DETAILED SPECIFICATIONS
FOR COMMERCIAL
UNDERGROUND ELECTRICAL CONSTRUCTION

ARTICLE 1 - USE OF DETAILED SPECIFICATIONS

The following is a set of detailed specifications for the construction of an underground electric distribution system.

Depending on the scope of the project, all articles may not pertain to all jobs. The Contractor will be responsible only for the articles, which pertain to his specific job. If the Contractor is not sure if an article pertains to his job he shall consult the Developer for verification.

ARTICLE 2 - MATERIALS FURNISHED BY CONTRACTOR

The following is a list of the major materials, which the Contractor shall furnish, but it does not necessarily include all of the materials, which will be necessary for the project:

1. Materials necessary to install 2 - 4” primary conduits.
2. Materials necessary to construct a three-phase transformer pad.
3. Materials necessary to construct a three-phase cabinet pad.

ARTICLE 3 - MATERIALS FURNISHED BY LUS

The following is a list of the materials, which LUS will supply to the Contractor to be installed. All materials supplied by LUS are located in the Warehouse, at 1210 Walker Road. It shall be the responsibility of the Contractor to transport material and equipment from the LUS Warehouse to the job site, as required, and return any excess materials and equipment upon completion of the work.

The Contractor shall be liable for materials and equipment lost for any reason after these materials have been released by LUS.

1. Three-phase metering equipment.
ARTICLE 4 - TRENCHING

Trenches shall be straight with centerline as shown on the drawings. A chalk line or other accepted means must be used to maintain a straight trench. Depth shall be as shown on the plans.

All excavated material shall be placed in such a manner so that the public will not be inconvenienced. Reasonable provisions shall be made to clear driveways, crosswalks, sidewalks, streets and private roadways. No streets shall be closed to through traffic without permission of LUS. All drains, gutters and sewers for surface drainage shall be kept open or if unavoidably closed, other provisions shall be made for drainage. Sufficient flares, red-light and barricades shall be placed along the trenches on right-of-ways and other locations if they are considered dangerous to the public.

The bottom of the trench shall be smooth and free of coarse aggregate and loose dirt. All trenches shall be backfilled the same day that they are trenched. The Contractor shall compact the backfill by rolling over the trench with his trenching tractor. In all backfilling, if the backfill material is too dry to compact to the desired density, it shall be wetted as required. If the backfill is too wet to compact, fresh backfill shall be used in its place. This is particularly required beneath all electrical structures, in which the backfilling shall be compacted to 95% of the surrounding undisturbed soil. No sand of any sort may be used in backfilling.

Regarding the backfill in situations where required, backfill shall be placed in 6" layers (loose depth) and mechanically tamped to a compaction equal to or greater than the density of the surrounding undisturbed earth, or to the satisfaction of LUS.

ARTICLE 5 - STREET CROSSINGS

All street crossings shall be made with PVC Schedule 40 conduit. Street crossings may be performed by one of two methods; 1) cutting the street or 2) jacking or boring the street. It shall be up to the Contractor to decide which method he prefers. If the Contractor chooses to cut the street, the following shall be adhered to. Conduits shall be laid in a horizontal fashion with no stacking of conduits. Separation between conduits shall be 6" in all directions or as otherwise specified. The street crossing shall be backfilled to sub grade with "Fill-Crete", a cementious grout mixture combined in the following proportions per yard:

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<tr>
<td>Cement</td>
<td>188 lbs.</td>
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<tr>
<td>Sand</td>
<td>3,010 lbs.</td>
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<tr>
<td>Water</td>
<td>42.6 gals.</td>
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Concrete or any other alteration of this mix is not acceptable.
Conduits are to be laid at a depth as called for in the drawings. Conduits may be laid at a minimum cover of eighteen (18) inches over an obstruction, provided there is 2” of earth separation between the conduits and the obstruction.

In the event the Contractor chooses to jack or bore the street, the requirements of Article 6 below shall be adhered to.

ARTICLE 6 - JACKING OR BORING

Conduit may be placed under an existing or proposed obstruction/pavement by approved jacking or boring methods. Conduits bored in most instances shall have a minimum cover of 36” unless otherwise specified, and, further, there shall be at least 12”, and no more than 18”, separation below any obstruction, in all cases. All bores are to be made level and flat with grade. No dipping in the horizontal alignment of the conduit shall be permitted. The Contractor is to determine the deepest he is to bore under any obstruction and is to maintain that depth consistently. See LUS standard detail ZUC for reference.

For bores made for a single conduit under an obstruction, the size of the bore hole shall be no greater than 1” more than the outside diameter of the coupling for the conduit to be housed inside said bore hole. Bores made for multiple conduits in the easement along the roadway for such obstructions as driveways, sidewalks, trees, etc. Will be one bore, the size of the bore hole of which shall be no greater than 2” more than the sum of the outside diameters of the couplings of the conduits in a diametric manner when the conduits are stacked together. LUS Engineering will determine the final size of the hole.

For all street crossings, the top of the conduit(s) shall be at least 42" below the top of the existing or proposed pavement, or as otherwise noted. For all street crossings of multiple conduits, a casing (PVC Schedule 40) shall be bored under the roadway at the required depth. LUS Engineering will determine the size of the casing. The size of the borehole for the casing shall be no larger than 1" more than the diameter of the casing. All conduits in the street crossing will be placed in the casing. The two pits involved with the bore for the casing will be inspected by LUS to assure proper installation, prior to backfilling.

Pits for boring shall not be closer than two feet to the back of the curb unless otherwise directed by LUS. Water jetting will not be permitted. Pits installed for this purpose shall be backfilled, thoroughly tamped and watered so that settlement does not occur. Backfilling shall be in accordance with regulations of LUS.
ARTICLE 7 - CROSSINGS AT COULEES, OBSTRUCTIONS AND SUBSURFACE DRAINAGE

Coulee crossings may be performed by one of two methods: 1) open cutting the coulee or 2) boring under the coulee. Concrete shall be provided for all open cut coulee crossings. The concrete shall be the same as described heretofore with the addition of red dye. The concrete shall encase the conduits with a minimum of 3" all around each conduit. In the event the contractor chooses directional boring, at least 36" minimum cover should be maintained under the coulee bed.

Conduits are to be laid at a depth as called for in the drawings. Conduits may be laid at a minimum cover of eighteen (18) inches over an obstruction, provided there is 2" of earth separation between the conduits and the obstruction. It shall be the decision of LUS to determine if an obstruction crossing warrants reinforcement with red dye concrete.

Subsurface drainage crossings shall comply with Public Works policy. All conduits are to be laid at a depth of at least three (3) feet below the invert of drainage pipes. This shall be the rule for both public and private drainage. With the approval of LUS and Public Works, in cases where this depth is deemed excessive, conduits may be laid above subsurface drainage provided minimum cover is maintained.

ARTICLE 8 - RISER POLES AND CONDUIT SUPPORTS

Conduit for riser poles shall extend from a minimum of one (1) foot below grade to a minimum of eight (8) feet above grade and shall be PVC Schedule 80, in accordance with NEMA Standard TC2-1970, EPC-80-PVC. All conduits above 8' may be PVC Schedule 40 conduit. Provide proper galvanized conduit hangers on a 6" galvanized riser standoff.

Crossarms required for pothead installations shall be provided and installed by LUS. Any existing facilities to be adjusted shall be done so by LUS. The Contractor shall be required to complete the underground system up to and including a point that shall be indicated in the drawings.

ARTICLE 9 - STAKING

The Developer shall stake the centerline of the trenches, right-of-ways, easements and the locations of all structures. The Contractor shall be responsible for locating all existing utilities.

The Contractor shall not disturb property corner pins, and if so, shall employ a Registered Land Surveyor to replace said pins. The Contractor shall be responsible for all damages to landscaping that he causes.
ARTICLE 10 - OTHER UTILITIES

It shall be the responsibility of the Contractor to coordinate the work with all other utilities, and all other Contractors involved with this project.

ARTICLE 11 - CONDUIT

All conduits shall be polyvinyl chloride plastic, Schedule 40, in accordance with NEMA Standard TC2, 1970, EPC-40-PVC. Cement glue shall be brushed on or sprayed liberally on all joints prior to assembly. Multiple conduits shall have a 6" earth separation in all directions, unless otherwise specified in the drawings. Bell ends shall be installed at the end of all risers or entries into structures, and shall extend at least ½", but no more than 1”, into the structure. Pull strings shall be installed in all empty conduits unless approved otherwise by LUS.

All 90 degree bends shall have the following criteria:

   a) For conduits of diameter 1" or less, the radius shall be a minimum of 12".
   b) For conduits of diameter 1 ¼” to 2”, the radius shall be a minimum of 24".
   c) For conduits of diameter 2 ½” to 4”, the radius shall be a minimum of 36".
   d) For conduits of diameter 5” and 6", the radius shall be a minimum of 48".

Conduits that do not meet the minimum cover required shall be encased in concrete.

ARTICLE 12 - CONDUIT STUBOUTS

The spare stub outs from the transformer pad, sectionalizer pad or pedestal shall be extended a minimum of 36" from the edge of the pad in the direction indicated in the drawings.

The Contractor shall provide the number of conduits in the transformer pad or sectionalizer pad as indicated in the drawings, as well as the number of spare stub outs specified.

The Contractor shall provide a minimum of at least one spare stub out for each transformer pad, sectionalizer pad or pedestal. The stub outs from transformers and pedestals for services to homes shall be 2".
ARTICLE 13 - CONDUIT PULL-LINE

The Contractor shall install a pull-line in all empty conduits. The pull-line shall be a high-strength self-lubricated polyolefin line, of braided nature, with a minimum diameter of 3/16" and a minimum breaking strength of 500 lbs. The line shall be guaranteed against rust or mildew. The line shall be GB Electrical Inc. Poly-Pull catalog no. PL235 or equal.

ARTICLE 14 - CONCRETE

Concrete shall have minimum compression strength of 3,000 psi at 28 days. All reinforcement shall be structural grade deformed bars, allowable stress of 20,000 psi. The water-cement ratio shall not exceed seven (7) U.S. gallons of water per sack of cement. The concrete slump shall be between 1" and 3" without a frequency vibrator, and reduced by 1/3 when a frequency vibrator is used. The concrete shall contain a minimum of five (5) sacks of cement per cubic yard, and shall be a gravel/sand mix. All concrete tests shall be performed by LUS.

ARTICLE 15 - STEEL CASINGS

The Contractor shall furnish and install a casing of cold-rolled hard carbon steel in the locations as indicated in the drawings. The casing shall be placed under the device required by boring such that the borehole is not greater than two (2) inches of the outside barrel diameter of the casing.

Lengths of casing shall be joined together by the shielded electric arc welding process, in compliance with the current specifications of the American Welding Society, applicable to the work performed. Welding operators and machines shall be qualified for the particular type of work to be done. In no case shall welding be done in inclement weather, or under physical conditions, which may in the opinion of LUS impair the efficiency of the welder in making acceptable welds. All welds are to be continuous.

The casing shall have a complete bitumastic coating, even after installation. The casing is to hold multiple PVC conduits, as called for in the plans.

ARTICLE 16 - FOUNDATIONS AND PADS

All poured-in-place concrete structures shall be poured monolithically, vibrated to assure freedom from cavities and honeycomb, and the surfaces to be finished smooth with no indentations or bumps.
ARTICLE 17 - TRANSFORMER AND CABINET GROUNDING

The primary neutrals will be bonded together in the high voltage compartment using compression connectors. The Contractor shall furnish one (1) transformer type ground lug. The ground wire shall be a # 2/0 bare soft drawn copper wire and shall be bonded to the primary neutral in the high voltage compartment and to the transformer ground lug. In the low voltage compartment, the # 2/0 wire shall be tied to the neutral bussing of the transformer and to the transformer ground at the pad. All ground wire running through the concrete pad shall be installed in 1” PVC conduit.

ARTICLE 18 - COMPRESSION FITTINGS

Compression fittings shall be used to terminate or splice all aluminum conductors.

Copper to aluminum connections shall not be made except by the use of the proper compression fitting.