

**SP-121002
(New)**



**SPECIAL PROVISIONS
FOR
TRAFFIC SIGNALIZATION**

**Polk County
STP-U-8260(624)--70-77**

**Effective Date
January 16, 2013**

THE STANDARD SPECIFICATIONS, SERIES 2012, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

TABLE OF CONTENTS

I GENERAL REQUIREMENTS

- 1.1 RELATED SPECIFICATIONS AND STANDARDS
- 1.2 LOCAL REQUIREMENTS
- 1.3 REMOVALS
- 1.4 RELOCATIONS
- 1.5 METHOD OF MEASUREMENT
- 1.6 BASE OF PAYMENT

II INSTALLATION REQUIREMENTS

- 2.1 FOUNDATIONS AND STRUCTURAL SUPPORT SYSTEM
- 2.2 CONDUIT
- 2.3 WIRING AND CABLE
- 2.4 BONDING AND GROUNDING
- 2.5 TRAFFIC SIGNAL DISPLAYS
- 2.6 CONTROLLER CABINET
- 2.7 PAINTING
- 2.8 LOOP DETECTORS
- 2.9 LOCATE BOX

III MATERIAL REQUIREMENTS

- 3.1 TRAFFIC SIGNAL CABLE
- 3.2 SIGNS

IV EQUIPMENT REQUIREMENTS

- 4.1 TRAFFIC SIGNAL CONTROLLER SYSTEM, TYPE 170
- 4.2 VEHICULAR TRAFFIC SIGNAL HEADS
- 4.3 PEDESTRIAN TRAFFIC SIGNAL HEADS
- 4.4 ALUMINUM TRAFFIC SIGNAL PEDESTAL
- 4.5 GALVANIZED STEEL TRAFFIC SIGNAL SUPPORT
- 4.6 PEDESTRIAN PUSH BUTTON DETECTORS

V POLE FINISH

- 5.1 GENERAL
- 5.2 SURFACE PREPARATION
- 5.3 ZINC COATING
- 5.4 EXTERIOR COATING
- 5.5 QUALITY CONTROL
- 5.6 PACKAGING
- 5.7 FIELD REPAIR PROCEDURE
- 5.8 METHOD OF MEASUREMENT

VI SCHEDULE OF UNIT PRICES

- 6.1 SCHEDULE OF UNIT PRICES

VII FIELD WIRING DIAGRAM

- 7.1 FIELD WIRING DIAGRAM

PART I - GENERAL REQUIREMENTS

This part consists of the general provisions necessary when furnishing a traffic signal installation complete, in place and operational as described in the project plans and these special provisions.

This project includes the design of a **Base Set** and **Added Option A** design. The contractor shall provide unit cost list as part of their bid for both the **Base Set** and **Added Option A**.

- **Base Set:** In summary, the design includes the relocation of the existing span wire traffic signal from the existing intersection location to the proposed intersection location.
- **Added Option A:** In summary, the design includes the removal of the existing span wire traffic signal from the existing intersection location and installation of a new traffic signal using mast arm type poles at the proposed intersection location.

1.1 RELATED SPECIFICATIONS AND STANDARDS

Unless otherwise specified in the project plans and special provisions the traffic signal installed under this specification shall comply with:

- A. Iowa D.O.T. Standard Specifications, Series 2012.
- B. Specifications of the Underwriters Laboratories Inc.
- C. National Electrical Code.
- D. Manual on Uniform Traffic Control Devices latest edition.

1.2 LOCAL REQUIREMENTS

The Contractor shall notify and receive approval from the City of Des Moines, from now on referred to as "City", prior to any operational shutdown of any existing traffic signal installation. Adherence to the City Electrical Code shall be required for service to the Controller.

The Contractor is responsible for locating all equipment installed as part of the project within the City right-of-way until project acceptance. Any damage as a result of failure to locate this equipment shall be the responsibility of the Contractor to replace with no additional cost to the City.

Contractor shall provide to the City "as-built" drawings that identify all changes made to the contract plans.

1.3 REMOVALS

All existing traffic signal pole foundations that become unused for the new traffic signal shall be removed completely and discarded by the contractor.

All existing traffic signal handholes that become unused for the new traffic signal shall be removed and discarded by the contractor.

Unless otherwise indicated on the plans, all existing wiring that becomes unused in this project shall be removed and discarded of by the contractor. Removal of existing conduit is not required unless in conflict with construction operations.

All holes shall be filled and surface restored.

Removals and restoration are incidental to the other pay items unless otherwise specified in the contract documents.

1.4 RELOCATIONS

During the relocation/storage of the existing traffic signal materials, 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 to the satisfaction of the Engineer 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 existing traffic signal materials to a like new condition.

Necessary equipment to be relocated as part of the **Base Set** includes:

- Traffic Signal Steel Poles (See Section 2.1 of special provision) – All expenses, including all labor, materials and associated cost are considered incidental to cost of "Relocate Traffic Signal Pole (Steel) and Luminaire" line item.
- Traffic Signal Heads – All mounting hardware required for new installation is considered incidental to cost of "Relocate Signal Head" line item unless otherwise specified in the contract documents.
- Luminaires – Cost of luminaire relocation is considered incidental to cost of "Relocate Traffic Signal Pole (Steel) and Luminaire" line item. Contractor shall coordinate luminaire installation with power service provider.
- Signs - All mounting hardware required for new installation is considered incidental to cost of "Relocate Street Name Sign (Mount to Signal Pole)" or "Relocate Street Name Sign (Mount to Span Wire)" line item(s) unless otherwise specified in the contract documents.
- Controller/Cabinet – All expenses, including all labor, materials and associated cost in order to provide a complete in place, fully operational traffic signal system are considered incidental to cost of "Relocate Controller, Cabinet, and Accessories" line item.

Necessary equipment to be relocated as part of the **Added Option A** includes:

- No materials identified at this time.

1.4 METHOD OF MEASUREMENT

None. Plan quantities are for estimating purposes only, and these quantities will not be paid for separately.

1.5 BASIS OF PAYMENT

- A.** Payment for Traffic Signalization will be made at the lump sum contract price.
- B.** Removal of the existing traffic signal installation will be paid for at the lump sum price for Removal of Traffic Signalization. The lump sum price for Removal of Traffic Signalization will be full payment for the removal and relocation of items as identified on the traffic signal plan sheets.

PART II - INSTALLATION REQUIREMENTS

This part consists of the installation details necessary during the construction of a traffic signal complete, in place, and operational as described in the project plans and these special provisions.

An anti-seize compound shall be used in the installation of all mechanical connections and fasteners, including all nuts and bolts.

2.1 FOUNDATIONS AND STRUCTURAL SUPPORT SYSTEM - APPLIES TO BOTH BASE SET AND ADDED OPTION A

The Contractor shall be responsible for the proper elevation, offset, and level of each foundation.

The foundations must be given seven days to cure before poles are erected.

The contractor shall provide signed and sealed designs for all concrete bases where mast arms are longer than 70 feet or when it is span wire type or when called for on the plans. The cost for the design shall be considered as part of the cost of the pole foundation. This design would then be used as a substitute for footing design as shown on the signal detail sheet of the plans. The use of the ground rod and the number of conduits as indicated on the signal detail sheet of the plans shall remain the same regardless of whether the foundation is for mast arm signal pole or span wire signal pole.

When installing a conduit bend in an existing base the conduit size shall be equivalent to the conduit in the ground. The steel in the base shall not be cut or damaged and the concrete shall be broken away in the shape of a "U" with an approximate depth of at least 12 inches below the depth of the surrounding ground surface. Enough concrete shall be removed so the conduit will be inside the anchor bolts of the foundation. The conduit shall be placed in the "U" with concrete added in the "U" and finished to match the base.

BASE SET NOTE:

The Contractor shall propose the structural support system for the span wire traffic signal design in which the signal poles and structural supports are designed to support the actual number of signal heads (use weight and projected areas of polycarbonate signal heads) and aluminum signs with actual span lengths. Design of poles and structural supports shall comply with AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, 2001 and current interims. The contractor shall submit shop drawings, signed and sealed by an Engineer Licensed in the State of Iowa, to the Engineer for review. The Contractor shall not order materials or equipment, nor begin construction of the temporary traffic signal until the shop drawings have been reviewed and approved by the Engineer.

The structural design shall demonstrate the design and construction of the relocated span wire traffic signal poles, structural supports and structural elements and shall include:

- Design for the pole reinforced concrete bases.
- Structural design verification of four existing steel signal poles
- Signal head and signing support system including appropriately sized tether and messenger cables. Bottom signal tether cable shall be provided. Maximum sag distance is 5% of span length. Existing tether and messenger cable shall not be used.
- Appropriately sized guy wires/down rods if necessary.
- The Contractor shall also provide soil investigation/information if necessary.

The cost for the structural support system design, other than the design of the reinforced concrete bases, shall be considered as part of the "Structural Support System" line item.

2.2 CONDUIT - APPLIES TO BOTH BASE SET AND ADDED OPTION A

Conduit buried in open trenches shall be placed a minimum of 36 inch deep and a minimum of 2 feet from the back of curb unless otherwise directed by the Engineer. Open trench methods of placing conduit will be permitted except where the conduit is to be placed under existing pavement. Conduit in pavement areas shall be placed to a minimum depth of 48 inches below the finished pavement surface or as directed by the Engineer.

When underground conduits parallel an existing facility, maintain at least 1 foot of separation.

All conduit shall include one, 1/2 inch wide, polyester cable pulling tape with a minimum 1200 pound tensile strength when installation is complete. All conduits shall include a tracer wire as specified in the Wiring and Cable section.

All conduit will be proofed by the Contractor upon completion to verify continuity and integrity of the duct.

2.3 WIRING AND CABLE - APPLIES TO BOTH BASE SET AND ADDED OPTION A

Each vehicle and pedestrian signal head shall have a separate cable from the signal head to the pole base. A signal head cables shall be spliced in the pole base. Within the cabinet, all signal cables shall be labeled as to their direction of origin.

All splices in the handhole compartment of a signal pole shall be made using silicone filled, screw-on wire connectors. Wires shall be twisted before the connector is added. Cable connections in signal heads and controller cabinets shall be made at the terminal blocks provided for that purpose, without using crimp-on connectors.

The Contractor shall also provide and install wiring from the end of the luminaire arm to the pole base. The Contractor shall connect the cables in the pole to the intersection lighting cable using fused connectors. Fused connectors shall be used for all connections. Unless otherwise indicated on the plans, luminaires will be supplied and installed by others.

A continuous orange tracer wire (1c #10) shall be included from each pole base to the controller cabinet. A separate orange tracer wire (1c #10) shall be included in all conduits with all fiber optic communication cable. A yellow tracer wire shall be used in conduits with only streetlight circuits. Tracer wire for the signal system shall terminate in the controller cabinet and shall be labeled with the direction of origin. Tracer wire for the communication/fiber system shall terminate in the locate box. The Contractor shall install, splice, and test the tracer wire for continuity. Every tracer wire run shall be grounded at one end.

See **Section 7.1** for field wiring diagram.

2.4 BONDING AND GROUNDING - APPLIES TO BOTH BASE SET AND ADDED OPTION A

Metal conduit, service equipment, anchor bolts, metal poles, pedestals, controller cabinets, interconnect cable shields, and all other electrical equipment shall be made mechanically and electrically secure to form a continuous system, and shall be effectively grounded. The grounding conductor shall be a No. 6 AWG copper, non-insulated wire.

Grounding shall be accomplished by bonding the grounding circuits to copper clad metal, driven electrodes. All electrodes shall be as a minimum, 5/8 inch in diameter by 10 feet long. The electrodes shall be driven vertically until the top of the rod is minimum of 4 inches below grade. Bonding to the ground rod shall be made by means of suitable screw type positive ground rod clamps. The controller cabinet ground shall measure 10 ohms or less.

Grounding to existing water lines will not be permitted.

Bonding of standards and pedestals shall be by means of a bonding strap attached to an anchor bolt or to 1 inch, or longer, brass or bronze bolt installed in the lower portion of the shaft.

The service meter and socket shall be bonded to a ground electrode by use of a ground clamp and a No. 6 AWG copper wire.

Bonding of metallic conduit in concrete pull boxes and manholes shall be by means of galvanized grounding bushings and bonding jumpers. Where there is a change, at a pull box or manhole, from non-metallic conduit to metallic conduit, the grounding wire in the non-metallic conduit shall be bonded to the metallic conduit. Saddle clamps are not acceptable.

Existing ungrounded metal poles on which cabinets are mounted shall be grounded by means of a driven ground rod.

The interconnect cable shield shall be bonded to the controller ground buss at one controller termination point for each interconnect run.

2.5 TRAFFIC SIGNAL DISPLAYS - APPLIES TO BOTH BASE SET AND ADDED OPTION A

All new overhead traffic signal heads shall have backplates. Universally adjustable brackets and cable banding shall be used to mount all pole-mounted and mast arm-mounted overhead signals. All overhead displays located on each mast arm shall have each red indication set at approximately the same elevation, unless otherwise directed by the Engineer. All optically limited signal heads shall be properly masked to limit their field of view as directed by the Engineer.

During the course of construction and until the signals are placed in operation, signal faces shall be covered or turned away from approaching traffic. When ready for operation, they shall be securely fastened in position facing toward approaching traffic.

2.6 CONTROLLER CABINET - APPLIES ONLY TO ADDED OPTION A

The aluminum rack edge shall be labeled for each detector amplifier, load switch, and isolator.

2.7 PAINTING - APPLIES TO BOTH BASE SET AND ADDED OPTION A

If the painted surface of any equipment is damaged in shipping or installation, such equipment shall be retouched or repainted in a manner satisfactory to the Engineer.

2.8 LOOP DETECTORS - APPLIES TO BOTH BASE SET AND ADDED OPTION A

The Contractor is responsible for replacing any loops found unacceptable after testing. An acceptable loop is defined as follows:

- A. Inductance: equal to or greater than the calculated value

- B.** Leakage to ground: greater than 100 megohms
- C.** Loop Frequency: equal to or greater than 0.0350. Loop frequency is defined as the frequency of the loop with a vehicle present (F_p) minus the frequency of the loop with no vehicle present (F_c) divided by the frequency of the loop with no vehicle present ($F_p - F_c$)/ F_c .

All loop detectors in new pavement shall be preformed. No saw-cut loops will be accepted in new pavement.

2.9 LOCATE BOXES - APPLIES TO BOTH BASE SET AND ADDED OPTION A

An outdoor-rated, single gang box to house communications/interconnect tracer wire shall be installed on the exterior of the controller cabinet. The location on the cabinet shall be determined by the project engineer. The locate box shall be constructed of die-cast aluminum with a die-cast zinc weatherproof cover and self-closing lid. The box shall be 2 3/4 inches by 4 1/2 inches by 2 5/8 inches D. A 12 inch long ground wire shall be attached to a lug within the box.

PART III - MATERIAL REQUIREMENTS

This part consists of material requirements necessary for the construction of a traffic signal installation complete, in place, and operational as described in the project plans and these special provisions.

3.1 TRAFFIC SIGNAL CABLE - APPLIES TO BOTH BASE SET AND ADDED OPTION A

Detector lead-in cable shall be No. 14AWG.

3.2 SIGNS - APPLIES TO BOTH BASE SET AND ADDED OPTION A

A. Traffic Sign Blanks: All sign blanks shall be aluminum alloy 6061-T6 conversion coated with Alodine 1200. 5052-H38 alloy is an acceptable alternative.

1. All blanks shall be 0.08 inches thick with the following exceptions:
 - a. If either the length or width dimension of a sign is 36 inches or greater, the blank shall be 0.125 inches thick.
 - b. Overhead mounted street name signs shall be 0.125 inches thick.
2. Blanks shall be finished free of any surface or edge burrs, cut marks, or other irregularities.
3. Standard signs shall be pre-drilled with standard hardware holes (0.375 inch diameter) and have no burrs or excess material retained in or around the hole. Holes placement and radii shall conform to the Standard Highway Signs Manual, current edition.
4. A diagram showing the location of holes for specialty signs will be provided at the time of order.
5. Street name signs shall not be pre-drilled.

B. Traffic Sign Faces: Shall meet all requirements of the latest edition of the "Manual on Uniform Traffic Control Devices" (MUTCD).

The background sheeting used on all signs, with the exception of pedestrian pushbutton signs, shall be 3M DG3 material. Any other applied material, including legends, letters, numbers, or borders, again with the exception of pedestrian push-button signs, shall also be 3M DG3 material. Pedestrian pushbutton signs shall be 3M Engineer Grade Prismatic reflective sheeting.

This material shall have a standard warranty to be free from any defects for a period of not less than 7 years from the date of manufacture. A copy of the standard warranty shall be provided as a part of the bid package.

C. Street Name Signs:

1. All street name signs shall be single-sided.
2. The length of the street name sign shall be in 6 inch increments and will vary based on the legend.

3. Lettering shall be white and the background shall be blue or green "EC" film. The background color will be specified at the time of order.
 4. Lettering shall be Series B as outlined in the Standard Highway Signs Manual.
 5. All 12 inch or larger signs shall have a white border as shown in the attached detail.
 6. Letter size and spacing shall conform to the MUTCD and the attached details. In cases where descending lower-case letters (g, j, p, q, and y) cannot be accommodated on the specified blank, the next larger blank size shall be used.
 7. 12 inch or larger street name signs shall be made of 3M Diamond Grade DG3 reflective sheeting. 8 inch street name signs shall be made of 3M High Intensity Prismatic reflective sheeting.
- D. Completed Signs:** Sign faces shall be firmly attached to the aluminum sign blanks, with no air bubbles, wrinkles, creases, tears or other surface blemishes. The faces shall be neatly trimmed to match the edge of the sign blank. The sign faces shall be properly positioned to provide a uniform border around all sides of the sign.

The signs shall be handled carefully and packaged to prevent any damage to the sign faces. Any sign faces which are damaged at the time of delivery will be rejected and returned to the manufacturer. Undamaged replacement signs shall then be promptly sent, at no extra cost to the City of Des Moines.

- E. Sign Mounting Brackets:** All signs shall be supplied with a sign bracket. The traffic sign bracket shall be an articulated serrated bracket assembly that includes top, middle, and bottom sign mounting brackets and provides a rigid-mount for the traffic sign. All necessary hardware for a complete installation on a span wire or mast arm shall be included. The mast arm type mounting assembly shall be of a cable type. Approval of other bracket supports shall be based on specifications and/or test data about their physical properties and performance properties.

All pedestrian pushbutton signs shall be mounted to the signal pole using stainless steel bolts. Bolts shall be 5/16 inch flanged with plastic washer. Holes shall be drilled and tapped.

PART IV - EQUIPMENT REQUIREMENTS

This part consists of the equipment 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.

4.1 TYPE 170, TRAFFIC SIGNAL CONTROLLER SYSTEM - APPLIES ONLY TO ADDED OPTION A

- A. Related Specifications:** Unless otherwise stated herein, all equipment furnished under this specification shall be new, meeting the requirements of "California/New York Type 170, Traffic Signal Controller System-Hardware Specification," U.S. Department of Transportation, Publication FHWA-IP-78-16, December 1978, with the following exceptions:
1. Any reference to the State of California shall mean the Jurisdiction.
 2. Chapter 1, Section II "General" paragraph 3, the second sentence shall be deleted.
 3. Chapter 1, Section VIII "Electrical, Environmental and Testing Requirements" shall be modified as follows:
 - a. Any reference to the Contractor shall mean equipment manufacturer or supplier.
 - b. Paragraph 5.2 shall be changed to read "Two manuals containing the flow chart, listing, and instructions of the test program shall be furnished to the Jurisdiction when the controller unit is delivered."
 - c. Paragraph 6.1 the words "State Approval" shall be deleted.
 - d. Paragraph 6.2 shall be deleted.
 - e. Paragraph 6.3.6 shall be deleted.
 4. When specified, the Model 332A Cabinet furnished for the project shall meet the requirements of Chapter 11 "Specifications for Cabinet Model 332A," and the Model 336 Cabinet shall meet the requirements of "Specifications for Cabinet Model 336" dated February 1982, except that the color specified in Section 1, paragraph 3 shall be changed to silver. Molex Flash Blocks shall be provided for all eight vehicle phases to program either red or yellow flashing indications. A detector input panel shall be provided on the rear left side of the cabinet. Cabinet locks as specified in Section I, paragraph 4 shall be changed to Corbin Type 2 locks. An aluminum cabinet shall be furnished.

The aluminum surface shall have an anodic coating applied. The anodic coating and anodic coating process shall meet the requirements of Section 2.4.1 and 2.4.2 of the "Traffic Signal Control Equipment Specifications," California Business, Transportation and Housing Agency, Department of Transportation, January 1989. Alternative aluminum surface treatments, which produce an equivalent uniformly textured surface, may be substituted as approved by the Jurisdictional Engineer.

5. All loop detector amplifier units furnished for this project shall be Model 222, Two-Channel Loop Detector Sensor Units meeting the requirements of Chapter 4 with the following exceptions:
 - a. Digital design capable of normal operation when operated with a grounded loop.
 - b. Shall comply with all performance requirements when connected to an inductance of from 50 to 1500 microhenries.
 - c. Each detector channel shall respond to an absolute inductance change (Delta L) rather than as a percentage of the total inductance (Delta L/L).

- 6. In Chapter 11, Section III "Cabinet Accessories" paragraph 4, a new subsection will be added "Each vehicular and each pedestrian phase shall be provided with a separate switch pack."
- 7. A model 412C prom module shall be provided, configured to the following table:

Memory Socket	Address Range	Device Type	Chip No.*
U1	8000-FFFF	32K EPROM	INT 27256A
U2	3000-4FFF	8K ZPRAM	DAL 1225
U3	7010-7FFF	8K ZPRAM	DAL 1225
U4	1000-2FFF	8K RAM	HD 6264

*or approved equal

- 8. A Model 242 Two-Channel Isolator shall be provided to introduce stop timing to the controller from the conflict monitor and the manual flash switch.
- 9. The Model 210e Monitor Unit shall meet the requirements of Chapter 3 with the following additional requirements:
 - a. The Monitor Unit shall be capable of RED FAILURE detection in accordance with NEMA specifications. Following a long power outage, (greater than two seconds) the Monitor Unit shall be capable of disabling the RED FAILURE detection, until the signal heads are energized (approximately four seconds).
 - b. The Monitor Unit shall have the required circuitry to allow the early detection of a conflict caused by a green or yellow signal "hang up" and shall preclude the presentation of the conflicting signal display at the intersection.
 - c. Any additional harnesses or hardware required shall be furnished with the Monitor Unit.
 - d. The conflict monitor unit shall be capable of ignoring the watchdog and placing intersection in flash if line voltage is less than 98 (+/-2) VAC RMS.
- 10. A "PDA-2" Power Distribution Assembly shall be provided in lieu of the PDA-1 and the 24 volt D.C. Supply.
- 11. A standard print shelf drawer shall be provided and installed above the input file.
- 12. Four ACIA ports shall be provided.
- 13. One Model 400 internal modem shall be supplied for each controller when twisted pair communications is specified in the plans.
- 14. All components supplied shall be on CalTrans Qualified Product Listing and operate successfully with McCain 233 software.
- 15. Each cabinet shall include two fluorescent lighting fixtures mounted inside the front and back portion of the cabinet. These fixtures shall include a cool white lamp with protective cover and shall operate by a normal power UL listed ballast. Two door actuated switches shall be installed to turn on the cabinet light when the door is open, front door front light back door back light. Each switch should work each individual light.

- 16.** Each cabinet shall be provided with devices to protect the control equipment from surges and over voltages. This shall include incoming power lines, the Input File, the Output File, and communication lines.

Each inductive loop detector input wire shall be protected with a 30V MOV with (30 Joule Rating) P/n ERZ-C20 KE 470 or equal. The output of all load switch outputs shall be protected with a 150V MOV (80 Joule Rating). P/n ERZ-C20 DK 241U or equal. The MOVs shall be connected from the AC positive field terminal to the chassis ground.

For the 332A cabinet, appropriate input surge protection shall be mounted on the Lower Input Termination Panel (LIP). The power distribution assembly (PDA#2) of each controller cabinet shall include a surge protection unit on the AC Service Input. The protector shall be installed between the applied line voltage and earth ground. The surge protector shall be capable of reducing the effect of lightning transient voltages applied to the AC line. The protection device shall be a two stage series parallel device. It shall include the following features and functions:

- a. Maximum AC line voltage: 140 VAC.
 - b. Twenty pulses of peak current, each of which will rise in 8 microseconds and fall in 20 microseconds to 1/2 the peak: 20,000 Amperes.
 - c. The protector shall be provided with the following terminals:
 - 1) Main line (AC line first stage terminal).
 - 2) Main Neutral (AC Neutral input terminal).
 - 3) Equipment Line Out (AC Line second stage output terminal, 10 Amps.).
 - 4) Equipment Neutral Out (Neutral terminal to protected equipment).
 - 5) GND (Earth connection).
 - 6) The Main AC line in and the Equipment Line out terminals shall be separated by a 200 Microhenry (minimum) inductor rated to handle 10 Amp AC Service. The first stage clamp shall be between Main Line and Ground terminals.
 - 7) The second stage clamp shall be between Equipment Line out and Equipment Neutral.
 - 8) The protector for the first and second stage clamp must have a MOV or similar solid state device rated at 20 KA and be of a completely solid stage design (i.e., no gas discharge between tubes allowed).
 - 9) The Main Neutral and Equipment Neutral Out shall be connected together internally and shall have an MOV similar solid state device or gas discharge tubes rated at 20 KA between Main Neutral and Ground terminals.
 - 10) Peak clamp voltage: 350 Volts at 20 KA (Voltage measured between Equipment Line Out and Equipment Neutral Out terminals. Current applied between Main Line and Ground Terminals with Ground and Main Neutral terminals externally tied together.). Voltage shall never exceed 350 volts.
 - 11) The Protector shall be epoxy encapsulated in a flame retardant material.
 - 12) Continuous service current, 10 Amps at 120 VAC RMS.
 - 13) The Equipment Line Out shall provide power to the Type 170 and to the 24 V power supply.
 - 14) Provide communications line protector with a mounting connector for incoming and outgoing communication line.
- B.** Manufacturers: The controller units, cabinets, and auxiliary control equipment furnished under this specification shall be from a manufacturer whose Type 170 Controller System has been approved and purchased by either the State of California or the State of New York. The Engineer may allow exceptions to this requirement provided that the equipment to be furnished has been successfully operated on the street by a public

agency for more than one year and has been certified by an independent testing laboratory as meeting the requirements of Chapter 1, Section VIII, U.S. Department of Transportation, Publication FHWA-IP-78-16.

- C. Software:** The software for this project will be provided by the Engineer. The Contractor shall supply two blank 27256 PROM chips per controller.
- D. Auxiliary Control Equipment:**
 - 1. Cabinets shall be furnished with all necessary auxiliary control equipment to properly operate eight signal phases and four pedestrian phases, which includes conflict monitor unit, isolation modules, detector sensing units as specified on contract documents, and load switch packs.
 - 2. A heavy-duty clear plastic envelope, minimum dimensions of 9 inch by 12 inch, shall be attached inside the cabinet for storing timing and maintenance records, electrical prints, etc.
- E. Certification:** In addition to the testing certification required in Chapter 1, Section VIII "Electrical, Environmental and Testing Requirements," paragraph 6, the Engineer shall be furnished with a certification from the equipment manufacturer or supplier stating that the equipment furnished under this specification complies with all provisions of this specification. With prior approval of the Jurisdictional Engineer, minor exceptions to this specification may be allowed, provided these exceptions are detailed on the certification.
- F. Warranty:** All Type 170 Controllers and auxiliary equipment furnished under this specification shall be provided with a standard industry warranty. Any parts found to be defective shall, upon concurrence of the defect by the manufacturer, be replaced free of charge.
- G. Manufacturer or Supplier:** A representative from the manufacturer and/or supplier of the Type 170 Controllers shall be at the project site when the controllers are ready to be turned on, to provide technical assistance including, as a minimum, programming of all necessary input data. All required signal timing data shall be provided by the Engineer.

A minimum of one week prior to the scheduled "turn-on", the Contractor or supplier shall deliver the controller(s), (not including the cabinets), to the Traffic Signal Shop located at 2000 SE Scott Avenue. It is the responsibility of the deliverer to call ahead to schedule delivery.

The City of Des Moines will install and verify the specified software and timings. Should any controllers be found faulty at the shop, the person/company who delivered the equipment will be contacted. The Signal Shop is not responsible for trouble shooting this equipment nor is any part of this process intended to replace "burn-in" responsibilities of the manufacturer.

The Contractor/Supplier is responsible for picking up the controller(s) from the Signal Shop and is solely responsible for bringing the controller(s) to full operation at the intersection(s). No assistance will be provided by the Signal crew once the software is working correctly and the signal timings have been verified in the Signal Shop. Having a knowledgeable representative at the project site(s) when the controller(s) is ready to be turned on is paramount to the safety and efficiency of this operation.

4.2 VEHICULAR TRAFFIC SIGNAL HEADS - APPLIES TO BOTH BASE SET AND ADDED OPTION A

The purpose of the specification is to describe minimum acceptable design and operating requirements for vehicular traffic signal heads with including all fittings and brackets as specified on the Plans. All new vehicular signal heads shall be light emitting diode (LED).

A. Main body Assembly:

Each section shall be complete with a one-piece, hinged door with water tight gaskets and two stainless steel locking devices. All screws, latching bolts, and hinge pins shall be stainless steel to prohibit rust and corrosion.

All sections of the vehicle signal head housings shall be of the black in color including the visor and door. The black color shall be permanently molded into the components.

B. Traffic Signal Mounting Brackets:

The traffic signal mounting bracket shall universally adjustable. It shall include internal wiring capability, and three axes of traffic signal adjustment, as well as vertical height adjustment. All necessary hardware for complete installation on a span wire or mast arm shall be included. The mast arm type mounting assembly shall be of a cable type.

4.3 PEDESTRIAN SIGNAL HEADS - APPLIES ONLY TO ADDED OPTION A

The purpose of this specification is to describe minimum acceptable design and operating requirements for pedestrian traffic signal heads including all fittings and brackets, as specified on the plans.

All pedestrian signal heads shall be light emitting diode (LED).

The signal head shall be designed so that all components are readily accessible from the front by opening the signal door.

The housing shall be one piece, 16 inch by 16 inch in size. The housing case shall include four integrally- cast, hinged lug pairs; two at the top and two at the bottom of each case. The case, when properly mated to other pedestrian signal components and mounting hardware, shall provide a dustproof and weatherproof enclosure and shall provide for easy access to and replacement of all components.

The door frame shall be one piece, complete with two hinged lugs cast at the bottom and two latch slots cast at the top of each door. The door shall be attached to the case by means of two, type 304 stainless steel spring pins.

All screws, latching bolts, and hinge pins shall be stainless steel to prohibit rust and corrosion.

The countdown pedestrian indicator unit shall fit in a traditional 16 inch X 16 inch pedestrian signal head housing.

4.4 ALUMINUM TRAFFIC SIGNAL PEDESTALS - APPLIES ONLY TO ADDED OPTION A

The purpose of this specification is to describe minimum acceptable design, material, and fabrication requirements for aluminum traffic signal pedestals and/or aluminum shafts.

Bases shall have a four bolt pattern uniformly spaced on a 13 3/4 inch diameter bolt circle.

4.5 GALVANIZED STEEL TRAFFIC SIGNAL SUPPORTS - APPLIES ONLY TO ADDED OPTION A

The purpose of this specification is to describe minimum acceptable design, material, and fabrication requirements for galvanized steel traffic signal supports.

The mast arms shall be of the length specified and shall be designed to support traffic signals as shown in the standard load detail on the plans. All mast-arms shall have a 4 percent rise when in-place and fully loaded.

Mast arms shall be continuous to 50 feet in length. Vertical pole configuration shall provide for two-piece combination pole with internal tapped plate connection to allow for addition or removal of luminaire pole extension. Poles shall be vertical under normal load.

4.6 PEDESTRIAN PUSH-BUTTON DETECTORS - APPLIES ONLY TO ADDED OPTION A

The purpose of this specification is to describe minimum acceptable design and operating requirements for side-of-pole mount, pedestrian push-button detectors, including all fittings and brackets as specified on the plans.

- A.** Construction: Pedestrian push-button detectors shall be of the direct push type without levers, handles, or toggle switches. Each detector shall consist of a solid state electronic switch with no moving plunger or moving electrical contacts. The case shall have one outlet for a 1/2 inch pipe. The operating button shall be made of stainless steel and shall be of sturdy design. This button shall not protrude out from the case. The entire assembly shall be weather tight, secure against electrical shock and of such construction as to withstand continuous hard usage. The contact shall be normally open and no current flowing except at the moment of actuation. The push-buttons supplied shall be ADA accessible push button assembly with momentary LED indicator. The push-button casing shall be black in color, oval with a raised directional arrow.
- B.** Vibrotactile/Audible Pushbuttons: When vibrotactile pushbuttons are specified in the plans they shall meet the following specification. Pushbutton assembly shall be black in color, have an integrated R10-3E sign and ADA compliant pushbutton with raised directional arrow. The pushbutton shall provide an LED light which lights when the button is pushed. Pushbutton shall provide the option of sounds during the clearance interval, direction of travel messages, and special messages determined by the user. The pushbutton shall have a control unit that mounts in the associated pedestrian signal head. All wiring and components to create a functional system are included in the unit price for this item.

PART V - POLE FINISH - Applies only to Added Option A**5.1 GENERAL**

This section specifies requirements for coating systems for certain items on the project; including light poles, light pole mast arms, and luminaires.

5.2 SURFACE PREPARATION

Prior to being incorporated into an assembled product, steel plates 3/4 inch or more in thickness shall be blast cleaned to removed rolled-in mill scale, impurities and non-metallic foreign materials. After assembly, all weld flux shall be mechanically removed. The iron or steel product shall be degreased by immersion in an agitated 4.5%-6% concentrated caustic solution elevated to a temperature ranging from 150 to 190°F. It shall then be pickled by immersion in a heated sulfuric acid solution of 6%-13% concentration, with a controlled temperature between 150-190°F. It shall next be rinsed clean from any residual effects of the caustic or acid solutions by immersion in a circulating fresh water bath. Final preparation shall be accomplished by immersion in a concentrated zinc ammonium chloride flux solution heated to 130°F. The solution's acidity content shall be maintained between 4.5-5.0 pH. The assembly shall be air dried to remove any moisture remaining in the flux coat and/or trapped within the product.

5.3 ZINC COATING

The product shall be hot-dip galvanized to the requirements of either ASTM A 123 (fabricated products) or ASTM A 153 (hardware items) by immersion in a molten bath of prime western grade zinc maintained between 810-850°F. The entire product shall be totally immersed with no part of it protruding out of the zinc (no double dipping). This is to limit a risk of trapped contaminants containing chlorides and reduce the risk of bare spots (bare spots can occur when flux on the steel surface is burned away by heat of the first dip). Maximum aluminum content of the bath shall be 0.01%. Flux ash shall be skimmed from the bath surface prior to immersion and extraction of the product to assure a debris free zinc coating.

5.4 EXTERIOR COATING

All galvanized exterior surfaces shall be coated with a Urethane or Triglycidyl Isocyanurate (TGIC) Polyester Powder to a minimum film thickness of 0.002 inch. Prior to application, the surfaces to be powder coated shall be mechanically etched by brush blasting (Ref. SSPC-SP7) and the zinc coated substrate preheated to 450°F for a minimum of one hour in a gas fired convection oven by heating the zinc coated substrate to a minimum of 350°F and a maximum of 400°F. The thermosetting powder resin shall provide both intercoat as well as substrate fusion adhesion that meets 5A or 5B classifications of ASTM D 3359. The poles are not to be painted a color over coating film.

5.5 QUALITY CONTROL

The galvanizing and powder coating facilities shall be owned and operated by the pole manufacturer to ensure a quality coating system.

5.6 PACKAGING

Prior to shipment, small poles shall be wrapped in 0.188 inch thick Ultraviolet-inhibiting plastic backed foam. Larger poles shall be cradled in a 1.0 inch rubberized foam base.

5.7 FIELD REPAIR PROCEDURES

Where factory applied coatings have become damaged or abraded due to handling, transport, installation, welding or other circumstances, they shall be repaired by the field painting crew or miscellaneous metal contractor.

All damaged areas shall be thoroughly wire brushed. All dirt, oil, grease, or other contaminants shall be removed in accordance with SSPC-SP1 and SP5. Touch-up paint supplied the galvanizer or steel fabricator, identical in color and composition to that used in the plant, shall be applied to all prepared surfaces to a dry film thickness of at least 4.0 mils.

5.8 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Combination Coating – Galvanized-Powder Top Coat shall be considered incidental to the price bid per each pole and shall be considered incidental to the lump sum bid for the traffic signal system.

PART VI - SCHEDULE OF UNIT PRICES - APPLIES TO BOTH BASE SET AND ADDED OPTION A

6.1 SCHEDULE OF UNIT PRICES

The Contractor shall submit a completed Schedule of Unit Prices (attached) detailing unit prices for the individual traffic signal component work included under this special provision for approval prior to contract award. Total costs for unit prices shall match the lump sum price. The Contractor shall submit a Schedule of Unit Prices for both the Base Set and the Added Option A.

SCHEDULE OF UNIT PRICES - BASE SET

Schedule of Unit Prices

Southwest Connector at SW 63rd St - Des Moines, IA

No.	Item Description	Plan Quantity	Units	Unit Price	Unit Extension
1	3-Section, 12" RYG Signal Head, w/Bkpl (where noted)	2	EA	\$	\$
2	Relocate Signal Head (including mounting hardware)	10	EA	\$	\$
3	Handhole, Type HHI 24" Poured or Precast, Ring and Cover	10	EA	\$	\$
4	Handhole, Type HHII "Tub" 30" x 48" Quazite Stackable	1	EA	\$	\$
5	Cable - Signal 16c #14	563	LF	\$	\$
6	Cable - 1c #14 Loop Wire in Tubing	4000	LF	\$	\$
7	Cable - 2c #14 Shielded Detector Lead-in Cable	5808	LF	\$	\$
8	Cable - Ground 1c #6	532	LF	\$	\$
9	Cable - Tracer 1c #10	1381	LF	\$	\$
10	Pull Rope	1381	LF	\$	\$
11	1c#6 Power Supply Cable	273	LF	\$	\$
12	1c#8 Power For Luminaire	1063	LF	\$	\$
13	Conduit - 1" PVC Trenched	431	LF	\$	\$
14	Conduit - 3" PVC Trenched	1218	LF	\$	\$
15	Conduit - 4" PVC Trenched	21	LF	\$	\$
16	Detector Saw Cut	1233	LF	\$	\$
17	Concrete Base - Signal Pole Footing	4	EA	\$	\$
18	Relocate Traffic Signal Pole (Steel) and Luminaire	4	EA	\$	\$
19	Structural Support System	1	LS	\$	\$
20	Wye Connectors - Type L1 (15A Fuse)	1	EA	\$	\$
21	Wye Connectors - Type L1 (5A Fuse)	2	EA	\$	\$
22	Wye Connectors - Type L2	3	EA	\$	\$
23	Wye Connectors - Type Y1 (5A Fuse)	2	EA	\$	\$
24	Wye Connectors - Type Y3	2	EA	\$	\$
25	Relocate Street Name Sign (Mount to Signal Pole)	2	EA	\$	\$
26	Relocate Street Name Sign (Mount to Span Wire)	2	EA	\$	\$
27	Street Name Sign "SW CONNECTOR" -> (96" x 18")	1	EA	\$	\$
28	Street Name Sign <- "SW CONNECTOR" (96" x 18")	1	EA	\$	\$
29	Street Name Sign "SW 63RD ST" (84" x 18")	2	EA	\$	\$
30	Traffic Sign (R3-5L) 30"x36" Span Wire Mounting	4	EA	\$	\$
31	Traffic Sign (R10-12) 30"x36" Span Wire Mounting	2	EA	\$	\$
32	Relocate Controller, Cabinet, and Accessories	1	LS	\$	\$
33	Traffic Control	1	LS	\$	\$
34	Mobilization	1	LS	\$	\$

Total Lump Sum to Furnish and Install Traffic Signals

\$

Approved:

City Traffic Engineer

Date

SCHEDULE OF UNIT PRICES – ADDED OPTION A

Schedule of Unit Prices
 Southwest Connector at SW 63rd St - Des Moines, IA

No.	Item Description	Plan Quantity	Units	Unit Price	Unit Extension
1	3-Section, 12" R, Y + G Left Turn Arrow Signal Head, w/Bkpl	2	EA	\$	\$
2	3-Section, 12" RYG Signal Head, w/Bkpl (where noted)	12	EA	\$	\$
3	2-Section, 12" Hand/Man Pedestrian Head	2	EA	\$	\$
4	Handhole, Type HHI 24" Poured or Precast, Ring and Cover	16	EA	\$	\$
5	Handhole, Type HIII "Tub" 30" x 48" Quazite Stackable	2	EA	\$	\$
6	Cable - Signal 2c #14	405	LF	\$	\$
7	Cable - Signal 5c #14	709	LF	\$	\$
8	Cable - Signal 7c #14	205	LF	\$	\$
9	Cable - Signal 16c #14	1308	LF	\$	\$
10	Cable - 1c #14 Loop Wire in Tubing	4269	LF	\$	\$
11	Cable - 2c #14 Shielded Detector Lead-in Cable	7571	LF	\$	\$
12	Cable - Ground 1c #6	1885	LF	\$	\$
13	Cable - Tracer 1c #10	4038	LF	\$	\$
14	Pull Rope	3397	LF	\$	\$
15	1c#6 Power Supply Cable	1040	LF	\$	\$
16	1c#8 Power For Luminaire	1848	LF	\$	\$
17	Conduit - 1" PVC Trenched	483	LF	\$	\$
18	Conduit - 3" PVC Trenched	2048	LF	\$	\$
19	Conduit - 4" PVC Trenched	58	LF	\$	\$
20	Conduit - 3" PVC Pushed	909	LF	\$	\$
21	Detector Saw Cut	1226	LF	\$	\$
22	Concrete Base - Controller Pad	1	EA	\$	\$
23	Concrete Base - Signal Pole Footing - Various Sizes	6	EA	\$	\$
24	Pole (Steel) - Combination Mast Arm Pole - 36' Arm	1	EA	\$	\$
25	Pole (Steel) - Combination Mast Arm Pole - 41' Arm	1	EA	\$	\$
26	Pole (Steel) - Combination Mast Arm Pole - 75' Arm	2	EA	\$	\$
27	Pedestrian Pole	2	EA	\$	\$
28	Wye Connectors - Type L1 (15A Fuse)	1	EA	\$	\$
29	Wye Connectors - Type L1 (5A Fuse)	1	EA	\$	\$
30	Wye Connectors - Type L2	2	EA	\$	\$
31	Wye Connectors - Type Y1 (5A Fuse)	3	EA	\$	\$
32	Wye Connectors - Type Y3	3	EA	\$	\$
33	Street Name Sign "SW MCKINLEY" -> (90" x 18")	1	EA	\$	\$
34	Street Name Sign <- "SW MCKINLEY" (90" x 18")	1	EA	\$	\$
35	Street Name Sign "SW CONNECTOR" -> (96" x 18")	1	EA	\$	\$
36	Street Name Sign <- "SW CONNECTOR" (96" x 18")	1	EA	\$	\$
37	Street Name Sign "SW 63RD ST" (84" x 18")	2	EA	\$	\$
38	Traffic Sign (R3-5L) 30"x36" Mast Arm Mounting	4	EA	\$	\$
39	Pedestrian Pushbutton with Sign R10-3E	2	EA	\$	\$
40	Controller, Cabinet, and Accessories - Complete	1	LS	\$	\$
41	Traffic Control	1	LS	\$	\$
42	Mobilization	1	LS	\$	\$

Total Lump Sum to Furnish and Install Traffic Signals

\$

Approved:

City Traffic Engineer

Date

7.1 "FIELD WIRING DIAGRAM"

ACTIVITY ID: STP-U-8260(624)—70-77

FIELD WIRING DIAGRAM											
Phase/No.	Field Terminal	Indication	Signal Head	Phase/No.	Field Terminal	Indication	Signal Head	Phase/No.	Field Terminal	Indication	Signal Head
Ø4	101	Red	WBT	Ø2 Ped	113	Don't Walk		Ø1	125	Red	NBL
Ø4	102	Yellow	WBT	Ø2 Ped	114	-		Ø1	126	Yellow ←	NBL
Ø4	103	Green	WBT	Ø2 Ped	115	Walk		Ø1	127	Green ←	NBL
Ø4 Ped	104	Don't Walk	WB	Ø3	116	Red		Ø2	128	Red	SBT
Ø4 Ped	105	-		Ø3	117	Yellow ←		Ø2	129	Yellow	SBT
Ø4 Ped	106	Walk	WB	Ø3	118	Green ←		Ø2	130	Green	SBT
Ø8	107	Red	EBT	Ø6 Ped	119	Don't Walk		Ø5	131	Red	SBL
Ø8	108	Yellow	EBT	Ø6 Ped	120	-		Ø5	132	Yellow ←	SBL
Ø8	109	Green	EBT	Ø6 Ped	121	Walk		Ø5	133	Green ←	SBL
Ø8 Ped	110	Don't Walk		Ø7	122	Red		Ø6	134	Red	NBT
Ø8 Ped	111	-		Ø7	123	Yellow ←		Ø6	135	Yellow	NBT
Ø8 Ped	112	Walk		Ø7	124	Green ←		Ø6	136	Green	NBT

FIELD WIRING DIAGRAM (OVERLAPS)											
Phase/No.	Field Terminal	Indication	Signal Head	Phase/No.	Field Terminal	Indication	Signal Head	Phase/No.	Field Terminal	Indication	Signal Head
Ø8 OL	A101	Red		Ø6 OL	A114	Red		Ø4 OL	A124	Red	
Ø8 OL	A102	Yellow →		Ø6 OL	A115	Yellow →		Ø4 OL	A125	Yellow →	
Ø8 OL	A103	Green →		Ø6 OL	A116	Green →		Ø4 OL	A126	Green →	
	A104	Red		Ø2 OL	A121	Red					
	A105	Yellow		Ø2 OL	A122	Yellow →					
	A106	Green		Ø2 OL	A123	Green →					
	A111	Red				Red					
	A112	Yellow				Yellow					
	A113	Green				Green					

Note: NBT=North Bound Through Signals, NBL=North Bound Left Signals, NBR=North Bound Right Signals, etc..