

**SPECIFICATIONS**  
**FOR**  
**ROADWAY LIGHTING**  
**DIVISION RL – ELECTRICAL LIGHTING SYSTEM**  
**CITY OF MAPLE GROVE, MINNESOTA**

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*April 2015*

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1. COMPLIANCE WITH ELECTRICAL CODES AND STANDARDS

Bidders are advised that the National Electrical Code (NEC) and the 2014 edition of MnDOT “Standard Specifications for Construction” shall govern. Compliance with provisions of MnDOT 2545.2A, and the first paragraph of MnDOT 2545.3a will be particularly enforced in conjunction with the construction of any kind or type of electrical system, conduit or conduit system for the conveyance of the electrical conductors, or the required portions thereof, as specified in the Contract. The Minnesota Electrical Act requires that a permit be obtained for the performance of all such work, including the installation of conduits. When required, the City of Maple Grove (Owner) shall obtain the necessary right-of-way permitting required by and through Hennepin County. The Contractor shall obtain all other necessary permits including, but not limited to, an electrical permit. Work shall be inspected and approved by the Owner.

Signal and Lighting Certification will be required for all Contractors, Supervisors or Foreman involved in the field installation of this Project. Signal and Lighting Certification is available through the MnDOT Office of Traffic, Safety, and Technology (OTST). Questions regarding certification or past certification may be directed to the MnDOT Office of Traffic, Safety, and Technology (OTST) at Telephone No. (651) 234-7055.

All material shall meet the requirements of the NEC (NEC), National Electrical Manufacturers Association (NEMA) specifications, and local codes and ordinances, and shall be Underwriter's Laboratories (UL) listed, where UL standards for such products exist.

All work shall be under the direct supervision of a master electrician.

## 2. (2545) ELECTRICAL SYSTEM

The provisions of MnDOT 2471, 2545, and 2565 shall apply in addition to the following:

## 3. SCOPE OF WORK

### a. DESCRIPTION

The work included in the project shall include the furnishing of all required labor and materials for a complete and operable electrical system as indicated on the accompanying Plans and as required by the project manual inclusive of all appurtenances not specifically shown or covered by the specifications but required for complete operation of the electrical system as defined in the documents. The work shall also include the testing, adjustment, start-up and troubleshooting of the electrical equipment and the training of the Owner's operating personnel in its operation and maintenance.

It shall be the responsibility of the Contractor to furnish a complete and fully operating system. The Contractor shall be responsible for all details which may be necessary to properly install, adjust and place in operation the complete installation. The Contractor shall assume full responsibility for additional costs which may result from unauthorized deviations from the contract documents.

Light standards are to be furnished and installed as shown in the Plans and including but not limited to the following items:

- i. furnish and install poles, GFCI's and LED luminaires
- ii. rigid steel and PVC conduits
- iii. light foundations
- iv. bushings
- v. caps
- vi. inline fuse holders and fuses
- vii. underground cable
- viii. pole wiring conductors
- ix. service cabinet with foundation
- x. service riser conduit & conductors
- xi. ground rods

## b. VERIFICATION OF DRAWINGS

The contract drawings indicate the required size of conduit and cable for wiring. The locations of equipment shall be verified in the field by the Contractor. In the event it should become necessary to change the location of any work due to interference with other work, consult with the Owner before making any changes. The Contractor shall determine and be responsible for the proper location and character of all anchor bolts, inserts, hangers, sleeves, etc. for the electrical equipment, unless specifically detailed otherwise. Rough-in location confirmation is required to be coordinated with equipment shop drawings prior to installation.

The drawings indicate the extent and general layout of the electrical systems. The drawings are drawn to the scale indicated, but the drawings shall not take precedence over field measurements. Make reasonable modifications to the layout to avoid conflict with other trades.

## c. QUALITY

All work shall be installed by skilled mechanics in a neat and workmanlike manner and shall be approved by the Owner before final acceptance.

If equipment is furnished having power and control requirements other than as specified, the Contractor shall make all necessary changes and furnish a complete set of drawings for installing the alternate equipment. The installation shall comply with the requirements of the 2014 edition of the NEC, local and state codes and ordinances. Where the contract documents call for workmanship or materials in excess of code requirements, the project manual shall take precedence. Electrical equipment and materials shall be UL listed, where UL standards for such products exist.

All equipment to be installed on the project shall be new and unused.

The Contractor shall keep the premises clean and orderly during installation of this work, remove rubbish periodically and as may be directed by the Engineer. Upon completion of this part of the

project, remove all dirt, debris, tools, scaffolding, etc. used or resulting from this work.

All excavation necessary for installation of the electrical lighting system shall be backfilled and compacted at the end of working day or when work has been suspended.

d. COORDINATION

It shall be the sole responsibility of the Contractor to coordinate with other private utilities.

It shall be the sole responsibility of the Contractor to coordinate among suppliers and contractors providing equipment for the project. The coordination shall include, but not be limited to, operators, power requirements, etc.

Cooperate with other trades to avoid interferences in the installation of this work. Install all equipment and systems so as not to delay progress of construction, and correlate with other trades to avoid delay. Should differences of opinion develop; the Owner's decision will be final.

All items shall be installed prior to Final Street, sidewalk, and boulevard grading and/or restoration.

Contract unit prices shall reflect all construction costs. Extra construction costs associated with the installation of items under this section after the completion of new street surfaces; curb, boulevard, and sidewalks, shall be considered incidental.

4. GENERAL

Lighting only distribution circuits shall consist of three conductors installed in PVC conduit. Two of the conductors shall constitute one 240-volt lighting circuit and the third conductor shall be used as an equipment ground.

Lighting and receptacle distribution circuits shall consist of six conductors installed in PVC conduit. Two of the conductors shall constitute one 240-volt lighting circuit, three additional conductors shall constitute two 120-volt receptacle circuits (with common neutral), and the sixth conductor shall be used as an equipment ground.

Power supply to the lighting system is 120/240-volt, single phase, alternating current, and controlled as outlined in the Plans.

a. CONSTRUCTION WIRING AND LIGHTING

If required, the Contractor shall make all arrangements with the utility and shall pay the costs of temporary power including costs of installation, maintenance, energy costs, and removal of the system. The Contractor shall not make use of the Owner's service without written permission by the Owner.

All temporary lighting and power shall use UL approved devices and all systems shall meet safety requirements of the NEC and other applicable ordinances.

5. SHOP DRAWINGS AND SUBMITTALS

The Contractor shall submit to the Owner for approval, a complete list of major electrical system components. This list shall include the names of all suppliers and manufacturers and catalog numbers for the various components. This list must be approved by the Owner prior to the commencement of work on the Lighting System.

The Contractor shall furnish to the Owner five (5) complete sets of shop detail drawings, in accordance with the provisions of MnDOT 2471.3B. The shop detail drawings shall bear the name of the City, the project, and the manufacturer. The five sets of drawings shall be distributed, after approval to the following:

- (1) Contractor
- (2) Contractor's Fabricator
- (3) City (3 sets)

Approval of shop drawings and submittals shall not relieve the Contractor from the responsibility for deviations from the drawings or specifications unless he has, in writing, called the Owner's attention to the deviations at the time of submission, and secured written approval, nor shall it relieve him from the responsibility for errors in shop drawings or submittals.

## 6. MATERIALS

The Owner reserves the right to sample, test, inspect, and accept or reject any of the materials used for the lighting systems based on its own tests. However, the Owner may at their option, accept materials on the basis of listing by UL.

Fabrication and inspection of structural metals used for the Lighting Systems shall be in accordance with the applicable provisions of MnDOT 2471.

### a. CONDUIT

The contractor shall furnish and install rigid steel conduit (RSC), non-metallic rigid conduit (NMC), or Continuous Length Conduit (HDPE) at the locations indicated in the Plans. Conduit shall be capable of being installed by plowing, trenching or directional boring methods. The size of the conduit shall be as indicated in the Plans. All conduits shall be in accordance with the following:

- i. Rigid Metal Conduit:
  1. Threaded couplings and fittings only; no set screw, gland type, or split fittings.
  2. Grounding type insulated bushings; O-Z/Gedney Type BLG, or equal.
  3. Insulated bushings; Midwest Electrical Mfg. Co., O-Z/Gedney Type B, or equal.
  4. Sealing locknuts; Midwest Electrical Mfg. Co., RACO, or equal.
  5. Expansion Fittings
- ii. 4-inches conduit movement.
- iii. External bonding jumper.
  1. Pull Fittings (C, LB, etc.): Clamp type, stamped covers with gaskets and stainless steel screws and clamps.
  2. Conduit Hubs
- iv. Full contact type with sealing "O" ring.
- v. Myers "Scru-tite," or equal.

1. Material: Fittings, hubs, etc. shall be galvanized steel for galvanized steel conduit and copper free aluminum for aluminum conduit.
2. Corrosion Resistant Coatings:
  - vi. Pretreatment:
    - a. Carboline Carbocryllic 120 (for both steel and aluminum conduit), or equal
  - vii. Coating:
    - a. Carboline Bitumastic 300M.
    - b. 3M Scotchrap Pipe Primer and wrapped with 3M Scotchrap Corrosion Protection Tape.
  - viii. Non-Metallic Conduit:
    1. EPC-40-PVC and EPC-80-PVC.
    2. Sunlight resistant.
    3. NEMA TC2.
    4. NFPA 70, Article 352.
    5. UL Listed.
    6. Manufacturer: Carlon, CertainTeed, or equal.
  - ix. HDPE Conduit
    1. Meets requirements of NFPA70.
    2. Thermoplastic polymer material.
    3. Smooth interior and smooth exterior wall.
    4. UL listed.
    5. NEMA –TC-7.
    6. Manufacturer: Carlon or equal.

Prior to the installation of cables and conductors, non-metallic conduit bell ends (appropriately sized for HDPE conduit) shall be installed to prevent damage to cables and conductors.

All conduits shall have markings indicating the manufacturer's name, size, type, UL listing, and any other markings required by the NEC.

b. LUMINAIRES

- i. Pendant – LED fixture with the following features:
  1. DMS50-65W49LED4K-ES-LE3S-240-LM-004-1A-AM8W-14-BAD24E-DRI-3/4x20-12 1/2-DEC-MC-026 - C 1 to match existing. Contractor shall verify existing fixture matches with shop drawings.
- ii. DMS50 Domus 50 Housing With Large Mounting Adaptor And Bell-Shaped Spun-Alum. Skirt.
- iii. Light-emitting diodes (LED) and shall be 49 LED, 65 watt, and color shall be 4000K (65W49LED4K).
- iv. Lamp Type ES Lamp type Philips Lumileds Rebel ES, or better.
- v. Optical System LE3S IES type III (asymmetrical).
- vi. Ballast 240 volts.
- vii. Bracket LM-004 Special - Modified Item as per client's specification.
- viii. Configuration 1A 1 Single Arm Bracket Configuration.
- ix. Dimming control module (Dynadimmer – one per fixture).
- x. Shoebox – LED fixture with the following features:
  - xi. EXEC-RT21 LED for all new construction
  - xii. EXPD-RT21 LED for all retro fitting construction
  - xiii. 30 or 60 high brightness LED configurations
  - xiv. 70W or 140W systems
  - xv. 3000K, 4200K, 5100K and Amber color temperatures
  - xvi. Type II, III, IV, VM, VS and VW distribution
  - xvii. 90 degree cutoff design
- xviii. Tool-less accessibility
- xix. Durable powder coat or anodized finish
- xx. Made by Hubbell Lighting

c. DRIVERS

- i. LED Drivers:
- ii. UL Class 2 power unit as per UL1310. It is also listed in the UL Sign Accessory Manual (UL SAM).
- iii. Class A sound rating.
- iv. Minimum operating ambient temperature of -40 degrees C.
- v. Life expectancy of 50,000 hours or greater at an average ambient temperature of  $\leq 40$  degrees C with use of the fixture it is supplied with.
- vi. Self-rise of 25 degrees C at maximum load in open air without heat sink.
- vii. Certified by UL for use in a dry or damp location (Outdoor Type I).
- viii. Tolerates sustained open circuit and short circuit output conditions without damage.
- ix. Allowable case temperature up to 85 degrees C.
- x. Reduce output power to LEDs if maximum allowable case temperature is exceeded.
- xi. Driver complies with governing FCC rules and regulations.
- xii. Tolerate sustained open circuit and short circuit output conditions without damage and need of external fusing or trip devices.
- xiii. Dimmable, controlled by 0-10V low voltage controller or other means compatible with lighting system controls.
- xiv. Manufacturer shall have a 5-year history of producing LED lighting drivers for the North American market.

d. POLES

- i. See fixture specification for pole details, and the following:
- ii. Paint which matches the luminaire.
- iii. Base plate cover over bolts and base plate.
- iv. Handhole with gasketed cover.
- v. All pole installations shall be capable of withstanding the forces produced by 90-mph winds with a 1.3-gust factor and the total number of luminaires and additional equipment required per pole.
  1. Type AM8W Aluminum, Bottleneck, Round, 4", 8-5/8", .318".

e. ANCHOR RODS

Anchor rods, nuts, and washers shall be galvanized in accordance with the provisions of MnDOT 3392, and the details shown in the lighting Plan.

Threaded portions of all anchor rods above the concrete foundations shall be coated with an approved rust inhibitor before installation of the street light pole or service cabinet.

f. ELECTRICAL CABLES AND CONDUCTORS

All electrical cables and conductors shall conform to the requirements of MnDOT 2545.2D except as modified within these specifications.

g. SERVICE CABINET

The service cabinet shall be as shown in the Plan details and shall be a "UL" approved NEMA-3R, pad mounted, and weatherproof. All door openings shall be sealed with neoprene gasketing and all hinges and hinge pins shall be of non-corroding construction. The cabinet shall be listed as "suitable for use as service equipment." The cabinet shall be made of 1/8" anodized aluminum and Duranodic #313 in color.

The wiring diagram for the service cabinet is shown in detail in the Plans.

The Contractor shall furnish and install photocontrol cell with contacts rated at 15 amperes.

The photo electric control shall be in accordance with MnDOT 3812 and have a 5 minute time delay capability.

The photo control shall be bracket mounted immediately behind a LEXAN covered hole. The hole shall be located on the right side of the cabinet. The cabinet shall be manufactured by Povolny Specialties Inc., 651.452.7335.

Unless otherwise defined, the main circuit breaker shall be rated at 200-amps and 240 volts with an interrupting rating of not less than 14,000 amps, r.m.s., sym. Circuit breakers shall indicate open, closed, or trip conditions by handle position. Circuit

breakers shall be quick-make, quick-break with thermal-magnetic trips having long-time and instantaneous tripping characteristics. Multi-pole breakers shall have one handle with handle tie or internal trip bar with the circuit breaker cases fastened together.

The electric meter enclosure shall be installed in the cabinet as shown on the service cabinet detail drawing. The electric meter sockets shall be suitable for single phase, 3 wire; 120/240-volt service.

#### h. LIGHTING STANDARD

The Contractor shall furnish and install all lighting poles, LED luminaires, mounting arms and accessories, (lighting standards) as required by the contract documents. No lighting standards shall be substituted without prior written approval.

All components of the lighting standard shall have a factory powder-coat finish. Color shall be **black** unless otherwise noted in the drawings and special provisions.

All equipment shall bear the UL label for the intended use.

The LED luminaire shall have toolless access for all components.

The Contractor shall follow manufacturer's instructions regarding LED luminaire installation.

All poles equipped with a 20 amp duplex GFCI receptacle shall have a metallic in-use cover.

All threaded equipment mounting hardware shall be stainless steel. All threaded stainless steel hardware and dissimilar metal, threaded hardware shall be coated with a zinc-based anti-seize compound by the Contractor. The lighting unit shall be installed in a workable first class condition, and shall include all miscellaneous hardware required for a complete lighting unit installation.

In addition to the installed light standards as shown on the Plans, the Contractor shall supply one complete light standard assembly of each style (including LED luminaires, poles, mounting arms, accessories, etc. as called out in the complete part

numbers shown on the Standard plates included in the appendix of the contract documents). The Contractor shall deliver the extra light fixture assembly to the Owner.

i. SINGLE CONDUCTOR WIRES

The single conductor feeder wires, distribution wires, pole wires, and control wires 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 NEC. Cable shall meet 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. Wire shall bear UL label for Type USE-2, have footage markings every three feet, and surface marking indicating manufacturers' ID, conductor size and metal, voltage rating, UL symbol and type designations. The insulation on each conductor shall be colored red, black, white or green. Single conductor pole wires connecting the LED luminaires to the distribution circuits shall be 1/c #12 stranded wire with XHHW-2 rated insulation.

- i. Wire Color Coding
- ii. Contractor may use color coding at his discretion, except for the following colors, which shall be used only as designated below for both power and control circuits.
- iii. Control Circuits
- iv. Dark Blue - Direct current circuits.
- v. Light Blue - Intrinsically safe conductors.
- vi. Green - Grounding conductor.
- vii. White - Neutral conductor.
- viii. Power Circuits (Use solid colors through Size No. 8 AWG. Use black conductors with tape color identification No. 6 AWG and larger)

	Voltage	120/240	208Y/120	480Y/277
a.	Phase A	Black	Black	Brown
b.	Phase B	Red	Red	Orange
c.	Phase C		Blue	Yellow
d.	Neutral	White	White	Gray
e.	Ground	Green	Green	Green

j. FUSES

Each LED luminaire in the 240-volt system shall be fused with two 6 amp fuses.

Each receptacle in the 120-volt system shall be fused with one 20 amp fuse. Fuse connectors shall be installed in the phase wires of their respective circuits at the access handhole of the light standards.

The fuses shall be mounted in inline molded fuse connector/holders with casing located at the level of the handhole. The two-pole fuse holders for the 240-volt LED luminaires shall be a Bussmann Catalog No. HEX-AW-DRLC-A or Littelfuse Catalog No. LEX-AA-S-WPB1. The one-pole fuse holders shall be a Bussman Catalog, No. HEB-AW-RLC-A, Littelfuse Catalog No. LEB-AA-S-WPB1, or approved equal. Fuses shall be of the breakaway type. The Contractor shall provide sufficient excess conductor length to allow withdrawal of the connected fuse holder. The grounding wires shall not be fused. Fuses and fuse holders shall be UL listed and shall be installed in such a manner that the fuse stays with the load side when holder is separated. In addition, the Contractor shall form loops in the leads on each side of the fuse holders and so position the fuse holders so that they may be easily removed or inserted through the access hole. The grounding conductor shall not be fused.

k. GROUNDING

The grounding conductor shall be bonded to the foundation ground rod where shown on the Plans, and to the metal frame of the LED luminaires at every decorative light standard. A No. 8 AWG insulated (green) copper-conductor shall be used. The size of the ground conductor shall be as required by the NEC or as shown on the Plans, whichever is more stringent. All ground rods shall be internal to the foundation.

I. HANDHOLES

- i. Precast concrete box and cover or fiber reinforced polyester box and polymer concrete cover.
- ii. Covers and boxes design/test load rating (lbs):
  - a. 22,500/33,750 – ANSI Tier 22
- iii. Minimum of 2 stainless steel bolts to secure cover to the box.
- iv. Sized as Required Per Code:
- v. Minimum Size: 13 inches wide, 24 inches long, and 36 inches deep.
- vi. Manufacturer: CDR Systems Corp., Quazite "Composite," or equal.

m. BOXES – CAST

Outlet and junction boxes shall be of the weatherproof, galvanized cast, ferrous alloy type with threaded hubs for use with rigid steel conduit. The boxes shall bear the UL label.

n. WIRING DEVICES – SPECIFICATION GRADE

Wiring devices shall be AC quiet, NEMA specification grade, heavy duty unless otherwise specified. All devices shall meet Federal and NEMA standards, and shall bear the UL label. The voltage rating shall be as required for the application. The devices shall have an ampacity of not less than 20 amps.

Wall plates shall be stainless steel.

Where applicable, devices located in hazardous areas or areas where adverse conditions exist, shall meet NEMA and NEC requirements for those areas.

o. SWITCH LABELS

All switches, other than lighting switches, shall have an engraved label identifying the function of the switch and switch positions. Labels shall be stainless steel, brass or engraved laminated plastic, attached with screws.

p. BUSHINGS

Plastic bushings shall be used when non-metallic cables enter or leave a conduit system. The appropriate bushings shall be used for HDPE conduit.

q. LIGHT FOUNDATIONS

In accordance with the Fixture Schedule, the contractor shall furnish and install galvanized, helix style steel screw-in foundations at the locations indicated in the Plan. The steel lighting base shall be manufactured by AB Chance, Millerbernd or approved equal. Helix style foundations shall be level with finished grade.

In accordance with the Fixture Schedule, the Contractor shall furnish and install a concrete Light Foundation, Design E Mod in accordance with MnDOT Standard Plate 8127, at the locations indicated in the Plan. The foundations for poles up to 25' in height shall be modified to be 5' in depth and have anchor bolts and a bolt circle specific to the light pole manufacturer. The foundations for poles 30' in height shall remain 6' in depth and shall be modified to have anchor bolts and a bolt circle specific to the light pole manufacturer. Ground rods shall be internal to the concrete foundation. Concrete foundations shall be 1" above finished grade.

Refer to the Standard plates included in the appendix of the contract documents and the Plan for style and/or part numbers.

7. CONSTRUCTION REQUIREMENTS

a. INSTALLATION

The Contractor shall furnish, install, wire and start up equipment as required by the contract documents. The manufacturer's installation recommendations shall be observed, and the completed assembly shall meet applicable code requirements.

## b. CONDUIT PLACEMENT

All raceways shall be installed in accordance with NECA 1, Standard Practices for Good Workmanship in Electrical Contracting, and as specified herein.

Conduit size shall be as shown on the Drawings or as required by the NFPA 70 with a minimum size of 3/4 inch, except that 1/2 inch may be used to connect to devices which have a knock-out or fitting for only 1/2 inch conduit.

Expansion fittings shall be installed where the length of straight run requires it.

All conduits shall be kept dry and free of water or debris with pipe plugs or caps.

Underground conduit runs shall have a minimum cover of 2 feet, and shall be rigid nonmetallic conduit, unless noted otherwise

1. Conduit shall be sloped to drain to handholes.
2. Rigid metal conduit shall be used for the vertical elbow and riser out of the ground.
3. Rigid metal conduit installed underground or in contact with concrete shall have a corrosion resistant coating or covering.
4. HPDE conduit may be used for underground conduit.

Contractor shall do all trenching for underground conduit with a minimum size trench. 3 inches of sand shall be placed below and above buried conduit in trench. All fill material shall be placed in 12-inch lifts and compacted to 90-Percent Standard Proctor Density. Underground warning tape shall be laid in the trench approximately 9 inches below the surface.

A nylon pull cord shall be installed in each empty conduit. Only raceway types which are specified in this section shall be used.

The roadway, sidewalk, or grade beneath which conduit is routed shall be restored to its original or better condition.

1. Provide grading, soil, and seeding or sod to restore turf to original or better conditions.
2. Coordinate type of soil, seeding and/or sod with Owner to match existing.

All splices performed on the HDPE conduit shall use equipment and procedures recommended by the manufacturer and which meet NFPA 70.

c. HANDHOLE INSTALLATION

Contractor shall furnish and install new handholes at locations indicated in the Plans or as directed by the Engineer. Excavate a minimum of 24 inches below base depth and refill with pea gravel. Handholes shall be installed flush with finished grade. Pea gravel for drainage of handholes and pull boxes shall be incidental to the handhole installation.

Handhole covers shall be bolted in place when work is complete.

d. CONDUCTOR INSTALLATION

The Contractor shall furnish, install, wire and start up equipment as required by the contract documents. The manufacturer's installation recommendations shall be observed, and the completed assembly shall meet applicable code requirements.

Splices shall not be made in signal or control conductors; the wiring shall be continuous from device to device.

All wire and cable shall be tested for grounds and continuity before the circuit is energized. The Contractor shall assume full responsibility for damage done to the equipment due to circuit grounds or open circuits.

e. POLE AND LED LUMINAIRES INSTALLATION

- i. In general, LED luminaires shall be located where shown on the Drawings.
- ii. Galvanized or stainless steel bolts, nuts, washers, and screws shall be used for mounting luminaires or luminaire outlets.

- iii. Lenses, refractors, and glassware shall be clean and free from cracks or chips. All reflectors, shades, LED luminaire bodies, etc. shall be free from dents and scratches, thoroughly cleaned, and properly aligned before installation is accepted by the Owner. All exposed tags and labels other than UL and emergency ballast identifiers shall be removed.
- iv. Pole erection and mounting shall be done according to pole manufacturer's recommendations.
- v. A concrete base shall be provided for each outdoor luminaire, unless noted otherwise. Base types shall be provided as detailed on the Drawings.
- vi. Test relays and switches after installation to confirm proper operation.

f. RESTORATION

Trenches shall be restored to grade, or as directed by the Owner.

All sections of sidewalk removed by the Contractor shall be replaced in full panel increments. Where sections of sidewalk intersections are removed, the Contractor shall remove and replace the entire sidewalk intersection to a point where it connects to the curb radius.

Any damages by the Contractor as a result of construction activities shall be restored to acceptable condition per the City of Maple Grove Specifications at no additional cost. This includes but is not limited to restoration of sod, settling/heaving/cracking of pavement due to construction activities and any other damage associated with the installation of the electrical lighting system.

Where sidewalks, pavement, or streets are opened, the opening shall be restored to the original thickness using a material type equal to that removed.

All necessary restoration due to construction activities shall be completed within 7 days of the completion of said activity.

g. DISTRIBUTION CIRCUITS

The complete underground distribution circuits shall extend from the service cabinets in conduit to the lighting units and pass through the base of each lighting unit.

h. WARNING RIBBONS

Red warning ribbons shall be installed to identify the location of service laterals per the requirements of the 2014 NEC, Section 300.5(D), and shall be installed along all direct burial underground branch circuitry.

This requirement applies to all approved wiring methods including raceways and direct buried cables.

- i. 6 inches wide, 4-mil polyethylene film.
- ii. Vivid, opaque, long-lasting red color with bold, black letters.
- iii. Lettering
  1. Top line – "...CAUTION CAUTION CAUTION..."
  2. Bottom line – "...ELECTRIC LINE BURIED BELOW..."
- iv. Seton Name Plate Corp. No. 210 ELE, EMED Co. Stock No. UT27737-6, or equal.

i. SPLICES

Splices shall be made only in the service panel and light standard bases. Splices in light bases and service cabinets shall only be made using Burndy Uni-tap splicing hardware. No more than one wire per screw will be allowed.

j. FOUNDATIONS

The contractor shall furnish and install an Equipment Pad in accordance with the details in the Plan. Anchor rods, nuts and washers in the lighting service cabinet concrete foundation shall be installed as per the requirements of the lighting service cabinet shown on the Plans. Anchor Rods in accordance with MnDOT 3385 shall be galvanized full length in accordance with

MnDOT 3392 and shall be four (4) in quantity for each cabinet. Each anchor rod shall be threaded a minimum of 4 inches and be provided with two (2) hex-head galvanized nuts and one galvanized washer.

Rust Inhibitor: Threaded portions of all anchor rods above the concrete foundations shall be coated with an approved rust inhibitor before installation of the light standards.

The concrete for all foundations shall be mix number 3Y43 free of chloride additives conforming to MnDOT Specification 2461. Concrete shall be placed and consolidated using vibratory equipment and be finished smooth, flat and level in accordance with MnDOT 2565.F. Concrete shall be allowed to cure for a minimum of seven (7) days before being placed into use unless otherwise permitted by the Owner.

An approved form shall be provided and placed for the foundation to ensure a good symmetrical top. Excavations for the concrete foundations, which are to be cast in place, shall be made to the exact dimensions of the foundation so that no backfilling will be required. If the soil conditions are such that the above provisions cannot be met, the Owner shall be contacted. The forms shall be removed no earlier than 12 hours and no later than 24 hours.

Where concrete sidewalk is to be placed adjacent to new foundations, such foundations shall be wrapped with tar felt to prevent bonding of the sidewalk to the new foundations.

Factory bent PVC conduit shall be required to bring the wireways in the foundation down to the depth as shown in the details in the Plan. Conduits shall extend a minimum of 2 inches above the foundation. Care shall be taken to ensure that all extended conduits will fit into the opening in the base of the pole.

#### k. INSTALLATION OF LIGHTING UNITS

Lighting standards shall be installed plumb and level.

#### l. WIRING OF LED LUMINAIRES AND RECEPTACLES

All conductors of the lighting and receptacle distribution circuits shall pass through the base of each light standard. The

conductors shall be fused as previously noted. All splices must take place in the base of the light standard. All splices shall be weather tight and use Burndy Uni-Tap BIBS 4-3 or 4-4 connectors.

The conductors to the luminaires and receptacles shall be stranded, No. 12 AWG Type XHHW-2 and be connected to the load and ground conductors of their respective distribution circuit.

#### m. WIRING OF SERVICE CABINETS

Lightning surge arrestors shall be installed in the cabinets on the supply side of the service equipment.

At the pad mounted control cabinets, Contractor shall establish a 25 ohm ground by the use of copper clad ground rods.

A No. 6 AWG bare copper wire shall be extended from the ground rods and be bonded to the pad-mounted control cabinet. The ground rods shall be cast into the control cabinet foundation and be under the control cabinet frame.

The grounding conductor shall be terminated in and be bonded to the pad mounted control cabinet. The neutral conductor shall be bonded to the grounding conductor in the pad-mounted control cabinet.

From the pad mounted control cabinet, two No. 3/0 AWG (Type USE-2) load conductors and one No. 3/0 AWG (Type USE-2) neutral conductor shall extend underground via a 2-inch rigid non-metallic conduit to the ground-mounted transformer, or to an overhead utility transformer or secondary conductors, via a pole mounted riser and weather-head, as outlined in the plans.

Contractor must install duct seal around all conduit entering service cabinet foundation or service cabinet.

All of these conductors shall be of the same type as specified for the underground conductors of the distribution circuits, and shall be color-coded in the control cabinet and at the utility transformer. Xcel Energy will make the final connections to their transformers or secondary overhead conductors.

n. PAINTING

Contractor shall touch-up all lighting equipment damaged during transportation and installation with a color-matched finish.

o. RUST INHIBITOR

A thorough application of an approved rust inhibitor shall be used for the following:

- i. To coat or otherwise protect the threads of the anchor rod, prior to pouring the concrete foundation to ensure that the concrete does not mold to the threaded portion of the rod.
- ii. For all lighting units, the Contractor shall grease the threads above the foundation both before and after erecting and plumbing of the light standard.
- iii. To grease the threads of the screws used to secure the access covers to the standard.
- iv. All stainless steel threaded hardware utilized with steel, aluminum, and other dissimilar metal components of standards and luminaires shall be coated with a zinc-based anti-seize compound prior to assembly by the Contractor.

p. SERVICE CABINET

The Contractor shall furnish and install all necessary service conductor and conduit to the Utility's ground-mounted transformer, or pole mounted transformer or secondary conductors. The connections shall be in accordance with requirements established by the Utility. Meter will be furnished and installed by the Utility.

It is the Contractor's responsibility to verify the actual work to be done and the associated costs. For questions contact Xcel Energy representative Jason Darrington at (763) 493-1649.

## 8. WARRANTY

The Contractor shall guarantee the operation of the installation and that the materials and workmanship of the equipment be free from defects in accordance with the contract specifications, providing the equipment has been operated and maintained in accordance with the manufacturer's recommendations. If a dispute exists regarding whether the equipment has been maintained according to the manufacturer's recommendations, the Engineer's decision will be final. The guarantee shall include all parts and labor necessary to return the system to normal operation. The guarantee on all equipment shall start after formal acceptance of equipment as defined by the General Conditions and after successful completion of start-up procedures.

## 9. RECORD DRAWINGS

Contractor shall supply accurate asbuilt drawings of the project to the Owner. Drawings shall indicate location and setback of conduit, service cabinet and Utility service point, and pole locations along the roadway measured from a reliable location.

The Owner will not be responsible for locating the underground wiring or damage to the system from failure to locate the systems until the system has been approved by the Engineer and an accurate asbuilt drawing has been provided to the Owner.

The Contractor shall collect, gather and assemble into one book the installation details, instructions, schematics of actual equipment and operations directions supplied by the manufacturer with all equipment. Final acceptance of the work will be withheld until such data has been presented complete to the Owner. The manual shall be available for instruction of operations and maintenance of equipment and systems.

The Contractor shall provide to the Owner a list of the manufacturers, suppliers and local distributors of the products used on this project.

## 10. SYSTEM TESTING

A factory-trained technician shall be present when the system is put into service and shall certify to the Engineer/Owner that all equipment has been installed correctly and is operating properly.

Technician shall make all modifications necessary to obtain proper operation of the system.

Verify that all wiring connections are complete and correct.

After installation and before termination, all wiring and cabling shall be checked and tested to ensure there are no grounds, opens, or shorts on any conductors or shields.

Test for and eliminate ground loops that may result from use of different power sources for various components.

Complete system software programming.

All functions and features to be tested as a complete system and corrections made at no cost to the Owner.

Test relays and switches after installation to confirm proper operation and confirm correct loads are recorded on directory card in each panel.

All devices shall be calibrated to obtain the specified function and to reach the specified footcandle level.

Contractor shall notify the Owner's Representative when testing is complete and the system is functioning as required per specifications. The contractor shall then coordinate with the Owner's Representative a time for the Owner's Review phase.

Contractor shall meet with the Owner's Representatives to review the programmed control schemes for the basic operations. At this time, the Owner may desire to alter the system programming after reviewing the system. Contractor shall revise the lighting system controls as directed by the Owner's Representatives. Base bid shall include all changes to the proposed system shown on the Drawings; Owner shall not be charged additional costs for modifying the system controls or Contractor's attendance at meetings.

Once the lighting control system revisions have been completed, Contractor shall test the system as described above. After the testing, Contractor shall notify the Owner's Representative when testing is complete and the system is functioning as required per specifications. The contractor shall then coordinate with the Owner's Representative a time for Engineer to walk through the system and develop a punch list.

Upon completion of the punch list and verification that all punch items have been resolved by the contractor the Owner's Representative will notify that the testing phase of the project has been completed and

that the contractor is ready to start the record drawings phase of the project.

[END ROADWAY LIGHTING]