

SPECIFICATIONS
FOR
ROADWAY LIGHTING
DIVISION RL – ELECTRICAL LIGHTING SYSTEM
CITY OF EDINA, MINNESOTA
TABLE OF CONTENTS
Revised January 2015

<u>ARTICLE</u>		<u>PAGE</u>
1.0	COMPLIANCE WITH ELECTRICAL CODES AND STANDARDS...	1
2.0	(2545) ELECTRICAL SYSTEM.....	1
3.0	GENERAL.....	4
4.0	SHOP DRAWINGS AND SUBMITTALS.....	5
5.0	MATERIALS.....	5
6.0	CONSTRUCTION REQUIREMENTS.....	11
7.0	WARRANTY.....	18
8.0	RECORDING DRAWINGS.....	18
9.0	SYSTEM TESTING.....	18

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SPECIFICATIONS
FOR
ROADWAY LIGHTING
CITY OF EDINA, MINNESOTA
Revised January 2015

1.0 **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 Edina (City) 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 City.

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.

2.0 **(2545) ELECTRICAL SYSTEM**

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

SCOPE OF WORK

2.1 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:

- furnish and install poles, GFCI's and luminaires
- rigid steel and PVC conduits
- light foundations
- bushings
- caps
- inline fuse holders and fuses
- underground cable
- pole wiring conductors
- service cabinet with foundation
- service riser conduit & conductors
- ground rods

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2.2 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 Engineer 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.

2.3 QUALITY

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

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.

2.4 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 Engineer'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.

3.0 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.

3.1 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.

4.0 SHOP DRAWINGS & SUBMITTALS

The Contractor shall submit to the City 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 City prior to the commencement of work on the Lighting System.

The Contractor shall furnish to the City 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 City'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.

5.0 MATERIALS

The City 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 City 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.

5.1 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:

- 5.1.1 Metal Conduit: Metal conduit shall be galvanized Rigid Steel Conduit (RSC) and conduit fittings per MnDOT 3801. Intermediate Metal conduit (IMC) and conduit fittings are not permitted.
- 5.1.2 Non-Metallic Conduit: Non-metallic conduit (NMC) and conduit fittings shall be Type II heavy-wall rigid PVC Schedule 40 plastic conduit and conduit fittings per MnDOT 3803.
- 5.1.3 Continuous Length Conduit (HDPE) conduit shall be red in color. Conduit fittings shall be appropriate for use with HDPE continuous length conduit.
- 5.1.4 Prior to the installation of cables and conductors, non-metallic conduit end bells (appropriately sized for HDPE conduit) shall be installed to prevent damage to cables and conductors.
- 5.1.5 All conduits shall have markings indicating the manufacturer's name, size, type, UL listing, and any other markings required by the NEC.

5.2 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.

5.3 ELECTRICAL CABLES AND CONDUCTORS

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

5.4 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. Panel phase bus shall be fabricated of copper.

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.

5.5 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 and in accordance with the Standard plates included in the appendix of 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 in accordance with the Standard plans and plates included in the appendix of the contract documents. Color shall be black unless otherwise noted in the drawings and special provisions.

Luminaire optical performance and cutoff shall be as defined in the Standard plates included in the appendix of the contract documents.

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

The luminaire shall have toolless access for all components.

Each luminaire shall have an internal multi-volt LED driver, surge protector, and LED arrays. Driver shall be dimmable (0-10 Volt).

The LED driver shall have a minimum power factor of 0.90 and <20% Total Harmonic Distortion (THD).

All fixtures shall be complete with guards, clips, retainers, etc. in accordance with the details, specifications and ordinances governing the installation of the fixtures.

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

The lighting unit shall be installed in a workable first class condition, and shall include all miscellaneous hardware required for a complete and operational lighting 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 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 City.

5.6 SINGLE CONDUCTOR WIRES

The single conductor feeder wires, distribution wires, pole wires, and control wires shall have Class B stranded annealed un-coated 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 luminaires to the distribution circuits shall be 1/c #12 stranded wire with XHHW-2 rated insulation.

5.7 FUSES

Each 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 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.

5.8 GROUNDING

The grounding conductor shall be bonded to the foundation ground rod where shown on the Plans, and to the metal frame of the 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.

5.9 HANDHOLES

5.9.1 Designed to carry light vehicular traffic.

5.9.2 Covers:

5.9.2.1 Bolt down type with stainless steel bolts.

5.9.2.2 Mold the word "Street Lighting" into cover.

5.9.2.3 Handholes shall be open bottom type. Pea gravel for bedding and drainage of handholes shall be incidental to handholes.

5.9.3 Materials:

5.9.3.1 Polymer Concrete

5.9.3.2 Conform to ASTM D-635.

5.9.3.3 Self-extinguishing material.

5.9.3.4 No change in physical properties due to weather exposure.

5.9.3.5 Color: Gray.

5.9.3.6 Top dimensions shall not exceed bottom dimensions by more than 1 inch.

5.9.3.7 Extensions shall be of same material.

5.9.3.8 Quazite #PC1324BA12, or approved equal.

5.10 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.

5.11 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.

5.12 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.

5.13 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.

5.14 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.

6.0 CONSTRUCTION REQUIREMENTS

6.1 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.

6.2 CONDUIT PLACEMENT

Conduit size shall be as specified in the Plans.

Contractor shall visit the site and make his own determination of the linear footage of conduit requiring boring in determining his bid on the project.

Conduits shall be installed underground in a direct line between light standards (unless trees or other obstructions require an alternate location) within the roadway right-of-way to a depth of 24 inches, as shown in the Plans or as directed by the City. All conduits installed across surfaced streets shall be installed with a minimum cover of 24 inches. Cover material shall not contain rock or other debris that could damage the conduit. The cover material shall be firmly tamped into place to minimize uneven settlement above or below the conduit.

All conduits that are to be placed under driveways, streets and sidewalks that are not scheduled for removal shall be pneuma-gophered, directional bored, or another method approved by City that will not damage or disturb the integrity of the driveway, street, or sidewalk.

Generally, permanent surfaces such as sidewalks, driveways and streets shall not be removed to install underground conduit. Contractor can remove these surfaces where it is necessary for boring with permission of the City. The Contractor is responsible to replace and compact the subgrade material and replace the permanent surface material in kind (exactly as the existing).

In general, all conduit runs shall be straight and true, and all offset and bends shall be uniform and symmetrical. Field bends of conduit shall only be accomplished through the use of approved conduit fittings. 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.

Contractor shall avoid disturbing tree roots when installing conduit for the underground electric distribution conductors. Where underground conductors must cross tree roots Contractor shall follow the procedure listed below.

Trees less than 12 inches in diameter bore at a minimum of 24 inches below grade. For trees over 12 inches in diameter bore at a minimum of 36 inches below grade.

Trenching for boring shall stay out of drip line of trees. The following distances from the tree shall be considered a minimum.

Tree Diameter	Distance
6 to 9 inches	5 feet
10 to 14 inches	10 feet
15 to 19 inches	12 feet
Over 19 inches	15 feet

Contractor boring tunnel shall be 1 to 2 feet either side of tree center to avoid damage to tap root.

Following installation of cables and conductors, seal the open ends of conduit entering cabinets, pole foundations, or handholes using duct seal compound NRTL classified under general use tapes.

6.3 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 12 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.

6.4 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.

6.5 RESTORATION

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

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 Edina Specifications at no cost to the City. 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.

6.6 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.

6.7 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.

6.8 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.

Apply two layers of protective vinyl electrical tape over the insulated wire splice connector blocks in the area where the conductors enter the block including the set-screw access covers, and extend the wrap at least one (1) inch over the incoming conductor insulation.

Wire-nuts are not an acceptable method of splicing.

No splicing shall be performed within handholes.

6.9 FOUNDATIONS

All foundations shall be located in the field by the City or Engineer following the Plan. The Contractor is responsible for obtaining location of existing utilities and identifying any possible conflicts. Any such conflicts shall be reported immediately to the Engineer and City.

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 City.

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 City 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.

Provide a rigid template of the pole base including anchor bolt holes and a slot to hold in proper position and height the anchor bolts, ground rod, and conduits during the concrete pouring. The template shall not be removed until the concrete has cured.

6.10 INSTALLATION OF LIGHTING UNITS

Lighting standards shall be installed plumb and level.

6.11 WIRING OF 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.

6.12 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.

6.13 PAINTING

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

6.14 RUST INHIBITOR

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

6.14.1 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.

6.14.2 For all lighting units, the Contractor shall grease the threads above the foundation both before and after erecting and plumbing of the light standard.

6.14.3 To grease the threads of the screws used to secure the access covers to the standard.

6.14.4 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.

6.15 SERVICE EQUIPMENT

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 Tyler Perrenoud at 952.829.4539.

7.0 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.

8.0 RECORD DRAWINGS

Contractor shall supply accurate asbuilt drawings of the project to the City. 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 City 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 City.

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 City. The manual shall be available for instruction of operations and maintenance of equipment and systems.

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

9.0 SYSTEM TESTING

The Contractor shall test the equipment installed under these specifications and shall coordinate and demonstrate its proper operation to the City staff.

No equipment shall be tested, or operated for any purpose until it has been fully prepared, connected and made ready for normal operation. Any damage to equipment occasioned by improper or ill-timed operation or testing shall be made good, at the Contractor's own expense, before final inspection and acceptance.

[End of Roadway Lighting]