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SPECIAL PROVISIONS
DIVISION “SS”
SPECIAL REQUIREMENTS

SS-1 **(2565) TRAFFIC CONTROL SIGNALS**

SS-1.1 **Revise Traffic Control Signal System**

This work shall consist of removal and salvage of portions of the in-place traffic signal control system; installing salvaged materials, furnishing and installing new materials and electrical equipment as specified herein; all to revise one (1) complete operating permanent Traffic Control Signal Systems at the following intersection:

CSAH 153 (Lowry Avenue) at Second Street N in Minneapolis, Hennepin County.

SS-1.2 **Traffic Control Interconnection**

Furnishing and installing conduit, handholes, 12PR #19 interconnect cable and salvaging and reinstalling 12PR #19 interconnect cable for traffic control interconnection on Lowry Avenue and Second Street at the locations shown in the Plans.

--- all in accordance with the Minnesota Department of Transportation “STANDARD SPECIFICATIONS FOR CONSTRUCTION, 2005 EDITION;” with the applicable provisions of Mn/DOT 2545 and 2565; with the current edition of the National Electrical Code; with the Plans; and as follows.

SS-1.3 **General**

- A. All applicable provisions of the current edition of the National Electrical Code shall apply in constructing the traffic control signal systems.
- B. Reference to “the City” or “the City of Minneapolis” in these Special Provisions shall be interpreted to mean “the City of Minneapolis Traffic and Parking Services” or its designated representative.
- C. The Contractor shall make all new field lead connections in the Type M signal controller cabinet. The Contractor shall label all cables and conductors in accordance with the field-wiring diagram.
- D. The City shall approve all foundation locations before construction is commenced.

- E. The Contractor for this contract shall be responsible for locating all Contractor installed underground facilities within or outside the project limits until acceptance of the completed project by the City.

Construction operations in the proximity of utility properties shall be performed in accordance with the provisions of Mn/DOT 1507, except the first paragraph is hereby deleted and the following substituted therefor:

The locations of any existing underground utilities shown on the Plans are approximate only. It shall be the Contractors own responsibility, prior to commencing work, to secure information and determine the exact location of any buried utility facilities as may exist, and to conduct operations in the vicinity of any such facilities in a manner that precludes damage thereto. The Contractor agrees to be fully responsible for any and all damages which might be occasioned by failure to exactly locate and preserve any and all underground utilities.

- F. The City shall review and approve all work performed by the Contractor prior to the Contractor requesting acceptance by the Engineer.
- G. The Contractor's attention is specifically directed to the requirements of 2565.2A5 regarding the required in service warranty period for workmanship and materials.
- H. The Contractor shall plan and coordinate the signal revision work to minimize the operation down time of the in-place signal system. The Contractor will be allowed to remove the signal system from operation to complete revision work as directed by the Engineer and as follows:
1. While the traffic signal is placed out of operation, all way stop control will be required. Refer to the Construction and Traffic Control Plans and specifications elsewhere. All in-place signs conflicting with the stop condition (i.e. Signal Ahead signs) shall be covered while the stop condition is in-place.
 2. At no time shall both the traffic signal be operational with the stop signs in-place. The traffic signal may operate in all red flash mode with the stop condition in-place.
 3. Work which interferes with traffic operations shall not be performed during the following times unless otherwise approved by the Engineer:

From 6:00 a.m. to 9:00 a.m.

Monday through Friday inclusive.
From 3:00 p.m. to 6:00 p.m.
Monday through Friday inclusive.

- I. The Contractor shall revise the existing traffic control signal system in accordance with the Plans and with the following to provide a complete operating revise signal system:
 1. Remove and dispose or salvage of items of the existing traffic control signal system not being reused in the revise signal system as required by the Plans and these Special Provisions.
 2. Incorporate into the revise signal system all in place items of the existing traffic control signal system as indicated in the Plans.
 3. Furnish and install new items as required by the Plans (which includes, but not limited to: concrete foundations; mast arm pole standards; vehicle signal indications; light emitting diode (LED) units for new vehicle signal indications; conduit and conduit fittings; traffic signal electrical cables and conductors; bonding and grounding materials; etc.).
 4. Furnish and install new labels to identify cables and conductors as required by the field wiring diagram; and terminate all cables and conductors as required to provide an operational revise signal system to the satisfaction of the Engineer.

SS-1.4

Materials

A. Metal Conduit

Metal conduit shall be Rigid Steel Conduit (R.S.C.) and conduit fittings per Mn/DOT 3801 Intermediate Metal Conduit (I.M.C.) and conduit fittings are not permitted.

B. Non-Metallic Conduit

Non-metallic conduit (N.M.C.) and conduit fittings shall be Type II heavy-wall rigid PVC Schedule 40 plastic conduit and conduit fittings per Mn/DOT 3803.

C. Handholes

New handholes shall be Minneapolis Electrical Handholes with metal frames and covers as shown in the details in the Plans (Minneapolis Detail No. 3776) and shall conform to the City of Minneapolis standards. A drain field shall be provided with each

handhole. Concrete for supporting the metal frames and covers in non-sidewalk areas shall be Mix No. 3A32 or equal.

Handhole rings and covers shall be constructed from Class 30 Grey Iron, primed and finish painted as specified elsewhere.

Relocated handhole rings and covers shall be cleaned and primed and finish painted.

D. Anchor Rods

The Contractor shall furnish all required anchor rods, nuts, and washers in mast arm pole foundations.

1. Minneapolis Mast Arm Foundation: Anchor rods, nuts, and washers in each mast arm pole standard concrete foundation shall conform to the City of Minneapolis standards; shall be galvanized at least the top half of each anchor rod in accordance with the provisions of Mn/DOT 3392; and shall be four (4) sets in quantity (anchor rod, two nuts, and two washers) of the dimensions and configuration in accordance with the “Minneapolis Overhead Signal Foundation” (Minneapolis Detail Nos. 3704 and 3755A) details in the Plans. All anchor rods required in each mast arm pole standard concrete foundation shall be either size 1.75 inches diameter by 71 inches long or 1.5 inches diameter by 68 inches long, as specified. See Minneapolis Detail Nos. A-3035 and A-4152 in Plans.
2. Rust Inhibitor: Threaded portions of all anchor rods above the concrete foundations shall be coated with an approved rust inhibitor before installation of the mast arm pole standards, and traffic signal pedestals on the anchor rods.

E. Traffic Signal Electrical Cables And Conductors

1. The provisions for electric cables and conductors of Mn/DOT 2565.3J and Mn/DOT 3815 are modified as follows. The required electrical cables to Xcel’s feed points shall be furnished and installed by the Contractor and shall be the size as required by the power company.
2. Signal Control Cable: The multiple conductor control cables for traffic control signals shall meet the following specification. This specification describes multi-conductor Type TC Tray Cable insulated with FR-XLP flame-retardant cross-linked polyethylene and PVC jacketed overall, for use on circuits rated 600 volts at 90 degrees C maximum continuous conductor temperature in wet or dry locations. The cables shall be approved for installation in

cable trays in accordance with Article 340 of the NEC and also for use in Class 1 remote control and signaling circuits per Article 725-11(b) of the Code. Cable shall be approved for installation in open air, in ducts or conduits, in tray or trough, and be suitable for direct burial.

Applicable Standards

- a. The following standards shall form a part of this specification to the extent specified herein:
- Underwriters Laboratories Standard 1277 for Type TC Power and Control Tray Cables.
 - Underwriters Laboratories Standard 44 for Rubber Insulated Wires and Cables.
 - ICEA Pub. No. S-66-524, NEMA Pub. No. WC7, Cross-linked-polyethylene-insulated Wire and Cable.
 - ICEA Pub. No. S-73-532, NEMA Pub. No. WC57, Control Cables
 - IEEE Standard 1202 - Flame Testing of Cables for Use in Cable Tray in Industrial and Commercial Occupancies.
- b. Conductors
- Conductors shall be Class B stranded uncoated soft copper conforming to Part 2 of ICEA. Conductor sizes shall be 14 AWG. A non-hygroscopic separator may be used over the conductors at the option of the manufacturer.
- c. Insulation
- Compound: Each conductor shall be insulated with FR-XLP flame-retardant chemically cross-linked polyethylene, meeting the requirements of ICEA S-66-524, Par. 3.6, ICEA S-73-532, Table 3-2 (Type I-XLPE) and Type XHHW-2, VW-1 requirements of Underwriter's Laboratories.
 - Thickness: The average thickness of insulation shall be 30 mils. The minimum thickness at any point shall be not less than 90 percent of the specified average thickness.
- d. Circuit Identification
- Circuit identification shall consist of Method 1 color coding for National Electrical Code applications in accordance with ICEA S-73-532, Appendix E, Table E-2. Cables shall contain the following color coding for individual conductors: 1-Black, 2-White, 3-Green, 4-Red, 5-Blue, 6-Orange, 7-Yellow, 8-Red

w/Black tracer, 9-Blue w/Black tracer, 10-Orange w/Black tracer, 11-Yellow w/Black tracer, 12-Black w/White tracer. Tracers shall be either spiral bands or hash marks on opposite sides of each conductor.

e. Assembly

The insulated color-coded conductors shall be cabled together with non-hygroscopic fillers, when necessary to make round. The cable assembly shall be covered with a suitable tape applied with a 10 percent minimum lap.

f. Overall Jacket

Compound: Each cable shall have a PVC protective jacket applied over the assembly. The jacket shall meet the requirements of Part 4 of ICEA S-73-532, Table 4-2, and the Sunlight Resistant requirements of UL Standard 1277.

Thickness: The average jacket thickness shall be in accordance with UL Standard 1277. The minimum thickness at any point shall be not less than 80 percent of the specified average thickness.

g. Surface Marking

Cables shall be clearly identified by means of surface ink printing indicating: Manufacturer, Type TC, (UL), 600V, 12 conductors, #12, XHHW-2 (or 90 degrees C) Conductors, Sunlight Resistant, Direct Burial, E57349, and have length markings approximately every meter.

h. Tests

- Individual conductors and completed cables shall be tested in accordance with UL requirements for Type TC Power and Control Tray Cables having XHHW-2 VW-1 insulated conductors.
- Cables shall be capable of passing the ribbon burner cable tray flame test requirements of UL and IEEE Standard 1202.

i. Signal Head Wire: All circuit wiring from the signal base or transformer base to the traffic signal vehicle and pedestrian indications mounted on pedestal and mast arm poles shall be 1/C#14 AWG solid copper wires with XHHW rating. Circuit wiring to vehicle indications mounted on mast arms shall be 7-conductor #14 XHHW-2 tray cable conforming to the above specification for signal control cable. The conductors shall have insulation color coded in accordance with Minneapolis Detail No's. 3738A, 3738B, 3738C and 3738D.

- j. Single Conductor Wires: The single conductor feeder wires, control wires, and lighting cables shall have Class B stranded annealed uncoated copper conductors and be listed by UL as Type RHW-2/USE-2, 90 degree C, Cross linked polyethylene insulation rated 600 volts in accordance with Article 338 of the National Electrical Code. Cable shall meet the requirements of ICEA Publication No. S-66-524, NEMA Pub. No. WC7 for Cross linked Polyethylene-Insulated Wire and Cable, and UL Standard 854 for Service Entrance Cables. Wires shall bear UL label for Type USE-2, have footage markings approximately every meter, and surface marking indicating manufacturer's ID, conductor size and metal, voltage rating, UL symbol and type designations. **The insulation on each conductor shall be colored red, black, green, or white in accordance with the color-coding shown in the construction plan and/or details.**
- k. EVP Confirmation Light Cable: Wire used for powering EVP confirmation lights shall be 2/c #14 W/GRD conforming to the requirements of International Municipal Signal Association, Inc., Specification No. 50-2 1984, Polyethylene Insulated, Polyethylene Jacketed Loop Detector Lead-In Cable.
- l. Optical Detector Cable:
Optical detector cable shall be in accordance with the provisions of Mn/DOT 3815.2C5.
- F. Mast Arm Pole Standards
The provisions of Mn/DOT 3831 are modified as follows for Minneapolis Style Equipment:
Each mast arm pole standard shall consist of a transformer base, a vertical pole shaft, a traffic signal upper cantilever mast arm, provisions for a lower mast arm for sign support, and (if specified in the Plans) a luminaire vertical pole shaft extension with davit-type mast arm and a lower sign arm.
Each mast arm pole standard shall be designed and constructed in accordance with the requirements of the 2001 edition of the "Standard Specifications for Structural Support for Highway Signs, Luminaires and Traffic Signals" as published by the American Association of State Highway and Transportation Officials."
The transformer base shall be stainless steel, constructed in accordance with details shown in the Plans, and be a square transformer base style complete with access hole and door. The access hole shall provide an opening of at least 100 square inches

on one side of the base and shall be provided with a door having positive closure. The locking mechanism shall be an integral part of the door.

The extended end of each traffic signal mast arm shall have a 2-3/8 inch outside diameter slip-fitter and signal mounting plate welded to the end in accordance with the details in Mn/DOT Standard Plate No. 8123E for attaching one-way or two-way mast arm signal head mounts.

Attachment of the traffic signal upper and/or lower cantilever mast arm to the vertical pole shaft shall be by high strength bolts and nuts.

Each mast arm pole standard shall be the City of Minneapolis design, as shown in the detail section of the Plans.

Each individual mast arm pole standard shall be constructed to the traffic signal mast arm length, luminaire mast arm length, and luminaire mounting height as specified in the Plans.

The Contractor shall furnish to the Engineer, for approval, seven (7) complete sets of shop detail drawings of each type of mast arm pole standard in accordance with the provisions of Mn/DOT 2471.3B. The shop detail drawings shall indicate all member materials and dimensions, section modulus of all main component parts, and other pertinent data and calculations. The shop detail drawings shall be identified by "City of Minneapolis" and the fabricator. The City of Minneapolis Traffic and Parking Services shall approve shop drawings.

A shop coat of primer and finish paint shall be applied to the outside surfaces of each mast arm pole standard, mast arm, and luminaire extension and transformer base.

G. Service Equipment For Signal System

The electrical service point is shown on the Plans. The service point shown is approximate; the exact location will be determined in the field by the Power Company and the City. See signal plan Equipment Schedule for specific service cabinet requirements.

1. Pad Mount Signal/Lighting Service Cabinet

The service cabinet shall be the City of Minneapolis standard street light and signal service cabinet; shall be no bigger than that shown on the Plans; and shall be a pad-mounted, weatherproof control cabinet. The cabinet shall be as shown on City of Minneapolis Standard Plate

Nos. 3760M. The wiring diagrams for the service cabinets are shown in detail on the Plans on City of Minneapolis Standard Plate Nos. 3760M and 3750M. The service cabinet shall conform to the following:

- a. The service cabinet shall be constructed in accordance with the detail drawings 3760M and 3750M.
- b. The cabinet enclosure (physical enclosure only) shall be UL listed with the UL label affixed to the inside of the cabinet, and shall carry a NEMA 3R rating to provide a degree of protection against rain, sleet, snow, and dripping water.
- c. Each cabinet shall be free of flaws, cracks, dents and other imperfections.
- d. All surfaces shall be smooth and clean.
- e. All seams and joints shall be smooth and even, without cracks, air leaks or pinholes with no sharp or jagged edges.
- f. All interior attachments to the cabinet exterior sheet metal shall be welded (i.e. no through bolts).
- g. There shall not be any sheet metal attached externally to the cabinet shell.
- h. The design, workmanship and attachment of the one-piece panel boards and dead fronts shall be a secure and aligned containment for the circuit breakers. The one-piece panel board and dead fronts shall be stamped with easily removable blank breaker cutouts to match the full capacity of the breaker panel. The panel board breaker cutouts shall precisely match the containment provisions of the breakers.
- i. The screws for attaching the cabinet dead fronts shall be of a permanent capture design to prevent lost and misplaced screws. Attachment of the dead fronts to the cabinet shall be accomplished using threaded inserts and offset cam cylinder latches.
- j. Contactors shall be normally open, NEMA rated, AC lighting contactors rated 277/480 volts with a 120-volt, 60 Hz coil, and contacts rated for 60 ampere tungsten filament load. Contactors shall be

double lugged with the double lugs on the contactors installed such that field wires shall be connectable on the front lugs of the contactor. Contactors shall be installed vertically in the cabinet. Contactors shall have a positive gravity release. Contactors shall have an (off or on) condition display mechanism.

- k. The service cabinet shall have one 100 amp two-pole thermo-magnetic circuit breaker as a main breaker and single pole thermo-magnetic circuit breakers as branch breakers.
- l. The Vendor shall furnish and install the following in each service cabinet:
 - Two (2) **200 amp meter sockets** with disconnect.
 - One (1) bracket mounted single pole test switch rated 15 amperes at 125 volts.
 - Two (2) 60 amp two pole contactors.
 - 15 amp and 60 amp circuit breakers as indicated on details.
 - One (1) photoelectric cell.
 - One (1) single pole 40 amp circuit breaker for powering a traffic signal system.
- m. The photoelectric cell shall have normally open contacts rated 15 amperes. The photo control shall be installed within the lighting service cabinet. It shall be bracket mounted immediately behind a Plexiglas covered hole. The hole shall be located on the side of the cabinet. The hole size and location shall be as shown on the service cabinet detail. Mounting shall be as directed by the Engineer. The photoelectric control shall be in accordance with the MN/DOT 3812 and have a minimum 30-second time delay capability.
- n. The electric meters shall be installed within the service cabinet as shown in the details. The electric meter sockets shall be suitable for single phase, 3 wire, 120/240 volt service with a utility approved manual bypass switch. The Utility Company will provide the electric meters. Sockets shall be provided and installed by the vendor. The placement of the meter socket and meter, door lock, and the viewing window shall permit the door to be

closed, and the meter to be read electronically from outside the cabinet.

- o. Locks shall be furnished and installed by vendor. Locks shall be keyed for a standard No. 2 traffic signal key.
- p. No company logo's and/or advertising shall be placed on any part of the cabinet exterior.

The Contractor shall provide an anodic finish to the cabinet after verification of the exact color with the City of Minneapolis Transportation and Parking Services Office.

In addition to the above the following requirements for electrical service connections to each signal system as detailed below shall apply:

- Power shall be obtained from a power company wood pole or ground mounted service cabinet as noted in the Plans. The City shall be responsible for the cost of electrical energy to operate the temporary and permanent traffic signal systems.
- Service equipment, conduit, and power conductor wiring shall be replaced for all locations identified in the plans as requiring a new pole mount service.
- When a new location for the source of power for the traffic signal is identified in the plans, the Contractor shall be responsible for removal of the existing pole mounted service equipment from the power company pole, when it is no longer required to operate the intersection.
- When service feeds for traffic signals and/or street lighting are to be provided from an existing signal/street light service cabinet, the Contractor shall provide a connection to the service cabinet and all necessary cable, conduit, and circuit breaker.
 - Service feeds for operating temporary signal systems shall not be disrupted until the newly constructed systems are ready to be made operational.

H. Terminal Blocks

The provisions for terminal blocks of Mn/DOT 2565.3J5 are modified as follows. The referenced terminal block terminals and screws shall be **nickel-plated brass** and be Kulka 603 series or equivalent.

I. Vehicle Signal Faces – Polycarbonate

1. Signal Indications:

All "Red", "Yellow", and "Green" signal indications shall utilize light-emitting diode (LED) units. The approved LED units are listed on the Mn/DOT Qualified Products List on the Office of Traffic, Safety, and Operations (OTSO) WEB site for Traffic Signals:

<http://www.dot.state.mn.us/products/index.html>

2. The provisions of Mn/DOT 3834 (ITE Vehicle Signal Faces) are modified as follows:

The housings, housing doors, tunnel-type visors, lenses, and background shields of new vehicle signal indications and faces mounted on the traffic signal upper cantilever mast arms shall be fabricated from polycarbonate resin material in accordance with the latest issue of the ITE standard for Adjustable Face Vehicular Traffic Control Signal Heads. The housings shall be one piece with the front, sides, top, and bottom integrally molded. Each vehicle signal face shall be sectional with separate adjustable housing for each vehicle signal indication. The housings, housing doors, visors, and background shields on overhead mast arms and on vertical pole shaft and pedestal-mounted signals shall be black in color. The color shall be completely impregnated in the resin material and scratches shall not expose uncolored material.

- a. The LED unit shall be sealed with a one-piece neoprene or EPDM (Ethylene, Propylene, Diene Monomers) gasket and shall be watertight.

A.C. or D.C. voltages at the input terminals of the LED indication shall be below 15 volts within 200mS after removing power. The indication shall work with a conflict monitor utilizing NEMA plus functions, specifically DUAL INDICATION.

All vehicle signal faces with LED indications shall be approved by the City prior to procurement.

Support plates shall be furnished with each overhead mast arm mounted vehicle signal face to distribute stresses evenly over the

ends of the vehicle signal face. Also, a plumbizer adapter in conformance with Mn/DOT Standard Plate No. M8124E shall be furnished with each overhead mast arm mounted vehicle signal face. Support plates and plumbizer adapters shall be black in color.

For each LED signal indication, the Contractor shall submit to the Engineer, for approval, four copies of all warranty information indicating the required 6-year warranty period (**from date of installation**), product invoice, and documentation indicating name of manufacturer, model number, and serial number. The four copies shall be distributed by the Engineer as follows:

- City of Minneapolis Traffic Division (2 copies)

For all LED signal indications, the manufacturer shall provide the following warranty provisions:

- a. Replacement or repair of an LED signal module that exhibits a failure due to workmanship or material defects within the first 72 months of field operations.
- b. Replacement or repair of "RED", YELLOW and "GREEN" LED signal modules that fall below the requirements for ITE

The Contractor shall, to the satisfaction of the Engineer, affix to the back of each "LED" signal indication a permanent label, or permanently marked (utilizing a "oil based paint marker") with the actual date of installation. The oil based paint marker shall be a contrasting color to ensure that the date can be easily read.

J. Pedestrian Signal Faces with Countdown Timers - Polycarbonate

Each pedestrian signal indication of each pedestrian signal face shall be a single section. The size shall be nominal 16 inch x 18 inch as called for in the Plans and the indication shall utilize the international hand and walking person illuminated message and countdown timer. Each pedestrian signal face housing, housing door, and visor shall be black in color. The color shall be completely impregnated in the resin material and scratches shall not expose uncolored material. The pedestrian signal face with countdown timers shall be listed on the Mn/DOT Qualified Products List on the Office of Traffic, Safety, and Operations (OTSO) WEB site for Traffic Signals:

<http://www.dot.state.mn.us/products/index.html>

The pedestrian indications with countdown timer shall utilize light-emitting diode (LED) units from the Mn/DOT Qualified Products

List on the Office of Traffic, Safety, and Operations (OTSO) WEB site for Traffic Signals:

<http://www.dot.state.mn.us/products/index.html>

1. Housing

Unused mounting holes shall be plugged to provide a watertight seal. A plug shall be provided for the bottom-mounting hole which

The pedestrian signal shall have mountings to properly fit brackets made of 1.5-inch pipe. The openings shall have a common vertical centerline through the housing to permit 360-degree rotation of the mounted pedestrian signal. The bottom and top opening shall be provided with a serrated ring, which shall permit indexing and locking of the signal in 5-degree increments throughout the entire 360 degrees of rotation when used with serrated brackets or fittings. The mounting brackets shall serve as the electrical conduit for the pedestrian signal.

A terminal block shall be mounted to the internal bosses at the bottom of the single section head assembly. The terminal block shall be a six position, twelve terminal barrier type strip and shall be secured on both ends.

Jumpers shall be installed on the lower row of terminal screws between adjacent pairs of terminals. The following terminal designations shall be used in terminating LED leads: Walk (LED), Walk (field), DW (LED), DW (field), N (LED), N (field) on the upper row of terminal screws.

2. Visor

Each signal head shall have a removable tunnel type visor for each signal indication. The visor shall be fabricated from black polycarbonate resin material and shall encompass the entire top and sides (bottom open) of the pedestrian signal face. The visor shall be designed to fit tightly against the door so as to prevent any perceptible filtration of light between the door and the visor. The top of the visor shall have a downward tilt of approximately 3-1/2 degrees. The length of the visors shall be a minimum of 9 inches with all sides of the visor approximately the same length. Visors shall be secured by at least six stainless steel screws.

3. Optical Unit

- a. Module shall be constructed for installation within the signal housing assembly without any modification to either the housing assembly or the LED module.
- b. Each unit shall be labeled with the manufacturers trademark, identification number, voltage rating and up arrow indication.
- c. Insulation displacement connectors shall not be used.
- d. Under no circumstances shall a “Walk” indication supersede a “Don’t Walk” indication when any amount of voltage is applied to both inputs.
- e. The LED unit shall include a one piece neoprene or EPDM (Ethylene, Propylene, Diene Monomers) gasket which shall make an assembled housing and LED module watertight.
- f. A.C. or D.C. voltages at input terminals of the L.E.D. shall be below 15 volts within 200ms after removing power. The indication shall work with a conflict monitor utilizing N.E.M.A. plus functions, specifically DUAL INDICATION.
- g. Each module shall have one opening located in each of the four corners to secure the module to the housing assembly door.
- h. Each LED module shall:

Be wired to the terminal strip located in the housing. The “Walk” input wire to the module shall be connected to the 1st terminal on the terminal strip, the “Don’t Walk” input wire to the module shall be connected to the 3rd terminal on the terminal strip and the neutral wire for the module shall be connected to the 5th terminal on the terminal strip.
- i. The manufacturer shall provide the following warranty provisions:
 - Housing Assemblies furnished shall be guaranteed to be free from electrical, mechanical, or structural defects for a period of 18 months from the date of delivery, and any

such defects developing within warranty period shall be remedied free of all expense to the City.

- LED modules shall have a minimum 6-year (72-month) warranty period from the date of installation. The warranty shall cover the replacement cost including the price of the unit and shipping. This warranty shall cover the replacement or repair of any LED signal module that exhibits a failure due to workmanship or material defects or falls below the minimum intensity levels.
- The Contractor shall, to the satisfaction of the Engineer, affix to the back of each pedestrian signal indication a permanent label or permanently marked (utilizing an “oil based paint marker”) with the actual date of installation. The oil based paint marker shall be a contrasting color to ensure that the date can be easily read.

4. Painting

All surfaces of the pedestrian signal housing and housing door shall be black in color. All surfaces of the visor shall have a dull non-reflective black finish.

The color shall be completely impregnated in the polycarbonate resin material of the molded parts such that scratches will not expose uncolored material. Color to be approved by the City prior to manufacture.

5. Manufacturer's Drawings, Specifications, and Sample Unit

The Contractor shall submit to the Engineer for approval by the City one (1) module and four sets of manufacturer's drawings and specifications of the pedestrian signal face. The supplier shall also provide at the time of submission of unit for approval written certification in the form of independent test results that the pedestrian indication equipment to be supplied meets or exceeds ITE performance requirements for intensity and color.

The Contractor shall also submit to the Engineer, for approval by the City, four copies of all warranty information, a Manufacturers' Certificate of Conformance to this specification, and all other pertinent manufacturer

data. As part of the pertinent manufacturer data, the Contractor shall include the product invoice.

The Engineer shall distribute two copies of the above documents as follows:

- City of Minneapolis Traffic and Parking Services

6. Inspection

The pedestrian signal shall be approved by the Engineer prior to procurement by the Contractor.

K. Luminaires on Signal Poles

The luminaires located on the luminaire extension on mast arm signal poles shall be furnished and installed under the signal portion of the Contract. All work related to luminaires installation on street light poles shall be furnished and installed under the street lighting portion of the contract.

Luminaires shall be "UL" listed, shall be of a rectilinear style with aluminum housing with a 2 3/8" O.D. pipe type slip fitter attachment connector. Units shall have an integral CWA regulator high power factor ballast, mogul type socket, medium cutoff IES Type III light distribution pattern, factory applied finish, a polycarbonate refractor, drop lens styling, and be equipped with a snow guard. Lamps shall be General Electric, Sylvania, Norelco, or an approved equal.

The luminaire shall be painted UPS Brown thermo-set acrylic exterior. Luminaires shall be City of Minneapolis approved and be:

American Electric

Series 153

Catalog No. 153 25S R3 DP,

or

City approved equal

Wiring from the transformer base to the luminaire shall be (2-1/c#12 AWG stranded wires with THHN/THWN rating). One conductor shall have insulation colored black, and the other shall have white colored insulation.

L. Concrete Foundations/Bases

Concrete for all foundations shall be Mix No. 3Y43 free of chloride additives, placed and consolidated using vibratory equipment and be finished all in accordance with the provisions of Mn/DOT 2565.3F except that edges **shall not** be chamfered or

beveled, but shall be neat and straight. Concrete shall be allowed to cure for a minimum of seven (7) days before being placed into use unless otherwise permitted by the Engineer.

M. Intersection Controller And Cabinet

The signal controller equipment pad, signal controller cabinet and signal controller are in place and shall be used with the Revised Traffic Signal System.

SS-1.5

Construction Requirements

A. Staging

The Contractor shall review the construction phasing plan and shall plan his work accordingly.

B. Conduit Placement

Where N.M.C. conduits are required to be placed underground below roadway surface areas that are to be reconstructed with bituminous or concrete pavement, the N.M.C. conduit shall be placed and backfilled (if trenching method used) and compacted to the satisfaction of the Engineer before any new pavement is placed.

Exposing existing utilities and surface restoration shall be considered incidental to the work required to provide a complete conduit system installation. **Exposing existing utilities or repairing damaged conduit under existing roadways shall require the Contractor to first secure a Utility Street Cut Permit from the City.**

The Contractor shall install red City of Minneapolis Traffic and Parking Services marking tape for marking underground transportation utilities at a distance of 6 inches above all new conduit placed by the trenching method. The required marking tape shall be purchased by the Contractor at the City of Minneapolis Traffic and Parking Services Office, 300 Border Avenue North. Provision and installation of the marking tape by the Contractor shall be considered incidental work to furnishing and installing the conduit.

Existing conduit to be reused as part of a revised permanent signal system (as shown in the Plans) shall be reused in accordance with the provisions of Mn/DOT 2565.3D5.

1. Extension of Conduits: The Contractor shall provide a continuous length of conduit of size and type noted on the Plans between the specified terminal points.

2. Installation of Conduit into Handhole: Conduits shall be installed into handholes by use of a hole saw to cut through the handhole wall. Areas surrounding conduit entrances shall be sealed by filling them with mortar. Conduits shall be installed entering handholes through the sidewalls of the handholes, not through the bottom gravel foundation. Conduits shall extend a minimum of 2 inches and no more than 3 inches into the handhole.
3. Connection to Existing Conduits: The Contractor shall locate the ends of existing conduit as shown on the Plans and extend the conduit to handhole, signal base, etc., which is to be built by the Contractor. Existing conduit shall be cut perpendicular to conduit and exterior surface cleaned to form secure connection to extension.
4. Installation of Conduits: The conduits shall be installed a maximum of 12 inches from the back of the curb, as shown in the Plans or as directed by the Engineer. Except as required to bypass foundations, the base on which the curb is placed shall not be disturbed. All conduits installed across newly surfaced streets shall be installed at a minimum depth of 24 inches or as directed by the Engineer.

Where existing sidewalks, pavement, or streets are opened, the opening shall be refilled to the original thickness using material equal to that removed, and the surface restored. In sidewalk areas whole panels shall be removed and replaced unless a utility joint exists in which case only the portion of the walk above the installation up to the joint need be removed and replaced.

In general, all conduits shall be straight and true, and all offsets and bends shall be uniform and symmetrical. Field bends of conduit shall only be accomplished with the use of an approved conduit heating/bending mechanism designed for that purpose. The Contractor shall adjust the elevations of the conduit assembly for its full length to approximately the same gradient as the finished roadway, and shall furnish and install, in the trench such suitable spacers and framing as may be necessary to maintain the correct grade and alignment. The cover material shall be firmly tamped into place in 6-inch lifts to minimize uneven settlement above or below the conduit.
5. Installation of Conduits Under Driving Surface and Sidewalk: All conduits that are to be placed under driveways, streets and sidewalk that are not scheduled for

removal shall be directional bored, or installed by another method approved by Engineer that will not damage or disturb the integrity of the driveway, street or sidewalk. All conduits that are to be placed under driveways, alleys, streets, or sidewalk that are scheduled for removal must be placed during the time between the removal of the existing surface and the commencement of pavement operations. The Contractor is responsible for coordination with the paving Contractor.

6. Installation of Conduits Under Driving Surface and Sidewalk Outside Paving Limits: All conduits that are placed under driveways, streets and sidewalk that are not scheduled for removal as part of the street or sidewalk paving shall be placed either by directional boring, surface removal or other approved methods. Any required surface removal and restoration shall be considered incidental to the work required to provide a complete conduit system installation. Damage to pavement or sidewalk shall be remedied at the Contractor's expense.
7. Conduit Attached to Wood Poles (Service): All conduits terminating near the top of a wood pole shall utilize a metal weatherhead service entrance type fitting with knockouts (knockouts shall not be opened if not used). Conduit shall be attached to a wood pole by galvanized RSC straps spaced 3 feet apart, or as directed by the Engineer.
8. Duct Seal: Duct seal or other Engineer approved material shall be furnished and installed to seal all controller cabinet and service cabinet conduit entrances as necessary in accordance with Mn/DOT 2565.3D2b.
9. Conduit Ends in Handholes: All ends of non-metallic conduit entering a handhole shall be trimmed by the Contractor, on the inside and outside of cut ends to remove rough edges. Conduits shall extend a minimum of 2 inches and no more than 3 inches into the handhole.
10. Damaged Conduit Identification and Replacement

The Contractor shall utilize all reasonable measures to reuse existing conduits when so identified within the Plans. If a conduit is found to be unusable because it is plugged or broken, the Contractor shall identify the point of impassability and perform the necessary conduit repair. Conduit repairs that are necessary on existing facilities not within the roadway shall be performed by the Contractor as

incidental work to the individual "Signal System" line item. Conduit blockages within the roadway shall be located from both directions of the in place conduit, and brought to the attention of the Engineer. If the Contractor is authorized to repair the conduit the Contractor shall first apply to the City for a "Utility Cut Permit" before proceeding. The Contractor shall be responsible for all fees associated with the required permit including placement of the permanent roadway patch by City of Minneapolis forces.

If the Engineer determines the conduit shall be repaired, the Contractor shall include all necessary traffic control, surface, base and sub-base removal, conduit removal and disposal, conduit replacement with appropriately sized PVC conduit, reattachment of replacement conduit to existing conduit ends, protection of cabling that may be within the existing conduit if necessary, installation and compaction of sub-base and base materials, and sidewalk repair necessary to repair the conduit. The conduit repair will be paid for as **EXTRA WORK**. in accordance with MnDOT 1904.

C. Concrete Traffic Signal and Service Cabinet Foundations

The existing concrete traffic signal cabinet foundation for the in-place traffic signal cabinet shall be core drilled in accordance with Minneapolis Standard Plate 3733 as shown in the Plans and to the satisfaction of the Engineer.

The concrete service cabinet foundation for the Contractor furnished and installed service cabinet shall be installed in accordance with Minneapolis Standard Plate 3728L as shown in the Plans. The foundation location shall be approved by the City before construction. Concrete pad finishing shall be smooth, level, and flat. No more than 0.125 inches of variability compensated by shims will be allowed. Variability in excess of this will require resurfacing or replacement at the direction of the Engineer. Inspections will be performed using a Contractor supplied City approved 1/2" thick steel template manufactured to match cabinet dimensions. The first pad shall be inspected in detail, approved and used as the standard for finish and workmanship. All templates required are incidental to the project.

D. Handholes

Frames and covers for new or relocated handholes shall be prepared for grounding prior to installation. Grounding shall be accomplished by exothermically welding a 30 inch long #6 solid

copper ground wire to the underside of the handhole ring and a 12 inch long #2 braided ground cable between the underside of the handhole ring and the underside of the handhole cover. Handhole frame shall be connected with a ground clamp to a 1/2 inch by 8 ft ground rod sunk inside of the handhole.

Frames and covers for new or relocated handholes shall be prepared for grounding prior to installation. Grounding shall be accomplished by exothermically welding a 30 inch long #6 solid copper ground wire to the underside of the handhole ring and a 12 inch long #2 braided ground cable between the underside of the handhole ring and the underside of the handhole cover. Handhole frame shall be connected with a ground clamp to a 1/2 inch by 8 ft ground rod sunk inside of the handhole.

Frames and covers shall be set in a bed of mortar and leveled to the finished surrounding grade. Cast-iron frame covers constructed in accordance with City of Minneapolis Details No. 3711 and 3776 shall be furnished and installed by the Contractor.

Conduits shall be installed by the use of a hole saw to cut through the handhole wall. The area surrounding the conduit entrance shall be sealed with a mortar filling. Conduits shall extend a minimum of 2 inches and not more than 3 inches into the handhole.

Signal interconnect conduit runs passing through handholes shall have both entering conduits placed in direct horizontal alignment.

Painting of the cast-iron frames and covers shall be as specified elsewhere in these Special Provisions.

The Contractor shall remove to the bottom of the handhole, any excess material inside of existing handholes that are to be reused.

The Contractor shall salvage in place handholes not reused as part of a revised permanent signal system unless otherwise directed by the Engineer.

Frames and covers shall be painted and than pretreated prior to concrete placement such that the concrete does not adhere to exposed surfaces. Frames and covers shall be cleaned free of adhering concrete after placement.

E. Adjust Handhole

At the locations indicated in the Plans, the Contractor shall adjust each handhole to an elevation as indicated in the Plans to the satisfaction of the Engineer.

If any handhole or handhole cover to be adjusted is damaged by the Contractor's operation, then the Contractor shall furnish and install a new identical handhole or handhole cover at his own expense. If the Engineer determines that a handhole or handhole cover to be adjusted is unusable due to circumstances beyond the Contractors' control, then a new identical handhole or handhole cover shall be furnished and installed by the Contractor and will be paid for as **EXTRA WORK**. in accordance with MnDOT 1904.

F. Installation of Mast Arm Poles

The Contractor shall mount all transformer bases directly on the foundation with the access door oriented 180 degrees away from the adjacent curb line. The use of the lower anchor rod nuts for leveling is not permitted. The lower anchor rod nut shall be tightened snug against the upper plate of the transformer base after leveling. Any pole that is not plumb shall be correctable up to ½-inch using stainless steel washers. The Contractor, at the Contractor's expense, shall recap foundations that are incorrectly installed.

G. Signal Out Requirements

The Contractor shall notify the Engineer five (5) days in advance of de-energizing the existing signal system. The Contractor shall coordinate removing the signal from operation with the area Traffic Control/Staging Plan and construction activities. The Engineer shall approve the day and time of the event.

H. Vehicle and Pedestrian Signal Face Installation

1. Vertical Pole Shaft Mounted: The provisions of Mn/DOT 2565.3L2 are modified to assure that vehicle and pedestrian signal faces required to be mounted on a vertical pole shaft of a mast arm pole standard shall be mounted in accordance with the Minneapolis Standard Signal Assembly Detail No. 3783 shown in the Plans.

The pedestrian indications Type 30A(R) and Type 30A(L) shall have no lower bracket and banding as shown.

The one-way pole mounted vehicle indications Type 10A shall have the upper mounting bracket attached to the vertical pole shaft by the use of knurled steel threaded inserts and not by banding.

The two-way pole mounted vehicle indications Type 20A shall have the upper mounting bracket attached to the vertical pole shaft by the use of knurled steel threaded inserts and not by banding.

2. Pedestrian Signal Attachment: Pedestrian signals shall be attached to the signal assembly plumbing using 1 ½" X 2" galvanized steel nipples to connect the signal to the 90-degree elbow at the top of the pedestrian signal. The pedestrian signal assembly shall be held in place on the 1 ½" plumbing through the use of a 2" – 10 gauge plated steel bushing and a 1 ½" by ½" galvanized steel lock nut.

I. Placing Traffic Control Signals In Operation

All vehicle signal faces and pedestrian indications shall be bagged or turned away from traffic immediately after erection to clearly indicate that the signal is not in operation. All bagging shall be gunnysacks or other like material approved by the Engineer and shall be maintained by the Contractor to the satisfaction of the Engineer. Bagging shall be of a grey or light brown color so as to clearly indicate that the signal face is not in use. Orange, red, or black bagging will not be permitted.

When the signal system is to be placed in operation, all vehicle signal faces and pedestrian indications shall be unbagged and aimed as directed by the Engineer.

At the time of controller cabinet connection and at turn on, the Contractor shall have on hand and available at the location: spare lamps of each size, workers and equipment to reach overhead indications, and shall perform such work as may be required to correct such incidents as may be revealed in the connection and/or energization process. Only the City shall place the signal system in operation.

J. Control Cable Installation

The Contractor for this Contract shall terminate all new electrical cables and conductors extending above the cabinet concrete foundation as follows:

Cables:

- Shall be cut 6.5 to 10 feet above the cabinet concrete foundations, and
- Shall have the ends taped, and
- Shall be labeled with the cable number as per the field wiring diagram - (label shall be applied 6 inches above the cabinet concrete foundation), and
- Shall be coiled, tie wrapped, and left in a neat manner.

K. Completed Intersection Installation Testing

After successful installation of all items required in the Plans and Special Provisions, the City shall inspect and test the intersection prior to acceptance of the completed installation.

Each completed intersection installation shall function to the satisfaction of the Engineer and in accordance with the intent of the Plans and Special Provisions.

L. Traffic Signal Cabinet

Controller Timing: Timing settings for controller units will be furnished and installed by the City.

EVP Equipment: The Contractor shall furnish and install cabinet located EVP electronics and any necessary additional harnessing. The Contractor shall connect the equipment in the traffic signal cabinet.

M. Painting

1. Contractor Furnished Equipment

The Contractor shall furnish all paint required after verification of the exact paints and colors with the City of Minneapolis Traffic and Parking Services.

All painting shall be in accordance with the provisions of Mn/DOT 2565.3T, except that finish coat paint for all traffic signal system items shall be two (2) manufacturers shop coats as modified below.

Traffic signal pedestal bases, pedestrian push button station bases, pedestrian push button assemblies shall be finish painted with Exterior Enamel, Minneapolis UPS Brown, conforming to the City of Minneapolis Specifications.

Handhole rings and covers shall be primed with a red oxide primer and finished with a City-approved Green Exterior Enamel. If field painting is required, it shall be approved in advance and be accepted by approval of the Engineer.

Mast arm pole vertical shafts (below bottom signal bracketing), traffic signal pedestal shafts, pedestal slipfitter collars, all signal brackets and pipe fittings and pedestrian push button stations, shall be finish painted with Exterior Enamel, Minneapolis UPS Brown conforming to Minneapolis Specifications.

A shop coat of primer paint shall be applied to the outside surface of all poles, bases, and shafts.

Mast arm pole vertical shafts (above bottom signal bracketing), traffic signal mast arms, auxiliary sign arms, luminaire pole shaft extensions, luminaire mast arms, and mast arm pole transformer bases shall be finish painted with Exterior Enamel Thermoset Acrylic conforming to the following color requirement and specifications of the City of Minneapolis:

- Paint color shall be Minneapolis UPS Brown.

The fitter on the top of the luminaire extension that transitions from the extension to the luminaire fixture shall be UPS Brown.

Dull Non-Reflective Black enamel shall be used on visors, directional louvers and background shields.

2. Refurbishing and Field Painting Traffic Signal Poles

As noted in the plans, Signal Pole 1 and Signal Pole 2 will be used in place under this Contract. The Contractor shall refurbish and field paint the signal pole equipment being reused within the Revised Signal System.

The existing mast arm pole, mast arm, and luminaire extension if designated for reuse shall be sandblasted clean, prime painted, in accordance with the provisions of Mn/DOT 2565.3T and applicable provisions of Mn/DOT 2478 and finished painted yellow and black or brown in color in accordance with City of Minneapolis Transportation Division requirements covered elsewhere in these specifications. The paint color used will depend upon the location of use for the standard.

PAINING

At each system, all painting shall be in accordance with the provisions of Mn/DOT 2565.3T, except that finish coat paint for all traffic signal system items shall be two (2) coats as modified below.

Exterior Enamel, Signal Green, conforming to the City of Minneapolis Specifications, on hand hole frames and covers.

Exterior Enamel, Minneapolis UPS Brown (Baking and Air Dry) conforming to Minneapolis Specifications on vehicle and pedestrian signal indication housings, mast arm pole standard vertical pole shafts (below bottom signal bracketing), traffic signal pedestal shafts, pedestal slip fitter

collars, all signal brackets and pipe fittings, and pedestrian push button stations.

Exterior enamel, Minneapolis UPS Brown, conforming to the City of Minneapolis Specifications on mast arm pole vertical pole shafts (above bottom signal bracketing), traffic signal mast arms, luminaire vertical pole shaft extensions, luminaire mast arms, mast arm pole transformer bases, street light poles (above bottom signal bracketing) and bases, and luminaires.

Dull Non-Reflective Black enamel on visors, directional louvers, background shields, and vehicle and pedestrian signal indication housing doors (inside and outside).

The Contractor shall submit a color sample to the City of Minneapolis Transportation Division for approval prior to procuring the product or painting the signal system.

SS-1.6 Removing, Salvaging, and Stockpiling Existing Materials and Electrical Equipment

This work shall consist of the removing portions of the existing traffic signal control system.

When directed by the Engineer, the Contractor shall remove and salvage for the City all items of the existing traffic control signal systems, signal equipment, interconnect cable, foundations, handholes, service equipment, and signs not being reused as part of the Revised Signal System, in accordance with the applicable provisions of Mn/DOT 2104; with the applicable provisions of Mn/DOT 2565.3U; and the following:

- A. Underground conduit and handholes shall be removed, unless otherwise directed by the Engineer.
- B. Salvaged items shall be disassembled as directed by the Engineer and shall be delivered to the City of Minneapolis Traffic and Parking Services Division at 300 Border Avenue North, Minneapolis.

The Contractor shall contact the City Traffic and Parking Services office 24 hours in advance of delivery as follows:

Traffic Stores

Telephone: 612-673-5750

- C. Salvaged items shall be disassembled before being delivered to the City of Minneapolis as follows:
 - Vehicle signals and pedestrian signals shall be removed and left intact.

- Remove background shields from vehicle signal faces without damaging shields or signal faces.
 - Remove and disassemble all signal bracketing and pipe fittings without damaging signal bracketing and signal faces.
 - All signal and communication cables and conductors salvaged shall be neatly coiled and tagged with correct footage.
 - Mast arm pole standards shall be disassembled by unbolting and removing mast arms, overhead signal head mounts, and signal brackets. All nuts and bolts shall be packaged and tagged.
 - Luminaires shall be removed from the luminaire mast arms.
 - Pedestal shafts and shaft rods shall be removed from pedestal bases. Pedestal slip fitter collars shall be removed and all set screws and plugs left intact.
 - Service equipment, conduit risers, power conductors, etc., shall be removed from service wood poles and conduits disconnected from enclosures.
 - Signs and sign brackets shall be removed from signal poles and mast arms.
 - All other salvable items shall be removed and disassembled as directed by the Engineer.
 - Existing handhole frames and covers that are not to be reused shall be salvaged and delivered to the City.
 - **Where controller equipment is being replaced, the existing traffic signal cabinet electronics will be removed and salvaged by the City.**
- D. Concrete cabinet and pole foundations, conduit, and items deemed non-salvageable by the Engineer of each existing traffic control signal system shall be removed and disposed of outside the right-of-way in any manner that the Contractor may elect subject to the provisions of Mn/DOT 2104.3C3 and as noted elsewhere in these Special Provisions.
- E. The concrete cabinet and pole foundations and the underground signal conduits may include asbestos containing electrical conduits (Transite). The 3' x 18" vertical pipe in handholes may also contain asbestos, Transite pipe. Underground signal conduits that contain asbestos will have been encased in concrete at the time of installation. For the procedure for handling and disposal of these

asbestos-containing materials see the “Technical Specifications for the Excavation of Asbestos-Containing Electrical Conduit” located in **Appendix A** of these Special Provisions.

- F. The removal of traffic signal handholes and foundations containing asbestos shall be incidental to the Revise Signal System pay item.
- G. All removal, disposal, and salvaging of materials of the existing traffic control signal systems, as required by the Plans and Special Provisions shall be incidental to the Revise Signal System pay item and no direct compensation will be made therefore.

SS-1.7 Type D Signs

The Contractor shall salvage and reinstall all mast arm mounted Type D signs for re-use with the Revise Signal System.

Salvaging and reinstalling the Type D sign panels at the locations indicated in the Plans, and as specified herein shall be considered incidental work and no direct compensation shall be made therefore.

SS-1.8 Traffic Signal Priority Control System

This work shall consist of the installation of new or reinstallation of existing at all the intersections, as shown in the Plans, a Priority Vehicle Detection and Control System (PVDCS). The PVDCS shall detect and verify priority vehicles such as emergency and non-emergency vehicles for preemptive or priority traffic signal service. Furnishing and installing materials and electrical equipment as specified herein, all to provide an installed and successfully tested priority vehicle detection and control system shall be considered incidental work to the Revise Signal System pay item and no direct compensation shall be made therefore.

Commonly used abbreviations:

(PVDCS) Priority Vehicle Detection and Control System

(NEVP) Non-Emergency Vehicle Preemption, low priority

(EVP) Emergency Vehicle Preemption, high priority

The PVDCS shall consist of a matched system of equipment that includes optical emitters, optical detectors, optical detector cables, phase selectors and confirmation light assemblies. The system shall work with the local intersection traffic signal controller to provide an effective total system operation.

The PVDCS shall employ infrared optical communication to detect the presence of all priority vehicles and collect and record pertinent priority vehicle information.

Once operational, the PVDCS shall require no additional action from the vehicle operator to provide proper operation. The system shall provide

priority operation on a first-come, first-served basis with high priority requests overriding low priority requests.

For application in Minneapolis, the PVDCS shall interface to traffic signal controllers. It shall be the Contractors responsibility to work with the City to verify proper operation of the total system.

A. System Description

The system shall utilize infrared optical communications technology to process valid optical signals emitted from authorized vehicles, and place calls to traffic controller preempt inputs to effect preemption of normal traffic control signals.

Components of the system shall consist of infrared optical emitters mounted on authorized vehicles, infrared receivers mounted in the intersections and interfaced to traffic controllers via an optical signal processor and confirmation lights mounted at the intersections.

Optical emitters shall emit infrared optical signals on both the industry standard high-priority carrier frequency 14.035 Hz (Emergency band), or the industry standard low-priority carrier frequency 9.639 Hz (Transit band) by user programmable selection.

Receivers shall consist of infrared optical detectors, mounted to view the approaches to intersections, an optical signal processor (OSP) installed in the traffic control cabinet and wired to the preempt call inputs of the traffic controller, and detector cable connecting the optical detectors to the OSP.

As emitter equipped vehicles approach receiver-equipped intersections, the optical detectors shall convert the incoming optical signal into an electronic signal. The OSP shall receive the electronic signal, delivered by the detector cable, determine the priority of the vehicle, arbitrate priority between any simultaneously approaching vehicles, place appropriate calls to controller inputs, and log vehicle detection events.

1. The OSP shall be capable of categorizing vehicles in both emergency and transit signal bands. The OSP shall be capable of the following actions, configurable on a per-band basis:
 - a. Local preempt – if enabled, the OSP shall place a call on the appropriate controller input in response to vehicle detection. (Default shall be enabled)

- b. Logging – if enabled, the OSP shall be capable of writing a log record in non-volatile memory consisting of the following information: (Default shall be enabled)
 - Signal band
 - Direction
 - Call duration
 - Final greens at end of call
 - Duration of final greens
 - Event start time and end time in real time
- c. Real-time announcement of vehicle detection – if enabled, the OSP shall send a short message via, RS-232 port upon the start of vehicle detection processing. The message shall consist of the following information: (Default shall be disabled)
 - Signal band
 - Direction
- d. End of event echo – if enabled, the OSP shall echo the complete log record for a vehicle detection event immediately after the end of the event. The information included shall include those items enumerated in 1.b above. (Default shall be disabled)

System receivers shall always give precedence to emergency band vehicles over transit band vehicles.

System receivers shall be capable of detecting emitter-equipped vehicles at a range of up to 2,500 feet (762 meters), under clear atmospheric conditions.

System receivers shall be interface with all NEMA TS-1 and TS-2 and Type 2070 traffic controllers equipped with programmable preemption routines, with no compromise to normal traffic controller functions.

Optical signal processors must be field programmable by the user, using the manufacturer's system software via computer.

B. System Components

1. Optical Emitter

Optical emitters shall generate the optical signal required to activate the receiver equipment in the intersection. The light pulses shall consist of a fixed base frequency emergency or transit band signal for standard preemption

systems.

Optical emitters shall effect the range adjustment of the system by using activated optical emitters positioned at the desired distance while the optical signal processor range adjustment features are activated in the traffic cabinet.

2. Optical Detector

Infrared optical detectors shall be manufactured from black UV stabilized polycarbonate suitable for all weather use. The detector electronics shall be waterproof.

Infrared optical detectors shall sense and transform optical energy from optical emitters into electrical signals to be received by the optical signal processor.

Infrared optical detectors shall sense optical emitter signals over an adjustable range of 2500 feet (762m) in optimum atmospheric conditions.

Infrared optical detectors shall transmit electrical signals to the optical signal processor via up to 1000 feet of optical detector cable.

Infrared optical detectors shall have an internal terminal strip with wiring label for convenient positive connection to the detector cable.

Infrared optical detectors shall have at least a nominal conical 13-degree field of view centered about the view port normal axis.

Infrared optical detectors shall operate over a range of 12 to 30 VDC and current of up to 50ma maximum.

Infrared optical detectors shall have a 1/2 inch or 3/4 inch FNPT mounting connection.

Infrared optical detectors shall be capable of performing a regularly occurring detector initiated diagnostic routine that tests all components used in the receipt and processing of incoming light pulses.

3. EVP Confirmation Lights

The confirmation light assembly shall be constructed from standard electrical hardware in conformance to the arrangement and configuration requirements described herein and shown on the Plans.

When the controller begins processing an EVP request, the controller shall also generate preempt confirmation outputs

indicating that an EVP request is being processed (confirmation outputs shall only be generated for EVP & rail operation).

The EVP confirmation outputs shall be wire connected to unused load switches in the controller cabinet. The circuits shall be connected to EVP confirmation lights in the intersection.

The controller circuits shall be programmed to provide an illuminated solid white light to the requesting phase of EVP service and illuminated flashing white lights to all other vehicle phases.

4. Optical Detector Cable

Optical detector cable shall be in accordance with the provisions of MN/DOT 3815.2C5.

5. Optical Signal Processor

Optical signal processors shall be installed in the traffic controller cabinet to receive the electrical signals from optical detectors. The optical signal processor shall interface directly with Type 2070 controllers with compatible software, and NEMA TS-1 and TS-2 with suitable system interface equipment and software.

Optical signal processors shall be powered from 120 VAC (95VAC to 135VAC), 60 Hz power and have an on board, regulated power supply that supports up to 10 optical detectors.

A communication module, which shall arbitrate priority between the signal processor modules, logs events, and provides RS-232 communication with the outside world for system configuration during installation, and real time communication with the traffic controller or central system during operation.

Non-volatile memory shall be included for storage of configuration parameters and event logs. Retention time for the non-volatile memory module shall be a minimum of 10 days with system power off.

The optical signal processor front panel shall have at least the following features:

- Power on/off switch with corresponding LED indicator.
- LED indicators for emergency and transit band reception status for each of four channels.

- Test switches for activating internal diagnostics.
- Optical signal processors shall have a method for enabling the setting of detection range without software interface with the RS-232 port. All available channels shall be able to be armed simultaneously for range setting.
- Optical signal processors shall have an RS-232 communications port.
- Indicator lights that identify optical detectors which have failed a self test routine.

Programming the optical signal processor and retrieving data stored in it via the RS-232 port shall be accomplished using an IBM PC-compatible computer either locally or remotely via a modem.

The optical signal processor shall be capable receiving and logging both standard emergency and transit band signals from system vehicles.

Optical signal processors shall log and store a minimum of 1,000 events in non-volatile memory. When the log is full, the oldest entry shall drop off to allow the newest entry to be logged.

C. System Software

Optical signal processor software shall be provided on CD-ROM. It shall run on IBM compatible computers with Windows 95, 98, NT 4.0, 2000, and XP software.

The software shall provide windows and menus for programming emergency and transit vehicle parameters, intersection and channel names, timing parameters, desired green signal indications during priority control operation, and for viewing and downloading logged information.

Environmental

All equipment supplied as part of the optical preemption traffic control system intended for use in the controller cabinet shall meet the electrical and environmental specifications spelled out in the NEMA Standards Publications TS2-1992 Part 2 where applicable.

D. Qualifications

The manufacturer or their qualified agents shall supply a list of at least five preemption system users having experience with the various types of preemption system components available from the manufacturer for a minimum of three years.

Manufacturers shall be able to demonstrate the ability to provide on going technical and product warranty support.

Manufacturer or the manufacturer's representative shall provide responsive service before, during and after the installation of the priority control system. The manufacturer or the manufacturer's representatives shall provide training to the system installer and maintenance department of the purchasing agency. Training shall consist of proper installation and operating procedures for the system hardware and software.

E. Warranty

The manufacturer shall warrant that system components that fail due to material flaws or workmanship shall be replaced or repaired under manufacturers published warranty provisions for a period of not less then 10 full years from the date of installation.

F. Contractor Work Tasks

The Contractor shall:

1. Furnish all PVDCS materials and equipment, mounting hardware, wiring, cables, optical detectors, confirmation light assemblies and bulbs, phase selectors, mounting brackets, detector connection cables, cable termination strips, communication cables, test equipment and computer software and other items as required. Install optical detectors with confirmation light assemblies at the locations shown on the Plans.
2. Aim, orient and test to demonstrate proper operation of the optical detectors at each intersection and that each detector will provide effective EVP system operation as required for the conditions shown on the Plans.
3. Install detector and confirmation light wiring from the detector device to a controller cabinet terminal strip.
4. Demonstrate correct operation of each properly equipped and operational intersection to serve as acceptance tests of the PVDCS system and components.
5. Provide system and component documentation.
6. Provide system and component application and maintenance training to support the proper installation and operation of system components.
7. Provide PC-based software and interconnection cables to fully implement all components into a complete operational system.

8. Install and connect all Contractor furnished PVDCS in-cabinet equipment.
 9. Connect optical detector wires to in-cabinet equipment.
 10. Connect confirmation light wires to in-cabinet equipment.
 11. Connect cable between the signal greens and the phase selector inputs.
 12. In general, install and connect all Contractor furnished in-cabinet equipment and cables.
- G. City Work Tasks
- City forces shall:
1. Provide installation, testing and inspection support.
 2. Be on-site during the Contractor installation to provide support and troubleshooting assistance.
- H. Optical Detector Mounting and Confirmation Light Assembly
- Combination optical detector mounting and confirmation light assemblies shall be furnished and installed at each intersection as shown on the Plans.
- Each assembly shall be made up from UL listed standard electrical hardware to provide a sturdy and weatherproof assembly suitable for mounting optical detectors and confirmation lights.
- Each assembly shall be designed to mount two optical detectors and two confirmation lights. When less than two optical detectors or confirmation lights are used, the unused mounting holes shall be capped or plugged in an approved manner.
- Each confirmation light assembly shall consist of incandescent lights that will operate in conjunction with the PVDCS to indicate the occurrence of a high priority preemption call.
- Confirmation lights shall be wired to provide confirmation for each preemption phase.
- An illuminated solid white light shall be displayed to the directions of traffic flow represented by the preempt phase, illuminated flashing white lights will be displayed to all other approaches.
- Confirmation displays shall only be used with emergency vehicle or rail preemption.
- Reflectorized outdoor type flood lamps shall be provided for each confirmation lamp holder by the Contractor.
- I. Priority Control Interface Software

The Contractor shall provide PVDCS PC based software to enable direct uploading and downloading of settings and control commands and the downloading of data describing priority vehicle operation.

The PVDCS interface software shall be provided on CD-ROM. It shall run on IBM compatible computers with Windows 95, 98, NT 4.0, 2000, and XP software, a touchpad and keyboard.

It shall be possible to connect a personal computer directly to the phase selector serial port to upload and download information and data. Local connection shall permit all upload and download operations to be provided in the field.

The Contractor-supplied priority control interface software shall enable:

- Setting up and presenting user-settable system parameters
- Viewing and changing settings
- Viewing activity screens
- Displaying and downloading records of previous activity showing all items of recorded information

The Contractor-supplied priority control interface software shall accommodate operation via the keyboard and touchpad.

The Contractor-supplied priority control interface software shall provide menu displays to enable:

- Establishing signal intensity thresholds (detection ranges), timing parameters, modem initialization, and intersection name.
- Resetting and/or retrieving logged data and priority vehicle activity.
- Setting of desired green signal indications during priority control operation, and upload and download capability to view.
- Addressing for each card in a multi-drop connected system.
- Confirmation light configuration when optical signal processor driven.
- NEMA control parameters.

J. Optical Detector Installation Requirements

The Contractor shall install optical detector and confirmation light assemblies and shall wire each intersection as shown on the Plans and as required herein.

The Contractor shall assemble and install the optical detectors in accordance with detector manufacturer's recommendations and these special provisions.

The Contractor shall construct each optical detector mounting and confirmation light assembly from standard UL listed electrical construction hardware. Each assembly shall consist of a steel nipple with top and bottom locknuts, a four-way steel Crouse-Hinds conduit with a gasketed, screw retained cover, a short optical detector connection nipple with top and bottom locknuts, optical detector(s) and one or two screw mount incandescent flood lamp holders with flood lamps. The conduit and each flood lamp assembly shall be designed, constructed and finished for outdoor use. The flood lamp holder shall be Carlon Model P80010-HCD Nonmetallic Weatherproof Lighting System Lamp holder or approved equal. Gaskets shall be provided and installed on the conduit cover and around the flood lamp base to provide a weatherproof assembly. The assembled parts shall be arranged with both conduit and terminal compartment covers facing in vehicle approach direction. Hardware shall be provided to allow signal mast arm, or pedestal mounting as indicated in the Plans.

The nipple length, optical detector position and flood light final alignment shall provide at least 6 inches of separation between the optical detector and the lamp. Reflectorized, outdoor type 40-watt flood lamps shall be provided.

After assembly, aiming, tightening and final mounting on the mast arm or pedestal pole, all extension hardware and exposed threads shall be painted the same color as signal framework or mast arms to which they are attached. Contractor shall secure paint to insure added components match the color of supporting facilities.

All assemblies whether for one optical detector and one confirmation light or for more than one optical detector or confirmation light shall utilize a 1-inch nominal conduit and nipples.

Threaded caps or plugs shall be used to cover any unused mounting holes. Optical detector unit drain holes shall be oriented as recommended by the manufacturer.

The Contractor shall mount the optical detector mounting and confirmation light assembly on the top edge of the mast arms. Mounting hubs shall be located at 2 ft., 4 ft., and 6 ft. from the end of the mast arm as shown on the Plans or as directed by the Engineer. In any event, the final mounting position shall be adjusted to provide lateral clearance between.

Traffic signal heads and traffic signs and shall be adjusted to provide a clear line of sight for priority vehicles.

The Contractor shall have hubs for mounting attached during pole manufacturing. If hub locations are not useable the Contractor shall mount the optical detector and confirmation light assembly using a Frey Manufacturing Model KBR- 3/4-inch pipe thread hub. The Contractor shall follow the manufacturers recommended installation instructions to properly align the drilled hole. Each mast arm mounting shall be installed such that the finish detector mounting will be plumbed perpendicular to the earth.

The Contractor shall install enough cable to ensure sufficient unspliced length to connect the optical detector and confirmation light assembly fixtures at the top of signal poles or mast arms to the controller cabinet. Strain relief shall be provided in all poles for detector and indicator cables.

All field wiring shall be furnished, installed and connected to the field units. All wiring shall run to the controller cabinet and shall be coiled at the controller cabinet as directed by the Engineer. Each lead shall be taped to exclude moisture and be tagged to indicate phase and function.

K. PVDCS System Acceptance and Testing

The Contractor shall provide information describing the proposed equipment including unit specifications and certifications that the furnished equipment conforms to the manufacturer's specifications and these special provisions. The Contractor shall also conduct tests to verify the operation of the furnished materials and equipment and to verify the proper installation of system components.

After all field connections have been completed and wiring is connected at the controller cabinet, the City shall conduct component operations and aiming verification tests.

The tests shall verify that:

- The appropriate vehicles were detected and received and that the appropriate outputs are generated.
- The zone of detection was appropriate for each type of vehicle.
- The Contractor shall have appropriately equipped personnel on-site to correct any problems associated with the Contractors work.

L. PVDCS Training and Documentation

If the PVDCS hardware and/or software is of a different manufacture than that which is currently utilized by the City, the Contractor shall provide a training session covering installation, maintenance and repair of all PVDCS components provided under this contract. The Contractor shall provide manuals for the training activities and to support the operation of the system.

The Contractor shall provide hookup and connection details as required to enable the proper operation of the PVDCS equipment in the field.

Documentation shall also be provided describing each of the PVDCS software programs furnished to meet the requirements of this project.

It is understood that the programs provided for this project are the property of the Manufacturer or others. The programs provided shall, however, be for unlimited licensed use by the City of Minneapolis. It is also required that the City be permitted to make any number of copies of the program for use by City forces. The City shall not distribute or otherwise make available copies of the program or programs to any other party unless specifically authorized by the Manufacturer or owner of the software.

SS-1.9 INPLACE Signal controller and cabinet (type M)

The Minneapolis Standard Type M signal cabinet shall remain in place. The Contractor shall disconnect all existing lead in cables to the cabinet to the satisfaction of the Engineer.

The Contractor shall make all new field lead connections in the Type M signal controller cabinet. The Contractor shall label all cables and conductors in accordance with the field-wiring diagram. City forces shall be on site to assist the Contractor during the installation process to trouble shoot issues identified during the cabinet connection process. The Contractor shall coordinate with the City of Minneapolis a minimum of (3) days in advance of the time the Contractor will be connecting the signal controller. The City of Minneapolis Forces shall inspect and approve the completed signal controller connection. The Contractor shall make all revisions necessary to the satisfaction of the Engineer and City Forces.

SS-1.10 Method of Measurement and Payment

This section shall define the bid items and the manner in which payment will be made to the Contractor.

A. Miscellaneous Work, Equipment, and Material

Items of miscellaneous work, equipment and material may be required to construct the signal system including such items as flagmen and traffic control personnel, traffic cones, markers, flashers, barricades, bolts, nuts, washers, electrical wire, etc. In each case where these items or similar miscellaneous items are necessary to the completion of the project in a safe and reliable fashion, their provision, use and installation by the Contractor shall be considered included in the various associated items of work and no direct payment will be made therefor.

B. Measurement

Removal and salvage of portions of the in-place traffic signal control system; installing salvaged materials, furnishing and installing new materials and electrical equipment; all to revise one (1) complete operating permanent Traffic Control Signal Systems in Minneapolis as contained in these Special Provisions and in the Plans will be measured as an integral unit complete in place and operating.

Removal and disposal of materials containing asbestos shall be incidental to this pay item.

C. Basis of Payment

1. Payment for traffic control signal system installation shall be in accordance with Mn/DOT 2565.4 and Mn/DOT 2565.5 respectively for a Fully Operational Signal System. Payment shall be compensation in full for all costs of salvaging, removing and disposing of signal equipment, poles, pedestals, luminaires, foundations, conduit, handholes, cable, service cabinets, hazardous materials, installing salvaged materials, and furnishing and installing signal equipment, poles, pedestals, luminaires, foundations, conduit, handholes, cable, signal service and equipment, and all incidentals in accordance with the following schedule at the appropriate contract bid price for the specified unit of measure.

<u>ITEM NO.</u>	<u>DESCRIPTION</u>	<u>UNITS</u>
2565.616	Revise Signal System	Signal System

SS-2

TRAFFIC CONTROL INTERCONNECTION

This work shall consist of furnishing and installing materials and salvaging and reinstalling existing materials and equipment as shown on the Plans, to provide complete operating communication links with the following traffic signal control systems:

- Lowry Avenue at Washington Avenue
- Washington Street at 26th Avenue
- Empty conduit system across Lowry Bridge (future capability)

The work as shown in the Plans shall include, but not limited to, installing the conduit, handholes, and new or existing interconnect cable into the controller cabinets via new or existing handholes and conduits, the removal of in place communication cable, all in accordance with these Special Provisions.

Existing interconnect cable salvaging and reinstalling and/or furnishing and installing interconnect cable as shown in the Plans shall be incidental to the Traffic Control Interconnect installation bid item and no direct compensation will be made therefore.

SS-2.1

Electrical (Communications) System

The revised communication system within the project area shall be located in place or new conduit as noted in the Plans. Inplace communication cable shall remain in place and in operation until such time as the inplace traffic signal systems are turned off, a roadway is closed and the various interconnect functions are no longer necessary.

A. Removal of Inplace Communications Cable

The communications cables shall be disconnected at the Lowry Avenue/2nd Street control cabinet by City forces, and with the approval of the City may then be salvaged by the Contractor back to and stored in the handholes shown in the Plans.

Where required, salvaged cable shall be coiled and tagged in accordance with the requirements of SS-1.4.

B. Salvaging and Reinstalling 12 PR Conductor, Number 19

Where required by the Plans, the Contractor shall pull back and re-install interconnect cable in accordance with the Plans and as directed by the Engineer. The Contractor shall verify the length of the inplace cables and determine whether they will be of sufficient length to accommodate the location of the new conduit and handholes shown in the plans. If the existing cables are found to be of sufficient length, the Contractor shall pull the cable back and coil in the handholes shown in the plans. The Contractor shall protect the interconnect cable and shall re-install the interconnect cable to cabinet where indicated in the Plans. Pulling back and re-installing the interconnect cable shall be considered incidental

work and paid for under pay Item “2565.601 Traffic Control Interconnection”.

If the interconnect cable is damaged by the Contractor, the Contractor shall furnish and install new identical interconnect cable at his own expense. **If the interconnect cable needs to be replaced due to circumstances beyond the Contractors control, or the Contractor determined and the Engineer concurs, that the in place cable is of insufficient length to accommodate the proposed handhold and conduit locations, a new interconnect cable shall be installed continuous without splices from terminal point to terminal point.** The new identical interconnect cable shall be furnished and installed by the Contractor continuous without splices from terminal point to terminal point and will be paid for as **EXTRA WORK**. in accordance with MnDOT 1904. If it is determined the Contractor is to provide a new interconnect cable, the interconnect cable shall be in accordance with Section C, below.

12 Pair Conductor, Number 19

Communication cable shall be a 12 Pair conductor, No. 19 AWG Cable as noted in the Plans. The cable shall be a multi-conductor, grease-filled, telephone cable designed for conduit and direct burial application.

The cable shall be double jacketed and conform to a modified version of the requirements of Rural Utilities Service (RUS) Specification 1755.390 latest edition. The specification modification consists of provision of double jacketing with the inner and outer jackets constructed in conformance with the requirements of ANSI/ICEA S-84-608-1988 paragraph 7.1 and 7.2.

Individual conductors shall be solid and No. 19 AWG. There shall be a single shield that shall be either fully annealed solid copper, Alloy 194, or fully annealed copper-clad stainless steel.

The following summarizes the primary requirements:

1. 12 Pair No. 19 AWG.
2. The cable is fully color-coded so that each pair in the cable is distinguishable from every other pair.
3. Each conductor shall be a solid round wire of commercially pure annealed copper.
4. Each conductor shall be insulated with a colored, solid insulating grade, high-density polyethylene or crystalline propylene/ethylene copolymer.

5. The insulated conductors shall be twisted into pairs. The twisted pairs shall be assembled in such a way as to form a substantially cylindrical group (cable core).
6. A petrolatum-polyethylene filling compound shall completely coat each insulated conductor and fill the air space between the conductors.
7. The cable core shall be completely covered with a layer of non-hydroscopic and non-wicking dielectric material. The covering shall be applied with an overlap.
8. An inner jacket applied over the cable core covering. The jacketing grade material used for the inner jacket shall be low density, high molecular weight polyethylene in accordance with ANSI/ICEA S-84-608-1988 paragraph 7.1/7.2.
9. A single corrugated metal shield shall be applied longitudinally with an overlap over the inner jacket. The metal shield shall be for "Gopher Resistant Cable" and shall be either **10-mil fully annealed solid copper, 6-mil 194 Alloy, or 6-mil fully annealed copper clad stainless steel.**
10. An outer jacket shall be applied over the metal shield and inner jacket. The jacketing grade material used for the outer jacket shall be low density, high molecular weight polyethylene in accordance with ANSI/ICEA S-84-608-1988 paragraph 7.1/7.2.
11. The cable shall be marked on the outer jacket with product description, year of manufacture, and sequential footage marks at two-foot intervals.

The City of Minneapolis Traffic and Parking Services shall be provided the opportunity to review and approve or disapprove the proposed communications cable before it is installed.

C. Installation of Communications Cable

Interconnect cable runs shall be installed as continuous runs, unless splices are specified. Approximately six (6) feet of slack cable shall be provided in each handhole through which the run of interconnect cable passes. Each interconnect cable entering the controller cabinets shall provide six (6) feet of slack cable within the controller cabinet and shall be permanently labeled as "East" or "West" or "North" or "South" to identify the direction of interconnect cable run. Such identification shall be affixed immediately on installation of the cable into the cabinet

foundation. **A pull rope, approved by the City, shall be installed in each conduit along with each run of communication cable. Where the conduit is noted as “Empty” a pull rope shall be installed continuous from handhole to handhole with sufficient slack provided on each end to allow for future cable installation.**

D. Electrical Handholes (Pull Boxes)

All New handholes shall be Minneapolis Electrical Handholes with metal frames and covers as shown in the details in the Plans (Minneapolis Detail No. 3776) and shall conform to the City of Minneapolis standards. A drain field shall be provided with each handhole. Concrete for supporting the metal frames and covers in non-sidewalk areas shall be Mix No. 3A32 or equal.

Handhole rings and covers shall be constructed from Class 30 Grey Iron, primed and finish painted as specified elsewhere.

Relocated handhole rings and covers shall be cleaned and primed and finish painted.

E. Conduit

1. New Conduit

Conduit required to complete the interconnect system in accordance with the Plans shall meet the requirements and provisions specified elsewhere in these Special Provisions

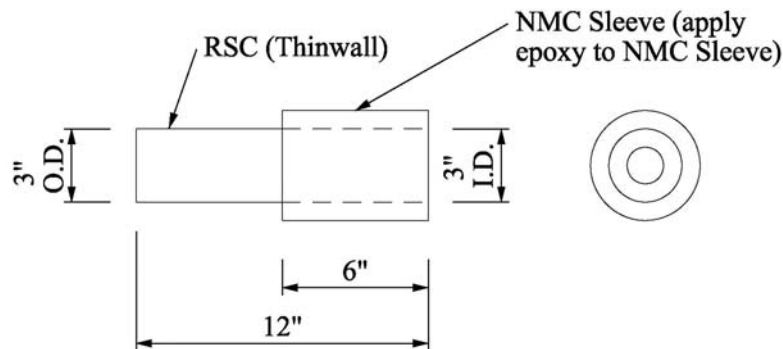
2. Damaged Conduit Identification and Replacement

The Contractor shall utilize all reasonable measures to reuse existing conduits when so identified within the Plans. If any conduit is damaged by the Contractor’s operation, then the Contractor shall furnish and install new conduit at his own expense. If a conduit is found to be unusable because it is plugged or broken, the Contractor shall identify the point of impassability and perform the necessary conduit repair. Conduit blockages shall be located from both directions of the in place conduit, and brought to the attention of the Engineer. The Contractor must receive authorization to repair the conduit before proceeding. If the Engineer determines the conduit shall be repaired, the Contractor shall include all necessary traffic control, surface, base and sub-base removal, conduit removal and disposal, conduit replacement with appropriately sized PVC conduit, reattachment of replacement conduit to existing conduit ends, protection of cabling that may be within the existing conduit if

necessary, installation and compaction of sub-base and base materials, and sidewalk repair necessary to repair the conduit. The conduit repair will be paid for as **EXTRA WORK** in accordance with MnDOT 1904.

F. Concrete Encased (Transite Conduit) Extension Adaptor

Where noted in the Plan, the Contractor shall extend the existing Concrete Encased (Transite Conduit) into a new handhole. An RSC/NMC adaptor will be required. In general, the Contractor is to cut the existing concrete encased conduit, attach the RSC/NMC adaptor to the existing concrete encased conduit, then attach bell end of the new 3" NMC conduit to the RSC/NMC adaptor and extend into handhole. The illustration below shows a typical RSC/NMC adaptor. Working with the existing concrete encased conduit may expose asbestos. Refer to **Appendix A (Asbestos Abatement)** for additional precautions and procedures.



SS-2.2 Method of Measurement and Payment

A. Measurement

Furnishing and installing all materials to provide a complete, useable interconnect system as contained in these Special Provisions and in the Plans will be measured as described below.

B. Payment

The conduit, handholes, cable system, pull rope and miscellaneous work, equipment and material required to construct each Traffic Control Interconnection System shall be paid for as listed below. Payment at the contract unit price shall be compensation in full for all costs of furnishing and installing all materials and incidentals required to provide the system as specified and as shown in the Plans.

<u>ITEM NO.</u>	<u>DESCRIPTION</u>	<u>UNITS</u>
2565.601	Traffic Control Interconnection	Lump Sum

APPENDIX A

City of Minneapolis

ASBESTOS ABATEMENT Removal/Replacement of Concrete Pole Bases, Concrete Encased Conduit, and Handholes that Contain Asbestos

Some Minneapolis signal and streetlight bases, pipe contain asbestos-containing (Transite) electrical conduit which can be broken during the removal and replacement of a streetlight or signal pole foundation. Some Minneapolis style handholes also have asbestos pipe used in the vertical pipe section of the handhole. Asbestos release can be controlled by wetting the concrete base and Transite before and during removal and painting encapsulant on any broken Transite edges exposed during the foundation removal/replacement process.

Equipment needed:

- Garden sprayer filled with amended water(water/surfactant mixture – dish washing detergent can be used as a surfactant, use 1 oz./gallon of water)
- Bucket of Childers CP-11 mastic – available at plumbing supply stores
- Disposable paint brush

Training needed:

- OSHA requires that workers who disturb asbestos-containing materials must get Class III training. A four-hour session, which includes hands-on training, will meet this OSHA requirement.

Procedures:

After the base is excavated, look at the conduit to determine if it is Transite. Transite is a rock hard, gray, slate-like material. Gray PVC pipe was also used as conduit. The PVC pipe requires no special precautions.

When removing wiring, make sure system is completely de-energized. If Transite conduit is present, spray the inside of the conduit and wiring with amended water. Pull the wires out of the conduit. If wires are visibly contaminated, wipe down the wires with disposable wipes.

If the base will be hoisted out of the ground in one piece, paint the exposed Transite conduit with CP-11 and spray amended water inside the conduit. If the base breaks during removal and Transite is exposed, wet the broken areas with amended water. When the base is moved, paint any newly exposed Transite areas with CP-11.

If the base will be broken apart and partially removed, wet the exposed Transite and inside surfaces of conduit with amended water.

When base breaks, immediately spray the newly exposed Transite surfaces with amended water. Paint the exposed Transite surfaces on the removed portion of the base with CP-11.

For the portion which remains in the ground, wet all exposed Transite. It is very important to wet the portion of conduit where any PVC/Steel adapters will be inserted. Carefully set the adapter and paint the Transite and adjacent portions of the adapter with CP-11. Paint any other exposed portions of Transite with CP-11.

Carefully haul removed bases and portions of bases to an area where they can be stored and kept separate from any other concrete which could be recycled.

Asbestos-containing material must not be recycled because crushing this material will release asbestos fibers into the air and also introduce asbestos into the recycled concrete aggregate.

The material which contains Transite conduit must be disposed of at a landfill which accepts asbestos-containing materials. This material can be legally placed in a demolition landfill, but some landfills do not accept asbestos. Call to insure acceptance.