SPECIAL PROVISIONS
FOR
TRAFFIC SIGNALIZATION

Polk County
NHSX-141-7(49)--3H-77

Effective Date
October 18, 2016

THE STANDARD SPECIFICATIONS, SERIES 2015, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

150143.01 GENERAL

This Special Provision consists of the general requirements necessary when furnishing a traffic signal installation complete, in place and operative as described in these Special Provisions.

A. Scope of Work.

The work shall consist of furnishing labor, materials and performing all work necessary to install and operate traffic control signals at locations shown in the Plans and as specified in these Special Provisions and contract documents, as directed by the Engineer, and in those sections of the Standard Specifications, that are either directly or by reference included herewith to result in a complete and finished job.

B. Signal Operation.

1. The Contractor's traffic engineer or applicable manufacturer's representative shall be responsible for initial traffic signal controller programming and for performing turn-ons of each traffic signal. The Contractor shall provide at least 15 working days notice to the City of Grimes that the signal will be ready for turn-on, and to request coordinated signal timings. At initial signal turn-on, the Contractor's traffic engineer or applicable manufacturer's representative shall utilize the timing as provided by the City of Grimes.

2. After initial signal activation and turn-on and during the operation of the traffic signal, if it's determined by the Engineer that subsequent signal timing modifications are necessary; the City will provide to the Contractor a signal timing report with modified signal timings. The Contractor shall program the controller to modify the existing signal timings based on this report.

3. During the operation of the traffic signals, any failures or malfunctions of the traffic signal materials or equipment that occur, regardless of cause, shall be immediately corrected at the Contractor's expense, including all labor, materials and associated cost.

4. Any damages to signal equipment or materials that occur regardless of cause shall be immediately repaired, corrected, or removed and replaced with materials and equipment of like kind at the Contractor's expense, including all labor, materials and associated cost. Typical damages that might be expected include damage from storms or weather events, or impacts that might result from moving vehicles. The Engineer shall approve the repair of all damaged equipment or materials. If deemed necessary by the Engineer, damaged equipment and materials will be replaced by the Contractor with new stock. All approved repairs to damaged equipment or materials must restore the traffic signal to a like new condition.

5. At all times during the operation of the traffic signal, the Contractor shall be able to provide at least one qualified service technician to respond to signal complaints received from the Engineer, the City, the Iowa DOT, or emergency service providers. This shall include, but not be limited to, the following complaints: signal timing phasing and coordination, equipment or material failures or malfunctions, and equipment or material damage. Response time shall be 1 hour for complaints received between 6 AM and 7 PM on non-holiday weekdays, and 2 hours for all other times. For some cases (due to travel times or other extenuating circumstances) additional time may be acceptable within reason, but must be approved by the Engineer.

6. The Contractor's responsibilities to operate, maintain and repair (if necessary) traffic signals, shall cease at such time the contract is complete and the Contractor is released from the project, except for warranty items and as noted in Article 150143.01, I.

C. Signal Downtime.

The existing traffic signals shall remain in operation during this project until temporary signals are turned on. The temporary signals are to remain in operation until the permanent signals are turned on. Any signal downtime shall not occur during peak hours. The peak hours are Monday - Friday, 6:00 A.M to 10:00 A.M and 2:00 P.M to 8:00 P.M. Signal down time shall not occur on the weekends (Saturday & Sunday) between 9:00 A.M to 4:00 P.M.

D. Traffic Control.

1. The Contractor at all times shall conduct the operation in such a manner as to insure the safety of the motorist, the pedestrian, and its own employees. The Contractor shall perform work in such a manner and sequence as to maintain vehicular and pedestrian traffic at all times and to maintain access to adjacent private properties, unless otherwise specified in the plans.

2. The Contractor shall furnish, install, and maintain all devices for directing, warning and rerouting traffic flow, including warning lights, barricades, and other devices necessary to adequately inform the motorist of unusual or unsafe conditions and guide them safely through the Project work area. A traffic control layout shall be submitted by the Contractor and approved by the Engineer prior to any field operations.

3. All required barricades and signs shall be in accordance with Part VI of the MUTCD and applicable Iowa DOT Standard Plans for traffic control.

E. Intersection Lighting.

1. The Contractor shall continuously maintain current illumination levels at the 37th, 19th, and 11th Street intersections throughout the duration of the construction period, as specified in the Plans. Illumination may consist of any combination of temporary light poles and existing and proposed combination light/signal poles. Contractor shall be responsible for identifying need and locations of temporary light poles and the associated power supplies and controls.

2. Electrical circuits to intersection lighting shall be relocated and repaired throughout the duration of the construction period to maintain continuity of electrical power.

3. Temporary light poles shall be installed and operational prior to removal of existing light poles.

F. Utilities.

Utility information of existing underground obstructions known to the Engineer is indicated on the Plans. The locations are from the most recent survey information. The Contractor shall notify owning utilities of the approach to any of their facilities and conform to their requirements. The Contractor shall perform exploratory operations as necessary to verify the location, elevation, and dimensions of all known or suspected underground obstructions ahead of any work affected thereby, and shall use care to avoid damage to them. The Contractor shall also ascertain whether any additional facilities other than those shown on the plans may be present.

G. Regulations and Code.

1. All electrical equipment shall conform to the standards of the National Electric Manufacturers Association (NEMA). In addition to the requirement of the plans and these Special Provisions, all material and work shall conform to the requirements of the National Electrical Code, the Standards of the American Society for Testing Materials (ASTM), the American Standards Association (ASA), and local ordinances.

2. Wherever reference is made in these Special Provisions or in the standard provisions to the code, the safety orders, the general order, or the standards mentioned above, the reference shall be construed to mean the code, order, or standard that is in effect at the date of advertising of these Special Provisions.

H. Testing of Signal Equipment.

1. After the project is open to normal traffic, the Contractor shall notify the Engineer the date the signal or signal system will be ready for testing.

2. Upon concurrence of the Engineer, the Contractor shall place the signal or signal system in operation for a consecutive 30-day test period. The signal(s) shall not be placed into operation without prior notification of the Engineer and concurrence by the Engineer that the signal(s) are ready to be placed into operation. Any failure or malfunction of the equipment, exclusive of minor malfunctions (such as lamp burnouts) occurring during the test period, shall be corrected at the Contractor's expense and the signal or system tested for an additional 30 consecutive day period. This procedure shall be repeated until the signal equipment has operated satisfactorily for 30 consecutive days.

I. Guarantee.

1. In addition to the warranties or guarantees on specific traffic signal equipment listed elsewhere in these Special Provisions, the Contractor shall fully guarantee the traffic control signal installation against defective equipment, materials, and poor work quality. Should any defect develop under normal and proper operating conditions within 12 months after acceptance of the completed installation by the Engineer, this malfunction shall be corrected by, and at the expense of the Contractor, including all labor, materials, and associated costs.

2. Contractor shall provide this guarantee in writing on Company or Corporation letterhead stationery to the Contracting Authority prior to final acceptance. The Contractor shall transfer all required equipment warranties on the date of final acceptance to the Contracting Authority.

J. Schedule of Unit Prices.
Prior to the preconstruction meeting the Contractor shall complete and forward to the Engineer for approval three copies of a list of unit costs for each item listed on the Schedule of Unit Prices attached to the Special Provisions. The sum of the costs for each item shall equal the total Contract Lump Sum price for the traffic signal installation. The total cost shall not be unreasonably distributed among the individual unit items. The unit costs will also be used to establish the total cost for any extra work orders related to traffic signal installation work items.

150143.02 MATERIALS.
This part of the Special Provisions consists of the material requirements necessary for the construction of a traffic signal installation complete, in place, and operative as described in the project plans and these Special Provisions.

A. General Material Requirements.

1. Section 2525 of the Standard Specifications is hereby modified by the following, which consists of the material requirements necessary for the construction of temporary traffic signal installation(s) complete, in place, and operative.

2. Equipment and materials shall be of new stock unless the Plans provide for the relocation or reinstallation of existing equipment. New equipment and materials shall be the product of reputable manufacturers of electrical equipment, and shall meet the approval of the Engineer.

3. Materials delivered to the project shall be stored at a secure site and shall be protected from damage due to inclement weather prior to installation.

B. Traffic Signal Poles.

1. The traffic signal mast arm and pole assemblies shall be designed to support the number of signal heads (use weight and projected areas of polycarbonate signal heads), future signal heads, and aluminum signs as shown on the plans.

2. Design for traffic signal poles shall conform to the 2013 AASHTO Standards for Highway Signs, Luminaires, and Traffic Signals and meet the requirements specified in Section 4189 of the Iowa DOT Standard Specifications.
- **a.** All traffic signal poles shall be detailed on shop drawings by the manufacturer indicating pole and arm dimensions and attachment method along with signal weight, projected areas, and type of mounting that it is designed to accommodate.
- **b.** Shop drawings shall be reviewed by the Engineer prior to fabrication and shall be stamped by a registered professional engineer in the State of Iowa.

3. Where a combination street lighting/signal pole is specified on the plans, the luminaire arm is to be mounted in the same vertical plane as the signal arm unless otherwise indicated on the plans or by the Engineer.
- **a.** The luminaire arm shall be of the single member tapered type with a 3’ rise.
- **b.** The luminaire arm shall provide the spread and nominal mounting height as shown on the plans.

4. Galvanizing Finish.
- **a.** The poles, mast arms, luminaire arms, and transformer bases be galvanized inside and out in accordance with ASTM A123, latest revision, with the following additional requirements.
  - **1)** All hot-dipped galvanized components, if powder-coated shall not receive a water quench or chromate quench.
  - **2)** All drainage spikes and surface defects shall be removed.
  - **3)** Galvanized components shall not be left outside or allowed to get wet.

4) Galvanized components shall not be transported uncovered.

b. **Surface Preparation.**

1) If contamination of the galvanizing has occurred or is suspected, the galvanizing shall be cleaned with a proprietary solvent/detergent designed for pre-cleaning and completely rinsed off prior to powder-coating. Solvents should only be applied with lint-free rags or soft-bristled nylon brushes. Once rinsed, the components shall be allowed to completely air-dry.
2) If ash residue from galvanizing is present, it should be removed using a solution of one to two percent ammonia. Apply the ammonia solution with a nylon brush, rinse thoroughly with hot water and allow to dry completely.
3) After the poles and arms are galvanized and all contamination, ash residue, etc. is cleaned off, their exterior surfaces shall receive a brush-off blast. The abrasive shall be Aluminum/Magnesium silicate with a particle size between 8 and 20 mils. Other natural media with a Mohs hardness of no more than five can also be used (corncobs, walnut shells, corundum, limestone, and mineral sands).
4) Brush-Off blasting should occur only when ambient temperature is 70°F or greater, with no more than 50% relative humidity.
5) If more than 1.5 mils of galvanizing is removed during brush-off blasting, the galvanized component shall be rejected.

5. **Exterior Finish.**

a. A powder coating applied liquid finish shall be provided to the exterior surface to traffic signal poles, mast arms, luminaire arms, and transformer bases
b. The finish coating for exterior surfaces is to be a semi-gloss colored black in accordance with RAL 9005 to match the existing signal poles at the intersection.
c. To insure quality control, the manufacturer of the poles and mast arms is to perform the process.

6. **Packaging and Shipment.**

For protection of the finish during shipping, poles, mast arms, luminaire arms and transformer bases are to be wrapped with a 3/16 inch ultra-violet inhibited plastic backed foam envelope with a built-in mechanism for easy removal of the wrap. In addition, traffic signal poles are to be cradled in a 1 inch thick rubberized foam base.

7. **Warranty.**

The manufacturer shall provide a minimum of a 10 year warranty for corrosion protection, weathering, and abrasion resistance finish of the steel substrate against defects for a period of 10 years from the date of installation. This warranty shall apply against excessive fading, cracking, or peeling of the finish material.

C. **Contractor Designed Foundation**

Where noted in the plans, the Contractor shall design the traffic signal pole foundation.

1. Foundation Design for signal poles shall conform to the 2013 AASHTO Standards for Highway Signs, Luminaires, and Traffic Signals and meet the requirements specified in Section 4189 of the Standard Specifications.

2. The Contractor shall submit calculations of all loads transmitted to the bases prior to fabrication. Calculations shall be stamped by a registered professional engineer in the State of Iowa. All calculations shall be submitted with shop drawings and shall be reviewed by the Engineer prior to fabrication.

3. Boring layout locations and soil information are provided in the following pages to support the foundation design.

HDR

January 15, 2016

Mr. Steve Megivern, P.E.
Iowa Department of Transportation
Office of Design - Soils Design
800 Lincoln Way
Ames, Iowa 50010

Re: S3 Submittal: IA 141 - Immediately North of I-80 to IA 44
Polk County, Iowa
Iowa DOT Project No. NHSX-141-7(42)-3H-77

Dear Mr. Megivern,

Attached are Boring Layout Plans and an LPILE soil input parameter report for use in traffic signal foundation design. CS.1, CS.2, CS.3, and CS.4 sheets are being sent separately, as is a Geotechnical Exploration Data Report from Thiele Geotech which includes soil boring logs and laboratory test results. Given the minimal amounts of sidehill sliver fills (up to approximately 5 feet) settlements are expected to be negligible. This letter report is very limited in accordance with the project scope which says: "***Consultant*** *will prepare a brief one-page 'report' email or transmittal letter which includes the boring logs and lab test data, the LPILE input parameter report, and the CS.1 sheet, as described by Mr. Robert Stanley of Iowa DOT in an email dated August 23, 2014.*"

Please contact us if you have any questions or comments concerning this information.

Sincerely,

HDR ENGINEERING, INC.

John A. Christiansen

John A. Christiansen, P.E.
Senior Geotechnical Engineer

Patrick H. Poepsel, P.E.
Geotechnical Section Manager

Attachments

LICENSED PROFESSIONAL ENGINEER
JOHN A. CHRISTIANSEN
12644
IOWA

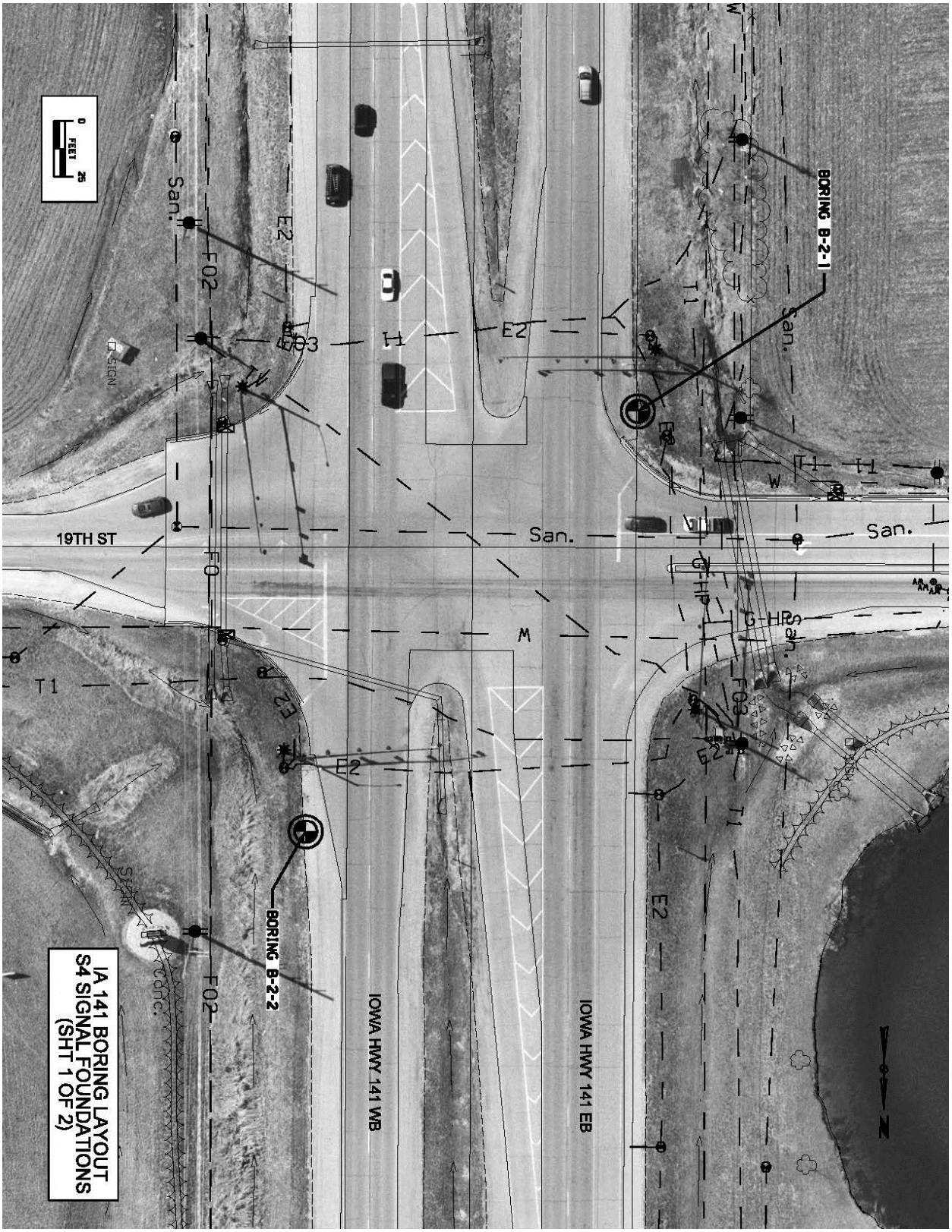
I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.

John A. Christiansen 2/26/16
John A. Christiansen, P.E. Date
My license renewal date is December 31, 2016.

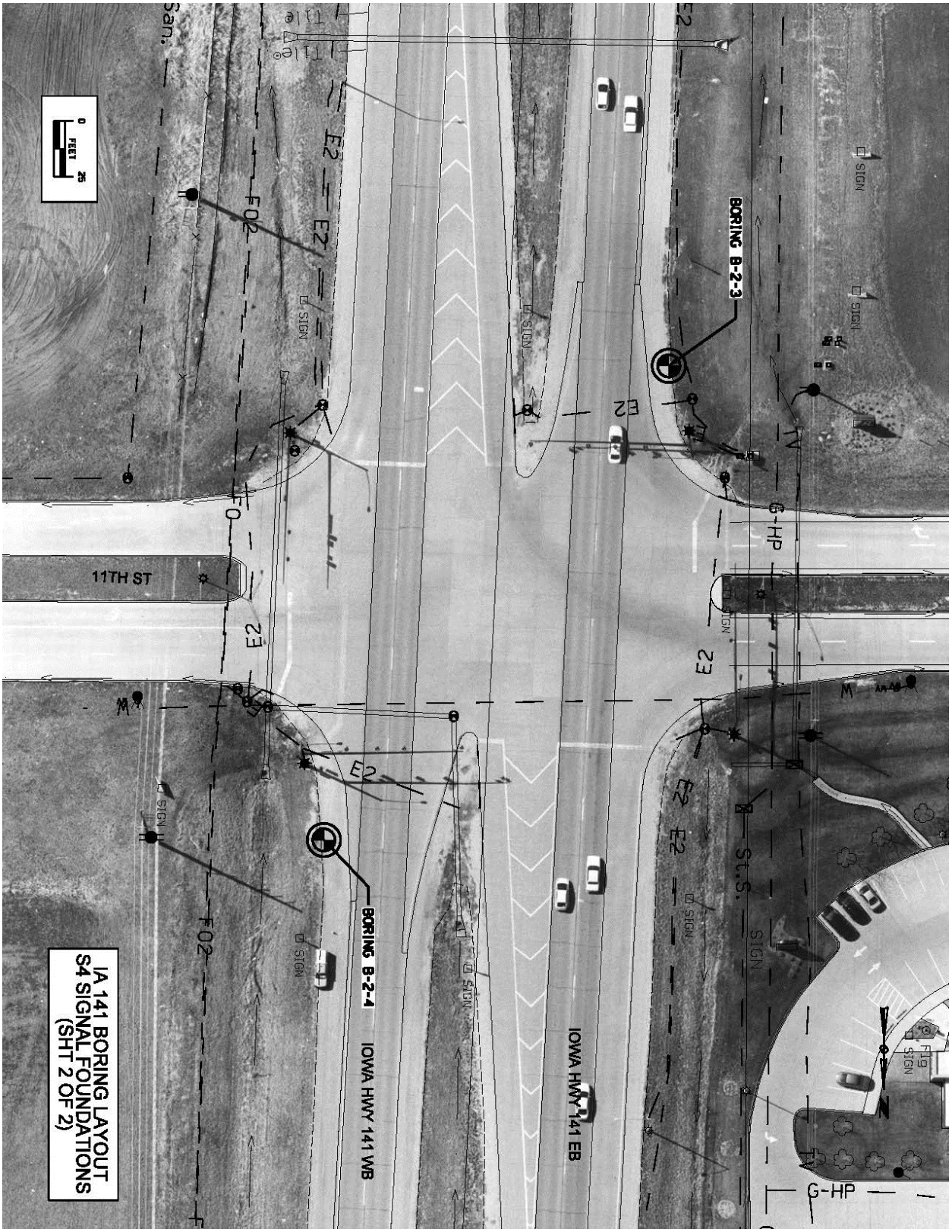
Pages covered by this seal: Letter report; LPILE Report

hdrinc.com

8404 Indian Hills Drive, Omaha, NE 68114-4098
(402) 399-1000



IA 141 BORING LAYOUT
S4 SIGNAL FOUNDATIONS
(SHT 1 OF 2)



IA 141 BORING LAYOUT
S4 SIGNAL FOUNDATIONS
(SHT 2 OF 2)

IA 141 Traffic Signal Foundations
LPILE Input Parameters

Boring No. B-2-1

Layer	Top Elevation (feet)	Unit Weight (pcf)	c_u (psf)	ε_{50} (in/in)	Φ (deg.)	k (pci)
Stiff Clay	951.3 (existing ground surface)	125	2,000	0.006	-	300
Silty Sand	943.8	58*	-	-	32	60
Soft Clay	938.3	60*	750	0.01	-	-
Stiff Clay	932.8	60*	1,500	0.007	-	200

Boring No. B-2-2

Layer	Top Elevation (feet)	Unit Weight (pcf)	c_u (psf)	ε_{50} (in/in)	Φ (deg.)	k (pci)
Stiff Clay	952.7 (existing ground surface)	125	2,000	0.006	-	300
Stiff Clay	944.2	60*	1,500	0.007	-	200

Boring No. B-2-3

Layer	Top Elevation (feet)	Unit Weight (pcf)	c_u (psf)	ε_{50} (in/in)	Φ (deg.)	k (pci)
Stiff Clay	956.6 (existing ground surface)	125	2,000	0.006	-	300
Soft Clay	948.1	60*	750	0.01	-	-
Stiff Clay	943.6	60*	1,500	0.007	-	200

Boring No. B-2-4

Layer	Top Elevation (feet)	Unit Weight (pcf)	c_u (psf)	ε_{50} (in/in)	Φ (deg.)	k (pci)
Stiff Clay	958.1 (existing ground surface)	125	2,000	0.006	-	300
Stiff Clay	954.6	60*	1,500	0.007	-	200

c_u = undrained cohesion
ε_{50} = strain at 50% maximum stress
k = soil modulus
ϕ = angle of internal friction
* effective unit weight

D. Vehicle Signal Heads.

This section of the specifications describes the minimum acceptable design and operating requirements for vehicular signal heads with 12 inch diameter lens openings, including all fittings and brackets as shown on the plans.

All components of the vehicular signal heads furnished under this specification shall comply with the latest version of the Institute of Transportation Engineers (ITE) Standard(s) for Adjustable Face Vehicle Traffic Control Signal Heads.

1. The housing for the individual signal sections shall be made of a durable polycarbonate. It shall be clean, smooth and free from flaws, cracks, blowholes, and other imperfections. It shall be designed as a self-contained unit capable of separate mounting or inclusion in a signal face containing two or more signal sections rigidly and securely fastened together. It shall be equipped with openings and positive locking devices in the top and bottom so that it may be rotated between waterproof supporting brackets capable of being directed and secured at any angle in the horizontal plane. Doors and lenses shall be provided with suitable watertight gaskets and doors shall be suitably hinged and held securely to the body of the housing by simple locking devices of non-corrosive material.

2. The optical system shall be so designed as to prevent any objectionable reflection of sunrays even at times of the day when the sun may shine directly into the lens.

3. Lenses shall be 12 inches in diameter as specified on the plans. Lenses shall be glass. Red, yellow, and green LED lenses shall be used in all signal heads. LED lenses shall meet the following ITE specification: Vehicle Traffic Control Signal Heads – Part 2: Light Emitting Diode (LED) Vehicle Traffic Control Signal Modules, An Interim Purchase Specification of the Institute of Transportation Engineers.

4. The visors for each signal section shall be durable polycarbonate not less than 0.10” in thickness. It shall be designed to fit tightly against the door, and shall not permit any perceptible filtration of light between it and the housing door. Visors shall be of the tunnel-type at least 8 inches long for all 12 inch rectangular pedestrian signals, at least 9 1/2 inches long for 12 inch diameter signals, shall angle slightly downward, and shall be of the type specified on the plans.

5. The reflector holder shall be designed to separately support the reflector and socket in proper relation to the lens. The reflector holder shall either be hinged to the left-hand side of the signal body when viewed from the front with the right-hand side held in place by a spring catch or other quickly releasable means, or the reflector shall be mounted in a manner that does not require it to be removed from its normal position during bulb replacement. Both the hinge device and the spring catch, or equivalent, shall be of a flexible nature which will permit the reflector holder to be pushed inwardly for at least one-sixteenth of an inch and to align itself correctly with the lens when the door of the optical unit is closed and pressed against the rim of the reflector holder. By such means, the joint between the reflector holder and the lens shall be rendered dust-tight. It shall not be necessary to remove any screws or nuts in order to swing the reflector holder out of the body section to obtain access to the light socket. The reflector shall be alzak treated aluminum or polycarbonate. Glass is not acceptable. The reflector assembly shall be interchangeable and shall be designed so that it can be easily removed without the use of tools. When polycarbonate reflectors are furnished, gaskets shall be fabricated of silicone material.

6. The lamp receptacle shall be of the fixed focus type, positioning the lamp filament at the correct focal point in respect to the reflector. The assembly shall be designed so that the lamp socket can be rotated through 360 degrees and eight positions of adjustment for proper positioning of the lamp filament after relamping the signal. The lamp socket shall be equipped with color-coded wire, either red, yellow, or green, depending upon the lens color of the

section. The socket wires shall be a minimum of 26 inches long, composed of wire with insulation designed to withstand 105°C. The wiring leads shall be terminated with spade lugs for ease of connection to the terminal block. The socket shall be equipped with a gasket to insure a dust-tight fit between the socket and reflector.

E. Countdown Pedestrian Signal Heads.

The pedestrian traffic signal head shall be countdown pedestrian signals manufactured as a one piece assembly that meet the following requirements:

1. A pedestrian traffic signal head with a 12 inch combination LED “Man” and “HAND” symbol messages and a 12 inch Numeric Display LED digital countdown display.

2. Lenses shall be polycarbonate; glass lenses are not acceptable. A polycarbonate signal housing that protects the light source and other required components and includes an indication mounting door and sun visor shall be used.

3. Capable of blanking out the walk time and only displaying the clearance time, when utilizing timings in a coordinated system.

4. All pedestrian signal indications shall be LED. The “Man” symbol, “Hand” symbol, and countdown indication shall be a LED display.

5. Pedestrian signal mounting hardware shall consist of 1 1/2 inch diameter polycarbonate with appropriate fittings. Pedestrian signals shall be secured to pole by using a minimum 5/8 inch wide stainless steel band.

6. The pedestrian signal head shall include polycarbonate visors for each section. Visors shall be a minimum of 9 inches long.

7. Conform with the latest version of the Institute of Transportation Engineers Standards on Pedestrian Traffic Signal Heads and the Vehicle Traffic Signal Heads.

8. The LED modules shall be replaced or repaired if it fails to function as intended due to workmanship or material defects within the first 5 years from date of operation.

F. Pedestrian Push Buttons.

1. The pedestrian push button shall be pressure activated with no moving parts and shall be capable of providing audible and visual feedback of actuation.

2. The push button shall have an LED light and shall flash each time the button is pushed.

3. The entire assembly shall be weatherproof, watertight, and freeze-proof, secure against electrical shock, and able to withstand continuous hard usage.

4. Push button installations shall be based on final sidewalk grade and not based on pole grade for lowered or raised sidewalk sections. Push buttons shall be mounted at a height of 42 inches and no more than 48 inches.

5. MUTCD R10-3E sign shall be located below the direction arrow on the sign shall be provided and installed by the contractor.

6. MUTCD sign R9-5 shall be located as shown in the Plans. Payment for the sign, materials, and labor is included as part of the lump sum bid for traffic signalization.

G. Loop Detection.

1. Preformed Loops.

a. In all projects where new pavement is to be placed in the loop areas and wherever possible and practical, preformed loops shall be installed within or under the pavement in lieu of pavement sawn loops. The Engineer shall be notified when the Contractor requests to substitute pavement sawn loops for preformed loops and the Engineer shall determine if the request should be approved. Preformed loops may either be manufactured by an approved supplier, or built by the contractor.

b. Preformed loops built by the contractor shall consist of 1/2 inch rigid polyvinyl chloride conduit with approved IMSA loop wire conductors placed within the conduit. The conductors within the conduit shall be held firmly in place by a filler material such as backer rod, expanding foam, or silicone based sealants, which will remain flexible and provide rigidity to the conductors throughout the life of the preformed loop.

c. The conduit shall be thoroughly solvent welded to prevent moisture infiltration and provide mechanical strength to the loop. A PVC pulling elbow shall be placed at the point where the lead-in point meets the edge of the loop.

d. When installed, no part of the loop shall be within 2 feet of reinforcement rods in the surrounding pavement.

e. The loop should not be situated directly over any large metal object in the ground within 5 feet of the surface.

2. Saw Cut Loops.

a. Loop Wire.

The detector loop wire shall be inserted into a flexible plastic tubing (IMSA Specification 50-2-1984) of the full length from the point of the splice and placed into the slot with the number of turns specified. The tubing shall be of a continuous length from the point of splicing of the loop wire to the lead-in cable. The field loop conductors installed in the pavement shall run continuously from the terminating service box or base with no splices permitted. The field loop conductors shall be spliced to the lead-in cable and the lead-in cable shall run continuously from the terminating service box or base to the detector sensing unit. However, on multiple loop installations additional loop conductors may be spliced to the lead-in cable as directed by the Engineer. At the time of placing the loop wire in the sawed slots, the ends of the tubing shall be sealed to prevent any entrance of moisture into the tubing.

b. Wire twisting.

Wherever possible in order to reduce line noise, all lengths of loop wires and tubing that are not embedded in the pavement shall be twisted with at least five turns per foot, including lengths in conduits and service boxes.

c. Loop Wire Splices.

1) The wires shall be spliced by soldering iron using 40/60 rosin core solder only. The solder joint shall be smooth and provide proper physical bonding of the conductors. A flame shall not be used for soldering.

2) The wire portion of the splice shall be covered with a layer of heat shrink tubing. The heat shrink shall be secured by an electrical heat gun with heat reflector to insure uniform heat distribution on the tube. No flame may be used on the heat shrink tubing.

3) The final layer of heat shrink tube shall be an outdoor rated heavy-wall, cross-linked polyolefin heat shrink tubing. The tubing shall be centered with a minimum of 1 inch of the outer jacket being encapsulated by the heat shrink tubing.

4) Lead-In cable to loop wire splices shall be soldered together leaving only enough exposed insulation and conductor to make the splice.

5) Loop wire to lead-in cable splices shall be environmentally sealed against weather, moisture and abrasion using a commercially available encapsulating enclosure kit.

d. Location of Loops.
The location of each loop shall be marked on the pavement with crayon or spray paint. The Contractor shall obtain the approval of the Engineer prior to cutting the saw slots.

e. Concrete Sawing.
The saw shall be equipped with a depth gauge and horizontal guide to assure proper depth and alignment of the slot. The blade used for the saw cut shall provide a clean, straight, well-defined 3/8 inch wide saw cut without damage to adjacent areas. The depth of the saw cut shall be 2 inches deep. Where the loop changes direction, the saw cuts shall be overlapped to provide full depth at all corners. All adjacent cuts must be at angles greater than or equal to 90 degrees. The saw cut depth shall not vary by more than 1/4 inch within each loop. A diamond blade with water shall be used in the saw cut operation. Carbide blades are not acceptable.

f. Loop Slots.
Before installing loop wire, the saw slots shall be checked for the presence of jagged edges or protrusions. Should they exist, they must be removed. The slots shall be cleaned and dried to remove cutting dust, grit, oil, moisture or other contaminants. Cleaning shall be achieved by flushing with a stream of water under a minimum of 1000 psi pressure and following, the slots shall be cleared of water and dried using oil-free air.

g. Loop Conductor Installation.
Loop detector conductor shall be installed using a 3/16 inch to 1/4 inch thick wood paddle or rotary wire insertion tool. If the wire does not lie close to the bottom of the saw cut, it shall be held down by means of a material such as duct sealant or backer rod.

h. Loop Wire Placement.
Each loop shall be coiled clockwise unless specified within the plans. The beginning conductor shall be marked with a single color-coded piece of permanent tape and the associated end marked with two pieces of permanent tape of the same color. The markings shall be recorded for future information.

i. Loop Detector Saw Slot Filler.

1) The saw slot filler shall be a rapid cure, high viscosity, liquid epoxy, or approved equal, formulated for use in sealing inductive wire loops and leads embedded in asphaltic concrete and portland cement concrete. The saw slot filler shall be usable on grades of 15% or less without excessive flow of material, unless otherwise approved by the Engineer.

2) The loop sealer or sealant shall be a two-component system, which consists of, a resin constituent identified as pourable and a hardener identified as quick setting. The sealer shall be Bondo P-606 for concrete and seasoned asphalt, E709 for new asphalt; WR Meadows Sealex; 3M Detector Loop Sealant Series 5000; or equal, as approved by the Engineer. Both the resin and the hardener shall be in liquid form before mixture of the two components.

3) Approval of other sealants shall be based on specification and/or test data about their physical properties and chemical resistance. Loop sealant shall not be installed during rain or other forms of precipitation or below temperatures specified by the manufacturer of the product. The cured sealer shall be unaffected by oils, gasoline, grease, acids and most alkalis. The mixing of components and the filling of the cut shall be in accordance with the directions of the manufacturer.

4) No measurable amount of sealant shall be left on the surface of the pavement and the sealant within the saw cut shall be level with the pavement surface.

j. Loop Testing.

1) After installation of the loops, the Contractor shall test the continuity, inductance, and resistance of the loop and lead-in wire. Tests should be conducted with one or more loop tester devices capable of measuring the induced ac voltage, inductance in microhenrys (μH), integrity of the wire insulation, and loop wire resistance in ohms.

2) The wiring diagram of the plan set or the inspection report should include a table of calculated values of the inductance in microhenrys and resistance in ohms for each loop.

3) Two values should be shown: one at the pull box without the lead-in cable, and the

second at the controller cabinet with the lead-in cable connected.

4) The loop installation is acceptable under the following conditions:
- **a)** Induced voltage: There is no deflection of the pointer on a voltmeter.
- **b)** Inductance: The inductance reading on the loop tester is within 10% of calculated value.
  - **(1)** Leakage to ground: The resistance to ground of a newly installed loop exceeds 100 megohms as measured with a 500 volt (V) megger.
  - **(2)** Loop resistance: The reading on an ohmmeter is within 10% of the calculated value.

5) The total loop system (loop plus lead-in) inductance is within the acceptable range of the vehicle detector specified in the plan.

6) The detector system (loops + lead-in + electronic detector) shall be capable of reliably detecting all licensed vehicles.

7) The Contractor shall provide the Engineer with a report on company letterhead indicating the inductance, leakage to ground, and loop resistance test values for each loop. The test shall be conducted from the curbside handhole. An inductance, leakage to ground, and loop resistance test shall also be conducted and reported for the total detector lead-in and loop system with the test being conducted at the Controller cabinet. The City Traffic Engineer may independently test any or all loops at any time. Any Loop not meeting the requirements for an acceptable loop installation shall be repaired or replaced as directed by the Engineer. The Contractor shall bear all costs of replacing loop installations deemed unsatisfactory by the Engineer.

H. Signal Head Covers

If, after the signal assemblies are erected and the signal is not put immediately into operation, the signal faces shall be covered securely with vinyl covers specifically designed for this purpose. The covers shall be fastened to the heads with nylon straps utilizing a cam lock mechanism to secure the straps. Plastic bags, cardboard, burlap and other similar materials are not acceptable covers.

I. Relocated Traffic Signal Controller and Cabinet.

The existing signal controller and cabinet at the intersection of SE 37th Street shall be removed and relocated as shown in the Plans. Special care shall be taken by the Contractor to ensure the signal controller and cabinet is stored properly to avoid corrosion and damage caused by moisture and water. Any parts found to be defective or damaged shall be replaced with new equipment in kind, at the expense of the Contractor.

J. Salvageable Equipment.

1. Contractor shall transport and deliver salvaged traffic signal equipment to the City of Grimes Maintenance Facility.

2. Contractor shall make an appointment with the City before delivering these items. Contractor shall deliver these items during normal business hours and supply men and equipment to unload the items.

3. The following are items that shall be returned to the City of Grimes at the end of the project:
- **a.** Signal Poles, luminaire arms, and Mast Arms
- **b.** Signal Heads
- **c.** Pedestrian Push Buttons and Signs

150143.03 CONSTRUCTION.

Installation shall be in accordance with requirements of Sections 2525 and 2528 of the Standard Specifications and per Manufacturer's Recommendations.

150143.04 METHOD OF MEASUREMENT.
No measurement or payment of individual traffic signal items will be made.

150143.05 BASIS PAYMENT.
Traffic Signalization measured as provided above will be paid for at the contract price lump sum bid price. Payment shall be full compensation for furnishing all equipment, materials, labor and all other work necessary or incidental to the construction of the complete traffic signal installation.

Traffic Signalization					
Item	Description	Quantity	Unit	Unit Price	Unit Extension
1	Remove and Reinstall Signal Controller with Cabinet, Accessories	1	Each	$_____	$_____
2	Pedestrian Pushbutton with R10-4A sign	2	Each	$_____	$_____
3	Pedestrian Signal Head-18 in Hand-Walking Person Symbol; Countdown	4	Each	$_____	$_____
4	Traffic Signal Head-12 in R,Y,G,<Y,<G; w/ Backplate	1	Each	$_____	$_____
5	Traffic Signal Head-12 in R,<Y,<G; w/ Backplate	4	Each	$_____	$_____
6	Traffic Signal Head-12 in R,Y,G; w/ Backplate	14	Each	$_____	$_____
7	Traffic Signal Head-12 in R,Y,G; No Backplate	6	Each	$_____	$_____
8	Traffic Signal Head-12 in R,Y,G,Y>,G>; w/ Backplate	4	Each	$_____	$_____
9	Traffic Signal Head-12 in R,Y,G,Y>,G>; No Backplate	7	Each	$_____	$_____
10	Remove and Reinstall Handhole - Type I	34	Each	$_____	$_____
11	Loop Detector	104	Each	$_____	$_____
12	Cable-1c, #6 AWG, Power Lead-In	72	Feet	$_____	$_____
13	Cable-12c, #14 AWG, Signal Circuits	118	Feet	$_____	$_____
14	Cable-7c, #14 AWG, Signal Circuits	295	Feet	$_____	$_____
15	Cable-5c, #14 AWG, Signal Circuits	94	Feet	$_____	$_____
16	Cable-2c (PB)	56	Feet	$_____	$_____
17	Cable-2c, #14 AWG, Detector Lead-In	2,281	Feet	$_____	$_____
18	Cable-1c, #14 AWG, Loop Wire	16957	Feet	$_____	$_____
19	Cable-1c, #8, for Street Lighting	44	Feet	$_____	$_____
20	Cable-1c, #6 AWG, Bare Copper Wire for Ground Circuits	102	Feet	$_____	$_____
21	Cable-1c, #10 AWG, Tracer Wire	102	Feet	$_____	$_____
22	Pull Rope	46	Feet	$_____	$_____
23	Detector Sawcut	5,781	Feet	$_____	$_____
24	Conduit-1 in Rigid Metal	965	Feet	$_____	$_____
25	Conduit-2 in PVC (HDPE)	2851	Feet	$_____	$_____
26	Conduit-2 in Rigid Metal	116	Feet	$_____	$_____
27	Conduit-3 in PVC (HDPE)	84	Feet	$_____	$_____
28	Conduit-3 in Rigid Metal	509	Feet	$_____	$_____
29	Conduit-4 in PVC (HDPE)	88	Feet	$_____	$_____
30	Conduit-4 in Rigid Metal	220	Feet	$_____	$_____
31	Concrete Base-Controller	1	Each	$_____	$_____
32	Concrete Base-Pedestal Pole 2 ft Dia. X 3 ft	2	Each	$_____	$_____
33	Concrete Base-3.5 ft Dia. X 21 ft	1	Each	$_____	$_____
34	Contractor Designed Foundation	4	Each	$_____	$_____
35	Pedestal Pole-10 ft	2	Each	$_____	$_____
36	Combo Pole-80 ft Mastarm Length	1	Each	$_____	$_____
37	Combo Pole-90 ft Mastarm Length	1	Each	$_____	$_____
38	Combo Pole-95 ft Mastarm Length	1	Each	$_____	$_____
39	Combo Pole-98 ft Mastarm Length	2	Each	$_____	$_____
40	Type A Sign; Post Mounted	1	Each	$_____	$_____
41	Street Name Sign; Mastarm Mounted	1	Each	$_____	$_____
42	Remove and Reinstall Sign	20	Each	$_____	$_____
43	Remove and Reinstall Luminaire	5	Each	$_____	$_____
44	Remove Pedestrian Pushbutton and Pedestrian Sign	10	Each	$_____	$_____