***ADD THE FOLLOWING SECTION TO DIVISION II – CONSTRUCTION DETAILS***

### SECTION 672 – TRAIL LIGHTING

**DESCRIPTION**

**672.01.01 GENERAL**

A. Trail lighting work shall consist of furnishing and installing, modifying or removing trail lighting systems, electrical equipment in structures, partial installations for future systems, or combinations thereof, all as shown on the Drawings, and as specified in these Special Provisions.

B. Unless otherwise indicated on the Drawings or specified in the Special Provisions, all materials shall be new.

C. All materials furnished and used shall conform to the provisions in Section 106. The materials shall be manufactured, handled, and used in a manner to insure completed work in accordance with the Drawings, specifications, and Special Provisions.

D. All systems shall be complete and in satisfactory operating condition at the time of acceptance of the contract. Where an existing system is to be modified, the existing material shall be reused in the revised system, removed, salvaged, and stockpiled or abandoned as shown on the Drawings, as specified in the Special Provisions or as directed by the Engineer.

E. The Contractor shall provide all labor, materials, equipment, transportation and services required to install the trail lighting and related items on the Drawings and in the specifications resulting in a complete and operational system.

F. All equipment shall function as designed. The trail lighting standards shall be leveled before they are energized.

G. The Contractor shall maintain the new lighting system from the date energized until the entire project has been accepted by the City of Las Vegas.

1. This includes maintaining proper operation of the new system and any necessary replacement parts to make the system operational including but not limited to lamps, igniters, ballasts, breakers, and photo-electric and time clock controls.
2. The Contractor is also responsible for any damage to the system as a result of vandalism or negligence during this period.

H. The lights must be operating properly.  The Contractor is responsible for replacement parts to make lights operational, (i.e. lamps, igniter, ballasts, breakers,  photo eyes, time clocks, and so forth).  The Contractor is also responsible for damage and vandalism during this period.

I. The Contractor shall have a qualified representative present at the time the City inspects the trail lighting installations.

**672.01.02 REGULATIONS AND CODE**

A. All electrical equipment shall conform to the standards of the National Electrical Manufacturers Association (NEMA), and listed by Underwriters' Laboratories, Inc. (UL), or the Electronic Industries Association (EIA), wherever applicable.

B. In addition to the requirements of the Drawings, the specifications, and these Special Provisions, all materials and workmanship shall conform to the requirements of the National Electrical Code (NEC); National Electrical Safety Code (NESC); ASTM International (ASTM); American National Standards Institute (ANSI) manuals; Institute of Electronic and Electrical Engineers (IEEE); Illumination Engineering Society (IES); Rural Electrification Association (REA); Nevada Occupational Safety and Hazard Act (NOSHA); National Board of Fire Underwriters (NBFU); Uniform Standard Drawings, Clark County Area; and any local ordinance which may apply.

C. Wire sizes shall be indicated in American Wire Gage (AWG).

**672.01.03 EQUIPMENT LIST AND DRAWINGS**

A. Unless otherwise permitted in writing by the Engineer, the Contractor shall within 15 days following approval of the contract, submit to the Engineer for approval, a list of equipment and materials which he proposes to install.

1. The list shall be complete as to name of manufacturer, size, and identifying number of each item.
2. The list shall be supplemented by such other data as may be required, including scale drawings of cabinets showing location and spacing of shelves, terminal blocks and equipment, including dimensioning.

B. All of the above data shall be submitted, in triplicate, for review. Where electrical equipment is constructed as detailed on the Drawings, the submission of detailed drawings and diagrams will not be required.

**672.01.04 WARRANTIES, GUARANTEES, AND INSTRUCTION SHEETS**

A. Manufacturers' warranties, guarantees, and certifications for materials used in the work and instruction sheets and parts list shall be supplied with materials and shall be delivered to the Engineer prior to acceptance of the project.

B. As a minimum, the equipment shall include the following warranty:

1. Full system warranty including parts and labor for 2 years' parts and labor from the project Substantial Completion and a warranty of 5 years for the light fixtures and poles.

2. The supplier shall repair or replace any defective part within 1 week of notification at no expense to the Owner during the warranty period.

**672.01.05 REMOUNT ELECTRICAL SERVICE**

A. Existing service shall remain fully operational during construction.

1. Outages required shall be scheduled with the Owner and timing devices reset after resumption of service.
2. The Contractor shall field verify wiring connections and routing prior to disconnecting any conductors.

B. The modification, extension or removal of the existing conductors and equipment shall be inspected by and accepted by the Engineer.

C. Electrical work shall be in accordance with the requirements of the National Electrical Code.

**MATERIALS**

**672.02.01 TRAIL LIGHTING STANDARDS AND POLES**

A. Trail lighting standards shall be as specified in these Special Provisions or as shown on the Drawings and shall conform to the requirements below.

B. The trail lighting standard shall consist of a continuous square steel pole assembly, base cover, mast arm, L.E.D. luminaire, pole top, anchor rods and necessary bolts, nuts and washers. Workmanship and finish shall be equal to the best general practice of modern metal fabrication.

C. Pole Assembly.

1. Trail lighting poles shall be manufactured steel poles with steel handhole covers; aluminum poles or handhole covers will not be allowed.
2. Unless otherwise specified, the pole shaft shall be 6-inch, 11-gauge, straight square steel, and shall have the height as indicated on the Drawings.
3. Poles shall be fabricated from hot rolled commercial quality, one-piece carbon steel with minimum yield strength of 55,000 psi.
4. A removable pole cap shall be provided for poles receiving drilling patterns for side-mount luminaire arm assemblies.
5. Pole Anchor base shall be fabricated from hot-rolled carbon steel plate conforming to ASTM A36. Base plate and shaft shall be circumferentially welded top and bottom. A matching metal base cover shall be provided.
6. All structural fasteners shall be galvanized high strength carbon steel.  All non-structural fasteners shall be galvanized, zinc-plated carbon steel, or stainless steel.
7. Pole and mast assembly to be finished with a high-build, acrylic polyurethane enamel with a clear acrylic polyurethane top coat. Alternatively, a polyester TGIC or urethane polyester powder coat may be used.

D. A minimum 4-inch by 6-inch steel access handhole with reinforced frame and slip‑resistant type steel cover located approximately 18 inches from the base plate shall be provided.

1. The steel cover shall include a bar with one weather and vandal resistant 1/4‑inch stainless steel hex socket head screw.
2. The handhole may have radius corners such that the handhole is oval in shape.
3. The handhole reinforcement shall provide a bending strength equal to that of the pole without an opening.
4. Field cutting, welding, or other adjustments of the access handhole will not be allowed.
5. After final inspection, contractor shall weld handholes closed and shall paint to match the pole as directed by the Owner.
6. Handholes on trail or ramp poles shall be located on luminaire side of pole. Handholes on bridge poles shall be located on the pole on the opposite side of the luminaire.
7. Each handhole shall be provided with grounding provision.

F. Posts, poles, standards, and cabinets shall not be erected until the foundation has set at least 72 hours, and shall be plumbed or raked, as ordered by the Engineer.

G. Existing trail lights displaced by new ramps shall be removed, salvaged, and returned to the Owner.

**672.02.02 TRAIL LIGHTING LUMINAIRES**

A. The standard luminaire for trail lighting shall be XXXXX, XXXX, or approved equal.

Note to Spec Writer – contact TED for catalog data for a minimum of two luminaires and consider applicability of house side shields/spill control. Specify color (Black for Trail Lighting, Bronze for Parks/Facilities)

**672.02.03 FUSE HOLDERS AND FUSES**

A. Fuses shall be installed in manufacturer installed fuse blocks located in the luminaire.

**672.02.04 LOW VOLTAGE UNDERGROUND TRAIL LIGHTING SYSTEM**

A. Unless otherwise specified on the Drawings, the low voltage lighting system shall be single phase, two wire, 240 volt multiple.

1. The 2-wire system shall consist of 2 insulated 600 volt THW conductors of the specified gage and a green THW equipment grounding conductor of the specified gage as shown on the Drawings and shall bear the U.L. label.
2. The service panel shall be 200 ampere, unless otherwise specified, and shall be wired for 120‑240 volt with a full size neutral.

B. Pole and Arm Cable (Load side):

1. Unless otherwise specified on the Drawings and if the feeding circuit breaker is 30 amps or less, the cable from the base of the lighting standard to the luminaire shall be 2-conductor No. 10 AWG plus ground, solid copper with insulation rated at 600 volts.
2. The individual conductors shall be insulated with TW grade, and the outer jacket shall be PVC jacket type UF grade.

**672.02.05 FOUNDATIONS**

A. Foundations for trail lighting shall be constructed as shown on the Drawings.

B. Foundations for posts, standards, and pedestals shall be concrete conforming to the applicable requirements of Section 501, "Portland Cement Concrete." The concrete shall be of a CLV approved mix design and shall have a minimum compressive strength of 4,500 pounds per square inch.

C. Forms shall be true to line and grade. Foundations shall extend 12 inches above finish grade in trail areas and shall extend 30 inches above finish grade with rebar cage in parking areas unless otherwise specified by the Engineer.

D. Forms shall be rigid and securely braced in place.

1. Conduit ends and anchor bolts shall be held in place by means of a template until the concrete sets.
2. Both forms and ground which will be in contact with the concrete shall be thoroughly moistened before placing concrete.

E. For pedestals, a 6-inch minimum concrete foundation cap shall be poured after the pedestal is in proper position.

F. For trail lighting standards, the foundation shall be poured to 1-1/2 inches below base plate in a single pour and shall slope away from the base plate.

1. Non-shrink grout shall be poured under the base plate after the light pole has been set and plumbed.
2. The forms shall be stripped off while concrete is still “green” and the foundation shall be stone rubbed to provide a smooth, seamless surface appearance.
3. A light broom finish shall then be applied.
4. The foundation shall be wet cured for a minimum of 72 hours.
5. Attempts to fill and shape poured foundation will not be allowed after the initial pour; improperly poured foundations shall be demolished and rebuilt at the contractor’s expense.

5. No. 4 AWG multi-strand bare copper grounding conductor wire shall be used to ground pole and all anchor bolts as shown on the Drawings or in the Standard Drawings.

6. A matching metal base cover shall be provided which makes contact with the top of the foundation and does not rest on the top of the anchor bolts.

**672.02.06 ANCHOR BOLTS**

A. Anchor bolts for standard lighting poles shall conform to the following:

1. Anchor bolts shall conform to ASTM F1554, Grade 55, or ATSM A307 and shall have minimum yield strength of 36,000 psi. Bolts shall have “L” bends on one end.
2. Anchor bolts shall be provided with 2 hex nuts and 2 washers.
3. The anchor bolts and all nuts and washers shall be galvanized by the hot-dip process conforming to ASTM A123 and ASTM A153.
4. Anchor bolts shall be galvanized for the entire length of the bolt.
5. After galvanizing, the bolt threads shall accept the standard galvanized nuts for the full length of the thread without requiring tools, causing removal of protective coating, or requiring rethreading of the bolt or nut.
6. The upper 8 inches of the anchor bolts shall be threaded.
7. Anchor bolt sizes shall be as specified on the Drawings.
8. Plumbing of standards shall be accomplished by adjusting the nuts before the foundation is finished to 1 inch minimum above final grade. Shims or other similar devices for plumbing or raking will not be permitted.

**672.02.07 CONDUIT**

1. All conduit shall be PVC schedule 40 unless otherwise indicated on the Drawings Underground conductors shall be installed in conduit unless otherwise specified in these Special Provisions or the drawings. Conduit shall be listed by the Underwriters' Laboratories Inc., and shall bear the U.L. label on each length.
2. Low voltage conductors shall not be installed in high voltage light standards.
3. The conduit sizes to be used will be indicated on the Drawings. Conduit shall be 1-1/4 inches minimum diameter, unless otherwise indicated on the Drawings.
4. The Contractor may, at his own expense and with Engineer approval, use larger size conduit, and where used, it shall be for the entire length of the run from outlet to outlet with no reducing couplings permitted.
5. PVC coated rigid steel conduit shall consist of galvanized rigid steel conduit conforming to applicable federal specifications and Underwriters' Laboratories.
6. The exterior surface of the conduit shall be acid-treated to provide an acceptable surface for plastic coating with a heat polymerizing lacquer with a thickness not to exceed 0.0005 inch thick.
7. A polyvinyl chloride compound shall then be bonded to the prepared conduit with a thickness not less than 0.035 inch for the full length of the conduit except the threads.
8. The bond between the metal and the plastic shall be equal or greater than the tensile strength of the plastic coating.
9. In addition, the PVC compound shall have the following physical characteristics:
   1. Hardness: 85+ Shore A Durometer
   2. Dielectric Strength: 400 (Volts/mil @ 60 cycles)
   3. Tensile Strength: 3,500 psi

F. PVC coated rigid steel conduit shall be used for all exposed conduit such as when attached to the exterior of pedestrian bridge and underpass structures. Electrical Metallic Tubing, or EMT conduit, will not be allowed.

G. When new conduit is to connect to existing conduit, the Contractor shall verify the integrity of the existing conduit and make necessary repairs. The Engineer shall approve any additional repair work prior to commencing.

H. Conduits shall extend continuous through and above pole bases to within 3 inches below bottom of handhole of lighting standard.

1. Conduits shall be bent, without crimping or flattening.
2. No single run shall include more than two 45-degree bends and two 90-degree bends without prior approval of the Engineer and shall not exceed 300 feet between pull boxes.

I. Conduits shall be proven free and clear of dirt and debris by use of an appropriately sized mandrel no less than 1/4 inch smaller than the inside diameter of the conduit.

J. All installed spare or empty conduit shall include a green No. 8 AWG conductor installed from end to end and shall conform to subsection 672.03.06, Wiring, of these Special Provisions.

**672.02.08 PULL BOXES**

A. New pull boxes shall comply with applicable portions of the Standard Specifications, the Standard Drawings, and the Drawings.

1. The interior of pull boxes shall be void of any other materials except conduit risers and necessary wiring.
2. All excess materials shall be removed to promote drainage.

B. Pull boxes installed in grass, dirt, or asphalt shall have an 8‑inch minimum concrete collar with No. 4 rebar.

C. Pull box lids shall be an approved non-metallic polymer type material and shall be secured with brass tie downs. Pull boxes 2 feet by 3 feet and larger shall have torsion assisted lids.

D. Pull box lids shall be factory imprinted with the word "LIGHTING" or "ELECTRIC."

E. A pull box shall be required in conduit runs greater than 300 feet and at every 300 feet thereafter.

F. Conduits shall be 3 inches above the bottom of the pull box.

G. Wires shall extend 24 inches outside of pull box.

**672.02.09 CONDUCTORS AND CABLE**

A. Insulation for multiple circuit lighting conductors shall be rated at 600 volts, 75 degrees C. minimum.

B. Conductors, unless otherwise specified, shall be single conductor, solid or stranded copper of the gage shown on the Drawings, or indicated herein, insulated with THW grade plasticized polyvinyl chloride.

C. Copper wire shall conform to the applicable portions of ASTM D2220, B3 and B8.

**672.02.10 CONNECTIONS**

A. Unless noted otherwise, all connections shall be made using bronze split bolt type connectors and coated with approved weatherproofing compound or other liquid-tight connection method as approved by Engineer and in accordance with these Special Provisions and the Standard Drawings. Wire nuts are not allowed.

**672.02.11 LIGHTING CONTROLS**

A. Photo-electric controls:

1. Photo‑electric controls shall be as shown below, or as shown on the Drawings.
2. The photo‑electric control shall be capable of switching multiple lighting systems directly or by a separate contactor as indicated on the Drawings.
3. The photo‑electric control shall consist of a photo‑electric unit installed in the pad mounted service and control cabinet, and control the lighting contactor in the pad mounted service and control cabinet.
4. A by‑pass switch shall be included to permit manual operation of the lighting system contactor.
5. **The photo-electric control shall be Tork 2007A, or approved equal.**
6. **Equipment Details:**
   1. The photo‑electric unit shall consist of a light sensitive element connected to a control relay.
   2. The light sensitive element shall have a spectral response such that it is especially sensitive to north sky illumination and shall have an "ON" level adjustable between minimum limits of 1 and 3 foot-candles.
   3. The unit shall be so designed such that a failure of any electrical or electronic component will energize the lighting circuit.
   4. The photo‑electric unit shall be mounted at the top of the standard designated on the Drawings and shall be oriented as directed by the Engineer.
7. **Contactor:**
   1. The contactor shall be constructed in accordance with NEMA standards for lighting contactors and shall have contacts rated to switch the specified lighting load.
   2. Contactor shall be the mechanical armature type.
   3. The mechanical type shall consist of an operating coil, a laminated core, a laminated armature, contacts, and terminals.
   4. Contacts shall be silver alloy.
8. **Housing:**
   1. The contactor may be either integral with the photo‑electric unit or may be located externally from it.
   2. When located externally, the contactor shall be housed in the same pad mounted service and control cabinet where the photo-electric unit is installed.

9. **Wiring:** Conductors between the photo‑electric unit and an external contactor shall be a minimum No. 10 AWG, and shall be installed inside the lighting standard.

B. Flood Level Control:

1. Flood level controls shall be as shown below, or as shown on the Drawings.
2. The flood level control shall be capable of switching multiple lighting systems by a separate contactor as indicated on the Drawings.
3. The flood level control shall consist of a level probe unit installed on the ramp wall which controls a relay in the pad mounted service and control cabinet. The relay shall open shunt trip-enabled circuit breakers to disconnect electrical power to circuits as indicated on the drawings.
4. **The flood level control shall consist of Warrick Series 16M relay, Warrick 3E2C electrode fitting, and Warrick 3RXC5 probes or approved equals.**
5. **Equipment Details:**
   1. The probes shall be constructed of Teflon coated, 316 stainless steel. One end of the probes shall be factory threaded for attachment to the electrode fitting.
   2. The electrode fitting shall be NEMA 4 rated and capable of directly receiving the level probes. Enclosed terminal lugs for wiring capable of accepting No. 12 AWG conductors shall be provided.
   3. The relay unit shall consist of a transformer providing secondary voltage less than or equal to 24 volts for the probes. The relay unit shall be enclosed in a plug-in module with a matching base for installation in the pad mounted service and control cabinet. Minimum sensitivity shall be 100K ohms. The relay unit shall also have an integral Form C contactor rated 10 Amp/240 Volts resistive. Entire relay shall be powered by a single 120 Volt AC source.
6. **Wiring:** Conductors between the electrode fitting and the relay shall be a minimum No. 12 AWG.
7. **Operation:** Probes shall be located so bottom of probes are at elevation indicated on Drawings. Upon contact with water, the probes shall provide a circuit of adequate resistance to change the state of the relay. The relay shall close the NO portion of the Form C contact and provide 120 Volt AC current to the shunt trip breakers as indicated on the Drawings.

C. Time Clock control:

1. Facility lighting set for dusk to facility closing will be controlled by a photocell on and a time clock off installed inside the service pedestal cabinet. **The time clock controller shall be Intermatic ET90115C, or approved equal**.

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**CONSTRUCTION**

**672.03.01 MAINTENANCE OF EXISTING AND TEMPORARY ELECTRICAL SYSTEMS**

A. Existing electrical systems (traffic signal, ramp metering, highway and street lighting, flashing beacon and sign illumination), or approved temporary replacements thereof, shall be kept in effective operation for the benefit of the traveling public during the progress of the work, except when shutdown is permitted to allow for alterations or final removal of the systems.

1. Traffic signal shutdown shall be as specified in the Special Provisions or as requested by the Engineer.
2. Lighting system shutdowns shall not interfere with the regular lighting schedule, unless otherwise permitted by the Engineer.
3. The Contractor shall notify the Operating Engineer’s Agency in writing 3 normal working days prior to performing any work on existing systems.

B. The CLV shall be notified in writing 3 normal working days in advance by the Contractor prior to any operational shutdown of a traffic signal system.

C. The CLV will continue operation and maintenance of existing electrical facilities.

D. Where damage is caused by the Contractor's operations, the Contractor shall at his expense, repair or replace, at the direction of the Engineer, damaged facilities promptly in accordance with these specifications. Should the Contractor fail to perform the required repairs or replacements, the cost of performing such repairs or replacements will be deducted from any monies due or to become due the Contractor.

E. The data indicated on the Drawings and in these Special Provisions is as exact as could be secured, but its absolute accuracy is not guaranteed. Exact locations, distances, levels, and other conditions will be governed by unforeseen obstacles in the field.

F. The exact location of existing conduits and pull boxes shall be ascertained by the Contractor before using equipment that may damage such facilities or interfere with any system. The Contractor shall use the Drawings and these specifications for guidance, and secure the Engineer’s approval for all changes of location or scope of work.

G. Where roadways are to remain open to traffic and existing lighting systems are to be modified, the lighting systems shall remain in operation and the final connection to the modified circuit shall be made so that the modified circuit will be in operation by nightfall of the same day.

H. Temporary electrical installations shall be kept in effective operation until the temporary installations are no longer required for the traveling public.

I. These provisions will not relieve the Contractor in any manner of his responsibilities as provided in Subsection 107.11, "Responsibility for Damage," and Subsection 107.16, "Contractor's Responsibility for the Work and Materials."

J. A temporary overhead cable system may be used for the existing signal system circuitry in lieu of maintaining the underground installations during construction if approved by the Operating Engineer’s Agency.

K. Where an existing system is being modified, work not shown on the Drawings or specified in these Special Provisions and which is considered by the Engineer as necessary to keep all or any part of the existing system in effective operation shall be considered as included in the prices paid for the systems, or units, therefore no additional compensation will be allowed.

**672.03.02 SCHEDULING OF WORK**

A. Storage:

1. Luminaires and wiring shall be stored off-site until they are ready for installation, assembly, and erection. Under no circumstances shall any of these items be stored on‑site when the contractor is not present.

2. Poles may be stored on-site for a short time period if they do not impact the day-to-day operation of the facility. The contractor is responsible for any damage or theft to any materials left on-site. Poles shall be placed on suitable supports off the ground.

B. Conductors shall not be pulled into conduit until pull boxes are set to grade, crushed rock sumps installed, and metallic conduit bonded, where applicable.

B. Lighting for pedestrian structures shall be placed in operation prior to opening the structure to pedestrian traffic.

C. If the Engineer orders lighting for pedestrian structures placed in operation before permanent power service is available, the cost of installing and removing temporary power service will be paid for as extra work as provided in Subsection 104.03, "Extra Work."

D. **Trail lighting shall not be inspected for acceptance or turned on until a completed set of red lined plans is received by the local agency. This does not preclude the preparation and submittal of as-built plans or Record Drawings.**

**672.03.03 SAFETY PRECAUTIONS**

A. Before starting work on existing lighting circuits, the Contractor shall obtain daily a safety circuit clearance from the responsible local agency.

B. By‑pass shall be switched to the "off" position, fuses shall be removed, and signs posted at the switch box before any work is done.

**672.03.04 EXCAVATING AND BACKFILLING**

A. All trenching and backfill shall comply with applicable portions of the USS, USD and Drawings.

1. All trenching shall be deep enough to ensure a minimum of 24 inches of cover over the conduit measured from the top of conduit to finish grade.
2. Vinyl power warning tape shall be placed above conduits at 12 inches below the finish grade.
3. The backfill in street areas shall be Type II gravel compacted to 95 percent relative density or an agency approved controlled low strength material (CLSM).
4. No trench shall be left open after established working hours without approval of the Engineer.

B. Conduit locations on the Drawings are for reference only.

1. Actual locations shall be determined by the Contractor as to the most economical location, either behind the curb or in front of the lip of the gutter, but in either case, the conduit shall remain parallel to the back of curb or the edge of pavement between the lighting standards, and the location shall be approved by the Engineer.
2. As-built marked prints or Record Drawings showing installed locations shall be given to the Engineer by the Contractor prior to final acceptance by the agency.

C. All conduit that is terminated, stubbed, and capped for future use shall be marked by a "+" a minimum of 3 inches high and directly above the conduit, cut into the face of the curb, wall, concrete paving, etc.

D. Excavations required for the installation of conduit, foundations and other facilities, shall be performed in such a manner as to cause the least possible damage to the streets, sidewalks, and other improvements.

1. Excavations shall not be larger than necessary for the proper installation of conduit, electrical facilities and foundations.
2. Excavating shall not be performed until immediately before installation of conduit, facilities, and foundations.

E. The material from the excavation shall be placed in a position where the least disruption and obstruction to vehicular and pedestrian traffic will be realized and the least interference with surface drainage will occur.

F. Surplus excavated material shall be removed and disposed of by the Contractor outside of the right-of-way.

G. At the end of each day's work, and at other times when construction operations are suspended, equipment and other obstructions shall be removed from the right-of-way.

H. Structural excavation and backfill shall conform to the requirements of Section 206, "Structure Excavation" and 207, "Structure Backfill."

I. Trench excavations shall be backfilled in conformance with the requirements of Section 208, "Trench Excavation and Backfill." Backfill shall be free of stones, caliche, or lumps of material exceeding 3 inches and free from sod, frozen earth and organic materials.

J. Backfilled excavations shall be kept well filled and maintained in a smooth and well drained condition, until permanent resurfacing is completed as specified in Subsection 208.03.05, "Cutting and Restoring Street Surfacing."

K. Unless otherwise specified in the Special Provisions, excavation in the street and highway shall be performed in such a manner that not more than one lane of traffic is restricted in either direction at any time, unless otherwise approved by the Engineer.

L. All streets upon or within which any work is being done shall be kept open to all traffic by the Contractor, as specified in Subsection 104.04, "Maintenance of Traffic," unless otherwise provided in these Special Provisions, or as approved by the Engineer.

M. Barricading shall conform to the latest editions of the Traffic Control Plans for Highway Work Zones for the Clark County Area and the *Manual On Uniform Traffic Control Devices*.

**672.03.05 REMOVING AND REPLACING IMPROVEMENTS**

A. Improvements, such as sidewalks, curbs, gutters, Portland cement concrete and asphalt concrete pavement, bituminous surfacing, base material and other improvements removed, broken or damaged by the Contractor, shall be replaced or reconstructed in compliance with the applicable sections of these specifications.

B. Whenever a part of a square or slab of existing concrete sidewalk or driveway is broken or damaged, it shall be repaired in accordance with Subsection 202.03.02, "Removal of Structures and Obstructions."

C. The outline of all areas to be removed in Portland cement concrete sidewalks and in pavements shall be cut to a minimum depth of 1‑1/2 inches with an abrasive-type saw prior to removing the sidewalk and pavement material.

1. Cut for the remainder of the required depth may be made by any method satisfactory to the Engineer.
2. Cuts shall be neat and true with no shatter outside the removal area.

**672.03.06 WIRING**

A. Wiring shall conform to appropriate articles of the National Electrical Code.

1. Wiring within cabinets, junction boxes, etc., shall be neatly arranged and laced.
2. Powdered soapstone, talc, or other approved lubricant shall be used when installing conductors in conduit.

B. Each conductor shall have 18 inches of slack coiled within each lighting standard and at least 2 feet of slack coiled in each pull box.

C. Conductors shall be installed without splices from luminaire to luminaire and from service to luminaire unless otherwise specified. Multiple lighting conductors may be spliced in the base of lighting standards or in pull boxes adjacent thereto.

D. Splices for trail light conductors shall be connected using bronze split bolt type connectors in accordance with these Special Provisions and the Standard Drawings. All splices, taps, or other connections in pull boxes, junction boxes or lighting standard bases shall be made liquid-tight and suitable for submersion in water using a suitable method approved by the Engineer.

E. Conductor insulation shall be well penciled, trimmed to conical shape, roughened and meet manufacturer’s recommendations before applying splice.

1. When conductors and cables are pulled into the conduit, all ends of the conductors and cables shall be taped to exclude moisture.
2. Ends of spare conductors shall be taped.

F. The ends of all conduits shall be well reamed to remove burrs and rough edges.

1. Field conduit cuts shall be made square and true so that the ends will butt or come together for the full circumference in the couplings or adapters.
2. Slip joints or running threads shall not be permitted for coupling metal conduit.

G. When a standard coupling cannot be used, an approved union coupling shall be used.

H. Couplings for steel conduit shall be tightened until the ends of the conduits are brought together, so that a good electrical connection will be made throughout the entire length of the conduit run.

I. Conduit ends shall be threaded and capped with standard pipe caps until wiring is started. When caps are removed, the threaded ends shall be provided with approved conduit bushings.

J. Manual or power-operated equipment normally used for cutting rigid steel conduit is acceptable for use in cutting PVC coated rigid steel conduit.

1. PVC shall not be peeled back before cutting and all cuts shall be reamed.
2. Threading shall be the same as for non-coated rigid conduit.
3. All scarred and grip marked areas shall be touched up with approved heavy consistency coating compound.

K. For PVC coated rigid steel, all couplings and threaded fittings shall be hand tightened before using a wrench.

1. Use strap wrench for the final two turns only.
2. All wrench marks and scores shall be recoated and joints must be sealed with heavy consistency PVC compound.
3. Ensure that the final installation does not have any exposed metal areas.

L. PVC coated rigid steel conduit, 2 inches in diameter or larger, shall be used for all bends, except for 90‑degree bends at trail light pole foundations.

1. Standard field bending techniques shall be used which typically uses a shoe one size larger to accommodate the larger pipe diameter.
2. The minimum radius of the bend shall be 36 inches for PVC coated rigid steel conduit.

M. Conduit terminating in pedestals shall be a minimum of 2 inches and a maximum of 4 inches above the foundation and should be sloped toward the handhole opening.

N. Conduit shall enter concrete pull boxes from the bottom and shall terminate 2 inches inside the box wall and not less than 3 inches nor more than 4 inches above the bottom, and shall be sloped to facilitate pulling of conductors.

1. Conduit entering the bottom of a pull box shall be located near the end walls to leave the major portion of the box clear.
2. At all outlets, conduit shall enter from the direction of the run.

O. Existing underground conduit to be incorporated into a new system shall be cleaned by blowing out with compressed air, or by other methods required by the Engineer.

P. Conduit runs shown on the Drawings are for bidding purposes only and may be changed with the approval of the Engineer to avoid underground obstructions.

**672.03.07 SERVICE**

A. Service points when required for trail lighting shall be as indicated on the Drawings.

1. Each service provided by the Contractor shall have a 200 amp rating and shall conform to the Clark County Area Uniform Standard Drawings as applicable.
2. Breakers as shown in the service panel schedule in the drawings will be required.

B. The Contractor shall obtain all addresses for new services from the City of Las Vegas, Department of Planning and Development, 731 South 4th Street, (702) 229-5408.

C. It shall be the Contractor’s responsibility to coordinate all work associated with service point connections required by this contract with the NV Energy.

D. The Contractor shall furnish and install conduit and conductors to the service point as shown on the Drawings or as required to complete the installation.

E. No service point will be considered acceptable unless approved in writing by the NV Energy and the Engineer or his designee.

**672.03.08 BONDING AND GROUNDING**

A. Metallic cable sheaths, steel conduit, metal poles, pedestals, pull boxes, and other metal enclosures shall be metallically joined together and made mechanically and electrically secure to form a continuous electrical conducting path and shall be effectively grounded as required by the National Electrical Code.

B. All non‑metallic conduits shall contain a green grounding conductor as specified herein, except if none is specified, this conductor shall be sized according to Article 250 of the National Electrical Code.

C. Bonding and grounding jumpers shall be copper wire or copper strap of the same cross‑sectional area as No. 4 AWG for series and multiple lighting circuits.

1. Bonding of standards and foundations shall be accomplished by means of a bare No. 4 copper wire attached to each anchor bolt and to a 1/2-inch, or larger, brass, cadmium-plated or bronze bolt installed on the lower lip of the lighting standard handhole as shown on the Standard Drawings or on the Drawings.
2. The No. 8 green grounding conductor from the conduit and the No. 10 luminaire ground shall be connected to the No. 4 grounding conductor.
3. Grounding of conduit and neutral at the service point shall comply with the applicable sections of Article 250 of the National Electrical Code.

**672.03.09 TESTING**

A. The Contractor shall be required to submit Record Drawings prior to any inspections being performed. Contractor and/or his representative shall be present at the project location during the Maintaining Agency’s inspection of the street light installation.

B. Prior to completion of the work, the Contractor shall cause the following tests to be made on all lighting circuits, in the presence of the Engineer:

1. Test for continuity of each circuit.
2. Test for grounds in each circuit with a 500 volt megohmmeter with a minimum acceptable reading of 200 megohms.
3. A functional test in which it is demonstrated that each and every part of the system functions as specified or intended herein.
4. A high‑pot test when specified.
5. Before acceptance of the work, the Contractor shall provide the Engineer with foot-candle readings showing average to minimum ratios in accordance with I.E.S. standard recommendations.

C. Any fault in any material or in a part of the installation revealed by these tests shall be replaced or repaired by the Contractor in a manner approved by the Engineer, and the same test shall be repeated until corrected.

**METHOD OF MEASUREMENT**

**672.04.01 MEASUREMENT**

The quantity of Modify Existing Service Pedestal will be measured for payment by each modified as required to meet additional lighting requirements, in place, complete and operational.

The quantities of POLE AND LIGHT ASSEMBLY (14.5 FOOT), POLE AND BRIDGE LIGHT ASSEMBLY (14.5 FOOT), and POLE AND LIGHT ASSEMBLY (11 FOOT) will be measured for payment by each installed, in place, complete and operational.

The quantity of NO. 3-1/2 PULL BOX will be measured for payment by each installed, in place, complete and operational.

The quantity of REMOVE, SALVAGE, AND RETURN LIGHT ASSEMBLY TO OWNER will be measured for payment by each removed, salvaged, and returned to Owner.

The quantity of 200 AMP SERVICE PEDESTAL will be measured for payment by each installed, in place, complete and operational.

The quantity of FLOOD LEVEL CONTROL UNIT will be measured for payment by each installed, in place, complete and operational.

The quantities of (Size, Type) Conduit with (#/AWG) Conductor will be measured for payment by linear foot installed, in place and complete.

All measurements will be made in accordance with Subsection 109.01, "Measurement of Quantities."

**BASIS OF PAYMENT**

**672.04.02 PAYMENT**

The accepted quantity of MODIFY EXISTING SERVICE PEDESTAL shall be paid for at the Contract unit price bid per each, which shall be full compensation for furnishing and installing all required upgrades to existing service pedestal to allow operation as indicated on the Drawings, including, but not limited to, circuit breakers, contactors, internal conductors, fittings, connections, tools, labor, and incidentals required to make the service pedestal complete and operational as shown on the Drawings, as specified, and as required by the Engineer.

The accepted quantities of POLE AND LIGHT ASSEMBLY (14.5 FOOT), POLE AND BRIDGE LIGHT ASSEMBLY (14.5 FOOT), and POLE AND LIGHT ASSEMBLY (11 FOOT) will be paid for at the Contract unit prices bid per each, which shall be full compensation for furnishing and installing all materials including trenching, conduit and/or conductors not shown as separate bid items, shipping, delivery, tools, fittings, bends, excavation, compacted backfill, concrete foundations, concrete or steel pedestals, connections to existing conduits and circuits, all wiring above ground from the hand hole of the pole to the luminaires and receptacles, poles, field modification of poles, mast arms, luminaires, hardware, making all required tests, and for providing all labor, tools, equipment, and incidentals required to make lights operational, as shown on the Drawings, as specified, and as directed by the Engineer.

The accepted quantity of NO. 3-1/2 PULL BOX will be paid for at the Contract unit prices bid per each, which shall be full compensation for furnishing and installing all materials including shipping, delivery, tools, foundations, required hardware to ensure item is complete, in place and operational, excavation, installation, conduit connections, and backfill, and for providing all labor, tools, equipment, and incidentals required to complete the work as shown on the Drawings, as specified, and as directed by the Engineer.

The accepted quantity of REMOVE, SALVAGE, AND RETURN LIGHT ASSEMBLY TO OWNER will be paid for at the Contract unit price bid per each, which shall be full compensation for removal of existing trail light and foundation, salvage and storage of existing trail light, and delivery of salvaged trail light to Owner in accordance with Owner's directions including trenching, rerouting existing conduit and conductors not shown as separate bid items, tools, fittings, bends, excavation, compacted backfill, connections to existing conduits and circuits, making all required tests, and for providing all labor, tools, equipment, and incidentals required to salvage existing trail light, as shown on the Drawings, as specified, and as directed by the Engineer.

The accepted quantity of 200 AMP SERVICE PEDESTAL will be paid for at the Contract unit price bid per each, which shall be full compensation for furnishing and installing all materials including shipping, delivery, tools, fittings, excavation, grading, compacted backfill, concrete foundations, contactors, circuit breakers, meters, hardware, photocells, making all required tests, and for providing all labor, tools, equipment, and incidentals required to make service pedestals complete, in place and operational, as shown on the Drawings, as specified, and as directed by the Engineer.

The accepted quantity of FLOOD LEVEL CONTROL UNIT shall be paid for at the Contract unit price bid per each, which shall be full compensation for furnishing and installing all materials including shipping, delivery, tools, fittings, excavation, grading, compacted backfill, relays, probes, fittings, hardware, conduit and/or conductors not shown as separate bid items, making all required tests, and for providing all labor, tools, equipment, and incidentals required to make flood level control complete, in place and operational, as shown on the Drawings, as specified, and as directed by the Engineer.

The accepted quantities of (Size, Type) Conduit with (#/AWG) Conductor will be paid for at the Contract unit prices bid per linear foot, which shall be full compensation for furnishing and installing all materials including shipping, delivery, tools, removal of pavement and the placing of temporary and permanent pavement patches; excavation, trenching, saw cutting, installation, bedding, backfill, conduit, conductor, pull strings, fittings, bends, clamps, anchors, stubouts, pole risers, concrete encasement, connections to existing conduit and conductors, making all required tests to ensure item is complete, in place and operational, and for providing all labor, tools, equipment, and incidentals required to complete the work as shown on the Drawings, as specified, and as directed by the Engineer. The cost of supplying and installing junction boxes as indicated on the Drawings or otherwise required in conduit shall be considered incidental to conduit installation and no additional compensation shall be allowed therefor.

Payment will be made under:

| **ITEM NO.** | **ITEM DESCRIPTION** | **UOM** |
| --- | --- | --- |
| 672.0050 | MODIFY EXISTING SERVICE PEDESTAL | EA |
| 672.0060 | POLE AND LIGHT ASSEMBLY (11 FOOT) | EA |
| 672.0070 | POLE AND LIGHT ASSEMBLY (14.5 FOOT) | EA |
| 672.0080 | NO. 3-1/2 PULL BOX | EA |
| 672.0090 | POLE AND BRIDGE LIGHT ASSEMBLY (14.5 FOOT) | EA |
| 672.0100 | REMOVE, SALVAGE, AND RETURN LIGHT ASSEMBLY TO OWNER | EA |
| 672.0110 | 200 AMP SERVICE PEDESTAL | EA |
| 672.0120 | FLOOD LEVEL CONTROL UNIT | EA |
| 672.XXXX | (Size, Type) Conduit with (#/AWG) Conductor | LF |

**END OF SECTION 672**