. Seal conduits leading to electrical equipment mounted on soffits, walls, and other locations below the grade of the serving junction box with an approved duct sealing compound.

19. Install expansion fittings in conduits that cross expansion joints.

20. Install a polypropylene pull rope with a minimum 200 pound tensile strength in future use or spare conduits, and reinstall the plugs. Double back pull rope, at least two feet, into both ends of each conduit.

21. The Contractor may install conduits larger than the sizes specified. If used, it must be for the entire length of the run. Reducing couplings or bushings are not allowed. Complete work associated with installing conduits larger than specified without extra compensation.

22. Clean existing conduits that will remain in service using a heavy duty air compressor that delivers at least 125 cubic feet of air per minute at a pressure of 110 pounds per square inch. Clean the conduits before pulling in new cables and after removing cables to be removed or replaced as follows:

    a. When the conduits contain cables that will remain in service, leave the cables in place during the cleaning, and

    b. Ream empty conduits with a mandrel or cylindrical wire brush before blowing them out with compressed air.

23. When modifying existing conduit runs, complete the work as required for new installations using the same sizes and types of conduit. When extending existing conduits, add no more than a 90 degree horizontal bend to the extension.

24. When installing a junction box in a continuous run of existing conduit, remove a length of conduit in each conduit run and complete the work of installing the conduits, elbows, and nipples as required for a new installation.

25. When adjusting existing junction boxes to a new grade, remove cables and replace the nipples as required to provide the clearances specified for new installations.

26. Remove the ends of abandoned conduits from junction boxes that will remain in service.

27. When Plans call for connecting polyethylene conduit to RMC use a UL listed electrofusion coupler rated for direct bury application. The coupler must be rated for same wall thickness as the adjoining conduits. Thread the ends of the RMC with the same number of threads as found on the factory threaded ends of RMC. Ream the inside of conduit ends cut in the shop or field to remove burrs and sharp edges.

28. Prior to HDPE buried conduit installation, provide a short demonstration section of conduit with an electrofusion coupling cut out and split for destructive testing and approval of fusion.

29. Assure that the conduit is open, continuous, and free of water and debris prior to installing cable. Pull a stiff bristle brush through the entire length of the conduit run immediately prior to the cable being installed. Grade conduit uniformly straight and without sags.

30. Make any butt connections between high-density polyethylene conduit sections above ground prior to laying in the trench. Couple HDPE conduit to rigid metal conduit for all surface exposures. Butt-weld the conduit using the manufacturer's recommended procedures and equipment or couple with compatible molded HDPE electrofusion couplings (as acceptable with the conduit manufacturer). Connections to RMC may be made below grade as necessary to connect with existing infrastructure using care to prevent foreign matter from entering the conduit. If using coilable conduit, each run may only be one section so there won't be any butt-welded connections needed. All bending of conduit will be by means recommended by the manufacturer.

660-3.04 JUNCTION BOXES. *Add the following to the fifth paragraph*: Install a sump (stone drain) to the dimensions shown on the plans or equaling the length and width of the junction box and to a depth of 18 inches. Sump material shall be a washed porous backfill material that conforms to Subsection 703-2.10. A

mortar brick base, pavers, concrete block or stepping stones shall line the entire bottom perimeter of all new, relocated, or adjusted Type I, IA, II and III junction boxes, as shown on the Plans. Compact the aggregate sumps as directed to prevent settlement of the trench backfill. Compact gravel drain material under J-boxes as directed by the Engineer to prevent settlement of foundations, J-boxes, and adjacent improvements.

Add the following: When noted, or when new conduits are routed to an existing junction box, the existing junction box shall be adjusted. When new junction boxes are used to replace existing junction boxes they may require modifications as approved by the Engineer.

660-3.05 WIRING. *Delete the last sentence of the first paragraph and substitute the following*: Run signal cabling continuously without splices from the controller cabinet to the termination lugs in the signal housing. Do not splice conductors within cabinets, poles, signal heads, and luminaries.

Add the following to numbered subparagraph 1 before the first sentence: Ensure that the conduit is open, continuous, and free of water and debris prior to installing the cable. Pull a stiff bristle brush through the entire length of the conduit run immediately prior to the cable(s) being pulled.

Add the following to numbered subparagraph 7: Spare lighting conductors shall be capped in the pole bases and load centers by cutting the wire flush with the end of the insulation and bending the conductor back against itself and securing with three layers of electrical tape to prevent any possibility of making contact with ground or current carrying conductors

In numbered subparagraph 11 delete the fourth paragraph and substitute the following: Insert a loose woven polyester web that allows for a full ¼ inch of insulating compound to flow between the splice and the inside of the mold. Fill the PVC molds with non-re-enterable polyurethane electrical insulating and sealing compound that is nontoxic, is non-corrosive to copper, and does not support fungi or mold growth.

In numbered subparagraph 13 delete the word "bases" *and substitute the following*: base terminal compartments.

660-3.06 BONDING AND GROUNDING. *Delete this subsection in its entirety and substitute the following:* Bond and ground branch circuits according to the NEC and the following requirements: Make noncurrent carrying but electrically conductive components, including: metal conduits, junction box lids, cabinets, transformer cases, and metal posts and poles, mechanically and electrically secure to an equipment grounding conductor. Make fixtures mounted on metal poles, including signal components and luminaires, mechanically and electrically secure to the pole.

Install grounding bushings with insulated throats on the ends of metallic conduits.

Install main or system bonding jumper as applicable at the service as required by NEC article 250. Install copper grounding electrode conductors (GEC), sized per NEC Table 250.66, or #6 AWG, whichever is larger. Install copper equipment grounding conductors (EGC) for each circuit or raceway, sized per NEC Table 250.122, or #12 AWG, whichever is greater. Where conduits are installed for future conductors, the EGC may be omitted.

Attach the grounding conductors to the grounding bushings, leaving 12 inches of slack between each bushing. Connect grounding conductors together using irreversible compression type connectors to form a fully interconnected and continuous grounding system.

Retrofit existing spare conduits that will contain new cables exclusively with new grounding bushings. When the Plans require installation or removal of conductors from existing conduits, retrofit with new grounding conductors sized according to the preceding paragraph.

Bond junction box lids to the grounding conductor using copper braid with a cross sectional area equal to a #8 AWG and eyelet spaced at 6 inch intervals. Copper braid shall be a minimum of three feet long for Type

I and IA junction boxes and a minimum of six feet long for Type II and III junction boxes. Connect bonding jumpers to the grounding conductors using irreversible compression type connectors. Replace missing or damaged conduit and junction box lid bonding jumpers.

Join the equipment grounding conductors from the conduits to the grounding electrode conductor using irreversible compression connectors at Portland cement concrete foundations. For pile foundations, attach the equipment grounding conductor from the conduit to the pile cap adapter with a listed mechanical grounding connector.

When installing signal poles, signal posts, and lighting standards with frangible coupling bases, run a 5 feet long grounding conductor from the grounding bushing on the conduit to the grounding lug located in the handhole of each pole.

Bond breakaway type standards and pedestals by using 2 conductors from the conduit, one attached with a ground rod clamp to an anchor bolt and the other connected to the grounding lug located in the handhole of each pole.

Ground one side of the secondary circuit of a transformer, as applicable.

Install a 3/4 inch by 10 feet copper clad ground rod inside each controller cabinet foundation and a 6 AWG bare stranded copper wire for the grounding electrode conductor.

When routing a new conduit into an existing junction box or replacing an existing junction box, new and existing conduits shall have the grounding improved to current specifications.

Ground rods shall be installed in J-boxes when required for an electrically secure system.

660-3.07 TRAFFIC CONTROLLER ASSEMBLIES.

1. Shop Tests. *Delete the first three paragraphs and substitute the following*: Deliver the controller units, auxiliary equipment, and fully wired cabinets (including wiring diagrams and manuals) to:

   Department of Transportation and Public Facilities
   Signal Maintenance Shop
   2301 Peger Road
   Fairbanks, Alaska 99709
   Attn: Traffic Safety Engineer

   The Department will not sign for or accept shipments from suppliers, vendors or shipping companies. The Contractor must be present at time of delivery if materials are shipped directly from vendor to the Department, and the Contractor shall be solely responsible for the materials being delivered.

   All items must arrive together in one shipment. Partial shipments will not be accepted and will be returned to the Contractor.

   Notify the Traffic & Safety Engineer, through the Engineer, two weeks prior to equipment arrival so scheduling of testing can be arranged.

   Allow 6 weeks for shop testing.

   Use traffic signal equipment that meets the operational and functional requirements of the plans and specifications when tested according to NEMA Standards Publication No. TS 2-1992, *Traffic Controller Assemblies*.

   Delete the last paragraph.

3. Controller Operation.

   f. Controller Priorities. *Delete the second paragraph and substitute the following*: Provide emergency vehicle preemption operations in accordance with NEMA Standards Publication No. TS 2-1992, *Traffic Controller Assemblies*, Section 3.7 *Preemption* and the following:

660-3.08 SIGNAL AND LIGHTING STRUCTURES. *Add the following:* Apply anti-seizing compound to the following fasteners: frangible couplings, mechanical grounding connectors, bolts that secure handhole covers and signal mounting hardware to poles and mast arms. Remove the fasteners from luminaire mounting brackets, fused disconnect kits, grounding bushings, and signal faces that secure the visors, and apply anti-seizing compound to these fasteners before completing the installation.

Before passing conductors through the holes made in posts, poles, and mast arms for wireways, remove the burrs and sharp edges from the inside and outside of these holes.

Until each traffic signal and/or flashing beacon goes into operation, keep the vehicular and pedestrian signal faces covered with beige colored canvas shirts sized to fit the signal faces shown on the Plans. Each signal shirt shall feature elasticized openings that fit over the visors and at least two straps to secure it to the signal. Provide shirts with a legend that reads "out of service" and a center section that allows an operator to see the indications during system tests.

When not shown on the Plans, determine the shaft lengths of lighting and signal poles and signal mast arm connector plate locations to provide the plan mounting heights of luminaires and traffic signal heads.

4. Signal Head Mounting. *Add the following:* Prior to drilling holes or installing pole/post mounted pedestrian or traffic signals, the Contractor with the Engineer shall check for visibility problems and when required revise mounting as approve by the Regional Traffic Safety Engineer.

   Immediately correct any misaligned signal heads, pedestrian heads, or nonconforming work found by the Engineer or his designee within 12 hours of notification.

   Once the Contractor has changed any signal lamps within a signal head, the Contractor assumes responsibility for alignment of that head until it is accepted by the Department.

   Generally, pedestrian signals are arranged in pairs with one pair per crosswalk. The Contractor must ensure that only one pedestrian signal per pair is disconnected at any one time. Failure to do so will cause the intersection to automatically be placed in flashing operation. Install pedestrian signals according to manufacturer's recommendations.

   With two piece mast arms, do not install signal heads within 12 inches on either side of the slip type field splice.

   Attach each side mounted terminal compartment with two 1/2" x 13 bolts, with washers, threaded into holes tapped into the side of the pole at the location shown on the Traffic Signal Hardware Detail Sheet -on the Plans. Install the vertical pipe members plumb.

   When installing 5 sections vertically stacked signal heads on the sides of poles, secure the vertical pipe to the pole using a steel conduit hanger mounted 6 inches below the top horizontal pipe.

5. Pedestrian Push Button Installation. *Delete the second sentence in the second paragraph and substitute the following*: Install push button signs above each push button.

660-3.09 MAINTAINING TEMPORARY AND EXISTING ELECTRICAL SYSTEMS. *Delete the fourth sentence in the first paragraph and substitute with the following:* The lighting system shall be fully functional during the regular operational hours of sunset to sunrise, between September 1 and the

following May 1. Perform luminaire installation when work will not impact lighting function during regular operating hours.

Add the following to the second paragraph: 48 hours prior to any traffic signal system shutdown and/or changeover, the Contractor must supply the Northern Region Traffic Safety Engineer with a detailed plan and set of procedures proposed for any such shutdown or changeover. This plan should include but not be limited to:

- Date of proposed change over
- Time period during the day for proposed change over
- Proposed traffic control plan during the change over

The Northern Region Traffic & Safety Engineer must approve this plan prior to implementation.

Add the following subsection:

660-3.11 MANUFACTURER ASSISTED START UP. Provide an on-site manufacturer's representative for the following systems:

Wavetronix Radar Presence Detection System

Submit a pre-construction plan for positioning and orienting the radar presence detectors to be approved by a Wavetronix Radar Presence Detection System Manufacturer's representative.

Wavetronix Radar Presence Detection System Manufacturer shall be on site during system startup to trouble shoot and provide guidance on modifications as necessary.

Traffic Controller Assembly

The Contractor shall retain the services of a representative from the controller equipment manufacturer (Manufacturer's Representative), subject to the approval of the Engineer. The Manufacturer's Representative shall have previous experience with either the Northern Region DOT&PF or Central Region DOT&PF in assisting with traffic signal controller testing, field testing and turn on. Submit name(s) and professional credentials at least 30 days before beginning this work. When required, work on, and connections to, the controller unit, amplifiers, and related equipment shall be performed by or directly supervised by a qualified person serving as the Manufacturer's Representative.

On-Site manufacturer assisted start up is required.

1. Required Credentials of Manufacturer's Representative.

    a. 10 years experience working in the traffic controller industry, 5 years of that must have been as a signal technician.
    b. Must have IMSA Traffic Signal Technician, Level II certification
    c. Experience assisting with traffic signal controller testing and start-up with the Northern Region DOT&PF, or the Central Region DOT&PF
    d. Familiarity with both the NEMA TS1 and TS2 specifications
    e. Experience setting up video detection
    f. Competent to program the Controller Unit
    g. Competent to program the MMU permissive card
    h. Competent to implement and adjust timing plans
    i. Competent to implement coordinated timing plans
    j. Competent to read cabinet wiring diagrams and troubleshoot cabinet components
    k. Competent to troubleshoot interconnect cable
    l. Competent to test inductive loop detectors and setup detector amplifiers
    m. Competent to conduct training on installed components

2. Cabinet Preparation. The Manufacturer's Representative shall provide oversight and supervision of the controller cabinet preparation. The Manufacturer's Representative shall be on-site for the duration of this work. Cabinet Preparation, includes, but is not limited to:

   a. Field Test. Conduct field test including needed adjustments and repairs as described in Subsection 660-3.01.7.

   b. Control Cable Wiring. The Manufacturer's Representative will oversee the connection of control cables within the controller cabinet to the terminal blocks.

   c. Interconnect Wiring. The Manufacturer's Representative will oversee and test connect wiring to the terminal blocks.

   d. Labeling. The Manufacturer's Representative will check labeling of traffic signal components and correct or cause to be corrected deficiencies. Labeling will be done according to 660-3.05.14. Labeling occurs in both the traffic signal cabinet and j boxes associated with the traffic signal. Complete this work before any functional testing of the signal heads.

   e. Schedule. Upon completion of the controller cabinet preparation the Contractor and Manufacturer's Representative shall submit a schedule for controller programming, detector testing, installation field-testing, signal start-up and training of Department personnel to the Engineer for approval. Once the schedule is approved the Manufacturer's Representative shall:
      (1) Review timing plans provided by the Engineer. The Manufacturer's Representative may recommend adjustments to timing to be considered and accepted by the Engineer.
      (2) Program the controller unit based upon the accepted timing plan.
      (3) Connect the programmed controller unit and electronics accessories in the cabinet as required to make the signal fully operational.
      (4) Oversee field testing. Coordinate field testing with the Engineer to allow participation by Department staff. Schedule the start-up day following successful field testing and 1 to 5 days of flashing operations. Flashing operations can immediately follow acceptable field testing.
      (5) Oversee the change of the signal from flashing operations to fully actuated operations
      (6) Place current timing plans in the controller cabinet by the close of business the day the signal is turned on.
      (7) Provide intersection diagrams compatible with the Aries software.
      (8) Be available for onsite timing adjustments for a minimum of 24 hours after signal turn-on.

3. Test Reports.

   a. Contractor and the Manufacturer's Representative will provide the Engineer with reports detailing test procedures and results of test.

      The report will include at a minimum:

      (1) Inductive Loop Test including measured values of Inductance, quality factor, continuity and insulation resistance.
      (2) Proper signal display illumination
      (3) Proper pedestrian display illumination
      (4) Correct number of signal faces per phase
      (5) Proper signal head alignment
      (6) Proper functioning of pedestrian buttons
      (7) Proper functioning of EVP system
      (8) Flash programming correct
      (9) Ensure ped indication is black during flash
      (10) Conflicting traffic control signs removed

Add the following subsection:

660-3.12 TRAFFIC SIGNAL MODIFICATIONS. Required work is detailed on the Plan sheets and notes and the following. Work related to the Traffic Signal Communications System will be paid for separately.

The Contractor will have 10 hours to "changeover" the new controller assembly. Changeover includes but is not limited to: removing the existing controller assembly, replacing with new controller assembly, landing new and existing wires, programming the new controller unit, and bringing the signal back to full functionality. The 10 hour window will only occur on the days Monday through Thursday at a time determined by the Engineer. The Contractor will be assessed a Traffic Price Adjustment for an unauthorized lane closure according to Subsection 643-3.06.

Traffic control during the changeover will be paid for under section 643 Pay Items. At a minimum, traffic control will include the following:

- A portable changeable message board in advance of each approach with the message "Traffic Signal Work, New Traffic Pattern Ahead, from 00:00 AM/PM mm/dd/yy to 00:00 AM/PM mm/dd/yy
- A flagger for each approach

Traffic signal modifications are subject to the full Standard Specification for Highway Construction, the Special Provisions and the following:

1. Traffic Controller Cabinet: When a new traffic controller cabinet is called for, ensure legible labeling of all cabinet cables including but not limited to; control, detector, Opticom (EVP), UPS, interconnect, and telephone. Label loops and signal heads individually.

2. Traffic Signal Heads: When new traffic signal heads are required, provide with new LED units and new mounting hardware. If new heads are not called for, replace any missing visors or backplates subsidiary to the Traffic Signal System Pay Item.

   When replacing traffic signal or pedestrian indications conform to Subsections 740-2.14 and 2.15 and maintain brand consistency throughout intersection. When new heads are provided aim heads according to Table 660-2.

3. Conduits: Unless new conduits are called for reuse existing conduits. When new conductors are being added to existing conduits, conform to sections 660-3.03, 3.05, and 3.06.

4. EVP Components: When called for on the plans provide EVP components including all cables and mounting hardware. Ensure proper operation of EVP system.

5. Load Center: When called for on the plans provide fully functioning Load Center. If no separate load center item exists, the load center will be paid for subsidiary to the Traffic Signal System Pay Item.

6. Conductors: Reuse existing conductors except where the plans call for new conductors.

Salvage decommissioned reusable traffic signal equipment, components/materials and deliver to Department of Transportation and Public Facilities, Signal Maintenance Shop, at 2301 Peger Road within 72 hours of removal. Decommissioned components damaged as part of the salvage effort must be replaced with new components at no additional cost.

Add the following subsection:

660-3.14 DIRECTIONAL BORE. The work specified in this Subsection documents the approved construction methods, procedures and materials for Directional Boring, also commonly called Horizontal Directional Drilling (HDD).

1. General. HDD is a trenchless method for installing a product that serves as a conduit for liquids, gasses, or as a duct for pipe, cable, or wire line products. It is a multi-stage process consisting of site preparation and restoration, equipment setup, and drilling a pilot bore along a predetermined path and then pulling the product back through the drilled space. When necessary, enlargement of the pilot bore hole may be necessary to accommodate a product larger than the pilot bore hole size. This process is referred to as back reaming and is done at the same time the product is being pulled back through the pilot bore hole.

   Accomplish alignment of the bore by proper orientation of the drill bit head as it is being pushed into the ground by a hydraulic jack. Determine orientation and tracking of the drill bit by an above ground radio detection device which picks up a radio signal generated from a transmitter located within the drill bit head. Then electronically translate the radio signal into depth and alignment. In order to minimize friction and prevent collapse of the bore hole, introduce a soil stabilizing agent (drilling fluid) into the annular bore space from the trailing end of the drill bit. The rotation of the bit in the soil wetted by the drilling fluid creates a slurry. The slurry acts to stabilize the surrounding soil and prevent collapse of the bore hole as well as provides lubrication.

   Select or design drilling fluids for the site specific soil and ground water conditions. Confine free flowing (escaping) slurry or drilling fluids at the ground surface during pull back or drilling. Accomplish this by creating sump areas or vacuum operations to prevent damage or hazardous conditions in surrounding areas. Remove all residual slurry from the surface and restore the site to preconstruction conditions.

2. Materials.

   a. General. Materials are defined as pipe, casing, or conduit that becomes the installed product. Incidental materials that may or may not be used to install the product depending on field requirements are not paid for separately and will be included in the cost of the installed product.

   b. Product Pipe. Provide product pipe material of the type and/or size shown on the Plans. Product pipe shall have an inside diameter that will accommodate a 2-inch HDPE conduit. When pipe material is not indicated on the Plans, use steel or HDPE pipe material that satisfies the project requirements, field conditions, and these specifications. The product pipe must comply with all applicable Department specification sections and ASTM standards depending on the purpose and material of the product pipe. Join the pipe sections so that the joined pipe sections are installable using HDD. Ensure that the joined product pipes have adequate strength and flexibility to withstand the installation stresses, overburden pressures, and operating pressures without compromising the structural stability of the pipe wall. Ensure that the product pipe meets the bend radius required for the proposed installation. Join the pipe sections so that the inner surfaces are flush and even, watertight, and does not separate during installation.

      If HDPE pipe material is used, install in one continuous piece with no joints. For steel pipe material, joints in the casing pipe shall be welded. Steel pipe ends shall be machine cut and beveled at an angle of 37 ½ degrees. The beveled ends shall be butted, aligned axially, and welded to provide a full strength joint capable of resisting stresses, including jacking stresses.

   c. Material Standards. The following material standards are to be interpreted as the minimum in place standards. Use materials that are appropriate for the stresses generated by the selected equipment and field conditions. It is not intended to portray that the use of materials with these minimum material standards will retain their required properties if the stress limits are exceeded for

which they were designed during installation. Ensure that the appropriate material is used to retain compliance once it is installed.

Material Standards for HDD Installation		
Material Type	Non-Pressure	Pressure
Polyethylene (PE)	ASTM D 2447	ASTM 2513 ASTM D 2447
High Density Polyethylene (HDPE)	ASTM D 2447 ASTM D 3350 ASTM F714	ASTM D 2447 ASTM D 3350 ASTM F714 ASTM 2513
Polyvinyl-Chloride (PVC)	ASTM F 789	ASTM D 1785 ASTM D 2241
Steel	ASTM A139 Grade B(1)	AWWA C200 API 2B(2)
(1) No hydrostatic test required (2) Dimensional tolerances only		

d. Detection Wire. Electronic detection material for non-conductive piping products. Use tracer wire designed for HDD to conductively locate underground non-conductive casing according to ASTM D-1248. Use either a continuous green sheathed solid conductor copper wire line (minimum #12 AWG for external placement) or a coated conductive tape. Select a minimum 12-gauge copper clad steel wire and able to withstand the installation tension along the entire length of the line.

e. Casing Spacers. Provide spacers when noted or detailed on the Plans, or when the casing is more than 2-3 pipe sizes larger than the carrier pipe. Upon completion of the casing installation, the Contractor shall furnish and install boltless casing spacers on the carrier pipe. Casing spacers shall be spaced a maximum of eight (8) feet apart along the length of the carrier pipe or as recommended by the manufacturer. Wood skids or shims are not an acceptable method of supporting the carrier pipe.

Casing spacers shall be all non-metallic (polypropylene), molded in segments for field assembly without any special tools. Spacer segments shall be secured around carrier pipe by insertion of a slide-lock or similar method. The casing spacer polymer shall contain ultraviolet inhibitors and shall have a minimum compressive strength of 3,000 psi, an 800 Volts/mil dielectric strength and impact strength of 1.5 ft-lbs./inch.

f. Casing End Seals. After insertion of the carrier pipe into the casing, the ends of the casing shall be closed by installing 1/8" minimum thick synthetic rubber end seals. Use duct seal when terminating the casing inside of a structure, vault, or junction box.

3. Construction.

a. Work Plan. Prior to beginning work, submit to the Engineer a Work Plan detailing the procedure and schedule to execute the HDD work. The work plan will be comprehensive, realistic, and based on actual working conditions for this particular project. The work plan documents the planning required to successfully complete the HDD work. The work plan includes complete descriptions of proposed plans, procedures, equipment, personnel, and if applicable, supporting material, for the following:

- Drilling operations: describe the pilot hole drilling procedure, the reaming operation, the pullback procedure, and illustrate the plan
- Profile of the bore plotted at a scale appropriate for the crossing and acceptable to the Engineer. The plot shall include locations of utility crossings.

- HDD site layout including entry and exit points.
- Directional drilling equipment list includes: drilling rig, drill bit, back-reamer, mud mixing and pumping systems, down-hole tools, guidance system, and rig safety system. Provide calibration records for guidance equipment.
- Drilling fluid management plan: drilling fluid types and specifications, cleaning and recycling equipment, estimated flow rates, procedures for minimizing drilling fluid escape, and the method/location for final disposal of waste drilling fluids. Provide the MSDS for all drilling fluid additives that will be used.
- Pipe storage and handling details.
- Pipeline assembly and installation procedures.
- MSDS of any potentially hazardous substances to be used.
- Contingency plans for possible problems.

Submit supporting calculations, certifications, or material demonstrating the strength of the product pipes for acceptance before the beginning of the installation. Submit for the Engineer's acceptance prior to construction, other product pipe material than those listed on the plans. Demonstrate that the proposed material satisfies the purpose and withstands the design and construction stresses and pressures.

If site conditions change and require modification to the work plan, resubmit revised drilling plans to achieve successful installation. Explain, in the revised submittal, the anticipated and encountered conditions that mandated the change in plans.

b. Daily Reports and Operator Logs. Submit the Daily Reports to the Engineer within 24 hours. Include, in the Daily Reports, log of boring operations and guidance system for each drill rod added or withdrawn during drilling, reaming, and pullback. The log covers downhole tools and equipment in use, drilling fluid, fluid pumping rate, drilling head location. Cover, in the report, details of and perceived reasons for any unusual events and delays greater than one hour excluding normal breaks.

c. Record Drawings. At the completion of the HDD product pipe installation, the general contractor will provide the Engineer marked up plans noting all deviations from the plans that result in change of location, material, type or size of work guided by the boring operations and guidance system log. Post, on the drawing, the x, y, and z coordinates of the starting and ending points of the line at minimum. Include in the marked up plans, the station number or reference to a permanent structure within the project right-of-way, name of person collecting data, including title, position and company name, detection method used, and elevations and offset dimensions. Certify the accuracy of the drawing to the capability of the tracking system. If the HDD Contractor is the General Contractor, the HDD Contractor provides the Engineer with the marked up plans.

d. Site Preparation. Prior to any alterations to worksite, walk the area prior to the commencement of the HDD project and visually inspect the site for potential problems.

e. Utility Location. Call for locates before conducting any excavation. See Plans and Specifications for additional information and requirements. The casing locations shown on the Plans are approximate only and must be field located and confirmed with the Engineer and area utilities before starting work.

f. Quality Control. Take control of the operation at all times. Have a representative who is thoroughly knowledgeable of the equipment, boring and Department procedures, present at the job site during the entire installation and available to address immediate concerns and emergency operations. Notify the Engineer 48 hours in advance of starting work. Do not begin installation until the Engineer is present at the job site and agrees that proper preparations have been made.

g. Certifications. Provide proof that the drill rig operator and digital walkover locating system operator are factory trained to operate the make and model of equipment provided and have a minimum of one (1) year experience operating the make and model of drill rig. Submit documentation of the operators' training and experience for review at least two (2) weeks before start of HDD operations.

4. Bore Hole Diameter. Minimize potential damage from soil displacement/settlement by limiting the ratio of the bore hole to the product size. To minimize soil displacement, the size of the back reamer bit or pilot bit, if no back reaming is required, will be limited relative to the casing diameter to be installed as follows:

Maximum Pilot or Back-Reamer Bit Diameter When Rotated 360 Degrees	
Nominal Inside Pipe Diameter - Inches	Bit Diameter - Inches
2	4
3	6
4	8
6	10
8	12
10	14
12 and greater	Maximum Product OD plus 6

5. Equipment Requirements. Ensure that appropriate equipment is provided to facilitate the installation as follows:

HDD Equipment				
System Description	Pipe(1) Diameter Inches	Bore Length Feet	Torque Ft-Lbs	Trust/Pullback Lbs
Maxi-HDD	18 and greater	>1,000	>10,000	>70,000
Midi-HDD	Up to 16	Up to 1,000	1,900 to 9,999	20,001 to 69,999
Mini-HDD	Up to 6	Up to 600	Up to 1,899	Up to 20,000
(1)For the above, multiple pipe or conduit installations must not exceed the total outside pipe diameters stated above.				

Match the HDD drill rig and its auxiliary pieces of equipment to the diameter and length of product pipe being installed and ensure that the drill rod can meet the bend radius required for the proposed installation. Anchor the directional drilling machine to the ground to withstand the pulling, pushing, and rotating pressure required to complete the HDD installation.

Thrust/Pullback Requirements. Unless approved by the Engineer, limit use of HDD equipment to installing the following product sizes and lengths based on the following casing size, force and length relationships.

HDD Bore Equipment Thrust/Pullback Capacity						
Lbs	5,000 to 7,000	7,001 to 12,000	12,001 to 16,000	16,001 to 25,000	25,001 to 40,000	>40,000
Casing Size(1) Inches	Maximum Pullback Distance In Feet					
4 or <	400 or <					
6 or <		600 or <				
8 or<			800 or <			
10 or<				1,000 or <		
12 or<					2,000 or <	
>12						Engineer's Discretion

(1) For the above, where a single pull of multiple conduits is to be attempted, the applicable product size must be determined by the diameter of a circle that will circumscribe the individual conduits as a group.

6. Guidance System. Use an acceptable guidance system to locate and track continuously and accurately the drill head during the pilot bore. The guidance system must be capable of tracking the drill bit in the expected underground environment.

The acceptable methods include: walkover, wire line, Magnetic Guidance System (MGS) probe, proven (non-experimental) gyroscopic probe, or any other system as accepted by the Engineer. Select the guidance system and the drill rig to deliver the required horizontal and vertical accuracy required for the product pipe. Use a locating and tracking system capable of ensuring that the proposed installation is executed as intended. Select the locating and tracking system to provide information on:

(a) Clock and pitch information
(b) Depth
(c) Transmitter temperature
(d) Battery status
(e) Position (x, y)
(f) Azimuth, where direct overhead readings (walkover) are not possible (i.e. subaqueous or limited access transportation facility).

Ensure proper calibration of all equipment before commencing directional drilling operation. Take necessary measures to ensure accurate record drawing. Install all facilities such that their location can be readily determined by electronic designation after installation.

7. Drilling Fluids. Use drilling fluids mixture composed of potable water and a stabilizing agent - usually bentonite and/or polymer and/or appropriate additives continuously pumped to the drill bit. Design/select the drilling fluid: to transport the spoils; maintain temperatures of bits and transmitter; clean cuttings from drill bit and reamers; reduce friction, pullback, and torque on drill rods and product pipe; stabilize the borehole; control ground water pressure; and reduce migration of drilling fluids in soil.

Use water with pH between 7.5 and 10 and free of chlorine with calcium < 100ppm, sodium chloride < 500ppm, and chlorine < 50ppm. Hard water may be treated with soda ash to reach the required pH.

Design the quantity and the mixture of drilling fluids to perform the preceding functions in the expected soil. Vary the fluid viscosity to best fit the encountered soil conditions. Do not use any other chemicals or polymer surfactants in the drilling fluid without written consent from the Engineer. Certify to the Engineer in writing that any added chemicals are environmentally safe and not harmful or corrosive to the product pipe and the environment. Approvals and permits are required for obtaining water from such sources as streams, rivers, ponds or fire hydrants. Any water source used other than potable water requires a pH test.

8. Drilling Operations. Prior to the start of the boring operation, survey the work site with x, y, z coordinates along the planned bore path. Where applicable, provide stakes at offset distances (left or right) from the HDD centerline and paint the HDD centerline control points and at all known existing utility crossings. Submit this information to the Engineer at least 24 hours before the start of pilot bore operations.

Locate the bottom inside face of the bore pit no closer than the catch point of a 1.25:1 slope (a horizontal to vertical ratio) from the edge of pavement or curb. Do not leave these pits unattended until installing an approved means of protection.

For HDD installations, maintain a minimum depth of 36-inches below finished grade, including ditch lines. For the following structures, the minimum clearance requirements are:

Man-made Structure	Minimum Clearance Requirement
Bridge Foundations	5' horizontal & 4' vertical (clearances greater than minimum horizontal should continue to use the 5H:4V ratio, i.e., 10' horizontal should be no deeper than 8')
Drainage Pipes (less than 60")	1' above or below (while maintaining a minimum depth of 36" below grade)
Drainage Pipes (greater than 60")	1' above or 4' below (while maintaining a minimum depth of 36" below grade)
Water, Sewer, and Natural Gas Pipes	2' above or 2' below (while maintaining a minimum depth of 36" below grade)
Slope Protection	3' below
Slope Protection – Foundation Footing	5' below

Drill the pilot hole along the path shown on the Plans within the allowable tolerance for the type of use. Provide and maintain instrumentation necessary to accurately locate the pilot hole (both horizontal and vertical placements). Ensure adequate removal of soil cuttings and stability of the bore hole by monitoring the drilling fluids parameters such as the pumping rate, pressures, viscosity and density during the pilot bore, back reaming, and product pipe installation. Relief holes can be used as necessary to relieve excess pressure down hole. Obtain the Engineer's approval of the location and all conditions necessary to construct relief holes. Maintain proper disposition of drilling fluids and minimize inconvenience to other facility users.

To minimize heaving during pull back, determine the pullback rate in order to maximize the removal of soil cuttings without building excess down hole pressure. Contain excess drilling fluids at entry and exit points until the recycle, vacuum, or removal from the site during drilling operations. Ensure that entry and exit containments are of sufficient size to contain the expected return of drilling fluids and soil cuttings. Carry out excavation for entry, exit, recovery pits, slurry sump pits, or any other excavation as specified in the specifications. Sump pits are required to contain drilling fluids if vacuum devices are not operated throughout the drilling operation, unless approved by the Engineer.

Ensure that all drilling fluids are disposed of or recycled in a manner acceptable to the appropriate local, state, or federal regulatory agencies. When drilling in contaminated ground, test the drilling fluid for contamination and appropriately dispose of it. The Engineer will adjust the contract value and/or time if the Contractor was not notified about the contamination during the bidding phase. Remove any excess material upon completion of the bore. Contact the Engineer immediately if it becomes evident that the soil is contaminated in the drilling process. Do not continue drilling without the Engineer's consent.

The timing of all boring processes is critical. Install a casing into a bore hole within the same day that the pre-bore is completed to ensure necessary support exists.

The ends of each installed casing shall be covered with end caps in such a way that material will not enter.

Backfill of the entry, exit, slurry, and recovery pits shall be according to Subsection 104-1.04 Use Of Materials Found On The Work, Section 203 Excavation and Embankment, and Subsection 703-2.07 Selected Material. For pits located within the roadway or pathway embankment, backfill shall be in 8-inch lifts with material meeting the requirements of Selected Material, Type A to 95 percent of the maximum density. If large quantities of water are evident, the Contractor may elect to install backfill with 2 to 6-inches of course oversized rock overlaid with geotextile. Compaction shall be by a mechanical compactor. When backfilling around the casing, provide 4-inch water compacted sand bedding below the casing to 4-inches above the casing. The Contractor shall then use materials that

have been excavated from the pit that meet the requirements of Selected Material, Type C, above the conduit sand bedding, up to the bottom of the roadway or pathway structural section. For pits located outside of the roadway or pathway embankment, the Contractor shall backfill above the sand bedding with excavated material meeting the requirements of Selected Material, Type C.

Install all HDD pipe and conduit such that their location can be readily determined by electronic designation after installation. For non-conductive pipe and conduit installations, attach a continuous conductive tracking (tracer wire) materials, either externally, internally or integral with the product. Tracking conductors must extend at least two feet beyond bore termini. Test conductors for continuity.

Casing pipe shall have an inside diameter that will accommodate a 2-inch HDPE conduit. Alignment of the bore casing shall be within 2-feet of the staked requirements per 100-feet of casing installed. Except at entry and exit pits, at no time shall the depth of the bore be less than 36-inches or as indicated on the Plans. The successful bore shall meet the above requirements and allow for 95 percent utilization of the ordered size bore to be considered successful. As a clearance test, the casing shall pass a rigid mandrel with a length not less than 1-foot and a diameter of 1/4-inch less than the inside diameter of the casing. Foreign material, water, earth, sand, and gravel shall be removed from the casing.

Within 48 hours of successfully completing installation of the boring product, clean the work site of all excess slurry or spoils. Take responsibility for the removal and final disposition of excess slurry or spoils. Ensure that the work site is restored to pre-construction conditions or as identified on the plans.

9. Boring Failure. If an obstruction is encountered during boring which prevents completion of the installation in accordance with the design location and specification, the pipe may be taken out of service and left in place at the discretion of the Engineer. Immediately fill the product left in place with excavatable flowable fill. Submit a new installation procedure and revised plans to the Engineer for approval before resuming work at another location. If, during construction, damage is observed to the roadway facility, cease all work until resolution to minimize further damage and a plan of action for restoration is obtained and approved by the Engineer.

10. Environmental Protection. Take all necessary measures to eliminate the discharge of water, drilling mud, and cuttings to nearby waterways and storm water systems during the HDD work. If applicable, provide equipment and procedures to maximize the recirculation or reuse of drilling mud to minimize waste.

11. Damage Restoration. Take responsibility for restoration of any damage caused by heaving, settlement, separation of pavement, or escaping drilling fluid (frac-out) from the directional drilling operation. Restore the facility to its original conditions or better at no cost to the Department.

12. Remediation Plans. When required by the Engineer, provide detailed plans which show how damage to any roadway facility will be remedied. When remediation plans are required, they must be approved by the Engineer before any work proceeds.

660-4.01 METHOD OF MEASUREMENT. *Add the following:*

Item 660.2025.0000, Pan Tilt Zoom (PTZ) Camera. By each unit installed, complete and in place.

01/20/15 (N45)
660-5.01 BASIS OF PAYMENT. *Add the following:* The Department will pay for the electrical power for all electrical systems that are scheduled to become a permanent part of the work.

The Traffic Signal System pay item includes all materials and labor for installation or modification of the traffic signal system as outlines on the Plans and specifications. All conduit, cable, detectors, and other materials and labor required for the installation or modification of the OPTICOM preemption system, and the Wavetronix radar presence detection system are included in this pay item. Interconnect is included in

this pay item when Pay Item 662.2005.0000 is not included in the Bid Schedule. Pan-tilt-zoom (PTZ) video camera system is included in this pay item when Pay Item 660.2025.0000 is not included in the Bid Schedule. New load centers and detection loops are not included in this pay item. This pay item includes removal of all existing traffic signal systems as indicated on the Plans.

The Highway Lighting System pay item includes all materials and labor for installation or modification of the highway lighting system as outlined on the Plans and specifications. This pay item includes all conduits and cables used exclusively for illumination at an intersection where a traffic signal is being installed. This pay item also includes the luminaires and associated mast arms installed on combination traffic signal mast arm poles. This pay item incudes removal of all existing highway lighting systems as indicated on the Plans. Items not included in this pay item are signal poles, signal pole mast arms for traffic signals, and new load centers.

The Traffic Count System pay item includes all materials and labor for installation or modification of the traffic count system as outlined on the Plans and specifications. This pay item includes all detector loops, cables, conduits, junction boxes, and cabinets used exclusively for the traffic count system. Items not included in this pay item are conduits and junction boxes shared by the highway lighting or traffic signal systems and new load centers.

The Interconnect System pay item includes all materials and labor for installation or modification of a telemetry based interconnect system as outlined on the Plans and specifications. This pay item includes all conduits, junction boxes, cables, terminal blocks, and all other materials and labor required for installation of the interconnect system. Items not included in this pay item are conduits and junction boxes shared by a traffic signal system.

Payment Includes labor, equipment, and materials required to provide fully functional traffic signals and lighting systems, permanent and temporary, using new equipment. Remanufactured or rebuilt equipment will not be permitted.

Subsidiary to each Pay Item including but not limited to (Except when included as a separate Pay Item):

(1) General construction requirements,
(2) Bonding and grounding,
(3) Bored Casings,
(4) Completing tests,
(5) Conductors,
(6) Conduit,
(7) Dewatering excavations,
(8) Excavation, trenches in rock or soil, bedding, backfill for foundations, conduits, components,
(9) Foundations including concrete to complete foundations,
(10) J-boxes including adjustment to final grade,
(11) Labeling conductors,
(12) Maintaining temporary and existing electrical systems,
(13) Minor routing changes directed by the Engineer
(14) Preparing as-builts
(15) Removal and disposal of existing/new unused foundations, conduit, conductors, and J-boxes,
(16) Removing, repairing and replacing improvements
(17) Removal of signs and reinstallations required to install foundations, conduits, and J-boxes,
(18) Repairing damage to finishes on new equipment
(19) Salvaging reusable equipment and materials and delivering to the location specified, see 660-3.01(6) for additional requirements.
(20) Wiring
(21) Maintaining temporary traffic signal system
(22) Cleaning luminaire lens and reflectors after luminaire installation
(23) Adjusting luminaire lens to be parallel to the illuminated surface.

660 Pay Items do not include: roadway planing, roadway paving, drainage structures, erosion, sediment and pollution control, signing, striping and pavement markings, traffic control, load centers, disconnect switches, transformers, and components of the fiber optic traffic signal communication system. Removal and replacement of concrete sidewalk will be paid for under Pay Item 608.0001.0006.

Item 660.0001.0000 Traffic Signal System Complete, _____. Will be paid by signal system, complete and accepted in place. Item includes all work, materials, and labor for the signal heads, radar detection sensors, opticom preemption system, controller cabinets, controllers, wiring, auxiliary equipment, installation and configuration of system modem/interface unit, and all necessary appurtenances required to complete the installation and testing as noted on the Plans, Specifications and directed by the Engineer.

Item 660.0003.0000 Highway Lighting System Complete, COF. Will be paid by lighting system, complete and accepted in place. Item includes all work, materials, and labor for the wiring, auxiliary equipment, electrical improvements, and all necessary appurtenances required to complete the installation and testing as noted on the Plans, Specifications and directed by the Engineer.

Item 660.2003.0000 Traffic Signal System Modification ____. Will be paid by traffic signal system modifications, complete and accepted in place.

Item 660.2018.0000 Traffic Signal System. Will be paid by the work performed under this pay item.

Item 660.2025.0000 Pan Tilt Zoom (PTZ) Camera. Includes labor, equipment, and materials required to provide a fully functional Pan Tilt Zoom Camera Unit including but not limited to:

The provided camera shall be of the type noted on the plans and as specified in Section 740.

The camera, camera housing, video management software and licenses, compatible with CENTRACS, wire, cable, conduit, connectors, transformer, brackets, mounting hardware, setup as stated and shown on the Plans.

Except when included as a separate Pay Item in the bid schedule, the following listed materials are subsidiary to the 660 Pay Item for Pan Tilt Zoom (PTZ) Camera installation:

(1) Camera mounting bracket and pole mount adapter
(2) Pendant dome housing
(3) Stainless steel (SS) bands, fittings, and hardware
(4) Providing and installing factory pre-terminated CAT-6a Ethernet cable
(5) High POE Midspan with AC power cable
(6) RJ45 pre-terminated Ethernet patch cords
(7) Ethernet switch
(8) Fiber Distribution, Patch, and Splice panels
(9) Fiber Optic patch cords/cables, and jumpers
(10) Labeling
(11) Preparing as-built drawings
(12) Fiber Connectors and Connectorization
(13) Splice kits and splicing
(14) Cleaning and proving existing conduits in accordance with 660-3.03, Conduit, for reuse
(15) Warranty and maintenance

Where indicated on Plans, remove and replace the existing PTZ camera. The mounting bracket and hardware, RJ45 push-pull connectors (IP66 rated), and POE injector must be compatible with the camera manufacturer recommendations. The Contractor may reuse the existing mounting bracket and hardware if compatible with the provided camera. The removed PTZ camera, mounting hardware, and POE injector shall become the property of the Contractor.

The camera shall be capable providing HDTV 1080p video at 25/30 fps; 30x or higher optical zoom; have a hydrophobic function that can easily shed water from the dome glass; operate in -67°F to 122°F temperature ranges; arctic temperature control for start-up as low as -40°F; automatic defog; high light sensitivity and day/night functionality; laser focus; auto-iris; casing shall be IP66 and NEMA 4X rated, constructed from aluminum and have a polycarbonate non-yellowing clear dome. The camera and video encoders/decoders shall be covered by a 5-year minimum manufacturer's warranty.

When requested by the Engineer, the Contractor shall assist with assigning IP addresses, and configuring the cameras and network. The Contractor shall ensure that the provided cameras can be operated by DOT&PF engineers located at the DOT&PF Traffic Operations Center (TOC) and view HDTV 1080p video at 25/30 fps using the Department's fiber optic interconnect system.

Add the following pay items:

PAY ITEM		
Item Number	**Item Description**	**Unit**
660.2003.0000	Traffic Signal System Modification _____	LS
660.2018.0000	Traffic Signal System	CS
660.2025.0000	Pan Tilt Zoom (PTZ) Camera	EACH

SECTION 661
ELECTRICAL LOAD CENTERS

661-3.01 CONSTRUCTION REQUIREMENTS. *Add the following before the first paragraph:*

It is the Contractor's responsibility to provide power for the load centers. This includes securing all the necessary applications, permits, inspections, installing conduit, weatherheads, and wiring as required by the serving utility. The Contractor must arrange to have load centers inspected and approved by an electrical inspector, certified by the State of Alaska, Department of Labor, Mechanical Inspection. Approval must be shown by a certificate of electrical inspection attached to the load center.

Add the following: Specific City of Fairbanks load centers shall have a contactor controlled by line voltage of a branch circuit from an upstream load center. These are referred to as "cascaded" load centers. For cascaded load centers, provide an additional enclosed circuit breaker for disconnecting the additional power source. Do not provide photocells for cascaded load centers.

Where indicated in the drawings, remove existing load center(s). This includes removal of any downstream step-down transformers and support frame. The electrical service shall be removed under division 687.

661-5.01 BASIS OF PAYMENT. *Delete the first paragraph and substitute the following:* The following items are subsidiary to 661 pay items, which includes all necessary materials and labor:

(1) General construction requirements.
(2) Bonding and grounding.
(3) Bored or jacked casings.
(4) Completing tests.
(5) Signal controller branch circuit conductors.
(6) Signal controller branch circuit conduit and associated fittings, couplings, elbows, etc..
(7) Dewatering excavations.
(8) Excavation, trenches in rock or soil, bedding, backfill for foundations, conduits, components.
(9) Labeling conductors.
(10) Preparing as-built drawings.

(11) Providing backfill and compaction to fill voids of any removed poles, conduit, conductors, or junction boxes required for removal of load centers.
(12) Repairing damage to finishes on equipment.
(13) Salvaging reusable equipment and materials and delivering to the location specified.
(14) All internal wiring, including control devices and over current protection devices.
(15) Remove associated step-down transformers and support frames.

The following items are included under other divisions and not included under division 661:

(1) Lighting branch circuits (see Section 660).
(2) Electric service to load centers (see Section 687).

Add the following pay item:

PAY ITEM		
Item Number	**Item Description**	**Unit**
661.2002.0000	Remove Existing Load Center	Each

Add the following section:

SECTION 662
FIBER OPTIC SIGNAL INTERCONNECT SYSTEM

662-1.01 DESCRIPTION. This Section consists of the work required to furnish and install fiber-optic interconnect cable in conduit between the controller assemblies shown on the Plans along the route indicated or on a route as directed by the Engineer.

Adjust existing signal interconnect manholes.

In case of specification conflicts with Section 660 and Section 740, the specifications in Section 662 will govern.

When working with telemetry interconnect cable (twisted pair copper conductors) and Ethernet cable, conform to the requirements of Section 660.

After staking locations for new fiber optic conduits, bored casing, vaults, and manholes and removing interconnect junction boxes, comply with the requirements of Subsection 660-3.01, General.

662-1.02 REGULATIONS AND CODE. Complete the work according to these Specifications and Section 660, Signals and Lighting. The Department requires third party certification for high-density polyethylene conduit (HDPE).

662-1.03 INSTRUCTIONS AND GUARANTEES. One set of maintenance and repair manuals shall be included with each project installation and submitted to the Engineer.

No changes or substitutions in these requirements will be acceptable unless authorized in writing.

The supplied conduit shall carry a two-year warranty from the date of project acceptance to be free of defects. The installer shall be fully responsible for the installation of defect-free conduit and for the replacement of any conduit found to be defective.

662-2.01 MATERIALS. Submit the materials for review and approval according to the requirements of subsection 106-1.05, Certificates of Compliance; Subsection 660-2.01, Materials; and Section 662.

Fiber optic manhole adjustment materials conforming to Subsection 712-2.05, precast concrete manhole sections.

662-2.02 POLYETHYLENE DUCT SYSTEM. Provide a polyethylene duct system in which to pull the interconnect cable. ADOT&PF will not permit the installation of the polyethylene conduit in a plowed trench.

Furnish a polyethylene duct made from extra high molecular weight HDPE pipe, having a thermoplastic polymer conforming to or exceeding the minimum standard of PE334480E/C as defined in ASTM D3350. Comply with Subsection 740-2.06, Electrical Conduit and Fittings.

When connecting HDPE to HDPE, use a UL listed electrofusion coupler rated for direct bury application and install in accordance with the manufacturer's instructions. The coupler must be rated for same wall thickness as the adjoining conduits.

When joining rigid metal conduit (RMC) to RMC, comply with the applicable sub-items of Subsection 660-3.03, Conduit.

When trenching, transition from HDPE to RMC before crossing named roadways. When connecting HDPE to RMC, use a mechanical coupling system. The mechanical coupling shall be a Dura-Line Shur-Lock coupling system, or approved equal. The mechanical coupling shall have the following features:

- Re-enterable, no special tools required
- Air and water tight
- Capable of withstanding head pressures of greater than 20 feet
- No internal diameter reduction
- Excellent pull out strength when joining HDPE and RMC
- Corrosion resistant
- ETL Listed to UL-514B standards
- ETL Listed for underground applications, HDPE conduit, and wet locations

Keep junction boxes, fiber optic vaults and manholes, and ends of conduit covered unless pulling cable.

Detection Warning Tape. For conduits with new fiber optic cable, mark new and existing underground conduits that have been exposed by excavation operations with a continuous strip of orange polyethylene electronic marking system (EMS) caution tape. Ensure that the buried cable warning tape material is flexible, elastic, 6 inches wide, at least 6 mils thick, and intended for burial and use as an underground utility warning notice. The embedded markers shall become activated when using a matched locator device and does not require batteries, access point, and connection to an external transmitter. The markers shall work independently, so even if a section of caution tape is cut or removed, the other markers on the tape would continue to provide accurate location. The tape shall not provide a path for lightning and have a 50-year design life. Install the tape 12 inches (+/- 3 inches) below finished grade. The tape shall have "CAUTION ADOT/PF FIBER OPTIC CABLE BURIED BELOW," or other similar wording approved by the Engineer, permanently printed on its surface.

Acceptable EMS caution tape manufacturers include:

- 3M, Dynatel EMS ball marker model no. 7601-XR-CT-TEL
- Substituted, equivalent approved equal device capable of being located using a 7400 or 7500 Series 3M Dynatel Locator. Substituted warning tape must be at least 6 mils thick, have a 50 year life, and have embedded markers that are activated with no external power sources.

Detection Wire. This project uses a combination of HDPE and RMC conduits. Provide tracer wire in every conduit with fiber optic cable. The tracer wire shall be designed to conductively locate underground utility lines according to ASTM D-1248. Use either a continuous green sheathed solid conductor copper wire line (minimum #12 AWG for external placement) or a coated conductive tape. Select a minimum 12-gauge copper clad steel wire that is able to withstand the installation tension along the entire length of the line.

Use care during backfill and compaction operations to prevent damage to the junction boxes, vaults, manholes, marker tape, and conduits. Remove and replace items damaged during the backfill and compaction operations at no additional cost to the Department.

All conduits and fittings shall carry UL label on each segment.

After testing and installing the interconnect cable, plug conduit openings with duct seal to prevent water from entering the duct system.

662-2.03 FIBER-OPTIC CABLE. Mainline (backbone) fiber optic able shall be suitable for placement in underground duct and shall conform to the following:

- United States Department of Agriculture Rural Utilities Service (RUS) standard 7 CFR 1755.900
- Department of Agriculture Rural Electrification Administration (REA) Bulletin 1753F-601 (PE-90) dated August 4, 1994
- National Electrical Code (NEC) Article 770; NFPA-National Fire Protection Agency
- Telecommunications Industry Association / Electronic Industries Association (TIA/EIA) FOTP-Fiber-optic Test Procedures
- These specifications

1. Buffer Tubes.

   a. Optical fibers shall be loose tube, all-dielectric designed for outdoor installation. Cable shall be a gel-free design utilizing water swellable tape and water swellable yarn. Each cable shall be equipped with kink resistant buffer tubes containing 12 optical fibers each. Buffer tubes shall be stranded around a dielectric, anti-buckling, central-strength member using a reverse oscillation or “SZ” stranding process.

   b. Fillers are allowed in the cable to achieve cross-section symmetry.

   c. All cable fibers within each buffer tube shall be usable and shall be sufficiently free of surface imperfections and inclusions to meet or exceed the optical, mechanical, and environmental requirements contained in this specification.

   d. Fiber coating shall be a dual-layered, UV-cured acrylate applied by the fiber manufacturer. The coating shall be mechanically or chemically strippable without damaging the fiber.

   e. Repairs to fiber coatings are not allowed except as determined by the ADOT&PF Traffic Signal personnel at designated splice locations.

   f. Two (polyester or aramid) yarn binders shall be applied contra-helically with sufficient tension to secure each buffer tube layer to the central strength member without crushing the buffer tubes. The binders shall be non-hygroscopic, non-wicking, and dielectric with low shrinkage.

   g. Individual buffer tubes and optical fibers shall be distinguishable by means of distinct and recognizable color-coding in accordance with TIA/EIA-598-B, "Optical Fiber Cable Color Coding." The colors shall be stable during temperature cycling and not subject to fading or smearing onto each other or into the gel filling material. Ensure colors do not cause fibers to stick together.

h. Distinguish each fiber and buffer from others by means of color-coding according to the following:

1.	Blue	5.	Slate	9.	Yellow
2.	Orange	6.	White	10.	Violet
3.	Green	7.	Red	11.	Rose
4.	Brown	8.	Black	12.	Aqua

2. Outside Jacket.

a. The outer jacketing (sheath) material shall be applied directly over high tensile strength yarns. The minimum nominal jacket thickness shall be 55 mils.

b. The outer jacket material shall be medium density polyethylene (MDPE) conforming to ASTM D1248, Type II, Class C, Category 4 or 5, Grade J4. The light absorption coefficient, when measured in accordance with ASTM D3349, shall be a minimum of 400 at a wavelength of 375 nanometers.

c. The polyethylene jacket (sheath) shall contain carbon black to provide ultra-violet light protection. The jacket material shall be fungus inert as described in ASTM G21.

d. The jacket shall be free of any holes, splits, or blisters.

3. Cable Features.

a. The cable shall contain at least one ripcord under the sheath for easy sheath removal.

b. The cable shall be low temperature rated with operating temperature range of the cable shall be -40° F to +158° F.

b. The fiber-optic cable shall withstand a maximum pulling tension of 600 lbs during installation (short-term loading) and 200 lbs (long-term loading) with no damage. Tensions on the cables shall not be exceeded under any circumstances.

4. Manufacturer.

a. All fiber-optic cable on this project shall be from a current IS0 9001 certified manufacturer who is regularly engaged in the production of these specifications for fiber-optic cable.

b. Fiber-optic cables shall be manufactured, tested, and prepared for shipping by one manufacturer. That manufacturer shall provide all fiber-optic cables and connectors called for on the project.

5. Cable Markings.

a. All cable markings shall be approximately 1/8-inch (3 mm) nominal height.

b. Be clearly legible and distinguishable.

c. Made at 2-foot intervals to be used as length markers.

d. If initial markings fail to meet marking criteria (i.e., non-legible, incorrect spacing, spelling error, etc.), cables may be remarked to meet criteria. Cable markings shall include the following:

- Cable ID
- Sequential numbers in whole foot or meter intervals to determine the length of the cable and amount remaining on the reel

- Number of fibers
- "SM" (for Single Mode Fiber)
- “ADOT Fiber”

662-2.04 FIBER-OPTIC DROP CABLE. Drop cable is defined as the assembly or pigtail consisting of fiber-optic cable, connectors, protective tubing, fan-outs (if required), and all incidental materials. This is used for connectivity between a mainline fiber cable and the fiber optic switch in the signal controller cabinet. Drop cables shall be factory assembled. Drop cables shall be packaged individually within a plastic bag marked clearly with the manufacturer’s part number. Fiber-optic drop cables shall be a SM fiber Gator Patch Drop Cable with SC Duplex connections manufactured by Fiber Connections Inc. or approved equal. Pigtail shall be 100 feet in length or as called out on the Plans.

Cable design and installation shall meet temperature requirements for outdoor use as described in Subsection, 662-2.03, Fiber-optic Cable. The drop cable shall be one continuous cable with no intermediate splices between the pigtail and the connectorized ends. Non-connectorized ends shall be suitable for heat fusion splicing as described in Subsection 662-3.08, Splices.

Factory testing information of each Fiber-optic Drop Cable (fully assembled) shall be provided for each connector/fiber. The information shall be provided in test tags attached to individual or paired connector/fiber.

Field testing information of each Fiber-optic Drop Cable (fully assembled) shall be in accordance with Subsection 662-3.04, Field Testing and Performance of Fibers. Documentation of testing shall be in accordance with Subsection 662-3.05, Documentation of Testing.

Fiber-optic drop cables shall be equipped with the following:

1. Six or twelve optical fibers, or as specified on the Plans.

2. Fiber-optic connectors that are as follows:

    a. Compatible with the equipment being used for fiber strands with preset usage.
    b. In accordance with Subsection 662-3.07, Connectorization.
    c. Factory installed unless otherwise allowed by Engineer.

3. Drop Cable Fan-out Kits that are as follows:

    a. Heavy-duty Spider design.
    b. Install fan-out kits for all connectorized ends to build up to 3 mm jacket.

4. Tubing that is 900 µm or 3 mm fan-out as required by the application.

5. Buffer tubes that are protected by the cable sheath or fan-out kit. Exposed buffer tubes are not acceptable.

6. Individual fiber strands that are protected by aramid fiber tubes.

662-2.05 SINGLE MODE OPTICAL FIBERS. Single mode (SM) fibers utilized in the cable shall be fabricated from 100 kPsi proof stress glass and primarily composed of silica, which shall provide a matched clad index of refraction (n) profile and the following physical and performance characteristics:

1. Core Diameter: 8.3 µm
2. Maximum Attenuation: 0.4/0.25 dB/Km at 1310/1550 nm, respectively
3. Maximum Dispersion: < 3.2 ps/nm-km from 1285 nm to 1330 nm; < 17 ps/nm-km at 1550 nm
4. Dispersion Wavelength (ZWD): 1301.5 to 1321.5 nm
5. Zero Dispersion Slope: 0.092 ps/nm^2-km

6. Cladding Diameter: 125 +/- 1.0 µm
7. Core-to-Cladding Offset (concentricity): < 0.8 µm
8. Cladding Non-Circularity: < 1.0 percent
9. Fiber Coating Diameter: 245 +/- 10 µm
10. Secondary Coating: 900 µm (as specified for breakout cable/kits, distribution cable, pigtails, and patch chords only)
11. Fiber Colored Diameter: 250 +/- 10 µm nominal
12. Mode-Field Diameter: 9.3 +/- 0.5 µm at 1310 nm; 10.5 +/-1 µm at 1550 nm
13. Attenuation Uniformity: No point discontinuity greater than 0.10 dB at either 1310 nm or 1550 nm
14. Cutoff Wavelength: <1260 nm
15. Maximum End-to-End Attenuation per cable length: 15 db
16. Fiber Polarization Mode Dispersion (PMD): 0.5 ps/km$^{1/2}$
17. Proof Test: All Optical fibers shall be proof tested by fiber manufacturer
18. Attenuation at Water Peak: The attenuation at 1383 ± 3 nm shall not exceed 2.1 dB/km
19. Numerical Aperture: 0.13

662-2.06 FIBER-OPTIC MANHOLES AND VAULTS

1. General. Fiber-optic manholes and vaults shall be as follows:

a. Spaced at intervals no greater 1,000 feet. In extreme cases where conduit has no bend as permitted by the Engineer, 2,500 feet is allowable (conduit shall be lubricated with no bends).
b. Installed at locations where the cumulative, conduit bends, measured from the last manhole/vault, exceed 360 degrees.
c. Excluding risers and grade rings, not greater than 5 feet in depth as measured from the lid to the base.
d. Not required for change in conduit installation method.

Covers shall meet the Heavy Duty requirements of AASHTO M306, Drainage, Sewer, Utility, and Related Castings.

Finished grade shall be in accordance with pertinent sections of Subsection 660-3.04, Junction Boxes. Manholes and vaults shall be located in the field to avoid drainage swales. Do not install Type I or II vaults within the traveled way or shoulders, unless called for on the plans. Level the top of manholes and vaults and grade accordingly.

When interconnect conduit is located in the same trench as conduit intended for other purposes (i.e. electrical circuits), manholes/vaults shall be offset a minimum of 2 feet from the conduit trench.

A fiber optic cable support assembly shall consist of multiple brackets, racks, and/or rails required to suspend the required surplus cabling and any splice enclosures for a single vault. The support assemblies shall be recommended and approved by the manufacturer of the fiber-optic cable and splice enclosure. The support assembly shall be made from or coated with weather resistant material such that there is no corrosion of the supports. The support assemblies shall be anchored to the existing wall using stainless steel anchors. The fiber-optic cable support assemblies shall be incidental to the manholes/vaults.

Void areas between conduit openings and conduit shall be filled with a self-curing high-expansion foam duct sealant that will provide a permanent, flexible rubber like seal. The foam duct sealant shall be FST Sealant or approved equal. The foam duct sealant shall be a two-part “blown” urethane foam with 98% closed cell content and have the following properties:

- Compressive strength: 300 pounds (ASTM D1691)
- Tensile strength: 250 pounds (ASTM D1623)
- Flexural strength: 450 pounds (ASTM D790)
- Shall be able to withstand temperatures from -20° F to 200° F.

- Shall be chemically resistant to gasoline, oils, dilute acids and bases.
- Shall be available as a kit suitable for sealing various sized ducts.
- Shall foam and react in five to ten minutes at 70° F.
- Shall be capable of holding 10-psi water pressure continuously (equivalent of 22 feet water-head pressure), when installed

All openings in manholes and vaults shall be machined at the time of fabrication, as shown on the plans, or core drilled at the time of placement. Openings shall be sized to facilitate conduit called for in the drawings. Make core drilled holes in vaults not more than 1/2-inch larger than the outside conduit diameter. Do not “knock out” thin wall sections.

Manhole and vault walls shall be provided with at least sixteen 4.5-inch diameter knockouts (four per side) for future conduit installation. The knockouts shall be aligned across from each other.

Provide one electronic ball marker in each junction box and vault, and one electronic mini-marker in each manhole with fiber optic cable. Ensure that the electronic ball marker and mini-marker is a device specifically manufactured to electronically mark and locate underground facilities. Ensure that the electronic marker includes circuitry and an antenna encased in a waterproof polyethylene shell. Ensure that the outer shell is impervious to minerals, chemicals, and temperature extremes normally found in underground plant environments. Ensure that the electronic marker does not require any batteries or active components to operate. Ensure that electronic markers used to mark fiber optic cable and general telecom applications are orange in color and operate at 101.4 kHz. When excited by a marker locator, ensure that the electronic ball marker’s passive circuits produce an RF field to direct the marker locator to its position. Ensure that the operating detection range from the marker locator instrument is as follows:

- EMS ball marker: 5 ft.
- EMS mini-marker: 6 ft.

Acceptable electronic ball marker manufacturers include:

- 3M, Dynatel EMS ball marker model no. 1401-XR
- Substituted, equivalent approved equal device capable of being located using a 7000 or 7500 Series 3M Dynatel Locator

2. Manholes.

Manholes shall be rectangular/square precast concrete having steel reinforcement for strength and durability. The precast reinforced lid opening shall be sized to accommodate the manhole frame.

When located in the roadway, the top of manhole lid shall be depressed 3/8” below finished pavement grade, unless otherwise noted on the Plans.

Manholes shall be manufactured with the following criteria:

a. Design Loading: HS-20-44 with 30% Impact and equivalent soil pressure of 130 PSF.
b. Concrete shall be 4,000 PSI Min. at 28 days.
c. Reinforcing is Grade 60 steel
d. Manufacture per ASTM C-858.
e. Shall have a 1-inch diameter drain hole in the base.

Place pre-cast concrete manholes on top of 12 inches of porous backfill material (Subsection 703-2.10).

Provide each manhole with fiber-optic cable support assemblies, as specified herein, and as shown on the Plans. The cost to provide the fiber-optic support assemblies shall be incidental to manholes.

Provide extra heavy-duty cast gray-iron frame with ductile iron cover. The nominal inside frame opening is 36 inches in diameter. The cover shall include a neoprene gasket for water tight seal, (4) hex-head or penta-head SS cap screws to fasten cover to the frame, and a watertight pick hole. Cover to be lettered "ADOT/PF FIBER" or similar lettering that meets the approval of the Engineer. The frame and cover shall be drilled and tapped for grounding strap. Provide EJIW #1580 or approved equivalent.

Provide a 6-foot long tinned copper braid grounding strap to bond the frame and cover of all manholes.

662-3.01 CONSTRUCTION REQUIREMENTS.

1. Fiber-optic Cable. All splicing, testing and terminating of optical fibers shall be performed by a technician in accordance with subsection 662-3.02, Certified Fiber-optic Technician.

   Physical condition of the cable upon receipt shall be recorded as outlined in Subsection 662-3.05, Documentation of Testing. Cable reel shall be inspected for nails, staples and other materials that might otherwise kink or damage the cable when unreeling. All fibers should be tested upon receiving cable. The Contractor shall assume full responsibility of cable that is damaged if testing is not performed after receiving cable.

   A detailed construction plan and installation procedure shall be submitted and approved by the Engineer before cable installation. Cable shall only be spliced at designated splice points as specified on the plan.

   Before installation, all cables shall be inspected to be free of damage (nail or staple holes, jacket tears, kinks, etc.), material defects, manufacturing defects, and dimensional non-uniformity that would:

   - Interfere with the cable installation using accepted cable installation practices
   - Degrade the transmission performance and environmental resistance after installation
   - Inhibit proper connection to interfacing elements
   - Otherwise yield an inferior product

   Take all necessary precautions to protect reeled cable from possible damage while unattended. Exposed cable shall be protected at all times from vehicular and public traffic. If cable ends are exposed and unattended, cable caps shall be taped onto cable ends to prevent ingress of moisture into the cable.

   When cable is installed by pulling, a swivel and woven cable grip designed for fiber-optic cable shall be used. Materials for lubricating shall be utilized when pulling. Cable shall be pulled in one continuous run. Splicing is not allowed until the entire length of cable is installed. Cable shall be pulled in multiple runs when 2 or more 90° bends occur in the run. One continuous cable pull shall not contain more than one 90° bend.

   Cable installation in conduit (duct) systems shall conform to Corning Cable Systems procedure SRP-005-011, "Fiber-optic Cable Placing-Duct," or manufacturer approved methods of jetting or pulling. Cable shall not be kinked or forced abruptly against conduit edge when pulling cable from conduit ends. Cable feed systems (reels, rollers, guide, tubes etc.) shall be used to install or retrieve cable from conduit ends in vaults, manholes, or junction boxes.

   Maximum tension of 600 lbs. when pulling cable during installation (short term loading) and 200 lbs. (long term loading) shall not be exceeded under any circumstances.

   Equipment shall be provided to monitor tensile forces on long cable runs. Monitoring equipment shall measure pulling tension as it occurs and record the maximum tension incurred during the pull.

Unless cable is assisted by jetting or winching, lengthy cables requiring multiple pulls shall be coiled in a "figure-eight" pattern. Coiled cable will be staged at intermediated access points to avoid twisting of cable. The “figure-eight” patterns shall be approximately 15 feet in length. Cardboard shims shall be installed between cable layers at the crossover of the "figure eight" to relieve pressure on the cable. Fiber-optic cable lengths greater than 100 feet shall not be coiled in one continuous direction.

Minimum bend radii (20 x diameter of the cable with loading, 10 x cable diameters without loading) on the cable shall not be exceeded at any time.

Temporary aerial installation methods shall be consistent with Corning Cable Systems SRP-005-010, "Fiber-optic Cable Placing-Lashed Aerial" or manufacturers approved method.

Excess fiber cable slack shall be stored in vaults and manholes on hooks/racks in accordance with the plans. Cable slack shall be neatly coiled in a “figure-eight” configuration on the inside wall of the manhole/vault and shall be supported by cable brackets. Coordinate with the Engineer for preferred method. Cable slack shall be supported as to not interfere with access into manholes and vaults. Unless otherwise noted on the Plans, excess fiber cable slack shall be provided as follows:

- 100 feet per manhole and vault.
- 50 feet per junction box.
- 6 feet per controller cabinet.

Provide #12 AWG, THWN, stranded copper wire to serve as tracer wire. Install tracer wire in all new or proposed conduits, and in all existing conduits where fiber optic cables are being installed. Tracer wire shall be grounded in accordance with the NESC and NEC for non-current carrying conductors. Pull tracer wire simultaneously in a continuous length with the fiber optic cable. Provide waterproof butt splices where tracer wire is spliced. Splicing is allowed only in cabinets, vaults, and manholes. Provide enough slack to neatly locate the tracer wire away from normal fiber installation, splicing, and maintenance activities. Label all tracer wires entering equipment cabinets, manholes, and vaults.

2. Vaults and Manholes. Vaults and manholes shall not be placed near drainage collection areas. To the extent possible, vaults and manholes shall be placed so that they are accessible by service vehicles driving close to them and are located out of the driving lanes.

Brackets for splice enclosures shall be mounted as per the vault manufacturer recommendations. Mounting equipment for cable or splice closures shall not fully penetrate the vaults or manholes in order to prevent water intrusion.

Metal conduits, armored cable, and tracer wire that enter fiber vaults and manholes shall be grounded and bonded as required by NESC, NEC, and local codes. Provide a 3/4-inch by 10-foot copper clad ground rod inside each vault and manhole, and a #6 AWG bare stranded copper wire for the grounding electrode conductor. Bond fiber manhole and vault lids to the grounding conductor using copper braid with a cross sectional area not less than a #8 AWG and eyelet spaced at 6-inch intervals. Connect bonding jumpers to the grounding conductors using irreversible compression type connectors.

Terminate flexible multi-cell innerduct inside of interconnect conduit end in accordance with the innerduct manufacturer’s recommendations. at the inside wall of vault or manhole. Flexible multi-cell innerduct termination sealant and caulking shall be allowed to fully cure as per the manufacture's specification before backfilling the vault or manhole. Openings required to install special or directional conduit shall be sealed with manufacturer approved termination kit.

The interior bottoms of all vaults and manholes shall be clean, dry, and free of construction debris.

Adjust existing manhole or manhole top section by raising or lowering the frame or ring casting 12 inches or less, without reconstructing the cone section.

3. Polyethylene Conduit.

Install new high density polyethylene (HDPE) conduits a minimum of 36 inches below finished grade in trenches, except when used as innerduct.

Where indicated on the Plans, install HDPE innerduct in existing RMC; or in new RMC that have been provided to join two existing RMCs together (junction box removal cases).

Keep junction boxes, vaults, manholes, and ends of conduit covered unless pulling conductors.

Conduit shall be installed in one continuous run between access points.

Conduit shall be installed as linear as possible to minimize pulling distances dictated by fiber-optic cable tension requirements. Bends in conduits shall be minimized to the extent possible.

Directional changes in continuous conduit runs shall not exceed 90 degrees. Manholes, junction boxes, or vaults shall be provided where 90 degree directional changes are exceeded.

Required bends, sweeps, fittings, and parts necessary to connect the conduit to vaults, manholes, and junction boxes shall be subsidiary and will not be paid for separately.

Flexible bend sections are not allowed.

Conduit bending radii shall not exceed the minimum bending radius as dictated by the Manufacturer's fiber-optic cable requirements.

Where lubrication has not been provided in existing conduit, conduits shall be lubricated according to Corning SRP-005-011 or manufacturer recommended procedures. Lubrication, when required, shall be suitable to avoid long-term cable jacket damage.

Conduit ends shall be protected at all times from migration of foreign materials and rodents during and after shipment and during installation. Pre-lubricated conduit with exposed ends will be rejected. Where provided, non-lubricated conduits left unprotected shall be cleaned before cable installation.

The conduit fill ratio shall not exceed 0.65 where,
Fill Ratio = ∑ Cross Sectional Areas of Cable(s) / Inner Conduit Cross Sectional Area

The recommended maximum fill ratios are as follows:

Fill Ratio	Number of Cables within Conduit
0.31	2 cables
0.40	3 cables

Terminate all conduit entering vaults or manholes 3 inches past the inside wall of the vault or manhole.

Provide detectable warning/marking tape in accordance with Subsection 662-2.02, Polyethylene Duct System and install in accordance with the details shown on the Plans.

Use care during compaction operations to prevent damage to junction boxes, vaults, manholes, and conduits. Remove and replace items damaged during the backfill and compaction operations at no additional cost to the Department.

Before installing HDPE innerduct in existing conduit, prove all existing conduit runs by pulling a rigid metal mandrel roughly 90% of the inside diameter of the subject conduit. Conduit proofing shall show conduit continuity, alignment, is cleared of all obstructions and deformations.

After installing HDPE conduit and before installing fiber optic cable in fiber manholes and vaults, prove all HDPE conduit runs by pulling a rigid metal mandrel roughly 90% of the inside diameter of the subject conduit. Conduit proofing shall show conduit continuity, alignment, is cleared of all obstructions and deformations.

After installing the conduit and fiber optic cable in fiber manholes and vaults, prepare the conduit and apply duct sealant to create a water tight seal in accordance with the multi-cell innerduct manufacturers' recommendations.

A polyethylene pull rope shall be installed in all empty conduits for future cable installations. The rope shall be rated for 1,000 lbs. or greater and shall not be less than 1/4 inch in diameter.

All sharp objects (rocks, debris, etc.) shall be removed from the conduit trench before backfilling. The conduit bedding shall be free of rocks exceeding 1-inch maximum dimension. Unless otherwise approved by the Engineer, comply with the conduit trench details shown on the Plans.

4. Multi-Cell Innerduct.

Flexible multi-cell innerduct shall be provided in each HDPE or RMC conduit containing fiber optic cable. The flexible multi-cell innerduct shall be a 3-cell configuration and designed for use in 2" conduits in underground applications. The 3-cell flexible innerduct shall be as follows:

- UL Listed
- Designed for outdoor use in underground Fiber-to-the-Home (FTTH) applications
- Enables overlay of cables in occupied conduits
- Reduces or eliminates number of conduits required in new construction
- No special blowing equipment is required
- Each cell in a multi-cell innerduct shall contain a 1250-pound-force rated polyester flat woven pull tape. The pull tape shall be printed with accurate sequential footage marks and color-coded.
- Resistant to ground chemicals and petroleum products
- Pre-lubed for easier installation

A. Flexible Innerduct Installation. During innerduct installation, swivels must always be used with a pull rope specifically designed for use in cable pulling and eliminates twisting; and the factory installed pull tapes must free-float.

B. Flexible Innerduct Termination. Terminate the flexible innerduct as recommended by the manufacturer. In absence of manufacturer's recommendations, terminate the innerduct as follows:

a. Before sealing the conduit end, fold the innerduct back into the conduit approximately 7" to allow for building of a front and rear dam.

b. If cables are present, slit the innerduct chamber or chambers that contain a cable at least 7" into the conduit. Fold the innerduct 7" back into the conduit.

c. Do not leave pull tapes protruding through the foam dams as pull tapes may wick liquid through the seal.

d. Wipe out loose dirt and grime from inside of conduit and from cable sheath.

e. Arrange packing around all existing cables. Using a push rod or dowel, push the packing into conduit approximately 6”. If there are no cables present, push inner packing in only 4”-5”.

f. Ensure the packing fits snugly between the cable and the conduit. For multiple cables, ensure that all gaps are blocked with some sort of packing material. For larger cables, support the cable near the conduit opening using a cable spacer to provide sufficient space for the Duct Sealing Foam to expand around the cable.

g. Wrap front packing around the cable. Push the packing into the conduit, flush with its face. Packing provides a temporary barrier to hold the sealing foam compound in place while it is expanding, and prevent it from migrating down the conduit and into the innerduct. Leave a small void in the outside packing (at the top of the conduit) to allow foam as it expands to expand to the outside of the conduit.

h. Insert the nozzle of the foam dispenser between the foam packing and the top of the duct. Inject foam into the conduit.

i. If too much foam is added between the packing, the front foam dam may try to push out, this is normal. Do not restrict movement of the front dam.

j. Provide an approved closed-cell foam sealing system for conduit openings into building structures and vaults.

    i. Do not use open-cell canned foams or duct putty as they can sag and dry out over time; do not fully cure in conduits; and they do not hold water-head pressure.

    ii. Use conduit foam sealants that complies with:

        1. NFPA 70 National Electric Code (NEC) Sections 225.27, 230.8, 300.5 (G), and 300.7 (A) on raceway seals
        2. TIA-758-B Standard 5.1.1.2.8, 5.4.2.3 and 7.4.2.8.1
        3. Re-enterable and compatible with cables and conduits
        4. Holds over 22’ of water head pressure
        5. Seals out water, sewer gases, and rodents from conduits

    iii. Provide Polywater FST-250 foam duct sealant or approved equal.

Flexible multi-cell innerduct shall be MaxCell or approved equal.

662-3.02 CERTIFIED FIBER-OPTIC TECHNICIAN. The Fiber-Optic Technician shall have attended and successfully completed at least one four-day "Installation of Fiber-optic Products School." This school shall be conducted by a major manufacturer of fiber-optic products and encompasses all aspects of fiber-optic technician certification. In addition to attending the four-day school, fiber-optic technicians shall have a minimum of two years of work experience with the installation, splicing, termination, and testing of fiber-optic cable.

The Engineer reserves the right to revoke the approval of any technician not having at least two years of experience or demonstrating the skills and knowledge to perform at accepted industry standards or to the quality required in these specifications.

662-3.03 TESTING AND PERFORMANCE BY MANUFACTURER. All outdoor cable installations shall meet or exceed requirements of the Fiber-optic Test Procedure (FOTP) criteria referenced in RUS 7 CFR 1755.9 and Bulletin 1753f-601 (PE-90) and these specifications.

Following specifications shall apply to the appropriate Fiber-optic Test Procedures (FOTP):

1. TIA-455-3-A, FOTP-3 "Procedure to Measure Temperature Cycling Effects on Optical Fibers, Optical Cable, and Other Passive Fiber Optic Components": The average change in attenuation at extreme operational temperatures (-40° F to +160° F) shall not exceed 0.05 dB/km at 1,550 nm for single-mode fiber. The magnitude of the maximum attenuation change of each individual fiber shall not be greater than 0.15 dB/km at 1,550 nm.

2. TIA-45-82-B, FOTP-82, "Fluid Penetration Test for Fluid-Blocked Fiber-optic Cable." When a one-meter static head or equivalent continuous pressure is applied at one end of one-meter length of un-aged cable for 24 hours, no water shall leak through the open cable end. When a one-meter static head or equivalent continuous pressure is applied at one end of one-meter length of aged cable of one hour, no water shall leak through the open cable end. The aging cycle is defined as exposing the cable to 85°C for 168 hours and two cycles of -40°C to +70°C with cable held at these temperatures for 24 hours. At the end of this cycle, the cable will be decreased to +23°C and held for 24 hours. The water penetration test is completed at the end of the 24 hours hold period.

3. TIA/EIA-455-81-B, FOTP-81, "Compound Flow (Drip) Test for Filled Fiber-optic Cable": The cable shall exhibit no flow (drip or leak) of filling and/or flooding material at +65°C.

4. TIA/EIA-455-41-A, FOTP-41, "Compressive Loading Resistance of Fiber-optic Cables": Ten percent of the fibers shall not experience a magnitude of attenuation change greater than 0.1 dB at 1550 nm (single mode fiber). The magnitude of the attenuation change shall be within the repeatability of the measurement system for the remaining 90 percent of the test fibers; the repeatability of the measurement system is typically 0.05 dB or less. No fibers shall exhibit a measurable change in attenuation after test load is removed.

5. TIA/EIA-455-104-A, FOTP-104, "Fiber-optic Cable Cyclic Flexing Test." Change in attenuation shall not exceed 0.1 dB at 1550 nm for single mode fiber. The magnitude of the attenuation change shall be within the repeatability of the measurement system for 90 percent of the test fibers; the repeatability of the measurement system is typically 0.05 dB or less. The remaining 10 percent of the fibers shall not experience an attenuation change greater than 0.1 dB at 1550 nm (single mode fiber). The cable jacket shall not exhibit evidence of cracking or splitting at the completion of the test.

6. TIA/EIA-455-25-C FOTP-25, "Repeated Impact Testing of Fiber-optic Cables and Cable Assemblies." The magnitude of the attenuation change shall be within the repeatability of the measurement of 90 percent of the test fibers; the repeatability of the measurement system is typically 0.05 dB or less. The remaining 10 percent of the fibers shall not experience an attenuation change greater than 0.1 dB at 1550 nm (single mode fiber). The cable jacket shall not exhibit evidence of cracking or splitting at the completion of the test.

7. TIA-455-33-A FOTP-33, "Fiber-optic Cable Tensile Loading and Bending Test." While subjected to a minimum load of 600 lb-f, the cable sample shall be able to withstand a twist of 360 degrees in less than 3 meters of length. The magnitude of the attenuation change shall be within the repeatability for the measurement system for 90 percent of the test fibers; the repeatability of the measurement system is typically 0.05 dB or less. The remaining 10 percent of the fibers shall not experience an attenuation change greater than 0.1 dB at 1550 nm (single mode fiber). The cable shall not experience a measurable increase in attenuation when subjected to the rated residual tensile load, 200 lb-f.

8. TIA/EIA-455-85-A FOTP-85, "Fiber-optic Cable Twist Test": The magnitude of the attenuation change shall be within the repeatability for the measurement system for 90 percent of the test fibers; the repeatability of the measurement system is typically 0.05 dB or less. The remaining 10 percent of the fibers shall not experience an attenuation change greater than 0.1 dB at 1550 nm (single mode fiber). The average increase in attenuation for the fibers shall be <0.40 dB at 1300 nm. The cable jacket will exhibit no cracking or splitting under a 5x magnification after completion of test.

9. TIA/EIA-455-181 FOTP-181, "Lightning Damage Susceptibility Test for Optic Cables with Metallic Components."

10. TIA/EIA-455-37-A FOTP-37, "Low or High Temperature Bend Test for Fiber-optic Cable".

11. TIA/EIA-455-98, FOTP-98-A, "Fiber-optic Cable External Freezing Test".

662-3.04 FIELD TESTING AND PERFORMANCE OF FIBERS. All testing of optical fibers shall be performed by a Certified Technician as described in Subsection 662-3.02, Certified Fiber-Optic Technician.

The Contractor shall schedule the date, time, and location of any tests required by this specification with the Engineer 72 hours before performing the tests. ADOT&PF personnel shall be present when the tests are conducted. The certification technician shall demonstrate clearly how the tests are being performed and shall be made available to discuss testing strategies with the Engineer.

Tests shall be conducted using standard operating procedures as defined by the manufacturer of the test equipment.

The following tests shall be conducted after the cable has been installed, spliced, and prior to closing the splice cases. Test results shall be submitted in accordance with Subsection 662-3.05, Documentation of Testing. Tests shall be performed before any permanent equipment connections. All fibers shall be tested for continuity, events above 0.05 dB, and total attenuation of the cable. If the fiber-optic cable installed is connected to an existing fiber-optic cable, perform installation tests on the installed cable and all existing fibers to which it is spliced or connected:

1. OTDR (Optical Time Domain Reflectometer) Testing. This test shall be conducted to identify loss events and estimated attenuation for all fibers installed, terminated and unterminated. Traces shall be provided for each operational wavelength for the type of fiber in the system to indicate attenuations and their locations. A Certified Technician utilizing an OTDR and Optical Source/Power Meter shall conduct the tests after installation. The Technician shall conduct the test according to the standard operating procedure as defined by the manufacturer of the test equipment.

   To eliminate or shift the "dead zone," either a factory patch chord or "fiber launch box" of length greater than the dead zone shall be used.

   Measurement shall be conducted for 1310 nm and 1550 nm for single mode fiber.

2. Attenuation Test. All fibers terminated on both ends shall be tested with a standard power-meter test and all attenuation shall be documented. For every fiber installed or connected to under this Contract, perform end to end attenuation test.

   For the test, use a calibrated optical source and power meter using the standard three-stage procedure. Determine acceptable link attenuation by the cumulative value of standard losses based on length, number, and type of splices and connectors. Provide test results of the fiber-optic cable that demonstrate the dB/km loss does not exceed 3 percent of the factory test or 1 percent of the cables published production loss. The Engineer may elect to allow bi-directional averaging of OTDR testing due to splice loss core alignments. Fiber-optic cable loss limits shall be in accordance with the following:

   a. No event shall exceed 1.0 dB. If any event is above 1.0 dB, repair or replace that event location.

b. Total dB loss of a cable fiber less events shall not exceed 3 percent of the factory test or 1 percent of the manufacturer's published production loss at 1310 and 1550 nm. Cable fiber loss shall not exceed Maximum Attenuation Limits as defined in subsection, "Single Mode Fiber-optic Cable."

Cable Fiber Loss (dB) = Total Loss (dB) - ∑ events (dB)

$$\text{Cable Fiber Loss (dB/km)} = \frac{\text{Cable Fiber Loss (dB)}}{\text{Cable Fiber Length (km)}}$$

c. Where total or event losses exceed these specifications, replace or repair that cable run and assume all expenses, both labor and materials. Elevated attenuation due to exceeding pulling tension during installation will require replacement of cable at the Contractor's expense.

d. Fusion splice losses shall not exceed 0.10 dB per fiber. Mechanical splices, where allowed, shall not exceed 0.30 dB.

e. Each connector, after factory assembled, shall not exceed the maximum loss of 0.50 dB (typical loss is 0.25 dB) and optical return reflective loss of < -0.45 dB.

f. If event losses exceed these specifications, event locations shall be replaced or repaired without additional cost reimbursement for expenses.

g. If total loss exceeds these specifications, Fiber-optic cable shall be replaced or repaired without reimbursement for expenses.

h. All fibers within the cable shall be tested and proven usable in accordance with these specifications.

662-3.05 DOCUMENTATION OF TESTING. Upon completion of the field test, the Contractor shall provide three copies of all documentation to the Engineer. Except for standard bound materials, documentation shall be neatly bound in 8.5-inch x 11-inch (size A4) documentation in logical groupings. Bindings shall be of either the 3-ring or plastic slide-ring type. Permanently and appropriately label each such bound grouping of documentation.

Documentation from manufacturer shall include manufacturer data of cable and fiber including the following:

- Optical performance (OTDR) including dB/km loss measured at 1310 and 1550 nm for single mode.
- Manufacturer's name
- Date of manufacture
- Index of Refraction
- Cable ID
- Connector losses and bandwidth/dispersion data

Documentation of field testing shall include a map. This map shall show the following:

- Cable part numbers
- Manufacturer
- Cable length markings, including slack length markings at all manholes, vaults, and junction boxes
- As-built cable routing
- Location of splice points and hardware at each splice point location (see below under testing also).

Documentation shall include the information below for end-to-end testing, splice loss measurements, OTDR traces.

The documentation shall be neatly tabulated for each field test and shall include the following:

1. Cable and Fiber Identification.
   - Manufacturer
   - Cable ID
   - Fiber ID (include tube and fiber color)
   - Cable Location - begin and end point
   - Operator Name
   - Date and Time
   - Date of installation
   - Fiber Count
   - Cable Type

2. Setup Parameters.
   - Wavelength
   - Pulse Width (OTDR)
   - Refractory index (OTDR)
   - Jumper and/or Launch Box Length
   - Range (OTDR)
   - Scale (OTDR)

3. Test Results.

   a. OTDR Test:

      - Total Fiber Trace (mile)
      - Splice Loss/Gain
      - Measured Length (Cable Marking)
      - Provide traces on a CD to Engineer
      - Total Length (OTDR) (mile)
      - Events > 0.05 dB
      - Backscatter

   b. End-to-End Attenuation Test:

      - Length
      - Number and type of splices and connectors
      - Link Attenuation
      - Provide test on a CD to the Engineer

Fiber-optic cable test results shall demonstrate that dB/km losses do not exceed limits in accordance with Subsection 662-3.04, Field Testing and Performance of Fibers.

662-3.06 PACKAGING. Fiber-optic cables shall be shipped on wooden reels. The diameter of the drum shall be a least 20 times the diameter of the cable. The following information shall be either stenciled on the reel or on a weatherproof tag firmly attached to the reel or a combination of both in order to trace the manufacturing history of the cable:

- Optical Cable
- Number of Fibers
- Date cable was tested
- Non-armored
- Year of cable manufacture
- Name of cable manufacturer

- Gross weight
- Part Number
- Handling Instructions
- Arrow indicating cable wind direction

Cable data sheets shall be supplied to the Engineer containing the following:

- Manufacturer Name
- Cable ID Number and fiber type
- Factory Order Number
- Cable Length
- Factory measured attenuation (each fiber)
- Index of Refraction
- Bandwidth Specification (where applicable

In addition to the quantities shown on the plan, sufficient cable length shall be provided for testing. Both ends of the cable shall be available for testing. Pack one continuous length of fiber-optic cable per reel; maximum overage shall not exceed 10 percent unless approved by the Engineer. Compensation will not be granted for overage or excess cable needed for testing and installation methods.

Package the cable for shipping to prevent the cable from coming loose in transit. Secure the outer and inner end of the cable. Cover the reel with thermal wrap to protect the cable. Apply end seals to each end of the cable to prevent moisture from entering the cable. Include the manufacturer's test documentation with each reel. This documentation indicates the attenuation of each cable fiber in dB/km (dB/ft), measured at 1310 and 1550 nm for single mode fiber.

Provide to the Department any fiber optic cable remaining on the reel after installation and deliver to the ADOT&PF Peger Road maintenance yard or a location designated by the Engineer. Comply fully with the requirements in the preceding paragraph.

662-3.07 CONNECTORIZATION.

1. Connectors. This subsection shall consist of furnishing and installing connectors (in-line or terminated ends) and attenuators as required on the Plans or as required for working fiber-optic system. All connectors shall be installed by a Certified Technician as described in this specification.

   Hybrid adaptors shall not be used to connect two different connectors. Provide hybrid jumpers with different connectors at each end of cable to interface with equipment or cables with different connectors where indicated on the Plans or as required for a working fiber-optic system.

   SC connectors shall be used for single mode fibers. LC, FC, and ST connectors are allowed only where compatibility with equipment is required for fibers with a preset usage. These must be approved by the Engineer.

   The connectors shall support 10 Gb/s or IEEE 10GBase-LR applications.

   Connectors shall be installed with ceramic ferrules. The fibers shall be secured within ferrule with epoxy, heat set or air dried, as specified by the manufacturer. Machine polished mating faces shall be provided. Install connectors per manufacturer application and recommendations, including proper termination to the outer tubing (900 micron, 3 mm fan-out as required by the application). Connectors shall meet ANSI/TIA-568-C.3 and Telcordia GR-326 standards and be rated for a minimum operating temperature range of -40° F to 167° F. Connectors shall be factory-installed for all applications except where approved by the Engineer.

If connections are made, connectors shall be cleaned once before the first connection and once every time thereafter before reconnection. Connectors shall be cleaned according to manufacturer's recommended practices.

Connector losses shall not exceed limits as described in Subsection 662-3.04, Field Testing and Performance of Fibers. Repeatability of keyed connectors shall not exceed 0.2 dB.

Boots shall be provided for durable cable strain relief.

Dust caps shall be provided and installed at all times when connector is not in use.

2. Patch Cables. Furnish and install patch cables which connect the fiber optic switch to the pre-terminated drop cable or patch panel. Patch cables shall be pre-terminated by the manufacturer with SC connectors. Patch cables shall be subsidiary.

   Hybrid patch cables with different connectors at each end of cable shall interface with equipment or cables with different connectors where needed.

3. Patch Panels. Terminate and secure the specified fibers from a Corning wall-mountable interconnect center (WIC) with jumper protection door or an approved equivalent located in the traffic signal controller cabinet that the fiber is shown to enter on the plans.

   Ensure the fibers used throughout the system are matched correctly to allow for communications from one cabinet to the next in the system.

   Ensure that the patch panel is compatible with the fiber optic cable/cables being terminated and color-coded to match the optical fiber color scheme.

   All patch connectors shall be clearly labeled. The panel shall have the number of SC type connectors as indicated on the Plans or as directed by the Engineer.

   All installed patch panels shall include documentation regarding the identification, route, and function of each patch panel connector at that location. Place at least one copy of this information alongside the installed equipment or in the controller cabinet door pouch.

   Ensure that the patch panel is compatible with the fiber optic cable/cables being terminated and color-coded to match the optical fiber color scheme. The panel shall support 10 Gb/s or IEEE 10GBase-LR applications. See subsection 662-2.03, Fiber-Optic Cable, for color code requirements.
   All patch connectors shall be clearly labeled. The panels shall accommodate a minimum of 12 SC type connectors and be expandable to accommodate future connectors.
   The WIC shall accommodate a minimum of two 12 fiber splice trays.

4. Attenuators. Attenuators shall be provided at no extra payment to the Contractor to achieve the desirable signal loss. Attenuators shall only be installed on the receiving end closest to the originating transmission.

Connecting ends shall be compatible to connectors described in subsection 662-3.07, 1. Connectors.

662-3.08 SPLICES. Two weeks before the start of the fiber-optic cabling installation, the Contractor shall submit the following:

- Proposed locations of the mainline spliced points for review by the Engineer
- Proposed process to be used for splicing including procedure
- Cleave tool and specific fusion splicer to be used

1. All Splices.

Splicing and termination of optical fibers shall be performed by a Certified Technician as described in subsection 662-3.02, Certified Fiber-Optic Technician.

Splicing shall only be allowed in areas as designated on the plans or as approved by the Engineer.

Splices and stripped cable shall be housed by a fiber splice closure (FSC) in designated locations shown on the plans.

Cable ends involved in splicing shall match colors of the fibers and buffer tubes to the extent possible.

No stresses shall be placed on the fibers before or after the splice is completed.

Splice loss shall not exceed limits as described in subsection 662-3.04, Field Testing and Performance of Fibers

Fan-out kits are required for splices to multiple fibers in the buffer tubes for single mode fiber.

Splices shall be located in the center of the slack cable in manholes or vaults.

All splices shall be fusion splices protected with a heat shrink sealant (RTV fusion splices). 60 mm heat shrink protectors shall be used. Mechanical splices are not allowed.

2. End-To-End Splices.

End-to-end splicing shall be performed as per manufacturer instructions for the supplied splice closure units.

End-to-end fusion splicing shall be conducted for any disturbed fibers within the disturbed buffer tube(s). Remaining buffer tube(s) that are not required for splicing shall be undisturbed and protected in the Splice Closure.

End-to-end fusion splices shall be used on mainline splices for all fibers (48 fibers typical) within the fiber-optic cable where designated on the Plans.

3. Fusion Splices.

Fusion splices shall be made with a portable fusion splicer capable of AC or internal battery powered operation. The unit shall be able to splice fibers specified herein with 250 micrometer coating and 900 micrometer coating with little or no modification in the field. The fusion splicer shall be capable of full battery recharge in an eight-hour charging period.

4. Drop Fiber Splices.

Drop fiber splices (6 or 12-fiber typical) and drop cables (6 or 12-fiber typical) shall be used for connectivity between a primary mainline fiber-optic cable (12-count typical) and field devices (i.e., traffic signal controller cabinet) as identified on the Plans.

Drop fiber splices shall consist of breaking out the required buffer tube(s) from the fiber-optic trunk cable (12-count typical) and fusion splicing the appropriate number of fibers to the fiber optic drop cable. Remaining undisturbed fibers, if any, shall be protected in the splice tray.

Drop fiber splice shall be performed for each device location at locations shown on the plans. Splicing shall be performed as per Corning Cabling Systems Recommended Procedure SRP- 004-013, Mid-Span Access of Fiber-optic Cable (Cable Slack Present), or an equivalent manufacturer's recommended procedure approved by the Engineer.

662-3.09 SPLICE CLOSURES. Fiber-optic splice closures (FSC) shall be installed in all splice locations. Closures shall contain splice trays or organizers that contain the splices.

Before installation, the Contractor shall provide certification from the manufacturer that the splice closures conform to the specifications and test procedures.

Furnish PLP COYOTE® Dome, TE Connectivity FOSC 450, or approved equivalent splice enclosure that meets the following requirements:

1. Closures.

Splice closures shall be designed for use under the most severe conditions such as moisture, vibration, impact, cable stress, and flex temperature extremes. This will be demonstrated by successfully passing factory test procedures and these specifications. The closure shall prevent the intrusion of water without the use of encapsulates.

Closure re-entry and subsequent reassemble shall not require specialized tools or equipment; these operations shall not require the use of additional parts.

Splice closures shall provide housing and storage for all splices, stripped cable, and undisturbed buffer tubes. All splices enclosures shall provide protection and strain relief to optical fibers. Splice closures shall be suitable to handle straight, butt or branch splices.

Provide Splice closures having a minimum 16 buffer tube handling capacity and meeting the following requirements:

a. One, six-cable entry end plate
b. One blank end plate
c. All endplates shall be pre-molded
d. Required accessories to complete splice
e. One future cable entry kit for each splice closure

Closures shall be provided with external valve pressurization ports. Closure shells shall be glass-filled high-density thermoplastic that effectively withstands corrosion; high impact and freeze thaw stresses. Closure endplates shall be interchangeable with each size of closure available from the closure supplier.

Where additional access is required into an existing splice closure, replace the existing endplate with an endplate suitable for the task.

Splice closures shall accept up to six cables in a butt configuration and 12 for in-line configuration without special adaptors.

Closure shall contain a permanent neoprene gasket seal.

All closures, including closing hardware, shall be from the same supplier.

External Schrader valve pressurization port shall be supplied.
The splice closure shall be designed and equipped with the necessary mounting hardware to be attached to the side of the manhole or vault and to be suspended with sufficient clearance at each end for acceptable cable bends.

All cables shall be properly dressed and affixed to rails or racks within the manhole or vault. No cables or enclosures will be permitted to lie on the floor.

Fiber-optic cables shall be restrained within the splice enclosure such that there is no discernible tensile force on the optical fiber.

The splice closure shall have provisions for storing fiber splices in an orderly manner, mountings for splice organizer assemblies, and space for excess or unspliced fiber. Splice organizers shall be re-enterable and re-sealable.

The closure shall be capable of accommodating a minimum of 4 splice organizer trays, which shall accept mechanical, fusion, or multi-fiber array splices.

Splice closures shall contain a basket allowing fiber buffer tube storage of exposed buffer tubes. The splice case shall be UL rated.

The closure shall be installed according to the manufacturer's recommended guidelines.

2. Splice Tray.

One splice tray shall be designed to hold a minimum of 12 mechanical splices. A second splice tray (for fiber-optic drop cable) shall be designed to hold a minimum of 12 fusion splices. All other splice trays provided in the closure shall be designed to hold fusion splices of 12 (typical) up to 36 splices. Total number of splices supported shall be 144 splices.

Splice trays shall allow for optical fiber storage as recommended by the manufacturer. The splice closure shall have provisions for controlling the fiber bend radius (1.5 inches typical) to a minimum as required by the manufacturer.

662-3.10 SPLICE CLOSURES - FACTORY TESTING REQUIREMENTS. The construction and testing of the fiber-optic splices and splice enclosures shall comply with all applicable industry standards including Electronic Industry Standards (EIA/TIA), ANSI and ASTM standards.
Splice closures shall meet the following test requirements:

1. Compression Test. The closure shall not deform more than 10 percent in its largest cross-sectional dimension when subjected to a uniformly distributed load of 300 lbf (1335 N) at temperatures between 0° F and 100° F (-18° C and +38° C). The test shall be performed after stabilizing at the required temperature for a minimum of 2 hours. It shall consist of placing an assembled closure between two flat paralleled surfaces, with the longest closure dimension parallel to the surfaces. The weight shall be placed on the upper surface for a minimum of 15 minutes. The measurement shall then be taken with weight in place.

2. Impact Test. The assembled closure shall be capable of withstanding an impact of 21 ft-lbf (28 N-m) at temperatures of 10° F and 100° F (-12° C and 38° C). The test shall be performed after stabilizing the closure at the required temperature for a minimum of 2 hours. The test fixture shall consist of a 20 lb (9 kg) cylindrical steel impacting head with a 2-inch (5 cm) spherical radius at the point where it contacts the closure. It shall be dropped from a height of 12 inches (30 cm). The closure shall not exhibit any cracks or fractures to the housing that would preclude it from passing the water immersion test. There shall be no permanent deformation to the original diameter or characteristic vertical dimension by more than 5 percent.

3. Cable Gripping and Sealing Testing. The cable gripping and sealing hardware shall not cause an increase in fiber attenuation in excess of 0.05 dB/fiber @ 1550 nm when attached to the cables and the closure assembly. The test shall consist of measurements from six fibers, from each buffer tube or channel, or randomly selected in the case of a single fiber bundle. The measurements shall be taken from the test fibers before and after assembly. This will determine the effects of the cable gripping and sealing hardware on the optical transmission of the fibers.

4. Vibrations Test. The fiber splice organizers and splice retaining hardware shall be tested per EIA standard FOTP-11, Test condition I. The individual fibers shall not show an increase in attenuation in excess of 0.1 dB/fiber.

5. Water Immersion Test. The closure shall be capable of preventing a 10-foot (3-meter) waterhead from intruding into the splice compartment for a period of 7 days. Testing of splice closure is to be accomplished by the placing the closure into a pressure vessel and filling the vessel with tap water to cover the closure. Apply continuous pressure to the vessel and maintain a hydrostatic head equivalent to 10 feet (3 meters) on the closure and cable. This process shall be continued for 7 days. Remove the closure and open to check for the presence of water. Any intrusion of water into the compartment containing the splices constitutes a failure.

6. Certification. It is the Contractor's responsibility to ensure that all of the above tests have been performed by either the manufacturer or an independent testing laboratory and the appropriate documentation has been submitted to the Engineer. Manufacturer certification is necessary for the model of closure supplied. It is not necessary to subject each supplied closure to the actual tests described herein.

662-3.11 WARRANTY AND MAINTENANCE. Ensure that the fiber optic cable, patch cords, drop cables, vaults, manholes, splice enclosures, connectors, and terminations have a manufacturer's warranty covering defects for a minimum of two years from the date of final acceptance. Ensure the warranty includes providing replacements, within 10 calendar days of notification, for defective parts and equipment during the warranty period at no cost to the Department or the maintaining agency.

662-4.01 METHOD OF MEASUREMENT. Section 109 and the following:

Pay Item 662.2004.0000 Fiber Optic Manhole - Adjustment. By the number of units adjusted.

Pay Item 662.2005.0000 Fiber Optic Interconnect. Lump Sum: The work associated with installing fiber optic signal interconnect cable in new and existing conduit. Except when a separate Pay Item is used, this work includes saw cutting, asphalt removal, trench excavation, backfill with sand bedding, HDPE and RMC conduit, inner duct, connection to existing conduit, fiber optic cable, asphalt and aggregate base course, tack coat, and providing hot mix asphalt.

662-5.01 BASIS OF PAYMENT. The contract unit price paid per each fiber optic manhole adjusted includes all equipment, labor, and material required for adjustment.

Fiber optic interconnect payment includes labor, equipment, and materials required to provide a fully functional signal interconnect system using new equipment. Using used, remanufactured, or rebuilt equipment will not be permitted.

Subsidiary to 662 Pay Items including but not limited to (Except when included as a separate Pay Item in the bid schedule or subsidiary to Section 660 Pay Item for Pan Tilt Zoom (PTZ) Camera installation:

1. General construction requirements
2. Excavation, trenches in rock or soil, bedding, backfill for foundations
3. Temporary pole shoring of adjacent utility poles and light poles during trenching
4. Bored or jacked casings
5. Dewatering excavations
6. All types and sizes of conduits, associated fittings, couplings, elbows, bushings, etc.
7. Installing conduit over or under drainage culverts, storm drain, and utilities to avoid conflicts in accordance with the details shown on the Plans. This includes 4" Class A concrete and flowable fill materials.
8. Interconnect manholes and vaults, including excavation, backfill, grading, and ditching to restore drainage

9. Minor fiber optic vault/manhole, and interconnect routing changes directed by the Engineer. This includes avoiding conflicts with buried underground utilities.
10. Labeling
11. Duct seal
12. 3 Cell innerduct
13. Tracer wires, bonding and grounding
14. Pull rope/tape
15. Fiber Optic cables, fan-out kits/cables, breakout kits/cables
16. Splice closures, splice trays, splice kits, and splicing
17. Fiber connectors and connectorization
18. Detectable warning tapes, marker balls, mini-markers, and above ground markers
19. Maintaining temporary and existing electrical system
20. Removing, repairing and replacing improvements
21. Removal of signs and reinstallations required to install conduits, manholes and vaults
22. Repairing damage to finishes on new equipment
23. Salvaging reusable equipment and furnishing new unused materials and delivering to the location specified. Unwanted materials by the ADOT&PF will become the property of the Contractor
24. Proving new interconnect conduits in accordance with 662-3.01.3.
25. Testing and documentation
26. Warranty and maintenance
27. Preparing as-built drawings

662 Pay Items do not include pavement removal and paving; removing and replacing curb ramps, sidewalk, and curb and gutter; drainage structures; erosion, sediment and pollution control; signing; pavement markings; traffic control; and components of the traffic signal system.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
662.2004.0000	Fiber Optic Manhole – Adjustment	EACH
662.2005.0000	Fiber Optic Interconnect	LS

Add the following section:

SECTION 669
AUTOMATIC VEHICLE CLASSIFICATION

669-1.01 DESCRIPTION. This work shall consist of furnishing and installing Traffic Data sites, also known as Automatic Vehicle Classification (AVC) systems at the specified locations.

The work includes the installation of counters, communications/data equipment, conduit, cables, conductors, grounding, load center, support stands and poles, junction boxes, cabinet equipment, and ancillary equipment. The counters will be connected to the communications modem by the Department's Traffic Data and Forecasting Section. All other equipment, ancillary or otherwise will be connected by the Contractor. Acceptance testing will be performed and coordinated through the Engineer.

The work requires coordination and provision of utility services to the sites as illustrated on the Plans, including power and cellular data communications. Include connection fees with the Bid. Coordinate access with the Project Engineer. Utilize non-switched power. Provide circuit breakers as required.

AVC Stations are operated and maintained by the Department's Traffic Data and Forecasting Section. Where the Plans and Specifications require them to be notified of their presence at an inspection and for the final connection of electronic equipment, contact shall be made through the Engineer.

669-1.02 REGULATIONS AND CODE. All materials and workmanship shall conform to the standards of the Underwriter's Laboratories, Inc. and the National Electrical Code and local safety code requirements, where applicable.

All electrical equipment shall conform to the standards of the National Electrical Manufacturer's Association, where applicable.

669-1.03 UTILITY SCHEDULE. Within 30 days after the Contract award, submit three (3) collated copies of a Utility Schedule identifying all actions required to ensure activation of electrical and communications services prior to installation and commissioning of AVC equipment at affected sites.

Create a separate list of chronologically and sequentially organized actions for each proposed or affected AVC station. Include the following:

1. A description of the action.
2. When the action will occur.
3. The name, employer, position title, and telephone number of the point of contact for initiating the action.
4. The name, employer, position title, and telephone number of the party responsible for completing the action.

669-1.04 AS-BUILT PLANS. Prepare four (4) complete sets of red-lined as-built plans and keep them current with the construction. Detail in the as-built plans all construction changes made to the Plans. Include the following information on the appropriate sheets:

1. Location and depth of all presence loops, piezoelectric sensors, and conduit runs.
2. Station and offset of all junction boxes.
3. Location of the load center.
4. Location of all equipment cabinets.

Before final inspection of the work, submit three (3) sets of the as-built plans to the Engineer and affix one (1) set to the inside of the cabinet door in a waterproof, clear plastic laminated holder. You may substitute three (3) colored copies of the as-built plans in lieu of keeping the four (4) separate original copies. If you elect to do this, a sample of the method of copying must be approved before starting any work on the Automatic Vehicle Classification. Redlines of full-size construction plans may be used as as-builts.

669-1.05 PHOTOGRAPHS. Before the final inspection of the work, submit one copy of photographic documentation of all sensor installations.

1. Media. Supply photographs in JPEG format on CDROMs or other media, such as USB flash drives. Label each photograph with the identification of its subject in type large enough to be read with the unaided eye. Include device designation (example: H1BLC). Organize CDROMs along with as-builts in one or more white-colored, D-ring style, 3- ring binders. Place CDROMs in CD storage sheets inside the binders.

2. Content. Show the piezoelectric axle sensors and conduit in place prior to covering in the photographs. Include photographs showing the following:

    a. Two or more overall views of each AVC installation showing placement of the sensors and cabinet.

b. One or more views of each piezoelectric sensor conduit showing the coaxial cable, saw cut, and conduit to the nearest junction box.

MATERIALS

Use materials that conform to Section 740, the Materials Certification List, the Plans, Specifications, and the following:

Concrete	Section 501 (Class A)
Grout	Subsection 701-2.03
Reinforcing steel	Section 530
Paint	Subsection 708-2.01
Steel Pipe Pile	Section 715
Anchor Plate	ASTM A709
Galvanizing	Subsection 716-2.07

669-2.01 PIEZOELECTRIC SENSOR. Supply piezoelectric sensors meeting the following requirements:

1. Functional Class. Class II.

2. Center Core. 16 gauge, flat, braided, silver-plated copper wire.

3. Piezoelectric Material. Spiral-wrapped PVDF, highly compressed Piezoelectric copolymer.

4. Outer Sheath. 0.016-in thick brass, CDA-260, ASTM B 587-88.

5. Dimensions. 0.260-in wide and 0.063-in thick; ±0.005-in. Supply piezoelectric sensors length as shown on the Plans.

6. Insulation resistance. Greater than 500M ohms between core and shield.

7. Piezoelectric Coefficient. Greater than or equal to 20 pC/N – nominal.

8. Passive Signal Cable. RG 58 type or electrical equivalent, with a direct-burial rated outer jacket. Provide a cable with a nominal capacitance of 27 pF/ft (89 pF/m).

9. Installation Bonding Agent. AS475 methylmethacrylate grout or manufacturer-approved substitute.

10. Piezoelectric axle sensor. Two per lane, with coaxial leads long enough to reach the controller cabinet without splices.

669-2.02 CABINET. Supply cabinets meeting or exceeding NEMA Type 3R rating. The cabinets with all of their installed stationary components shall be third-party certified as a single assembly. The assembly shall include recognition of the portable devices to be enclosed and interconnected within. Comply with the following requirements.

1. Cabinet Dimensions. 40-in high, 24-in wide, and 17-in deep, unless specified otherwise on the Plans.

2. Cabinet Construction. Construct the cabinet and hinged door from 5052-H32 or better sheet aluminum alloy with a minimum thickness of 1/8-in. Supply an unpainted cabinet with a smooth grain finish on the exterior. Completely weld all seams and joints. Ensure that all welds are neatly formed and free of irregularities. Provide a cabinet totally enclosed with six (6) sides and a full front access that is free of burrs on all inside and outside edges and designed with a top sloped a distance of one inch, nominal, to prevent the accumulation of water on its top surface.

3. Insulation. Insulate the cabinet with a material consisting of a double layer of polyethylene air-bubble sheet laminated on both sides with aluminum foil. Attach the insulation material before other cabinet accessories. Use insulation meeting the following material requirements:

   Vapor resistance permeability rating of 0.006
   Fire-resistance rated as NFPA Class A, UBC Class 1
   Thermal resistance: Down r 14.9, Up R 6.0, Horizontal R 7.2

4. Door. Double-flange on all four sides to prevent dirt and liquids from entering the enclosure when the door is open. Provide a door restraint to prevent door movement in windy conditions. Provide a door that is a minimum of 80% of the front surface area and hinged on the right side when facing the cabinet. Furnish with a gasket meeting the physical properties found in UL508 table 21.1 and that forms a weather-tight seal between the cabinet and the door. Use a continuous hinge made of a minimum 0.075-in thick stainless steel with a ¼-in stainless steel hinge pin. Attach the hinge to the cabinet using ¼-20 stainless steel carriage bolts and non-slip nuts.

5. Latch/Lock. Provide a 3-point draw roller-type latching mechanism. The center catch and pushrods must be either stainless steel or cadmium plated, Type II Class 1, equal or better. Provide ¾-in diameter nylon rollers. Furnish a stainless steel operating handle with a 3/4-in shank. Provide a Corbin #2 lock keyed to match existing State cabinets. Furnish two keys with each lock.

6. Ventilation. Provide ventilation by means of louvered vents in the front door with a removable air filter. Louvers must satisfy the NEMA rod entry test for 3R ventilated cabinets. Secure the filter firmly in place with bottom and top brackets and a spring-loaded top clamp. Ventilate exhaust air out between the top of the cabinet and the door.

7. Shelves. Provide two (2) adjustable equipment shelves mounted on "C" mounting channels inside of the cabinet and supported on both sides. Mount two (2) vertical channels mounted on both sides of the cabinet and the back, for a total of six (6) inside each cabinet. Construct shelves from 5052-H32 or better sheet aluminum alloy with a minimum thickness of 1/8-in with a minimum shelf depth of 10.5-in. Supply shelves that are adjustable to within 4-in of the bottom, and to within 8-in of the top of the cabinet.

8. Terminal Blocks. Mount terminal blocks horizontally as shown on the Plans.

9. Interior Sensor and Communication Circuits. All sensor conductors and cables shall be routed parallel and perpendicular to the interior surfaces. Common runs of cables shall be laced together. All cables shall be fastened to the cabinet with fasteners not using adhesives.

Cabinets that include electrical service shall also meet the following requirements:

1. Load Center. Supply a load center with circuit breakers conforming to UL67 and NEMA PB1 standards. Furnish with Main Lugs Only, Two-Pole, 3 wire configuration, rated 100 Amp (minimum) 120/240 Volts, in a NEMA Type 1 enclosure with separate neutral and ground buses. Unit shall support the use of back-fed main circuit breakers. Provide a 40-amp, 240-volt back-fed main circuit breaker, and additional branch circuit breakers as indicated in the plan drawings. All circuit breakers shall have a minimum short-circuit interrupting rating of 10,000 AIC.

2. Transient Voltage Surge Protection. Provide load center with type 2 transient voltage surge protective device, with a minimum 22.5kA per-phase rating. Unit shall be installed within the branch circuit pole spaces, or otherwise external to the load center and protected by dedicated circuit breakers. Square D Model QO2175SB or equal.

3. Interior Light. Provide an 18-inch long, linear type fixture with LED light sources providing an asymmetrical distribution toward the interior of the cabinet with 270 lumens, minimum. The cross-section dimensions shall be 0.75 inches x 0.75 inches. The light color shall be 5000

degrees K. Provide a driver and required cables. Control the light by a single-pole, illuminated toggle switch mounted inside of the cabinet door.

4. Cooling Fan. Provide a thermostatically controlled exhaust fan at the top of the cabinet. Exhaust air must exit through a filtered and hooded vent at the top front of the cabinet. The fan shall be controlled by a thermostat located within the cabinet or integral to the fan unit. The fan shall be sized to exhaust heat generated by components contained within the cabinet on the warmest day, limiting the interior temperature to no more than 90 degrees F. The thermostat setting shall be coordinated with the setting required for the heater limiting operation to one or the other.

5. Receptacles. All receptacles shall be minimum extra heavy-duty, industrial grade, weather-resistant rated, with integral class A (4-6-mA) ground fault protection and NEMA 5-20R configurations. Receptacle basis of design is Hubbell "GF5362SGW" or equal. The receptacle cover plates shall be galvanized steel. Provide two duplex receptacle outlets inside the cabinet, one for the portable heater and for general purpose. Provide two double-duplex receptacle outlets dedicated for active electronics, with one at the top and one at the bottom of the cabinet. Mount receptacles within the cabinet as shown on the Plans.

6. Heater. Provide a cabinet heater with a circulating fan. The heater shall have a capacity of 710-800 watts utilizing 120-volt ac power, fan forced, cord connected electric heater. Rittal Model 3105-430 or equal. Single-stage thematically controlled heater connection power cord rated 16 amps at 120 VAC. 30°F to 100°F range. Sure-stat Cat #T118P or equal. The heater shall be controlled by a remote thermostat. The fan shall operate continuously. Mount near the bottom of the cabinet, with adequate clearance from instruments, circuits, and ventilation openings within the cabinet. Provide a single-pole, single-throw switch to bypass the thermostat control, enabling the heater to operate continuously.

7. Thermostats. Supply industrial type remote bulb type thermostats with SPDT contacts rated for 16 amps @ 120 VAC for combined motor and resistive loads for the heater and exhaust fan. The thermostats for the heater must have a contact that closes on lowering the temperature and set at 35°F. The thermostat for the exhaust fan must have a contact that closes on rising temperature and set at 80°F. The settings shall be adjustable with a 5 Fahrenheit degree differential above the heater setting and below the exhaust fan setting. The two thermostats may be combined into one cooling/heating type.

8. Interior Power Circuits. Provide all circuits for the light, exhaust fan, heater, and equipment receptacles within the cabinet utilizing metal-clad (MC) cable. The cable shall be routed parallel and perpendicular to the interior surfaces and fastened to the cabinet with metal straps. Terminate all other low voltage wiring on terminal blocks neatly trained within cabinet using wiring duct or ties.

9. Certification. The Cabinet Assembly consists of the cabinet itself and all high voltage (greater than 24 volts) components that are permanently installed, including the circuit breaker panel, receptacles, light, and fan as shown on the Plans or described herein. Provide certification that the cabinet and associated permanently installed equipment, as a unit, complies with recognized applicable national standards through an authorized local or national testing agency or fabrication shop that complies with ANSI Z34.1-1987 "Third-Party Certification Programs for Products, Processes, and Services", including but not limited to; Electrical Testing Laboratories (ETL), Underwriters Laboratories (UL), Canadian Standards Association (CSA), Electro Test Incorporated (ETI), or other certified testing agency recognized by the Labor Standards & Safety Division of the State of Alaska Department of Labor.

669-2.03 CELLULAR MODEM. Provide cellular modems as noted on the plans meeting the following requirements:

1. Bands. HSPA/HSPA +900/2100, LTE 700MHz, GPRS 900/1800/1900, and/or CDMA/EV-DO 800, 1900 technologies.

2. Technology: LTE with fallback to HSPA+, HSPA, Edge, GPRS, or LTE with fallback to EV-DO Rev. A, CDMA EV-DO (Rev. 0) CDMA 1xRTT.

3. Security: Include VPN Pass-Through, GRE Tunneling' IP Filtering, Port Filtering, SSH, and HTTPS.

4. Signal Methods. Coordinated with local service providers with the highest performance achievable.

5. Operating Systems. Must be compatible with Windows and other systems with 10/100 Base-T Ethernet RJ45, RS-232 serial, and USB ports.

6. Interface. Conform to the EIA RS-232/ITU-TSS V.24 standard and be compatible with the EIA RS-232C and RS-423 standards, along with USB, TCP/IP, UDP/IP, HTTP, NMEA, TAIP, TSIP, GPS, and DHCP.

7. Connections. Provide a serial port with a DB9 (female) connector and RJ45 10/100 Base-T Ethernet port. Fully implement leads for RS-232 and/or Ethernet signals.

8. Connection Accessories. Equip with appropriate connectors, cables and 120VAC power adapter.

9. Indicators: LEDs indicating network, signal strength, activity, and power conditions.

10. Environmental Limitations: Operating temperature, -22 degrees F (-30 degrees C) to +158 degrees F (+70 degrees C); and Storage temperature, -40 degrees F (-40 degrees C) to +185 degrees F (+85 degrees C).

11. Standards: FCC, Mil-Spec 810-F, IP64, and RoHS Compliant.

12. Antenna: Equip with external surface mounted on top of the cabinet enclosure, multi-band LTE cellular antenna with IP 67 rating. Also, include two (2) 6-9-inch Dipole antenna equipped with an articulated SMA connector for flexible positioning of 0-90º pivot and a sleek ruggedized for durability as spares.

Provide Sierra Wireless AirLink Raven RV55 Series gateway, LTE-A Pro 1104302, FirstNet Ready LTE Router with Wi-Fi includes 1-Year Airlink Complete, Sierra Wireless AirLink Antenna: Paddle Cellular 6001110, Sierra Wireless Surface Mount, Multi-Band LTE Cellular Antenna LTMG302-3C3C2C-BLK-180, Sierra Wireless AirLink AC-12 Vdc Power Adapter or approved equal.

669-2.04 AUTOMATIC VEHICLE CLASSIFICATION (AVC) COUNTERS. Provide counters classifying vehicles using loop, piezoelectric sensors, and contact closure inputs as appropriate for the site's sensor configuration, associated electronics, and software necessary to automatically poll counters with the following features:

1. Capacity: Up to 8 loop count and 8 piezoelectric sensors.

2. Counter Rate: 200 counts per second per input.

3. Intervals: Selectable 1, 2, 5, 6, 10, 15, 30, and 60 minutes, 2, 3, 6, 12, and 24 hours with four minimum daily peak periods.

4. Classification: FHWA Scheme F, or user-defined.

5. Communications: RS-232 with baud rates 115K, USB, and Bluetooth.

6. Memory: 16 GB, minimum, SDHC Memory Card.

7. Battery: Rechargeable with 12 hour, minimum, capacity, and 120 volt AC power supply.

8. Display: 20 digits x 4 lines, liquid crystal.

9. Cables: As required for a complete and operable system.

10. User manual.

11. Quality Assurance: NEMA TS/2.

12. Polling Software and Hardware & Training: Windows-based; automatically find the correct baud rate; automatically find the correct serial communication port; give the operator the ability to download and save data; give the operator the ability to save/back up the configuration to a file or load/restore the configuration from a file, and provide a virtual connection option so that the software can be used without connecting to an actual sensor. Ability to export data and generate reports. Provide DOT&PF Traffic Data Section staff with training on AVC polling Hardware and Software.

13. Warranty: Two (2) years, minimum.

669-2.05 REMOTELY CONTROLLABLE SERIAL SWITCH. Provide remotely-operated switches meeting the following requirements:

1. Interface: Conform to the EIA RS-232/ITU-TSS V.24 standard and will be compatible with the EIA RS-232C and RS-422 standards.

2. Connections: Provide a minimum of two addressable serial ports with DB25 (female) connectors.

3. Protocol: Provide asynchronous data communication at all standard data rates from 1200 bps to 19.2 Kbps. Support hardware (DTR/CTS/RTS) or software (XON/XOFF) flow control and data formats of 7 or 8 data bits with odd, even, or no parity.

4. Port Configuration: Each code operated switch port must be independently configurable for the following parameters:

    a. DTE or DCE interface function.
    b. All standard data rates between 1200 bps to 19.2 Kbps.
    c. Data format of 7 or 8 data bits; odd, even, or no parity.
    d. Hardware (DTR/CTS) or software (XON/XOFF) flow control.
    e. RS-232 break signal detection and response, enable or disable.
    f. Power Consumption. Accept supply voltages of 115-120 VAC at 60 Hz, and consume less than 5W.

5. Serial cables: Provide serial cables with DB-9 connectors appropriate to connect switch with existing and new serial equipment.

Provide code-operated switches from Lantronix EDS4100 with the Evolution operating system or approved equal. Lantronix switches are available from:

Lantronix
7535 Irvine Center Drive, Suite 100
Irvine, CA 92618
Voice: (800) 526-8766
Fax: (949) 453-3995
https://www.lantronix.com

669-2.06 DATA LOGGERS AND TEMPERATURE DATA SENSORS. Provide temperature data probes as noted on the Plans meeting the following requirements:

1. Datalogger: Campbell Scientific CR1000X-NA-XT-SW-CC. NA: No Additional Communication, XT -55C to +85C, SW Standard Warranty 3yr, CC with Calibration Cert.

2. Ground Temperature Probe (TP): Campbell Scientific temperature probe model 105E-L with 150 feet of cable length.

3. Ambient Air Temperature Sensor (TA): Campbell Scientific temperature probe 107-L with 15 feet of cable length.

4. Solar Radiation Shield: Campbell Scientific Model 41303-5A 6 Plate Radiation Shield UV-Stabilized white thermoplastic plates, aluminum mounting bracket, white powder-coated stainless-steel U-bolt clamp.

5. Temperature Data Probe (TG): Campbell Scientific model CS230-L50meters-S15-E0 (CSC Temperature Profiler 50m cable per string – 15 sensors per String – E0 Zero Ext Probes) and install per the Plans.

   Following the specifications for spacing of the 15 temperature sensors:

Cable Length	50 meters
# of External Probes	0
# of Internal Probes	15
Measurement Depth Starting Point	0

Sensor Details:

# External Probes	Depth (m)
0	None
1	None
2	None
3	None
4	None

# Internal Sensors	Depth (m)
1	0.0000
2	0.0762
3	0.1524
4	0.2286
5	0.3048
6	0.4572
7	0.6096
8	0.7620
9	0.9144
10	1.0668
11	1.2192
12	1.3716
13	1.5240
14	1.6764
15	1.8288

669-2.09 MATERIAL SUBMITTALS. Within 30 days after the Contract award, submit three (3) collated copies of a portfolio of equipment and materials proposed for installation to the Department for review and approval. Include a table of contents in the portfolios that include each item's intended use(s); the identity of each component's proposed features; and the following:

1. Materials on the *Qualified Products List*: A description that includes product name, manufacturer, model or part number, and the conditions listed for approval.

2. Materials Not on the *Qualified Products List*: Catalog cuts that include the manufacturer's name, type of product, size, model number, conformance specifications, and other data as may be required, including manufacturer's maintenance and operations manuals, or sample articles. Catalog cuts shall be clearly marked indicating which item on the catalog cut will be used when multiple items are shown.

3. Materials Requiring Certification: Submit certification from the supplier for all steel products incorporated in the AVC installation indicating origin with the material catalog cuts or the shop drawings in accordance with Subsection 106-1.01, Source of Supply and Quality Requirements.

4. Materials Not Requiring Certification: Incidental materials incorporated into the work (such as nuts, ties, bolts, washers, etc.) must meet all applicable Specifications and be installed per all manufacturer's recommendations. Certification is not needed unless required by the Special Provisions or requested by the Engineer.

669-2.10 WARRANTIES, GUARANTEES, MANUALS, AND INSTRUCTION SHEETS. Deliver to the Engineer all manufacturers' warranties, guarantees, repair and operation manuals, instruction sheets, and parts furnished with materials used in the work before the Department assumes maintenance responsibilities.

CONSTRUCTION REQUIREMENTS

669-3.01 GENERAL. Complete each AVC and ensure it is ready for operation, not more than one month after disabling an existing data collection site. The site is not considered complete until the system, including communications, is configured and can be polled with provided electronics and software from the DOT Traffic Data & Forecasting Section offices at 2301 Peger Road, Fairbanks, AK 99709. Phone (907)451-2257.

Prior to installing conduit, conductors, presence loops, piezoelectric sensors, or cabinets, notify the Engineer in writing, a minimum of 3 working days prior to installation. The Engineer shall be present to approve the installation prior to final burial or encasement. Correct any unacceptable installations and then request reinspection by the Engineer for completeness prior to burial or encasement. Uncover, remove and replace any burial or encasement not approved by the Engineer.

After staking pole foundations, verify that there will be no overhead or underground utility conflicts with foundations, poles, mast arm, or conduits. Locate and protect all existing underground and overhead utilities. The location of cables, conduits, junction boxes, foundations, and poles that are shown on the plan sheets are approximate and it is the Contractor's responsibility to verify the actual locations when working in the area. See Subsection 105-1.06.

669-3.02 WIRING. Install all wiring in accordance with Subsection 660-3.05, Wiring.

Terminate all unused pairs with splices at junction boxes.

Provide a minimum of 2-feet of slack conductor in each junction box and a minimum of 6-feet of slack conductor in the equipment cabinet prior to the terminal block.

Label all conductors in accordance with Subsection 660-3.05, 14.

669-3.03 CONDUIT. Install all conduits in accordance with Subsection 660-3.03, Conduit, or as indicated on the Plans.

Provide nylon pull cords in all conduits larger than 1-in and in all spare conduits.

Use plastic-sleeved grounding bushing. Install plastic-sleeved grounding bushings before pulling any conductors.

Where conduit runs cross below existing curb and gutter, saw cut the curb and gutter at the nearest joint and remove that entire section and replace.

669-3.04 JUNCTION BOXES. Install all junction boxes in accordance with Subsection 660-3.04, Junction Boxes.

Emboss the word TRAFFIC on the lids of all junction boxes that contain loop or sensor conductors.

Emboss the word ELECTRIC on the lids of all junction boxes used to provide electrical service to AVC installations.

Junction boxes for 120V/240V electrical service must be kept separate from junction boxes containing loop or sensor conductors. Junction boxes used for AVC installations must not contain any system operating at or greater than 24 V.

Install a sump (stone drain) to the dimensions shown on the plans. Sump material shall be a washed porous backfill material that conforms to Subsection 703-2.10. A mortar brick base, pavers, or stepping stones shall line the entire bottom perimeter of all new, relocated, or adjusted Type I, IA, II, and III junction boxes. Compact the aggregate sumps as directed to prevent settlement of the trench backfill. Compact gravel drain material under J-boxes as directed by the Engineer to prevent settlement of foundations, J-boxes, and adjacent improvements.

669-3.05 TERMINAL BLOCKS. Mount terminal blocks within cabinets so that all terminals are easily accessible from the front of the cabinet.

Label wire pairs clearly on both sides of the terminal block.

Terminate and solder all conductors, including unused spares, to "spade" type terminal lugs on the terminal block.

669-3.06 PRESENCE LOOPS. Install all presence loops in accordance with Subsection 660-3.05, Wiring, unless otherwise specified on the Plans. Closely conform to the location and layout of conduit runs shown on the Plans.

Construct loops to within plus-or-minus 1-in (± 1-in) tolerance for size, lane alignment, and relative location from other presence loops.

Install lead-in conduits straight and perpendicular to the centerline of the road from the edge of pavement to the presence loops.

Form presence loops, located in through traffic lanes, with four (4) turns of wire in a 6-ft square, unless noted otherwise on the Plans.

Install all presence loops prior to overlaying pavement. Saw cutting for loop installation is not permitted.

Inductance Test. Measure each detector loop and lead-in cable system at the detector cabinet. The inductance must be in the range of 50 to 500 microhenries.

Test each loop detector circuit for continuity at two locations:

1. Loop detector at the junction box before splicing with loop detector lead-in cable must have a value less than 0.5 ohms. Test the loop before the saw-cut slot has been filled with loop sealant.

2. Loop detector and lead-in cable system at the traffic signal controller cabinet or detector cabinet after splicing in the junction box must have a value less than 5 ohms for single pair lead-in cable and 10 ohms for multi-par lead-in cable. The continuity test ohm reading at the traffic signal controller cabinet or detector cabinet must be greater than the ohm reading measured at the loop detector at the junction box.

669-3.07 PIEZOELECTRIC SENSORS. Install per AVC equipment and piezoelectric sensor manufacturer's recommendations. The Engineer and a manufacturer's direct representative shall be present to approve the installation prior to final burial or encasement. Correct any unacceptable installations and then request reinspection by the Engineer for completeness prior to burial or encasement. Uncover, remove and replace any burial or encasement not approved by the Engineer.

Install piezoelectric sensors to within plus-or-minus 1-in (± 1-in) tolerance for size, lane alignment, and relative location from the sensors adjoining presence loops.

Run coaxial cables to the equipment cabinet without splices and terminate on the specified terminal block, provide a minimum of 6-ft of slack in the cabinet prior to the terminal block. Do not bend coaxial cable beyond manufacturer's specification. Damaged coaxial cable shall be replaced without compensation.

Install lead-in conduit straight and perpendicular to the centerline of the road from the edge of pavement to the piezoelectric sensors. Cap the ends of the lead-in conduit beyond the edge of the pavement. Lead-in conduit runs to junction boxes and cabinets may be complete before or after paving.

Install piezoelectric sensors in new asphalt pavement only after final paving and ten days of normal traffic use of that particular section of road. Perform saw cutting after receiving approval from the Engineer. Submit saw cutting method to the Engineer for approval prior to beginning cutting. Clean, blow out, and thoroughly dry saw cuts prior to installing piezoelectric sensors.

669-3.08 RESERVED

669-3.09 CABINETS. Make all conduit entries through the bottom of the enclosure. No cuts through the sides or top are permitted.

669-3.10 UTILITIES.

1. Electrical. Preserve and protect the existing load center and utility connection. Provide a new underground feeder circuit and stepdown transformer for supplying power to the new traffic cabinet per the Plans and Specifications

2. Cellular Modem. A cellular modem shall be installed; compatible with a local service provider. Determine the best and most appropriate provider based on the signal strength and quality of transmission. Coordinate with the Engineer. The final selection shall be approved by the Engineer.

669-3.11 ACCEPTANCE TESTING. Perform tests on the AVC installations in accordance with Subsection 660-3.01.7, Field Tests.

1. AVC Acceptance Tests. Provide an AVC counter manufacturer's representative with a current certification to observe and assist in conducting the acceptance tests. Notify the Engineer a minimum of one week prior to the acceptance testing so that the Department's Traffic Data and Forecasting Section representative may be on site. Coordinate with the Traffic Data Staff to verify testing requirements and vehicle specifications prior to conducting the acceptance test.

2. Provide documentation noting the test vehicle's gross weight and measured axle spacing to the Engineer prior to conducting testing. Receive the Engineer's approval of the data sampling and testing schedule prior to testing. The Engineer and a Traffic Data and Forecasting

representative shall be on-site during final acceptance testing and will provide certification, in writing, when the installation has met the accuracy requirements of the acceptance tests.

In addition to the tests noted in Subsection 660-3.01.7, Field Tests, perform the following Acceptance Tests:

a. Acquire a set of test data for the AVC sensor array. Obtain test data by passing a test vehicle over the AVC sensors in each lane. Obtain ten (10) valid samples, per direction, for the test vehicle. Test data samples will include FHWA class designation and computed axle spacing for each sensor pass.

   To be considered valid, obtain sample data under the following conditions:

   1) Maintain good lane discipline while traversing the entire sensor array.
   2) Maintain a constant speed, between 40 mph and the posted speed limit, while traversing the entire array.
   3) Acquire all data for a particular lane using the same vehicle.
   4) Obtain data from successive sensor passes of the test vehicle; data may not be omitted or included out of order for any 10 samples.

b. Meet the following requirements separately in each lane:

   1) The AVC system correctly assigns FHWA class designation for 9 out of 10 successive sensor passes of the test vehicle.
   2) The AVC system computes axle spacings to within one foot of the actual measurements, for 9 out of 10 successive sensor passes of the test vehicle.

c. Provide and make arrangements for test vehicles and drivers as needed for the acceptance testing. Provide the following test vehicles (if a vehicle of the specified types is not available or is not practical at any of the locations, advise and determine substitutions with the Engineer one week prior to the test):

   1) A two-axle, six-wheel, single-unit vehicle (FHWA Class 5). Class 5 vehicles have 13 to 23 ft spacing between the steering and drive axles.
   2) A three-axle, ten-wheel, single-unit vehicle (FHWA Class 6). Class 6 vehicles have 11.5 to 23 ft spacing between the steering axle and drive axle group; and a spacing of 3.5 to 6 ft between the drive axles.
   3) A five-axle, eighteen-wheel, single trailer vehicle (FHWA Class 9), with a high-cube rated (HCR) trailer. Class 9 vehicles have 11.3 to 24.6 ft spacing between the steering axle and drive axle group; a spacing of 3.5 to 6 ft between the drive axles; 6.1 to 46 ft spacing between the drive axle and the trailer axle group; and a spacing of 1.1 to 40 ft between the trailer axles.

   Load the test vehicle with non-shifting material to a minimum of 50% of the legal load during testing. The gross weight of the test vehicle and the weight of the test vehicle's axle groups shall be determined by weighing on a static scale at a scale house operated by the State of Alaska Department of Commerce, Division of Weights and Measures. An axle group is defined as any two axles whose centers are within 8-ft of each other. Class 6 test vehicles have two axle groups and Class 9 test vehicles have three-axle groups.

d. Ensure that all tires on the test vehicle are inflated to recommended pressures during testing.

3. AVC Acceptance tests govern acceptance or rejection of the AVC installation.

4. Test Results. Provide a copy of the final test results in written or printed form to the Engineer, prior to the acceptance of the AVC installation. Sign the test results attesting to their accuracy and compliance to the Special Provisions.

   Include both an electronic copy and a paper copy of the final AVC counter's per-vehicle-record logs of the AVC tests. Provide sorted calibration test data by test vehicle, tabulated in a spreadsheet and certified by the AVC manufacturer's representative.

669-5.01 BASIS OF PAYMENT. The contract unit price for Traffic Data Sites, AVC system installations, shall be full compensation for furnishing all equipment, labor, and materials necessary to complete the work as specified; including but not limited to: conductors, conduits, junction boxes, presence loops, piezoelectric sensors, automatic vehicle classification counter, temperature data probes, terminal blocks, cabinets equipment, support post and foundations, excavation, backfill, topsoil, seeding, saw cutting, cabinet(s), underground feeder circuit, stepdown transformer, electrical equipment, and branch circuits within the traffic cabinet, as-built plans, acceptance testing, and calibration required for these installations.

Installation of cellular service equipment will be subsidiary to 669 Pay Items. Load center modifications are subsidiary to the 669 items unless a separate item is provided.

Removal and disposal of existing data collection sites are subsidiary to 669 Pay Items. Work includes all labor, materials, excavation, backfill, topsoil, and seeding needed to remove and dispose of conduit, conductors, junction boxes, abandoning the existing underground feeder circuit conduit and removal of existing wiring, stepdown transformer, existing cabinet(s), support post and foundations.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
669.2000.0000	Traffic Data _____	LS

SECTION 670
TRAFFIC MARKINGS

670-3.01 CONSTRUCTION REQUIREMENTS. *Add the following after the first sentence:*

All completed pavement marking symbols and words will be solid as shown on the Plans. All markings shall be inlaid with the exception of methyl methacrylate paint applied to median and curb noses, which shall be surface applied, as identified on the Plans.

Delete item 4. Methyl Methacrylate Pavement Markings. in its entirety and substitute the following:

4. Methyl Methacrylate Pavement Markings.

   a. General. 15 days before starting work meet with the Engineer for a prestriping meeting. At this meeting, do the following:

      1. Furnish a striping schedule showing areas and timing of work, placing materials and Traffic Control Plans to be used.
      2. Discuss placement of materials and potential problems.
      3. Discuss work plan for off-ramps, on-ramps and intersections.
      4. Discuss material handling procedures.
      5. Provide copies of the manufacturer's installation instructions and copies of the Safety Data Sheets.

b. Manufacturer's Authorized Individual. Provide the services of a manufacturer's authorized individual (the "Manufacturer's Representative") on each day that striping material is installed. Ensure the Manufacturer's Authorized Individual observes the application of the pavement marking materials. Cooperate with the Manufacturer's Authorized Individual and the Engineer to ensure that the materials are placed according to these Specifications and the manufacturer's recommended procedures.

c. Manufacturer Certified Installers. Install methyl methacrylate pavement markings using only striping installers certified by the marking materials manufacturer for the specific striping material and method. Submit these certifications to the Engineer at the Preconstruction Conference.

d. Manufacturer Warranty. Furnish a Warranty, signed by an individual who is authorized by the Manufacturer, according to the following:

1. The Warranty period will start on the date the Engineer accepts the work and authorizes final payment.

2. For methyl methacrylate materials, provide a two year warranty that all markings will stay in place, maintain their color and maintain a minimum retroreflectivity of 120 millicandellas for white and 100 millicandellas for yellow.

3. Include in the Warranty that the manufacturer will repair or replace, at the discretion of the Engineer and at no additional cost to the Department, all markings that fail to stay in place, drop below the required minimum retroreflectivity, or fail to maintain color stability during the warranty period. Complete repairs within four months of the Department's written request to do so.

   Upon the receipt of the Department's written request to the manufacturer for repairs or replacement, the warranty time will suspend and then resume once the requested repairs or replacement are made and accepted.

   If the retroreflectivity becomes a concern during the warranty period, the Engineer will measure the retroreflectivity of the area in question, using a Delta LTL2000 Retrometer, a 100-foot retro reflectometer, or similar device.

   A cumulative 5% or greater material loss of any line on any 300-foot segment of longitudinal marking or cumulative 15% or greater material loss of any transverse marking will constitute failure of the material in that segment.

   Perform Warranty repair work as soon as weather permits.

e. Preparation. Prepare the roadway surface to receive methyl methacrylate according to these Specifications and the manufacturer's recommendations. Clean and dry the roadway surface. Completely remove contaminants such as dirt, loose asphalt, curing agents, surface oils, or existing road marking materials before applying pavement marking material.

   Do not apply markings to new asphalt until the asphalt has cured for at least 3 days, or unless approved by the Engineer per Manufacturer Authorized Individual's recommendation. Perform a bond test in accordance with the manufacturer's procedures. Apply markings upon a successful bond test.

f. Application. Apply methyl methacrylate marking material according to these Specifications and the manufacturer's recommendations. If conflicts exist between these Specifications and the manufacturer's recommendations, use the more restrictive of the two. Use equipment designed

and capable of properly mixing at the point and time of application and approved by the manufacturer for the type of product being installed.

Apply all methyl methacrylate markings prior to September 21.

For longitudinal markings use truck mounted automatic extrusion equipment capable of installing a double centerline and a single shoulder line in a single pass. Use automatic bead applicators that place a uniform layer of beads on the lines. Hand units will not be allowed, unless approved by the Engineer.

For transverse markings, words, and symbols use manual or automatic application equipment. Any stripe that is 8 inches or greater in width, regardless of orientation with the exception of lane lines, shall be considered a transverse marking. Stencils or extruders are required to form sharply defined markings.

For inlaid applications use grooving equipment that produces a dry cut. Use vacuum shrouded equipment or other equally effective containment procedures. Install markings in the same work shift as the grooving operation.

(1) Longitudinal Extruded Markings Inlaid. Groove the area for the inlaid markings to a minimum depth of 120 mils. Fill the groove completely to achieve a flush finish with the surface of the pavement for all lane lines, edge lines, and centerlines.

(2) Transverse and Symbol Markings Inlaid. Groove the area for inlaid markings to a minimum depth of 200 mils. Fill the groove completely to achieve a flush finish with the surface of the pavement for all words, arrows, stop bars, gore stripes, railroad symbols, and cross walks.

(3) Transverse and Symbol Markings Surface Applied (Median Noses Only). Apply markings to a minimum depth of 120 mils for paint on all median and curb noses as identified on the Plans.

(4) Roundabout Markings Inlaid. All markings within the roundabout functional areas shall be inlaid to a minimum depth of 500 mils. The roundabout functional area shall be defined on the Plans.

Inspect the markings initially, and again two weeks after placement, to ensure the material has cured properly. Remove soft spots or abnormally darkened areas and replace with material meeting specifications.

If it is determined that the material is being placed too thin, or otherwise not to specification, make immediate adjustments to correct the problem.

Methyl methacrylate pavement markings applied by any method will be unacceptable if:

1. The marking is not straight or wide enough.
2. The thickness of the line is not uniform or less than specified.
3. The top of the line is not smooth and uniform.
4. The material is uncured.
5. The material blackens or is inconsistent in color.
6. The inlay slot is not ground to the specified depth.
7. The inlay slot is not filled to the specified depth.
8. The edge of the markings are not clear-cut and free from overspray.
9. The reflective elements are not properly embedded.
10. The markings exhibit poor adhesion.
11. The retro-reflectivity of the markings is less than specified.
12. The color is not as specified.

Perform repairs using equipment similar to the equipment initially used to place the materials. Do not perform repairs in a "patch-work" manner. If more than one repair is required in a single 300-foot section, grind and repair the entire section.

g. Disposal of Waste. Waste material becomes the Contractor's property. This includes grindings and removed marking material. Do not dispose of or store stripe removal waste material or asphalt grindings on State property. Dispose of waste material according to applicable Federal, State, and local regulations.

h. Sampling. On an 8.5"x11" sheet of paper, record the following readings and the locations where they were taken using project stationing and submit them to the Engineer within 24 hours for evaluation.

(1) For inlay applications, record the depth of the slot every 300 feet during the grinding operation. Measure depth of slot from the surface of pavement.

(2) For surface applied transverse markings measure the thickness (above the pavement surface) in three locations for each marking.

(3) Measure the retroreflectivity of each transverse marking at three locations, and of each longitudinal marking at intervals not to exceed 1,500 feet. Take these measurements using a Delta LTL2000 Retrometer, a 100-foot retro-reflectometer, or approved similar device. Perform testing within 72 hours of curing.

The Engineer may elect to use the Contractor's readings or perform additional sampling.

670-3.04 PAVEMENT MARKING REMOVAL. *Add the following:* Coordinate removal work with construction activity. Remove pavement markings the same day permanent markings are applied, unless otherwise directed. Use vacuum shrouded equipment or other equally effective containment procedures.

670-3.06 TOLERANCES FOR LANE STRIPING. *Add the following:*

7. Double Stripe Gap. ± ¼ inches
8. Depth of Inlay Slot. Minimum specified to a maximum of + 5 mils.
9. Thickness of Inlaid Methyl Methacrylate. Flush with the surface of the pavement to + 20 mils above the pavement.
10. Thickness of Surface Applied Methyl Methacrylate. Minimum specified to a maximum of + 30 mils.

670-4.01 METHOD OF MEASUREMENT. *Delete the first paragraph and substitute the following:* For all inlaid markings, thickness will be measured from the bottom of the approved groove to the surface of the pavement marking. The pavement marking shall be even with the surface of the surrounding pavement and no additional payment will be made for excess groove or overfilling of groove. For surface applied markings, thickness will be measured from the top of the marking to the top of the pavement surface. Marking material placed in a depression left by pavement line removal will not be included in measuring the thickness of the line.

Delete Items 2 and 3 and substitute the following:

2. Square Foot Basis. Transverse pavement marking lines, stop bars, cross walks and gore stripes will be measured by nominal width times actual length. This does not include 24-inch wide transverse lines required for railroad markings.

3. Each. Symbol pavement markings words and arrows will be measured on a unit basis with each separate word or symbol constituting a unit.

4. Linear Foot Basis. Longitudinal Pavement Markings, surface applied or inlaid, will be measured by the linear foot of a 4-inch wide line. Wider striping will be measured in multiples of 4 inches.

Add the following:

Item 670.2014.0000, MMA Pavement Markings Inlaid. At the contingent sum prices specified in the Directive using time and materials or other agreement to authorize necessary extra, additional, or unanticipated work. Compensation for this item will be by time and materials according to Subsection 109-1.05, or by mutual agreement between the Engineer and Contractor.

670-5.01 BASIS OF PAYMENT. *Add the following*: There will be no separate or additional payment for the following:

- Over-runs of material caused by the variation of the gradation of the asphalt.
- Additional material required to achieve the thickness specified on open graded pavement.
- Over-runs of material if the Contractor installs the material thicker than specified.

Milling for installation of the inlaid markings is subsidiary to 670 items. Payment includes all costs associated with this item, including the removal of millings.

All traffic control required for the installation of the permanent and temporary markings is subsidiary to 670 items.

All temporary traffic markings required for all phases of the construction of the roadway are subsidiary to 670 items.

Add the following pay items:

PAY ITEM		
Item Number	**Item Description**	**Unit**
670.2002.0000	MMA Pavement Markings, Inlaid	LS
670.2014.0000	MMA Pavement Markings Inlaid	CS

Add the following section:

SECTION 680
TELECOMMUNICATIONS UTILITIES

680-1.01 DESCRIPTION. This includes the provision of all required work and materials to complete the telecommunications utility work as noted or detailed on the Plans and in these Specifications.

The applicable telecommunications utility companies that will require system modification includes Alaska Communications System (ACS), General Communication Inc. (GCI), and Matanuska Telephone Association Company (MTA).

680-2.01 MATERIALS. All materials shall conform to the latest standards developed by each corresponding utility. Contact each utility company for the latest developed standards at the time of construction.

Utility companies shall only supply materials specified within this section or as specified in the drawings. The Contractor shall supply all other materials as specified in this section, on the Plans, and incidental parts required to complete a fully functioning telecommunications system.

680-2.02 ACS. ACS is providing all telecommunications materials, equipment, and labor as listed within these specifications, for the relocation of their facility.

ACS Contractors or ACS employees will:

1. Provide all material, labor, and appurtenances to construct and install the concrete encased duct bank system and all concrete vaults as shown on the Plans.

    a. This item includes provision of conduits and conduit innerducts installed as part of the concrete encased duct bank system.

2. Provide all materials, labor, and appurtenances to install direct buried conduits and conduit innerducts.

3. Provide all labor to install pedestals as shown on the Plans.

4. Provide all material and labor to install all cables in the concrete duct bank, conduit system(s), concrete vaults, and pedestals.

5. Provide all material and labor for reconnection and/or modification of aerial and underground services, as applicable.

6. Provide all moisture seals where conduits (ie risers at poles and buildings) to prevent moisture from entering the system.

7. Provide all labor to remove retired aerial facilities and abandon-in-place the decommissioned below grade facilities.

The Contractor shall:

1. Coordinate with ACS prior to installing any infrastructure to avoid conflicts and to schedule ACS work.

2. Protect ACS infrastructure during work.

680-2.03 GCI. GCI is supplying some communications materials, equipment, and labor as listed within these specifications for the relocation of their facility. The Contractor shall sign for all material when picked up at GCI's warehouse. Ensure that all materials on GCI's list are received. Material issued but not used shall be returned to the GCI warehouse.

GCI Contractors or GCI employees will:

1. Install all loose coaxial cables and provide all required splicing.

2. Pull fiber in contractor installed HDPE duct and provide all required splicing of the fiber.

3. Install all cabling routing through risers where loose coaxial or fiber will be installed.

4. Provide all cable splicing between new and existing to remain systems and between new systems and building service equipment.

5. Install all conduit innerduct.

6. Install all pedestals, handholes, and cabinets.

7. Provide all aerial plant relocation, adjustment, and retirement.

The Contractor shall:

1. Coordinate with GCI prior to installing any infrastructure.

2. Provide all labor and appurtenances to install all provided material from GCI, including direct burial HDPE conduit raceway systems and direct burial cable-in-conduit for the GCI infrastructure as shown on the Plans.

3. Provide all conduit sweeps and risers/stub-ups.

    a. At poles (where conduit sweeps are installed), the Contractor shall install sweep and riser up to top of pole.

    b. At poles (where cable-in-conduit sweeps are installed), the Contractor shall install sweep and riser to top of pole, and coil 6-feet of excess cable-in-conduit for GCI use.

    c. At pedestals, the Contractor shall install sweep and stub-up within pedestal as required by GCI standards. Where cable-in-conduit is installed, the Contractor shall stub up and coil 4-feet of excess for GCI use.

    d. At buildings, the Contractor shall install sweep and riser up building 4-feet. Where cable-in-conduit is installed at buildings, the Contractor shall coil 4-feet of excess for GCI use.

4. Provide all moisture seals where conduits or cable-in-conduits are installed for GCI use (ie risers at poles and buildings) to prevent moisture from entering the system.

Safe handling and storage of materials supplied by GCI is the Contractor's responsibility. The Contractor shall replace any damaged material at their own expense.

680-2.04 MATANUSKA TELEPHONE ASSOCIATION CO. (MTA). MTA is providing all communications materials, equipment, and labor as listed within these specifications for the relocation of their facility.

MTA Contractors or MTA employees will:

1. Provide all materials, labor, and appurtenances to install direct buried conduits and conduit innerducts.

2. Provide all labor to install pedestals and handholes as shown on the Plans.

3. Provide all material and labor to install all fiber optic cables in the conduit system(s), pedestals, and handholes.

4. Provide all material and labor for reconnection and/or modification of aerial and underground services, as applicable.

5. Provide all moisture seals where conduits (ie risers at poles and buildings) to prevent moisture from entering the system.

6. Provide all labor to remove the portions of the decommissioned areas in their entirety.

The Contractor shall:

1. Coordinate with MTA prior to installing any infrastructure to avoid conflicts and to schedule MTAC work.

2. Protect MTA infrastructure during work.

CONSTRUCTION REQUIREMENTS

680-3.01 GENERAL. All utility work shall satisfy the requirements of Subsection 105-1.06.

Perform all construction in accordance with Rural Utilities Service (RUS) Bulletins and all Utility policies, procedures, and construction standards. Where conflicts exist between standards, the utility standards take precedence.

Excavate and place bedding and backfill according to Section 204 and plan details.

Install conduit according to the Plans and these Specifications, using methods recommended by the manufacturer.

Each utility company will designate a single point of contact responsible for construction coordination and inspection.

1. Direct Burial Conduit. Run telecommunication conductors in conduit, except for overhead wiring, or when otherwise specified. Install conduits of the sizes and types as specified on the Plans. Route conduits per the plan drawings or as otherwise directed by the Engineer.

    a. Unless otherwise directed by the plans or by the Utility, install conduits at least 30-inches below the finished grade of the ground above the conduit. Conduits that will be sealed under a minimum 4-inch thick Portland cement concrete sidewalk may be installed a minimum of 18-inches below the top back of curb or surface above the conduit, whichever is lower.

    b. Unless otherwise directed by the plans or by the Utility, conduits shall be placed in excavated trenches. Excavate, bed conduits, and backfill trenches according to Subsection 660-3.01.3, Excavating and Backfilling.

        i. Jacking conduits into position in lieu of trenching is allowed. However, if subsurface conditions prevent the successful completion of the work, install the conduit(s) by boring, drilling, or excavating methods without additional compensation.

        ii. If encountering obstructions during jacking or drilling operations obtain approval and cut small holes in the pavement to clear the obstruction. Locate the bottom inside face of the bore pit no closer than the catch point of a 1.25:1 slope (a horizontal to vertical ratio) from the edge of pavement. Do not leave pits unattended until an approved means of protection has been provided.

    c. Sweep both rigid metal and polyethylene conduits through the bottom of handholes or pedestals, by installing 90-degree rigid metal elbows on the ends of conduit runs. To each elbow, install a nipple that terminates 5 to 12 inches above the bottom edge of each handhole or pedestal.

    d. Drill a 3/8-inch drain hole in the bottom of the lower straight section of elbows and in the bottom of conduits at the low points of conduit runs. Smooth the edges of the drilled holes on the inside of elbows to prevent scraping the conductors. Cover the holes with a wrap of approved filter cloth secured with two (2) self-clinching nylon cable ties.

    e. Keep conduits clean. Install grounding bushings and approved plastic insert type plugs on the ends of conduit runs before backfilling around the conduit ends.

f. At the low points of conduit runs, install sumps containing a minimum of 2-cubic-feet of washed porous backfill material that conforms to Subsection 703-2.10. Compact the aggregate sumps as directed to prevent settlement of the trench backfill.

g. Install conduits that must cross existing facilities such as storm drainpipes, duct systems, and other underground utilities at the minimum depths specified, going under the facilities if necessary. Install additional drains and aggregate sumps at the low spots, if any.

h. Position conduits of similar utilities in trenches to provide clearances of at least 21/2-inches around 2-inch or smaller conduits and at least 2-inches around conduits larger than 2-inches. Provide a minimum of 12-inches clearance between conduits of separate utilities.

i. Coat drilled holes, shop and field cut threads, and the areas with damaged zinc coating with zinc rich paint.

j. When standard couplings cannot be used to join conduit components, use approved threaded unions.

k. Bury a continuous strip of 4-mils thick, 6-inch wide polyethylene marker tape above underground conduit runs. Install the tape 9-inches (± 3 inches) below finished grade, using two strips side by side to mark road crossings.

    i. Furnish tapes with a black legend on an orange background for identifying telecommunications conduits.

l. Install expansion fittings in conduits that cross expansion joints.

m. Install a polypropylene pull rope with a minimum 200-pound tensile strength in future use or spare conduits, and reinstall the plugs. Double back pull rope, at least two feet, into both ends of each conduit.

n. The Contractor may install conduits larger than the sizes specified. If used, it must be for the entire length of the run. Reducing couplings or bushings are not allowed. Complete work associated with installing conduits larger than specified without extra compensation.

o. Clean existing conduits that will remain in service using a heavy-duty air compressor that delivers at least 125-cubic-feet of air per minute at a pressure of 110-pounds per square inch. Clean the conduits before pulling in new cables and after removing cables to be removed or replaced as follows:

    i. When the conduits contain cables that will remain in service, protect the cables during the cleaning, and

    ii. Ream empty conduits with a mandrel or cylindrical wire brush before blowing them out with compressed air.

p. When modifying existing conduit runs, complete the work as required for new installations using the same sizes and types of conduits, except where the Plans allow for the use of HDPE. When extending existing conduits, add no more than a 90-degree horizontal bend to the extension.

q. When the Plans specify using HDPE conduit, the conduit shall transition to IMC or RMC for all sweeps to exposed areas above grade, including the surfaces of poles and other structures.

r. When Plans call for connecting polyethylene conduit to RMC use a UL listed electrofusion coupler rated for direct bury application. The coupler must be rated for same wall thickness as

the adjoining conduits. Thread the ends of the RMC with the same number of threads as found on the factory threaded ends of RMC. Ream the inside of conduit ends cut in the shop or field to remove burrs and sharp edges.

s. Make any butt connections between high-density polyethylene conduit sections above ground prior to laying in the trench. Couple HDPE conduit to rigid metal conduit for all surface exposures. Butt-weld the conduit using the manufacturer's recommended procedures and equipment or couple with compatible molded HDPE electrofusion couplings (as acceptable with the conduit manufacturer). Connections to RMC may be made below grade as necessary to connect with existing infrastructure using care to prevent foreign matter from entering the conduit. If using coilable conduit, each run may only be one section so there won't be any butt-welded connections needed. All bending of conduit will be by means recommended by the manufacturer and in no case with a cold bend radius greater than the manufacturer's recommendation.

t. Prior to HDPE buried conduit installation, provide a short demonstration section of conduit with an electrofusion coupling cut out and split for destructive testing and approval of fusion. Assure that the conduit is open, continuous, and free of water and debris prior to installing cable. Pull a stiff bristle brush through the entire length of the conduit run immediately prior to the cable being installed. Grade conduit uniformly straight and without sags.

u. Fabricate rigid metal conduits less than 10-feet long from standard lengths of conduit. Cut conduits squarely to ensure the threading die starts squarely on the conduit. Cut the same number of threads as found on the factory threaded ends. Ream the inside of conduit ends cut in the shop or field to remove burrs and sharp edges. Do not use slip joints or pieces of running thread pipe.

2. Equipment. Refer to each Utility's latest construction standard for equipment types and corresponding installation requirements. This applies to, but is not limited to, pedestals, metering equipment, main disconnect equipment, and communications network interface devices.

a. Where an item is noted for replacement, the item shall be of new manufacture. Remanufactured or rebuilt equipment is not permitted.

b. Where pedestals shall be located adjacent to utility poles, the Contractor shall coordinate with the Power utility for pole climbing fall zone area. Pedestals, pedestal stub-ups, and similar shall not be located within the fall zone area.

Each Utility has the opportunity to provide their own modifications for their facility at their discretion. The Contractor shall coordinate with each respective utility to determine any areas, if any, that the utility will be preforming in fieldwork internally.

All utility work within this section must be performed by a utility-approved contractor. The following contractors have been pre-approved by GCI for work on their systems.

Alaska Directional, LLC
200 E. Commercial Drive
Palmer, AK 99645
Tel: (907) 357-9015
Fax: (907) 357-9027
Email: akdirectional@alaskadirectional.com
Web: www.alaskadirectional.com

Northern Powerline Constructors Inc
7941 Sandlewook Pl
Anchorage, AK 99507
Tel: (907) 344-3436
Fax: (907) 349-1813
Email: npcinc@nothernpowerline.com
Web: www.northernpowerline.com

Sturgeon Electric Company, Inc.
1301 E. 64th Ave.
Anchorage, AK 99518
Tel: (907) 344-0321
Web: www.sturgeonelectric.com

680-3.02 TESTING. Coordinate with each utility to ensure all required utility testing and inspections are completed. The Contractor shall not backfill any below grade systems prior to the corresponding utility's approval of the system.

680-4.01 COORDINATION. The Contractor shall coordinate with each utility to acquire all utility policies, procedures, and construction standards, and to determine all required testing and inspections as required by the utility and this specification.

The Contractor shall coordinate with each utility for providing excavation, backfill, and construction surveying requirements.

The existing utility facilities shall remain in place and operational until all property services have been transferred over to the new utility systems. Only after all services are operational on the new system may the existing utilities be demolished.

Coordinate with each utility at least one week in advance before any necessary service outages are required for work and before demolition of the existing utility system.

680-5.01 BASIS OF PAYMENT. All telecommunications utility work shall be paid for at a lump sum price. The lump sum shall include all required labor, materials (as described in above sections), appurtenances, supervision, utility coordination, and all other incidentals for the relocated and fully functional, cut overed, commissioned, and utility system approval by each respective utility.

Temporary supporting or protection of existing utility poles or other system infrastructure shall be subsidiary to construction of the respective telecommunications systems pay item.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
680.2000.0000	Telecommunications Utility Relocation, GCI	LS

Add the following section:

SECTION 687
POWER UTILITIES

687-1.01 DESCRIPTION. This includes the provision of all required work and materials to complete the electrical utility work as noted or detailed on the Plans and in these Specifications.

The applicable electrical utility company that will require system modification includes Golden Valley Electric Association (GVEA).

687-2.01 MATERIALS. All materials shall conform to the latest standards developed by the utility. Contact the utility company for the latest developed standards at the time of construction.

The utility company shall only supply materials specified within this Section or as specified in the drawings. The Contractor shall supply all other materials as specified in this Section, on the Plans, and incidental parts required to complete a fully functioning electrical system.

687-2.02 GVEA. GVEA is supplying some materials for relocation of the primary power distribution system. The Contractor shall sign for all material when picked up at GVEA's warehouse. Ensure that all materials on GVEA's list are received. Material(s) issued but not used shall be returned to the GVEA warehouse.

GVEA Contractors or GVEA employees will:

1. Supply all material, appurtenances, and labor to install:
    a. Utility poles & associated pole top equipment,
    b. Utility pole down guys and anchors,
    c. Primary power distribution conductors
    d. Utility pole-mounted transformers.
2. Install service lateral conduit risers on poles via Contractor supplied material.
3. Provide all connections of service entrance riser to pole top equipment.

The Contractor shall:

1. Supply all material, appurtenances, and labor to install:
    a. Direct buried service lateral conduits;
    b. All below grade service lateral conductors;
    c. All aerial service drop cables.
    d. Modification, replacement, or relocation of service equipment.
    e. New service equipment at site location or at buildings, as applicable.
2. Provide all conduit sweeps and risers/stub-ups.
    a. At poles, the Contractor shall install sweep and riser up 3-feet above grade per GVEA standards. The Contractor shall supply the remaining vertical portion of conduit riser, which will be installed by GVEA.
    b. At buildings, the Contractor shall install the conduit sweeps and risers as required to reconnect service equipment.
3. Provide all moisture seals where conduits are installed for GVEA use (i.e. risers at poles) to prevent moisture from entering the system.

4. Complete all GVEA service applications required for new or modified electrical services.

Safe handling and storage of materials is the Contractor's responsibility. The Contractor shall replace any damaged material at their own expense.

CONSTRUCTION REQUIREMENTS

687-3.01 GENERAL. All utility work shall satisfy the requirements of Subsection 105-1.06.

Perform all construction in accordance with Rural Utilities Service (RUS) Bulletins and all Utility policies, procedures, and construction standards. Where conflicts exist between standards, the utility standards take precedence.

Excavate and place bedding and backfill according to Section 204 and plan details.

Install conduit according to the Plans and these Specifications, using methods recommended by the manufacturer.

The utility company will designate a single point of contact responsible for construction coordination and inspection.

1. Direct Burial Conduit: Run electrical conductors in conduit, except for overhead wiring, or when otherwise specified. Install conduits of the sizes and types as specified on the Plans. Route conduits per the plan drawings or as otherwise directed by the Engineer.

    a. Unless otherwise directed by the plans or by the Utility, install conduits at least 30-inches below the finished grade of the ground above the conduit. Conduits that will be sealed under a minimum 4-inch thick Portland cement concrete sidewalk may be installed a minimum of 18-inches below the top back of curb or surface above the conduit, whichever is lower.

    b. Unless otherwise directed by the plans or by the Utility, conduits shall be placed in excavated trenches. Excavate, bed conduits, and backfill trenches according to Subsection 660-3.01.3, Excavating and Backfilling.

        i. Jacking conduits into position in lieu of trenching is allowed. However, if subsurface conditions prevent the successful completion of the work, install the conduit(s) by boring, drilling, or excavating methods without additional compensation.

        ii. If encountering obstructions during jacking or drilling operations obtain approval and cut small holes in the pavement to clear the obstruction. Locate the bottom inside face of the bore pit no closer than the catch point of a 1.25:1 slope (a horizontal to vertical ratio) from the edge of pavement. Do not leave pits unattended until an approved means of protection has been provided.

    c. Sweep both rigid metal and polyethylene conduits through the open bottom of junction boxes by installing 90-degree rigid metal elbows on the ends of conduit runs. To each elbow, install a nipple that terminates 5 to 12 inches above the bottom edge of each junction box.

    d. Drill a 3/8-inch drain hole in the bottom of the lower straight section of elbows and in the bottom of conduits at the low points of conduit runs. Smooth the edges of the drilled holes on the inside of elbows to prevent scraping the conductors. Cover the holes with a wrap of approved filter cloth secured with two (2) self-clinching nylon cable ties.

    e. Keep conduits clean. Install grounding bushings and approved plastic insert type plugs on the ends of conduit runs before backfilling around the conduit ends.

f. At the low points of conduit runs, install sumps containing a minimum of 2-cubic-feet of washed porous backfill material that conforms to Subsection 703-2.10. Compact the aggregate sumps as directed to prevent settlement of the trench backfill.

g. Install conduits that must cross existing facilities such as storm drainpipes, duct systems, and other underground utilities at the minimum depths specified, going under the facilities if necessary. Install additional drains and aggregate sumps at the low spots, if any.

h. Position conduits of similar utilities in trenches to provide clearances of at least 21/2-inches around 2-inch or smaller conduits and at least 2-inches around conduits larger than 2-inches. Provide a minimum of 12-inches clearance between conduits of separate utilities.

i. Coat drilled holes, shop and field cut threads, and the areas with damaged zinc coating with zinc rich paint.

j. When standard couplings cannot be used to join conduit components, use approved threaded unions.

k. Bury a continuous strip of 4-mils thick, 6-inch wide polyethylene marker tape above underground conduit runs. Install the tape 9-inches (± 3 inches) below finished grade, using two strips side by side to mark road crossings.

    i. Furnish tapes with a black legend on a red background for identifying power conduits.

l. Install expansion fittings in conduits that cross expansion joints.

m. Install a polypropylene pull rope with a minimum 200-pound tensile strength in future use or spare conduits, and reinstall the plugs. Double back pull rope, at least two feet, into both ends of each conduit.

n. The Contractor may install conduits larger than the sizes specified. If used, it must be for the entire length of the run. Reducing couplings or bushings are not allowed. Complete work associated with installing conduits larger than specified without extra compensation.

o. Clean existing conduits that will remain in service using a heavy-duty air compressor that delivers at least 125-cubic-feet of air per minute at a pressure of 110-pounds per square inch. Clean the conduits before pulling in new cables and after removing cables to be removed or replaced as follows:

    i. When the conduits contain cables that will remain in service, protect the cables during the cleaning, and

    ii. Ream empty conduits with a mandrel or cylindrical wire brush before blowing them out with compressed air.

p. When modifying existing conduit runs, complete the work as required for new installations using the same sizes and types of conduits, except where the Plans allow for the use of HDPE. When extending existing conduits, add no more than a 90-degree horizontal bend to the extension.

q. When the Plans specify using HDPE conduit, the conduit shall transition to IMC or RMC for all sweeps to exposed areas above grade, including the surfaces of poles and other structures.

r. When Plans call for connecting polyethylene conduit to RMC use a UL listed electrofusion coupler rated for direct bury application. The coupler must be rated for same wall thickness as the adjoining conduits. Thread the ends of the RMC with the same number of threads as found on the factory threaded ends of RMC. Ream the inside of conduit ends cut in the shop or field to remove burrs and sharp edges.

s. Make any butt connections between high-density polyethylene conduit sections above ground prior to laying in the trench. Couple HDPE conduit to rigid metal conduit for all surface exposures. Butt-weld the conduit using the manufacturer's recommended procedures and equipment or couple with compatible molded HDPE electrofusion couplings (as acceptable with the conduit manufacturer). Connections to RMC may be made below grade as necessary to connect with existing infrastructure using care to prevent foreign matter from entering the conduit. If using coilable conduit, each run may only be one section so there won't be any butt-welded connections needed. All bending of conduit will be by means recommended by the manufacturer and in no case with a cold bend radius greater than the manufacturer's recommendation.

t. Prior to HDPE buried conduit installation, provide a short demonstration section of conduit with an electrofusion coupling cut out and split for destructive testing and approval of fusion. Assure that the conduit is open, continuous, and free of water and debris prior to installing cable. Pull a stiff bristle brush through the entire length of the conduit run immediately prior to the cable being installed. Grade conduit uniformly straight and without sags.

u. Fabricate rigid metal conduits less than 10-feet long from standard lengths of conduit. Cut conduits squarely to ensure the threading die starts squarely on the conduit. Cut the same number of threads as found on the factory threaded ends. Ream the inside of conduit ends cut in the shop or field to remove burrs and sharp edges. Do not use slip joints or pieces of running thread pipe.

2. Conductors. All conductors shall be copper, unless otherwise noted. All conductors No. 10 AWG and smaller shall be stranded or solid. Conductors No. 8 AWG or larger shall be stranded. All conductor insulation shall be minimum XHHW type. All conductors and cables shall be installed within NECA standards of installation. Refer to the plan drawings and details for specific conductor sizes.

3. Connections. All conductor connections shall be made up securely with solderless pressure connectors such as setscrew lugs, wirenuts, "wingnuts", insulated tap connectors, insulation piercing tap connectors, or suitable crimp fittings. Split bolt connectors shall not be used. Where the connector manufacturer does not require twisting of conductors, conductors shall be left untwisted.

   Thoroughly clean wires before installing lugs and connectors. Make splices, taps, and terminations to carry full ampacity of conductors without perceptible temperature rise. Terminate spare conductors with wirenuts. Where stranded conductors are used, their ends shall be terminated with crimp-on connectors, set screw lugs, box lugs, or self-lifting pressure terminals.

   Where conductors or their connectors are to be connected to metal surfaces, the surface shall first be scraped free of any paint, oxide, or other non-conductive substances. Where there is possibility of corrosion due to moisture or other causes, a conductive corrosion inhibitor shall be used between the conductor and the metal surface.

   Conductor terminations shall use the manufacturer's recommended methods and hardware.

4. Wiring. Pull conductors/cables into conduit only after sumps are installed, grounding bushings have been installed, and the conduit system has been approved by the utility.

   a. Pull conductors by hand or by approved commercially built cable-pulling equipment that is specifically designed for that purpose. Do not pull conductors/cables by any other means. Equip the cable-pulling device with a force limiting circuit and force gauge.

   b. Use wire-pulling lubricant when placing the cables and conductors in conduit. Do not allow the tension of the wire or cable to exceed the manufacturer's recommended allowable tension for the conductor or cable.

c. When adding new conductors to a conduit with existing conductors, remove all conductors and clean the conduit with a mandrel or brush. Pull both old and new conductors through as a unit. In a new installation, pull all conductors through the conduit as a unit.

d. Leave at least 1-foot of conductor or cable slack on each side of the conduit. Where conduit is connected to equipment, neatly route or coil the slack conductors or cable within the equipment.

5. Equipment. Refer to the Utility's latest construction standard for equipment types and corresponding installation requirements. This applies to, but is not limited to, metering equipment and main disconnect equipment.

a. Where an item is noted for replacement, the item shall be of new manufacture. Remanufactured or rebuilt equipment is not permitted.

The utility has the opportunity to provide their own modifications for their facility at their discretion. The Contractor shall coordinate with the utility to determine any areas, if any, that the utility will be preforming fieldwork internally.

All utility work associated with GVEA's primary power system shall be completed by a certified Lineman contractor. The following Lineman contractors have been pre-approved by GVEA for work on their system.

Fullford Electric, Inc.
303 East Vanhorn Road
Fairbanks, AK 99701
Tel: (907) 456-7356
Web: www.fullfordelectric.com

Northern Powerline Constructors, Inc
7941 Sandlewook Pl
Anchorage, AK 99507
Tel: (907) 344-3436
Fax: (907) 349-1813
Email: npcinc@nothernpowerline.com
Web: www.northernpowerline.com

Sturgeon Electric Company, Inc.
1301 E. 64th Ave.
Anchorage, AK 99518
Tel: (907) 344-0321
Web: www.sturgeonelectric.com

687-3.02 TESTING. Coordinate with the utility to ensure all required utility testing and inspections are completed. The Contractor shall not backfill any below grade systems prior to the corresponding utility's approval of the system.

687-4.01 COORDINATION. The Contractor shall coordinate with the utility to acquire all utility policies, procedures, and construction standards, and to determine all required testing and inspections as required by the utility and this specification.

The Contractor shall coordinate with each utility for providing excavation, backfill, and construction surveying requirements.

The existing utility facilities shall remain in place and operational until all property services have been transferred over to the new utility systems. Only after all services are operational on the new system may the existing utilities be demolished.

Coordinate with the utility at least one week in advance before any necessary service outages are required for work and before demolition of the existing utility system.

687-5.01 BASIS OF PAYMENT. All electrical utility work shall be paid for at a lump sum price. The lump sum shall include all required labor, materials (as described in above sections), appurtenances, supervision, utility coordination, and all other incidentals for the relocated and fully functional, cut overed, commissioned and utility system approval by each respective utility.

Temporary supporting or protection of existing utility poles or other system infrastructure shall be subsidiary to construction of the respective telecommunications systems pay item.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
687.2000.0000	Power Utility Relocation, GVEA	LS

SECTION 702
ASPHALT MATERIALS

08/04/22 (N82)
702-2.01 ASPHALT BINDER. *Delete the first paragraph and substitute the following:* Meet AASHTO M 320 for PG 52-28 binder.

Meet AASHTO M 332 for PG 52E-40 binder, except that J_{NR} Diff (AASHTO T 350) and Direct Tension (AASHTO T 314) do not apply. PG 52E-40 binder shall have a minimum Percent Recovery$_{3.2}$ of 75% according to AASHTO T 350.

702-2.03 EMULSIFIED ASPHALT.

1. Cationic Emulsified Asphalt. *Add the following:* CRS-2P shall meet AASHTO M 316, except the penetration value shall be 100 – 200 mm.

SECTION 703
AGGREGATES

12/08/15 (N63)
703-2.09 SUBBASE. *Add the following:*

Subbase, Grading F. Aggregate containing no muck, frozen material, roots, sod or other deleterious matter and with a plasticity index not greater than 6 as tested by ATM 204 and ATM 205. Table 703-8 and the first paragraph of Subsection 703-2.09 do not apply to Grading F. Meet the following gradation as tested by ATM 304:

Sieve	Percent Passing by Weight
2 in	100%
No. 4	15-65%
No. 200	0-6%

SECTION 712
MISCELLANEOUS

712-2.06 FRAMES, GRATES, COVERS, AND LADDER RUNGS. *Add the following:* The traffic cover shall have a diameter of twenty-five (25) inches with a clear inside diameter of twenty-three (23) inches. Overall depth shall be six (6) inches. The word "SEWER" shall be cast into the manhole cover. Manhole cover shall be solid except for one (1) - one (1) inch lifting hole. Manhole rings and covers shall be machine ground on seating surfaces so as to assure a non-rocking fit in any position and interchangeability. Manhole rings and covers shall be East Jordan Iron Works IFCO 740 or approved equal.

Watertight Manhole Insert: Watertight manhole inserts shall be high-density polyethylene and shall be designed to fit just below the lid to capture all dirt and inflow entering, while allowing pressure inside the manhole to exhaust. The insert shall be insulated with a minimum of 2" of insulation.

Flushwell Type Cleanout Frame and Lid: Flushwell shall be constructed with a forty-five (45) degree elbow, eight (8) inch ductile iron pipe to surface and East Jordan Iron Works IFCO 221 cleanout cover assembly.

712-2.09 CORPORATION STOPS AND CURB STOPS. *Delete this subsection in its entirety.*

712-2.10 GATE VALVES. *Delete this subsection in its entirety.*

712-2.11 VALVE SERVICE BOXES. *Delete this subsection in its entirety.*

712-2.12 HYDRANTS. *Delete this subsection in its entirety.*

Add the following subsections:

712-2.23 INSULATION.

Spray Foam Insulation. Foam insulation shall be a closed cell two-part urethane with the following properties:

"K" Factor:	0.13 BTU - IN/HR. FT² °F (ASTM C-177)
Water Absorption:	0.1 PSF Maximum (ASTM C-2841 96 Hours Under 2 in. Head)
Compressive Strength:	23 PSI Minimum (ASTM D-1621 Perpendicular to Rise)
Nominal Density:	2.0-4.0 PCF (ASTM D-1622)
Water Vapor Permeability:	2.0 Perm-in (ASTM C-355)

Rigid board insulation placed below manholes and inlets shall be extruded polystyrene (XPS) meet the requirements of ASTM C578 Type IV, Rigid, Cellular Polystyrene Thermal Insulation.

Any system or applicator shall be able to demonstrate prior experience of at least two years and the Engineer shall be the sole judge of the qualifications of a system, material, application method and applicator.

712-2.24 WATERPROOF PROTECTIVE COATING.

Waterproof protective coatings. Waterproof protective coating shall be a two (2) component, one hundred (100) percent solids, sprayable polyurethane coating with the following properties:

Tensile Strength:	1800 PSI
Elongation (percent):	120
Water Vapor Transmission:	0.413 Perms

Any system or applicator shall be able to demonstrate prior experience of at least two years and the Engineer shall be the sole judge of the qualifications of a system, material, application method and applicator.

Delete Section 724 in its entirety and substitute the following:
12/10/20 (N51)

SECTION 724
SEED

724-2.01 DESCRIPTION. This specification provides the requirements for grass seed, used to provide a living vegetative cover.

724-2.02 MATERIALS. Furnish seed true of genus and species. Meet applicable requirements of the State of Alaska *Seed Regulations*, Alaska Administrative Code, Title 11, Chapter 34 (11 AAC 34), and the Federal Seed Act, 7 CFR Part 201. Seed shall meet or exceed the percentages of purity and germination as specified in Table 724-1.

The Contractor may propose an alternate seed mix to the Engineer. Alternate seed mix proposals must include confirmation that the Alaska Plant Materials Center finds the proposed seed mix suitable for use on the project, and that the vendor can provide the proposed seed mix in quantities adequate for the project. The Engineer will determine the acceptability of the proposed alternate for use on the project.

Grass seed shall be furnished in standard containers on which shall be shown the following information:

(1) common accepted name of the specie (kind) and cultivar (variety) of the seed;
(2) country or state where the seed was grown;
(3) total percentage by weight of pure seed;
(4) total percentage by weight of all weed seed;
(5) total percentage by weight of inert matter;
(6) total percentage by weight of other crop seed;
(7) name and approximate number per pound of each kind of restricted noxious weed seed;
(8) percentage of germination of the seed, together with the month and year the seed was tested;
(9) percentage of hard seed, if any is present;
(10) name and address of the person labeling the seed or selling, offering, or exposing the seed for sale within the state; and
(11) lot number or other lot identification.

If furnished as a premixed seed, the containers shall state that the seed is a mixture; the name of the species and cultivars of seed; and total percentage by weight of each species of seed present in order of predominance; and the information listed above: (4), (5), (7), (8), (10) and (11).

Furnish seed certified to be free of prohibited noxious weeds or quarantined pests, and certified to contain no more than the maximum allowable tolerances for restricted noxious weeds, according to 11 AAC 34. Prohibited and restricted noxious weeds are listed in 11 AAC 34.020, and can be viewed at the following URL: http://plants.alaska.gov/invasives/noxious-weeds.htm

Seed found to contain prohibited noxious weeds or quarantined pests will be rejected, according to 11 AAC 34.020(a) and 11 AAC 34.105 through 34.180, respectively.

Seed found to contain restricted noxious weed seed in excess of the maximum allowable tolerance per pound will be rejected, according to 11 AAC 34.020(b).

The Contractor shall furnish to the Engineer duplicate copies of a statement signed by the vendor certifying that each lot of seed has been tested by a recognized seed testing laboratory. Seed that has not been tested

within nine (9) months shall be rejected. The Contractor shall not remove tags from the seed containers. Seed containers that do not have tags shall be rejected. Discrepancies in the lot numbers listed on the statement to the lot numbers indicated on the tags of the seed containers shall be grounds for rejection. Seed which has become wet, moldy, or otherwise damaged in transit or storage will not be accepted. The Contractor shall immediately remove rejected seed from the project premises.

TABLE 724-1
SEEDING REQUIREMENTS

SPECIES (KIND)	CULTIVAR (VARIETY)	PERCENT PURITY	PERCENT GERMINATION	PURE LIVE SEED (PERCENT PURITY X PERCENT GERMINATION)
American Sloughgrass	Egan	90	80	72
Annual Ryegrass	---	85	80	68
Alpine Bluegrass	Gruening	90	90	81
Beach Wildrye	Benson, Reeve	95	40	38
Bering Hairgrass	Norcoast	95	75	71
Bluejoint	Sourdough	95	75	71
Brome	Manchar, Polar	90	80	72
Glaucous Bluegrass	Tundra	95	80	76
Kentucky Bluegrass	Merion, Nugget, Park	95	80	76
Perennial Ryegrass	---	85	80	68
Polargrass	Alyeska, Kenai	95	75	71
Red Fescue	Arctared, Boreal, Pennlawn	98	80	78
Timothy	Climax, Engmo	95	90	85
Tufted Hairgrass	Nortran	95	75	71
Wheatgrass	Wainwright	95	85	81

SECTION 725
FERTILIZER

01/20/15 (N52)

725-2.02 MATERIALS. *Add the following:* Fertilizer which has become wet, moldy or otherwise damaged in transit or storage will not be accepted. The Contractor shall immediately remove rejected fertilizer from the project premises.

Delete Section 726 in its entirety and substitute the following:

01/20/15 (N53)

SECTION 726
TOPSOIL

726-1.01 DESCRIPTION. This work will consist of furnishing commercial-grade topsoil and spreading the topsoil, in conformance with the Plans and these Special Provisions.

726-2.01 MATERIALS. Topsoil shall consist of organic matter uniformly blended with mineral matter. It shall be friable, free-draining and non-toxic. The topsoil shall not contain refuse. It shall be reasonably free from roots, clods, hard clay, noxious weeds, tall grass, brush, sticks, or stubble. Deleterious material shall not exceed 5%, of the sample submitted.

Topsoil shall consist of 60% mineral matter and 40% organic matter by volume. Organic matter passing the #4 sieve shall be a minimum of 7%. The topsoil shall have a pH between 5 and 7. Organic content shall be determined by ASTM 2974, Method B and C. Topsoil pH shall be determined by ASTM 4972.

TABLE 726-1
TOPSOIL REQUIREMENTS

Sieve Designation	Percent Passing By Weight
3 inch	---
1/2 inch	100
No. 4	95-100
No. 16	90-100
No. 200	45-65

If the topsoil pH is below 5, the Contractor shall add lime to the topsoil. Lime shall be uniformly blended with the topsoil. The quantity of lime added will be the amount necessary for the topsoil to fall within the pH range. Lime shall be considered as subsidiary to this item and will not be measured separately for payment.

The Contractor shall notify the Engineer of the location from which he proposes to furnish topsoil at least 30 calendar days prior to delivery of topsoil to the project. The topsoil and its source will be inspected and tested by the Engineer before approval will be granted for its use.

SECTION 727
SOIL STABILIZATION MATERIAL

8/02/2018 (N54)

727-2.01 MULCH. *Delete this subsection in its entirety and substitute the following:* All mulch, excluding trace mulch, shall provide 100% ground coverage. Apply mulch at the manufacturer's recommended application rate and increase as needed to achieve 100% ground coverage. All mulch, including trace mulch, shall meet one of the following:

1. Wood Cellulose Fiber or Natural Wood Fiber. Fiber shall be produced from natural or recycled (pulp) fiber, such as wood chips or similar wood materials, or from newsprint, corrugated cardboard, or a combination of these processed materials. Fiber shall not contain any rock, metal, or plastic. Fiber shall be treated with a green dye nontoxic to plant and animal life to facilitate inspection of the placement of the material. Fiber shall be manufactured in such a manner that after addition and agitation in slurry tanks with water, the fibers in the material will become uniformly suspended to form a homogenous slurry. When hydraulically sprayed on the ground, the material shall allow the absorption and percolation of moisture. The organic matter content shall be at least 90 percent on an oven-dry basis. The moisture content shall be no more than 15 percent as determined by oven dried weight. Each package of the cellulose fiber shall be marked by the manufacturer to show the dried weight. Product must be nontoxic to plant and animal life.

   Wood Cellulose Fiber or Natural Wood Fiber may be used to stabilize slopes flatter than 4H:1V. On slopes 4H:1V or steeper Wood Cellulose Fiber or Natural Wood Fiber may be used if an approved tackifier is used, in addition to Wood Cellulose Fiber or Natural Wood Fiber, according to the

Manufacturer's recommendations. Wood Cellulose Fiber or Natural Wood Fiber may not be used after August 1.

2. Wood Strand. Wood Strand shall be a blend of loose, long, thin wood pieces derived from native conifer or deciduous trees with high length to width ratio. A minimum of 95-percent of the wood strands shall have lengths between 2 and 10 inches, with a width and thickness between 1/16 and 3/8 inches. Wood Strand shall not contain resin, tannin, or other compounds in quantities that are detrimental to plant life. Sawdust or wood shavings shall not be used as Wood Strand. Wood Strand may be used on slopes flatter than 4H:1V. Wood Strand may not be used after August 1.

3. Straw. All straw material shall be in an air dried condition, free of noxious weeds, seeds, and other materials detrimental to plant life. Hay is not acceptable. Straw shall be suitable for spreading with mulch blower equipment. Straw may be used on slopes flatter than 4H:1V. Straw may not be used after August 1.

4. Bonded Fiber Matrix (BFM). The BFM shall be a hydraulically-applied blanket/mulch/covering composed of long strand, thermally processed wood fibers and crosslinked, hydro-colloid tackifier. The BFM may require a 24-48 hour curing period to achieve maximum performance. Once cured, the BFM shall form an intimate bond with the soil surface to create a continuous, absorbent, flexible erosion resistant blanket that allows for rapid germination and accelerated plant growth. BFM may be used to stabilize slopes between 2H:1V and 4H:1V. BFM may be used after August 1.

5. Fiber Reinforced Matrix (FRM). The FRM shall be a hydraulically-applied, flexible erosion control blanket/mulch/covering composed of long strand, thermally processed wood fibers, crimped, interlocking fibers and performance enhancing additives. The FRM shall require no curing period and upon application shall form an intimate bond with the soil surface to create a continuous, porous, absorbent and erosion resistant blanket that allows for rapid germination and accelerated plant growth. FRM may be used to stabilize slopes 2H:1V and steeper. FRM may be used after August 1.

A list of pre-approved products can be found in Table 1.

Table 1. Pre-Approved Mulch Products List

Product Name	Product Type	Manufacturer
Astro-Mulch	Wood Cellulose Fiber	Thermo-Kool Inc. Wasilla, AK
Fibermulch	Wood Cellulose Fiber	Thermo-Guard Insulation Spokane, WA
NaturesOwn High Density Paper Hydroseeding Mulch	Wood Cellulose Fiber	Hamilton Manufacturing, Inc. Twin Falls, ID
Hydro-Spray	Wood Cellulose Fiber	National Fiber Belchertown, MA
EcoFibre	Natural Wood Fiber	Profile Products LLC Buffalo Grove, IL
EcoFibre plus Tack	Natural Wood Fiber	Profile Products LLC Buffalo Grove, IL
Terra Novo Wood Fiber Plus Tackifier	Natural Wood Fiber	Terra-Novo Inc. Bakersfield, CA
Conwed Fiber 1000	Natural Wood Fiber	Profile Products LLC Buffalo Grove, IL
Rainier Fiber plus Tack	Natural Wood Fiber	Fiber Marketing International Spokane, WA

Product Name	Product Type	Manufacturer
Terra Wood with Tack	Natural Wood Fiber	Profile Products LLC Buffalo Grove, IL
Excel Fibermulch II	Natural Wood Fiber	American Excelsior Co. Rice Lake, WI
Mat-Fiber Plus	Natural Wood Fiber	Mat, Inc. Floodwood, MN
Mat-Fiber	Natural Wood Fiber	Mat, Inc. Floodwood, MN
EcoAegis	Bonded Fiber Matrix (BFM)	Profile Products LLC, Buffalo Grove, IL
ProMatrix Engineered Fiber Matrix	Bonded Fiber Matrix (BFM)	Profile Products LLC, Buffalo Grove, IL
Verdyol Virgin BFM	Bonded Fiber Matrix (BFM)	Erosion Control Blankets Manitoba, Canada
Rainier Fiber Bonded Fiber Matrix	Bonded Fiber Matrix (BFM)	Fiber Marketing International Spokane, WA
Profile Hydro-Blanket BFM	Bonded Fiber Matrix (BFM)	Profile Products LLC Buffalo Grove, IL
Soil Guard	Bonded Fiber Matrix (BFM)	Mat, Inc. Floodwood, MN
Flexterra FGM	Fiber Reinforced Matrix (FRM)	Profile Products LLC Buffalo Grove, IL
Flex Guard	Fiber Reinforced Matrix (FRM)	Mat, Inc. Floodwood, MN
Hydra CX	Fiber Reinforced Matrix (FRM)	Tensar North American Green Poseyville, IN

SECTION 740
SIGNALS AND LIGHTING MATERIALS

740-2.02 SIGNAL AND LIGHTING STRUCTURES.

1. Design: *Add the following*: Design poles with a Basic Wind Speed of 100 mph and a Wind Importance Factor of 1.00. All poles shall have a combined Effective Projective Area (EPA) rating exceeding the combined EPA value of the luminaire and all other components mounted on the pole.

740-2.03 WOOD POLES. *Change the subsection to read*: **WOOD POLES, GUYS AND ANCHORS.**

Add the following: Use 8-inch double helix round anchors with beveled cutting edges (DIXIE No. D8472R or approved equal). Use triple eye ¾-inch x 7 feet (CHANCE No. 12632P or approved equal) anchor rods. Use 5/16-inch diameter 10,000 lb. galvanized steel strand messengers and guys. Place guys before conductors are strung at locations shown on the plans. Attach guys to the anchor rod and pole as required by the utility owner. Use yellow 8-foot guy guards on all guys and attach in accordance with manufacturer's recommendations (Preformed No. PG-5718 or approved equal). Install all anchors and rods in direct line with the strain unless noted or detailed otherwise.

Install anchors so that approximately 6 inches of the rod will remain exposed. In cultivated areas or other locations as deemed necessary, the anchor rod projection may be increased to prevent burial of the eye rod.

740-2.05 CONDUCTORS. *Delete Table 740-2 and substitute the following:*

TABLE 740-2
CONDUCTOR TERMINATION TABLE

CONDUCTORS PER CABLE	CIRCUIT	WIRE COLOR	AWG. NO.	BAND LEGEND
5	Vehicle Red Vehicle Yellow Vehicle Green Common Neutral Spare	Red Orange Green White Black	14	Head No.
7	Vehicle Red Arrow Vehicle Yellow Arrow Vehicle Green Arrow Common Neutral Spare Spare Vehicle Yellow Flashing Arrow	Red Orange Green White White/Black Blue Black	14	Head No.
7	Vehicle Red Vehicle Yellow Vehicle Green Common Neutral Spare Vehicle Yellow Arrow Vehicle Green Arrow	Red Orange Green White White/Black Black Blue	14	Head No. (s)
5	Pedestrian Don't Walk Pedestrian Walk Common Neutral Spare Spare	Red Green White Orange Black	14	Head No.
5	Photo Electric Control Load to Contactor Neutral Spare Spare	Black Red White Orange Green	14	PEC
4	Flashing Beacon Neutral Spare Spare	Black White Red Orange	8	AAWF
2	Pedestrian Pushbutton Neutral	Black White	14	Head No. Located Under
2	Flashing Beacon Neutral	Black White	14	Head No.
2	Preemption Neutral	Black White	14	“PRE”
3	Highway Luminaire Highway Luminaire Highway Luminaire Spare	Black Red White	6	Circuit No. Circuit No.
3	Service to Controller Neutral Spare	Black White Red	6	“SIG” No Band No Band
3	Sign Luminaire Sign Luminaire Sign Spare	Black Red White	8	SIGN SIGN

1. Power Conductors: *In the second paragraph, delete* “ballast” *and substitute the following:* driver.

5. Detector Loops. *Delete and substitute the following:* Use No. 14 AWG conductors for detector inductive loops that meet IMSA Specification 51-3, Type RHW/USE, or IMSA Specification 51-5, when called for on the Plans or specified in the Special Provisions.

6. Loop Lead-In Cables. *Delete* "6 twisted pairs" *in the second sentence of the fourth subparagraph and substitute the following:* 7 twisted pairs.

Delete Table 740-3 and substitute the following:

TABLE 740-3
INTERCONNECT TERMINATION TABLE

TELEMETRY CABLE: Type PE-39, No. 19 AWG, Solid Copper, as noted on the Plans or in the Special Provisions

Pair No.	Tip	Ring	Pair No.	Tip	Ring
1	White	Blue	14	Black	Brown
2	White	Orange	15	Black	Slate
3	White	Green	16	Yellow	Blue
4	White	Brown	17	Yellow	Orange
5	White	Slate	18	Yellow	Green
6	Red	Blue	19	Yellow	Brown
7	Red	Orange	20	Yellow	Slate
8	Red	Green	21	Violet	Blue
9	Red	Brown	22	Violet	Orange
10	Red	Slate	23	Violet	Green
11	Black	Blue	24	Violet	Brown
12	Black	Orange	25	Violet	Slate
13	Black	Green			

Delete Subsection 740-2.06 and substitute the following:

740-2.06 ELECTRICAL CONDUIT AND FITTINGS. Unless specified otherwise, use rigid metal conduit and fittings for raceways. Furnish galvanized rigid type conduit and elbows conforming to UL Standard 6 and are manufactured of mild steel according to ANSI C80.1. Furnish third party certified fittings designed for rigid metal conduit.

For loop detectors, use Schedule 80 polyvinyl chloride (PVC) conduit that conforms to UL Standard 651. Use PVC fittings meeting NEMA TC 3.

When polyethylene conduits are specified on the Plans, use a smooth wall, schedule 40, high-density polyethylene (HDPE) conduit that conforms to UL Standard 651 A and NEMA TC-7-2013.

Furnish insulated throat grounding bushings made of malleable iron or steel with a mechanically galvanized or zinc plated finish. Grounding lugs shall either be an integral part of the bushing or consist of

an attached tin plated copper saddle. Grounding lugs shall feature a stainless steel screw, the centerline of which falls within 20 degrees of conduit centerline. The bushings furnished shall also feature a stainless steel or brass mounting screw that locks the bushing onto the conduit end.

Furnish conduit outlet bodies and their covers with a hot dip galvanized finish and stainless steel screws. For loop detectors, furnish Type X bodies and, for photoelectric control installation, furnish Types C and LB conduit bodies.

When Myers hubs are specified, furnish rain tight, grounding type hubs made of malleable iron with a hot dip or mechanically galvanized finish.

At expansion joints, provide watertight expansion fittings capable of the following movements without damaging the conduits attached to it or the conductors that pass through it. The movements include: axial expansion or contraction to 3/4 inch, angular misalignments in any direction to 30 degrees, and parallel misalignment of the conduits to 3/4 inch. The fittings shall also include a braided copper bonding jumper equal to an 8 AWG conductor, bushings to prevent scraping the conductors, and a smooth inner sleeve that maintains a constant diameter regardless of conduit alignment.

740-2.09 CONTROLLER ASSEMBLIES through **740-2.13 SPECIAL AUXILIARY EQUIPMENT.** *Delete in their entirety and substitute the following sections:*

740-2.09 CONTROLLER ASSEMBLIES. Provide solid state, traffic controller assemblies having level 2 conformance to NEMA Standard Publication TS 2-2003 V02.06, *Traffic Controller Assemblies* with NTCIP Requirements as defined in NTCIP1202. Traffic Controller Assemblies must meet or exceed the Environmental Requirements of Section 2 of the NEMA TS2-2003 V02.06 document. The Original Equipment Manufacturer (OEM) and its manufacturing and testing facilities shall be ISO 9001:2000 certified for processes involving the Traffic Controller Assemblies.

Use traffic control equipment that is compatible with the existing traffic signal monitoring system. Compatibility must be 100% at the cabinet level to include inputs, outputs, telemetry protocol, and block upload and download of RAM data.

Use LED indicators for all electronic devices covered under Subsections 740-2.09 through 740-2.13.

740-2.10 CONTROLLER UNIT.

Actuated Controller Unit (CU).

Provide solid state, Type A2N Actuated Controller Units (CU) meeting the requirements of Section 3 of the NEMA Standard Publication TS 2-2003 V02.06, *Traffic Controller* Assemblies with NTCIP Requirements.

- The CU must meet the referenced National Transportation Communications for ITS Protocol (NTCIP) and comply with publication TS 3.2 the Simple Transportation Management Framework, and shall meet the requirements for Conformance Level 2

- The software shall comply with NEMA TS 3.3, the Class B Profile, and shall include both an EIA/TIA 232-E and an FSK modem interface for NTCIP based communications.

- The CU shall implement conformance groups and optional object groups as defined in NEMA TS 3.4 and TS 3.5 for A2N level 2.

- Provide controllers with display heaters or enhancements to improve viewing in temperatures below 0°F.

- Provide controllers having an interface compatible with SYNCRO-7 traffic modeling software.

Furnish Econolite Cobalt ATC Touch controller unit or approved equal also meeting the following requirements:

HARDWARE

1. Enclosure

1.1. The controller shall be compact so as to fit in limited cabinet space. It shall require no more than 7" shelf depth. External dimensions shall not be larger than 8.5" x 15.2 1/4" x 6.375" (H x W x D)

1.2. The top and bottom of the chassis shall be made from extruded aluminum and include an integral handle on the back for easy transport.

1.3. The sides shall be constructed of injection molded polycarbonate.

1.4. The front panel shall meet specifications set forth in Section 5 (Front Panel)

2. Electronics

2.1 The electronics shall be modular in design and shall consist of vertical circuit boards. Horizontal circuit boards shall not acceptable.

2.2 In the interest of reliability, no sockets shall be used for any electronic device. All devices shall be directly soldered to the printed circuit board. Surface mount parts shall be used for the majority of the electronic components in the controller.

2.3 A built-in, high-efficiency switching power supply shall generate the primary, +5VDC internal voltage, an isolated +24 VDC for internal and external use, VSTANDBY, LINESYNC, POWERUP and POWERDOWN signals. All voltages shall be regulated.

2.4 The 120 or 220VAC fuse shall be mounted on the front of the controller. Protection for the 24VDC supply shall be provided by a resettable electronic fuse.

2.5 All printed circuit boards shall meet the requirements of the NEMA Standard plus the following requirements to enhance reliability:

a. Both sides of the printed circuit board shall be covered with a solder mask material.
b. The circuit reference designation for all components and the polarity of all polarized capacitors and two-leaded diodes shall be clearly marked adjacent to the component. Pin 1 for all integrated circuit packages shall be designated on all printed circuit boards.
c. All printed circuit board assemblies shall be coated on both sides with a clear moisture-proof and fungus-proof sealant.

2.6 Timing of the controller traffic application shall be derived from the AC power line.

2.7 To facilitate the transfer of user-programmed data from one controller to another, a Datakey receptacle for using a separate 2070-style, serial flash memory device shall be an available hardware option. In addition, two USB sockets and one SD Card socket shall be provided for memory devices that can be used for data transfer. These data transfer devices shall be easily removable and directly accessible from the outside of the controller. The controller will not require this Datakey, USB memory thumb drive, or SD Card to be present for proper operation.

2.8 All controller software shall be stored in Flash Memory devices. The controller software shall be easily updated without the removal of any memory device from the controller. The use of removable PROMS or EPROMS from the controller shall not be acceptable. The controller shall

include an option that allows updating software using a Windows based computer, a USB memory thumb drive, or an SD card.

3. ATC Engine Board

3.1 The controller shall include an ATC engine board compliant to ATC standard 5.2b and proposed version 6.10.

3.2 The engine board shall include a PowerPC 83XX family processor with QUICC engine.

3.3 The engine board shall have a minimum of the following memory:

a. 128 Mbytes of DDR2 DRAM memory used for application and OS program execution

b. 64 Mbytes of FLASH memory used for storage of OS Software and user applications

c. 2MB of SRAM memory used for non-volatile parameter storage

3.4 The engine board shall provide the seven ATC serial ports, Ethernet, USB and all other control signal required by ATC standard.

3.5 The operating system shall be Linux 2.6.35 or later.

4. Graphical User Interface

4.1 The controller shall include an advanced graphics card.

4.2 The graphics card shall enable:

a. Graphical display of status and programming selections

4.2.a.1 The status displays shall include direction arrows for each of the phases and overlaps.

4.2.a.2 The selection of programming sections menus shall be by use of icons.

4.2.a.3 Programming shall use touch data entry, allowing touch gestures to select yes/no, select enable/disable, pull-down list selections, and more.

b. Touch selection of status and programming

c. Swiping to advance from one screen to the next

4.3 Program values shall be entered through either the keypad or the touch screen.

4.4 The controller shall allow connection of a tablet to the controller.

a. The tablet connection shall be by Wi-Fi connection either by a Wi-Fi to USB adapter or an Ethernet to Wi-Fi adapter.

b. Once connected it shall be possible to observe the exact same graphics displays as are visible on the touch screen of the controller.

c. It shall be possible to change the controller's programming values from the tablet while it is connected.

5. Front Panel

5.1 The front of the controller shall consist of a panel for the display, keyboard and connectors for all necessary user connections.

5.2 The display shall be a seven-inch (7”), color, TFT (Thin Film Transistor) LCD (Liquid Crystal Display) with high brightness. It shall be readable in direct sunlight. The display shall perform over the NEMA temperature range and shall have a resolution of 800 X 480 with an 18 bit color depth. The luminous intensity shall be a minimum of 800 nits. The display shall include an industrial, resistive touch screen that can be operated with gloved hands. The touch screen and display shall not be affected by condensation or water drops.

5.3 Front-panel operator inputs shall be via touch screen or by clearly labeled elastomeric keypad. These shall include a 10-digit numeric keypad, Main and Sub keys, toggle keys, special function and enter keys, six function keys, status and help keys and a large four direction cursor control key.

5.4 The front panel shall include a built in speaker for enhanced controller audio feedback.

5.5 The front panel shall include a tri-color status LED.

6. Ethernet Ports

6.1 The controller shall have the capability of supporting Ethernet communications, using TCP/IP communications protocols.

6.2 The controller shall provide four front-panel Ethernet ports

6.3 Two of the ports shall be connected to Ethernet switch ENET1 and the other two shall be connected to Ethernet switch ENET2

7. USB Ports

7.1 The controller shall provide two USB 2.0 ports.

7.2 USB ports shall be used for USB thumb drives to update software, upload or download configuration, or uploading logged data.

8. Connectors

8.1 All non-optional interface connectors shall be accessible from the front of the controller in the NEMA Configured Controller models. Configurations shall be offered to accommodate different versions, as follows:

8.1.1 NEMA TS2 Type 1
8.1.2 NEMA TS2 Type 2
8.1.3 NEMA TS1

8.2 The D connector shall be compatible with the Econolite Model ASC/2, ASC/2S, and ASC/3 D connectors.

8.3 To facilitate special applications the controller shall have the capability of assignment of any input or output function to any input or output pin respectively on the interface connectors, with the exception of Flashing Monitor, Controller Voltage Monitor, AC+, AC-, Chassis Ground, 24VDC, Logic Ground and TS2 Mode bits.

8.4 The controller shall as a minimum have the following communications ports:

8.4.1 Port 1 SDLC for communications to other devices in the cabinet
8.4.2 Port 2 serial port for systems communications
8.4.3 Console serial port for local communications

An optional telemetry module shall utilize TDM/FSK data transmission at 1200 baud or 9600 baud over two pairs of wires. This module shall include the Econolite 25-pin D-sub connector.

8.5 Serial communications shall operate at from 1200 to 115.2 K baud.

9. Serviceability

9.1 All electronic modules including the power supply shall be easily removable from the controller using a screwdriver as the only tool. All power and signal connections to the circuit boards shall be via plug-in connectors.

10. Hardware Options

For each new controller unit required by the the contract, provide the following optional hardware.

10.1 Optional Data Key

10.1.1 A Datakey and receptacle shall be available for use as a database storage device (backup) or as a database transfer module. It shall be capable of storing a minimum 2MB of data.

10.1.2 The Datakey shall be hot swappable, so that it can be inserted and removed without powering down the controller.

10.1.3 The Datakey shall be capable of storing the entire controller database and shall retain the information without use of battery or capacitor backup.

10.1.4 The controller shall not require this key to be present during normal operation.

10.1.5 If the Datakey is present, the controller shall automatically backup the database to the data key 20 minutes following the last data change.

DISPLAY

1. General

1.1 A **Title Bar** that provides selection of Home, Main Status, Logged Events, I/O status, Network Status, Consistency Checks, and USB status shall always be visible at the top of the screen. Also the current date and time and Function Key Options.

2. Dynamic Displays

2.1 Dynamic displays listed below shall be provided to show the operational status of the controller. Additional displays shall be offered for programming. It shall be possible to jump from a status screen to the appropriate programming screen and return after viewing is complete.

2.2 When the cursor is pointed to a dynamic location on the screen, an audible shall be provided when the display changes

2.3 When the cursor is moved around the status screen and the help key is pressed, a context sensitive help shall be displayed.

2.4 The **Main Status Display** shall indicate a summary of the coordination plan in effect and if in-sync or in transition. Also a graphic that shows the phase sequence, the phases in each ring, the phase direction in the form of a direction arrow, or a left turn arrow pointing in the basis direction of travel. Each phase shall indicate when the phase has detector call, recall, a ped call, or ped recall. The background for the phase shall indicate green when the phase is green, yellow when yellow, and red when in all red clearance. Also, there shall be an indication of the current timing interval in effect and the current timing value.

2.5 It shall be possible to place vehicle, pedestrian, preemption, and TSP calls from the keyboard while displaying status information.

2.6 The **Event Log Display** shall indicate current logged events for controller events, detector events, detector activity, and MMU events.

2.6.1 Controller events shall include at a minimum pattern changes and power failures.

2.6.2 Detector events shall include the detector number of the detector failed and the mode of failure to include no activity, constant calls, or erratic calls.

2.6.3 Detector activity shall include the volume and occupancy of the detectors enabled for logging.

2.6.4 MMU events shall include all of the failure messages reported by the MMU.

2.7 The **Input Output Status Display** in the controller mode shall indicate the status of vehicle and pedestrian signal outputs including check and phase next, vehicle and pedestrian omit inputs, preempt input status including calls and active, overlap signal outputs, special function output status, and logic processor flag status. It shall be possible to switch to displaying MMU input/output status, detector or T/F BIU input/output status, or Power Supply status shall be displayed in combination with vehicle and pedestrian calls. The display shall also show the split plan, timing plan, sequence, action plan, and day plan in effect. Also displayed shall be, current coordination pattern information, local and system cycle count, time-based control status, hold, force-off, vehicle permissive, pedestrian permissive, split count down, split extension, and offset from ring 1.

2.8 The **PREEMPTOR STATUS DISPLAY** shall indicate the status of vehicle, pedestrian overlap, and overlap signal outputs shall be displayed in combination with vehicle and pedestrian calls. Priority (railroad, fire, emergency) preemptors and bus preemptors with calls, preemptor active, inhibit, and delay status. When a preemptor is active, the display shall also indicate preemptor interval, timing, duration, and dwell status. A portion of the display shall indicate the controller status during preemption including current status, interval, and timing by phase and ring and the status of vehicle and pedestrian signals for each phase.

2.9 The **TIME BASE STATUS** display shall indicate the current time and date, the current day and week program, the active program step for both coordination pattern and Time-of-Day (TOD) functions, the start time of the next eleven program steps and the day the next day plan will start. The programmed selections of the active coordination pattern and TOD pattern shall also be displayed.

2.10 The **Communications Status** displays shall be communications status displays for Ethernet, Port 1 (SDLC), Port 2 (terminal) Port 3, and NTCIP.

2.10.1 An Ethernet status display shall indicate the line speed, the line status, the total number of transmit, and receive counts and the number of transmit and receive error counts.

2.10.2 Port 1 (SDLC) status display shall indicate the frame responses from the MMU, the terminal and facilities, BIUs, and the detector BIUs.

2.10.3 Ports 2 and 3 status display shall indicate the interconnect format, transmit, valid data, data error, carrier detect, and the last valid command.

2.10.4 An NTCIP status display shall indicate the total number of SNMP and STMP transmit and receive counts.

2.11 The **DETECTOR STATUS** display shall indicate activity for up to 64 detectors. The display shall show detector calls as they are processed by the controller. The display shall also show the extension and delay timers for the selected detector. In addition the failure status of the detector shall be displayed.

2.12 The **FLASH/MALFUNCTION MANAGEMENT UNIT (MMU)** status display shall indicate flash status plus MMU channel, conflict, and monitoring function status. A separate display shall indicate the results of the controller's comparison of its MMU programming to the programming in the controller.

2.13 The **Consistency and Warning Checks** display shall indicate the status of these two checks. Consistency checks shall include the results of tests that make sure interrelated database functions are compatible with each other. Warning checks are intelligent diagnostics designed to indicate any data entries that, by themselves or in combination with other entries, may result in unexpected operation.

3. Traffic Applications Programming Displays

3.1 Traffic applications shall be selected from the title bar of the touch screen,

3.2 The **Approaches** icon shall allow the operator to select signalization, vehicle detection, or pedestrian detection programming.

3.2.1 Signalization shall include programming for the type for each movement as vehicle or pedestrian, the phase or overlap assigned to the movement, the direction of travel by selecting either direction arrows or left turn arrows, and dimming.

3.2.2 Vehicle Detection shall include selection of 1 of 4 detector plans and in each plan, the detector to phase assignment, the detector type, the delay and extension time, NTCIP volume and/or occupancy logging, type TS2 or ECPI, cross switching, and other phases called.

3.2.3 Pedestrian Detection shall include the phase or phases called and the type as either Ped push button or Bike input.

3.3 The **Phase Order** icon shall provide programming for the phase sequence, the phase to ring assignment, and barrier placement. It shall also include backup prevention, no serve phase, and simultaneous gap programming.

3.4 The **Overlap** icon shall provide programming of the overlap type, the lag timing, and the phases included in the overlap.

3.5 The **Flash** icon shall provide programming for startup flash and automatic flash entry and exit phases and overlaps. It shall include start up flash time and all red start up time.

3.6 The **Timing Plan** icon shall provide selection of 1 of four timing plans. It shall be possible to name the plans. Each plan shall be programmed by phase for green minimums, passage, green maximums, pedestrian timing, clearance times, phase demand options, and guaranteed minimum timing. It shall be possible to program timing by using a moving along a slider bar, by incrementing the bar, using a touch keypad, or by using the keypad.

3.7 The **Phase Options** icon shall provide for green flashing rates, ped clearance timing options, start of vehicle extension options, rest in walk, phase service options, non-actuated phase assignment, and pre-timed phases.

3.8 The **Event Plans** icon shall provide for naming TOD events such as flash, free, or the name of the coordination plan. It shall include naming and programming the day plans, and scheduling the day plans.

3.9 The **Preemption Plans** icon shall include all of the programming for rail road, emergency vehicle and bus preemption. It shall also include Transit Signal Priority (TSP) programming.

3.10 The **Logic Processor** icon shall include naming and programming of the 100 logic processor statements.

The **Settings** icon shall include setting for display brightness, sound volume, and date and time. It shall also include setup of user security.

Programming

1. Programming Methods

1.1. The methods listed below shall be available for controller configuration and timing entries. The manufacturer shall be able to provide as off-the-shelf items all of the firmware and software required to affect the listed methods and to implement network operation with system host PC's or approved tablets.

1.1.1 Manual data entry via the touch screen or the front panel keyboard

1.1.2 Downloading via telemetry from a host PC in a central server in an enterprise system.

1.1.3 Downloading from a portable PC-compatible computer via a serial or Ethernet cable.

1.1.4 Transfer from one controller to another, or restoring for a back-up copy, using a data key, USB thumb drive, or an SD card.

1.1.5 Uploading or downloading from an approved android tablet using a Wi-Fi connection.

1.1.6 A PC web interface shall allow the operator to view the current status and programming for the controller. It shall be possible to change programming from a remote device like a PC and if the device is connected to the controller, the programming changes shall take effect the next time that interval or function is used.

2. Programming Security

2.1 A minimum of three access levels shall be available to provide programming security.

2.1.1 The highest or administrator level shall have access to all programming entries including setting access codes.

2.1.2 The second or data change level shall have read-write privileges for all programming entries except access codes and CRC enable/disable.

2.1.3 The third or data display level shall only have access to read programmed data and status screen.

2.2 User selectable, access codes shall be provided for the administrator and data change and read only access levels. Each user shall have a user name that is entered using from 6 to 15 characters. Access codes shall initially be set to provide unrestricted access.

2.3 If there has been no keyboard activity the controller shall automatically logoff the user after 30 minutes.

3. Programming Utility Functions

3.1 A copy function shall permit copying all timing data from one phase to another. It shall also permit copying all timing plans from one timing plan to another, one detector plan and detector options plan to another, all coordination pattern data from one pattern to another and one sequence to another. This feature will facilitate data entry when programming any two or more phases with the same timing values, or detectors with the same programming, and/or two or more coordination patterns with the same pattern data.

3.2 The controller unit shall contain a backup data base with user specified values stored in non-volatile memory. A copy function shall permit transferring the backup database to the active database. The user shall be able to create their database and copy it to the default database.

3.3 A sign-on message shall allow the user to view the controller software version number. It shall also be possible to display the sign-on message by keyboard selection. The sign-on display shall allow a user-defined message of up to two lines with 38 characters per line.

3.4 The controller shall have the capability to output a memory image of the user programmed settings and intersection configuration data in binary format. This shall allow transferring the memory image data to a data key, USB thumb drive, or SD card.

Actuated Control Functions

The controller software shall provide all actuated control functions and operations required by the NEMA TS2 Standard. In addition, it shall provide the features described in the following sub-sections.

1. Phase Sequence

1.1. The phase sequence of the controller shall be programmable in any combination of 16 phases, using up to 16 concurrent groups, and four timing rings.

1.2. Up to 16 unique phase sequences shall be user configurable and used in the controller.

i. Four additional fixed sequences shall conform to the following TxDOT “Diamond” configurations:

a. 3-phase diamond
b. 4-phase diamond
c. NEMA 8-phase diamond
d. 2 intersection diamond control

1.3. Phase sequence information shall be changeable from the keyboard and stored in data memory.

1.4. The standard phase sequence of the controller shall also be capable of being altered by coordination, TOD, or external alternate sequence command, by selection 1 of the 16 configurable sequences or 1 of the 4 “diamond” sequences.

1.5. An exclusive pedestrian phase feature shall be provided which will time and display the pedestrian indications with the vehicle movements remaining in all red.

2. Timing Intervals

2.1. Timing intervals shall be programmable from 0-255 in one-second increments or from 0-25.5 in one-tenth second increments, depending on the function.

2.2. Four independent timing plans shall be provided. Any plan shall selectable on a TOD basis, by coordination pattern, or for one cycle following preemption.

2.3. Each timing plan shall contain the following interval timings:

Minimum Green	Maximum 3
Bike Green	Dynamic Maximum
Delay Green	Dynamic Maximum Step
Conditional Service Minimum Green	Yellow Clearance
Walk	Red Clearance
Walk 2	Red Maximum
Walk Maximum	Red Revert
Pedestrian Clearance	Actuations before Reduction
Pedestrian Clearance 2	Seconds per Actuation
Pedestrian Clearance Maximum	Maximum Initial
Pedestrian Carryover	Time before Reduction
Vehicle Extension	Cars Waiting
Vehicle Extension 2	Time to Reduce
Maximum 1	Min Gap
Maximum 2	Steps to Reduce

2.3.1 The bike green interval shall replace the phase minimum green if the interval time is larger than the min green time and if a detector input designated as a bike detector has been activated.

2.3.2 Two Walk and Pedestrian Clearance intervals shall be provided for each phase per timing plan. The second Walk and Pedestrian Clearance shall be activated by a time base action plan.

2.3.3 Two vehicle extension intervals shall be provided for each phase per timing plan. The active vehicle extension interval shall be selected by a time base action plan.

2.3.4 If enabled, a Delay Green timer shall delay the vehicle phase from starting until the timer has expired. This shall provide an additional all red for the vehicles movement and allow the pedestrian indications to precede the vehicle movement.

2.3.5 The Pedestrian Walk interval shall extend from Walk to the smaller of the Walk Max time or the phase maximum in effect with a constant input from the “Walk Extension detector”. The Pedestrian Clearance interval shall also extend Pedestrian Clearance to the smaller of the Pedestrian Clearance Max time or the phase maximum in effect with a constant input from the “Walk Extension detector.”

2.3.6 Volume density intervals shall include actuations before and cars waiting. Actuations before added shall provide a user-specified number of actuations that must occur before

adding variable (added) initial time. Cars waiting shall provide a user specified number of actuations, or cars waiting, that must occur before starting gap reduction. Gap reduction shall be initiated by either time before reduction or cars waiting, whichever reaches its maximum value first.

2.3.7 The controller shall be capable of dynamically extending the maximum green time for each phase based on vehicle demand. Three maximum green intervals shall be selectable per phase based on TOD, coordination pattern or external input. The initial interval shall be selectable as Max 1, Max 2, or Max 3. If the phase terminates due to max-out for two successive cycles, then the maximum green time in effect shall automatically be extended by a dynamic max step interval on each successive cycle until it is equal to dynamic maximum. If the phase gaps out for two successive cycles, then the maximum green time shall be reduced by the dynamic max step time until it reaches to the original max value.

2.3.8 Each phase shall have a red maximum timing interval. An input (red extension) shall extend the all red period of the assigned phase as long as the detector input is true. This input must be true within the all red time of the assigned phase to be able to extend the all red period. If this detector fails then the all red extension feature shall be disabled.

2.4 Guaranteed minimum interval values shall be settable and shall not be overridden by the controller. Values shall be provided for the following intervals:

2.4.1 Minimum green
2.4.2 Walk
2.4.3 Pedestrian clearance
2.4.4 Yellow clearance
2.4.5 Red clearance
2.4.6 Overlap green

3. Overlaps

3.1 The controller shall provide sixteen internally-generated overlaps (A - P). All Overlap functions shall be programmable from the controller keyboard.

3.2 Overlaps shall be individually programmable as standard (normal), other (to include minus green / yellow, protected, pedestrian protected and protected permissive flashing arrow), with lag overlap timing capabilities. The green, yellow and red and lag interval timings shall be individually programmable with respect to the activation or termination of the parent phase, respectively.

3.2.1 The standard overlap shall require only included phases to be configured

3.2.2 A protected overlap shall operate according to the following rules:

a. Overlap shall be green, yellow or red like a normal overlap except its outputs shall be blank when the protected phase is green, or the controller is transitioning to a non-included phase.

3.2.3 Minus green / yellow overlaps shall operate according to the following rules:

a. Overlap shall indicate green when any of the overlap phases are green or when in transition between overlapped phases and a modifier phase is not green.

b. The overlap shall be yellow when an overlapped phase is yellow and the modifier phase is not yellow and none of the overlapped phases are next.

3.2.4 A pedestrian protected overlap shall be green under the following conditions:

a. When an included phase is green and the protected pedestrian is NOT in walk or pedestrian clearance

b. When the controller is in transition between included phases and a pedestrian protected phase is not next

c. After servicing an included phase pedestrian demand if there is enough time before max out to service the overlap minimum green

3.2.5 The controller shall provide an overlap selection for Protected/Permissive Left Turn PPLT Flashing Yellow Arrow FYA operation. PPLT/FYA shall allow selection of the protected phase, permissive phase, flash yellow output to either the overlap output, or a pedestrian clearance (yellow) output. The PPLT/FYA shall also allow the yellow arrow to continue flashing once the permissive through phase reaches yellow clearance. PPLT/FYA shall be enabled on a time of day basis.

3.3 The controller shall provide the capability of sixteen pedestrian overlaps. These shall be capable of overlapping the pedestrian displays of any combination of phases with a pedestrian movement.

4. Conditional Service

4.1 The controller shall provide a programmable conditional service feature. When selected, the controller shall service an odd-numbered phase once normal service to that phase has been completed and enough time for additional service exists on the concurrent even phase.

4.2 A conditional service minimum green time shall be programmable for each phase. This interval shall ensure a minimum green if the phase is conditionally served.

4.3 It shall be possible to program the controller to re-service the even phase after conditionally serving an odd phase. Once an even phase has been conditionally re-serviced, the odd phase shall not be conditionally served again until returning to the concurrent group that is timing.

5. Additional Features

5.1 The following features shall be programmable for each phase in each of four separate timing plans:

5.1.1 Locking/non-locking detector memory
5.1.2 Vehicle recall
5.1.3 Pedestrian recall
5.1.4 Maximum recall
5.1.5 Soft recall
5.1.6 No-rest phase
5.1.7 Enable Added Initial

5.2 Also programmed by phase shall be:

5.2.1 Phase in use
5.2.2 Exclusive Pedestrian phase

5.3 Soft recall shall return the controller to the programmed phase in the absence of other calls.

5.4 If a phase is designated as a no-rest phase the controller shall not rest in the phase, and proceed to the next phase with serviceable demand, or if no demand is present the next soft recalled phase.

5.5 The controller shall permit power start and external start to be programmed by phase and interval. Start intervals shall be green, yellow red , or yellow with overlaps forced yellow.

5.6 During a power start condition, the controller shall be capable of timing an all-red or flash interval before the power start phase(s) and interval are displayed. The controller shall support the MUTCD 2009 that requires a minimum of 6 seconds of all red following red/red flash.

5.7 The controller shall provide guaranteed passage operation on a per phase basis. When selected, this feature shall provide a full passage (vehicle extension) interval when a phase gaps out with a gap in effect less than the vehicle extension interval (preset gap).

5.8 The controller shall provide both single and dual entry operation. When selected, dual entry shall cause the controller to ensure that one phase is timing in each ring.

5.9 It shall be possible via keyboard selection to inhibit the service of a phase with other phase(s) within the same concurrent group.

5.10 The controller shall provide the following additional selectable pedestrian functions:

5.10.1 Actuated phase rest in WALK
5.10.2 Flashing WALK output
5.10.3 Pedestrian clearance protection during manual control
5.10.4 Pedestrian clearance through yellow
5.10.5 Pedestrian timing shall be capable of being carried over from one phase to another

5.11 Programming shall be provided to inhibit re-service of odd phases (left turns) within the same concurrent group. Also, programming shall be provided to place a demand on a phase in another concurrent group to cause the controller to leave the concurrent group prior to servicing the odd phases in the same concurrent group.

5.12 The controller shall provide a programmable simultaneous gap termination feature. When programmed, phases in both rings shall gap out together in order to terminate the green interval and cross the barrier.

5.13 The controller shall provide automatic flash selection per the requirements of the MUTCD. Both the flash entrance and exit phases shall be programmable through the keyboard, and flashing shall be controlled by either setting the fault/voltage monitor output to be FALSE or by flashing through the load switch driver outputs. If flash desired through the load switches, both the phase and overlap outputs shall be flashed either yellow or red as selected by the operator. Automatic flash shall be selectable by external input, system command, or TOD action plan.

5.14 The controller shall provide dimming for selectable load switch outputs. Dimming shall be accomplished by inhibiting the selected outputs for alternate half cycles of the 120 VAC line. Dimming shall be controllable by time of day and an external input; both functions must be TRUE for dimming to occur. Programming shall permit individual dimming of the Green/Walk, Yellow/Ped Clear, Red/Don't Walk outputs for each load switch. Based upon controller programming the controller shall automatically compute the MMU channel compatibility The compatibility computed shall be based on phases-in-use, phase concurrency, valid pedestrian movements, vehicle and pedestrian overlaps, and pedestrian carryover.

Coordination

Coordination functions to control intersection cycle lengths, system offset relationships, and phase split percentages shall be provided as a standard feature, with no need for additional modules or software.

1. Coordination Patterns

1.1. A minimum of 120 coordination patterns shall be provided. Each pattern shall allow selection of an independent cycle length, offset value, and split pattern. The coordination patterns shall be selected using telemetry (system), hardwire, or non-interconnected (time base) coordination commands. Offset and Split values shall be entered in either seconds or percentage.

1.2. The coordination patterns shall be selected by the coordination command using the following formats:

a. Pattern - This format shall allow selecting the coordination patterns directly, that is, commanding Plan 1 selects Pattern 1. Pattern command shall include 1-120 patterns, pattern 254 shall select free, and pattern 255 shall select flash.

b. Standard - This format shall allow selecting the coordination patterns using a pattern number derived from a cycle offset-split command. Each pattern shall be assignable to a specific cycle-offset-split combination. The coordination pattern shall be selected programmed by the user to each pattern used.

c. TS2 - This format shall allow selecting the coordination patterns as a function of Timing Plan and one of three offsets. With this format a minimum of 20 Timing Plans shall be available for selection of one of sixty coordination patterns.

1.3. The following functions shall be programmable in each coordination pattern:

a. Cycle length
b. Split pattern number
c. Offset value
d. Dwell/Add time
e. Actuated coordination
f. Timing plan
g. Actuated walk rest
h. Phase sequence
i. Phase re-service
j. Action plan
k. Maximum select
l. Fixed/Floating force off
m. Split timing per phase in seconds of percentage
n. Directed split preferences
o. Coordinated phase split extension
p. Crossing artery pattern
q. Permissive timing
r. Ring extension
s. Split demand pattern
t. Ring displacement
u. Coordinated phase
v. Split value by phase
w. Omit by phase
x. Min recall by phase
y. Max recall by phase
z. Pedestrian recall by phase
aa. Special function outputs

1.4. The following functions shall be programmable for each of the 120 Split patterns:

a. Coordinated phase
b. Split value by phase
c. Omit by phase
d. Min recall by phase
e. Max recall by phase
f. Pedestrian recall by phase
g. Max and Pedestrian recall by phase

2. Cycle Length

2.1. One cycle length shall be provided for each coordination pattern. The cycle shall be adjustable over a range of 30-999 seconds in 1-second increments.

2.2. The cycle length shall serve as the reference time for all coordination timing.

3. Synchronization

3.1. For systems with a single system sync pulse, coordination timing shall be synchronized to the leading edge of that pulse, which shall serve as the master zero reference for all offset timing.

3.2. For hardwire systems with multiple sync pulses, the coordinator shall lock onto the correct.

3.3. sync by trying different syncs and checking for reoccurrence during successive cycles.

3.4. After a valid system sync pulse has been received the coordinator shall check for the proper occurrence of the system sync pulse during each subsequent cycle. If a sync pulse does not occur, the coordinator shall self-sync and continue to operate with the last set of coordination commands for a programmable number of cycles from 0-255. If a sync pulse does not occur within the programmed period (or until the first sync pulse is received), the coordinator shall revert to the non-interconnected coordination mode.

4. Offset

4.1. Offset shall normally be defined as the time period from the system sync pulse to the beginning of the leading coordinated phase green (local zero). The coordinator shall also be capable of referencing the offset to the beginning of the lagging coordinated phase green, coordinated phase yield, start of yellow point or the start of the ring 1 coordinated phase

4.2. Offsets shall be programmable using both percent and seconds. The range shall be from 0-99% of the cycle length in 1% increments or 0-255 seconds in 1-second increments.

4.3. Offset changes shall be achieved by adding or subtracting cycle time over a maximum of three cycle periods to allow a smooth transition to the new offset. Other offset change methods shall be adding 20% or a user-selectable value to each cycle or to snap to the sync point once the permissive period are complete and the coordinated phases are green.

4.4. Offset correction using dwell shall also be selectable.

5. Split

5.1. Each split shall provide a split interval for each of sixteen phases. The split interval shall be programmable using percent or seconds. The range shall be from 0-99% of the cycle length in 1% increments or 0-255 seconds in 1-second increments.

5.2. Split interval settings shall determine the maximum time, including vehicle clearance (yellow and red), for a non-coordinated phase, or the minimum time for a coordinated phase. Phase termination shall be controlled by establishing a force-off point for each phase within the cycle. Except for the coordinated phases the force-off point shall be selectable to be a fixed point within the cycle or allowed to float. If floating force-offs are selected each phase shall time no more than its own split interval.

5.3. During coordination, it shall be possible to operate a coordinated phase as actuated or non-actuated. If a coordinated phase is actuated, vehicle detections shall permit the coordinator to extend a phase beyond the normal yield point. Extended coordinated phase green shall be selectable using the same range as split interval settings (percent or seconds). If actuated coordinated phases are used they shall be able to have actuated or non-actuated (walk rest) pedestrian movements.

6. Permissive Periods

6.1. Permissive periods shall be provided to control the time period during which coordinated phases are released to service calls on non-coordinated phases.

6.2. All permissive timing shall begin at the lead coordinated phase yield point. A yield point shall be automatically computed for the coordinated phase in each ring. The coordinated phase yield points shall allow the coordinated phases to yield independent of each other. The yield point shall be the point at which the coordinated phase is released to allow the controller to service calls on non-coordinated phases. The computation shall take into account the coordinated phase split interval plus pedestrian and vehicle clearance times.

6.3. Automatic permissive period operation shall be provided by automatically calculating a permissive period for each non-coordinated phase. The permissive period shall consist of a separate vehicle and pedestrian period computed from the phase split interval and the vehicle/pedestrian minimum time. The controller shall answer a call only during the associated phase permissive period. However, once the controller has been released to answer a call, all remaining phases shall be served in normal sequence.

6.4. Single permissive period operation shall be provided by defining a single time period per cycle beginning with the yield point during which the controller is allowed to answer phase calls for any phase. The duration of this period shall be selectable in each coordination pattern.

6.5. Dual-permissive period operation shall also be provided. During the first permissive period, the controller shall answer only vehicle or pedestrian calls on the phases following the coordinated phase. If the controller yields to a call during this period, calls on the remaining phases are served in normal rotation. During the second permissive period, the controller shall answer calls on all remaining phases except the first permissive phase. The duration of the two permissive periods, and the time at which to start the second permissive period (displacement), shall be selectable in each coordination pattern.

7. Phase Re-service

7.1. If actuated coordinated phases are in use it shall be possible to re-service non-coordinated phases within the same cycle if sufficient time remains. A phase shall be re-serviced only if the permissive period for the phase indicates there is sufficient time remaining in the cycle to service the phase.

7.2. Phase re-service shall be capable of being enabled/disabled in each coordination pattern.

8. Transition Cycles

8.1. It shall be possible to program the controller to ignore the pedestrian timing when calculating the minimum cycle length for offset correction.

8.2. The controller shall provide a smooth and orderly transition when changing from free operation to coordinated operation and from one coordination command to another.

8.3. During a free-to-coordinated transition, the controller shall initiate a pick-up cycle beginning upon receipt of a sync pulse and a valid coordination command. The controller shall then enter coordination mode upon crossing a barrier or if resting in the coordinated phases.

8.4. Each coordination command shall select a pattern. A command change shall be implemented concurrent with a sync pulse. Cycle, offset, and split changes shall not take effect until local zero.

9. Local Split Demand

9.1. The coordinator shall provide a minimum of two split demand detector inputs, which shall allow the selection of a preferred split plan based on intersection demand.

9.2. If the split demand detector indicates continuous vehicle presence during a programmed monitoring period beginning with the onset of a selected phase green, the coordinator shall force a selectable split plan to be in effect during the next cycle. This split plan shall remain in effect for a selected number of cycles from 0-255. A specific split plan shall be capable of being selected in each coordination pattern.

10. Adaptive Split Demand

10.1. The coordinator shall provide a method to select the split using measurement of each phase's green utilization. From the measurement the coordinator shall determine which phase or phases had excess time that was not used during the last measurement period. Then the excess time shall be added to the first set of preferential phases. If the first set of preferential phases gapped out during the last measurement period, then the excess time will be added to a second set of preferential phases. If both sets of preferential phases gapped out during the last measurement period then the time shall be added to the beginning of the coordinated phases.

11. Free Mode

11.1. The coordinator shall provide a free mode of operation, where all coordination control is removed.

11.2. Free mode operation shall be selectable by coordination commands, by external input or by keyboard entry.

11.3. The coordinator shall revert to the free mode when active controller inputs or functions would interfere with coordination. Such inputs or functions shall include the following:

a. Manual control enable
b. Stop time
c. Automatic flash
d. Preemption

11.4. The coordinator shall provide an active free mode, where coordination control is removed but the coordinator continues to monitor system sync so as to keep its timing in step with the system or TOD if operating under TOD or central system control.

12. Manual Control

12.1. The controller shall allow manual override of the current coordination command from the keyboard. The manual command shall allow selection of any coordination pattern to be in effect.

13. Interconnect Modes

13.1. The coordinator shall be capable of operating with any of the following interconnect types:

a. Non-interconnected coordination (time-based)
b. Telemetry
c. Hardwired
d. Fiber Optic

13.2. The coordinator shall be compatible with fixed-time interconnect, which provides the sync pulse superimposed on the offset lines. It shall also operate within an interconnected system using a separate sync line. The non-interconnected coordination mode shall serve as a backup when using telemetry, fiber optic, or hardwired interconnect.

Preemption

The controller shall provide a minimum of ten preemption sequences that can be programmed as either railroad-fire-emergency or bus vehicle preemption sequences. Preemption capability shall be standard and shall not require additional modules or software.

1. Railroad-Fire-Emergency Vehicle Preemption

1.1. The ten railroad-fire-emergency vehicle preemptors shall be selectable as a priority or nonpriority type. Priority preemptor calls shall override non-priority preemptor calls. Lownumbered priority preemptors shall override higher-numbered priority preemptor calls. Nonpriority preemptor calls shall be serviced in the order received.

1.2. Each preemptor shall provide a locking and non-locking memory feature for preemptor calls. If a preemptor is in the non-locking mode and a call is received and dropped during the delay time, the preemptor shall not be serviced.

1.3. Preemptor timing intervals shall be programmable from 0-255 in one-second increments or 0-25.5 in one-tenth second increments, depending on function. Delay, max presence, and duration timing intervals shall be programmed from 0 – 65535 seconds in one-second increments.

1.4. A programmable delay time interval shall be provided to inhibit the start of the preemption sequence. This interval shall begin timing upon receipt of a preemption call. This time shall be programmable from 0-65535 seconds in one-second increments.

1.5. An inhibit time shall be provided as the last portion of the delay time interval. During this time, phases that are not part of the preempt sequence shall be inhibited from service. This time shall be programmable from 0-255 seconds in one-second increments.

1.6. A programming option shall be available that allows termination of all phases prior to entering preemption.

1.7. A programmable extend input shall cause the preemptor to remain in the dwell interval following the removal of the preempt call. If a preempt call is reapplied during this time, the preemptor shall revert to start of dwell interval. This time shall be programmable from 0-25.5 seconds in one-tenth second increments.

1.8. A programmable duration time shall be provided to control the minimum time that a preemptor remains active. This time shall be programmable from 0-65535 seconds in one second increments.

1.9. A programmable maximum presence time shall be provided to control the maximum time that a preemptor input remains active and still be recognized by the controller. Once failed, the input must return to inactive state to be recognized again. This time shall be programmable from 0-65535 seconds in one-second increments.

1.10. Phases timing at the beginning of a preemption sequence shall remain in effect for a minimum time before the controller advances to the next sequential interval. If the phase has been timing for longer than the programmed preemptor minimum time, the controller shall immediately advance to the next sequential interval. Minimum times shall be programmable for the following intervals:

a. Green/walk/pedestrian clearance
b. Yellow
c. Red

1.11. A phase shall advance immediately to pedestrian clearance if it has been timing a WALK interval at the beginning of a preemption sequence. It shall be possible to time the minimum pedestrian clearance through the yellow interval, or alternately to advance immediately to yellow. During preemption, pedestrian indicators shall be selectable as being a solid DONT WALK, OFF (blank) or fully operational.

1.12. If an overlap is in effect when the preemption sequence begins, it shall be possible to terminate the overlap so that it remains red for the remainder of the preemption sequence. Overlaps terminating or forced to terminate shall time the preemptor minimum yellow and red clearance times.

1.13. Each preemptor shall provide user-programmable green, yellow and red track clearance intervals. These shall begin timing immediately after the preemptor minimum red interval.

1.14. Each preemptor shall provide a user-programmable gate down extension and gate down max green. The gate down extension shall extend the track clearance green time after the gate down input in received. The gate down max green is the maximum the track clearance green time will be extended. If the gate down max green is exceeded the intersection shall be forced to flash.

1.14.1 The forced flash shall be programmable to be either hard or soft. If hard flash is enabled then exiting flash to normal operation shall require either pressing the clear key or the MMU reset. A programmed soft flash shall automatically return to normal once the fault condition no longer exits. For gate down fault this shall be once preemption is deactivated.

1.15. Up to four permissive phases shall be selectable as track clearance phases. During the track clearance period, the selected phases shall time the track clearance green, yellow and red intervals once, and then advance to the hold interval. If track clearance phases are not selected the track clearance interval shall be omitted from the preempt sequence. Controller interval timing shall be used if track clearance interval times have been programmed as zero.

1.16. The preemption hold interval shall begin immediately after track clearance. It shall remain in effect until the preemptor duration time and minimum hold times have elapsed and the preemptor call has been removed or the preemptor maximum time has been exceeded. During the preemption hold interval, any one of the following conditions shall be selectable:

a. Hold phase green
b. Limited phase service
c. All red
d. Flash

1.17. Any valid phase, except a track clearance phase, shall be selectable as a hold phase. If hold phases are not selected, the controller shall remain in all red during the hold interval. If flash is selected for the hold interval, up to two permissive phases shall be selectable to flash yellow, and the remaining phases shall flash red. Overlaps associated with the phases flashing yellow shall also flash yellow unless they have been forced to terminate, in which case they shall remain red.

1.18. The preemptor shall immediately cause flashing operation if the preemption input and the track interlock input are not in opposite states and the track interlock function is enabled.

1.19. Each preemptor shall provide a user-programmable green, yellow and red dwell interval, during which the dwell phase(s) shall operate normally, except that the minimum green interval time shall equal the hold green time. At the completion of the dwell green interval, the controller shall time the dwell yellow and red clearance intervals prior to transfer to the exit phases.

1.20. Up to four permissive exit phases shall be selectable to time after the preemption sequence has been completed. These shall serve as transition phases to return the controller to normal operation. It shall also be possible to place calls on selected phases upon exiting preemption. The option shall be provided to cause the preemptor to exit preemption to the correct phase to maintain coordination.

1.21. Each preemptor shall provide a user-selectable exit timing plan. Upon exiting the preemption sequence, this timing plan shall serve as the phase times in effect for one controller cycle for all phases.

1.22. Preemptor linking shall permit preemption sequences, where lower-priority preemptors may call the higher-priority preemptors from their preemption sequence.

1.23. Each preemptor shall allow programming of an inhibit extension timer. This timer shall be the length of time the max call inhibit can be extended.

1.24. Preemptor active outputs shall be provided for each of the preemptors. The output shall be set to ON when the preemption sequence begins and shall remain ON for the duration of the sequence. It shall also be possible to program preempt active outputs to be ON only during preempt hold intervals. Additionally, it shall be possible to program the non-active, non-priority preemptor outputs to flash while another preemptor is active.

1.25. Preemptors shall normally override automatic flash. It shall be possible to inhibit this feature for each preemptor.

1.26. Each preemptor shall provide the ability to delay the preempt input based on vehicle and pedestrian service request in relation to the coordinated cycle. The preemptor will compare the preempt delay time to the minimum time required to service a phase or pedestrian and then skip the phase or pedestrian movement if there is not enough time left in the delay to service the movement.

1.27. Each preemptor shall allow pedestrian movements which were interrupted by a preempt call to be dynamically selected as that Preemptor's exit phases.

1.28. Each preemptor shall allow vehicle phases which have been interrupted by a preempt call to be dynamically selected as that Preemptor's exit phases. The preemptor shall calculate the percentage of green time served of phases interrupted by a preempt call. If the amount serviced does not meet the limits defined by the Priority Return % data entries then the preemptor run shall select those interrupted movements as exit phases.

1.29. Each preemptor shall allow phases which have been waiting the longest to be serviced or which have the most cars waiting to be dynamically selected as that Preemptor's exit phases.

1.30. The conditional delay, interrupted pedestrian, interrupted vehicle and queue delay functions shall be programmed for enable, disable or time of day selection.

1.31. Each preemptor shall, if free one cycle is enabled, allow the preemptor to exit to free for one cycle before returning to coordination.

1.32. Each preemptor shall, if exit phase once is enabled, allow the preemptor to exit to specific phases in free mode (for a special minimum green time as defined in a new timing plan) before returning to coordination.

2. Bus Preemption

2.1. Ten bus preemptors shall provide control for bus or other low-priority vehicles. Bus preemptors shall have low priority and shall be overridden by railroad-fire-emergency vehicle preemptor calls.

2.2. The preemptor shall be programmed to accept either a 6.25 pulse-per-second signal with a 50% duty cycle or a solid input to identify a bus preemptor call. Bus preemptor calls shall be capable of preemptor call memory and shall be served in the order received.

2.3. Bus preemptor timing intervals shall be programmable from 0-255 in one second increments or 0-25.5 in one-tenth second increments depending on the function.

2.4. A re-service time shall be provided to avoid excessive utilization of the same bus preemptor. If a call is received before the re-service time has elapsed, the bus preemptor shall not be re-serviced. If re-service time has not been entered then all phases with a call when leaving the bus preemption sequence shall be serviced before the bus preemptor may be served again.

2.5. Bus preemptors shall provide delay, inhibit, and maximum time functions similar to those for railroad-fire-emergency vehicle preemptors described above.

2.6. Bus preemptors shall provide the following entrance intervals:

2.6.1 Green/walk/pedestrian clearance
2.6.2 Yellow
2.6.3 Red

2.7 At the completion of the entrance red clearance, the bus preemptor shall advance to the hold green interval. During this interval, up to four permissive phases shall be selectable to remain green until the minimum hold time has elapsed and the bus preemptor call has been removed or the preemptor maximum time has been exceeded.

2.8 It shall be possible to program the controller to allow concurrent phases to be serviced for a bus preemptor with only one phase selected as the hold interval phase.

3. Preemption Safeguards

3.1 If a preemptor call is active when power is restored to a controller, the fault/voltage monitor output shall be set to FALSE, placing the intersection in flash. Similarly, if external start is applied during a preemption sequence, the intersection shall be set to flash. Intersection flash shall remain in effect until the preemptor call has been removed and the preemptor duration time has elapsed.

3.2 An input shall be provided to stop timing of the current active preemptor under control of the MMU/CMU.

3.3 A preemptor safety interlock shall be provided to cause the intersection to go into flash whenever the controller has been replaced and/or has not been programmed for preemption. This shall be achieved with an appropriate signal to the MMU/CMU.

4. Optional Transit Signal Priority (TSP)

4.1 The controller shall include a transit signal priority algorithm that provides for transit vehicle movement through the intersection, while not interrupting coordination or skipping phases.

4.2 A check-in detector input shall be provided that senses the arrival of the transit vehicle. When active this input shall initiate TSP.

4.3 A TSP delay shall delay the beginning of TSP operation until a set interval after check-in.

4.4 A check-out detector input shall determine the departure of the transit vehicle.

4.5 Assignment of a single pulse from the check-in detector and check-out detector to the controller inputs shall be programmable to any controller input.

4.6 When under coordination the TSP sequence shall use adjusted split times to accommodate transit vehicles while maintaining coordination.

4.7 When under free operation the TSP sequence shall use adjusted maximum times to accommodate transit vehicle while not skipping phase.

Time-Based Control (Non-Interconnected) Coordination

The controller shall include time-based control. This capability shall be a standard feature and shall not require additional modules or software.

1. Clock/Calendar Functions

1.1. The controller shall provide a TOD clock, which shall be used for all time-based control functions. The only required clock settings shall be the current time (hour, minute and second) and date (month, day and year). Day of week and week of year shall be automatically computed from the date setting. It shall also be possible to set the number of hours that the local standard time is ahead or behind Greenwich Mean Time.

1.2. During normal operation, the TOD clock shall use the power line frequency as its time base. When power is removed, the time shall be maintained by a crystal oscillator for up to 30 days. The oscillator shall have a timing accuracy of +/- 0.005% over the entire NEMA temperature range as compared to the Universal Coordinated Time Standard.

1.3. In addition to entering time and date via the keyboard, it shall be possible to download the information from a central system.

1.4. The controller shall include a time reset input. This feature shall reset the TOD clock to 03:30 whenever the time reset input is TRUE.

1.5. The controller shall provide support for a serial input from a GPS clock that supports NMEA protocol to set the time and date of the controller.

1.6. The TOD clock shall automatically compensate for leap year and shall be programmable to automatically switch to daylight savings time.

2. Time-Based Control

2.1. Time-based control shall utilize a day plan program format. The month program shall consist of 200 programmable schedules, each assignable to one of sixteen day programs. Each day program shall consist of from 1 to 50 program steps which define a program for the entire day. Each program step shall be programmed with a starting time and an action plan number. The day plans shall also be assigned to days of the week and days of the month.

2.2. Time based control shall use action plans to assign:

a. Coordination pattern number
b. Vehicle detector plan number
c. Controller sequence
d. Timing plan
e. Vehicle detector diagnostic plan
f. Pedestrian detector diagnostic plan

2.3. Time based control shall also use action plans to enable:

a. Automatic flash
b. System override
c. Detector log
d. Dimming
e. Special functions
f. PPLT/FYA
g. Priority return
h. Ped priority return
i. Queue Delay
j. Conditional delay
k. Auxiliary functions
l. Logic Processor statements
m. By-Phase functions
    1. Pedestrian recall
    2. Walk 2 enable
    3. Vehicle extension 2 enable
    4. Vehicle recall
    5. Vehicle max recall
    6. Max 2 enable
    7. Max 3 enable
    8. Conditional service inhibit
    9. Phase omit

2.4. There shall be a minimum of 36 holiday or exception day programs, which override the normal day program. Holiday programs shall be capable of being set as floating (occurs on a specific day and week of the month) or fixed (occurs on a specific day of the year). It shall be possible to program a fixed holiday so that it automatically repeats in the following year.

2.5. It shall be possible to manually force any of the action plans to override the current action plan. The forced plan shall be entered from the keyboard and shall remain in effect until removed.

3. Time-Based Coordination

3.1. A minimum of 200 time base schedule programs shall be available for the day-programs. There shall be up to 16 day plans with up to 50 events per day plan; these shall not have to be entered in any special sequence. It shall be possible to add and delete steps from a day-program without affecting any other day-program. Each of the program steps shall permit selection of the following functions:

a. Day program assignment
b. Start time
c. Action plan

3.2. Selection of system override in an action plan shall allow the coordination pattern selected by the action plan to override the current telemetry or hardwire system commanded coordination pattern.

3.3. When operating in the time-based coordination mode the synchronization point for all cycles shall be referenced to a user selected reference time (sync reference), last event or last sync as selected from the keyboard. The sync reference time is that time at which all cycles shall be reset to zero.

3.4. If the sync reference time is selected, the synchronization point for the cycle selected by the current program step shall be computed using the present time, sync reference time, and cycle length. The synchronization point shall occur whenever the present time is such that an even number of cycle length periods has occurred since the sync reference time.

Detectors

1. Detector Functions

1.1. The controller shall provide a minimum of 64 vehicle detector inputs. Each input shall be assignable to one or more phases and be configured with optional detector functions.

1.1.1 Extend and delay timing shall be provided for each detector.

1.1.2 Each detector shall be capable of operating in a lock or non-lock mode.

1.2 The controller shall also be capable of providing 16 pedestrian detector inputs. Each pedestrian detector shall be assignable to one or more phases.

2 Detector Cross Switching

2.1 The controller shall provide detector cross switching, permitting a vehicle detector to alternately place calls on assigned phases and assigned cross switch phases.

2.1.1 If the assigned phase is not green and the cross-switch phase is green, the detector shall place calls on the cross switch phase.

2.1.2 If the assigned phase is omitted for any reason, the detector shall place calls on the cross switch phase.

3 Detector Types

3.1 Each vehicle detector shall be user-programmable to operate as one of the following seven (7) detector types:

3.1.1 **Type N (NTCIP):** supports all NTCIP detector functionality.

3.1.2 **Type S (Standard):** supports all standard detector functionality except the call and extend options will always be enabled.

3.1.3 **Type D (Disconnect queue/stop bar):** This detector will disconnect from extending the phase during green if either there is a gap in the detector input OR the detectors disconnect time times out. The detector's input must be active before the phase turns green for this detector to operate.

3.1.4 **Type P (Passage queue/stop bar):** If the detector input is active when the phase turns green the detector passage time is reset as long as the input is active. When the detector input becomes inactive the detector passage timer begins running. If addition calls are received before the detector passage timer expires, the detector passage timer shall be reset until the input becomes inactive. Once the detector passage timer times out the detector is disconnected for the balance of the phase green.

3.1.5 **Type C (Calling):** This detector shall place calls on the phase only when the phase is NOT green.

3.1.6 **Type R: (Red Extend):** An actuation on a red extend detector during the red clearance of the assigned phase shall extend the red up to the red max phase time.

3.1.7 **Type G (Green Delay/Extend):** When the phase is red the detector input becoming active to the controller shall be delayed by the amount of time programmed in the delay time. When the phase is green, the detector input shall be extended after removed by the amount of time programmed in the detector extension timer.

3.1.8 **Type B (Bike):** Activation shall cause the phase to use the Bike minimum green in place of the minimum green.

4 System Detectors

4.1 Each detector input shall be capable of functioning as 1 (one) of 16 (sixteen) system detectors.

4.2 Vehicle detectors shall be capable of being assigned to a minimum of 16 speed detectors. Speed shall be detected using both one and two detector configurations. Speed shall be computed using a keyboard entered average vehicle length and loop length for a one- detector configuration. When using two detectors, speed shall be calculated using a keyboard entered distance between detectors and travel time between detectors.

Logic Processor Commands

1. Standard Logic Commands

1.1. One Hundred (100) logic processor commands shall be assessable from the front panel of the controller or through remote database management software.

1.2. Each logic command shall be allowed to be enabled or disabled by TOD control

1.3. Each logic command shall consist of 10 “IF” statements, 5 “THEN” statements and 5 “ELSE” statements. At least 1 “IF” statement and 1 “THEN” statement are required to create a valid command.

1.3.1 “IF” statements shall be logically grouped using Boolean gating including:

1. AND
2. OR
3. XOR
4. NAND
5. NOR

1.3.2 When combined “IF” statements create one single “TRUE” result, the “THEN” statements shall be implemented.

1.3.3 When combined “IF” statements create one single “FALSE” result, the “ELSE” statements shall be implemented.

1.3.4 The “IF” statements shall monitor controller functions and timer including, but not limited to the following:

Phase/Overlap Green	Phase Calls
Phase/Overlap Yellow	Phase Omits
Phase/Overlap Red	Phase Force Offs
Phase/Overlap Active	Detector Fails
Detector Plan Number	Ring Timers
Detector Activity	Preemption Activity
Detector Volume	Preemption Dwell
Detector Occupancy	Preemption Exit
Coordination Timers	Stop Time
Coordination Holds	Manual Control
Phase Holds	Overlap timers (lagging/leading green)
Phase Walks	Active Coordination Plan Number
Phase Don’t Walks	TBC parameter
Phase Next	Input / Output Bits
Phase Checks	Logic Flags

1.3.5 The “THEN” and “ELSE” statements shall be used to control functions and events (on/off) in the controller, including, but not limited to, the following:

1.3.6

Set Logic Flags	Set Phase/OVL Greens
Set Phase calls	Set Phase/OVL Yellows
Set Input or Output Bits	Set Phase/OVL Reds
Set Delays	Set Walk / Ped Clear / Don’t Walk
Set Load Switch circuits (R/Y/G)	Set Pedestrian Detectors
Set Vehicle Detectors	Set Holds
Omit Phase / Peds	Set Force-offs
Change Max Timers (max1, max2)	Set Red Rest
Set Stop Time	Set Flash
Set Alarms	Set External Start
Set Recalls, CNA1, CNA2, etc	Set Manual Control Enable
Set Coordination Plan	Set Manual Advance
Set Free	Call Preempt
Call TSP	Call Phase
Set Action Plan	Set Timing Plan

2. Extended Options Logic Commands

2.1 An additional one-hundred logic commands (101-200) shall be available in the controller, but hidden from front panel access.

2.1.1 These commands shall be stored and used for easy implementation of common logic required at multiple intersections.

2.1.2 These commands shall only be assessable through computer software and shall be uploaded and downloaded to the controller using the same computer software.

2.2 Once downloaded to the controller, the logic shall be activated using an extended options file.

2.2.1 This file shall be downloaded to the controller and used to initialize the logic statements.

2.2.2 This file shall be used to create a custom menu on the controller. From this menu the user shall be able to enable or disable any of the extended options hidden in the upper one hundred logic commands.

System Communications

1. System Commands

1.1. The telemetry module shall allow the controller to receive, as a minimum, the following commands:

a. Cycle, offset, and split (coordination pattern)
b. System sync
c. Special function commands (minimum of four)
d. Free and flash mode commands
e. Time and date
f. Request for local status
g. Recall to Max

1.2. All commands must occur more than once in any three-second period in order to be recognized.

1.3. All mode and special function commands shall be cleared after 20 minutes of loss of communication between controller and central system.

1.4. The status of each of the following functions shall be transmitted to the central system in response to a local status request:

a. Green and yellow status for all phases and overlaps
b. Walk and pedestrian clearance status for all phases
c. Vehicle and pedestrian detector status
d. Phase termination status
e. Local time
f. Coordination status
g. Command source
h. Sync or transitioning status of coordinator
i. Conflict flash status
j. Local flash status
k. Preempt activity and calls
l. Volume and occupancy data from a minimum of 16 system detectors
m. Speed data from a minimum of two speed detectors
n. Maintenance required (cabinet door open) status

o. Status of two user-defined alarms

1.5. The status of each of the following parameters shall be calculated on a per-cycle basis and transmitted to the central system for Split Monitor Reporting:

a. Actual time spent in each phase
b. Time of day at end of cycle
c. Phases forced off during cycle
d. Type of coordination operation
e. Whether transitioning to new offset
f. Cycle, offset, and split in effect during last cycle
g. Flash status if operation is Free

1.6. Upload/Download Capability – The controller shall provide the capability to upload/download the entire intersection database. Phase assignments for overlaps and preemptors shall not be downloaded to preclude unsafe controller operation. Data transfer shall not require the intersection to be in flash.

2. Telemetry

2.1. Telemetry shall utilize TDM/FSK data transmission from 1200 baud to 9600 baud over two pairs of wires. These may be leased lines (Type 3002, voice grade, unconditioned) or dedicated cable. Optional external fiber optic or wireless communications capability shall also be available.

2.2. The nominal transmitter output level shall be 0 dbm into a 600-ohm load. The receiver sensitivity shall be -34 dbm and shall be adjustable from -40 to +6 dbm.

2.3. Parity and error checking shall be employed to assure transmission and reception of valid data. Indicators shall be provided on the telemetry module to show telemetry activity as follows: transmit, receive carrier, and valid data.

2.4. In the event of a telemetry failure, the controller shall revert to the non-interconnected coordination mode after it has self-synchronized for a number of cycles, which shall be selectable from 1-254. If the number of cycles is set to 255, the controller will self-synchronize until a synchronizations pulse is detected.

3. Communications Protocols

3.1. The controller shall have the capability of supporting communications with traffic management systems using industry standard protocols with the installation of appropriate optional software.

3.2. At a minimum the controller shall have optional software to support the following protocol:

a. NTCIP Level 2 as defined by Section 3.3.6 of NEMA TS2- 2003. NTCIP v02.06 capabilities shall include all NTCIP mandatory and optional objects. The controller vendor shall provide access to all controller data via vendor specific objects. These and all other objects supported by the controller shall be defined in a standard MIB file.

4. Ethernet Communications

4.1. The controller shall have the capability of supporting Ethernet communications, using TCP/IP communications protocols.

4.2. This communications protocol shall utilize the controller's built-in switches and shall not require Ethernet-to-Serial converters.

5. External Clock

5.1. The controller shall have the capability of communicating with an external clock like a GPS or WWV clock for setting its internal time of day clock.

5.2. The controller shall include a time reset input. This feature shall reset the TOD clock to 03:30 whenever the time reset input from the GPS of WWV clock is TRUE.

Diagnostics

1. General Diagnostics Features

1.1. The controller shall include both automatic and operator-initiated diagnostics. This capability shall be a standard feature and shall not require additional modules or software.

1.2. Automatic diagnostics shall verify memory and microprocessor operation each time power is reapplied to the controller. After power has been applied, diagnostics shall continually verify the operation of essential elements of the controller including at a minimum communications.

2. Detector Diagnostics

2.1. TOD controlled detectors diagnostics shall be provided that allow testing vehicle and pedestrian detectors for no activity, maximum presence, and erratic output.

2.2. A minimum of four detector diagnostic plans shall be provided. These plans shall be selectable on a TOD basis. This shall allow varying the detector diagnostic intervals to correspond with changes in detector activity.

2.3. If a detector is diagnosed as failed, the associated phase shall be placed in one of the following keyboard selectable modes:

a. Detector fail recall from 1 to 255 seconds
b. Disable the detector from calling or extending.

2.4. Diagnostics for NEMA TS2 detectors connected to the controller using a Bus Interface Unit (BIU) shall also include detection of watchdog, open and shorted loop, and excessive inductance change failures.

Logging

The controller shall be capable of logging and reporting detector activity, detector failures, and the occurrence of selected events or alarms. Logs shall be capable of being printed or displayed on the front of the controller.

1. Detector Logging

1.1. The controller shall include a detector log buffer capable of logging volume, occupancy and average speed for selected vehicle and speed detectors.

1.2. The detector-logging interval shall be keyboard selectable as 5, 15, 30, or 60 minutes.

1.3. Detector logging shall be capable of being enabled or disabled by TOD.

2. Detector Failure Logging

2.1. The controller shall include a detector failure log buffer capable of storing a minimum of 100 time and date-stamped detector failure events. Once logged, detector failure events shall remain in the log until cleared or the log buffer capacity is exceeded at which time the oldest detector failure events shall be overwritten.

2.2. All detector diagnostic failures shall be recorded in the detector failure log including: no activity, maximum presence, erratic output, watchdog failure, open loop, shorted loop, and excessive inductance change. If a detector recovers after a diagnostic failure, a detector online event shall be stored in the detector failure log.

2.3. Detector failure logging shall be capable of being disabled.

3. Event Logging

3.1. The controller shall include an event log buffer capable of storing a minimum of 200 time and date-stamped events or alarms. Once logged, events shall remain in the buffer until cleared or the log buffer capacity is exceeded at which time the oldest events shall be overwritten.

3.2. At a minimum the following events shall be logged: communication failures, coordination faults, MMU and local flash status, preempt, power ON/OFF, low battery, and status of a minimum of two alarm inputs. An on-line event shall be logged when an event or alarm returns to normal status.

3.3. If security is enabled, an event shall be logged when a user enters a data change. This event shall include the user's ID. It is necessary to log the first change only and not every change. Also an entry shall be recorded when a user logs in and out of the controller.

3.4. Event logging shall be capable of being enabled or disabled for each category of event or alarm.

EMULATION

1. Emulation Software.

1.1. With each controller provide software designed to emulate the controller. The emulation software shall employ the full functionality of the controller including but not limited to:

a. Configuration, timing, coordination, preemption, time base, detector setup, status display, utilities including special logic and diagnostic information. The software shall employ a graphical user interface that looks and acts like the controller. The software shall be designed to operate on the latest Microsoft Windows operating system and be capable of direct interface with Trafficware Synchro 7 or later traffic modeling software.

740-2.11 CONTROLLER CABINET. Provide a controller cabinet that meets the requirements of NEMA Standard TS 2-2003 V02.06 *Traffic Controller Assemblies* with NTCIP Requirements (NEMA TS-2), Section 5 *Terminals and Facilities* and Section 7 *Cabinets*. Cabinet enclosure shall be UL listed.

1. Standard Features. Supply the following standard features:

a. Materials

Unless otherwise designated on the Plans, provide cabinets constructed of sheet Aluminum.

b. Cabinet Dimensions

Unless otherwise designated on the Plans, provide a size 6 cabinet as defined in NEMA TS-2 Table 7-1.

c. Doors

(1) Provide a cabinet with lockable front and back doors meeting the requirements of NEMA TS-2 Section 7.5. The lock must accept a Best CX series core that will be installed by the Department after the Contract is complete.

(2) Provide a Police Compartment meeting the requirements of NEMA TS-2 Section 7.5.7. Provide two keys for lock. The Police Compartment shall house the following switch:
   (a) signal ON/OFF switch
   (b) "flash/automatic" switches that when placed in the "flash" position causes the intersection displays to go into the flashing mode. When placed in the "automatic" position, the signal system must resume normal operation.

(3) Provide a removable, rigid metal cover on the back of the police panel to cover the live switch terminals.

(4) Permanently label switches in the Police Compartment.

d. Shelves

Provide shelves meeting the requirements of NEMA TS-2 Section 7.6. Provide additional laptop computer shelf mounted approximately 42" above ground level. The laptop shelf must accommodate a standard 17" computer, be retractable below one of the cabinets' shelves and contain a storage drawer.

e. Finish and Preparation

Unless otherwise designated on the Plans, provide unpainted Aluminum Cabinets with a "natural" brushed appearance.

f. Cabinet Mounting

(1) Provide cabinet mounting features as defined NEMA TS-2 Section 7.8.

(2) The cabinet manufacturer is responsible for providing a cabinet that will mount without modification on the existing foundations and on new controller foundations as detailed on the Plans.

(3) The cabinet shall come with lifting ears affixed to the upper exterior of the cabinet. These ears shall utilize only one bolt for easy reorientation.

g. Cabinet Ventilation

Furnish a cabinet that fully meets the requirements of NEMA TS-2 Section 7.9 and the following:

(1) Furnish the fan and cabinet vent with internally mounted metal covers that are fabricated to close off the flow of air during winter operation.

(2) Equip the cabinet with a selectable, 600/900/1500 watt cabinet heating device with a 2 speed fan. The heating device must have a remote air sensing thermostat. The contacts must be rated 20 amps, 120 volts, 60 hertz.

(a) Construct the thermostat so that contacts close on descending temperature and are adjustable between 0 and 30 °F ±5 °F. The contacts must open on rising temperatures of 48°F above the closing temperature. The adjustment must have an indicating pointer. Remote bulb type thermostat shall not be used.

(b) Connect the thermostat in series with an electrical resistance heater and blower fan. The blower fan must be rated for continuous duty. The heater and fan must be connected in parallel and rated 120 volts, 60 Hertz. Mount the unit on the cabinet door below the auxiliary panel.

(c) Do not block the air intake or outlet. Provide the unit with a SPST manual override switch that bypasses the thermostat to enable the fan and heater to operate at warmer temperatures.

h. Auxiliary Cabinet Equipment

(1) Light fixture. Mount a hooded LED light fixture with a 15 inch flexible "goose neck" from the cabinet front door. Use a fixture UL rated to accommodate a 25 watt lamp with an integral "ON-OFF" rotary switch mounted on the lamp hood. Mount a fluorescent lighting fixture on the inside of the cabinet near the front edge. Use a fixture rated to accommodate an F15T8 lamp operated from a high power factor UL or ETL listed ballast. The lamp must be included. The lighting fixture "ON-Off" switch must be a toggle switch mounted on an inside control panel. Include in the circuit a door actuated switch that turns the light ON when either the front or back doors are open and OFF when both doors are closed.

(2) Provide a resealable print pouch. The pouch shall be mounted to the door of the cabinet. The pouch shall be of sufficient size to accommodate one complete set of cabinet prints.

(3) Provide three (3) paper sets of complete and accurate cabinet drawings, wiring diagram and intersection signal layout with each cabinet. Make cabinet drawings available electronically in AutoCAD v2010 or later format and deliver with paper set.

(4) Provide one paper set of manuals for the controller, Malfunction Management Unit and vehicle detector amplifiers with each cabinet. Make said manuals available in electronic Adobe "pdf" format and deliver with paper set.

i. Cabinet Wiring

Neatly arrange the wiring within controller cabinets to conform to the requirements of Subsections 660-3.05 and 740-2.05. Furnish controller cabinets wired to accommodate

(1) Configuration #4 in Table 5-2 of the NEMA Standards Publications No. TS 2-2003 V02.06, Traffic Controller Assemblies with NTCIP requirements with two each Type 2 detector racks.

(a) Equip the cabinet with required control and auxiliary equipment connecting cables to operate the phases and detection indicated on the Plans, including future use.

(b) Size wiring, switches, surge protectors, flash relays, and flashers to handle the necessary amperage required under full cabinet use. Use orange colored wires to run from the flash transfer relay used for emergency flash programming.

(c) Wire the cabinet to accommodate 6 unique preempt sequences as defined by NEMA TS-2 Section 3.7 and 2 auxiliary preempt sequences. Configure each detector rack to accommodate 4 unique sequences.

j. Field Terminal Blocks

Provide Terminals and Facilities meeting the requirements of NEMA TS-2 Section 5, Configuration #4 (Table 5-2) and the following:

(1) Provide 2 or more insulated terminal blocks to terminate field conductors. Provide each block with 12 poles with 10-32 screw type terminals. Use a terminal block that is a barrier type with removable shorting bars in each of the 12 positions and with integral type marking strips. Terminate conductors to a terminal block.

(2) Terminate conductors from the controller unit in ring type terminal lugs or solder them to a through panel solder lug on the rear side of the terminal. Terminate other conductors in spade type terminal lugs.

(3) Do not bring more than 3 conductors to any one terminal. Two flat metal jumpers, straight or U shaped, may also be placed under a terminal screw. Fully engage at least 2 full threads of terminal screws when the screw is tightened. Do not extend live parts beyond the barrier.

(4) Terminals must be provided to terminate a future 25 pair telemetry interconnect cable with each conductor terminated on individual terminals. Terminate telemetry interconnect cable conductors on individual terminals.

(5) On the right side of controller cabinets, install two 16 position bus bars, for terminating the equipment grounding and neutral conductors used inside the cabinets. On the left side of the controller cabinets, install two 32 position bus bars, for terminating the equipment grounding and neutral conductors from field wiring.

k. Cabinet Accessories

See NEMA Standard TS 2-2003 V02.06, Section 5 Terminals and Facilities, Figure 5-4 Cabinet Power Distribution Schematic for Items (1) through (6).

(1) Disconnecting Means

(a) Main circuit breaker must be a single pole, 30 ampere, 10,000 amperes interrupting capacity for each cabinet.

(b) Auxiliary circuit breaker(s) must be single pole, 20 ampere, 10,000 amperes interrupting capacity to protect fan, heater, light, and convenience outlet(s).

The rating of the main disconnect means with overcurrent protection must be not less than 125% of the maximum anticipated continuous load. When using disconnecting circuit breakers, use "trip indicating trip free," Type.

(2) Signal Bus. Connect the signal bus to the incoming AC line through a signal bus mercury contactor and an overcurrent protection device. Energize the signal bus mercury contactor to provide power to the signal bus. The current rating of the signal bus mercury contactor must be at least the current rating of the main overcurrent protection device.

(3) AC Service Transient Suppression. Connect the transient suppression device for the primary feed of the cabinet on the load side of the cabinet overcurrent protection device. The transient voltage suppression device connected to the controller power circuit must provide protection against voltage abnormalities of 1 cycle or less duration.

(a) The suppressor must be solid state high energy circuit containing no spark gap, gas tube, or crow bar component. The current rating of the device must be 15 amps

minimum. The device must provide transient protection between neutral and ground, line and ground, as well as line and neutral. If the protection circuits fail, they must fail to an open circuit condition. The device must meet requirements of UL Standard 1449.

(b) The suppressed voltage rating must be 600 volts or less when subject to an impulse of 6,000 volt, 3,000 amp source impedance, 8.0/20 microsecond waveform as described in UL Standard 1449. In addition, the device must withstand, without failure or permanent damage, one full cycle at 264 volts RMS.

(c) The device must contain circuitry to prevent self-induced regenerative ringing. There must be a failure warning indicator light that must illuminate when the device has failed and is no longer operable. The transient suppression device must withstand a 20,000 ampere surge current with an 8x20 microsecond (time to crest x time to second halfcrest) waveform 20 times at 3 minute intervals between surges without damage or degradation to the suppressor. Output voltage must not exceed 500 volts at any time during the test. Use a device that is a solid state, high energy circuit with no spark gap, gas tube, or bar component.

(4) Radio Interference Suppression. Equip each traffic cabinet, flasher, and other current interrupting device with a suitable radio interference suppressor installed at the input power point. Install the radio interference suppressor after the AC service transient suppression unit described in Subsection 740-2.11.1.k (3). It must provide a minimum attenuation of 50 decibels over a frequency range from 200 kilohertz to 75 megahertz, when used with normal installations.

(a) The interference suppressor must be hermetically sealed in a substantial metal case filled with suitable insulating compound. Terminals must be nickel plated, 10-24 brass studs of sufficient external length to provide space for connecting two No. 8 conductors and must be so mounted that the terminals cannot be turned in the case. Ungrounded terminals must be properly insulated from each other and must maintain a surface leakage distance of not less than 1/4 inch between any exposed current conductor and any other metallic part, with an insulation factor of 100 to 200 megohms dependent on external circuit conditions.

(b) The radio interference suppressor must have a minimum current rating equal to the rating of the main disconnect means as specified in Subsection 740-2.11.1.k (1) (a). It must be designed for operation on 120 volts, 60 hertz, single phase circuits and be UL and EIA compliant.

(c) Connect the ground connection of the radio interference suppressor only to AC neutral. Do not connect to Earth Ground directly.

(5) Communications Transient Suppression. Provide a transient suppressor for the system interface communications lines when used. This suppressor must withstand a 100 ampere 10 x 700 microsecond waveform 20 times at 30 second intervals between surges without damage or degradation to the suppressor. Apply the transient surge both line to line and line to ground. Output voltage must not exceed 8 volts line to line and line to ground. Output voltage must not exceed 8 volts line to line or 250 volts line to ground at any time during the test.

(6) Control Panel. Provide and label a control panel assembly that is readily accessible from the front of the cabinet. The control panel assembly must consist of:

(a) "controller power" switch to energize the controller while the signal lights are off or are being operated by the flasher. Label and rate the switch for load current.

(b) “cabinet light” “ON-OFF” switch.

(c) "auto/flash" switch that when placed in the "flash" position provides flashing operation without interrupting the controller unit power. When the switch is placed in the "auto" position the controller unit must provide normal operation.

(d) "stop time/off/on" switch that when placed in the "ON" position causes the controller unit to stop time. In the "off" position, the controller unit must be active regardless of external commands. In the "AUTO" position, the timing must be normal but subject to external command interruptions.

(e) "heater by-pass" switch to bypass the remote heater thermostat.

(f) momentary contact test switches to place calls on each vehicle and pedestrian phase. Switches must provide tactile feedback and be rated at 1 ampere, minimum, for a resistive load at 120 VAC and at 28 VDC. Contacts must be coin silver or gold plated and be enclosed and labeled as to their function.

(g) Provide a hinged clear plastic cover over the control panel switches. Plastic cover shall be of a minimum thickness of 0.1”.

(h) Control Panel shall be attached to door with a hinge located along bottom edge, to allow panel to be lowered for testing or replacement of switches.

(7) Receptacle Outlets. The cabinet shall be wired with one duplex outlet with a ground fault interrupter, one convenience duplex outlet without ground fault interrupters and one single outlet, exclusively for the heating device without ground fault interrupter. The ground fault outlet shall be mounted on the right side of the cabinet on or near the power panel. The one convenience outlet shall be near the top shelf. The heater outlet shall be mounted on the right side of the cabinet on or near the power panel. No outlets shall be mounted on the door. The GFI power shall be fed through the auxiliary breaker. The convenience outlet power shall be fed through an EDCO SHP300-10 transient voltage suppressor located on the cabinet power panel.

(8) Power panel cover. Clear plastic cover material shall be a minimum thickness of 0.1”. Cover shall be firmly attached at four points. Holes shall be slotted for easy removal and replacement.

(9) Both sides of the Control Panel and the Load-Bay shall be silkscreened on both sides. Aluminum panel for the Power Panel shall be silk screened also.

(10) The entire load bay shall roll down and provide access to all of the back of panel wiring. All solder terminals shall be accessible when the load-bay is rolled down. The assembly shall be able to roll down without requiring other components, cables or load switches to be removed The load-bay shall be balanced such that it will not roll down when fully loaded with load switches, flashers and flash transfer relays, when retaining attachments are removed.

(11) Rear load bay cover. Clear plastic cover material shall be a minimum thickness of 0.1”. Cover shall be firmly attached at two points. Provide a “DANGER 115 VOLTS A.C.” warning label and affix to center of panel.

(12) Warning Sign. The cabinet must contain a conspicuous warning sign against operation without the malfunction management unit being installed.

2. Special Features. Provide special features if called for on the Plans and as follows:

Coordination "Remote/Time of Day/Free" Switch. When the switch is in the "Remote" position, supervisory functions performed on the controller unit from a master coordinator or central computer must operate normally.

When the switch is in the switch is in the "Time of Day" position, the local controller must use the local coordinators time of day plan. When the switch is in the "Free" position, it must be possible to remove any or all coordination devices and maintain normal, non-coordinated controller operation without wire jumpers, jumper plugs or other special devices.

740-2.12 STANDARD AUXILIARY EQUIPMENT. Furnish and install the following auxiliary equipment:

1. Solid State Flasher. Use a NEMA Type III flasher unit that conforms to NEMA Standards Publication No. TS 2-1992, *Traffic Controller Assemblies*, Section 6.3 *Solid State Flashers*.

2. Three-Circuit Solid State Load Switches. Use load switches that conform to NEMA Standards Publication No. TS 2-1992, *Traffic Controller Assemblies*, Section 6.2 *Three Circuit Solid State Load Switches* and, as a minimum, be supplied with Light Emitting Diode indicators on the DC input circuitry. The load switch must have 3 independent switching circuits, each being an individually replaceable solid state module.

3. Malfunction Management Unit. The malfunction management unit must meet the requirements of NEMA Standards Publication No. TS 2-1992, *Traffic Controller Assemblies*, Section 4 *Malfunction Management Unit*.If the circuit connected to the sensing input of the unit exhibits high impedance characteristics caused by dimmers or burned out lamps, furnish and install a low impedance device external to the unit between the input and AC- (Common).

4. Flash Transfer Relay. Use flash transfer relays that meet the requirement of NEMA Standards Publication No. TS 2-1992, *Traffic Controller Assemblies*, Section 6.4 *Flash Transfer Relays*.

740-2.13 SPECIAL AUXILIARY EQUIPMENT. Use the following special auxiliary equipment when called for on the Plans and/or Special Provisions:

Provide equipment meeting the requirements of the cited Sections of the NEMA Standard Publication TS 2-2003 V02.06, Traffic Controller Assemblies with NTCIP Requirements (NEMA TS-2).

1. Inductive Loop Detectors Units. Provide inductive loop detectors that conform to the requirements of NEMA TS-2, Section 6.5 Inductive Loop Detector Units. Unless otherwise called for on the Plans provide 2 Channel Inductive Loop Detectors with audible feedback of detection events. The audible feature must be manually switchable between audible "on" and silent "off."

2. Local Coordination Units. Provide actuated coordination that conforms to the requirements of NEMA TS-2, Section 3.6 Actuated Coordination.

Delete item no. 3 and substitute the following:

3. System Modem/Interface Unit. Supply a system modem/interface unit assembly that is compatible with the existing computerized traffic control system.

The cabinet shall come with a fiber optic ethernet switch. The ethernet switch shall support all of the following minimum requirements; virtual local area networks (VLAN) tagging (IEEE 802.1q) and dynamic bridging (IEEE 802.1). The ethernet switch shall be a Siemens Ruggedcom model RS940G or approved equivalent. The following cables, cords and licenses shall be supplied with the fiber optic ethernet switch:

a. One AC power adapter
b. Two 1000BaseLX SFP optics ports
c. Minimum of four 10/100/1000BaseTX ports

At intersections where three or more fiber optic interconnect cables meet or where called for on the Plans, supply Siemens Ruggedcom model RSG920P or approved equivalent. The ethernet switch shall support all of the following minimum requirements; virtual local area networks (VLAN) tagging (IEEE 802.1q) and dynamic bridging (IEEE 802.1). The following cables, cords and licenses shall be supplied with the fiber optic ethernet switch:

a. One AC power adapter
b. Four 1000BaseLX SFP optics ports
c. Minimum of Eight 10/100/1000BaseTX ports

4. Preemption Units. Provide preemption that conforms to the requirements of NEMA TS-2, Section 3.7 Preemption and the following:

Install the following components of the GTT Company's Opticom Priority Control System according to GTT's written installation instructions at the signalized intersections listed on the Drawings.

a. The system must be capable of sending a signal to the controller when an Opticom signal from a vehicle-mounted "GTT OPTICOM Emitter" has been received and maintained for a period of 1.7 seconds.

b. Use Opticom Priority Control System Model 792H emitters.

c. Unless otherwise shown on the Plan use Opticom Traffic Control Systems Opticom Detector Model 721 preemption detectors.

d. Furnish the appropriate number of Opticom Traffic Control Systems 764 Phase Selectors to meet the number of channels of detection for each intersection. Use rack mounted phase selectors.

e. When more than one detector is required per phase, furnish the appropriate number of harnesses for the 764 Phase Selectors to handle the auxiliary detection.

f. Install Model 138 Optical detector lead in cable between the end of each signal mast arm and the controller cabinet. Furnish enough slack in these cables for them to extend 2 feet beyond the end of each signal mast arm and to leave 10 feet of slack in the controller cabinet. Seal both ends of each lead in cable with mastic lined, heat shrink tubing end caps.

g. The controller, rather than the phase selector or auxiliary logic, must perform interval timing, signal sequences, and phase skips.

h. Mount detectors according to manufacturer recommendations or as approved by the Engineer. Mount and aim detectors to provide maximum emergency vehicle recognition. Detector locations shown on the Plans are approximate and subject to change as directed by the Engineer.

g. When emitters are required, provide GTT Opticom Priority Control System, Model 792H Emitter with 793 in vehicle switch. The Emitter shall be factory programmed to the class and vehicle identification numbers assigned by jurisdiction as shown in the Drawings and the following:

(1) Class 0 and Vehicle ID. Number 0 (Zero) shall be disabled for Emitters.

(2) Vehicle Id. Numbers shall be sequential, beginning with the lowest number in the EVP Emitter table for the appropriate class.

(3) Provide one copy of 790IS Emitter Software Kit including "Y" cable.

(4) One GTT Opticom Portable Emitter Kit with 792R emitter on a magnetic base, 793R switch and cigarette lighter adapter power cord in a "Camera Bag" case.

5. Bus Interface Unit (BIU). Provide BIU's that fully meet the requirements of NEMA TS-2 Section 8. Unless otherwise called for on the Plans provide BIU's that meet the NEMA designation BIU2.

6. Traffic Logging System. If called for on the Plans, furnish, and install in the controller cabinet, a stand-alone unit that collects, time stamps, and stores data in an unattended manner.

7. Radar Detection System.

a. General.

(1) System Hardware. Use digital wave radar vision system hardware consisting of the following components:

(a) Provide an above-ground stop bar detector (SBD) equivalent to the Wavetronix SmartSensor Matrix® that will detect all vehicles, including bicycles for reliable and accurate presence detection where shown on the Plans

(b) Provide an above-ground continuous tracking advance extended range detector (CTAD) equivalent to the Wavetronix SmartSensor Advance Extended Range® for enhanced dilemma zone detection where shown on the Plans

(c) A Click 650 cabinet interface device (CIB)

(d) Contact closure input file detector rack cards with patch cables

(e) SmartSensor Manager Matrix (SSMM) software

(f) SmartSensor Manager Advance software for automatic and manual sensor configurations

Stop Bar Detector (SBD)

a. General. Provide an above-ground digital wave radar stop bar detector (SBD) equivalent to the Wavetronix SmartSensor Matrix® that will detect all stopped vehicles, including bicycles for reliable and accurate presence detection where shown on the Plans.

b. Product Description. The SBD units shall:

(1) Be able to simultaneously detect and track vehicles through a 90 degree field of view in two dimensions.

(2) Reports real-time presence of both moving and stopped vehicles for up to 10 lanes.

(3) Maximum number of zones: 16.

(4) Maximum number of channels: 16.

(5) User-selectable zone to channel mapping.

(6) AND logic triggers the channel when all the selected zones are active.

(7) OR logic used to combine multiple zones to a channel output.

(8) Channel output extend and delay functionality.

(9) Algorithms mitigate detections from wrong way or cross traffic.

(10) Fail-safe mode for contact closure outputs if communication is lost.

c. Detectable Area.

(1) Mounting Location.

(a) The SBD shall be able to detect and report vehicle information when mounted between 15-35 ft. (4.6-10.7 m) above the road surface.

(2) Detection Range.

(a) The SBD shall have a 90 degree field of view, and be able to detect and report information on the roadway located with the near boundary at 6 ft. (1.8 m) and a far boundary of 140 ft. (42.7 m) from the base of the pole on which the SBD is mounted.

(3) Lane Configuration.

(a) Be capable of providing flexible lane configuration support including:

- Up to 10 lanes
- Curved lanes
- Islands and medians

d. Performance.

(1) Stop Bar – Approach Only Counting Accuracy. For a four-lane, 35 mph approach, the SBD shall detect at least 80 percent of vehicles.

e. Performance Maintenance.

(1) The SBD shall not require cleaning or adjustment to maintain performance.

(2) The SBD shall not rely on battery backup to store configuration information.

(3) Once the SBD is calibrated, it shall not require recalibration to maintain performance unless the roadway configuration changes.

f. Physical Properties. The SBD shall not exceed 5 lbs. (2.3 kg) in weight. The SBD shall not exceed 14 in. by 12 in. by 4 in. (35.5 cm x 30.5 cm x 10 cm) in its physical dimensions. All external parts of the SBD shall be ultraviolet-resistant, corrosion resistant, and protected from fungus growth and moisture deterioration.

(1) Enclosure. The SBD shall be enclosed in a Lexan EXL polycarbonate.

(a) The enclosure shall be classified "f1" outdoor weather ability in accordance with UL 746C.

(b) The SBD shall be classified as watertight according to the NEMA 250 Standard.

(c) The SBD enclosure shall conform to test criteria set forth in the NEMA 250 standard for type 4X enclosures. Test results shall be provided for each of the following type 4X criteria:

- External Icing (NEMA 250 clause 5.6)
- Hose-down (NEMA 250 clause 5.7)
- 4X Corrosion Protection (NEMA 250 clause 5.10)
- Gasket (NEMA 250 clause 5.14)

(d) The SBD shall be able to withstand a drop of up to 5 ft. (1.5 m) without compromising its functional and structural integrity.

(e) The SBD enclosure shall include a connector that meets the MIL-C-26482 specification. The MIL-C-26482 connector shall provide contacts for all data and power connections.

g. Power.

(1) The SBD shall consume less than 10 W.

(2) The SBD shall operate with a DC input between 9 VDC and 28 VDC.

(3) The SBD shall have an onboard surge protection.

h. Communication.

(1) The SBD shall have two half-duplex RS-485 com ports support:

(a) Dedicated detection comms

(b) Configuration, verification or traffic display without disrupting detection comms

(2) The SBD shall support the upload of new firmware into the SBD's non-volatile memory over Ethernet communication port.

(3) The SBD shall support the user configuration of the following:

(a) Baud rate

(b) Communication port response delay

(c) Contact closure output frequency

(4) Both communication ports shall support all of the following baud rates: 9600, 19200, 38400, 57600 and 115200 bps.

i. Radar Design.

(1) Frequency Stability. The circuitry shall be void of any manual tuning elements that could lead to human error and degraded performance over time. All transmit modulated signals shall be generated by means of digital circuitry, such as a direct digital synthesizer, that is referenced to a frequency source that is at least 50 parts per million (ppm) stable over the specified temperature range, and ages less than 6 ppm per year. Any upconversion of a digitally generated modulated signal shall preserve the phase stability and frequency stability inherent in the digitally generated signal.

(a) The SBD shall not rely on temperature compensation circuitry to maintain transmit frequency stability.

(b) The bandwidth of the transmit signal of the SBD shall not vary by more than 1% under all specified operating conditions and over the expected life of the SBD.

(c) Matrix of 16 radars.

(2) Antenna Design. The SBD antennae shall be designed on printed circuit boards.

(a) The vertical beam width of the SBD at the 6dB points of the two-way pattern shall be 65 degrees or greater.

(b) The horizontal field of view: 90 degrees.

(c) The sidelobes in the SBD two-way antenna pattern shall be -40dB or less.

(d) Transmit bandwidth: 245 MHz

(e) Un-windowed resolution: 2 ft. (0.6 m)

(3) RF Channels. The SBD shall provide at least eight RF channels so that multiple units can be mounted in the same vicinity without causing interference between them.

j. Configuration.

(1) Automatic and manual configuration of lanes, stop bars and zones.

(2) Lane positioning increment: 1 ft. (0.3 m)

(3) Four-sided zones of any shape and size

(4) Overlapping zones supported

(5) Sensor reconfiguration without detection disruption supported

(6) Graphical user interface with traffic pattern display

(7) Counting and Pulsed channels supported

(8) Windows Mobile®-based Software. The SBD shall include graphical user interface software that displays the current traffic pattern using a graphical traffic representation.

(a) The graphical user interface shall also display all configured alerts and provide visual representation of their actuation.

(b) The graphical user interface shall provide a means of logging the vehicular track files with an update rate of greater than five times per second.

(c) The graphical interface shall operate on Windows Mobile v5.0 or greater, Windows XP, Windows Vista, and Windows 7 in the .NET framework.

(d) The software shall support the following functionality:

- Automatically find the correct baud rate
- Automatically find the correct serial communication port
- Operate over a TCP/IP connection
- Provide a virtual sensor connection for software usabilty without a sensor
- Give the operator the ability to save/back up the SBD configuration to a file or load/restore the SBD configuration from a file
- Real-time traffic visualization for performance verification
- Zone and channel actuation display
- Local or remote sensor firmware upgradability

k. Operating Conditions. The SBD shall maintain accurate performance in all weather conditions, including

(1) Rain, freezing rain, snow, wind, dust, fog and changes in temperature and light, including direct light on sensor at dawn and dusk.

(2) SBD operation shall continue in rain up to 1 in. (2.5 cm) per hour.

(3) The SBD shall be capable of continuous operation over an ambient temperature range of -40°F to 165°F (-40°C to 74°C).

(4) The SBD shall be capable of continuous operation over a relative humidity range of 5% to 95% (non-condensing).

l. Testing.

(1) FCC. Each SBD shall be Federal Communications Commission (FCC) certified under CFR 47, Part 15, section 15.249 as an intentional radiator.

(a) The FCC certification shall be displayed on an external label on each SBD according to the rules set forth by the FCC.

(b) The SBD shall comply with FCC regulations under all specified operating conditions and over the expected life of the SBD.

(2) Tested under IEC 61000-4-5 class 4

(3) NEMA TS2-2003 Testing. The SBD shall comply with the applicable standards stated in the NEMA TS2-2003 Standard. Third party test results shall be made available for each of the following tests:

(a) Shock pulses of 10g, 11 ms half sine wave

(b) Vibration of 0.5 g up to 30 Hz

(c) 300 V positive/negative pulses applied at one pulse per second at minimum and maximum DC supply voltage

(d) Cold temperature storage at -49°F (-45°C) for 24 hours

(e) High temperature storage at 185°F (85°C) for 24 hours

(f) Low temp, low DC supply voltage at -29.2°F (-34°C) and 10.8 VDC

(g) Low temp, high DC supply voltage at -29.2°F (-34°C) and 26.5 VDC

(h) High temp, high DC supply voltage at 165.2°F (74°C) and 26.5 VDC

(i) High temp, low DC supply voltage at 165.2°F (74°C) and 10.8 VDC

m. Manufacturing. The SBD shall be manufactured and assembled in the U.S.A.

(1) The internal electronics of the SBD shall utilize automation for surface mount and wave solder assembly, and shall comply with the requirements set forth in IPC-A-610C Class 2, Acceptability of Electronic Assemblies.

(2) The SBD shall undergo a rigorous sequence of operational testing to ensure product functionality and reliability. Testing shall include the following:

(a) Functionality testing of all internal sub-assemblies

(b) Unit level burn-in testing of duration 48 hours or greater

(c) Final unit functionality testing prior to shipment

(d) Test results and all associated data for the above testing shall be provided for each purchased SBD by serial number.

n. Support. The SBD manufacturer shall provide both training and technical support services.

(1) Training. The manufacturer-provided training shall be sufficient to fully train installers and operators in the installation, auto-configuration, and use of the SBD to ensure accurate SBD performance.

(a) The manufacturer-provided training shall consist of comprehensive classroom labs and hands-on, in-the-field, installation and configuration training.

(b) Classroom lab training shall involve presentations outlining and defining the SBD, its functions, and the procedures for proper operation. These presentations shall be followed by hands-on labs in which trainees shall practice using the equipment to calibrate and configure a virtual SBD. To facilitate the classroom presentation and hands-on labs, the manufacturer-provided training shall include the following items:

- Knowledgeable trainer or trainers thoroughly familiar with the SBD and its processes.
- Presentation materials, including visual aids, printed manuals and other handout materials for each student.
- Computer files, including video and raw data, to facilitate the virtual configuration of the SBD.
- Laptop computers or Windows CE hand-held devices with the necessary software, and all necessary cables, connectors, etc.
- All other equipment necessary to facilitate the virtual configuration of the SBD.

(c) Field training shall provide each trainee with the hands-on opportunity to install and configure the SBD at road-side. Training shall be such that each trainee will mount and align the SBD correctly.

(2) Technical Assistance. A manufacturer-provided technical representative shall be available to assist with the physical installation, alignment, and configuration of each supplied SBD. Technical support shall be provided thereafter to assist with troubleshooting, maintenance, or replacement of SBDs should such services be required.

o. Documentation. SBD documentation shall include an instructional training guide, a comprehensive user guide, as well as an installer quick-reference guide and a user quick-reference guide.

(1) The SBD manufacturer shall supply the following documentation and specification test results at the time of the bid submittal:

(a) FCC CFR 47 certification

(b) IEC 61000-4-5 class 4 test report

p. Warranty. The SBD shall be warranted free from material and workmanship defects for a period of two years from date of shipment.

Extended Range Detector (CTAD)

The CTAD shall:

(1) Be able to simultaneously detect and report information from up to 25 vehicles on the roadway when they are serially sequenced between the near and far boundaries.

(2) Turn on a zone output when the range, speed, ETA, and qualified count or instantaneous roadway efficiency requirements for that zone are satisfied.

(3) Turn on an alert output on when the user-defined zone output combinational logical is satisfied.

(4) Turn on a normal channel output when any of the channel's alerts is on and the channel's delay and extend time constraints are satisfied.

(5) Turn on a latched channel output when the on alert is turned on and the delay time is satisfied. The CTAD shall turn off a latched channel output when the off alert is turned on or the max timer expires and the extension time is satisfied.

(6) Provide vehicle call and extend data on up to eight channels that can be connected to contact closure modules compliant with NEMA TS1, NEMA TS2, 170, and 2070 controller cabinets.

(7) Be capable of providing data for each tracked detection over the serial ports.

a. Detectable Area.

(1) Mounting Location.

(a) The CTAD shall be able to detect and report vehicle information when mounted within 50 ft. (15.2 m) of the center of the lanes of interest.

(b) The CTAD shall be able to detect and report vehicle information when mounted at heights up to 40 ft. (12.2 m) above the road surface.

(2) Detection Range.

(a) The CTAD shall be able to detect and report information on the roadway located with the near boundary at 50 ft. (15.2 m) and a far boundary of 500 ft. (152.4 m) from the base of the pole on which the CTAD is mounted.

(b) For incoming traffic, 95 percent of large vehicles within the line-of-site of the CTAD shall be detected and reported before they arrive 400 ft. (121.9 m) from the sensor. For incoming traffic, 90 percent of all motor vehicles within the line-of-site of the CTAD shall be detected and reported before they arrive 400 ft. (121.9 m) from the sensor.

b. Performance.

(1) Detection Accuracy. The CTAD shall detect at least 98 percent of large vehicles like truck-trailer combinations and at least 95 percent of all motor vehicles within the line-of-sight of the CTAD sensor where multiple detections of multi-unit vehicles are not considered false detections and merged detections of adjacent lane vehicles are not considered missed detections.

(2) Range Accuracy. The CTAD shall provide range measurements in which 90% of the measurements are accurate within 10 ft. (3 m) when the vehicle is tracked independently.

(3) Speed Accuracy. The CTAD shall provide per vehicle speed measurements in which 90% of the measurements are accurate within 5 mph when tracked independently.

(4) ETA Accuracy. The CTAD shall provide estimated time-of-arrival (ETA) measurements in which 85% of the measurements are accurate within one second, when the detected vehicles are tracked independently at a constant speed above 40 mph (64 kph} and are within 2.5 and 5.5 seconds of the stop bar.

c. Performance Maintenance.

(1) The CTAD shall not require cleaning or adjustment to maintain performance.

(2) The CTAD shall not rely on battery backup to store configuration information.

(3) Once the CTAD is calibrated, it shall not require recalibration to maintain performance unless the roadway configuration changes.

d. Physical Properties. The CTAD shall not exceed 5 lbs. (2.3 kg) in weight. The CTAD shall not exceed 14 in. by 12 in. by 4 in. (35.5 cm x 30.5 cm x 10 cm) in its physical dimensions. All external parts of the CTAD shall be ultraviolet-resistant, corrosion resistant, and protected from fungus growth and moisture deterioration.

(1) Enclosure. The CTAD shall be enclosed in a Lexan EXL polycarbonate.

(a) The enclosure shall be classified "f1" outdoor weather ability in accordance with UL 746C.

(b) The CTAD shall be classified as watertight according to the NEMA 250 Standard.

(c) The CTAD enclosure shall conform to test criteria set forth in the NEMA 250 standard for type 4X enclosures. Test results shall be provided for each of the following type 4X criteria:

- External Icing (NEMA 250 clause 5.6)
- Hose-down (NEMA 250 clause 5.7)
- 4X Corrosion Protection (NEMA 250 clause 5.10)
- Gasket (NEMA 250 clause 5.14)

(d) The CTAD shall be able to withstand a drop of up to 5 ft. (1.5 m) without compromising its functional and structural integrity.

(e) The CTAD enclosure shall include a connector that meets the MIL-C-26482 specification. The MIL-C-26482 connector shall provide contacts for all data and power connections.

e. Power.

(1) The CTAD shall consume less than 8 W.

(2) The CTAD shall operate with a DC input between 12 VDC and 28 VDC.

f. Communication.

(1) The CTAD shall have two serial communication ports, and both ports shall communicate independently and simultaneously.

(2) The CTAD shall support the upload of new firmware into the CTAD's non-volatile memory over Ethernet communication port.

(3) The CTAD shall support the user configuration of the following:

(a) Baud rate

(b) Communication port response delay

(c) Contact closure output frequency

(4) Both communication ports shall support all of the following baud rates: 9600, 19200, 38400, 57600 and 115200 bps.

(5) The contact closure output frequency shall be user configurable as short as 10 ms, with a default near 130 ms for compatibility.

(6) Contact closure data shall be reliably communicated over homerun cable connections as long as 600 ft. (182.9 m) with latency from the time of channel requirement satisfaction to the eventual reporting of on the back edge of the contact closure card in 15 ms or less.

g. Radar Design.

(1) Frequency Stability. The circuitry shall be void of any manual tuning elements that could lead to human error and degraded performance over time. All transmit modulated signals shall be generated by means of digital circuitry, such as a direct digital synthesizer, that is referenced to a frequency source that is at least 50 parts per million (ppm) stable over the specified temperature range, and ages less than 6 ppm per year. Any upconversion of a digitally generated modulated signal shall preserve the phase stability and frequency stability inherent in the digitally generated signal.

(a) The CTAD shall not rely on temperature compensation circuitry to maintain transmit frequency stability.

(b) The bandwidth of the transmit signal of the CTAD shall not vary by more than 1% under all specified operating conditions and over the expected life of the CTAD.

(2) Antenna Design. The CTAD antennae shall be designed on printed circuit boards.

(a) The vertical beam width of the CTAD at the 6dB points of the two-way pattern shall be 65 degrees or greater.

(b) The horizontal beam width of the CTAD at the 6dB points of the two-way pattern shall be 11 degrees or less.

(c) The sidelobes in the CTAD two-way antenna pattern shall be -40dB or less.

(3) RF Channels. The CTAD shall provide at least four RF channels so that multiple units can be mounted in the same vicinity without causing interference between them.

h. Configuration.

(1) Auto-configuration. The CTAD shall have a method for automatically configuring the sensitivity of detection in at least 5-ft. (1.5-m) increments.

(a) The auto-configuration method shall not prohibit the ability of the user to manually adjust the CTAD configuration.

(b) The CTAD shall support the configuration of up to eight channel outputs with up to four alerts per channel and up to four zones per alert, resulting in 32 configurable alerts and 128 configurable zones.

(2) Zone Configuration.

(a) The CTAD shall support the configuring of zones in 5-ft. (1.5 m) increments.

(b) The CTAD shall support detection zones as long as 450 ft. (137.2 m).

(c) The CTAD shall support user configurable high-speed and low-speed detection filters for each zone.

(d) The CTAD shall support the configuring of speed filters in 1-mph (1.6-kph) increments.

(e) The CTAD shall support user configurable upper and lower estimated time-of-arrival (ETA) filters for each zone.

(f) The CTAD shall support the configuring of ETA filters in increments of 0.1 seconds.

(g) The CTAD shall provide configurable upper and lower count filters that help determine if a required number of qualified detections are present.

(h) The CTAD shall support the configuring of qualified count filters in increments of one.

(3) Windows Mobile®-based Software. The CTAD shall include graphical user interface software that displays the current traffic pattern using a graphical traffic representation.

(a) The graphical user interface shall also display all configured alerts and provide visual representation of their actuation.

(b) The graphical user interface shall provide a means of logging the vehicular track files with an update rate of greater than five times per second.

(c) The graphical interface shall operate on Windows Mobile, Windows 2000, Windows XP and Windows Vista in the .NET framework.

(d) The software shall support the following functionality:

- Automatically find the correct baud rate
- Automatically find the correct serial communication port
- Operate over a TCP/IP connection
- Provide a virtual sensor connection for software usabilty without a sensor
- Give the operator the ability to save/back up the CTAD configuration to a file or load/restore the CTAD configuration from a file

i. Operating Conditions. The CTAD shall maintain accurate performance in all weather conditions, including

(1) Rain, freezing rain, snow, wind, dust, fog and changes in temperature and light, including direct light on sensor at dawn and dusk.

(2) CTAD operation shall continue in snow or rain up to 4 in. (10 cm) per hour.

(3) The CTAD shall be capable of continuous operation over an ambient temperature range of -40°F to 165°F (-40°C to 74°C).

(4) The CTAD shall be capable of continuous operation over a relative humidity range of 5% to 95% (non-condensing).

j. Testing.

(1) FCC. Each CTAD shall be Federal Communications Commission (FCC) certified under CFR 47, Part 15, section 15.245or15.249 as an intentional radiator.

(a) The FCC certification shall be displayed on an external label on each CTAD according to the rules set forth by the FCC.

(b) The CTAD shall comply with FCC regulations under all specified operating conditions and over the expected life of the CTAD.

(2) NEMA TS2-1998 Testing. The CTAD shall comply with the applicable standards stated in the NEMA TS2-1998 Standard. Third party test results shall be made available for each of the following tests:

(a) Shock pulses of 10g, 11 ms half sine wave

(b) Vibration of 0.5 g up to 30 Hz

(c) 300 V positive/negative pulses applied at one pulse per second at minimum and maximum DC supply voltage

(d) Cold temperature storage at -49°F (-45°C) for 24 hours

(e) High temperature storage at 185°F (85°C) for 24 hours

(f) Low temp, low DC supply voltage at -29.2°F (-34°C) and 10.8 VDC

(g) Low temp, high DC supply voltage at -29.2°F (-34°C) and 26.5 VDC

(h) High temp, high DC supply voltage at 165.2°F (74°C) and 26.5 VDC

(i) High temp, low DC supply voltage at 165.2°F (74°C) and 10.8 VDC

k. Manufacturing. The CTAD shall be manufactured and assembled in the U.S.A.

(1) The internal electronics of the CTAD shall utilize automation for surface mount and wave solder assembly, and shall comply with the requirements set forth in IPC-A-61 OC Class 3, Acceptability of Electronic Assemblies.

(2) The CTAD shall undergo a rigorous sequence of operational testing to ensure product functionality and reliability. Testing shall include the following:

(a) Functionality testing of all internal sub-assemblies

(b) Unit level burn-in testing of duration 48 hours or greater

(c) Final unit functionality testing prior to shipment

(d) Test results and all associated data for the above testing shall be provided for each purchased CTAD by serial number.

l. Support. The CTAD manufacturer shall provide both training and technical support services.

(1) Training. The manufacturer-provided training shall be sufficient to fully train installers and operators in the installation, auto-configuration, and use of the CTAD to ensure accurate CTAD performance.

(a) The manufacturer-provided training shall consist of comprehensive classroom labs and hands-on, in-the-field, installation and configuration training.

(b) Classroom lab training shall involve presentations outlining and defining the CTAD, its functions, and the procedures for proper operation. These presentations shall be followed by hands-on labs in which trainees shall practice using the equipment to calibrate and configure a virtual CTAD. To facilitate the classroom presentation and hands-on labs, the manufacturer-provided training shall include the following items:

- Knowledgeable trainer or trainers thoroughly familiar with the CTAD and its processes.
- Presentation materials, including visual aids, printed manuals and other handout materials for each student.
- Computer files, including video and raw data, to facilitate the virtual configuration of the CTAD.

- Laptop computers or Windows CE hand-held devices with the necessary software, and all necessary cables, connectors, etc.
- All other equipment necessary to facilitate the virtual configuration of the CTAD.

(c) Field training shall provide each trainee with the hands-on opportunity to install and configure the CTAD at road-side. Training shall be such that each trainee will mount and align the CTAD correctly.

(2) Technical Assistance. A manufacturer-provided technical representative shall be available to assist with the physical installation, alignment, and configuration of each supplied CTAD. Technical support shall be provided thereafter to assist with troubleshooting, maintenance, or replacement of CTADs should such services be required.

m. Documentation. CTAD documentation shall include a comprehensive user guide as well as an installer quick-reference guide and a user quick-reference guide.

(1) The CTAD manufacturer shall supply the following documentation and specification test results at the time of the bid submittal:

(a) Detection accuracy
(b) Range accuracy Earliest range of detection
(c) Speed accuracy
(d) ETA accuracy
(e) FCC CFR 47 certification
(f) NEMA 250 Standard for Type 4X Enclosure third-party test data
(g) NEMA TS2-1998 Standard third-party test data

n. Warranty. The CTAD shall be warranted free from material and workmanship defects for a period of two years from date of shipment.

Click! 200

a. General. Provide and install a surge suppression module (SSM) equivalent to the Wavetronix Click! 200™. Test results and other documentation demonstrating performance and capabilities shall be provided.

b. Product Description. The SSM shall suppress electrical surges up to 4 kV on DC power lines, RS-485 and RS-232 with CTS/RTS communication lines to any device connected to the SSM. The SSM shall be designed to protect a radar vehicle sensing device (RSVD) equivalent to the Wavetronix SmartSensor™ from surges coming from a traffic cabinet, or protect a cabinet from surges coming from the RVSD.

c. Physical. The SSM shall not exceed 0.3 lbs. (0.14 kg) in weight.

(1) The SSM shall not exceed 4.5 in. x 4 in. x 0.9 in. (11.4 cm x 10.2 cm x 2.3 cm) in its physical dimensions.

(2) The SSM shall operate in the temperature range of -29°F to 165°F (-34°C to 74°C).

(3) The SSM shall operate in humidity up to 95% RH.

d. Mounting. The SSM shall mount to a DIN rail with hot swappable surge protected power and communication buses for quick installation and replacement.

e. Connections. The SSM shall have pluggable screw terminals allowing the user to wire a contact closure data collector to the SSM before installation to make installation easy and to minimize incorrect wiring.

(1) The SSM shall also have a protected DB-9 connector tor the RS-232DTE with CTS/RTS communication bus.

(2) The SSM shall also have a protected RJ-11 connector tor the RS-485 communication bus.

(3) The SSM shall also have a 5-position connector tor connecting power and RS-485 communications to and from the T-bus.

f. Three-stage Protection. The SSM shall have a three-stage surge suppression design. The first stage shall be gas tubes followed by a second stage using inductors on the DC power lines and TVS diodes on the communication buses. The third stage shall have a resettable fuse (PTC) on the DC power line and varistors on all communication buses.

g. DC Power Protection. The SSM shall comply with the applicable standards stated in the IEC 61000-4-5 Standard for DC power lines. Test results shall be made available tor the following test conditions:

(1) Surge voltages + 0.5kVA, 1 kVA, 2kVA and 4kVA

(2) Common mode (input to ground)

(3) Differential mode (input to input)

(4) 8x20µs waveform

(5) ohm generator impedance

(6) Minute-long pause between surges

h. RS-485 Protection. The SSM shall comply with the applicable standards stated in the IEC 61000-4-5 Standard for communication lines. The RS-485 communication bus shall have a clamping voltage of 8 VDC and a 12 VDC differential clamping voltage. Test results shall be made available for the following test conditions:

(1) Surge voltages ±0.5kVA, 1 kVA, 2kVA and 4kVA

(2) Common mode (input to ground)

(3) Differential mode (input to input)

(4) 8x20µs waveform

(5) 12 ohm generator impedance

(6) Minute-long pause between surges

i. RS-232 with CTS/RTS Protection. The SSM shall comply with the applicable standards stated in the IEC 61000-4-5 Standard tor communication lines. The RS-232 communication bus shall have a clamping voltage of 11 VDC. Test results shall be made available for the following test conditions:

(1) Surge voltages ±0.5kVA, 1 kVA, 2kVA and 4kVA

(2) Common mode (input to ground)

(3) Differential mode (input to input)

(4) 8x20µs waveform

(5) 12 ohm generator impedance

(6) Minute-long pause between surges

j. NEMA TS2-1998 Testing. The SSM shall comply with the applicable standards stated in the NEMA TS2-1998 Standard. Test results shall be made available for each of the following tests:

(1) Shock pulses of 10g, 11 ms half sine wave

(2) Vibration of 0.5 Grms up to 30 Hz

(3) 300 V positive/negative pulses applied at one pulse per second at minimum and maximum DC supply voltage

(4) Cold temperature storage at -49°F (-45°C) tor 24 hours

(5) High temperature storage at 185°F (85°C} for 24 hours

(6) Low temp, low DC supply voltage at -29.2°F (-34°C} and 10.8 VDC

(7) Low temp, high DC supply voltage at -29.2°F (-34°C) and 26.5 VDC

(8) High temp, high DC supply voltage at 165.2°F (74°C) and 26.5 voe

(9) High temp, low DC supply voltage at 165.2°F (74°C) and 10.8 VDC

k. Testing. Each SSM shall be tested by the manufacturer before shipment.

l. Support. A manufacturer-provided technical representative shall be available to assist with the physical installation, setup, and configuration of each Click! 200 provided. Technical support shall be provided thereafter to assist with troubleshooting, maintenance, or replacement of Click! 200 should such services be required.

m. Warranty. The SSM shall be warranted to be free from material and workmanship defects for a period of one year from date of shipment.

Click! 650

a. General. When called for on the plans, provide and install the number of cabinet interface devices(s) (CID) equivalent to the Wavetronix Click! 650. The CID shall be used to provide power to the SBD and CTAD sensors, protects the controller cabinet from surges, and communicates with the IFCC contact closure devices.

b. Product Description. The CID can be used in place of Intersection Preassembled Backplates (IPB) or the Click 600. It shall convert real-time serial data from the RVSD to contact closure data in a form factor compatible with 170, 2070, NEMA TS2 and NEMA TS1 input file racks, or SDLC communication to the Controller BIU, allowing the RVSD to emulate loop-based traffic detection systems without replacing existing contact closure data collection infrastructure.

c. Physical. The CID shall not exceed 5 lbs. (2.25 kg) in weight.

(1) The CID shall not exceed 7.8 in. x 10.3 in. x 3.9 in. (19.8 cm x 26.2 cm x 9.9 cm) in its physical dimensions.

(2) The CID shall operate in the temperature range of -29°F to 165°F (-34°C to 74°C).

(3) The CID shall operate in up to 95% relative humidity.

d. Mounting. The CID shall be a shelf mounted unit capable of being mounted to the side of the controller cabinet using u-channel mounting brackets.

e. Power. The CID shall be capable of providing:

(1) Power supply voltage: 90 to 260 VAC

(2) AC frequency: 50-60 Hz

(3) Maximum Power: 75 W at 80°C

(4) 24 VDC on sensor connectors

f. Connections and Communication.

(1) Power.

(a) AC input: IEC AC input.

(2) Four RJ-11 jacks on faceplate of device for connecting to contact closure devices.

(a) Communicate via RS-485

(b) Jacks make up physical interface of data bus on device and are for sending detection data from CTAD and SBD sensors on to contact closure devices such as rack cards.

(c) Communicate with rack cards via jumper cables

(3) Terminal Block Connectors. Four terminal block connectors on back of device for connecting to SBD and CTAD sensors.

(a) Cable terminal points for sensor power and RS-485 communications

(b) Matching terminal blocks are included with the CID

(c) Matches terminal blocks used for cable termination with Wavetronix intersection preassembled backplates

(4) Four communication ports on faceplate make up physical interface of control bus and are for connecting to the sensors to configure them.

(a) DB-9 port for communicating via RS-232

(b) Two RJ-11 jacks for communicating via RS-485

(c) USB mini-B connector

(d) T-bus port for connecting to a T-bus; allows the CID to send DC power and RS-485 communications to other devices connected to a T-bus

(5) SDLC

(a) One SDLC port on the front of the Device

(6) Ethernet

(a) One RJ-45 10/100 Ethernet jack on the front of the device

g. Other Features. The CID shall have the following features:

(1) LEDs. The CID shall have four multicolored LEDs with activity indicating functions.

(a) Red LED (PW) illuminates when device has power

(b) Blue LED (OK) extinguishes if device has been disabled by surges

(c) Green LED (TD) illuminates when data is transmitted on the control bus

(d) Yellow LED (RD) illuminates when data is received on the control bus

(2) Data Bus RJ-11 Jack. Each data bus RJ-11 jack on the faceplate corresponds to one sensor and has the following features:

(a) Switch for turning the power to each SBD and CTAD sensor on and off

(b) LED for indicating when that sensor has power

(3) Power Switch. Switch for turning power on and off to entire CID

(4) OLED Panel with Keypad. Panel and keypad for CID device configuration.

(5) Web Interface. Web interface for CID device configuration, accessible through a web browser from a network-connected device.

(6) Configuration. CID configuration shall support up to 64 detector channels.

h. NEMA Testing. The CID shall comply with the applicable standards stated in NEMA TS2-2003. Test results shall be made available for each of the following tests:

(1) Shock pulses of 10 g, 11 ms half sine wave

(2) Vibration of 0.5 Grms up to 30 Hz

(3) 300 V positive/negative pulses applied at one pulse per second at minimum and maximum DC supply voltage

(4) Cold temperature storage at -49°F (-45°C) for 24 hours

(5) High temperature storage at 185°F (85°C) for 24 hours

(6) Low temp, low DC supply voltage at -29.2°F (-34°C) and 10.8 VDC

(7) Low temp, high DC supply voltage at -29.2°F (-34°C) and 26.5 VDC

(8) High temp, high DC supply voltage at 165.2°F (7 4 °C) and 26.5 VDC

(9) High temp, low DC supply voltage at 165.2°F (7 4 °C) and 10.8 VDC

i. Testing. Before shipping, each CID shall have passed a manufacturer's test and be FCC compliant.

j. Support. A manufacturer-provided technical representative shall be available to assist with the physical installation, setup, and configuration of each Click! 650 provided. Technical support shall be provided thereafter to assist with troubleshooting, maintenance, or replacement of Click! 650 should such services be required.

k. Warranty. The CID shall be warranted to be free from material and workmanship defects for a period of one year from date of shipment.

Cabling and Connectors

Supply cable and connectors of the appropriate length for the application stated.

a. General. Provide a traffic sensor-to-pole mounted cabinet cable equivalent to the Wavetronix SmartSensor cable.

(1) Cable. The cable shall be the Orion Wire Combo-2207-2002-PVCGY or an equivalent cable that conforms to the following specifications:

(a) The RS-485 conductors shall be a twisted pair.

(b) The RS-232 and RS-485 conductors shall have nominal capacitance conductor to conductor of less than 71 pF/Ft at 1 Khz.

(c) The RS-232 and RS-485 conductors shall have nominal conductor DC resistance of less than 16.5 ohms/1000 ft. at 20°C.

(d) The power conductors shall be a twisted pair with nominal conductor DC resistance of less than 11.5 ohms/1000 ft. at 20°C.

(e) Each wire bundle shall be shielded with an aluminum/mylar shield with a drain wire or the entire cable shall be shielded with an aluminum/mylar shield with a drain wire.

(2) Connector. The cable end connector shall meet the MIL-C-26482 specification and shall be designed to interface with the appropriate MIL-C-26482 connector. The connector backshell shall be an environmentally sealed shell that offers excellent immersion capability. All conductors that interface with the connector shall be encased in a single jacket, and the outer diameter of this jacket shall be within the backshell's cable O.D. range to ensure proper sealing. The backshell shall have a strain relief with enough strength to support the cable slack under extreme weather conditions. Recommended connectors are Cannon's KPT series, and recommended backshells are Glenair Series 37 cable sealing backshells.

b. General. Provide a pole mounted cabinet-to-traffic cabinet home-run cable.

(1) Cable. The home-run cable shall be the Alphawire 6023C or an equivalent cable that conforms to the following specifications:

(a) Operate between -20°C to 60°C

(b) Rated to 300 volts

(c) Conductor: Stranded Tinned Copper

(d) Insulation: Color-Coded Polypropylene

(e) Shield: Individually Foil Shielded Pairs

(f) Drain Wire: Stranded Tinned Copper
(g) UL Type CM, AWM 2493

(h) CSA CMG FT

SmartSensor Mount

a. General. Provide traffic sensor mounting assembly equivalent to the Wavetronix SmartSensor mount.

b. Mounting. The mounting assembly shall provide at least two axes of rotation to ensure proper installation.

(1) The mounting assembly shall be able to support at least a 15-lb. (6.8-kg) load.

(2) The mounting assembly shall feature a symmetric hole pattern that mates with fixed and rotational SmartSensor back plates.

(3) The mounting assembly shall have two contact points with the pole.

(4) The mounting assembly shall be slotted for 3/4" banding.

c. Construction. The mounting assembly shall be constructed of 0.1875" thick or thicker aluminum with 316 stainless steel hardware.

(1) The mounting assembly shall be powder coated for oxidation resistance.

Installation Kit

a. General. Provide an installation kit equivalent to the Wavetronix Install Kit, for use while installing and configuring radar vehicle sensing devices (RVSDs) or continuous tracking advance detectors (CTADs), equivalent to the Wavetronix SmartSensor products, or in-cabinet contact closure and communication connectivity devices (ICD) equivalent to the Wavetronix Click! products.

b. Product Description. The RVSD, CTAD or ICD shall be installed and configured using a manufacturer supplied installation kit that includes the following elements: a handheld computer equivalent to the Socket Mobile SoMo 650, a serial to USB adapter equivalent to the Socket Serial USB to serial adapter, a Bluetooth to serial converter equivalent to the Click! 421, and pertinent documentation.

Smartsensor Cable Junction Box
For each radar sensor, provide a 6-conductor Type 4X cable junction box enclosure (WX-SS-710) to connect the Wavetronix 6-conductor pigtail cable (WX-SS-704) to the APT Matrix 2 homerun cable. Place this cable junction box in the upper portion of the nearest Type II traffic junction box; or controller cabinet foundation (for signal poles with traffic conduits running directly to the controller).

Delete item no. 8 and replace with the following:

8. Pan Tilt Zoom Video Camera System

a. General.

(1) System Hardware. Furnish only fully functional new equipment of the name and type as stated on the Plans or approved equal. To be considered an approved equal, equipment must meet or exceed the listed specifications.

(a) Pan-Tilt-Zoom (PTZ) Camera. Furnish a Camera meeting the following specifications.

PAN-TILT ZOOM CAMERA SPECIFICATIONS

Camera	**Detail**
Minimum Illumination Signal System	Color: 0.15 lux at 30 IRE, F1.6 B/W: 0.01 lux at 30 IRE, F1.6 Color: 0.2 lux at 50 IRE, F1.6 B/W: 0.02 lux at 50 IRE, F1.6
Electronic Shutter Speed	2 s to 1/60,000 s
Gain Control	Auto/Manual (-3 to 28 dB)
Exposure Control	Full auto, Shutter priority, Iris Priority, Manual
White Balance Mode	Auto, ATW, Indoor, Outdoor, One-push, Manual, Sodium vapor lamp
Lens Type	Auto-focus Zoom Lens
Zoom Ratio	Optical zoom 30x, Digital zoom 12x
Horizontal Viewing Angle	57.8 to 1.7 degrees
Minimum Object Distance	10 mm (wide) to 1500 mm (tele)
Pan Angle	360 degrees
Pan Speed	700 degrees/s (max)
Tilt Angle	110 degrees
Tilt Speed	500 degrees/s (max)
Wide-D	Yes (120 dB)

Image	**Detail**
Codec Image Size (H x V)	1920x1080p, 704 x 576, 720 x 480, 640 x 480, 384 x 288, 320 x 240
Video Compression Format	H.264, MPEG-4, JPEG
Codec Streaming Capability	Dual streaming
Maximum Frame Rate	30 fps in 1080p, 60 fps in 1080p,

Scene Analytics	**Detail**
Intelligent Motion Detection	Yes

Network	Detail
Protocols	IPv4, IPv6, TCP, UDP, ARP, ICMP, IGMP, HTTP, HTTPS, FTP (client/server), SMTP, DHCP, DNS, NTP, RTP/RTCP, RTSP, SNMP (MIB-2)
ONVIF Software	Yes (Ver. 1.02)
Number of Clients	5
Authentication	IEEE802.1X

Interface	Detail
Ethernet	10BASE-T / 100BASE-TX (RJ-45)
Card Slots	SD memory card x 1 (Compatible with the SD/SDHC standards)

General	Detail
Power Requirements	HPoE (IEEE802.3at compliant), AC24V
Power Consumption	Approx. 74W
Operating Temperature	-67 to 122° F (-55 to +50° C)

System Requirements	Detail
Operating System	Microsoft Windows 7™ (32/64bit) – compatible
Web Browser	Microsoft Internet Explorer® Ver. 6.0 or later Firefox® Ver.3.5 (Plug-in free viewer only) Safari® Ver.4.0 (Plug-in free viewer only) Google Chrome® Ver.4.0 (Plug-in free viewer only)

Additional Equipment	Detail
Enclosure	Outdoor vandal resistant housing with heater and blower
Warranty	5 years

The provided PTZ camera shall be compatible with the Econolite Centracs 2.0 Advanced Transportation Management System (ATMS) and CCTV Module. The camera shall be AXIS Q6315-LE or approved equivalent.

740-2.14 VEHICULAR SIGNAL HEADS. *Delete this subsection in its entirety and substitute the following:*
Provide Light Emitting Diode, (LED) Signal Heads that conform to the following publications:

- Circular Indications: *Vehicle Traffic Control Signal Heads: Light Emitting Diode (LED) Circular Signal Supplement, 6/27/05* (ITE Publication ST-052). This is hereafter referred to as "VTCSH-Circular-05".
- Arrow Indications: *Vehicle Traffic Control Signal Heads – Light Emitting Diode (LED) Vehicle Arrow Traffic Signal Supplement, 7/1/07 (ITE Publication ST-054).* This is hereafter referred to as "VTCSH-Arrow-07".

"The applicable ITE Specification", as used in this specification, means VTCSH-Circular-05 for circular LED indications and VTCSH-Arrow-07 for arrow LED indications.

1. Signal Heads. Use signal heads that: are the adjustable, vertical type with the number and type of lights specified; provide a light indication in one direction only; are adjustable through 360 degrees about a vertical axis; and are mounted at the location and in the manner shown on the Plans. Ensure that all vehicular signal heads at any one intersection, except for programmed visibility signal heads, are of the same make and type.

   Provide a removable aluminum tunnel visor with an open slot at the bottom for each optical unit.

   Furnish housing, backplates and visors factory finished with a single coat of environmentally safe, ultraviolet-resistant, polyester powder coating that is applied electrostatically at 90kV and baked for 20 minutes at 400 degrees Fahrenheit per ASTM D-3359, ASTM D-3363 and ASTM D-522. Coating to be a Dull Black finish meeting Federal Standard 595b-37038.

   a. LED Optical Units. Use LED optical units and lenses meeting the requirement of the applicable ITE specification for all indications. Also meet the following requirements:

      (1) Gaskets. Use one-piece EPDM (ethylene propylene rubber) gaskets to seal LED modules.

      (2) Markings. Provide LED Signal module with manufacturer applied markings listed in Section 3.6, Module Identification, of the applicable ITE Specification. For circular indications marking shall include: “Manufactured in conformance with the ITE Vehicle Traffic Control Signal Heads: LED Vehicle Circular Traffic Signal Supplement (June 27, 2005).” For arrow indicationsmarking shall include: “Manufactured in conformance with the ITE Vehicle Traffic Control Signal Heads: LED Vehicle Arrow Traffic Signal Supplement (July 1, 2007).”

      (3) Compatibility. Use LED signal modules that are operationally compatible with currently used controller assemblies (solid state load switches, flashers, and conflict monitors).

      (4) Testing Requirements.

         (a) All LEDs Functional. LED modules with any non-functioning individual LEDs at the final inspection will be rejected.

         (b) Burn-in. Manufacturer shall energize each new LED module for a minimum of 24 hours at operating voltage before shipment to ensure electronic component reliability.

         (c) Production Testing and Inspection. Submit manufacturer’s certification that all tests in Section 6.3 of the applicable ITE Specification have been successfully completed on each LED module to be used on the project.

            Show results of each individual test on the certification.

         (d) Design Qualification and Quality Assurance Testing by an Independent Lab. Have ETL/Intertek or other approved OSHA “Nationally Recognized Testing Laboratory” do the following:

            a. Perform an initial assessment of the manufacturer’s factory, engineering and manufacturing systems, and procedures to confirm compliance with ISO 9000.
            b. Perform initial Design Qualification Testing as specified in Section 6.4 of the applicable ITE specification.

c. Every 6 months, conduct a factory inspection and perform Quality Assurance Tests on two samples of each certified LED module in accordance with the following sections of the applicable ITE specification:

6.4.2 Conditioning
6.4.4.1 - 6.4.4.4 Luminous Intensity
6.4.4.6 Chromaticity
6.4.6.1 Current Consumption
6.4.6.6 Power Factor
6.4.6.7 Total Harmonic Distortion

d. Provide a certification label on each certified LED traffic signal module verifying the manufacturer's factory and modules passed the tests listed in a. through c. above.

(e) Warranty. Provide written warranty by the signal module manufacturer that covers defects in materials, workmanship, and compliance with the applicable ITE specification for a period of 60 months after the manufacture date. No new LED module will be accepted if its manufacture date is more than 12 months before the date of installation. Begin warranty period for modules that replace failed modules on the date of installation.

The warranty shall require the manufacturer to replace LED modules that fail within the warranty period with new LED modules at no cost to the Department, and to cover the cost of shipping failed modules. The warranty does not include the cost of removing failed modules or reinstalling new modules. Warranty shall require the manufacturer to send the Department prepaid authorization to return the failed module and provide a toll free telephone number for notifying them when it becomes necessary to return failed LED modules.

The warranty shall require the manufacturer to deliver replacement LED modules within 5 working days of receiving failed modules to the location specified by the Department.

2. Housing.

a. Use die cast aluminum, meeting ASTM B 85, for all parts of the housing, including the doors and end plates. Ensure all parts are clean, smooth, and free from flaws, cracks, blow holes, or other imperfections.

b. Use a one-piece housing with integral top, bottom, sides, and with square doors, for each signal section.

c. Use stainless steel for all exposed bolts, screws, hinges, pins, and door-locking devices. Use stainless steel or approved non-ferrous, corrosion-resistant material for all interior screws and fittings.

d. Provide an opening in the top and bottom of each housing to accommodate standard 1-1/2 inch pipe fittings and brackets.

e. Provide the top and bottom openings of each housing with integral serrated bosses that will provide positive positioning of the signal head in 5-degree increments to eliminate undesirable rotation or misalignment of the signal head as well as between sections. Provide a total of 72 teeth in the serrated boss. Ensure teeth are clean and sharp to provide positive positioning with the grooves of the mating section or framework.

f. Fasten individual signal sections together with a cadmium-plated tri-stud connector, lockwashers, and nuts with access holes for the passage of electrical conductors from one section to another.

g. Provide 2 integral hinge lugs on the left side of each signal housing for mounting the door.

h. Provide 2 latches with stainless steel wing nut assemblies on the right side of each signal housing to engage the door latches.

i. Provide each signal housing door opening with a one-piece EPDM gasket around the periphery to provide a weather tight seal in a NEMA Type 3R enclosure.

j. Provide a round opening designed to accommodate any standard traffic signal lens in each signal housing door.

3. Backplates. Furnish and attach backplates to all vehicle signal heads except post-mounted flashers.

Construct backplates of 0.1-inch minimum thickness aluminum alloy sheet meeting ASTM B 209, alloy 3003-H14. Use 8 inch wide backplate extensions for 12-inch displays and 5-1/2 inch wide backplate extentions for 8-inch displays. When there are 2 or more backplate sections, fasten them together with aluminum rivets or bolts and peen after assembly to prevent loosening.

Use 5 or 5-1/2 inch wide backplate extensions (borders) for all post mounted and pole side mounted vehicle signal heads. Provide nominal 5-inch wide backplate extensions on all 5 section overhead cluster mounted signals. Provide backplates with nominal borders of 8 inches for the 8-inch sections and 5 inches for 12-inch sections on all combination 8-inch/12-inch vertical mounted signal heads.

Finish the back plates with a black powder coat. The front plates shall have a 3” wide yellow Type IV retroreflective finish or sheeting as a border around the back plate. This finish applies to both new and existing back plates.

740-2.16 PEDESTRIAN PUSH BUTTONS. *Delete this subsection in its entirety and substitute the following:* Push buttons shall be Tamper proof with a 2 inch minimum diameter convex 316 stainless steel actuator button.

Construct a weatherproof assembly designed to prevent an electrical shock under any weather condition and grounded per the NEC.

Push Button Switch. Push buttons must be ADA-compliant. Furnish DCC-4EVR 120 (rectangle) or Bulldog RBDLM2-B-4H. Substitutions must be approved by the Engineer or designated representative and meet the following criteria: Provide a solid state electronic piezo type, switching unit, with screw type terminals, rated 15 amperes at 125 VAC. Must have the following characteristics:

1. Switching unit that is solid state electronic piezo rated for 100 million cycles.

2. Sealed to prevent ice from impeding function.

3. Must hold the call for a minimum of 5 seconds.

4. Switch operating force of 3 pounds or less with no moving plunger or moving electrical contacts.

5. Provide an LED indication and an audible tone or beep within the button when pushed.

6. Must have a raised rim or ridges to protect the button from side impacts.

7. Powder coated cast switch housing of dark olive green or black.

Where a pedestrian push button is to be mounted on top of a 2-1/2 inch diameter post, provide the housing with a slip-fitter with screws for securing to the post.

Factory finish pedestrian push button housings, mountings, brackets, and fittings with 2 coats of dull black enamel or powder coat. Painting/powder coating is not required where the color is an integral part of the component material.

740-2.17 FLASHING BEACONS. *Delete this subsection in its entirety and substitute the following:* Furnish beacons that consist of one or more traffic signal sections meeting the requirements of Subsection 740-2.14 Vehicular Signal Heads. See the Plans for the number, size and color of the signal sections required for each beacon.

Use the flasher in signal controller cabinets to energize beacons that flash continuously and are installed near traffic signals. Otherwise, each flashing beacon controller assembly consists of the following 120 VAC equipment housed in a NEMA 3R enclosure: a circuit breaker, a radio interference suppressor, a transient voltage suppressor, a NEMA Type 3 flasher, neutral and ground busses, and terminal blocks.

Controller assemblies for school zone speed limit sign beacons shall also include a time switch and a second 120 VAC circuit breaker that protects a thermostat and heater.

The NEMA 3R enclosure shall feature a single shelf and a hinged door with a hasp and staple for sealing and locking the cabinet door.

The radio interference and transient voltage suppressors shall meet the requirements of Subsections 740-2.11.1.k.(3) and (4), respectively.

Use a solid state NEMA Type 3 flasher meeting the requirements of NEMA Standard TS 1-1989, Traffic Control Systems.

Use 20 ampere, 600 volt barrier type phenolic terminal blocks with plated brass screw type terminals and integral strips can be marked with a pen or pencil.

Furnish an RTC Manufacturing model AP41-L time switch complete with wiring harness, or an approved, calendar programmable, solid state time switch with liquid crystal display, keyboard, input/output port, and wiring harness. The approved time switch shall:

1. Operate on line voltages from 95 to 135 VAC, operate in temperatures from -22° F to 165° F, and include a capacitor that provides 48 hours of backup power to retain programming and time when the unit is disconnected from AC voltage.

2. Include a backlit display and provide 2 lines of alphanumeric legend with 16 characters per line. The display shall automatically prompt the operator while programming the device through the keyboard for ease of use.

3. Include an input/output port and keyboard activated special functions that transfer the program to other units and download the program to a printer for a hard copy record of the program.

4. Automatically compensate for changes in Daylight Savings Time and leap years and include a keyboard activated special function to quickly change the dates for the begin and end of Daylight Savings Time.

5. Provide at least 10 basic plans for daily and/or weekly use and at least 200 program steps that are equally divided amongst the actual number of basic plans. Each program step shall be assignable to a single day, weekend, weekday, or every day. The time switch shall also include 20 plans that activate the basic plans to provide one year of time based control.

6. Include at least 4 single pole double throw, relay controlled outputs rated for 15 amperes of resistive load at 115 VAC. Each pole shall be independently activated for steady on or momentary on and be manually switched on through the keyboard.

When a signal controller cabinet flasher is used to energize a beacon, furnish a two pole, fused block with built in fuse pullers to protect the flasher. Furnish third party certified blocks that hold 13/32" x 1-1/2" midget ferrule fuses, are rated for 30 amperes, and feature tubular screw terminals that accommodate conductors to 8 AWG. Furnish blocks with two fast acting, 3 ampere (BAF-3) fuses, and flat bases that can be directly mounted on a dead panel.

Furnish beacons that consist of one or more traffic signal sections meeting the requirements of Subsection 740-2.14 Vehicular Signal Heads. See the Plans for the number, size and color of the signal sections required for each beacon.

Use the flasher in signal controller cabinets to energize beacons that flash continuously and are installed near traffic signals. Otherwise, each flashing beacon controller assembly consists of the following 120 VAC equipment housed in a NEMA 3R enclosure: a circuit breaker, a radio interference suppressor, a transient voltage suppressor, a NEMA Type 3 flasher, neutral and ground busses, and terminal blocks.

The NEMA 3R enclosure shall feature a single shelf and a hinged door with a hasp and staple for sealing and locking the cabinet door.

The radio interference and transient voltage suppressors shall meet the requirements of Subsections 740-2.11.1.d.(3) and (4), respectively.

Provide a solid state NEMA Type 3 flasher meeting the requirements of NEMA Standard TS 1-1989, Traffic Control Systems with the following capabilities:

1. Operates on line voltages from 89-135 VAC RMS,
2. Operating temperature range of -40°F to 165°F,
3. Supplies a flash rate of 57±3 flashes per minute to the signal heads,
4. Dual circuit operation.

Use 20 ampere, 600 volt barrier type phenolic terminal blocks with plated brass screw type terminals and integral strips can be marked with a pen or pencil.

When a signal controller cabinet flasher is used to energize a beacon, furnish a two pole, fused block with built in fuse pullers to protect the flasher. Furnish third party certified blocks that hold 13/32" x 1-1/2" midget ferrule fuses, are rated for 30 amperes, and feature tubular screw terminals that accommodate conductors to 8 AWG. Furnish blocks with two fast acting, 3 ampere (BAF-3) fuses, and flat bases that can be directly mounted on a dead panel.

740-2.18 LUMINAIRES.

1. Mast Arm Mounted Luminaires: *Under subparagraph d, delete "dated 1983" and substitute "dated 2014".*

Add the following lettered subparagraphs:

h. Have a Correlated Color Temperature (CCT) of 4,000K ± 300K.

i. Have a minimum Color Rendering Index (CRI) or 70.

j. Start and operate in negative 40-degrees Celsius ambient temperature.

Add the following section:

SECTION 802
CONTAMINATED SOIL

802-1.01 DESCRIPTION. Provide all services for identifying, stockpiling, testing, transporting, and disposing of soil contaminated with specific regulated contaminants as described in the Quality Assurance Project Plan (QAPP). These services are necessary for all soil that is excess to the project.

802-2.01 REFERENCES. The publications are referred to in the text by basic designation only. Use the most recent version of the document.

1. 18 AAC 75 Oil and Other Hazardous Substances Pollution Control
2. 18 AAC 78 Underground Storage Tanks
3. DEC Field Sampling Guidance
4. DEC Technical Memorandum for Managing Petroleum Contaminated Soil, Water, or Free Product During Public Utility and Right-of-Way Construction and Maintenance Projects
5. RCRA Waste Sampling Draft Technical Guidance, EPA-530-D-02-002

802-3.01 PROFESSIONAL SERVICES.

1. Media Specialist. The Media Specialist must meet the DEC definition of a Qualified Environmental Professional to perform site sampling. Provide a Media Specialist responsible for developing and overseeing all contaminated soil work. The Media Specialist shall be an independent third party, experienced in all phases of the required work. Independent shall mean that no ownership agreement shall exist between the Media Specialist and the Contractor. The Media Specialist shall have a minimum of a 4-year college degree in Chemistry, Environmental Science, Engineering, Geology, Hydrology, or a related field; experience in and have knowledge of EPA and DEC methods for collecting environmental and hazardous waste samples; and experience in operation of field screening equipment. The Media Specialist shall coordinate all testing and laboratory analysis.

2. Testing Laboratory. All soil sample testing shall be done by a DEC approved and independent Testing Laboratory to provide analytical laboratory services. Independent shall mean that no ownership agreement exists between the testing laboratory and the Contractor.

802-3.02 GENERAL. The Media Specialist shall field screen and sample excess excavated soil in a timely manner. The Specialist shall exercise a high degree of control over timely and accurate field screening, sampling, and testing in coordination with construction activities. All field screening, sampling, and reporting as described in this specification shall be completed by the Media Specialist. The Testing Laboratory shall perform laboratory analysis of submitted soil samples.

802-3.03 INSPECTION AND COMPLIANCE. Federal, State, and local agencies may require their representative(s) to be present to inspect operations; notify the Engineer as soon as possible of any such inspections and comply with all inspection requirements. If conflicts occur between various regulations or between any regulation and the contract specifications, the most stringent shall apply unless otherwise approved by the Engineer.

802-3.04 QUALITY ASSURANCE PROJECT PLAN. A QAPP has been approved for the project and addresses the elements listed below. The Contractor shall also provide information regarding any proposed deviations from the QAPP.

1. Project Organization and Signatures
2. Background
3. Regulatory Context
4. Project Management and Communication
5. Procedures and Requirements Summary
6. Field Screening and Analytical Sampling Methodology

7. Soil Handling and Storage
8. Data Review, Verification, and Validation
9. Reporting
10. Site-Specific Health and Safety Plan Requirements

802-3.05 AREAS OF POSSIBLE CONTAMINATION.

TABLE 802-1
AREAS OF POSSIBLE CONTAMINATION

SITE NAME	STATIONING
Former NC Machinery	"O" 39+53 to 43+10
Former Army Barracks	"O" 43+20 to 59+40, including Parcel 8
Former Tax Lot 201 – Bentley Trust Property	"O" 59+40 to 70+80

802-3.06 SITE SAFETY AND HEALTH PLAN. Develop a Site Safety and Health Plan (SSHP) in accordance with applicable Occupational Safety and Health Administration (OSHA) and State of Alaska Statutes (AS) guidelines. The level of detail provided in the SSHP shall be tailored to the type of work, complexity of operations to be accomplished, and the hazards anticipated. All subcontractors shall comply with the Contractor's SSHP. The SSHP shall be updated if new hazards are identified during execution of the work described in this section. This Subsection does not relieve the Contractor of health and safety requirements that may be listed in other Sections.

The SSHP shall provide evidence of applicable safety and health training received by the supervisors and employees. Supervisors' and employees' qualifications shall be submitted to the Engineer for approval. Acceptability will be determined on the basis of education, training, and experience. Additionally, at least one person certified in first aid and CPR by the Red Cross, or equivalent agency, shall be present on-site during all field operations.

The SSHP shall address testing for hazardous, flammable, or combustible vapor concentrations at the work site. Special attention shall be given to compounds or contaminants that may affect the accuracy of monitoring instruments. The plan shall address safe working levels with and without appropriate protective equipment, and levels at which personnel shall be removed from the area. The SSHP shall address required testing, frequency of testing, and action levels.

Provide personal protective equipment and other tools required for worker protection as appropriate for work conditions and as required by this Subsection. Provide two sets of personal protective equipment for the Engineer. The Engineer is responsible for having appropriate medical clearance for the PPE.

802-3.06 DEWATERING. The Contractor shall schedule work to avoid situations that may require dewatering. Dewatering is specifically prohibited on this project.

802-4.01 METHOD OF MEASUREMENT. Section 109.

802-5.01 BASIS OF PAYMENT.

1. Item 802.2000.0000 Contaminant Soil Removal and Disposal, Unrestricted. At the negotiated price, determined under the contingent sum pay item, to provide all work, labor, materials, and equipment to segregate, stockpile, double handle, haul, and dispose of uncontaminated soil. All additional contaminated soil administration necessary due to this item will not be paid for separately but will be subsidiary to other bid items.

2. Item 802.2000.0000 Contaminant Soil Removal and Disposal, Upland Location. At the negotiated price, determined under the contingent sum pay item, to provide all work, labor, materials, and equipment to segregate, stockpile, double handle, haul, and dispose of uncontaminated soil. All additional contaminated soil administration necessary due to this item will not be paid for separately but will be subsidiary to other bid items.

3. Item 802.2000.0000 Contaminant Soil Removal and Disposal, Petroleum. At the negotiated price determined under the contingent sum pay item, to provide all work, labor, materials, and equipment to segregate, stockpile, double handle, haul, and treat petroleum contaminated soil. All additional contaminated soil administration necessary due to this item will not be paid for separately but will be subsidiary to other bid items.

4. Item 802.2000.0000 Contaminant Soil Removal and Disposal, RCRA. At the negotiated price determined under the contingent sum pay item, to provide all work, labor, materials, and equipment to segregate, stockpile, double handle, haul, and dispose of RCRA contaminated soil. All additional contaminated soil administration necessary due to this item will not be paid for separately but will be subsidiary to other bid items.

5. Item 802.2001.0000 Laboratory Testing, Petroleum and VOCs. The contract price includes all labor, equipment and materials required to collect and analyze soil samples at a testing laboratory for gasoline range organics, diesel range organics, and residual range organics (GRO/DRO/RRO) by AK101/102/103 and volatile organic compounds (VOCs) by EPA 8260.

6. Item 802.2001.0000 Laboratory Testing, TCLP VOCs. The contract price includes all labor, equipment and materials required to collect and analyze soil samples at a testing laboratory for the Toxicity Characteristic Leaching Procedure TCLP) for VOCs by EPA 1311/8260.

7. Item 802.2002.0000 Media Specialist. The contract price includes all labor, equipment, and materials required to administer all work under this section. It includes, but is not limited to developing work plans, reports, supervision, inspections, field screening, soil classifications, soil disposal, compliance, monitoring, reporting, record keeping and records retention.

Payment will be made under:

PAY ITEM		
Item Number	**Item Description**	**Unit**
802.2000.0000	Contaminant Soil Removal and Disposal, Unrestricted	CS
802.2000.0000	Contaminant Soil Removal and Disposal, Upland Location	CS
802.2000.0000	Contaminant Soil Removal and Disposal, Petroleum	CS
802.2000.0000	Contaminant Soil Removal and Disposal, RCRA	CS
802.2001.0000	Laboratory Testing, Petroleum and VOCs	EACH
802.2001.0000	Laboratory Testing, TCLP VOCs	EACH
802.2002.0000	Media Specialist	LS

APPENDIX A

PERMITS

Placeholder

ADEC Stormwater Plan Approval Letter

Placeholder

ADEC Water System
Approval to Construct Letter

Placeholder

ADEC Sanitary Sewer Approval to Construct Letter

Placeholder

ARRC Temp. Construction Permit

Placeholder

AARC Letter of Non-objection

Placeholder

City of Fairbanks Noise Variance

APPENDIX B

MATERIALS CERTIFICATION LIST (MCL)

Project Name	OLD STEESE HIGHWAY RECONSTRUCTION
Project Number	Z624870001
Project Engineer Signature	

Unshaded boxes indicate who approves the manufacturer's certificate of compliance or materials submittals. If two boxes are unshaded, either approving authority may be used.

Instructions to Designers: The Master Materials Certification List is intended to provide a starting point for the Submittal Registry. Designers are instructed to review this list, remove any items that are not applicable to the project, indicate who determines acceptance, and include with bid documents.

SECTION 660/661/669/740 MATERIALS CERTIFICATION LIST (Updated 01/01/2021)

Item	2020 Specifications	Third Party Listing or Labeling Required? (Y/N)	Acceptance By:							Remarks
			Construction			Design			Statewide	
			Project Engr		QA/ Matls Engr	Design Engr	Bridge Engr	Traffic Engr	State Materials Engineer	
				QPL						
660 SIGNALS AND LIGHTING										
TRAFFIC SIGNAL SYSTEMS										
JUNCTION BOXES: (from Manufacturers on APL)										
Type I / IA, II, III	See Detail in Plans 660-2.01 660-3.04 709-2.01 711-2.01	N								
JUNCTION BOXES: (from Manufacturers NOT on APL)										
Type I / IA, II, III	See Detail in Plans 660-2.01 660-3.04	N								
Electronic ball marker/Locator bauble	660-3.04	N								
Concrete Mix Design	660-2.01 550-2.02	N								Special Provision
Curing Materials	711-2.01	N								
Reinforcing Steel	709-2.01	N								
Junction Box Cover	See Detail in Plans 660-3.04	N								
CONDUIT:										
Galvanized Rigid Metal Conduit	740-2.06	Y								
Galvanized Couplings	740-2.06	Y								
Galvanized Split Couplings	740-2.06	Y								
Galvanized Elbows	740-2.06	Y								
Galvanized Nipples	740-2.06	Y								
Expansion Joints	660-3.03.14	N								
Bored Casing	Special Provisions	N								
Underground Marker Tape	660-3.03.14	N								

SECTION 660/661/669/740 MATERIALS CERTIFICATION LIST (Updated 01/01/2021)

Item	2020 Specifications	Third Party Listing or Labeling Required? (Y/N)	Acceptance By:							Remarks
			Construction			Design			Statewide	
			Project Engr		QA/ Matls Engr	Design Engr	Bridge Engr	Traffic Engr	State Materials Engineer	
				QPL						
Electronic Marker Capsule (underground junction boxes - antenna encapsulated in a 4 inch red polyethylene ball - responsive to locator device up to 5 feet)	Special Provisions 660-3.04	N								
Electronic Marker Locator	740-2.13	N								
Pull Rope	660-3.03.13	N								
Duct Sealing Compound (for conduits thru Controller Foundation Slab)	Std. Dwg T-35.00 (eff. 8/03)	Y								
BONDING & GROUNDING:										
Copper Ground Rod	660-3.06	Y								
Grounding Bushings	660-3.06	Y								
Ground Rod Clamps	660-3.06	Y								
#6 & #8 Bare Copper Grounding Wire	660-3.06	N								
Braided Copper J-Box Lid Bonding Wire	660-3.06	N								
Compression Tap Connectors	Detail in Plans	Y								
CONDUCTORS / CABLES:										
Control Cables 2/3/5/7C#14	740-2.05	Y								
CAT5e	740-2.05	Y								
CAT6a	740-2.05	Y								
Terminals	660-3.05	Y								
Identification Labels	660-3.05	N								
SPLICES and TERMINALS										
Spade type crimp-on terminals	660-3.05	Y								
Re-enterable Splice Kits (for Loops)	660-3.05	N								
Heat Shrink Tubing Only		Y								
Wye Resin Splice Kit (Lighting)	660-3.05	N								
Overlap Type Crimp Connectors	660-3.05	N								
Heat Shrink Tubing or Electrical Tape	660-3.05	Y								
Fused Disconnect Kits (Lighting)	740-2.07	Y								
Fuses for Disconnect Kits	740-2.07	Y								
Inline Resin Splice Kit (Lighting) (Only for tying into existing circuits)	660-3.05	Y								
TRAFFIC SIGNAL CONTROLLER										
Econolite Cobalt ATC Touch	740-2.10	N								
COMMUNICATION SYSTEMS										
Ethernet Switch	740-2.13-4	N								
VDSL Modem	740-2.13-3	N								
PAN, TILT, ZOOM CAMERA SYSTEM										

SECTION 660/661/669/740 MATERIALS CERTIFICATION LIST (Updated 01/01/2021)

Item	2020 Specifications	Third Party Listing or Labeling Required? (Y/N)	Acceptance By:							Remarks
			Construction			Design			Statewide	
			Project Engr		QA/ Matls Engr	Design Engr	Bridge Engr	Traffic Engr	State Materials Engineer	
				QPL						
Mounting Bracket	740-2.13-8	N								
Pole Mount Adapter	740-2.13-8	N								
Goosneck Wall Mount	740-2.13-8	N								
Connector	740-2.13-8	N								
Strain Relief	740-2.13-8	N								
Camera	740-2.13-8	N								
Pendant Dome Housing	740-2.13-8	N								
HIGHWAY LIGHTING SYSTEMS										
JUNCTION BOXES: (from Manufacturers on APL)										
Type IA	See Detail in Plans 660-2.01 709-2.01 711-2.01	N								
JUNCTION BOXES: (from Manufacturers NOT on APL)										
Type IA	See Detail in Plans 660-2.01 709-2.01 711-2.01	N								
Concrete Mix Design	660-2.01 550-2.02	N								Special Provision
Curing Materials	711-2.01	N								
Reinforcing Steel	709-2.01	N								
Junction Box Cover	See Detail in Plans 660-3.04	N								
CONDUIT :										
Galvanized Rigid Metal Conduit	740-2.06	Y								
High Density Polyethylene Conduit	740-2.06	Y								
High Density Polyethylene Couplings	660-3.03	Y								Special Provision
RMC to HDPE Electrofusion Coupler	660-3.03	N								Special Provision
Galvanized Couplings	740-2.06	Y								
Galvanized Split Couplings	740-2.06	Y								
Galvanized Elbows	740-2.06	Y								
Galvanized Nipples	740-2.06	Y								
Expansion Joints	660-3.03	Y								Special Provision
Bored Casing	660-3.03	N								Special Provision
Underground Marker Tape	660-3.03	N								Special Provision
Pull Rope	660-3.03	N								Special Provision
Type "C" and "LB" Conduit Outlet Bodies with Covers, Gaskets & Plugs	See Detail in Plans 740-2.06	Y								

SECTION 660/661/669/740 MATERIALS CERTIFICATION LIST (Updated 01/01/2021)

Item	2020 Specifications	Third Party Listing or Labeling Required? (Y/N)	Acceptance By:							Remarks
			Construction			Design			Statewide	
			Project Engr		QA/ Matls Engr	Design Engr	Bridge Engr	Traffic Engr	State Materials Engineer	
				QPL						
BONDING & GROUNDING:										
Grounding Bushings	See Detail in Plans 740-2.06 660-3.01 660-3.06	Y								Special Provision
#8, #6, or larger Bare Copper Ground Wire	See Detail in Plans 660-3.06	N								Special Provision
Braided Copper J-Box Lid Bonding Wire	See Detail in Plans 740-2.06 660-3.06	Y								Special Provision
Compresssion Tap Connectors	See Details in Plans 660-3.02 660-3.06	Y								Special Provision
CONDUCTORS / CABLES:										
3C#6 Illumination Cable - PE Jacket	740-2.05	Y								
Illumination Cable - PE Jacket	740-2.05	Y								
1C#10 Luminaire Tap Conductors	740-2.05	Y								
Identification Labels	660-3.05	N								
SPLICES:										
Heat Shrink Tubing	See Detail in Plans 660-3.05	Y								
Electrical Tape	See Detail in Plans 660-3.05	Y								
Power Cable Splice Kit (Lighting)	See Detail in Plans 660-3.05	Y								
Double Fuse Connector Kits (Lighting)	See Detail in Plans 740-2.07	Y								
Fuses for Double Fuse Connector Kits	See Detail in Plans 740-2.07	Y								
661 ELECTRICAL LOAD CENTERS										
FOUNDATIONS:										
Type 1A Foundations	Std. Dwgs. L-25.01	N								
BONDING & GROUNDING:										
Copper Ground Rod	Std. Dwgs. L-25.01	Y								
Ground Clamps	Std. Dwgs. L-25.01	Y								
#6 or larger Bare Copper Grounding Wire	Std. Dwgs. L-25.01	N								
COMPONENTS IN COMMON:										
Photoelectric Control	661-2.01	Y								

SECTION 660/661/669/740 MATERIALS CERTIFICATION LIST (Updated 01/01/2021)

Item	2020 Specifications	Third Party Listing or Labeling Required? (Y/N)	Acceptance By:							Remarks
			Construction			Design			Statewide	
			Project Engr		QA/ Matls Engr	Design Engr	Bridge Engr	Traffic Engr	State Materials Engineer	
				QPL						
1-5C#14	661-3.01	Y								
Contactors	661-2.01	Y								
Multi-Pole Contactor for Type 1A Ld Ctr	661-2.01	Y								
Load Panel	661-2.01	Y								
Neutral Bus Bar System	661-2.01	Y								
Ground Bus Bar System	661-2.01	Y								
Meter Socket	661-2.01	Y								
Manual Circuit Closing Device	661-2.01	Y								
Circuit Breakers	661-2.01	Y								
Galvanized Rigid Metal Conduit	661-2.01	Y								
LOAD CENTER ASSEMBLIES:										
Type 1A	661-2.01	Y								
662 FIBER OPTIC SIGNAL INTERCONNECT SYSTEM										
Polyethylene Duct System	662-2.02 / 740-2.06	N								
HDPE to RMC Coupling	662-2.02	N								
Electrofusion Coupling	662-2.02	N								
Fiber Optic Cable	662-2.03	N								
Fiber-Optic Drop Cable	662-2.04	N								
Identification Labels	660-3.05	N								
Duct Sealant	662-2.06	N								
SPLICES										
End-To-End Splices	662-3.08	N								
Fusion Splices	662-3.08	N								
Drop Fiber Splices	662-3.08	N								
Splice Closures	662-3.10	N								
Fiber Optic Vaults/Manholes	662-2.06 Detail in Plans	N								
Electronic ball marker/Locator bauble	662-2.06 / 740.2.24	N								
Concrete Mix Design	660-2.01	N								
Curing Materials	711-2.01	N								
Reinforcing Steel	709-2.01	N								
Vault/Manhole Frame/Cover	662-2.06 Detail in Plans	N								
Tinned Copper Braided Manhole Lid Grounding Strap	662-2.06	N								

SECTION 660/661/669/740 MATERIALS CERTIFICATION LIST (Updated 01/01/2021)

Item	2020 Specifications	Third Party Listing or Labeling Required? (Y/N)	Acceptance By:							Remarks
			Construction			Design			Statewide	
			Project Engr		QA/ Matls Engr	Design Engr	Bridge Engr	Traffic Engr	State Materials Engineer	
				QPL						
669 AUTOMATIC VEHICLE CLASSIFICATION										
JUNCTION BOXES: (from Manufacturers on APL)										
Type II	See Detail in Plans 660-2.01 709-2.01 711-2.01	N								
JUNCTION BOXES: (from Manufacturers NOT on APL)										
Type II	See Detail in Plans 660-2.01 709-2.01 711-2.01	N								
Concrete Mix Design	660-2.01 550-2.02	N								Special Provision
Curing Materials	711-2.01	N								
Reinforcing Steel	709-2.01	N								
Junction Box Cover	See Detail in Plans 660-3.04	N								
Ground Wire from Bushing to Cover	660-3.04	N								
CONDUIT / LOOPS:										
Galvanized Rigid Metal Conduit	740-2.06, 660-3.03	Y								Special Provision
Galvanized Couplings	740-2.06	Y								
Galvanized Split Couplings	740-2.06	Y								
Galvanized Elbows	740-2.06	Y								
Galvanized Nipples	740-2.06	Y								
Bore Casing	660-3.03	N								Special Provision
Underground Marker Tape	660-3.03	N								Special Provision
Pull Rope	660-3.03	N								Special Provision
Schedule 80 PVC Conduit (Loops)	740-2.06	Y								
PVC Fittings & Adapters (Loops)	740-2.06	Y								

SECTION 660/661/669/740 MATERIALS CERTIFICATION LIST (Updated 01/01/2021)

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			Construction			Design			Statewide	
			Project Engr		QA/ Matls Engr	Design Engr	Bridge Engr	Traffic Engr	State Materials Engineer	
				QPL						
Type "X" Conduit Bodies with Covers, Gaskets & Plugs (Loops)	See Detail in Plans	Y								
BONDING & GROUNDING:										
Copper Ground Rod	See Detail in Plans 660-3.06	Y								Special Provision
Grounding Bushings	660-3.06	Y								Special Provision
Ground Rod Clamps	660-3.06	Y								Special Provision
#6 & 8 Bare Copper Ground Wire	660-3.06	N								Special Provision
Braided Copper J-Box Lid Bonding Wire	660-3.06	Y								Special Provision
CONDUCTORS / CABLES:										
1C#14 Detector Loops	Plans, 660-3.05, 740-2.05	Y								
2 C#14 Temperature Sensors	Plans, 669-2.06, 740-2.05									Special Provision
RG58 COAX Piezoelectric Sensors	Plans, 669-2.01, 669-3.07									Special Provision
6pr#18 Loop Lead-in Cable	Plans, 660-3.05, 740-2.05	Y								
CONTROLLER CABINET										
Style CBA2 Cabinet	740-2.11 669-2.01	Y								Special Provision
Terminal Blocks:	669-2.02	Y								Special Provision
Transient Voltage Surge Protection	669-2.02	Y								Special Provision
Interior Light	669-2.02	Y								Special Provision
Cooling Fan	669-2.02	Y								Special Provision
Thermostatically Controlled Outlet	669-2.02	Y								Special Provision
Heater	669-2.02	Y								Special Provision
Thermostat	669-2.02	N								Special Provision
SPLICES										
Overlap Type Crimp Connector	660-3.05	Y								
Heat Shrink Tubing	660-3.05	Y								

SECTION 660/661/669/740 MATERIALS CERTIFICATION LIST (Updated 01/01/2021)

Item	2020 Specifications	Third Party Listing or Labeling Required? (Y/N)	Acceptance By:							Remarks
			Construction			Design			Statewide	
			Project Engr		QA/ Matls Engr	Design Engr	Bridge Engr	Traffic Engr	State Materials Engineer	
				QPL						
Electrical Tape	660-3.05	Y								
DATA LOGGERS AND TEMPERATURE SENSORS										
Data Logger	669-2.06	N								Special Provision
Ground Temperature Probe (TP)	669-2.06	N								Special Provision
Ambient Air Temperature Sensor (TA)	669-2.06	N								Special Provision
Solar Radiation Shield	669-2.06	N								Special Provision
Temperature Data Probe (TG)	669-2.06	N								Special Provision
ADDITIONAL COMPONENTS										
Piezoelectric Sensor	669-2.01	N								Special Provision
AS475 methyl grout for sensor	669-2.01	N								Special Provision
Cellular Modem	669-2.03	N								Special Provision
Remotely Controllable Code Operated Switch	669-2.05	N								Special Provision
Automated Vehicle Classification (AVC) Counter	669-2.04	N								Special Provision
ADDITIONAL MATERIALS										

APPENDIX C

EROSION AND SEDIMENT CONTROL (ESCP)

Erosion and Sediment Control Plan

For

Old Steese Highway Reconstruction

Z624870000

Fairbanks, Alaska

Alaska Department of Transportation & Public Facilities
Northern Region
2301 Peger Rd
Fairbanks, Alaska 99709

ESCP Preparation Date: October 2022

The following Erosion and Sediment Control Plan (ESCP) has been prepared by the Alaska Department of Transportation and Public Facilities (DOT&PF) to assist bidders in successfully planning their construction means and methods to comply with the Alaska Construction General Permit (ACGP), United States Army Corps of Engineers (USACE) 404/10 Permit, Alaska Department of Environmental Conservation (ADEC) 401 Water Quality Certification, and other permits associated with this project. This document is not intended to be all inclusive of the best management practices (BMPs) that will be required to reduce the potential for sediment discharge during construction and comply with permit conditions or construction specifications. This ESCP is intended to guide contractors during the bidding process and assist in the preparation of the contractor's Storm Water Pollution Prevention Plan (SWPPP) that must be approved prior to commencing construction after award. The contractor is responsible for the risk assessment analysis, planning, preparation and implementation of the SWPPP.

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SECTION 1 - GENERAL INFORMATION

1.0 PERMITTEE (5.3.1)

The Department of Transportation & Public Facilities (DOT&PF) will be a permittee for the project. Upon the approval of the contractor's Storm Water Pollution Prevention Plan (SWPPP) by DOT&PF, the contractor will be required to submit a Notice of Intent (NOI) and obtain permit coverage as an operator. The contractor's contact information, as well as contact information for all subcontractors must be included in the contractor's SWPPP. All subcontractors will be required to sign a certification (DOT&PF Form 25D-105) demonstrating they have read the Alaska Construction General Permit (ACGP), the contractor's SWPPP, and will adhere to their terms and conditions.

1.1 Operator(s)/Contractor(s)

Insert Company or Organization Name
Insert Name
Insert Address
Insert City, State, Zip Code
Insert Telephone Number
Insert Fax/Email

The contractor has day-to-day operational control over activities in the field, including subcontractors and implementation of the SWPPP.

Alaska Department of Transportation and Public Facilities, Northern Region
Joseph P. Kemp, P.E.
2301 Peger Road
Fairbanks, Alaska 99709
907-451-2210
Joseph.kemp@alaska.gov

DOT&PF has operational control over construction plans and specifications, including the ability to make modifications and ensure compliance with the SWPPP.

3.0 PROJECT INFORMATION (5.3.3)

3.1 Project Information

Project/Site Name: **Old Steese Highway Reconstruction**

Project State Number/Federal Number: **Z624870000**

Project Street/Location: **Old Steese Highway – 3rd Street to Johansen Expressway**

City: **Fairbanks** State: **Alaska** Zip Code: **99701**

Borough or Subdivision: **Fairbanks North Star Borough**

Latitude/Longitude: **64º 51' 04" N, -147º 41' 37" W**

Method for determining latitude/longitude:

Old Steese Highway Reconstruction Design Study Report (DSR)

3.2 Project Site-Specific Conditions (5.3.3)

Mean annual precipitation based on nearest weather station (inches):

The nearest weather station is COLLEGE OBSY, ALASKA (502107), which receives a mean annual precipitation of **12.35 inches** per year. Copies of precipitation data for the weather station from the Western Region Climate Center website (https://wrcc.dri.edu/summary/Climsmak.html) is included in Appendix D.

Size of the 2-yr, 24-hr storm event (in inches):

The project can expect a 2-year, 24-hour storm event of **1.09 inches** based on the FAIRBANKS F.O. (10-0215) weather station. Copies of storm event data from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 website (http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_ak.html) is included in Appendix D.

Soil Type(s) and Slopes:

According to the Old Steese Highway Reconstruction DSR, which is based on the Geotechnical Memorandum completed during the original scoping of this project, soils north of Trainor Gate Road consist of one to five feet of gravel on top of layers of silty sands. The groundwater table is approximately 15 feet deep. Permafrost is also present at depths between 8 and 40 feet below the ground surface. Since no geotechnical investigation was performed south of Trainor Gate Road, these soil conditions are assumed for the entire project area.

Landscape Topography:

The landscape topography of the project is located in an urban setting and is characterized as flat.

Drainage Patterns:

Existing drainage for Stage 1 has stormwater flow discharging into the surrounding grass and municipal separate storm water system (MS4) whereas Stage 2 has stormwater flow primarily discharging into the MS4.

The proposed drainage system for Stage 1 and 2 will have stormwater flow discharging into the MS4 and proposed drainage basins. One drainage system is located across Trainor Gate Road whereas the other two are located one on each side of Seekins Drive.

Type of Existing Vegetation:

Due to the urban location of the project, existing vegetation is limited within the project area. ROW vegetation predominantly consists of grass with intermittent birch, spruce and alder trees.

Approximate Growing Season:

According to the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Alaska Region (Version 2.0), the project is located in the Interior Forested Lowlands and Uplands ecoregion which has an approximate growing season of **May 3** through **October 3**. A copy of growing season data from the manual is included in Appendix D.

Seeding Dates:

According to Section 618 of the project specifications, seeding shall be performed between **May 15** to **August 15**. Written approval must be obtained from the Project Engineer for seeding to take place outside of this specified timeframe.

Fall Freeze-Up and Spring Thaw Dates:

Based on the Fall 'Freeze' Probabilities and Spring 'Freeze' Probabilities for the weather station closest to the project, COLLEGE OBSY, ALASKA (502107) estimates that the **fall freeze-up date is October 5**, and the estimated **spring thaw date is May 5**. Winter shutdown may start on or after October 19 (14 days after the anticipated fall freeze date). Inspections shall resume on or before April 14 (21 days prior to the anticipated spring thaw date). Copies of Fall 'Freeze' Probabilities and Spring 'Freeze' Probabilities from the Western Region Climate Center website (https://wrcc.dri.edu/coopmap/) is included in Appendix D.

The inspections will be conducted jointly with Department personnel as directed by the Project Engineer. The schedule for site inspections will be established and updated daily as necessary to meet the requirements of the ACGP and provide the department with notice and opportunity to participate in the site inspection.

Clearing Window:

According to the U.S. Fish & Wildlife Service's (USFWS) Construction Advisory for Protecting Migratory Birds/Land Clearing Guidance for Alaska (July 2009), vegetative clearing should be avoided from **May 1** to **July 15** to minimize impacts to migratory birds. Any clearing for this project will be conducted in accordance with the Migratory Bird Treaty Act, 16 U.S.C. 703.

Fish Window:

According to the Alaska Department of Fish & Game (ADF&G) Fish Resource Monitor website, the anadromous bodies of water on or near the project limits are the Noyes Slough and Chena River. Chinook salmon are present in the Noyes Slough whereas Chena River is home to chinook salmon, chum salmon, and arctic lampreys. Due to the limited nature of this project, a Fish Habitat permit is not required.

Historic site contamination evident from existing site features and known past usage of the site:

A search of the Alaska Department of Environmental Conservation (ADEC) Contaminated Sites Program Database in June 2022 yielded **twelve (12)** sites that are currently active, and **eight (8)** sites that are marked as cleanup complete with institutional controls. The table below summarizes contaminated sites that are active or have institutional controls. Appendix A contains a map showing these contaminated sites and their proximity to the project limits.

Site Name	Hazard ID	Location	Status
Seekins Ford-Lincoln-Mercury	24445	1625 Seekins Ford Drive, Fairbanks, AK 99701	Active
Seekins Ford Injection Well	2328	1625 Seekins Ford Drive, Fairbanks, AK 99701	Active
NC Machinery Company	24295	730 Old Steese Hwy, Fairbanks, AK 99701	Active
NC Machinery Steese Hwy UHOT	3680	730 Old Steese Highway, Fairbanks, AK 99701	Active
VIP Cleaners	26475	510 Old Steese Highway, Fairbanks, AK 99701	Active
Bentley Mall East Satellite	4033	32 College Road, Fairbanks, AK 99701	Active
229 3rd Street	4134	229 3rd Street, Fairbanks, AK 99701	Active
Steese Mall	25767	201 Old Steese Highway, Fairbanks, AK 99701	Active
US Travel Systems, Former	24310	230 Old Steese Hwy, Fairbanks, AK 99701	Active
ADOT&PF Front Street Right of Way	27711	Front Street Right of Way; Off NW corner of Wendel Ave Bridge, Fairbanks, AK 99707	Active
FNSB - Nordale Elementary School HOT	4131	20 Eureka Avenue, Fairbanks, AK 99701	Active
Commercial Property - 48 College Road	27022	48 College Road, Fairbanks, AK 99701	Active
Home Depot Fairbanks	3822	1600 Block Old Steese Hwy, Fairbanks, AK 99701	Cleanup Complete - Institutional Controls

Fred Meyer Fairbanks	4098	930 Old Steese Hwy, Fairbanks, AK 99701	Cleanup Complete - Institutional Controls
Tesoro - Northstore #103	24149	527 Old Steese Highway, Fairbanks, AK 99701	Cleanup Complete - Institutional Controls
Bentley Mall Complex USTs	3681	32 College Road, Fairbanks, AK 99701	Cleanup Complete - Institutional Controls
Bentley Trust Property Tax Lot 221	3961	19 College Road, Fairbanks, AK 99701	Cleanup Complete - Institutional Controls
Holiday Station Store #618, formerly Williams Express Store #5018	23796	205 3rd Street, Fairbanks, AK 99701	Cleanup Complete - Institutional Controls
Northside Grocery & Gas Property	24264	140 Minnie Street, Mailing address is 138 Minnie Street, Fairbanks, AK 99701	Cleanup Complete - Institutional Controls
Residence - Ina Street Overfill	3236	239 Ina Street, Fairbanks, AK 99701	Cleanup Complete - Institutional Controls

Additional information about these sites is available on the ADEC Division of Spill Prevention and Response website: https://dec.alaska.gov/spar/csp.aspx.

4.0 NATURE OF CONSTRUCTION ACTIVITY (5.3.4)

4.1 Scope of Work

The Proposed Action for the project has been separated into two segments:

Stage 1: Full roadway reconstruction between Kutter Road and the Johansen Expressway. Project improvements include:

- Widening the roadway by the addition of one northbound and one southbound through lane north of Kutter Road.
- 4-foot wide paved shoulders.
- Adding 7-foot wide sidewalks to both sides of the road.
- Installing a new traffic signal at the Fred Meyer Drive/Blair Road intersection.
- Signal upgrades at the Helmericks Avenue/Seekins Drive and Johansen Expressway intersections.
- Upgrade the street lighting to meet current design standards.
- Drainage and storm drain improvements.
- New signs.
- Re-paving the road.

Stage 2: Pulverize and re-pave the road between 3rd Street and Kutter Road. Existing sidewalks and curb and gutter will remain (not be replaced). Project improvements include:

- New signs.
- Re-paving the road.
- Re-striping the road to add 4-foot wide paved shoulders.

4.2 Project Function (5.3.4.1)

The purpose of this project is to improve operations, capacity (reduce delay), and safety for motorists, pedestrians, bicyclists traveling through the Old Steese Highway corridor.

4.3 Support Activities (As Applicable)

Support Activity	Location	Dedicated	
		Yes	No
Concrete Batch Plant	N/A – Batch plant won't be dedicated to project.	☐	☑
Asphalt Batch Plant	N/A – Batch plant won't be dedicated to project.	☐	☑
Equipment Staging Yards	N/A – Equipment staging yards won't be dedicated to project.	☐	☑
Material Storage Areas	Contractor will designate material storage area.	☑	☐
Excavated Material Disposal Areas	N/A – Disposal area won't be dedicated to project.	☐	☑
Borrow Areas	N/A – Borrow won't be dedicated to project.	☐	☑

4.5 Size of property and total area expected to be disturbed (5.3.4.3)

The following are estimates of the construction site:

Description	Number	Remarks
Total project area:	**13.0** acres	Area within ROW.
Construction-site area to be disturbed:	**12.7** acres	Total disturbed area includes proposed pavement, sidewalks, pavement patches, rock mulch locations, and topsoil and seeding areas.
Percentage impervious area BEFORE construction:	**72** %	
Runoff Coefficient BEFORE construction:	**0.30**	
Percentage impervious area AFTER construction:	**83** %	
Runoff coefficient AFTER construction:	**0.30**	

The values shown in the table above were calculated with the information available at the time of the final design. The contractor's values will be different due to staging areas, batch plants, material stockpiles, etc. A weighted "C" from the Rational Method was used to calculate the Runoff Coefficient, with coefficient values of 0.83 and 0.30 for impervious and pervious surfaces, respectively. If a discrepancy is found, contact the Project Engineer to request further information.

4.6 Size of property and total area expected to be disturbed (5.3.4.3):

Potential sources of sediment to storm water runoff:

Construction materials and activities that have the potential to contribute sediment pollutants to storm water runoff originating on-site, include:

Source	Storm Water Pollutants	Location
Excavation/Backfilling/Grading	Silt, Sand, Gravel, Organic Soil	Within the project limits and areas disturbed by construction activity
Paving	Sand, Gravel	Within project limits and areas or paving operations
Stockpiles	Silt, Sand, Gravel	Within the general construction staging area and areas of excavation & fill activities
Vehicle Tracking	Silt, Sand, Gravel, Organic Soils	At project exits

Potential pollutants and sources, other than sediment, to storm water runoff:

Construction materials that have the potential to contribute pollutants other than sediment to storm water runoff originating on-site, include:

Trade Name Material	Storm Water Pollutants	Location
Diesel Fuel/Gasoline/Hydraulic Oil/Lubricants	Petroleum distillate, oil, grease, naphthalene, xylene	Within the project limits and material staging areas
Coolant	Ethylene Glycol, heavy metals (copper, lead, zinc)	Within the project limits and material staging areas
Sanitary Toilet	Fecal Coliform	General construction staging area
Fertilizer	Nitrogen, Phosphorus	Areas requiring seeding operations
General Site Litter	Paper, Plastic	Within the project limits and at material staging areas
Paving/Recycled Asphalt Pavement (RAP)	Petroleum distillate, oil	Within project limits and areas of surface improvements
Portland Cement Concrete (P.C.C.)/Grout	Limestone, sand, pH, chromium	Within the project limits and at concrete wash-out areas

No pollutant sources from areas other than construction have been identified for this project.

5.0 SITE MAPS (5.3.5)

See Q-sheets and site maps in Appendix A

SECTION 2 – COMPLIANCE WITH STANDARDS, LIMITS, AND OTHER APPLICABLE REQUIREMENTS DOCUMENTATION OF PERMIT ELIGIBILITY RELATED TO TOTAL MAXIMUM DAILY LOADS (3.2, 5.6)

A search of the "Alaska's Final **2020** Integrated Water Quality Monitoring and Assessment Report" found listings and impairments for the **Noyes Slough**.

The Noyes Slough was placed in Category 4a by the ADEC for debris and petroleum hydrocarbons.

7.1 Identify Receiving Waters (5.3.3.3)

Description of receiving waters:

Chena River

The Chena River is a Tanana River tributary flowing approximately 100 miles from the White Mountains through interior Alaska. Chena River is known to provide habitat for chum and chinook salmon and arctic lampreys. Chena River is located approximately 350 feet from the southern end of the project and receives discharge from the Old Steese Highway storm drain system located between 2nd Street and the Wendell Avenue bridge.

AWC No.: 344-40-11000-2490-3301

Noyes Slough:

The Noyes Slough is a tributary to Chena River, located approximately 350 feet northwest of the southern end of the project. It is home to chinook salmon. The Noyes Slough receives discharge from the project's storm drain systems located between Trainor Gate Road and 3rd Street.

AWC No.: 334-40-11000-2490-3301-4015

Unnamed Wetlands: A large wetland complex is located approximately 800 feet north of the project terminus. The wetlands are classified as freshwater forested/shrub and freshwater emergent wetlands. These wetlands are not anticipated to receive runoff from the project since drainage patterns within the project area promote southerly drainage.

Outstanding Natural Resource Waters (2.1.6):

> The ADEC must be consulted, at least 30 days prior to construction activities, when determining requirements for water quality analysis on all projects that meet the following:
>
> - Will or may discharge storm water to a Tier 3 water body, also known as Outstanding Natural Resource Waters (ONRW).
>
> No ONRW are designated in Alaska as of the date of this document.

Description of storm sewer and/or drainage systems:

The two existing storm sewer systems plus a new additional system are proposed to collect and convey runoff from the project area. These systems will be part of the Fairbanks Municipal Separate Storm Sewer System (MS4). The storm sewer systems are composed of a network of corrugated HDPE pipes, storm drain manholes, and curb inlet catch basins. North of Trainor Gate Road, a proposed HDPE pipe will convey stormwater south towards a drainage basin adjacent to the Trainor Gate Road railroad. The two existing storm sewer systems, from Trainor Gate Road to 3rd Street and from 2nd street to the Wendell Avenue bridge, collect runoff from the project area south.

7.2 Identify TMDLs (5.6.1)

Is an EPA-established or approved TMDL published for the receiving water(s) listed in Section 7.1? **Yes.**

TMDL: Residue in the Waters of Noyes Slough in Fairbanks, Alaska (May 2008) and Petroleum Hydrocarbons, Oils and Grease in the Waters of Noyes Slough in Fairbanks, Alaska (October 2011).

Summary of consultation with state or federal TMDL authorities (5.6.2):

There is potential for storm water runoff to enter the Noyes Slough and/or the Fairbanks MS4. To combat this with best efforts, temporary erosion control and stabilization measures will be in place during construction activities to mitigate the effects on sediments and soil beyond the immediate construction site. These Best Management Practices (BMPs) used during this project will be submitted prior to construction, if necessary, in addition to being detailed within the Erosion and Sediment Control Plan (ESCP) and the Storm Water Pollution Prevention Plan (SWPPP) as well.

Measures taken to ensure compliance with TMDL (5.6.3): N/A

8.0 DOCUMENTATION OF PERMIT ELIGIBILITY RELATED TO ENDANGERED SPECIES (3.3, 5.7)

8.1 Information on endangered or threatened species or critical habitat (5.7.1)

Are endangered or threatened species and critical habitats on or near the project area?

☐ Yes ☒ No

Describe how this determination was made:

According to the States Project Environmental Form approved on September 14, 2017, no endangered or threatened species and critical habitats are on or near the project. A copy of the document is located in Appendix D.

Will species or habitat be adversely affected by storm water discharge (5.7.2)?

☐ Yes ☒ No

9.0 APPLICABLE FEDERAL, STATE, TRIBAL, OR LOCAL REQUIREMENTS (4.15)

Permittees must ensure that the storm water control measures implemented at the site are consistent with all applicable federal, state, tribal, or local, requirements for soil erosion control and storm water management.

The project will comply with all applicable Federal, state, local, and tribal requirements for soil erosion control and storm water management. The contractor will be responsible for obtaining all necessary permits and clearances for material and disposal sites, and/or equipment storage areas in accordance with the ACGP for Storm water Discharges from Construction Activities.

Projects with boundaries encompassed within or intersecting Public Water System (PWS) Drinking Water Protection Area(s) (DWPA), and Provisional Protection Area(s) shall abide by the requirements set forth under Section 4.10 of the ACGP. These requirements include:

1.) Notifying the appropriate PWS contact of construction activity;

2.) Within the DWPA, restrict activities that may significantly impact natural surface water drainage or groundwater gradient; and,

3.) Immediately notify the PWS of any potential contaminants, such as spills or excess erosion.

The project boundary intersects **one (1)** Public Water System (PWS) Drinking Water Protection Area(s) (DPWA) and **zero (0)** Provisional Protection Area(s). Prior to construction activities, the DOT&PF Project Engineer on behalf of both permittees, will notify the PWS contact by whichever communication method – either email or telephone – is most expedient.

The intersecting DWPAs ID numbers (PWSID) with contact information are:

Water System Name	PWSID	Contact Name	Phone #	Address	Email
Golden Heart Utilities	AK2310730	Bernie Stack	(907) 455-0117	P.O. Box 80370, 3691 Cameron St. Suite 201, Fairbanks, AK 99701	Bernie@akwater.com

Appendix A contains a map showing the location of the intersected DWPA and the Provisional Protection Area within the project boundaries.

10.12 Dewatering (4.4)

Will dewatering be conducted during construction?

☐ Yes ☒ No

Will excavation dewatering be conducted within 1,500 feet of a ADEC mapped contaminated site found on the following website?

☐ Yes ☒ No

http://www.arcgis.com/home/item.html?id=315240bfbaf84aa0b8272ad1cef3cad3

If YES to either question above, then describe BMPs below that comply with the CGP and the ADEC Excavation Dewatering General Permit (AKG002000). If a NOI for coverage under the excavation dewatering permit is submitted, attach it and ADEC's response in Appendix D of the SWPPP with a copy of the permit. **N/A**

12.0 MONITORING PLAN (IF APPLICABLE) (5.5; 7.0)

12.1 Determination of Need for Monitoring Plan

Is there an EPA-established or approved TMDL for the listed receiving waters in Section 2?

Yes. The Noyes Slough has an approved TMDL for residue in 2008 and for hydrocarbons, oils, and grease in 2011.

Is the receiving water listed as impaired for turbidity and/or sediment?

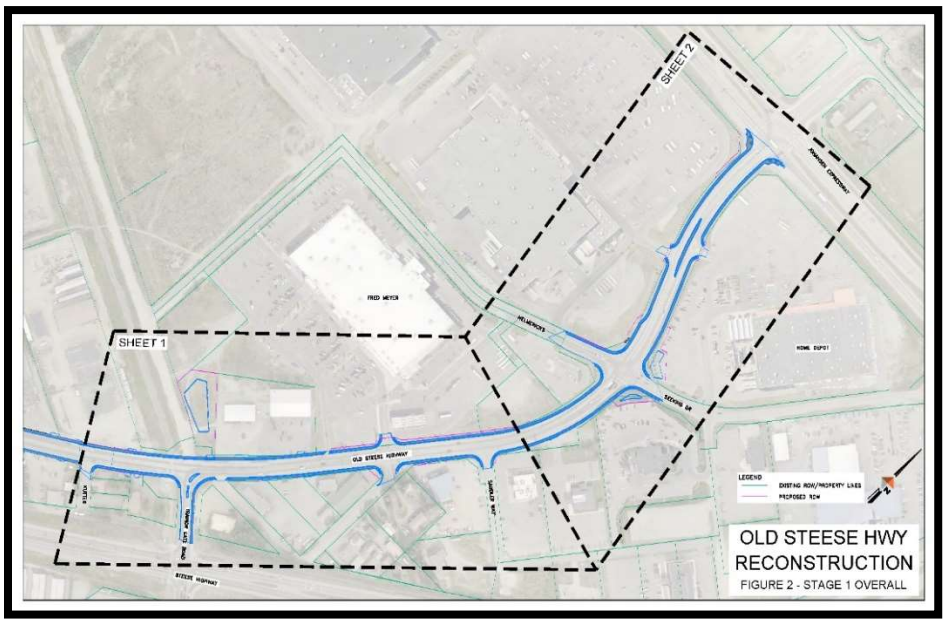
No. The sediment standard impairment will be reviewed by the ADEC to be either addressed in a separate TMDL document or be delisted.

APPENDIX D

QUALITY ASSURANCE PROJECT PLAN (QAPP)

DRAFT QUALITY ASSURANCE PROJECT PLAN
OLD STEESE HIGHWAY RECONSTRUCTION
FAIRBANKS, ALASKA

JUNE 17, 2022



Prepared for:

State of Alaska Department of Transportation and Public Facilities
2301 Peger Road
Fairbanks, Alaska 99709

Prepared by:

NORTECH

NORTECH **Managing Office**	**Approval Names and Titles**	**Signature**	**Date**
2400 College Road **Fairbanks**, AK 99709 p. 907.452.5688 f. 907.452.5694	DEC Program Manager Jim Fish		
	DOT&PF Design Project Manager Russell Johnson, PE		
	DOT&PF Construction Manager David Arvey, PE		
	NORTECH Program Manager Peter Beardsley, PE		

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ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
°F	degrees Fahrenheit
AAC	Alaska Administrative Code
AMSL	above mean sea level
AOC	Area of Contamination
ARRC	Alaska Railroad Corporation
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, xylenes
COC	contaminant of concern
CVOC	chlorinated volatile organic compound
cy	cubic yard
DEC	Alaska Department of Environmental Conservation
DOT&PF	Alaska Department of Transportation and Public Facilities
DRO	diesel range organics
EPA	US Environmental Protection Agency
ESA	Environmental Site Assessment
eV	electron Volt
FSG	January 2022 DEC *Field Sampling Guidance*
GRO	gasoline range organics
HAZWOPER	Hazardous Waste Operations and Emergency Response
mg/kg	milligrams per kilogram
PCE	tetrachloroethene
PHC	petroleum hydrocarbon
PID	photoionization detector
POL	Petroleum, Oil, and Lubricants
PPE	personal protective equipment
ppm	part per million
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
QEP	Qualified Environmental Professional
RCRA	Resource Conservation and Recovery Act
ROW	right of way
RRO	residual range organics
SSHSP	Site Specific Health and Safety Plan
TCLP	Toxicity Characteristic Leaching Procedure
UST	underground storage tank
UTAA	utility trench agreement area
VOC	volatile organic compound

PROJECT ORGANIZATION

The following list provides the roles/duties of each organization that is involved in the implementation of this Quality Assurance Project Plan. This identifies the approving authority for this QAPP and associated field program. This QAPP will be considered approved when owner and regulatory agency comments have been addressed and the QAPP cover page has been signed.

Design, Construction, and Regulatory Entities

Organization	Roles/Duties
DOT&PF 2301 Peger Road Fairbanks, AK 99709 Russell Johnson, PE Email: russell.johnson@alaska.gov Phone: (907) 451-5059	**Design Project Manager/Owner's Representative** • Provide review of technical documents • Provide approval of scope of work and contracting documents to DOT&PF Procurement
DOWL, Inc. 3535 College Rd. Suite 100 Fairbanks, AK 99709 Gary Jenkins, PE Email: gjenkins@dowl.com Phone: (907) 374-0275	**Prime Design Consultant** • Develop and coordinate project design with consultants and agencies • Provide project management coordination
DOT&PF 2301 Peger Road Fairbanks, AK 99709 Dave Arvey, PE Email: david.arvey@alaska.gov Phone: (907) 451-2621	**Construction Manager** • Manage project during construction • Provide project management coordination between Contractors and Designers • Transmit Interim and Final Reports to ***NORTECH*** and DEC (and EPA as needed)
NORTECH, Inc 2400 College Road Fairbanks, AK 99709 Peter Beardsley, PE Email: peter.beardsley@nortechengr.com Phone: (907) 452-5688	**Environmental Consultant** • Develop design documents (plans, specifications, and estimates) for project • Provide agency coordination and guidance to design team and owner • Provide review of Daily, Interim, and Final Reports
DEC Division of Spill Prevention and Response Contaminated Sites Program 610 University Avenue Fairbanks, AK 99709 James Fish Email: james.fish@alaska.gov Phone: (907) 451-2117	**State Regulatory Approval** • Provide review of technical documents in accordance with State of Alaska regulations and guidance related to the project • Provide review and approval of Interim and Final Reports (existing contaminated sites)

Design, Construction, and Regulatory Entities (continued)

DEC Prevention, Preparedness, and Response Program Division of Spill Prevention and Response 610 University Avenue Fairbanks, AK 99709 Kimberly Maher Email: kimberly.maher@alaska.gov Phone: (907) 451-2124	**State Regulatory Approval** • Provide oversight coordination on newly reported spills and newly detected contamination. • Provide review of technical documents in accordance with State of Alaska regulations • Provide review and approval of Interim and Final Spill/Cleanup Reporting (new sites)
United States Environmental Protection Agency Land, Chemicals, and Redevelopment Division 1200 Sixth Avenue, Suite 155, M/S 15-H04 Seattle, WA 98101 Dave Bartus Email: bartus.dave@epamail.epa.gov Phone: (206) 553-2804	**Federal Regulatory Approval** • Provide review of technical documents in accordance with EPA regulations and guidance related to the project • Provide review and approval of Interim and Final Report

The following table is to be completed as the information becomes available.

SIGNATURES ARE REQUIRED

Organization	Roles/Duties
Project Manager: Email: Phone: On-site QC/Superintendent: Email: Phone:	**Prime Construction Contractor** ▪ Construct project
Project Manager: Email: Phone: On-site QC/Superintendent: Email: Phone:	**Civil/Earthwork Subcontractor** ▪ Under direction of QEP, place segregated soil in designated stockpiles ▪ Construct, maintain and decommission contaminated soil stockpiles
QEP: Email: Phone:	**Environmental Consultant/** **Qualified Environmental Professional** ▪ Implement the QAPP
Project Manager: Email: Phone:	**Analytical Laboratory** ▪ Provide analytical data deliverables

1.0 OVERVIEW

DOT&PF plans to reconstruct the Old Steese Highway from 3rd Street to the Johansen Expressway in Fairbanks, Alaska (Appendix 1, Figure 1). Stage 1 of the project extends from the Johansen Expressway intersection to Kutter Road and is the subject of this document. The project will reconstruct Old Steese Highway including typical section modifications, intersection improvements, and enhanced bicycle and pedestrian facilities. Support objectives include addressing storm water drainage, electrical upgrades, a railroad crossing, and applicable landscaping enhancements. The storm drain system improvements will include new underground storm pipe and manholes, enhanced surface ditches, and new infiltration basins. Right of way (ROW) acquisition will be minimal, but will include area for three infiltration basins up to 0.8 acres in size. Construction of this project is currently planned for 2024.

Excavation on this project will primarily consist of removal of soil for slope and drainage adjustments north of Helmericks Avenue and installation of underground utilities from Helmericks Avenue to the railroad crossing. The deepest excavation will be to about 435 feet above mean sea level (AMSL) in the infiltration basin west of the Old Steese Highway. The deepest excavation within the Old Steese Highway is approximately 12 feet below the existing grade, at Station 44+80 for installation of a storm drain.

The objective of this QAPP is to guide soil characterization and disposal in accordance with the US Environmental Protection Agency (EPA) Resource Conservation and Recovery Act (RCRA) since solvent-contaminated soil may be classified as hazardous waste. This QAPP is also applicable to petroleum-contaminated sites which are regulated by the Alaska Department of Conservation (DEC) under 18 AAC 75 Oil and Other Hazardous Substances Pollution Control Regulations.

This QAPP describes the scope of work and methodology for contaminated soil identification and management during this project. Petroleum- and chlorinated solvent-contaminated soil has been documented at various locations adjacent to the project corridor. Excavations that generate petroleum-contaminated soil will be managed in accordance with this QAPP and the DEC September 2018 “Technical Memorandum: Managing Petroleum-Contaminated Soil, Water, or Free Product during Public Utility and Right-of-Way Construction and Maintenance Projects” (Technical Memorandum). Excess soil that contains chlorinated solvents may require management in accordance with this QAPP in a manner similar to that described in the DEC Technical Memorandum.

This QAPP details the field screening, soil sampling, laboratory analysis, quality assurance (QA) and quality control (QC), and other activities and procedures to be implemented during excavation. The prescribed procedures in the QAPP are intended to identify and segregate potentially contaminated soil from non-impacted soil. Laboratory analytical results will be used to determine applicable disposal requirements for excess soil. Field screening and laboratory analysis of all excess soil is required.

Excess soil with no detected contaminants of concern (COCs) can be disposed without limitations. Excess soil with detected COCs less than cleanup levels will be disposed at an upland, non-environmentally sensitive location. Excess soil that exceeds cleanup levels for only petroleum constituents will be remediated as petroleum contaminated at a DEC-approved facility. Disposal of excess soil that is determined to be RCRA hazardous waste will be coordinated through DEC and EPA.

2.0 BACKGROUND

2.1 Construction Project Summary

DOT&PF plans to reconstruct the Old Steese Highway from 3rd Street to the Johansen Expressway in Fairbanks, Alaska (Appendix 1, Figure 1). Stage 1 of the project extends from the Johansen Expressway intersection to Kutter Road and is the subject of this document. The project will reconstruct Old Steese Highway including typical section modifications, intersection improvements, and enhanced bicycle and pedestrian facilities and connectivity. Support objectives include addressing storm water drainage, electrical upgrades (pole locations, signals, and street lighting), a railroad crossing, and applicable landscaping enhancements. The storm drain system improvements will include new underground storm pipe and manholes, enhanced surface ditches, and new infiltration basins. Right of way (ROW) acquisition will be minimal, but will include area for three infiltration basins up to 0.8 acres in size. Construction of this project is currently planned for 2024.

Excavation on this project will primarily consist of removal of soil for slope and drainage adjustments north of Helmericks Avenue and installation of underground utilities from Helmericks Avenue to the railroad crossing. Other miscellaneous excavation will be for improvements to pedestrian facilities, signal poles, light poles, and other utilities. The deepest excavation will be to about 435 feet above mean sea level (AMSL) in the infiltration basin west of the Old Steese Highway. The deepest excavation within the Old Steese Highway is approximately 12 feet below the existing grade, at Station 44+80 for installation of a storm drain.

While this QAPP includes the signalization for the Alaska Railroad crossing south of Trainor Gate Road, the QAPP does not apply to earthwork within the Alaska Railroad ROW. Work in this area will be contracted by the Alaska Railroad under a separate contract.

In addition, this QAPP does not include Stage 2 of the Old Steese Highway Reconstruction. Stage 2 is limited to resurfacing from Kutter Road to 3rd Street. No excavation is planned as part of the Stage 2 resurfacing work.

2.2 Purpose of This Quality Assurance Project Plan

This QAPP describes the scope of work and methodology for contaminated soil identification and management during this project. Petroleum- and chlorinated solvent-contaminated soil has been documented at various locations adjacent to the project corridor. Excavations that generate petroleum-contaminated soil will be managed in accordance with this QAPP and the DEC September 2018 “Technical Memorandum: Managing Petroleum-Contaminated Soil, Water, or Free Product during Public Utility and Right-of-Way Construction and Maintenance Projects” (Technical Memorandum). Excess soil that contains chlorinated solvents may require management in accordance with this QAPP in a manner similar to that described in the DEC Technical Memorandum that adheres to the EPA Utility Excavation policy memorandum (https://rcrapublic.epa.gov/files/11671.pdf).

This QAPP details the field screening, soil sampling, laboratory analysis, quality assurance (QA) and quality control (QC), and other activities and procedures to be implemented during excavation. The prescribed procedures in the QAPP are intended to identify and segregate potentially contaminated soil from non-impacted soil. Field screening data is collected to segregate and identify soil sample locations for laboratory analysis. Laboratory analytical results will be used to determine applicable disposal requirements for excess soil. This QAPP and the

procedures herein are not intended to delineate or remediate releases of hazardous substances at or beyond the project excavation limits. Known and potential contaminated sites are described in Section 2.3.

2.3 Contaminated Sites and UTAA Locations

NORTECH completed a Phase I Environmental Site Assessment (ESA) of the Old Steese Highway Reconstruction Project corridor. The Phase I ESA identified nearby and adjacent properties with chlorinated solvent or petroleum-related contamination. The Phase I indicates former leaking underground storage tank (UST) sites and other operations (surface releases, floor drains, etc.) impacted these adjacent parcels and may have resulted in the presence of soil and groundwater contaminants within the Old Steese Highway ROW that could be encountered during project excavation activities.

These known and potential contaminated sites are listed in Table 1 and shown in Figure 2. Table 1 lists the sites and project stationing that are considered suspect based on the currently available information. Each of these sites is described in detail in the following subsections. For other nearby sites that are not expected to impact the project, additional information is available in the Phase I ESA, which is available upon request.

For the purpose of this project, contaminants of concern (COCs) are defined as compounds that have been detected in concentrations exceeding DEC soil or groundwater cleanup levels listed in 18 AAC 75.341. Contaminants of concern at these adjacent sites include petroleum hydrocarbons, chlorinated solvents, and chlorinated solvent breakdown products.

Table 1
Known and Potential Contaminated Sites Adjacent to Old Steese Highway Project ROW

Site Name	COCs and Potentially Affected Media	Project Stationing	Feature and Excavation Depth
Former NC Machinery	Petroleum and solvents in soil and groundwater	39+53 to 43+10 (approx.)	Electrical (approx. 4 feet)
Former Army Barracks • Fred Meyer	Petroleum and solvents in soil and groundwater	43+20 (approx.) to 59+40, including Parcel 8	Storm Drain (approx. 12 feet)
Former Tax Lot 201 – Bentley Trust Property • Walmart • Home Depot	Petroleum and solvents in soil and groundwater	59+40 to 70+80	Road Subbase (approx. 5 feet) Signal Pole Foundation (approx. 12 feet)

2.3.1 Former NC Machinery Site (39+53 to 43+10, South of ARRC Tracks)

This site was developed at least as early as 1966, when the site buildings are visible in air photos. NC Machinery operated as a heavy equipment service and rental facility. Operations included steam cleaning heavy equipment and parts, routine maintenance and lubrication, complete tear-downs and rebuilds of major components (including engines and transmissions), and refueling operations at aboveground and former underground storage tanks. In the 1990s, seven underground storage tanks were decommissioned and associated contaminated soil was removed. Three former sump discharge locations, including one injection well, were also closed.

Two areas of residual soil contamination are located under buildings and have contaminated the groundwater in the immediate area. These areas are near the northwest portion of the main shop building and to the northwest. Petroleum hydrocarbons and chlorinated solvents were detected. Diesel range organics (DRO), residual range organics (RRO), and tetrachloroethene (PCE) in soil and groundwater exceeded cleanup levels. Trichloroethene (TCE) was detected in groundwater below its cleanup level. Groundwater was observed at about 15 feet below ground surface (bgs) and flows to the west. Groundwater sampling in 2021 indicated DRO, RRO, 1,2,4- and 1,3,5-trimethylbenzene, *cis*-1,2-dichloroethene, and naphthalene still exceeded cleanup levels. The source areas are located about 300 feet northwest of the Old Steese Highway ROW. In addition, an unregulated 1,000-gallon underground heating oil tank was located about 200 feet northwest of the Old Steese Highway ROW.

The deepest excavation from Station 39+53 to 44+10 during the reconstruction project will be for the electrical utility, which is estimated to be four feet below grade in this area. Specific petroleum or volatile organic compound (VOC) impacts from the former NC Machinery site are not expected in this portion of the project. Field screening of the excavated soil by a QEP is required for this portion of the project as described in Section 6.1. In the event that potential contamination is indicated, based on field screening or visual or olfactory evidence, the stockpiling, reuse criteria, and disposal characterization requirements of this QAPP must be followed. In addition, any excavation below the water table smear zone shall be treated as suspect for petroleum and VOCs and the laboratory sampling and disposal requirements outlined in this QAPP for the COCs will apply.

2.3.2 Former Army Barracks (43+20 to 59+40, ARRC Tracks to Helmericks)

The Fred Meyer store's snow dump is located on the southeast portion of former Tax Lot 201, currently designated as Lot 8A, Bentley Brothers Subdivision 1st Addition. Based on historical aerial photography, Army barracks were located here in the 1950s. Historic uses of the property were also "a storage yard for the Alyeska Pipeline, an RV park, and occasional transient housing." Four areas of DRO soil contamination were discovered in 2004 during site preparation for construction of the Fred Meyer store. One soil sample collected at 20 feet bgs (the depth of the groundwater interface) at the northeast side of the current building contained 1,220 milligrams per kilogram (mg/kg) DRO and 366 mg/kg arsenic, both above DEC cleanup levels. The source area was located about 400 feet northwest of the Old Steese Highway ROW. Detected groundwater contaminants did not exceed cleanup levels.

A barrier system was designed using a portion of the asphalt parking lot as a cap over the relocated contaminated soil. The cap is located in the store's southeast parking lot, southwest of the Fred Meyer gas station. In DEC's 2010 Decision Document, they determined that no further remedial action was required as long as institutional controls were maintained. The "6,417 square feet of former stockpiled soil (with DRO contamination up to 3,450 mg/kg) underneath asphalt cap" is depicted about 40 feet from the Old Steese Highway ROW in the Decision Document site figure.

The deepest excavation from Station 44+10 to 59+40 including the acquired portion of Parcel 8 will be for the storm drain, which is estimated to be 13 feet below grade in this area. Specific petroleum or VOC impacts from the Former Barracks are not expected in this portion of the project. Field screening by a QEP is required for this portion of the project as described in Section 6.1. In the event that potential contamination is indicated, based on field screening or visual or olfactory evidence, the stockpiling, reuse criteria, and disposal characterization

requirements of this QAPP must be followed. In addition, any excavation below elevation the water table smear zone shall be treated as suspect for petroleum and VOCs and the laboratory sampling and disposal requirements outlined in this QAPP for the COCs will apply.

Groundwater may be encountered during period of seasonal high water (typically August). Dewatering is not permitted under this QAPP and a separate dewatering plan, including modifications to this QAPP, is required if dewatering is to be considered for this project.

2.3.3 Former Tax Lot 201 (59+40 to 70+80, Helmericks to Johansen)

Walmart

Lot 5 of the Bentley Brothers Subdivision is part of the northeast portion of Bentley Trust TL-201 and contained the Surfcote building where steel piping received either zinc or epoxy coatings, the POL (petroleum, oil, and lubricants) Facility, and Repair Shop. There are no existing surface structures at these areas; only remnants of associated infrastructure such as buried tanks, pipelines, and utilidors remain. The property has been essentially vacant since the late 1970s. Diesel range organics (DRO) petroleum contamination was associated with the POL Facility piping and operation. Petroleum volatile organic compounds (VOCs) were detected in soil near a 1,000-gallon heating oil tank and 10,000-gallon regulated underground storage tank at the former Surfcote facility. Chlorinated VOCs in soil and groundwater were detected near an injection well system at the Surfcote building, located at the northwest corner of the current Walmart Store.

An air sparging/soil vapor extraction system was installed to remediate groundwater and operated from 2002 to spring 2003, with a substantial reduction in all detected contaminant concentrations. The concentration of 1,1,1-trichloroethane in groundwater was reduced to less than the cleanup level. The site received No Further Action designation in 2004. The former source area on this property is located about 1,000 feet southwest of the Old Steese Highway ROW.

Home Depot

Diesel range petroleum soil and groundwater contamination was associated with former site uses of this portion of TL-201. About 1,500 tons of vadose zone contaminated soil were excavated in 2001, but soil in the smear zone at 15 to 17 feet bgs exceeded the DRO cleanup level. Further cleanup was determined to be impracticable due to its limited extent and the weathered nature of the soil and groundwater contamination. The DRO contaminated soil and groundwater that remains under the Home Depot store building is approximately 15 feet below the ground surface. Associated VOCs did not exceed cleanup levels. The groundwater plume was confirmed to be stable and not migrating. Conditional closure was approved in 2001. The source area is located about 500 feet northeast of the Old Steese Highway ROW.

The Home Depot and Walmart parking lots are adjacent to Station 59+40 to 70+80. The deepest excavation in this portion of the project is expected to be 5 feet bgs for new subbase for the typical section. Smaller areas of excavation to 12 feet bgs will be required for signal pole foundations.

Field screening by a QEP is required for this portion of the project as described in Section 6.1. In the event that potential contamination is observed, the stockpiling, reuse criteria, and disposal characterization requirements of this QAPP must be followed. In addition, any excavation below

the water table smear zone shall be treated as suspect for petroleum and VOCs and the laboratory sampling and disposal requirements outlined in this QAPP for the COCs will apply.

3.0 REGULATORY CONTEXT

The following sections describe the project agency oversight and applicable policies and regulations.

3.1 Alaska Department of Environmental Conservation

The Alaska DEC is the governing agency for work at contaminated sites in Alaska. DEC will be the lead regulatory agency for this project, providing oversight, review, and comment during QAPP development, implementation, and reporting. Should new contamination be identified during project activities, DEC will be notified in accordance with regulatory requirements.

3.1.1 Oil and Pollution Control Regulations and Cleanup Levels

Management of petroleum-related contaminated soil will be conducted under the State of Alaska Oil and Hazardous Substances Pollution Control Regulations (18 AAC 75) which are intended to protect human health and the environment. Soil cleanup levels are specified in 18 AAC 75.341 Table B1 Method Two, Migration to Groundwater cleanup levels. Stockpiling, disposal, and reporting requirements are also presented in these regulations.

3.1.2 Utility Trench Agreement Areas

The ADEC September 2018 Technical Memorandum entitled “Managing Petroleum-Contaminated Soil, Water, or Free Product during Public Utility and Right-of-Way Construction and Maintenance Projects” (Technical Memo) is applicable to contaminated media that may be encountered during construction projects in utility corridors and rights of way. It is applicable to petroleum contaminated soil and water and free-phase petroleum product. DEC is expected to approve the Petroleum Utility Trench Agreement for the petroleum-contaminated sites.

The objectives of the Utility Trench Agreement, as described in the Technical Memo, are to prevent delays in construction activities that encounter petroleum contamination, and to prevent improper management of contaminated media and the migration of contamination. The Technical Memo allows contaminated soil to be returned to excavations from which it was removed as long as it does not present a risk to a public water system. Mixing of excavated contaminated soil with uncontaminated soil is not permitted. Drinking water utility excavation projects may require additional consideration.

3.2 US Environmental Protection Agency

The EPA Region 10 RCRA Hazardous Waste Program is responsible for RCRA regulatory determinations. Former floor drains discharging to the subsurface may be sources of chlorinated solvents and related degradation products in soil and groundwater. Contamination associated with these sites may impact the Old Steese Highway Reconstruction Project. Excess solvent-containing soil generated as part of this project may be subject to regulation under the EPA RCRA Program if it characterized as a hazardous waste.

3.2.1 Area of Contamination Policy

EPA’s Area of Contamination (AOC) policy allows wastes to be consolidated and treated in situ within an AOC without triggering land disposal restrictions or minimum technology requirements. For an AOC to be determined, the contamination within an AOC must be contiguous and of like contamination, but the levels of contamination do not have to be uniform (Summary Chart of

October 14, 1998 Memorandum, “Management of Remediation Waste Under RCRA”, October 15, 1998).

The act of excavating or otherwise disturbing soil that contains potentially hazardous constituents may be considered generation of a hazardous waste. The excavated soil would normally be subject to RCRA regulations regarding containerization, storage, and other permitting requirements for accumulated waste; however, under the EPA AOC policy, movement of soils within defined areas of generally dispersed contamination (such as a defined AOC) can be conducted without being subject to land disposal restrictions and other RCRA requirements.

The project ROW may contain solvent-contaminated soil from floor drains or other sources that may meet one of the criteria to be designated a hazardous waste. If a hazardous waste is identified, DOT&PF will work with EPA to determine the applicability of the AOC policy to these project areas. The AOC policy will allow excavated soil containing chlorinated volatile organic compounds (CVOCs) to be temporarily stockpiled on site then replaced as backfill from its original location under the Utility Trench Agreement described below.

3.2.2 RCRA Contained-In Policy and Utility Trench Agreement

Under EPA’s Contained-In policy, environmental media containing listed hazardous waste or that exhibiting a hazardous characteristic must be managed as hazardous waste. If the concentration of listed hazardous waste/hazardous constituents are below conservative health-based levels based on direct exposure using a reasonable maximum exposure scenario, the EPA may issue a written contained-in determination that the media no longer contains listed hazardous waste, provided the media does not exhibit a hazardous characteristic. Media subject to a contained-in determination do not need to be managed as hazardous waste (Summary Chart of October 14, 1998 Memorandum, “Management of Remediation Waste Under RCRA”, October 15, 1998).

The EPA has a similar policy to that described in the DEC Technical Memorandum for handling of excavated soil that would otherwise be considered hazardous waste during construction in utility corridors and rights of way. Since no RCRA-regulated site has been identified within the project limits at this time, DOT&PF has not requested EPA review of this QAPP.

EPA is not anticipated to object to DOT&PF’s request for a UTAA designation for the Old Steese Highway Reconstruction Project area since the proposed work is consistent with the application of the EPA Utility Excavation Policy (https://rcrapublic.epa.gov/files/11671.pdf).

4.0 PROJECT MANAGEMENT AND COMMUNICATION

4.1 Project Team Organization and Responsibilities

The QAPP will be implemented by a project team consisting of DOT&PF and its consultant, contractors, and subcontractors. General roles and responsibilities are described below. The individuals responsible for implementing the QAPP are listed on the signatures page.

4.1.1 Department of Transportation and Public Facilities

The DOT&PF is the landowner and agency for the construction project. DOT&PF has the ultimate authority and responsibility for implementing the QAPP.

Field reporting will include daily submittals to DOT&PF and ***NORTECH*** by the Contractor's environmental consultant. ***NORTECH*** will review the daily reports. DOT&PF will be listed as the EPA generator of hazardous waste responsible for signing the Hazardous Waste Manifest required under 40 CFR 262.20.

4.1.2 Environmental Consultant

NORTECH is DOT&PF's consultant on this project. ***NORTECH*** will provide field oversight of the contractor's environmental consultant during excavation in UTAAs and review of the QEP's submittals. ***NORTECH*** will also communicate with other agencies at the request of DOT&PF.

4.1.3 Prime Contractor

Services contracted directly to DOT&PF include earthwork, utility installation, paving, etc. DOT&PF will retain authority and responsibility for its contractors. The Contractor's Site Safety Officer should have a proficient level understanding of the hazards of petroleum and chlorinated solvent exposure and provide worker safety training.

The prime contractor will establish stockpile areas for clean, suspected, and contaminated soil. All stockpiles will be labeled to be visible to the equipment operators. Stockpile construction and maintenance will be the responsibility of the prime contractor. The prime contractor will perform decontamination of equipment working in the UTAAs, under the direction of its environmental consultant. The prime contractor will instruct its employees to avoid disturbing the UTAAs until the planned excavation is to occur.

4.1.4 Prime Contractor's Environmental Consultant

The prime contractor's environmental consultant will perform field screening and sampling as described in this QAPP. Sampling activities for this project will be conducted by a qualified environmental professional under 18 AAC 75.3339(b).

Each Qualified Environmental Professional (QEP) who will work in the field during this project must meet the minimum qualifications of a media specialist as defined in the project specifications (Section 802). Each QEP shall have current Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) training. The QEP must be proficient in photoionization detector (PID) field screening and analytical sampling methods. The operating procedures and QC methods for each specified piece of field equipment should be reviewed prior to use in the field. Certifications are not required to operate the project-specified sampling equipment.

The QEP will be responsible for the following:

- Field screening and analytical sampling of excess soils
- Transmitting daily field reports to DOT&PF and ***NORTECH***
- Providing data quality review of analytical data
- Overseeing construction and labeling of stockpiles
- Arranging for soil transport and disposal
- Obtaining DEC permission to transport contaminated soil off site
- Notifying DOT&PF of any discovery of previously unknown contaminated soil
- Preparing the Interim and Final Reports

4.1.5 Regulatory Agencies

The Alaska Department of Environmental Conservation will be the lead environmental regulator for this project. It will be responsible for oversight of the environmental aspects of the project and will make regulatory determinations under its Contaminated Sites Program site cleanup rules (18 AAC 75.325). DEC will provide review of the Interim and Final Reports. The Interim and Final Reports will be transmitted to the DEC Contaminated Sites Program.

DEC and DOT&PF will evaluate the need for EPA involvement if chlorinated solvent-containing soil is identified during the project. The EPA Region 10 RCRA Hazardous Waste Program will be responsible for RCRA regulatory determinations. If hazardous waste is identified during the project, EPA will provide direction on the reporting requirements.

4.2 Project Coordination and Communication

Project coordination and communication will occur throughout the planning, implementation, and reporting stages. Coordination during field activities will depend on the nature of the information to be communicated as discussed below. ***NORTECH*** will not share technical information about scope, status, or screening and analytical results to persons other than the designated project team members, and in accordance with this communications plan. Members of the public will be asked to direct questions and concerns to the DOT&PF Design Project Manager.

DOT&PF will be notified immediately of conditions that pose an immediate safety hazard, damage to utilities, accidents/injuries to field personnel or public, or unexpected conditions that may impact the project scope, schedule, or budget. Examples of unexpected conditions include:

- Unanticipated subsurface conditions
- Conditions that pose a safety hazard to site workers and/or the public
- Inclement weather
- Investigation-derived wastes requiring special handling or disposal
- Discovery of unanticipated contamination

Scope changes and/or other measures associated with unexpected site conditions will be proposed by the Prime Contractor's Environmental Consultant and authorized by the DOT&PF Design Project Manager and/or Construction Engineer. If the variances have a material potential to impact the quantity or quality of screening/sampling data or regulatory compliance, the proposed modification will be communicated to the agencies for approval prior to implementation.

5.0 PROCEDURES AND REQUIREMENTS SUMMARY

Soil management procedures will be the same for the three UTAAs, shown in Appendix 1, Figure 3. Requirements for field screening, sampling, stockpiling, and disposal are summarized in Appendix 2, Table 3 – Excess Soil Management Summary. Field screening or sampling of the limits of excavation is not required unless directed by the Engineer. All excess soil will be stockpiled within the project area or contained by the Contractor for transport to and storage within a secure soil storage area. Soil characterization will be performed within the soil storage area. Field activities will be performed in accordance with the DEC January 2022 Field Sampling Guidance (FSG) which describes the field screening and analytical sampling procedures and quality control requirements.

Excess soil is defined as excavated soil that cannot be returned to the project limits within the associated UTAA. Soil that will be placed back into excavations will not be field screened or sampled. All excess soil from UTAAs will require sampling and laboratory analysis to determine contaminant concentration and management or disposal options.

5.1 Alaska Railroad Track Reconstruction

The ARRC will be responsible for specific track reconstruction and resurfacing tasks associated with the tracks. This track reconstruction includes the steel tracks and the concrete pads adjacent to the tracks (between and approximately two feet outside each track). This also includes any reconstruction of the ballast beneath the tracks and concrete pads. The detail(s) for this work will be generated by the ARRC at a later time. This QAPP does not apply to the track reconstruction tasks that will be performed by the ARRC or their contractors.

5.2 Excess Soil From UTAAs

The following is a summary of requirements for excess soil from UTAAs:

- Stockpile in accordance with DEC requirements
- Perform PID field screening at the rate listed in Section 6.1.1 prior to sampling
- Perform sampling and laboratory analysis at the rate given in Section 6.2.1
- If CVOCs are identified, DOT&PF will work with DEC to coordinate with EPA as needed
- If contaminants of concern (COCs) are less than the laboratory detection limit
  - The soil is not contaminated
  - There are no restrictions on disposal
- If COC concentrations are less than or equal to DEC soil cleanup levels
  - The soil is not contaminated
  - Dispose at upland, non-environmentally sensitive area
- If COC concentrations are greater than DEC soil cleanup levels
  - The soil is contaminated
  - Remediate and dispose as appropriate based on the identified contaminants and as approved by regulatory agencies
- If COC concentrations indicate the soil may be regulated as a RCRA hazardous waste, additional sampling and analysis for RCRA determination may be required

5.3 Groundwater

Groundwater is not anticipated to be encountered as part of this project due to the limitation on the depth of excavation. Due to the potential presence of groundwater contamination and proximity to DEC-listed contaminated sites, dewatering is specifically prohibited on this project.

6.0 FIELD SCREENING AND ANALYTICAL SAMPLING METHODOLOGY

NORTECH has completed a review of available DEC contaminated sites mapping information and of site assessment reports provided by DOT&PF summarizing characterization activities of known contaminated sites in the Old Steese Highway Reconstruction Project area. This information was used to develop Table 1 in Section 2.3 identifying known and potential contaminated sites.

The existing contaminated sites information and recent experience on projects in the Fairbanks area have been used to develop the field screening and sampling process outlined below. This information indicates that contamination may be encountered based on proximity to known contaminated sites. With this understanding, all excavated soil will be field screened with the PID within the UTAAs.

Location, depth, and results of PID headspace screening samples will be documented, along with visual observations and odors, to provide qualitative information on the soil as it is excavated in order to identify soil contamination. Delineation of contamination within and outside the project limits is not within the scope of this project. Field screening and analytical soil samples will be collected at the frequencies described below.

6.1 PID Field Screening

The PID will be outfitted with the standard 10.6 eV lamp capable of detecting volatile organic compounds in soil samples using the headspace method described below.

6.1.1 PID Field Screening Frequency

PID field screening will be performed during excavation at a rate of one headspace sample per 25 cy to allow segregation based on the potential for contamination. For excavations less than 25 cy, a minimum of five headspace field screening samples are required. For trenches, field screening is required at a minimum of 1/50 LF or 1/250 SF.

PID field screening shall be performed on excess soil stockpiles from UTAAs at the rate specified in Table 2A in the DEC FSG for untreated stockpiles.

6.1.2 PID Field Screening Procedures

Headspace screening consists of partially filling (one-third to one-half full) a new resealable bag with freshly uncovered soils. The total capacity of the bag will not be less than eight ounces. The resealable bag is closed and headspace vapors will be allowed to develop for at least 10 minutes and not more than one hour. The bag will be shaken at the beginning and end of the headspace development period.

The soil and headspace will be tested at a temperature of at least 40 degrees Fahrenheit (°F) (5° Celsius). A small opening will be made in the top of the bag and the PID probe inserted into the bag. Headspace vapors will be drawn from the center of the bag above the soil and analyzed by the PID for total volatile organic compounds (VOCs). The highest PID reading from each sample will be recorded in the project field notes for inclusion in the final report.

6.1.3 PID Field Screening Threshold Values During Excavation

During excavation, excess excavated soil from each UTAA will be segregated for stockpiling based on field screening results and observations of staining or olfactory evidence of petroleum or solvent odors. The following field screening values will be the basis of segregation.

- Soil with PID readings from 0.0 to 19 parts per million (ppm) will be considered clean
- Soil with PID results between 20 ppm and 100 ppm usually exceeds DEC's soil cleanup levels and is assumed to be contaminated
- Soil with PID results greater than 100 ppm will be considered known contaminated soil and is typically contaminated above soil cleanup levels

6.2 Analytical Sampling

Soil sampling and laboratory analysis is required to determine appropriate disposal method for excess soil from each stockpile generated during this project. Stockpile sample location selection will be based on stockpile field screening locations where elevated PID field screening results indicate the greatest potential for detection of contaminants. Analytical data will be used to determine soil disposal requirements.

If analytical results indicate the soil may be regulated as a RCRA hazardous waste, additional laboratory analysis may be required. Additional sampling and analysis for RCRA determination are to be completed only at the direction of the Engineer.

6.2.1 Analytical Sampling Locations and Frequency

Soil samples will be collected from excess soil stockpiles at the rate specified in Excavated Soil Sample Collection Guide in the FSG, which specifies the frequency at which laboratory soil samples should be collected based on the volume of excavated soil. The table from the FSG (identified as Table 2A in the DEC FSG document) is reproduced below as Table 2.

Table 2
DEC Field Sampling Guidance
"Excavated Soil Sample Collection Guide"

By Volume (cubic yards)	Number of Field Screening Samples	Associated Number of Laboratory Samples
0-10	5	1
11-50	5	2
51-100	1 per 10 cy	3
More than 100	1 per 10 cy, or as the PM determines necessary	3 samples, plus one (1) sample for each additional 200 cubic yards, or portion thereof, or as the Contaminated Sites Program (CSP) determines necessary
The Table is appropriate for characterizing the levels of petroleum contamination in soil suitable for management onsite subject to 18 AAC 75.325(i) or for transport to a treatment or disposal facility. Consult with CSP for determining the appropriate numbers of field screening and laboratory soil samples for characterizing maximum petroleum concentrations in soil for on-site treatment.		

6.2.2 Analytical Sampling Procedures

The following are the prescribed methods for analytical sampling:

Soil samples will be collected into laboratory-provided certified clean sample containers. The sample containers and any required chemical preservatives will comply with the DEC FSG and the laboratory's standard operating procedures. Field environmental personnel will don new clean nitrile gloves during sample collection and handling.

Once the appropriate sample collection depth has been reached, sample parameters shall be collected in the following order:

- Volatile compounds (VOCs, GRO)
- Semivolatile compounds (DRO, RRO)

For volatile soil samples, including methods AK101 and EPA 8260, 50 grams of soil should be collected with minimum disturbance into a tared 4-oz jar with a Teflon®–lined septum-fused lid. Immediately after collection add 25 milliliters of methanol preservative until the sample is submerged.

Sample containers should be filled quickly and preserved immediately upon collection as required based on the analytical method and laboratory directions. Samples will be collected in decreasing order of volatility. Sample jars will be adequately sealed, with rims cleaned before tightening the lid.

Disposable sampling tools, such as plastic spoons, can be used during collection however they must be discarded after one use. If reusable equipment such as stainless-steel spoons or sampling trowels are used, they must be decontaminated between each use. Decontamination waste and rinsate shall be collected for later disposal. Equipment decontamination procedures are described in Section 7.6.

Laboratory soil samples from stockpiles will be collected as grab samples (not composited) in general accordance with the DEC FSG. Samples collected for volatile analyses should be collected a minimum of 18 inches into the stockpile. Soil samples can be collected as the soil is excavated instead of from the stockpile.

6.2.3 Sample Handling and Custody

All laboratory analytical samples will be collected by the QEP and remain in their custody until delivered to the analytical laboratory.

Containers will be labeled with laboratory-supplied labels, placed in a cooler and chilled to 4°C (+/- 2°C). Care will be taken by the sampler to maintain appropriate preservation temperature until delivery to laboratory. Once the samples and chain of custody are transferred to the laboratory transfer office in Fairbanks, they should be checked for temperature, repackaged as necessary by laboratory personnel and transferred to the analyzing laboratory. Sample preservation should be performed in accordance with the FSG and as described above.

6.2.4 Laboratory Analytical Methods

Analytical soil samples will be analyzed for the following parameters. The analyzing laboratory must be accredited by DEC for the specified methods.

- GRO by Method AK101
- DRO by Method AK102
- RRO by Method AK103
- VOCs by EPA Method 8260
- TCLP VOCs by EPA 1311/8260

6.3 Instrument Testing, Inspection, Calibration, and Maintenance

Photoionization Detector
The PID should be calibrated daily using isobutylene standard gas (100 ppm) and fresh air (0.0 ppm) daily before beginning field screening activities. In addition, the PID should be periodically checked with the isobutylene gas during periods of continuous use. At a minimum, calibration checks should be performed every four hours. This will help ensure instrument accuracy and enable the field screener to determine if the PID requires maintenance if it is not measuring within the specified gas range.

All calibration results should be recorded daily in a bound field book. Lamps, filters, and tubing should be replaced as necessary.

Inspection and Quality Verification of Supplies and Consumables
Sampling supplies for the project will be inspected for any signs of damage, expiration dates, or possible cross-contamination prior to use in the field. Any sampling supplies with a designated expiration date will not be used after the expiration date. Expired or damaged sampling containers shall be replaced with new materials.

Field personnel should keep a written record of the following in the field notebook:

- Date consumable sampling supplies were received from the analytical laboratory
- Expiration dates of all consumable supplies
- Verification that the correct sample containers are on hand for project-specified analyses
- Record the date the materials were inspected and inspecting personnel

Consumable sampling supplies should be stored in a clean, temperature-controlled location away from potential contaminants. Effort should be made to bring only the amount of sampling supplies, sample containers, on site as is necessary for the specified sampling event. Minimizing quantities of sampling supplies will reduce the chances for sample cross contamination and expense in replacing damaged unused supplies.

6.4 Quality Control

The following sections summarize quality control requirements for analytical sample collection and handling. Upon receipt of laboratory reports, the contractor's environmental consultant (QEP) will review the report and complete the DEC Laboratory Data Review Checklist (LDRC) to evaluate data quality.

Field Documentation
The QEP shall document all field readings, sample locations, and observations made during field work into a bound, numbered field notebook. Errors in the field log should be corrected with a single line through the information using indelible ink. No erasures are allowed. Field personnel on site must date and initial entries. Complete copies of all field notes shall be provided daily to the Prime Contractor Project Manager along with a daily field report.

PID Field Screening
At laboratory sample locations selected by PID field screening results, a second field screening sample shall be tested at the same time as the laboratory sample. This result and the initial result will be used for comparison to laboratory results. This result will not be used to change laboratory sampling locations, even if significantly different than the initial field screening result.

Analytical Samples
The ADEC Table B1 - Method Two Soil Cleanup Levels for Migration to Groundwater applies to this project site. Therefore, the QA/QC requirements in the DEC FSG are appropriate and will be followed for this project. The minimum quality control requirements are available for review in Section 9.0, Table 6 of the FSG. They are summarized below for reference.

Field Duplicate Samples
A minimum of one (1) field duplicate shall be collected for every 10 field samples per matrix, and for each target analyte. For sampling occurring over multiple days, the goal should be to collect a minimum of one field duplicate per day. A minimum of one field duplicate is required per laboratory work order. Field duplicates shall be collected from areas of known or suspected contamination.

Duplicate samples must be collected in the same manner as primary samples and at the same time as the primary cohort sample. Duplicate samples should be submitted as blind samples with their own unique sample identifier and collection time. Duplicate sample information shall be adequately documented in the field book by the sampler so their result can be correlated to the correct location.

Trip Blank Samples
Laboratory supplied trip blanks will accompany the sample containers to and from the laboratory and remain unopened. One trip blank will be submitted per 20 volatile samples with a minimum of one trip blank analyzed per target volatile analyte and one per laboratory work order. These samples will be analyzed for VOCs.

Decontamination Blank Samples
Decontamination (equipment rinsate) blank samples will be collected to document effectiveness of sampling equipment decontamination. Following collection of known or suspected contaminated soil, reusable sampling equipment will be decontaminated as described in Section 7.6. Analyte-free water will then be poured over the equipment and collected directly into the decontamination blank sample container. These samples will be analyzed for VOCs. Detections of analytes exceeding the laboratory reporting limits suggest that field contamination may have affected associated sample results.

6.5 Data Management

The QEP is responsible for collecting data and maintaining thorough records of all sampling that occurs during the project in accordance with the approved QAPP. This includes field screening sample and analytical sample results. Daily field notes should be copied or scanned and submitted with a Daily Field Report to the DOT&PF Project Manager and ***NORTECH***. The DOT&PF Project Manager is responsible for forwarding all reports of field activities to regulatory agencies as requested.

The contractor's Environmental Consultant QA Manager is responsible for ensuring field work is completed in accordance with the QAPP. ***NORTECH*** will provide project QA Management for DOT&PF and conduct field visits, attend meetings, and answer technical questions as they arise. ***NORTECH*** will review the QEP's data deliverables and reports to ensure accuracy and completeness.

7.0 SOIL HANDLING AND DISPOSAL

Excess soil derived from UTAAs may contain contaminants based on the proximity to known contaminated sites. Laboratory results are necessary to evaluate excess soil for disposal. This section discusses the handling, storage, and disposal of excess soil. Concentrations of petroleum and VOC contaminants of concern (COCs) must be evaluated with respect to their respective DEC cleanup levels. Table 3 in Appendix 2 summarizes the requirements presented in the following sections.

The DOT&PF Engineer and Prime Contractor shall coordinate all contaminated soil handling and disposal in accordance with the DEC Technical Memorandum dated September 2018 titled *Managing Petroleum-Contaminated Soil, Water, or Free Product During Public Utility and Right-of-Way Construction and Maintenance Projects*. The technical memorandum section titled "Project Implementation: Leaving or Returning Contaminated Material to the Excavation" outlines the procedures for delineating, handling, and disposing of petroleum-contaminated soil.

7.1 Identification and Handling of Potentially Contaminated Soil

Soil within the UTAAs will be excavated to project-required limits. Soil from these areas determined to be in excess and not able to be returned to the excavation will be stockpiled for laboratory characterization. All excavated soil must be stockpiled in accordance with Section 7.3 below. Soil stockpiles will be segregated based on UTAA, PID results, and observation of staining or odor.

The Prime Contractor will be responsible for excavation and handling of excess soil, including stockpile construction and management. Stockpile locations will be within the project limits or at a secure excess soil storage area. The Contractor is responsible for handling and transporting soil in accordance with all applicable regulations to ensure that the work is completed safely and minimizes the potential for inadvertent release. Mixing of suspect contaminated soil with suspect uncontaminated soil is not approved.

7.2 Stockpile Requirements

Stockpiles will be placed in bermed, lined (10 mil thickness) stockpiles, covered with plastic sheeting (minimum 6 mil thickness), and secured with sandbags until the excavation is backfilled. Stockpiled soil must be on a liner and securely covered pursuant to 18 AAC 75.370, to prevent soil direct contact with soil as well as contaminant migration with wind and stormwater runoff. The Contractor shall refer to Table D Bottom Liner Specifications, for short-term storage of petroleum contaminated soils (less than 180 days) when selecting stockpile liner materials.

Soil stockpiles will be constructed to include:

- A chemically resistant geomembrane liner free of holes and other damage. Non-reinforced geomembrane liners will have a minimum thickness of 10 mils and be in accordance with 18 AAC 75
- Geomembrane cover free of holes or other damage to prevent precipitation from entering the stockpile. Non-reinforced geomembrane covers will have a minimum thickness of 6 mils. Reinforced geomembrane covers will have a minimum weight of 26 pounds per 1,000 square feet

- The cover material will be extended over the berms and anchored or ballasted to prevent it from being removed or damaged by wind
- Berms surrounding the stockpile will be a minimum of 12 inches in height. Vehicle access points will also be bermed
- A sloped liner system to allow for collection of leachate
- All stockpiles shall be labeled

The Prime Contractor is responsible for backfilling, borrow source material, and hauling. Care will be taken to ensure the integrity of the liner during soil management to prevent rips and tears during soil placement and removal. Where possible, liners shall be constructed on pavement. If a liner is damaged, all soil from this location will be relocated to a stockpile with an undamaged liner. All liner material will be disposed to prevent reuse.

7.3 Excess Soil Disposal

Following segregation based on field screening or other field observations, samples will be collected from stockpiles of excess soil for laboratory analysis in accordance with Section 6.2. Disposal of soil will be based on analytical results as follows:

- If COC analyte concentrations are less than laboratory detection limits, there are no restrictions on disposal
- If COC concentrations are between laboratory detection limits and DEC soil cleanup levels, dispose at an upland, non-environmentally sensitive area
- If any COC concentration exceeds DEC soil cleanup levels, soil disposal will be based on the following criteria:
  - The type of COC(s) detected
  - The suspected source of the COCs, if reasonably ascertainable
  - Regulatory approval of the disposal facility and approval to transport to that facility

The Contractor will be responsible for subcontracting contaminated soil and hazardous waste disposal through approved waste disposal facilities and/or subcontractors based on the laboratory results. The QEP shall complete the necessary approval for transport and disposal forms and receive DEC approval prior to disposal off site.

Excess soil from UTAAs that exceeds DEC cleanup levels for only petroleum constituents will be remediated as petroleum contaminated at a DEC-approved facility. Disposal of excess soil that is determined to be RCRA hazardous waste will be coordinated through DEC and EPA to and completed by a licensed disposal contractor working under the direction of the Prime Contractor.

7.4 Decontamination and Investigation Derived Waste

Contaminated soil may be encountered during this project. Workers will be instructed not to walk through areas of obvious or known contamination or to handle/touch contaminated materials directly. Care will be taken to limit equipment encounters with contamination (e.g., on excavators, limit contact to bucket).

Contaminated materials include soils that show visible or olfactory evidence of contamination, decontamination fluids, and equipment that encountered these types of soils or used fluids. As

mentioned above, samples will be collected using disposable sampling devices, such as plastic spoons. Disposable sampling tools will not be re-used.

Reusable sampling tools such as trowels will be decontaminated with a solution of tap water and laboratory-grade detergent, rinsing with tap water, then rinsing with distilled or deionized water. Decontamination will be performed in a manner that minimizes waste generation. Decontamination fluids will be collected for disposal in approved containers. Laboratory sample containers will be dry wiped before packaging. Hand tools and heavy equipment will be brushed clean prior to leaving the project site. It is not anticipated that heavy equipment will need to track through areas of soil contamination, therefore only the excavator bucket may require decontamination. Potentially contaminated soil removed from an excavator bucket will be collected and placed on the corresponding soil stockpile for management/disposal.

Investigation derived waste consists of used disposable sampling materials (i.e., used gloves, spoons, paper towels, field-screening sample bags etc.), used personal protective equipment (PPE), decontamination fluids, and potentially contaminated soil. Used sampling materials and PPE will be bagged following use for disposal off site as municipal waste. Decontamination fluids will be applied to the corresponding excess soil stockpile for disposal as appropriate.
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8.0 DATA REVIEW, VERIFICATION, AND VALIDATION

The focus of data collection during this project is to document proper and appropriate handling and disposal of clean and contaminated soils within the project footprint and monitor worker safety. Data collected during this process will be accepted or rejected based on the following:

- Proper records and completeness of field notes
- Appropriate number of collected primary samples and duplicate samples
- Laboratory surrogate recoveries within acceptable range
- Primary/duplicate relative percent difference calculations within acceptable range
- Completed DEC laboratory data review checklists
- Results are representative of contaminated soils encountered during excavation activities.

The Prime Contractor QA Manager will be responsible for verifying sample collection methods for both field and laboratory analytical samples. The QEP shall submit Daily Field Reports with copies of field notes to the Prime Contractor and DOT&PF for review. The QEP is responsible for preparing the Interim Report upon completion of field activities.

9.0 REPORTING

The field environmental personnel are responsible for monitoring conditions at the Site for changes or events that may affect data quality. Conditions suspected to affect data should be noted in the field book and reported in the daily field report. The QEP is responsible for preparation of the daily reports of field activities, daily field notes, and the Interim and Final Report. All analytical and field results will be discussed in the Interim and Final Report. The Interim and Final Report shall include a summary of field activities, measurement data, and observations recorded in the field notes. The Interim and Final Report shall document methods used and laboratory analyses performed.

Included in this should be documentation of all sample locations, requested analyses, and laboratory results. The Interim Report will utilize both field screening and laboratory results to identify locations with contaminated soil that may remain. The report should also include a discussion characterizing any excavated materials whether contaminated or clean. The Final Report shall include all of the above plus details of all contaminated soil disposal.

9.1 Daily Field Reports

Daily reporting shall include all observations made during field screening and sampling by the QEP and other recorded observations relayed to the QEP by on site personnel regarding environmental conditions. The daily report shall also include a complete list of all field screening and laboratory sampling completed that day and the results of any samples collected and if contamination was encountered, stockpiles generated, quantity and location of stockpiles, and disposal methods.

Additionally, the QEP will keep a log of all field activities in a bound field notebook with numbered pages. Locations of samples will be marked in the field and documented on project drawings or site sketches.

At a minimum, the following information shall be recorded in the field notebook:

- Name and location of work site
- Date(s) of sample collection/event
- Names of field personnel on site and their responsibilities
- Daily start/stop times
- Weather conditions
- Pertinent field observations
- Daily summary of field equipment preparation, maintenance, and calibration procedures
- Time/date/location information for all samples collected
- Numbers and types of samples collected daily
- Sample identification number
- Sample physical characteristics (depth, color, odor, etc.)
- Description and sketch of sampling locations and any areas where contamination is encountered
- Record of daily phone calls and/or contact with individuals at the site
- Management of or disposal of investigation derived waste

The QEP shall use the following procedures when recording the above information:

- Make entries chronologically by time notation
- Use only indelible ink for written entries

- Record data directly into the field book
- Line out errors, initial, and date the correction
- Avoid blank spaces between entries
- Line out blank spaces that exist with a single line and initial and date the last page of the day

At the end of each field day, the QEP will submit a copy of the Daily Field Report along with scanned copies of field notes and site sketches to the Prime Contractor Project Manager who will forward the information to the DOT&PF Engineer. DOT&PF will manage internal review of daily field reports and coordinate with ***NORTECH***. DOT&PF will compile daily field reports which will be submitted weekly to DEC (and EPA as appropriate), or more frequently as requested.

9.2 Interim Report

An Interim Report will be submitted to DOT&PF within 30 calendar days of completion of soil excavation activities. Any activities not completed, such as final soil disposition or remediation, shall have a timeline for completion. One complete electronic copy (public document format) of the Interim Report will be provided to the Engineer. DEC shall provide review comments on the draft report to the Prime Contractor within 30 calendar days after the draft report has been submitted. All comments will be addressed in a final Interim Report, which will be submitted to DOT within 14 calendar days of receipt of comments on the draft, who will review and forward to the DEC and EPA as applicable.

The draft and final and Interim Report shall be completed by the QEP and shall include the elements of a complete characterization report described in the DEC 2017 “Site Characterization Work Plan and Reporting Guidance for Investigation of Contaminated Sites.”

9.3 Final Report

The Final Report shall include all the elements of the Interim Report plus soil disposal documentation/remediation certificates.

10.0 SITE-SPECIFIC HEALTH AND SAFETY PLAN (SSHSP) REQUIREMENTS

10.1 Introduction and Applicability

This QAPP assumes all personnel will receive the appropriate training and monitoring as required by their individual employer. All personnel who work in the identified UTAAs and everyone else on this construction project will be covered by corporate or site-specific health and safety plans from their respective employer. The general information provided in this section is for use in preparation of such plans.

NORTECH will prepare a separate SSHSP specifically for ***NORTECH*** employees on this project. This section is not meant to be a comprehensive evaluation of site hazards, nor is it meant to apply to non-***NORTECH*** employees.

10.2 Chemical and Physical Hazards

Chlorinated solvents and related daughter products, as well as petroleum constituents, are identified in the QAPP as chemical hazards. Refer to the specific site reports for concentrations and locations of chemicals.

Physical hazards are those typically encountered in a construction zone, including but *not limited* to:

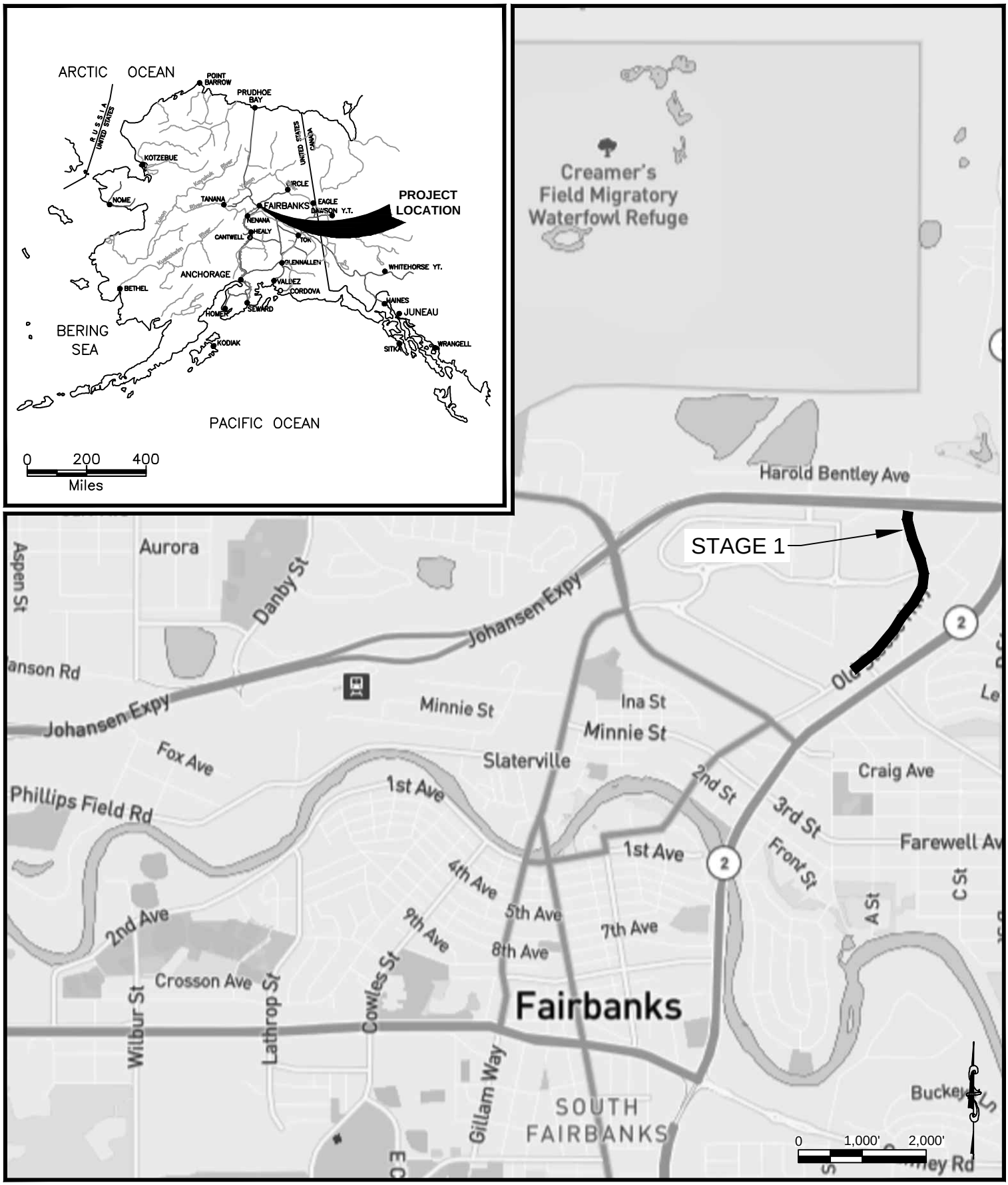
- Moving equipment
- Traffic
- Buried utilities
- Noise
- Slip, trip, and fall hazards
- Excavation hazards
- Weather

10.3 Site-Specific Health and Safety Requirements

Minimum contents of the SSHSP shall be:

- Organization and Responsibilities
- Hazard Analysis
- Personal Protective Equipment
- Personal Exposure and Perimeter Monitoring
- Standard operating procedures
- Decontamination
- Emergency Response and Accident Prevention
- Training
- Medical Surveillance and Recordkeeping

Appendix 1

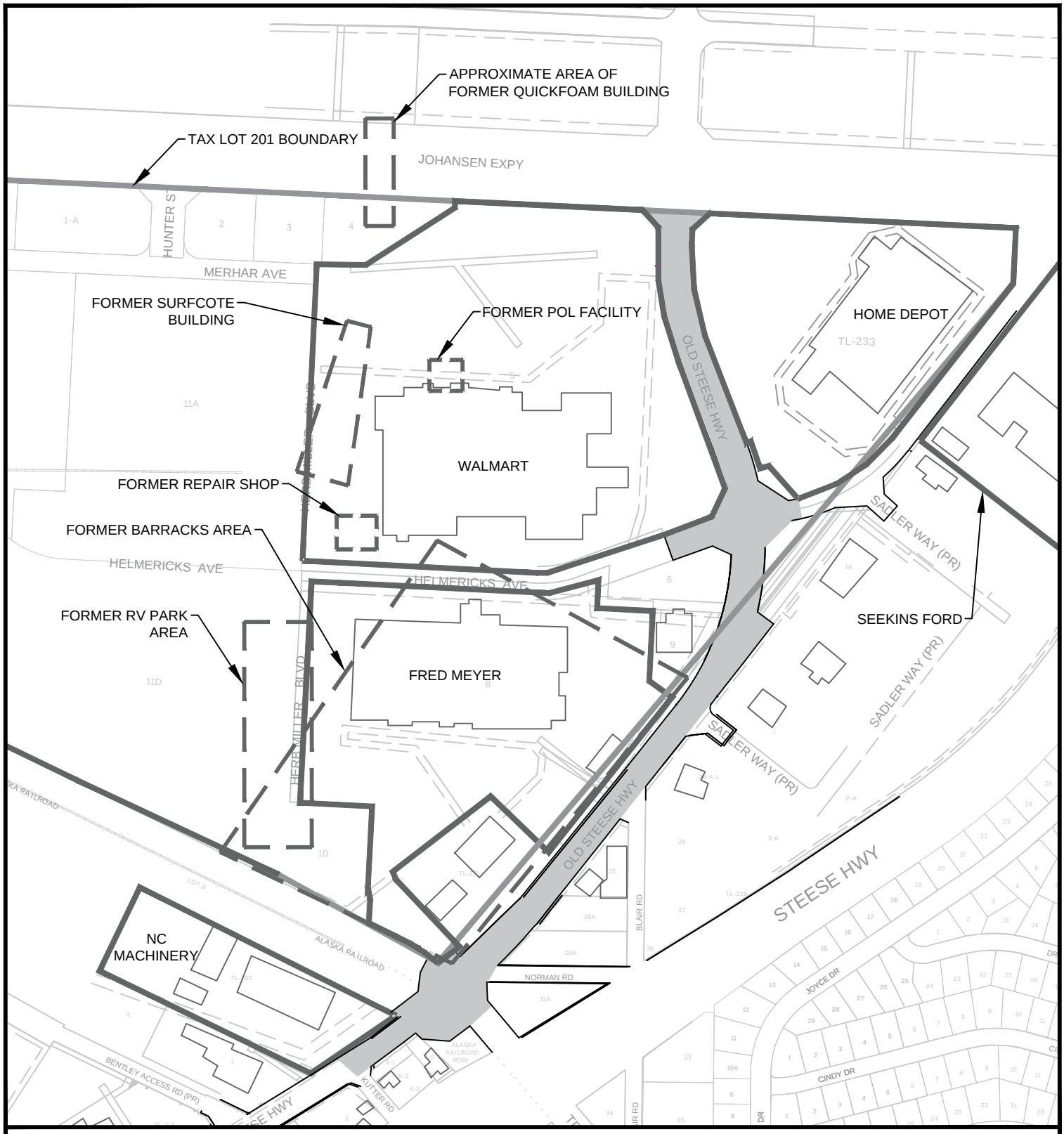


NORTECH

SUSTAINABLE ENVIRONMENT, ENERGY, HEALTH & SAFETY
2400 College Road, Fairbanks, AK. 99709, 907-452-5688
3105 Lakeshore Dr., Anchorage, AK. 99517 907-222-2445
5438 Shaune Dr., Juneau, AK. 99801 907-586-6813

Location Map
Old Steese Highway Reconstruction QAPP
Fairbanks, Alaska

SCALE: As Shown	FIGURE: 1
DESIGN: JAK	
DRAWN: SPH	
PROJECT NO: 20-1064	
DWG: 201064(QAPP)b	
DATE: 06/17/2022	



LEGEND

- EXISTING ROW
- STAGE 1 PROJECT AREA
- ADJACENT CONTAMINATED SITE
- HISTORICAL TL-201 FEATURE

N

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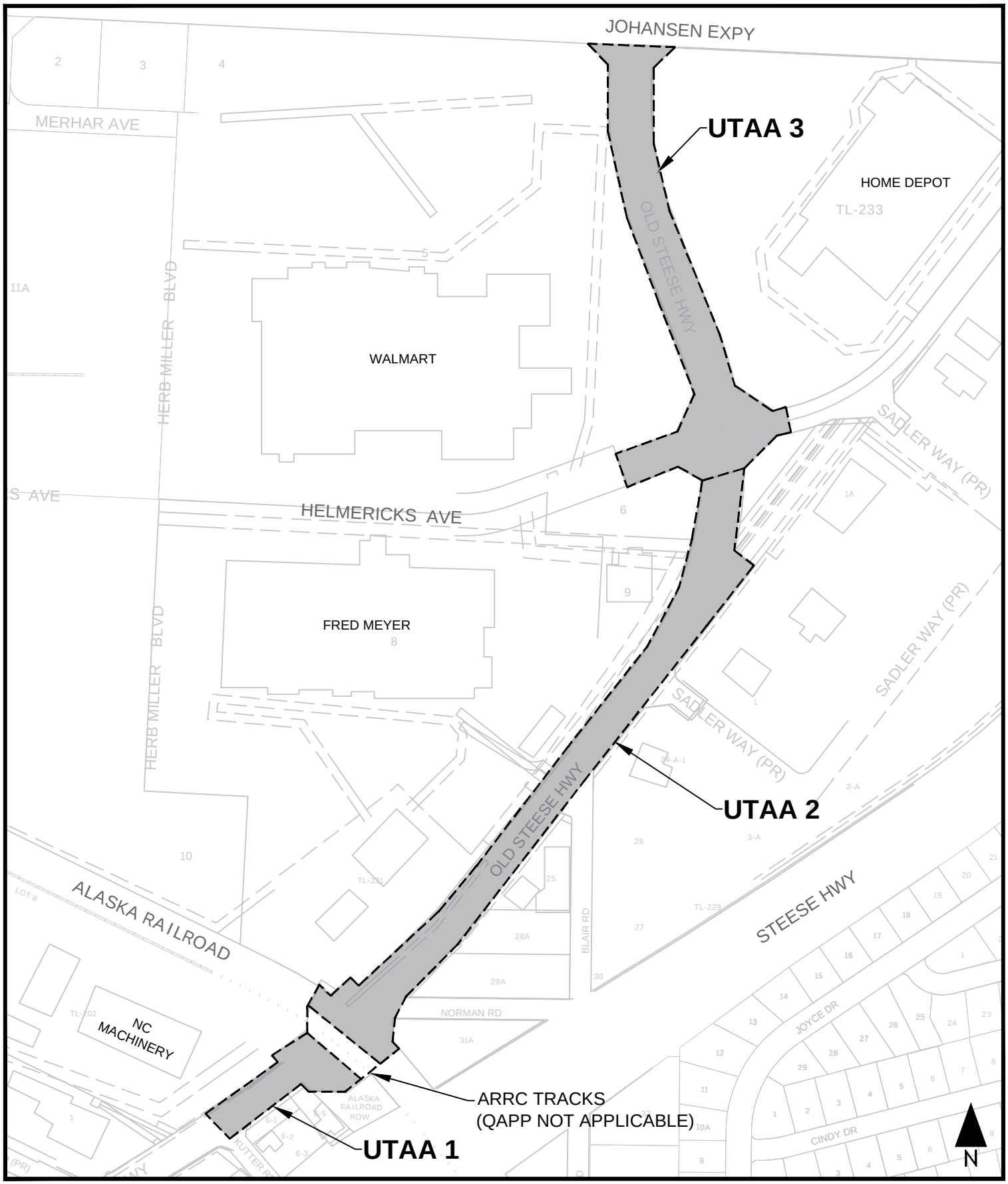
5438 Shaune Dr., Juneau, AK. 99801 907-586-6813

Vicinity Map and Adjacent Contaminated Sites
Old Steese Highway Reconstruction QAPP
Fairbanks, Alaska

SCALE: 1" = 400'	FIGURE: 2
DESIGN: JAK	
DRAWN: SPH	
PROJECT NO: 20-1064	
DWG: 201064(QAPP)b	
DATE: 06/17/2022	



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2400 College Road, Fairbanks, AK. 99709, 907-452-5688
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Utility Trench Agreement Areas
Old Steese Highway Reconstruction QAPP
Fairbanks, Alaska

SCALE: 1" = 300'	FIGURE: 3
DESIGN: JAK	
DRAWN: SPH	
PROJECT NO: 20-1064	
DWG: 201064(QAPP)b	
DATE: 06/17/2022	

Appendix 2

TABLE 3 - EXCESS SOIL MANAGEMENT SUMMARY
OLD STEESE HIGHWAY RECONSTRUCTION

Description	PID Field Screening Rate	Analytical Sampling Rate	Laboratory Analysis	Soil Management		
				COC Concentration Less than DL	COC Concentration Between DL and CL	COC Concentration Greater than CL
Excavated soil (during excavation)	1/25 CY	No	No	N/A	N/A	N/A
Excess soil (after excavation)	DEC FSG Table 2A	DEC FSG Table 2A	GRO (AK 101) DRO (AK 102) RRO (AK 103) VOCs (EPA 8260D)	No restrictions on disposal	Dispose at upland, non-environmentally sensitive area	Treat and/or dispose based on identified contaminants

Notes: All excess soil must be stockpiled in accordance with 18 AAC 75.370 within the project area or in a designated soil storage area.
Field screening and analytical sampling is not required at excavation limits.

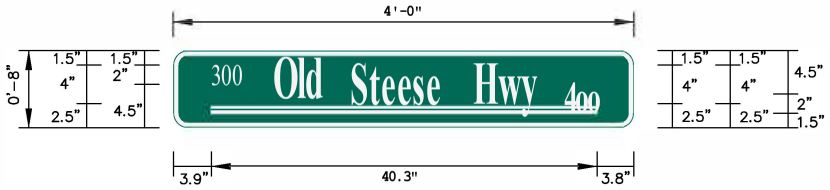
CL DEC soil cleanup level (18 AAC 75.341)
COC Contaminant of concern
DL Laboratory detection limit
FSG DEC January 2022 Field Sampling Guidance
N/A Not applicable

APPENDIX E

SIGN LAYOUTS

SIGN DETAIL

1:20



SIGN NUMBER	SPECIAL 1
WIDTH x HGHT.	4'-0" X 0'-8"
BORDER WIDTH	0.5"
CORNER RADIUS	1.5"
MOUNTING	Ground Mounted
BACKGROUND	TYPE: Reflective
	COLOR: Green
LEGEND/BORDER	TYPE: Reflective
	COLOR: White/White

SYMBOL	ROT	X	y	WD	HT

BORDER
R=1.5"
TH=0.5"

LETTER POSITIONS (X)																			LENGTH	SERIES/SIZE
3	0	0																		B 2000
3.9	5.1	6.3																	3.3	2
0	l	d																		B 2000
10.4	12.9	13.9																	5	4/3
S	t	e	e	s	e															B 2000
18.4	20.3	21.7	23.5	25.2	26.8														9.9	4/3
H	w	y																		B 2000
31.3	33.5	35.9																	6.5	4/3
4	0	0																		B 2000
40.7	42	43.3																	3.5	2

SIGN DETAIL

1:20

SIGN NUMBER	SPECIAL 2
WIDTH x HGHT.	4'-0" X 0'-8"
BORDER WIDTH	0.5"
CORNER RADIUS	1.5"
MOUNTING	Ground Mounted
BACKGROUND	TYPE: Reflective
	COLOR: Green
LEGEND/BORDER	TYPE: Reflective
	COLOR: White/White

SYMBOL	ROT	X	y	WD	HT

BORDER
R=1.5"
TH=0.5"

LETTER POSITIONS (X)																				LENGTH	SERIES/SIZE
4	0	0																			B 2000
3.9	5.2	6.5																		3.5	2
0	l	d																			B 2000
10.4	12.9	13.9																		5	4 / 3
S	t	e	e	s	e																B 2000
18.4	20.3	21.7	23.5	25.2	26.8															9.9	4 / 3
H	w	y																			B 2000
31.3	33.5	35.9																		6.5	4 / 3
3	0	0																			B 2000
40.7	41.9	43.1																		3.3	2

SIGN DETAIL

1:20

SIGN NUMBER	SPECIAL 3
WIDTH x HGHT.	4'-0" X 1'-0"
BORDER WIDTH	0.5"
CORNER RADIUS	1.5"
MOUNTING	Ground Mounted
BACKGROUND	TYPE: Reflective
	COLOR: Green
LEGEND/BORDER	TYPE: Reflective
	COLOR: White/White

SYMBOL	ROT	X	y	WD	HT

BORDER
R=1.5"
TH=0.5"

LETTER POSITIONS (X)																			LENGTH	SERIES/SIZE
2	0	0																		C 2000
5.3	7.4	9.7																	6.2	3
4	t	h																		C 2000
14.5	18.8	21.5																	10.1	6/4.5
S	t																			C 2000
27.6	31.4																		5.9	6/4.5
3	0	0																		C 2000
36.5	38.7	41																	6.2	3

SIGN DETAIL
1:20

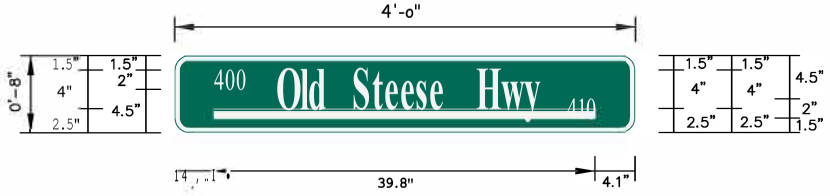
SIGN NUMBER	SPECIAL 4
WIDTH x HGHT.	4'-0" X 1'-0"
BORDER WIDTH	0.5"
CORNER RADIUS	1.5"
MOUNTING	Ground Mounted
BACKGROUND	TYPE: Reflective
	COLOR: Green
LEGEND/BORDER	TYPE: Reflective
	COLOR: White/White

SYMBOL	ROT	X	y	WD	HT

BORDER
R=1.5"
TH=0.5"

LETTER POSITIONS (X)																			LENGTH	SERIES/SIZE
3	0	0																		C 2000
5.3	7.4	9.7																	6.2	3
4	t	h																		C 2000
14.5	18.8	21.5																	10.1	6/4.5
S	t																			C 2000
27.6	31.4																		5.9	6/4.5
2	0	0																		C 2000
36.5	38.7	41																	6.2	3

SIGN DETAIL
1:20



SIGN NUMBER	SPECIAL 5
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BORDER WIDTH	0.5"
CORNER RADIUS	1.5"
MOUNTING	Ground Mounted
BACKGROUND	TYPE: Reflective
	COLOR: Green
LEGEND/BORDER	TYPE: Reflective
	COLOR: White/White

SYMBOL	ROT	X	y	WD	HT

BORDER
R=1.5"
TH=0.5"

LETTER POSITIONS (X)																			LENGTH	SERIES/SIZE
4	0	0																		B 2000
4.1	5.4	6.6																	3.5	2
0	l	d																		B 2000
10.5	13	14.1																	5	4/3
S	t	e	e	s	e															B 2000
18.5	20.5	21.9	23.7	25.4	26.9														9.9	4/3
H	w	y																		B 2000
31.4	33.7	36.1																	6.5	4/3
4	1	0																		B 2000
40.9	42.1	42.9																	3	2

SIGN DETAIL
1:20

SIGN NUMBER	SPECIAL 6
WIDTH x HGHT.	4'-0" X 0'-8"
BORDER WIDTH	0.5"
CORNER RADIUS	1.5"
MOUNTING	Ground Mounted
BACKGROUND	TYPE: Reflective
	COLOR: Green
LEGEND/BORDER	TYPE: Reflective
	COLOR: White/White

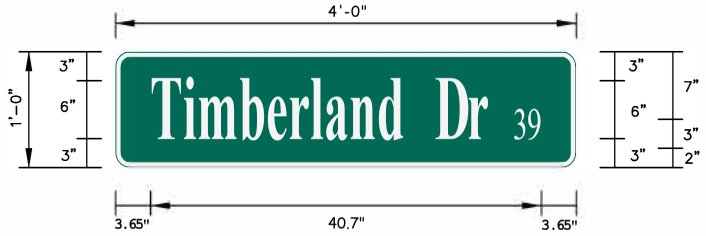
SYMBOL	ROT	X	y	WD	HT

BORDER
R=1.5"
TH=0.5"

LETTER POSITIONS (X)																			LENGTH	SERIES/SIZE
4	1	0																		B 2000
4.1	5.3	6.1																	3	2
0	l	d																		B 2000
10	12.5	13.6																	5	4 / 3
S	t	e	e	s	e															B 2000
18	20	21.4	23.2	24.9	26.4														9.9	4 / 3
H	w	y																		B 2000
30.9	33.2	35.6																	6.5	4 / 3
4	0	0																		B 2000
40.4	41.7	42.9																	3.5	2

SIGN DETAIL

1:20



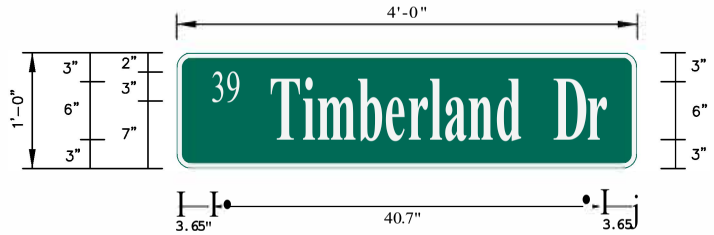
SIGN NUMBER	SPECIAL 7
WIDTH x HGHT.	4'-0" X 1'-0"
BORDER WIDTH	0.5"
CORNER RADIUS	1.5"
MOUNTING	Ground Mounted
BACKGROUND	TYPE: Reflective
	COLOR: Green
LEGEND/BORDER	TYPE: Reflective
	COLOR: White/White

SYMBOL	ROT	X	y	WD	HT

BORDER
R=1.5"
TH=0.5"

LETTER POSITIONS (X)																			LENGTH	SERIES/SIZE
T	i	m	b	e	r	l	a	n	d											B 2000
3.6	6.6	8.3	12.8	15.6	18.5	20.6	22.1	25.2	28.1										26.6	6/4.5
D	r																			B 2000
33.3	36.8																		5.1	6/4.5
3	9																			B 2000
41.4	43.1																		3	3

SIGN DETAIL
1:20



SIGN NUMBER	SPECIAL 8
WIDTH x HGHT.	4'-0" X 1'-0"
BORDER WIDTH	0.5"
CORNER RADIUS	1.5"
MOUNTING	Ground Mounted
BACKGROUND	TYPE: Reflective
	COLOR: Green
LEGEND/BORDER	TYPE: Reflective
	COLOR: White/White

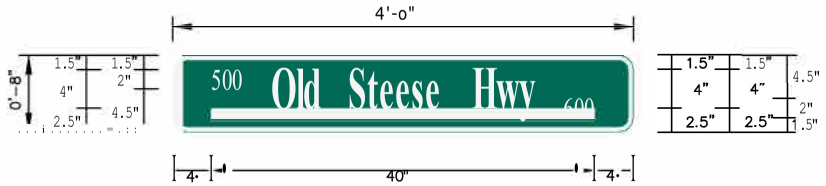
SYMBOL	ROT	X	y	WD	HT

BORDER
R=1.5"
TH=0.5"

LETTER POSITIONS (X)																			LENGTH	SERIES/SIZE
3	9																			B 2000
3.6	5.3																		3	3
T	i	m	b	e	r	l	a	n	d											B 2000
9.6	12.6	14.3	18.7	21.6	24.4	26.6	28	31.2	34										26.6	6/4.5
D	r																			B 2000
39.2	42.8																		5.1	6/4.5

SIGN DETAIL

1:20



SIGN NUMBER	SPECIAL 9
WIDTH x HGHT.	4'-0" X 0'-8"
BORDER WIDTH	0.5"
CORNER RADIUS	1.5"
MOUNTING	Ground Mounted
BACKGROUND	TYPE: Reflective
	COLOR: Green
LEGEND/BORDER	TYPE: Reflective
	COLOR: White/White

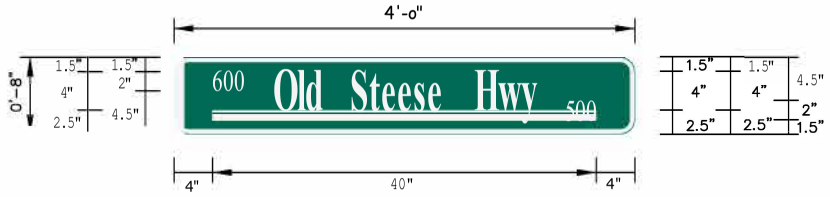
SYMBOL	ROT	X	y	WD	HT

BORDER
R=1.5"
TH=0.5"

LETTER POSITIONS (X)																			LENGTH	SERIES/SIZE
5	0	0																		B 2000
4	5.1	6.4																	3.3	2
0	l	d																		B 2000
10.3	12.8	13.8																	5	4 / 3
S	t	e	e	s	e															B 2000
18.3	20.2	21.6	23.4	25.1	26.7														9.9	4 / 3
H	w	y																		B 2000
31.2	33.4	35.8																	6.5	4 / 3
6	0	0																		B 2000
40.6	41.8	43.1																	3.3	2

SIGN DETAIL

1:20



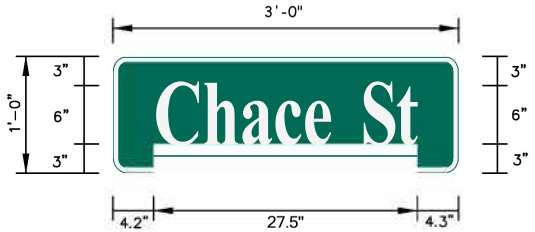
SIGN NUMBER	SPECIAL 10
WIDTH x HGHT.	4'-0" x o'-8"
BORDER WIDTH	0.5"
CORNER RADIUS	1.5"
MOUNTING	Ground Mounted
BACKGROUND	TYPE: Reflective
	COLOR: Green
LEGEND/BORDER	TYPE: Reflective
	COLOR: White/White

SYMBOL	ROT	X	y	WD	HT

BORDER
R=1.5"
TH=0.5"

LETTER POSITIONS (X)																			LENGTH	SERIES/SIZE
6	0	0																		B 2000
4	5.2	6.4																	3.3	2
0	l	d																		B 2000
10.3	12.8	13.9																	5	4/3
S	t	e	e	s	e															B 2000
18.3	20.3	21.7	23.5	25.2	26.7														9.9	4/3
H	w	y																		B 2000
31.2	33.5	35.9																	6.5	4/3
5	0	0																		B 2000
40.7	41.8	43.1																	3.3	2

SIGN DETAIL
1:20



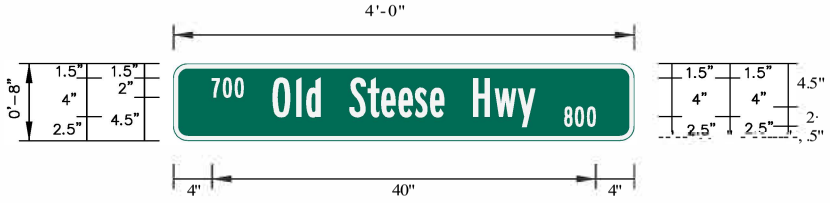
SIGN NUMBER	SPECIAL 11
WIDTH x HGHT.	3'-0" X 1'-0"
BORDER WIDTH	0.5"
CORNER RADIUS	1.5"
MOUNTING	Ground Mounted
BACKGROUND	TYPE: Reflective
	COLOR: Green
LEGEND/BORDER	TYPE: Reflective
	COLOR: White/White

SYMBOL	ROT	X	y	WD	HT

BORDER
R=1.5"
TH=0.5"

LETTER POSITIONS (X)																			LENGTH	SERIES/SIZE
C	h	a	c	e																C 2000
4.2	8.7	12.5	16.2	19.7															18.5	6/4.5
S	t																			C 2000
25.8	29.6																		5.9	6/4.5

SIGN DETAIL
1:20



SIGN NUMBER	SPECIAL 12
WIDTH x HGHT.	4'-0" X 0'-8"
BORDER WIDTH	0.5"
CORNER RADIUS	1.5"
MOUNTING	Ground Mounted
BACKGROUND	TYPE: Reflective
	COLOR: Green
LEGEND/BORDER	TYPE: Reflective
	COLOR: White/White

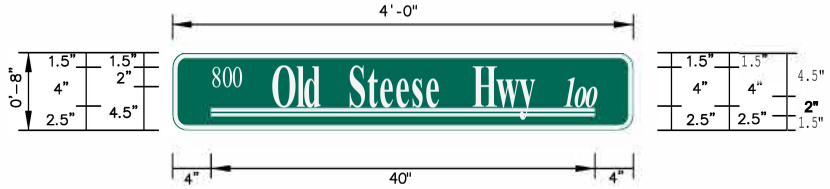
SYMBOL	ROT	X	y	WD	HT

BORDER
R=1.5"
TH=0.5"

LETTER POSITIONS (X)																			LENGTH	SERIES/SIZE
7	0	0																		B 2000
4	5.2	6.4																	3.3	2
0	l	d																		B 2000
10.3	12.8	13.9																	5	4 / 3
S	t	e	e	s	e															B 2000
18.3	20.3	21.7	23.5	25.2	26.7														9.9	4 / 3
H	w	y																		B 2000
31.2	33.5	35.9																	6.5	4 / 3
8	0	0																		B 2000
40.7	41.8	43.1																	3.3	2

SIGN DETAIL

1:20



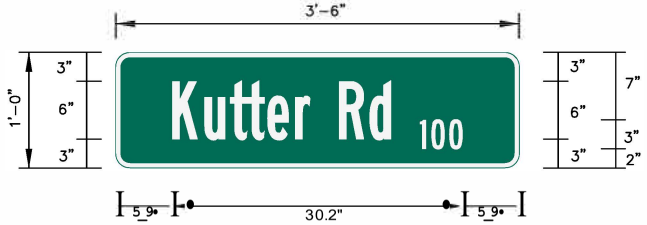
SIGN NUMBER	SPECIAL 13
WIDTH x HGHT.	4'-0" x o'-8"
BORDER WIDTH	0.5"
CORNER RADIUS	1.5"
MOUNTING	Ground Mounted
BACKGROUND	TYPE: Reflective
	COLOR: Green
LEGEND/BORDER	TYPE: Reflective
	COLOR: White/White

SYMBOL	ROT	X	y	WD	HT

BORDER
R=1.5"
TH=0.5"

LETTER POSITIONS (X)																			LENGTH	SERIES/SIZE
8	0	0																		B 2000
4	5.1	6.4																	3.3	2
0	l	d																		B 2000
10.3	12.8	13.8																	5	4/3
S	t	e	e	s	e															B 2000
18.3	20.2	21.6	23.4	25.1	26.7														9.9	4/3
H	w	y																		B 2000
31.2	33.4	35.8																	6.5	4/3
7	0	0																		B 2000
40.7	41.8	43.1																	3.3	2

SIGN DETAIL
1:20



SIGN NUMBER	SPECIAL 14
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BORDER WIDTH	0.5"
CORNER RADIUS	1.5"
MOUNTING	Ground Mounted
BACKGROUND	TYPE: Reflective
	COLOR: Green
LEGEND/BORDER	TYPE: Reflective
	COLOR: White/White

SYMBOL	ROT	X	y	WD	HT

BORDER
R=1.5"
TH=0.5"

LETTER POSITIONS (X)																			LENGTH	SERIES/SIZE
K	u	t	t	e	r															B 2000
5.9	9.3	11.9	13.7	15.8	18.7														14.3	6/4.5
R	d																			B 2000
23.2	26.4																		5.4	6/4.5
1	0	0																		B 2000
31.6	32.8	34.7																	4.4	3

SIGN DETAIL
1:20

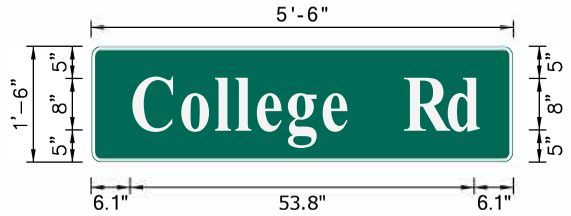
SIGN NUMBER	SPECIAL 15
WIDTH x HGHT.	3'-6" X 1'-0"
BORDER WIDTH	0.5"
CORNER RADIUS	1.5"
MOUNTING	Ground Mounted
BACKGROUND	TYPE: Reflective
	COLOR: Green
LEGEND/BORDER	TYPE: Reflective
	COLOR: White/White

SYMBOL	ROT	X	y	WID	HT

BORDER
R=1.5"
TH=0.5"

LETTER POSITIONS (X)																				LENGTH	SERIES/SIZE
1	0	0																			B 2000
5.9	7.1	9																		4.4	3
K	u	t	t	e	r																B 2000
13.3	16.7	19.3	21.1	23.2	26.1															14.3	6/4.5
R	d																				B 2000
30.7	33.9																			5.4	6/4.5

SIGN DETAIL
1:30



SIGN NUMBER	D3-1
WIDTH x HGHT.	5'-6" X 1'-6"
BORDER WIDTH	0.5"
CORNER RADIUS	1.5"
MOUNTING	Overhead
BACKGROUND	TYPE: Reflective
	COLOR: Green
LEGEND/BORDER	TYPE: Reflective
	COLOR: White/White

SYMBOL	ROT	X	y	WD	HT

BORDER
R=1.5"
TH=0.5"

LETTER POSITIONS (X)																				LENGTH	SERIES/SIZE
C	o	l	l	e	g	e															D 2000
6.1	12.8	19	21.9	24.4	29.9	36														34.6	8/6
R	d																				D 2000
48.7	55.1																			11 .1	8/6

SIGN DETAIL
1:30

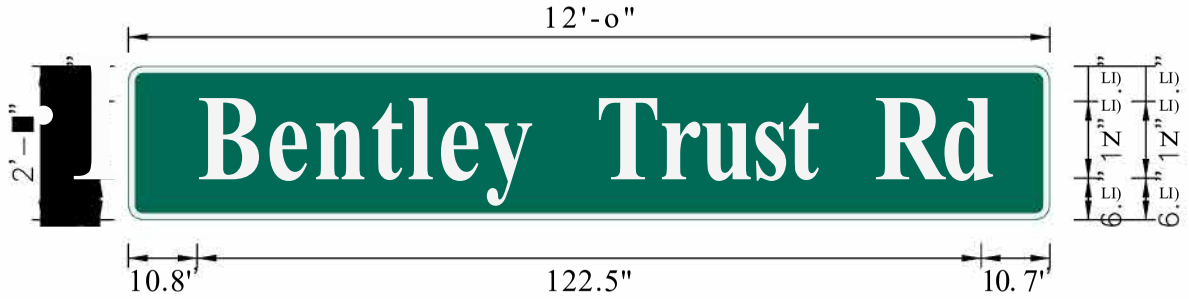
SIGN NUMBER	D3-1
WIDTH x HGHT.	7'-6" X 1'-6"
BORDER WIDTH	0.5"
CORNER RADIUS	1.5"
MOUNTING	Overhead
BACKGROUND	TYPE: Reflective
	COLOR: Green
LEGEND/BORDER	TYPE: Reflective
	COLOR: White/White

SYMBOL	ROT	X	y	WD	HT

BORDER
R=1.5"
TH=0.5"

LETTER POSITIONS (X)																			LENGTH	SERIES/SIZE
0	l	d																		D 2000
5.8	13.1	15.7																	14.6	8/6
S	t	e	e	s	e															D 2000
26.5	32.4	36.2	41.7	47	51.5														29.8	8/6
H	w	y																		D 2000
62.2	68.8	78.2																	21.9	8/6

SIGN DETAIL
1:30



SIGN NUMBER	D3-1
WIDTH x HGHT.	12'-0" X 2'-0"
BORDER WIDTH	1"
CORNER RADIUS	2.25"
MOUNTING	Overhead
BACKGROUND	TYPE: Reflective
	COLOR: Green
LEGEND/BORDER	TYPE: Reflective
	COLOR: White/White

SYMBOL	ROT	X	y	WD	HT

BORDER
R=2.25"
TH=1"

LETTER POSITIONS (X)																				LENGTH	SERIES/SIZE
B	e	n	t	l	e	y															D 2000
10.8	20.2	29	37.3	43.4	47.2	55														53.3	12/9
T	r	u	s	t																	D 2000
73	82	87.9	96.7	102.8																34.6	12/9
R	d																				D 2000
116.6	126.1																			16.7	12/9

SIGN DETAIL
1:30

SIGN NUMBER	D3-1
WIDTH x HGHT.	11'-6" X 2'-0"
BORDER WIDTH	1"
CORNER RADIUS	2.25"
MOUNTING	Overhead
BACKGROUND	TYPE: Reflective
	COLOR: Green
LEGEND/BORDER	TYPE: Reflective
	COLOR: White/White

SYMBOL	ROT	X	y	WD	HT

BORDER
R=2.25"
TH=1"

LETTER POSITIONS (X)																			LENGTH	SERIES/SIZE
0	l	d																		D 2000
10.3	21.2	25																	22	12/9
S	t	e	e	s	e															D 2000
41.2	50.1	55.7	64	72	78.8														44.6	12/9
H	w	y																		D 2000
94.8	104.7	118.7																	32.9	12/9

SIGN DETAIL
1:30

SIGN NUMBER	D3-102 MOD
WIDTH x HGHT.	14'-0" X 4'-0"
BORDER WIDTH	1"
CORNER RADIUS	3"
MOUNTING	Overhead
BACKGROUND	TYPE: Reflective
	COLOR: Green
LEGEND/BORDER	TYPE: Reflective
	COLOR: White/White

SYMBOL	ROT	X	y	WD	HT
ARROW	90	13	27.8	16	18.3
ARROW	270	136.7	4.2	16	18.3

BORDER
R=3"
TH=1"

LETTER POSITIONS (X)																			LENGTH	SERIES/SIZE
F	r	e	d																	D 2000
43.3	52.3	57.8	66.1																30	12/9
M	e	y	e	r																D 2000
85.3	96.8	104.6	114.5	123.3															42.6	12/9
D	r																			D 2000
139.9	150.4																		15.1	12/9
B	l	a	i	r																D 2000
58.4	68.3	72	81.2	85.5															31.7	12/9
R	d																			D 2000
102	111.5																		16.7	12/9

SIGN DETAIL
1:30

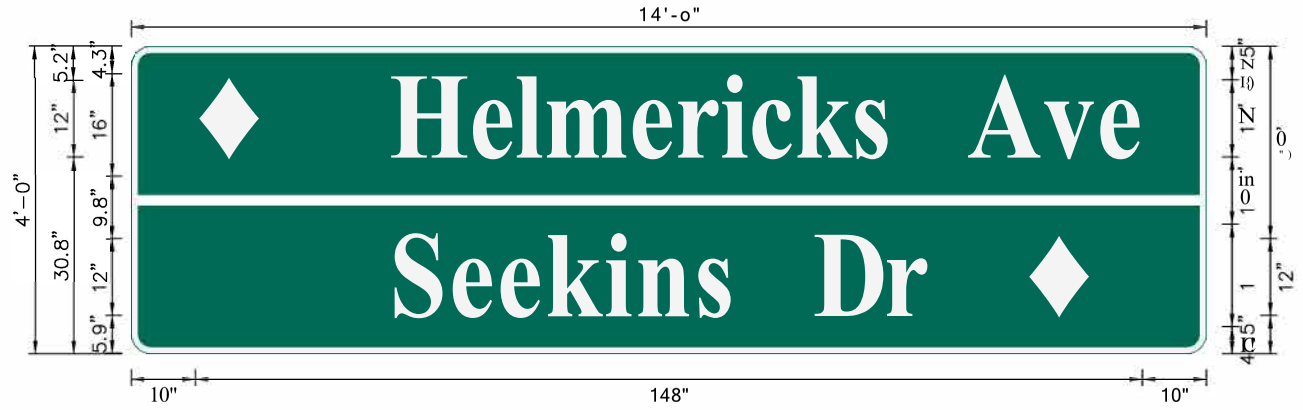
SIGN NUMBER	D3-102 MOD
WIDTH x HGHT.	14'-0" X 4'-0"
BORDER WIDTH	1"
CORNER RADIUS	3"
MOUNTING	Overhead
BACKGROUND	TYPE: Reflective
	COLOR: Green
LEGEND/BORDER	TYPE: Reflective
	COLOR: White/White

SYMBOL	ROT	X	y	WD	HT
ARROW	90	13	27.8	16	18.3
ARROW	270	136.7	4.3	16	18.3

BORDER
R=3"
TH=1"

LETTER POSITIONS (X)																				LENGTH	SERIES/SIZE
B	l	a	i	r																	D 2000
49.3	59.2	62.9	72.1	76.4																31.7	12/9
R	d																				D 2000
92.9	102.4																			16.7	12/9
F	r	e	d																		D 2000
13	22	27.5	35.8																	30	12/9
M	e	y	e	r																	D 2000
55	66.5	74.3	84.3	93																42.6	12/9
D	r																				D 2000
109.6	120.2																			15.1	12/9

SIGN DETAIL
1:30



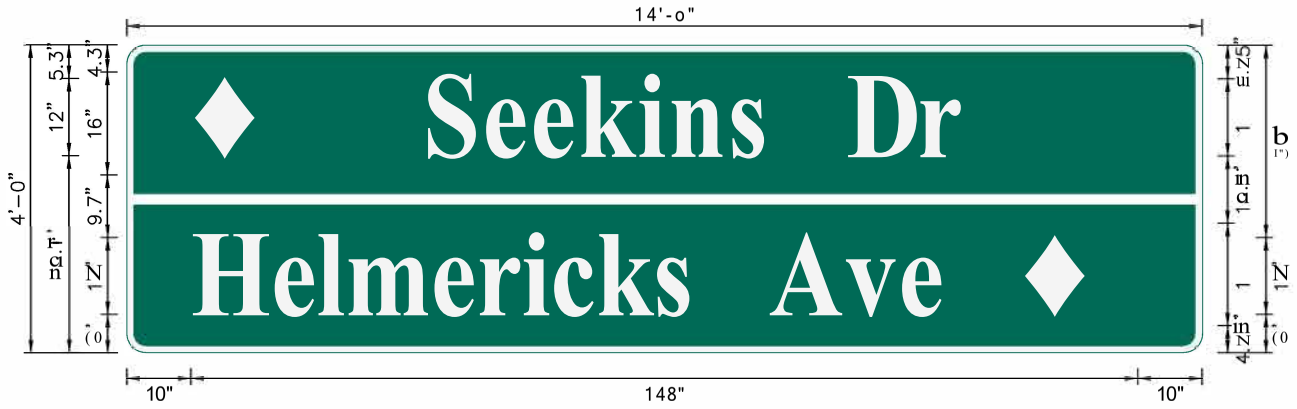
SIGN NUMBER	D3-102 MOD
WIDTH x HGHT.	14'-o" X 4'-0"
BORDER WIDTH	1"
CORNER RADIUS	3"
MOUNTING	Overhead
BACKGROUND	TYPE: Reflective
	COLOR: Green
LEGEND/BORDER	TYPE: Reflective
	COLOR: White/White

SYMBOL	ROT	X	y	WID	HT
ARROW	90	10	27.8	16	18.3
ARROW	270	139.7	4.3	16	18.3

BORDER
R=3"
TH=1"

LETTER POSITIONS (X)																			LENGTH	SERIES/SIZE
H	e	l	m	e	r	i	c	k	s											D 2000
40.3	50.6	59.3	63.7	77.3	86.1	92.1	95.9	104.6	113										78.4	12/9
A	v	e																		D 2000
130.6	141.4	150.9																	27.4	12/9
S	e	e	k	i	n	s														D 2000
40.4	49.8	58.1	66.9	76	80.3	89													54.2	12/9
D	r																			D 2000
106.6	117.2																		15.1	12/9

SIGN DETAIL
1:30



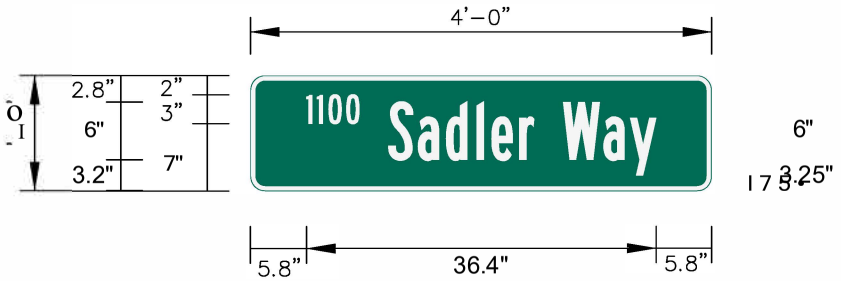
SIGN NUMBER	D3-102 MOD
WIDTH x HGHT.	14'-0" X 4'-0"
BORDER WIDTH	1"
CORNER RADIUS	3"
MOUNTING	Overhead
BACKGROUND	TYPE: Reflective
	COLOR: Green
LEGEND/BORDER	TYPE: Reflective
	COLOR: White/White

SYMBOL	ROT	X	y	WID	HT
ARROW	90	10	27.8	16	18.3
ARROW	270	139.7	4.3	16	18.3

BORDER
R=3"
TH=1"

LETTER POSITIONS (X)																			LENGTH	SERIES/SIZE
S	e	e	k	i	n	s														D 2000
46.3	55.7	64	72.8	81.9	86.2	94.9													54.2	12/9
D	r																			D 2000
112.5	123.1																		15.1	12/9
H	e	l	m	e	r	i	c	k	s											D 2000
10	20.3	29.1	33.4	47.1	55.8	61.8	65.7	74.3	82.7										78.4	12/9
A	v	e																		D 2000
100.4	111.2	120.6																	27.4	12/9

SIGN DETAIL
1:20



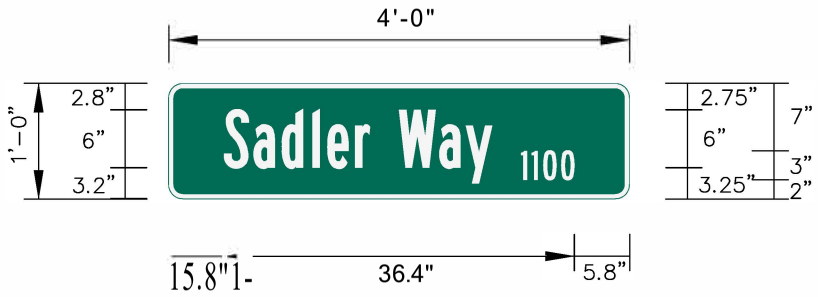
SIGN NUMBER	SPECIAL 23
WIDTH x HGHT.	4'-0" X 1'-0"
BORDER WIDTH	0.5"
CORNER RADIUS	1.5"
MOUNTING	Ground Mounted
BACKGROUND	TYPE: Reflective
	COLOR: Green
LEGEND/BORDER	TYPE: Reflective
	COLOR: White/White

SYMBOL	ROT	X	y	WD	HT

BORDER
R=1.5"
TH=0.5"

LETTER POSITIONS (X)																			LENGTH	SERIES/SIZE
1	1	0	0																	B 2000
5.8	6.9	8.1	10																5.6	3
S	a	d	l	e	r															B 2000
14.4	17.4	20.3	23.5	25.1	28														15.2	6/4.5
W	a	y																		B 2000
32.5	36.7	39.5																	9.7	6/4.5

SIGN DETAIL
1:20



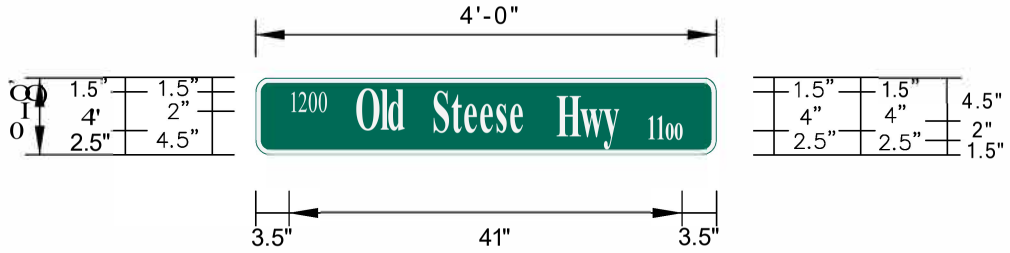
SIGN NUMBER	SPECIAL 24
WIDTH x HGHT.	4'-0" X 1'-0"
BORDER WIDTH	0.5"
CORNER RADIUS	1.5"
MOUNTING	Ground Mounted
BACKGROUND	TYPE: Reflective
	COLOR: Green
LEGEND/BORDER	TYPE: Reflective
	COLOR: White/White

SYMBOL	ROT	X	y	WD	HT

BORDER
R=1.5"
TH= 0.5"

LETTER POSITIONS (X)																			LENGTH	SERIES/SIZE
S	a	d	l	e	r															B 2000
5.8	8.9	11.8	15	16.5	19.4														15.2	6/4.5
W	a	y																		B 2000
24	28.2	30.9																	9.7	6/4.5
1	1	0	0																	B 2000
36.7	37.8	39	40.9																5.6	3

SIGN DETAIL
1:20



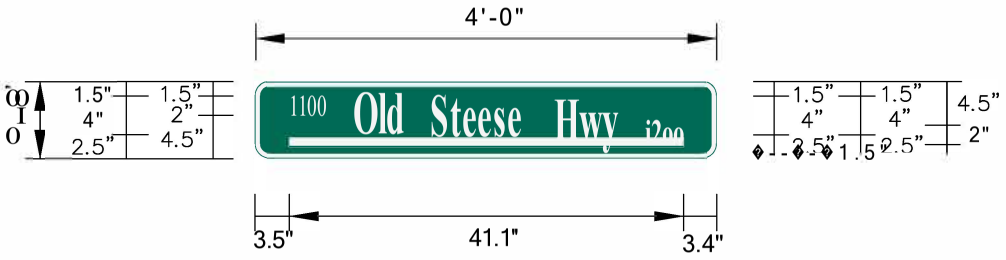
SIGN NUMBER	SPECIAL 25
WIDTH x HGHT.	4'-0" X 0'-8"
BORDER WIDTH	0.5"
CORNER RADIUS	1.5"
MOUNTING	Ground Mounted
BACKGROUND	TYPE: Reflective
	COLOR: Green
LEGEND/BORDER	TYPE: Reflective
	COLOR: White/White

SYMBOL	ROT	X	y	WD	HT

BORDER
R=1.5"
TH=0.5"

LETTER POSITIONS (X)																			LENGTH	SERIES/SIZE
1	2	0	0																	B 2000
3.5	4.2	5.3	6.6																4	2
O	l	d																		B 2000
10.4	12.9	13.9																	5	4/3
S	t	e	e	s	e															B 2000
18.4	20.3	21.7	23.5	25.2	26.8														9.9	4/3
H	w	y																		B 2000
31.3	33.5	35.9																	6.5	4/3
1	1	0	0																	B 2000
40.8	41.5	42.3	43.5																3.7	2

SIGN DETAIL
1:20



SIGN NUMBER	SPECIAL 26
WIDTH x HGHT.	4'-0" X 0'-8"
BORDER WIDTH	0.5"
CORNER RADIUS	1.5"
MOUNTING	Ground Mounted
BACKGROUND	TYPE: Reflective
	COLOR: Green
LEGEND/BORDER	TYPE: Reflective
	COLOR: White/White

SYMBOL	ROT	X	y	WD	HT

BORDER
R=1.5"
TH=0.5"

LETTER POSITIONS (X)																			LENGTH	SERIES/SIZE
1	1	0	0																	B 2000
3.5	4.2	5	6.3																3.7	2
O	l	d																		B 2000
10.2	12.7	13.7																	5	4/3
S	t	e	e	s	e															B 2000
18.2	20.1	21.5	23.3	25	26.6														9.9	4/3
H	w	y																		B 2000
31.1	33.3	35.7																	6.5	4/3
1	2	0	0																	B 2000
40.6	41.3	42.4	43.7																4	2