

SP- 157015
(New)



**SPECIAL PROVISIONS
FOR
TRAFFIC SIGNALIZATION**

**Polk County
STP-A-1945(823)--86-77**

**Effective Date
August 16, 2016**

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

TRAFFIC SIGNAL SPECIFICATIONS

TABLE OF CONTENTS

I GENERAL REQUIREMENTS

- 1.1 RELATED SPECIFICATIONS AND STANDARDS
- 1.2 LOCAL REQUIREMENTS
- 1.3 REMOVALS

II INSTALLATION REQUIREMENTS

- 2.1 FOUNDATIONS
- 2.2 CONDUIT
- 2.3 WIRING AND CABLE
- 2.4 BONDING AND GROUNDING
- 2.5 TRAFFIC SIGNAL DISPLAYS
- 2.6 LOOP DETECTORS

III MATERIAL REQUIREMENTS

- 3.1 TRAFFIC SIGNAL CABLE
- 3.2 SIGNS

IV EQUIPMENT REQUIREMENTS

- 4.1 VEHICULAR TRAFFIC SIGNAL HEADS
- 4.2 PEDESTRIAN TRAFFIC SIGNAL HEADS
- 4.3 ALUMINUM TRAFFIC SIGNAL PEDESTAL
- 4.4 PEDESTRIAN PUSH BUTTON DETECTORS
- 4.5 RADAR PRESENCE DETECTION SYSTEM

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 PROCEDURES

VI METHOD OF MEASUREMENT AND BASIS OF PAYMENT

- 6.1 METHOD OF MEASUREMENT
- 6.2 BASIS OF PAYMENT

VII ADDITIONAL BIDDING ATTACHMENTS

- 7.1 SCHEDULE OF UNIT PRICES

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. Iowa Department of Transportation Standard Specifications
- 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 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. 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 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, ½ 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 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.

2.4 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. 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

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.

2.6 LOOP DETECTORS

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.

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 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 FHWA 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:
6. All street name signs shall be single-sided
 7. The length of the street name sign shall be in 6 inch increments and will vary based on the legend.
 8. 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.
 9. Lettering shall be Series B as outlined in the Standard Highway Signs Manual.
 10. All 12 inch or larger signs shall have a white border as shown in the attached detail.
 11. 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..
 12. 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 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 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 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. 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 mast arm shall be included. The mounting assembly shall be of a cable type.

4.2 PEDESTRIAN 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 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.

4.3 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.

4.4 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 R10-4b 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 the option of sounds or messages 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 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.

4.5 RADAR PRESENCE DETECTION SYSTEM

- A. General: This item shall govern the purchase and installation of an above-ground radar presence detector (RPD) system. An RPD detects vehicles by transmitting electromagnetic radar signals through the air. The signals bounce off vehicles in their paths and part of the signal is returned to the RPD. The returned signals are then processed to determine traffic parameters.
- B. Sensor Outputs: The RPD shall present real-time presence data for the approach to be detected. It shall support a minimum of eight zones and a minimum of four channels. The RPD algorithms shall mitigate detections from wrong way or cross traffic.

The RPD system shall have fail-safe mode capabilities for contact closure outputs if communication is lost.

- C. Detectable Area: The RPD shall be able to detect and report presence individually in all approach lanes. The RPD shall be able to detect and report presence in up to six lanes. It shall be able to detect and report presence in curved lanes and areas with islands and medians.
- D. System Hardware: For each approach to be detected, one RPD shall be used. Each RPD shall have either a traffic cabinet preassembled backplate with AC/DC power conversion, surge protection, terminal blocks for cable landing, and communication connection points; or a rack-mounted sensor interface board that operates on 24VDC with communications to the sensing unit via an Ethernet interface with Power-over-Ethernet (POE).

Any preassembled backplate for the RPD shall be a cabinet side mount or rack mount.

The RPD shall use contact closure input file cards with two or four channel capabilities. The contact closure input file cards shall be compatible with industry standard detector racks.

- E. Maintenance: The RPD shall not require cleaning or adjustment to maintain performance. It shall not rely on battery backup to store configuration information, thus eliminating any need for battery replacement.

Once the RPD is calibrated, it shall not require recalibration to maintain performance unless the roadway configuration changes.

The mean time between failures shall be 10 years, which is estimated based on manufacturing techniques.

- F. Physical Properties: The RPD unit shall not exceed 6 pounds in weight. The general dimensions of the unit shall not exceed 13.2 inches by 10.6 inches by 8 inches in its physical dimensions.

All external parts of the RPD shall be ultraviolet-resistant, corrosion-resistant, and protected from fungus growth and moisture deterioration. The enclosure shall be rated for outdoor weatherability in accordance with UL standards. The unit shall be classified as watertight.

The RPD enclosure shall include a connector that meets the UL standards for outdoor weatherability connections. The connector shall provide contacts for all data and power connections.

- G. Electrical: The RPD shall consume less than 10 W. It shall operate with a DC input between 9 VDC and 28 VDC and have onboard surge protection.
- H. Communications Ports: The RPD system shall have a communication port, allowing it to be used for configuration, verification and traffic monitoring without interrupting communications on the dedicated data port serving the controller operation. The RPD shall support the upload of new firmware into the RPD's nonvolatile memory over either communication port.
- I. Radar Design: The RPD shall be designed to provide detection over a large area and to discriminate lanes. The circuitry shall be void of any manual tuning elements that could lead to human error and degraded performance over time.

During operation, the RPD shall strictly conform to FCC requirements and the radar signal quality shall be maintained for precise algorithmic quality. The RPD must not experience unacceptable frequency variations which may cause it to transmit out of its FCC allocated band and thus will be non-compliant with FCC regulations.

The RPD shall transmit a signal with a bandwidth of at least 245 MHz. This translates directly into radar resolution, which contributes directly to detection performance.

The RPD shall provide at least five RF channels so that multiple units can be mounted in the same vicinity without causing interference between them.

The RPD shall have a self-test that is used to verify correct hardware functionality. It shall also have a diagnostics mode to verify correct system functionality.

- J. Configuration: The RPD shall have a method for defining traffic lanes, stop bars and zones. It may have an auto-configuration process that would execute on a processor internal to the RPD. If equipped, the auto-configuration process shall work under normal intersection operation and may require several cycles to complete.

The auto-configuration method shall not prohibit the ability of the user to manually adjust the RPD configuration.

The RPD shall support the configuring of lanes, stop bars and detection zones in 1 foot increments.

The RPD shall include graphical user interface software that displays all configured lanes and the current traffic pattern using a graphical traffic representation.

The graphical interface shall operate on Windows Mobile, Windows XP, Windows Vista and Windows 7 in the .NET framework.

The software shall support the following functionality:

- Operate over a TCP/IP connection
- Give the operator the ability to save/back up the RPD configuration to a file or load/restore the RPD configuration from a file
- Allow the backed-up sensor configurations to be viewed and edited
- Provide zone and channel actuation display
- Provide a virtual connection option so that the software can be used without connecting to an actual sensor
- Local or remote sensor firmware upgradability

- K. Operating Conditions: The RPD shall maintain accurate performance in all weather conditions, including rain, freezing rain, snow, wind, dust, fog and changes in temperature and light, including direct light on sensor at dawn and dusk. Its operation shall continue in rain up to 1 inch per hour. It shall be capable of continuous operation over an ambient temperature range of -40°F to 165.2°F, and over a relative humidity range of 5% to 95% (non-condensing).

- L. Testing: Each RPD shall be certified by the Federal Communications Commission (FCC) under CFR 47, part 15, section 15.249 as an intentional radiator. The FCC certification shall be displayed on an external label on each RPD according to the rules set forth by the FCC. The RPD shall comply with FCC regulations under all specified operating conditions and over the expected life of the RPD.

The RPD shall comply with the applicable standards stated in the NEMA TS 2-2003 standard.

- M. Manufacturing: The RPD shall undergo a rigorous sequence of operational testing to insure product functionality and reliability. Testing shall include the following:

- Functionality testing of all internal sub-assemblies
- Unit level burn-in testing of 48 hours' duration or greater
- Final unit functionality testing prior to shipment

Test results and all associated data for the above testing shall be provided for each purchased RPD by serial number, upon request.

- N. Support: The RPD manufacturer shall provide both training and technical support services. The manufacturer--provided training shall be sufficient to fully train installers and operators in the installation, configuration, and use of the RPD to insure accurate RPD performance.

Manufacturer-provided technical support shall be available according to contractual agreements, and a technical representative shall be available to assist with the physical installation, alignment, and configuration of each supplied RPD. Technical support shall be provided thereafter to assist with troubleshooting, maintenance, or replacement of RPDs should such services be required.

- O. Documentation: RPD documentation shall include an instructional training guide and a comprehensive user guide as well as an installer quick-reference guide and a user quick-reference guide.
- P. Warranty: The RPD shall be warranted free from material and workmanship defects for a period of 18 months from date of shipment.

- Q. Installation Requirements: The RPD shall be mounted directly onto a mounting assembly fastened to a mast arm, pole or other solid structure. The mounting assembly shall provide the necessary degrees of rotation to ensure proper installation. The mounting assembly shall be constructed of weather-resistant materials and shall be able to adequately support the sensor unit provided.

The RPD shall be mounted at a height that is within the manufacturer's recommended mounting heights. The UNIT shall be mounted at an offset from the first lane that is consistent with the RPD's minimum offset. It shall be mounted so that at least 20 feet along the farthest lane to be monitored is within the field view of the RPD.

The RPD shall be mounted with its cable connector down and shall be tilted so that the RPD is aimed at the center of the lanes to be monitored.

The RPD shall be mounted on a vertical signal pole or on the horizontal mast arm, and mounted so that its field of view is not occluded by poles, signs or other structures.

RPDs must be capable of being configured to operate on different RF channels.

The cable end connector shall be an environmentally sealed shell that offers excellent immersion capability. All conductors that interface with the connector shall be encased in a single jacket, and the outer diameter of this jacket shall be within a weatherproof cover to ensure proper sealing. The cable shall have a strain relief with enough strength to support the cable slack under extreme weather conditions.

The cable shall be terminated only on the two farthest ends of the cable.

Both communication and power conductors can be bundled together in the same cable.

The input file cards shall meet the following specifications:

The input file cards shall be compatible with 170, 2070, NEMA TS 1, and NEMA TS 2 style input racks.

The input file card shall translate data packets from the RPD into contact closure outputs.

The input file card shall support presence detection.

The input file card shall comply with the NEMA TS 2-1998 Traffic Controller Assemblies with NTCIP Requirements (Section 2.8 spec).

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 $\frac{3}{4}$ 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.

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.

PART VI METHOD OF MEASUREMENT AND BASIS OF PAYMENT

6.1 METHOD OF MEASUREMENT

Lump sum item; no measurement will be made.

6.2 BASIS OF PAYMENT

Payment will be at the lump sum price for Traffic Signalization. Progress payments will be made on a percentage basis estimated by the Engineer from Section 7.1 Schedule of Unit Prices.

**PART VII
ADDITIONAL BIDDING ATTACHMENTS
STP-A-1945(823)--86-77**

7.1 SCHEDULE OF UNIT PRICES

CITYWIDE FIXED TIME SIGNAL UPGRADE PROJECT PHASE 2				
ITEM	UNIT	UNIT COST	QUANTITY	TOTAL EXTENSION
2-CHANNEL INDUCTIVE LOOP DETECTOR, CARD RACK STYLE	EACH		68	
MICROWAVE DETECTION SYSTEM (PER INTERSECTION)	EACH		2	
PEDESTRIAN PUSHBUTTON WITH SIGN	EACH		94	
16" PEDESTRIAN HEAD, HAND/PERSON, COUNTDOWN, SIDE-OF-POLE MOUNTED	EACH		34	
16" PEDESTRIAN HEAD, HAND/PERSON, COUNTDOWN, INSERT ONLY	EACH		24	
TYPE I - PRE-CAST CONCRETE HANDHOLES, 24" DIAMETER	EACH		27	
PEDESTRIAN DETECTOR CABLE - 2c#14	LIN FT		11630	
SIGNAL CABLE - 16c#14 AWG	LIN FT		585	
SIGNAL CABLE - 7c#14 AWG	LIN FT		560	
DETECTOR CABLE - 2c#14	LIN FT		6225	
LOOP WIRE IN TUBE	LIN FT		20410	
GROUND WIRE - 1c#6 BARE	LIN FT		235	
TRACER WIRE - 1c#10	LIN FT		510	
PULL ROPE	LIN FT		510	
DETECTOR SAWCUT	LIN FT		5862	
1" PVC, TRENCHED	LIN FT		1155	
3" PVC, TRENCHED/BORED	LIN FT		411	
POLE FOOTING, 2' DIA 3' DEPTH	EACH		2	
POLE FOOTING, 3' DIA 8' DEPTH	EACH		1	
STEEL PUSH BUTTON POST, 4'	EACH		2	
STEEL PEDESTAL POLE, 14'	EACH		1	
REMOVE EXISTING SIGNAL HEAD	EACH		20	
TOTAL SIGNALIZATION COST				