SP- 157136
(New)

SPECIAL PROVISIONS
FOR
TRAFFIC SIGNALIZATION

Polk County
TAP-T-1945(851)--8V-77

Effective Date
June 16, 2020

THE STANDARD SPECIFICATIONS, SERIES 2019, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

TRAFFIC SIGNAL SPECIFICATIONS

TABLE OF CONTENTS

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.

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. Specifications of the Underwriters Laboratories Inc.
B. National Electrical Code.
C. Manual on Uniform Traffic Control Devices latest edition.

1.2 LOCAL REQUIREMENTS

The Contractor shall notify and receive approval from the 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.
The Contractor shall receive delivery of traffic signal poles and equipment and assumes responsibility for delivery and installation in the field.
The Contractor shall provide at least 48 hours notice to the City of Des Moines Signal Shop prior to placing the permanent traffic signals into operation.

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. Foundations three feet or less in depth shall be removed completely. Foundations greater than three feet in depth shall be removed to one foot below grade

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.

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.

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

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

The top elevation of the traffic signal footing must be square and two inches above finished grade.

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

The contractor shall provide designs for all concrete bases where mast arms are longer than 70 feet or when it is called for on the plans. The cost for the design shall be considered as part of the cost of the mast arm pole. 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.

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.

2.2 CONDUIT

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

Each vehicle and pedestrian signal head shall have a separate cable from the signal head to the pole base. A 7-conductor cable shall be used for all four or five section vehicle heads. A 5-conductor cable shall be used for all three section vehicle heads unless otherwise specified in the plans. All 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 all wiring and luminaires as shown in the plans. The Contractor shall connect the cables in the pole to the intersection lighting cable using fused connectors. Breakaway, fused connectors shall be used for all connections.

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.

The Contractor shall coil 50 feet of power service cable at the base of the secondary service pole. The Contractor is responsible for coordinating power service locations with MidAmerican Energy prior to conduit/cable installation. The Contractor is responsible for the cost of the secondary service riser installed by MidAmerican Energy and all associated power service connection costs and fees until acceptance of the project.

2.4 FIBER OPTIC CABLE

The cable end shall be secured inside the controller cabinet so that no load is applied to the exposed fiber strands. The minimum bend radius for static storage shall not be less than ten times the diameter of the cable measuring the cable on the outside, or as recommended by the manufacturer.

The minimum bend radius during installation shall not be less fifteen times the diameter of the cable measuring the cable on the outside, or as recommended by the manufacturer. The Contractor should not use tie wrap devices on fiber optic cable.

A. Cable Slack: Slack shall be left in each handhole, at the top of any conduit riser, in each junction box, in each controller cabinet, and at each equipment rack or other point of termination. Slack in handholes shall be 100 feet in Type II, Type III or Type IV handholes, 30 feet in Type I handholes, and ten feet in 18 inch handholes. This slack cable requirement may be deleted where existing handholes or through points lack sufficient area to maintain the minimum bend requirements. Where slack has been deleted, extra slack equal to the amount that would have been distributed in the through points shall be equally divided between the two controller cabinets and shall be in addition to the slack mandated at the cabinets. Slack in each handhole type shall be provided as designated on the plans. Slack cable shall be coiled and the coils bound at three points around the coil perimeter and supported in their static storage position.

B. Cable Installation in Conduits:
At each handhole or through point and at the cabinet, the cable shall be visibly and durably marked or tagged with the type of cable (single mode or multi-mode), the fiber count, and "FIBER OPTIC CABLE, CITY OF DES MOINES". Additionally, each cable shall be marked with the adjacent intersection of origin and destination. In cases where cables are spliced in a splice enclosure only the intersection of origin is needed.

Example:

FIBER OPTIC CABLE, CITY OF DES MOINES 48 FIBER – SM EAST – 63rd & HICKMAN WEST – WESTOVER & HICKMAN

C. Fiber Optic Termination Unit:

All fibers, unless stated otherwise in the plans, shall be terminated in the fiber optic termination unit.

The enclosure shall be mounted on an EIA 19 inch rack in an area that does not interfere with the normal maintenance of the cabinet electronics

The field cable shall be secured to the enclosure in a manner that does not degrade the fiber optic cable but insures a firm and secure mount. Sufficient lengths of every loose fiber shall be coiled within the enclosure to provide spare distance and reach the fiber interface panel. Sprial wrap each individual fiber in the fan out kit.

Each fiber shall be labeled on the bulkhead by direction and intersection of origin.

Example:

A – North –
B – South – 63rd & Univ.
C – East – MH & Hick.

2.5 BONDING AND GROUNDING

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. 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.

2.6 TRAFFIC SIGNAL DISPLAYS

All 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.

2.7 CONTROLLER CABINET

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

The cabinet shall be oriented with the back of the cabinet toward the intersection such that the signal heads can be viewed while facing the controller unless otherwise directed by the project engineer.

2.8 PAINTING

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.

2.9 LOOP DETECTORS

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

Detector loops shall have three turns of wire in the loop, unless otherwise specified in the plans.

2.10 LOCATE BOXES

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 ¾ inches by 4 ½ 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

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

3.2 SIGNS

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

1. All blanks shall be 0.08 inches thick will 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 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. Twelve inch or larger street name signs shall be made of 3M Diamond Grade DG3 reflective sheeting. Eight 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 mast arm shall be included. The 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 shalled be drilled and tapped.

3.3 FIBER OPTIC CABLE AND ACCESSORIES

A. Fiber Optic Termination Unit: The unit shall be a rack mount, drawer type enclosure that is dust and moisture repellent. The unit shall provide easy front access with removable rear tray for easy rear access and shall have a maximum dimension of 3.5 inchesH by 18.5 inchesW by 11.25 inchesD. The size of the unit shall be adequate for the number of fibers, proper winding area, and splices. The unit shall provide for cable entry from the side and be capable of accommodating up to 48 connections. All fibers entering the traffic signal controller cabinet shall be terminated in the fiber optic termination unit within the traffic controller cabinet.

B. Connectors: Only SC or LC type connectors of ceramic ferrule and Physical Contact end finish shall be used to terminate fibers to equipment. SC, LC or mechanical connectors shall not be used to splice cables. All multimode fibers shall be terminated with SC connectors. All single mode fibers shall be terminated with LC connectors.

Maximum attenuation per connector shall be 0.75 dB.

C. Splice Enclosure: Ends of continuous fiber cable runs and/or traffic signal controller branch circuit points will be spliced in an outside plant splice enclosure located in handholes as shown on plans.

Enclosure shall accept a minimum of six cables and provide enough trays to splice all fibers. All fiber cables shall enter the enclosure at one end.

Enclosure shall be watertight and re-enterable using gel-compressed cable connections and a re-enterable gasket.

3.4 STREETLIGHTING

A. Luminaires: Luminaires shall be Autobahn Series wattage equivalent as shown in the plans.
- 100 watt equivalent = ATB0 20BLEDE53 MVOLT R2
- 150 watt equivalent = ATB0 20BLEDE10 MVOLT R2
- 250 watt equivalent = ATB2 40BLEDE10 MVOLT R2

B. Disconnect: Contractor shall provide and install a disconnect breaker in the signal cabinet for the streetlighting. The disconnect shall be a QOU120 or approved equal.

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 2070 ADVANCED TRAFFIC CONTROLLER WITH CLS

This part consists of the equipment requirements necessary for furnishing a 2070 Advanced Traffic Controller (ATC) system on vendor matching 1C CPU module and traffic signal Controller Local Software (CLS) as described in the project plans and these special provisions.

4.1a RELATED SPECIFICATIONS AND STANDARDS

Unless otherwise specified in the project plans and special provisions the 2070 ATC system furnished and installed under this specification shall comply with:

A. California Department of Transportation (Caltrans) TEES 2009 with Errata
B. Caltrans Qualified Products List
C. Institute of Transportation Engineers (ITE) ATC Standard 5.2b
D. NTCIP Base Standards
E. National Electrical Code.
F. Manual on Uniform Traffic Control Devices latest edition.

4.1b GENERAL SPECIFICATIONS

A. Equipment Certification
    a. The Contractor shall furnish the Engineer 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.
B. Warranty
    a. All 2070 ATC controllers, 1C CPU Module, software, 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.
C. Delivery and Coordination
    a. A minimum of one week prior to the scheduled “turn-on”, the Contractor or supplier shall deliver the necessary components to the Traffic Signal Shop located at 1551 E Martin Luther King Jr Pkway. It is the responsibility of the deliverer to call ahead to schedule delivery.
    b. 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” responsibility of the manufacturer.
    c. 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.

4.1c CONTROLLER CHASSIS

A. The ATC Controller Chassis shall comply with TEES 2009 with latest Errata and be listed on Caltrans Qualified Products List. The product shall be McCain 2070LX or City of Des Moines Project Manager approved equal.
B. ATC Controller Chassis shall be equipped with Linux Operating System with serial motherboard.
C. ATC Controller Chassis Microprocessors shall be Freescale Power QUICC II Pro.
D. ATC Controller Chassis shall include the following memory:

a. 16MB Flash memory
b. 128MB DDR RAM (expandable)
c. 2MB Non-volatile SRAM

E. ATC Controller Chassis shall include Backup Real-Time Clock (RTC).
F. ATC Controller Chassis shall include the following Communication Interfaces:
   a. Two SDLC ports
   b. Four asynchronous Serial ports
   c. ENET 1: 100 Base-T Ethernet switch, one uplink port, and three additional port
   d. ENET 2: 100 Base-T Ethernet port dedicated for local communications
   e. Two USB ports
G. ATC Controller Chassis shall include a Front Panel Interface with:
   a. One Display: 8 lines by 40 characters
   b. One Keyboard: 3 by 4 navigation and 4 by 4 data entry keypads
H. ATC Controller Chassis shall include the following Cabinet Interfaces:
   a. Rear Connections: TEES C1S, C11S, C12S
I. ATC Controller Chassis dimensions shall be 7inchesH by 19inchesW by 13inchesD and shall be EIA rack mount compatible.
J. ATC Controller Chassis power requirements shall be: 89 VAC to 135 VAC, 60 Hz (±3 Hz).
K. ATC Controller Chassis shall be capable of operating in the following environment:
   a. Temperature: -37°C to + 74°C
   b. Humidity: 0 to 95% (non-condensing)

4.1d CONTROLLER MODULES

2070 ATC System shall be furnished with the 2070 ATC Controller Modules listed within this section.

A. ATC Controller Modules shall comply with TEES 2009 form factor for 2070 components.
B. ATC Controller Modules shall be capable of operating in the following environment:
   a. Temperature: -37°C to + 74°C
   b. Humidity: 0 to 95% (non-condensing)
C. The 1C CPU Module shall be 2070-ATC with the following:
   a. 400MH Core Speed
   b. Linux OS
   c. 128MB DDR RAM
   d. 16MB Flash Memory
   e. 2MB non-volatile SRAM
   f. Up to five SDLC ports
   g. Up to 7 ACIA ports
   h. Four 10/100MBPS Ethernet ports
   i. Two USB ports
D. I/O Module shall be 2070-2E for Caltrans 170/2070 cabinets. I/O Module shall comply with TEES 2009 with latest Errata and be on Caltrans Qualified Products List.
E. Front Panel Display shall be 2070-3B small font LCD panel module with 8 lines by 40 characters, 3 by 4 navigation keypad, 4 by 4 data entry keypad.
F. Power Supply Module shall be 2070-4A. Power Supply Module shall comply with TEES 2009 with latest Errata and be on Caltrans Qualified Products List.

4.1e CONTROLLER LOCAL SOFTWARE (CLS)

2070 ATC 1C CPU module shall be furnished with vendor matching Controller Local Software (CLS) which shall include the following functions/features:

A. Phases
   a. 16 volume/density vehicle phases
   b. 16 pedestrian phases
   c. Four rings
   d. Automatic barrier calculation based on compatible phases

e. Variable phase sequence
f. Exclusive pedestrian-phase operation
g. Alternate timing for special vehicles, bicycles or pedestrians
h. Advanced and delayed walk
i. Texas diamond operation
j. 32 output channels
k. Four unique sets of phase timing and options selectable by pattern

B. Overlaps
a. 16 vehicle overlaps
b. 16 pedestrian overlaps
c. Negative (excluded) vehicle and pedestrian phases
d. Delayed start of green
e. Flashing yellow or red arrow overlaps
f. Detector call phases and locking
g. Four unique sets of overlap configurations selectable by pattern

C. Coordination
a. 250 free or coordinated patterns
b. Automatic or manual permissive
c. Fixed or floating force off
d. Reference beginning or end of green
e. Change virtually all operational parameters by pattern
f. 16 phase sequence selection by pattern

D. Cabinet Inputs and Outputs
a. Support all cabinet types
b. Individually assignable input and output functions (I/O mapping)
c. Internal multi-input Boolean logic gates with delay, extend and latch, and flashing output features
d. 16 generic alarm inputs
e. 16 special functions
f. External pattern selection
g. Pulsing preempt and transit priority input discrimination

E. Detection
a. 128 local/system detectors
b. Single or dual detector speed calculation
c. Phase assignments configurable per detector, multiple phases per detector
d. Direct detector actuation for vehicle and pedestrian overlaps
e. All NTCIP detector options
f. Delay and extend timing
g. Alternate passage, minimum green and pedestrian timing detection
h. Vol/Occ configurable per detector
i. Detector failure monitoring configurable by time-of-day
j. Connect directly to video detection

F. Communications
a. Support all industry standard communication
b. Fully NTCIP 1201 and 1202 compliant (mandatory and optional objects)
c. NTCIP MIB and block objects for all vendor-specific parameters
d. Data validation during download
e. Network time client and/or server
f. GPS, WWV, NMEA, and NTP time synchronization
g. California AB3418E with master function for time and patter broadcast
h. USB for database upload/download, firmware upgrades, log retrieval
i. Peer to peer sharing of I/O between intersections
j. Web browser support
k. Connected vehicle SPaT interface

G. Preemption
a. 8 preemption sequences
b. Each sequence configurable for railroad or emergency vehicle operation
c. Definable priority and linking

d. User configurable overlap enable/disable during all preempt intervals
e. Flashing and limited service options
f. User assignable status options

H. Transit Priority
a. Estimated time of arrival
b. 16 priority strategies in four sets, selectable by pattern
c. Options to support any type of vehicle detection
d. Configurable headway and preempt lockout times
e. Queue jump
f. Intelligent phase time adjustment based o expected vehicle arrival
g. Remotely actuation or enable/disable of priority strategies
h. Support for user configurable special logic and advanced operations
i. Programmable logic for advanced TSP applications

I. Time-of-Day Scheduler
a. 64 schedule
b. 64 day plans
c. 48 events
d. 128 actions
e. Operational parameters changeable by time-of-day

J. Logs
a. High resolution logging
b. Extensive event log for management and diagnostic purposes
c. Cycle-based measures of effectiveness
d. Detector volume, occupancy and speed
e. Speed trap data
f. NTCIP global reporting conformance group for user-defined event logging
g. User access logs

The 1C module and CLS software shall be McCain Omni EX (version 1.11.3 or City accepted version) or City of Des Moines Project Manager approved equal.

4.2 FIBER OPTIC DATA LINK

A. Fiber Optic Data Link

When specified in the plans, a fiber optic data link shall be provided. It shall be of the type that will install in Type 2070 controller chassis and provide a dual mode, double duplex, multi-drop communications link designed to interconnect traffic control equipment. Data links shall include the following functional requirements:

1. Master or Local operation mode set by board mounted switch.

2. Two sets of front mounted fiber optic receptacles with ST type connectors.

3. Accommodate 850nm, Multimode fiber optic cable.

4. Complies with 170 and NEMA Environmental specifications.

5. Includes a rechargeable NiCad battery backup to maintain communications in case of power disruption. Battery assembly shall be secured to board and charge circuit shall be built in.

6. Expansion port, which will allow for up to two additional fiber optic ports for directional branching of communication circuits.

7. Status LED’s which provide visual signal indicators associated with communications between the modems and can be easily viewable by a maintenance technician. Signals displayed shall include:

a. Transmit Data 1 (TD-1)
b. Receive Data 1 (RD-1)
c. Transmit Data 2 (TD-2)
d. Receive Data 2 (RD-2)
e. Power (PWR)
f. Built-In Test Fail (Fault)

4.3 TRAFFIC SIGNAL CABINET

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 shall 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.

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.

Each cabinet shall be provided with devices to protect the control equipment form 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 or 332D 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 rate 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.

Cabinets shall be furnished with all necessary auxiliary control equipment to properly operate twelve signal phases and six pedestrian phases, which includes conflict monitor unit, isolation modules, detector sensing units as specified on contract documents, and load switch packs.

Cabinets shall include 14 inch aluminum riser.

Contractor shall provide/install/integrate conflict monitor/malfunction management unit, flasher, load switches, terminals and facilities, and miscellaneous equipment and materials as necessary to provide for a complete and operational traffic signal system. Specific notes include:

a. Loop Detector Amplifier: 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).

D. Unit must have optically isolated outputs.

b. Switch Pack: Each vehicular and each pedestrian phase shall be provided with a separate switch pack.

A. 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

c. Isolator: 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.

d. Conflict Monitor: The Model 2010ECLip (w/ Ethernet Port) Monitor Unit shall be provided. The conflict monitor provided shall have broad fault coverage, full intersection display, event logging and RMS voltage reporting. It shall include support for flashing yellow arrow operation. The monitor shall include an

Ethernet port for communication with a personal computer or traffic management center. Downloadable information shall include monitor status, event logs, and fiver signal sequence history logs, which are stored in the monitor's nonvolatile memory.

e. Power Supply: A "PDA-2" Power Distribution Assembly shall be provided.

f. Shelf: A standard print shelf drawer shall be provided and installed above the input file.

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.

4.4 ETHERNET SWITCH

When specified for on the plans, the Contractor shall coordinate with the City Traffic & Transportation Department to have a Cisco IE-4000 Ethernet Switch procured for the project. The City Information Technology Department will purchase and configure the switch. Once configured, the City Traffic & Technology Department will coordinate with the project Contractor to install the Ethernet switch into the cabinet. Contractor shall provide all necessary jumpers, small form-factor pluggable (SFPs) and any other equipment necessary to install and integrate the Ethernet switch into the traffic signal cabinet.

4.5 VEHICULAR TRAFFIC SIGNAL HEADS

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 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. Rigid mounted, consisting of both top and bottom brackets and easily adjustable in both horizontal and vertical planes. The mounting assembly shall be of a cable type.

4.6 PEDESTRIAN TRAFFIC SIGNAL HEADS

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 (nominal) 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 by 16 inch pedestrian signal head housing.

All pedestrian signal heads shall be mounted using a clamshell-style mounting bracket.

4.7 ALUMINUM TRAFFIC SIGNAL PEDESTALS

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 inches diameter bolt circle.

4.8 GALVANIZED STEEL TRAFFIC SIGNAL SUPPORTS

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% 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.

4.9 PEDESTRIAN PUSH-BUTTON DETECTORS

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. Accessible Pedestrian Signal Pushbutton (APS): When APS pushbuttons are specified in the plans they shall meet the following specification. Pushbutton assembly shall be black in color, have an integrated R10-3 sign and ADA compliant pushbutton with raised directional arrow. The pushbutton shall provide confirmation through latching LED light, sound and tactile bounce. Pushbutton shall provide both sounds and message options during the WALK interval as well as vibration, sounds during the clearance interval, adjustable volume locator tone during the DON'T WALK interval, direction of travel messages, and special messages determined by the user. The pushbuttons shall have a control unit that mounts in the controller cabinet to operate all pushbuttons for the intersection. All wiring and components to create a functional system are included in the unit price for this item.

PART V
POLE FINISH

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 ¾ 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% to 6% concentrated caustic solution elevated to a temperature ranging from 150°F to 190°F . It shall then be pickled by immersion in a heated sulfuric acid solution of 6% to 13% concentration, with a controlled temperature between 150°F to 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 to 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°F to 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 contaminates 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 or a combination Urethane base primer / Polyurea finish top coat as approved by the Engineer. 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.

5.5 QUALITY CONTROL

The galvanizing,powder coating, and/or finish painting 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 PAVEMENT

Combination Coating – Galvanized-Powder Top Coat and Galvanized-Polyurea 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.