GENERAL NOTES FOR ALL ELECTRICAL WORK

1. The location of all conduits, junction boxes, ground boxes, and electrical services is
   shown on the plans and in accordance with the NEC. Ensure all metallic conduits are isolated
   from the ground by means of a ground bushing or an equipment grounding conductor.

2. Provide all new and unused materials. Ensure that all materials and installations comply
   with the applicable requirements of the National Electrical Code (NEC), TxDOT standards
   and specifications, national recognized laboratories (NRL) or a nationally recognized testing
   lab (NRTL). NRLs such as Underwriters Laboratories (UL) or Factory Mutual (FM) or
   any laboratory recognized by the Texas Department of Transportation. Intersecting Services
   Inc. or any other laboratory approved by the TxDOT.

3. The use of this standard is governed by the “Texas Engineering Practice Act.” No warranty of
   any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility
   for the conversion of this standard.

4. Provide conduit, junction boxes, fittings, and hardware as per TxDOT Departmental Material
   Specifications (DMS) 11030 “Conduit” and Item 618 “Conduit” of TxDOT’s “Standard Specifications
   for Transportation Works” and Item 618E “Conduit” of TxDOT’s “Standard Specifications
   for Maintenance of Traffic Operations” unless otherwise noted on the plans. Size all galvanized
   steel junction boxes and conduit at least No. 2/0AWG and 10% for No. 6AWG or less in
   diameter. For situations where TxDOT's Material List (ML) is used for the project, provide the
   sizes specified in the Design and Engineering Specifications for the project.

5. Install grounding as shown on the plans and in accordance with the NEC. Ensure all metallic
   conductors, metal poles, luminaires, and metal enclosures are bonded to the equipment
   grounding conductor. Provide stranded bare copper or green insulated grounding conductors.
   Ground ring, tank, and bonding jumpers are subsidiary to various bid items.

6. Install PVC elbows in PVC conduit systems, unless otherwise shown on the plans. Use only
   new and unused materials. Ensure that all materials and installations comply with the
   applicable requirements of the National Electrical Code (NEC), TxDOT standards and
   specifications, and all laboratory recognized laboratories (NRL) or nationally recognized
   testing laboratories (NRTL). Provide liquidtight flexible nonmetallic conduit (LFNC) when
   flexible conduit is required by the Engineer. Ensure that all bonding jumpers are the same size
   and that all conductors are the same size as the equipment grounding conductor. Ensure all bonding
   jumpers are the same size as the equipment grounding conductor. Ensure all bonding jumpers
   are the same size as the equipment grounding conductor. Ensure all bonding jumpers are the same size
   as the equipment grounding conductor.

7. During construction, temporarily cap or plug open ends of all conduit and raceways immediately
   after installation to prevent entry of dirt, debris, and animals. Temporary caps constructed of
   a flat, high tensile strength polyester fiber pull tape for pulling conductors through
   cut conduit openings. After installation, file smooth the cut ends of all conduit openings.

8. Use only new and unused materials. Ensure that all materials and installations comply with the
   applicable requirements of the National Electrical Code (NEC), TxDOT standards and
   specifications, and all laboratory recognized laboratories (NRL) or nationally recognized
   testing laboratories (NRTL). Ensure that all bonding jumpers are the same size as the equipment
   grounding conductor. Ensure all bonding jumpers are the same size as the equipment grounding
   conductor.

9. Provide conduit, junction boxes, fittings, and hardware as per TxDOT Departmental Material
   Specifications (DMS) 11030 “Conduit” and Item 618 “Conduit” of TxDOT’s “Standard Specifications
   for Transportation Works” and Item 618E “Conduit” of TxDOT’s “Standard Specifications
   for Maintenance of Traffic Operations” unless otherwise noted on the plans. Size all galvanized
   steel junction boxes and conduit at least No. 2/0AWG and 10% for No. 6AWG or less in
   diameter. For situations where TxDOT's Material List (ML) is used for the project, provide the
   sizes specified in the Design and Engineering Specifications for the project.

10. Install a bonding jumper from each grounding bushing to the nearest ground rod, grounding lug,
    or equipment grounding conductor. Ensure all bonding jumpers are the same size as the equipment
    grounding conductor. Ensure all bonding jumpers are the same size as the equipment grounding
    conductor. Ensure all bonding jumpers are the same size as the equipment grounding conductor.

11. Seal ends of all conduits with duct seal, expandable foam, or by other methods approved by
    the Engineer. Ensure that all materials and installations comply with the applicable
    requirements of the National Electrical Code (NEC), TxDOT standards and
    specifications, and all laboratory recognized laboratories (NRL) or nationally recognized
    testing laboratories (NRTL). Provide liquidtight flexible nonmetallic conduit (LFNC) when
    flexible conduit is required by the Engineer. Ensure that all bonding jumpers are the same size
    and that all conductors are the same size as the equipment grounding conductor.

12. Provide new and unused materials. Ensure that all materials and installations comply with the
    applicable requirements of the National Electrical Code (NEC), TxDOT standards and
    specifications, and all laboratory recognized laboratories (NRL) or nationally recognized
    testing laboratories (NRTL). Ensure that all bonding jumpers are the same size as the equipment
    grounding conductor. Ensure all bonding jumpers are the same size as the equipment grounding
    conductor. Ensure all bonding jumpers are the same size as the equipment grounding conductor.

13. File smooth the cut ends of all conduit openings. Before installing, file smooth the cut ends of
    all conduit openings. After installation, file smooth the cut ends of all conduit openings.

14. Install expansion joint conduit fittings on all service riser conduit. Provide all new and unused
    materials. Ensure that all materials and installations comply with the applicable requirements of
    the National Electrical Code (NEC), TxDOT standards and specifications, and all laboratory
    recognized laboratories (NRL) or nationally recognized testing laboratories (NRTL). Provide
    liquidtight flexible nonmetallic conduit (LFNC) when flexible conduit is required by the Engineer. Ensure that all bonding jumpers are the same size and that all conductors are the same size as the equipment grounding conductor.

15. Ensure that all materials and installations comply with the applicable requirements of the National
    Electrical Code (NEC), TxDOT standards and specifications, and all laboratory recognized
    laboratories (NRL) or nationally recognized testing laboratories (NRTL). Provide liquidtight flexible
    nonmetallic conduit (LFNC) when flexible conduit is required by the Engineer. Ensure that all bonding
    jumpers are the same size and that all conductors are the same size as the equipment grounding
    conductor.

16. Use new and unused materials. Ensure that all materials and installations comply with the
    applicable requirements of the National Electrical Code (NEC), TxDOT standards and
    specifications, and all laboratory recognized laboratories (NRL) or nationally recognized
    testing laboratories (NRTL). Provide liquidtight flexible nonmetallic conduit (LFNC) when
    flexible conduit is required by the Engineer. Ensure that all bonding jumpers are the same size and
    that all conductors are the same size as the equipment grounding conductor.
CONDUIT MOUNTING OPTIONS

1. Use torque-controlled mechanical expansion anchors that are approved for use in cracked concrete by the International Code Council, Evaluation Service (ICC-ES). The chosen anchor product shall have a designated ICC-ES Evaluation Report number, and its approval status shall be maintained on the ICC-ES website under Division 031600 for Concrete Anchors.

2. Unless otherwise approved by the Engineer, do not use adhesive anchors. Do not use expansion anchors that are not included in the ICC-ES approved list, do not use expansion anchors that are only approved for use in uncracked concrete.

3. Use anchors manufactured with stainless steel expansion wedges. Anchors manufactured with carbon steel expansion wedges are not allowed. Anchor bodies must be either hot-dip-galvanized carbon steel or stainless steel. For installation in marine environments, both the anchor body and expansion wedge shall be stainless steel.

4. Install anchors as shown on the plans and in accordance with the anchor manufacturer’s published installation instructions. Arrange a field demonstration test to evaluate the procedures and tools. The test shall be witnessed and approved by the Engineer prior to furnishing anchors on the structure.

5. Prior to hole drilling, use rebar locator to ensure clear of existing reinforcing bars or reinforcement. Install anchors to ensure a minimum effective embedment depth, as shown. Anchor torque values needed to ensure sufficient thread length for proper torquing and tightening of anchors.

6. Use anchors of minimum 1600 lbs tensile capacity in steel, concrete, masonry, and concrete butt joint strength as determined by ACI 318 Appendix J in the required minimum embedment depth. No embedment tools shall be introduced after anchor installation.
A. MATERIAL INFORMATION


2. Use listed compressed or screw type pressure connectors, terminal blocks, or listed wire nuts for temporary wiring. Use listed compression or screw type pressure connectors, terminal blocks, or listed wire nuts for temporary wiring.

3. Where two or more circuits are present in one conduit or enclosure, permanently identify each circuit conductor or group of conductors with a different color tape or identifier. Conductors must be identified with the color tape or identifier as shown in the plans. Paint circuit identification on the jacket of the conductor to ensure positive identification.

4. Use listed compression or screw type pressure connectors, terminal blocks, or listed wire nuts for temporary wiring. Use listed compression or screw type pressure connectors, terminal blocks, or listed wire nuts for temporary wiring.

5. Ground messenger wires that support power conductors in overhead lines. Ground vertical messenger wires at the lowest point. Ground messenger wires that support power conductors in overhead lines. Ground vertical messenger wires at the lowest point.

6. Provide a solid copper 6 AWG grounding electrode conductor to bond the electrical service equipment to the ground for surge protection and the ac power system. Use TxDOT approved, listed, and tested electrical equipment. Use TxDOT approved, listed, and tested electrical equipment.

7. When terminating conductors, remove the insulation and jacketing material without nicking the individual strands of the conductor. Conductors with nicked individual strands must be cleanly terminated.

8. Support conductors in illumination poles with a J-hook at the top of the pole. Support conductors in illumination poles with a J-hook at the top of the pole.

9. Do not repair damaged conductors with duct tape, electrical tape, or wire nuts. Do not repair damaged conductors with duct tape, electrical tape, or wire nuts.

10. Do not terminate more than one conductor under a single connector, unless the connector is rated for multiple conductors. Do not terminate more than one conductor under a single connector, unless the connector is rated for multiple conductors.

11. Install breakaway connectors on conductors bid under Item 620 whenever those conductors pass through a temporary service support device. Install breakaway connectors on conductors bid under Item 620 whenever those conductors pass through a temporary service support device.

12. Do not repair damaged conductors with duct tape, electrical tape, or wire nuts. Do not repair damaged conductors with duct tape, electrical tape, or wire nuts.

B. CONSTRUCTION METHODS

1. Use only a flat, high tensile strength polyester fiber pull tape for pulling conductors through the conduit system. After installing conductors in conduit, perform conductor pull tests. If a conductor cannot be pulled with ease, make any necessary adjustments in the conduit system or repositioning of a branch circuit. Use only a flat, high tensile strength polyester fiber pull tape for pulling conductors through the conduit system. After installing conductors in conduit, perform conductor pull tests. If a conductor cannot be pulled with ease, make any necessary adjustments in the conduit system or repositioning of a branch circuit.

2. Leave unused openings factory sealed. Use prequalified breakaway connectors around the conductor to ensure waterproof connection. Only one conductor may enter breakaway devices. Leave unused openings factory sealed. Use prequalified breakaway connectors around the conductor to ensure waterproof connection. Only one conductor may enter breakaway devices.

3. Wire nuts with factory applied waterproof sealant may be used for 8 AWG or smaller conductors. Do not exceed the pressure connector's rated pressure rating. Wire nuts with factory applied waterproof sealant may be used for 8 AWG or smaller conductors. Do not exceed the pressure connector's rated pressure rating.

4. Use listed wire nuts with factory applied sealant for temporary wiring when approved. Use listed wire nuts with factory applied sealant for temporary wiring when approved.

5. Provide a ground fault circuit interrupter (GFCI) for power outlets for portable electrical equipment, power tools, ice machines, ice storage bins, refrigerators located outdoors or grills, GFCI may be any of the following, but must be accessible, and plug and receptacle, or circuit breaker type. Provide a ground fault circuit interrupter (GFCI) for power outlets for portable electrical equipment, power tools, ice machines, ice storage bins, refrigerators located outdoors or grills, GFCI may be any of the following, but must be accessible, and plug and receptacle, or circuit breaker type.

6. Use listed wire nut approved for conduit run with communication wiring. Use listed wire nut approved for conduit run with communication wiring.

7. Install temporary conductors and electrical equipment in accordance with the NEC and the plans, ensuring that all conductors and equipment comply with the NEC and the plans, ensuring that all conductors and equipment comply with the NEC and the plans. Installation shall be witnessed by the Texas Department of Transportation Engineer to witness the tests. Installation shall be witnessed by the Texas Department of Transportation Engineer to witness the tests.

8. Use listed compression or screw type pressure connectors, terminal blocks, or listed wire nuts for temporary wiring. Use listed compression or screw type pressure connectors, terminal blocks, or listed wire nuts for temporary wiring.

9. Use approved, listed, and tested electrical equipment. Use approved, listed, and tested electrical equipment.

10. Do not repair damaged conductors with duct tape, electrical tape, or wire nuts. Do not repair damaged conductors with duct tape, electrical tape, or wire nuts.

11. Install breakaway connectors on conductors bid under Item 620 whenever those conductors pass through a temporary service support device. Install breakaway connectors on conductors bid under Item 620 whenever those conductors pass through a temporary service support device.

C. TEMPORARY WIRING

1. Install temporary conductors and electrical equipment in accordance with the NEC and the plans, ensuring that all conductors and equipment comply with the NEC and the plans, ensuring that all conductors and equipment comply with the NEC and the plans. Installation shall be witnessed by the Texas Department of Transportation Engineer to witness the tests. Installation shall be witnessed by the Texas Department of Transportation Engineer to witness the tests.

2. Use listed compression or screw type pressure connectors, terminal blocks, or listed wire nuts for temporary wiring when approved. Use listed compression or screw type pressure connectors, terminal blocks, or listed wire nuts for temporary wiring when approved.

3. Provide a ground fault circuit interrupter (GFCI) for power outlets for portable electrical equipment, power tools, ice machines, ice storage bins, refrigerators located outdoors or grills, GFCI may be any of the following, but must be accessible, and plug and receptacle, or circuit breaker type. Provide a ground fault circuit interrupter (GFCI) for power outlets for portable electrical equipment, power tools, ice machines, ice storage bins, refrigerators located outdoors or grills, GFCI may be any of the following, but must be accessible, and plug and receptacle, or circuit breaker type.

4. Use listed wire nut approved for conduit run with communication wiring. Use listed wire nut approved for conduit run with communication wiring.

5. Use listed compression or screw type pressure connectors, terminal blocks, or listed wire nuts for temporary wiring when approved. Use listed compression or screw type pressure connectors, terminal blocks, or listed wire nuts for temporary wiring when approved.

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7. Use listed compression or screw type pressure connectors, terminal blocks, or listed wire nuts for temporary wiring when approved. Use listed compression or screw type pressure connectors, terminal blocks, or listed wire nuts for temporary wiring when approved.
APRON FOR GROUND BOX

1. Uniformly space ends of conduits within the ground box. Position ends of conduits so that ground box walls do not interfere with the installation of grounding bushings or bell end fittings.
2. Maintain sufficient space between conduits to allow for proper installation of bushing.
3. Place aggregate under the box, not in the box. Aggregate should not encroach on the interior volume of the box.
4. Install a grounding bushing or bell end fitting on the upper end of all PVC conduits terminating in a ground box. Ground RMC elbows when any part of the elbow is less than 18 inches below the bottom of the ground box.
5. Install a PVC bushing or bell end fitting on the upper end of all RMC terminating in a ground box.

GROUND BOX DIMENSIONS

<table>
<thead>
<tr>
<th>TYPE</th>
<th>OUTSIDE DIMENSIONS (INCHES)</th>
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</thead>
<tbody>
<tr>
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<tr>
<td>B</td>
<td>12 X 23 X 22</td>
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<tr>
<td>C</td>
<td>16 X 29 X 11</td>
</tr>
<tr>
<td>D</td>
<td>16 X 29 X 22</td>
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<tr>
<td>E</td>
<td>12 X 23 X 17</td>
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GROUND BOX COVER DIMENSIONS

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<tr>
<td>C &amp; D</td>
<td>30 1/4  30 1/4  17 1/4  17 1/4  13 1/4  6 1/2  1 1/2  2</td>
</tr>
</tbody>
</table>

For cover logo and labeling requirements. See DMS 11070.
### ELECTRICAL SERVICES NOTES

1. Provide new meters, ensure installation and metering comply with the applicable utility requirements. Use National Electrical Manufacturing Association (NEMA) and Underwriters Laboratories (UL) listed meters. Ensure meter wiring meets American National Standards Institute (ANSI) and UL requirements. All meters shall be permanently mounted and accessible.

2. Provide service in accordance with Electrical Code Standards, as outlined in the National Electrical Code (NEC) and Underwriters Laboratories (UL) guidelines. Ensure all service equipment and materials are UL or CSA approved.

3. Provide all necessary materials and equipment for service installation, including and not limited to, service entrance conduits, service conductors, service panelboards, and service disconnects.

4. Coordinate with the Engineer and the utility provider to ensure compliance with utility requirements. Ensure that the service installation meets all necessary safety regulations.

5. Provide new service conductors and service panelboards, ensuring that the service conductors meet the required specifications. All service panelboards shall be UL or CSA approved.

6. Provide all necessary service equipment, including service panelboards, service switches, and service disconnects, ensuring that they meet the required specifications.

7. Ensure that all service conductors are properly sized and rated, and that they meet the required specifications. All service panelboards shall be UL or CSA approved.

8. Provide all necessary service equipment, including service panelboards, service switches, and service disconnects, ensuring that they meet the required specifications.

9. Ensure that all service conductors are properly sized and rated, and that they meet the required specifications. All service panelboards shall be UL or CSA approved.

10. Provide all necessary service equipment, including service panelboards, service switches, and service disconnects, ensuring that they meet the required specifications.

11. Ensure that all service conductors are properly sized and rated, and that they meet the required specifications. All service panelboards shall be UL or CSA approved.

12. Provide all necessary service equipment, including service panelboards, service switches, and service disconnects, ensuring that they meet the required specifications. The service panelboards shall be UL or CSA approved.

13. Ensure that all service conductors are properly sized and rated, and that they meet the required specifications. The service panelboards shall be UL or CSA approved.

14. Provide all necessary service equipment, including service panelboards, service switches, and service disconnects, ensuring that they meet the required specifications. The service panelboards shall be UL or CSA approved.

15. Ensure that all service conductors are properly sized and rated, and that they meet the required specifications. The service panelboards shall be UL or CSA approved.

### ELECTRICAL DETAILS

#### SERVICE ASSEMBLY ENCLOSURE

1. Provide threaded hub for all conduit entries into the top of the enclosure.

2. Type 316 stainless steel (SS) enclosures may be used for Type C service panels. Ensure that all SS conduit systems are not used in an enclosure mounted loadcenter or lighting controller. Provide SS enclosures in accordance with UL 1080, 1081, 1082, and 1083, 1084, 1085.

3. Provide all LTS conduit systems in accordance with the PS descriptive code, on all SS enclosures.

#### SERVICE DETAILS

- **Electrical Service Description**

<table>
<thead>
<tr>
<th>Electric Service</th>
<th>Pole/Panel</th>
<th>Trip Rating</th>
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- **Electrical Details**

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<th>Trip Rating</th>
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<tr>
<td>240/480 100</td>
<td>60/200</td>
<td>240/480</td>
</tr>
</tbody>
</table>

#### MAIN DISCONNECT & BRANCH CIRCUIT BREAKERS

1. When the utility company provides a transformer larger than 50 KVA, verify that the available fault current is less than the circuit breaker's ground fault current. Provide documentation from the electric utility provider to the engineer.

2. Provide parts as shown on the MPL, Model, order, or select the parts from a catalog. Provide documentation for each switch or device used. Mount photocells for all underground utility feeds to 10 foot above grade. Install photocells on all underground utility feeds after the transformer or the elbow below ground are de-energized. Ensure that the available fault current is less than the circuit breaker's ground fault current. Provide documentation from the electric utility provider to the engineer.

### PHOTOELECTRIC CONTROL

- **Provide photocells as shown on the MPL, Model, order, or select the parts from a catalog.**

#### EXPLANATION OF ELECTRICAL SERVICE DESCRIPTIVE CODE

**ELEC SERV TY**

X: SS = Stainless Steel

XXX/XXX

XX: SS = Stainless Steel

X: SS = Stainless Steel

XX: SS = Stainless Steel

X: SS = Stainless Steel

#### ELECTRICAL SERVICE DATA

- **Conductors**

<table>
<thead>
<tr>
<th>Circuit</th>
<th>Loadcenter</th>
<th>Panelbd/Receptacle</th>
<th>Two-Pole Switch</th>
<th>Main Disconnect</th>
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<td>100</td>
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<td>N/A</td>
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<td>2P/20</td>
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### ELECTRICAL DETAILS

#### SERVICE NOTES & DATA

- **Date:** October 2014

- **File:** ED(5)-14
SERVICE SUPPORT TYPE SF (U) - OVERHEAD SERVICE

1. Provide steel pole and steel frame supports as per TxDOT Departmental Material Specification (MS-11080) Electrical Service. Install all equipment and conduit at least 12 inches above ground on 3/8" galvanized steel or stainless steel channel steel. Transfer load to the 1500 lbs capacity base. Use 3/8" thick anchor bolts above grade. Refer to the electrical utility to determine service drop and service entrance conductors. Make a hole 5" diameter in the concrete for each anchor bolt.

2. Provide pole for overhead service with an eyebolt or similar fitting for attachment of the service drop to the pole in conformance with the electric utility. Provide conduit or tubing from the enclosure to the steel frame post. Connect electrical service grounding conductor to the tank ground fitting. See steel frame and steel pole details and Inset A for conduit support details.

3. Provide poles for overhead service supports. Ensure anchor bolts have 3 in of thread, with 3/4" dia. x 20" long. Provide and install galvanized 3/4" x 18" x 4 in. (dia. x length x hook length) anchor bolts for overhead service supports. Ensure anchor bolts have 3 in of thread, with 3/4" dia. x 20" long. Provide and install galvanized 3/4" x 6 in. (dia. x length x hook length) anchor bolts for underground service supports. Provide and install galvanized 3/4" x 12 in. (dia. x length x hook length) anchor bolts for underground service supports.

4. Bond one of the anchor bolts to the rebar cage with 6 AWG bare stranded copper conductor. Use listed mechanical connectors rated for embedment in concrete. See Inset B.

5. Drill and tap steel poles and frames for 1/4" in. X 13 UNC tank ground fitting. For steel pole service supports, use standard weight 2-1/2" long. Ensure tap holes for 1/4" X 13 UNC tank ground fitting are at 6" pitch (typ.). Provide and install galvanized 3/4" x 18" x 4 in. (dia. x length x hook length) anchor bolts for overhead service supports. Ensure anchor bolts have 3 in of thread, with 3/4" dia. x 20" long. Provide and install galvanized 3/4" x 6 in. (dia. x length x hook length) anchor bolts for underground service supports. Provide and install galvanized 3/4" x 12 in. (dia. x length x hook length) anchor bolts for underground service supports.

6. Steel post or frame is painted, bond each separate painted piece with a bonding jumper attached to the metal pole or frame. See Inset B.

7. If Steel pole or frame is painted, bond each separate painted piece with a bonding jumper attached to the metal pole or frame. See Inset B.

8. Bond one of the anchor bolts to the rebar cage with 6 AWG bare stranded copper conductor. Use listed mechanical connectors rated for embedment in concrete. See Inset B.


10. Avoid contact of the service drop and service entrance conductors with the metal pole to the prevention of the insulated conductors.

11. Shop drawings are not required for service support structure unless specifically stated elsewhere or directed by the Engineer.
1. Do not pass luminaire conductors through the signal controller cabinet.

2. Include an equipment grounding conductor in all conduits throughout the electrical system. Bond all exposed metal parts to the grounding conductor.

3. Provide roadway luminaires, when required, in accordance with the material and construction sections of Item 610, "Roadway Illumination Assemblies", except for performance testing of luminaries, test installed roadway luminaries for proper operation as part of the associated traffic signal system test.

4. If internally illuminated street name signs are approved for use, ground the fixture to the pole with a 12 AWG green W/G conductor.

5. Bond anchor bolts to rebar cage in two locations using #3 bars or 6 AWG stranded copper conductors, use listed mechanical connectors rated for embedment in concrete. See TxDOT standard TS-FD for further details.

6. Drift and top signal poles for ½ in. X 13 UNC tank ground fitting, ensure tank ground fitting 4 in. to 6 in. above electrical service entrance. Ensure properly sized hole through the bottom of the enclosure for the service grounding electrode conductor. Connect the electrical service grounding electrode conductor to the tank ground fitting. Ensure electrical service grounding electrode conductor is as short and straight as possible from the enclosure to the tank ground fitting. See Note 7 for further Information. Size service entrance conduit and branch circuit conduit as shown in the plans.

7. Mount electrical service enclosure and never to signal pole with stainless steel bands. Ensure bands are a minimum width of ½ in. Secure enclosures to bands using two bolt brackets, install brackets near top and bottom of each enclosure. Install properly sized stainless steel washers on each bolt in the enclosure, bend or drift and top properly sized stand-off straps to signal pole for supporting conduit.

8. Conduct pull tests and insulation resistance tests on all illumination and power conductors as required in Item 620 "Electrical Conductors" and ED(3) to prevent electronic damage, do not conduct insulation resistance tests on traffic signal cables after termination.

9. Lock all enclosures and bolt down all ground box covers before applying power to the signal installation.

10. Terminate conduits entering the top of enclosures with a conduit-sealing hub or bell and top conduit-sealing hub threaded boss, grounding bushing to the ground bus with a bonding jumper, bond all conduits to the enclosure with red tape where conductor exits weatherhead. Red insulation or color code 6" length of Line 1 or Line 2 conductor's insulation with white tape where conductor exits weatherhead.

11. For all conduits, ensure the burial depth is a minimum of 18". Ensure the minimum burial depth for conduit placed under a roadway is 24".

SIGNAL POLE WITH SERVICE

Type 3 electrical service mounted in signal pole. See electical details, layout sheets, and electrical service data chart for additional details.
### PEDESTAL SERVICE NOTES

1. Manufacture pedestal electrical services in accordance with Departmental Material Specifications (DMS) 11080 "Electrical Services", 11085 "Electrical Services-Pedestal IPS" and Item 628 "Electrical Services." Provide pedestal electrical services in accordance with the Department's Specification on the Department's web site under "Roadway Illumination and Electrical Supplies." Item 628, "Electrical Services-Pedestal IPS," requires all mounting hardware and installation details of services meet utility company specifications. Contact the local utility company for approval of pedestal details prior to installing the electrical pedestal service. Submit all changes required by the utility company prior to manufacturing the pedestal enclosure.

2. When a meter socket is required, provide a socket with a minimum 100 amp rating that complies with local utility requirements.

3. Provide Cross A or C anchors for pedestal service foundations in accordance with Item 420, "Concrete Substructures," except that concrete will not be paid for directly but is considered subsidiary to Item 628.

4. Provide 4" reinforcing steel for foundations in accordance with Item 440, "Reinforcement for Concrete.

5. Install ½ in. X 2 ½ in. minimum length concrete single expansion type anchors for mounting pedestal enclosure to foundation. Anchor location to match mounting holes in each corner of enclosure. Secure each of the four corners of the pedestal enclosure to the anchors in the foundation with ½ in. galvanized or stainless steel machine thread bolt, a properly sized locknut and a flat washer.

6. Finish top of concrete foundation in a neat and workmanlike manner. If leveling washers are used, ensure no more than ½ in. gap in any corner. Do not exceed a maximum 3/4 in. rise in the foundation of ½ in. per foot. When properly installed, ensure the top of the service enclosure is level front to back and side to side within ½ in. Repair rocking or movement of the service enclosure at no additional cost to the department.

7. Do not use liquidtight flexible metal conduit (LFMC) on pedestal type services.

8. Ensure all elbows in the foundation are sized as per utility provider's conduit requirements for underground conduit and feeders. PVC extensions may be installed provided the ends of the rigid metal conduits are more than 2 in. below the top of the concrete foundation. Where extension conduits are metal, grounding bushings must be installed with a bonding jumper properly terminated.

9. Do not use liquidtight flexible metal conduit (LFMC) on pedestal type services.

10. Install anchor bolts in accordance with Departmental Material Specifications (DMS) 11080 "Electrical Services", 11085 "Electrical Services-Pedestal IPS" and Item 628 "Electrical Services." Provide pedestal electrical services in accordance with the Department's Specification on the Department's web site under "Roadway Illumination and Electrical Supplies." Item 628, "Electrical Services-Pedestal IPS," requires all mounting hardware and installation details of services meet utility company specifications. Contact the local utility company for approval of pedestal details prior to installing the electrical pedestal service. Submit all changes required by the utility company prior to manufacturing the pedestal enclosure.

11. Manufacture pedestal electrical services in accordance with Departmental Material Specifications (DMS) 11080 "Electrical Services", 11085 "Electrical Services-Pedestal IPS" and Item 628 "Electrical Services." Provide pedestal electrical services in accordance with the Department's Specification on the Department's web site under "Roadway Illumination and Electrical Supplies." Item 628, "Electrical Services-Pedestal IPS," requires all mounting hardware and installation details of services meet utility company specifications. Contact the local utility company for approval of pedestal details prior to installing the electrical pedestal service. Submit all changes required by the utility company prior to manufacturing the pedestal enclosure.

12. Provide Cross A or C anchors for pedestal service foundations in accordance with Item 420, "Concrete Substructures," except that concrete will not be paid for directly but is considered subsidiary to Item 628.

13. Provide 4" reinforcing steel for foundations in accordance with Item 440, "Reinforcement for Concrete.

14. Install ½ in. X 2 ½ in. minimum length concrete single expansion type anchors for mounting pedestal enclosure to foundation. Anchor location to match mounting holes in each corner of enclosure. Secure each of the four corners of the pedestal enclosure to the anchors in the foundation with ½ in. galvanized or stainless steel machine thread bolt, a properly sized locknut and a flat washer.

15. Finish top of concrete foundation in a neat and workmanlike manner. If leveling washers are used, ensure no more than ½ in. gap in any corner. Do not exceed a maximum 3/4 in. rise in the foundation of ½ in. per foot. When properly installed, ensure the top of the service enclosure is level front to back and side to side within ½ in. Repair rocking or movement of the service enclosure at no additional cost to the department.

16. Do not use liquidtight flexible metal conduit (LFMC) on pedestal type services.

17. Ensure all elbows in the foundation are sized as per utility provider's conduit requirements for underground conduit and feeders. PVC extensions may be installed provided the ends of the rigid metal conduits are more than 2 in. below the top of the concrete foundation. Where extension conduits are metal, grounding bushings must be installed with a bonding jumper properly terminated.

18. Do not use liquidtight flexible metal conduit (LFMC) on pedestal type services.

19. Install anchor bolts in accordance with Departmental Material Specifications (DMS) 11080 "Electrical Services", 11085 "Electrical Services-Pedestal IPS" and Item 628 "Electrical Services." Provide pedestal electrical services in accordance with the Department's Specification on the Department's web site under "Roadway Illumination and Electrical Supplies." Item 628, "Electrical Services-Pedestal IPS," requires all mounting hardware and installation details of services meet utility company specifications. Contact the local utility company for approval of pedestal details prior to installing the electrical pedestal service. Submit all changes required by the utility company prior to manufacturing the pedestal enclosure.

### ELECTRICAL DETAILS

**ELECTRICAL SERVICE SUPPORT PEDESTAL SERVICE TYPE PS**

**SECTION A-A**

**ANCHOR BOLT DETAIL**

**FRONT VIEW**

**SIDE VIEW**

**LEGEND**

1. Meter Socket, when required
2. Meter Socket Window, when required
3. Equipment Mounting Panel
4. Photo Electric Control Window, when required
5. Hinged Deadfront Trim
6. Load Side Conduit Trim
7. Line Side Conduit Area
8. Utility Access Door, with handle
9. Pedestal Door
10. Hinges, Weather Access
11. Control Station (H-O-A Switch)
12. Main Disconnect
13. Branch Circuit Breakers
14. Copper Clad Ground Rod - 5/8" x 10'
CONCRETE SERVICE SUPPORT

GRANITE CONCRETE (GC) & OTHER CONCRETE (OC) NOTES

Ensure electrical service support structures bid as type Granite Concrete (GC) or Other Concrete (OC) meet the following requirements:

1. Provide GC and OC poles that meet the requirements of DMS 11080 "Electrical Services."

2. Provide prestressed concrete poles suitable for direct embedment into the ground without specific foundations.

3. Ensure the pole embedment depth is greater than 60% of the pole length plus 2 feet, whichever is greater.

4. Install a one point rack or eye bolt bracket 6 inches to 12 inches below the weatherhead as an overhead service drop anchoring point for the electric utility.

5. Furnish and install galvanized or stainless steel channel strut 1/2 inch, or 6 inches wide if used as a base of a weatherhead, conductive or non-conductive. Attach channel strut with stainless steel channel and plate (max. 1 inch) or other secure mounting as approved by the Engineer. Ensure bolts are galvanized in accordance with ASTM A153. Do not stack channel strut.

6. When excess length must be trimmed from poles, trim from the top end only.

7. The minimum length, 12 inches, is required. See Electrical Service Data (when required)

CONCRETE SERVICE SUPPORT

SERVICE SUPPORT TYPE TP (O)

6. When excess length must be trimmed from poles, trim from the top end only.

7. The minimum length, 12 inches, is required. See Electrical Service Data (when required)

ELECTRICAL DETAILS

SERVICE SUPPORT TYPES GC, OC & TP

ED(110)-14

Texas Department of Transportation
Traffic Operations Engineering Center
Austin, Texas

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CONCRETE SERVICE SUPPORT

SERVICE SUPPORT TYPE TP (O)

SIDE VIEW

DETAIL A

See Note 7. Before installing channel that has been cut, file sharp edges and paint with non-conductive paint. Ensure there is no point aplastic on the pole.
1. Provide duct cable in accordance with Departmental Material Specification (DMS) 11060 "Duct Cable" and Item 622 "Duct Cable." Provide duct cable as listed on the Material Producer List (MPL) on the Department web site under "Roadway Illumination and Electrical Supplies" Item 622.

2. Provide high-density polyethylene (HDPE) conduit in accordance with DMS 11060 and Item 622 "Conduit." Provide HDPE as listed on the MPL on the Department web site under "Roadway Illumination and Electrical Supplies." Item 622.

3. Supply duct cable with a minimum 2 in. diameter, unless otherwise shown in the plans. Provide duct cable and HDPE conduit as shown by descriptive code or on the plans. Bend duct cable and HDPE conduit as recommended by the manufacturer, with a minimum bending radius of 26 in. For 2 in. duct, follow manufacturer's recommendations when handling duct cable and HDPE conduit reels and during installation of duct cable and HDPE conduit.

4. Do not splice conductors within duct cable or HDPE conduit. Couple duct cable and HDPE entering a ground box or foundation to a PVC elbow. When galvanized steel RMC elbows are called for in the plans and any portion of the RMC elbow is buried less than 18" from possible contact, ground the RMC elbow.

5. Furnish and install duct cable with factory installed conductors, sized as shown in the plans and as required by the National Electrical Code (NEC). The NEC contains specific requirements for duct cable in Articles, "Nonmetallic Underground Conduit with Conductors: Type NUCC."

6. When conduit casing is called for in the plans, extend duct cable or HDPE conduit through the conduit casing in one continuous length without connection to the casing.

7. Seal the ends of duct cable or HDPE conduit with duct seal, expandable foam, or other approved method after completing the pull tests required by Item 622.

8. Provide a minimum cover of 24 in. under roadways, 18 in. in other locations, or as shown on the plans.

9. Furnish and install listed fittings to couple duct cable or HDPE conduit to other types of ducts. Duct cable and HDPE conduit may be field-threaded and gelled with PVC or RMC threaded couplings. Connected with listed field-threaded fittings connected using listed coupling made of HDPE with stainless steel external bonding clamps and locking rings connected with approved electrofusion joint couplings or connected using an approved chemical fusion method using an epoxy or adhesive specifically designed for HDPE. Couplings and connectors are listed in accordance with their manufacturer's instructions. Do not use PVC glue on HDPE. Do not use water pipe fittings, or connect conductors with non SHPIP coupling.

10. Provide duct cable and HDPE conduit as shown by descriptive code or on the plans. Duct cable and HDPE conduit may be field-threaded and spliced with PVC or RMC threaded couplings. Ensure conductors extend into pole base. Do not splice conductors in conduit.

11. Provide duct cable and HDPE conduit in accordance with Departmental Material Specification (DMS) 11060 "Duct Cable" and Item 622 "Duct Cable." Provide duct cable as listed on the Material Producer List (MPL) on the Department web site under "Roadway Illumination and Electrical Supplies" Item 622.

12. Provide high-density polyethylene (HDPE) conduit in accordance with DMS 11060 and Item 622 "Conduit." Provide HDPE as listed on the MPL on the Department web site under "Roadway Illumination and Electrical Supplies." Item 622.

13. Supply duct cable with a minimum 2 in. diameter, unless otherwise shown in the plans. Provide duct cable and HDPE conduit as shown by descriptive code or on the plans. Bend duct cable and HDPE conduit as recommended by the manufacturer, with a minimum bending radius of 26 in. For 2 in. duct, follow manufacturer's recommendations when handling duct cable and HDPE conduit reels and during installation of duct cable and HDPE conduit.

14. Do not splice conductors within duct cable or HDPE conduit. Couple duct cable and HDPE entering a ground box or foundation to a PVC elbow. When galvanized steel RMC elbows are called for in the plans and any portion of the RMC elbow is buried less than 18" from possible contact, ground the RMC elbow.

15. Furnish and install duct cable with factory installed conductors, sized as shown in the plans and as required by the National Electrical Code (NEC). The NEC contains specific requirements for duct cable in Articles, "Nonmetallic Underground Conduit with Conductors: Type NUCC."

16. When conduit casing is called for in the plans, extend duct cable or HDPE conduit through the conduit casing in one continuous length without connection to the casing.

17. Seal the ends of duct cable or HDPE conduit with duct seal, expandable foam, or other approved method after completing the pull tests required by Item 622.

18. Provide a minimum cover of 24 in. under roadways, 18 in. in other locations, or as shown on the plans.

19. Furnish and install listed fittings to couple duct cable or HDPE conduit to other types of ducts. Duct cable and HDPE conduit may be field-threaded and gelled with PVC or RMC threaded couplings. Connected with listed field-threaded fittings connected using listed coupling made of HDPE with stainless steel external bonding clamps and locking rings connected with approved electrofusion joint couplings or connected using an approved chemical fusion method using an epoxy or adhesive specifically designed for HDPE. Couplings and connectors are listed in accordance with their manufacturer's instructions. Do not use PVC glue on HDPE. Do not use water pipe fittings, or connect conductors with non SHPIP coupling.

20. Provide duct cable and HDPE conduit as shown by descriptive code or on the plans. Duct cable and HDPE conduit may be field-threaded and spliced with PVC or RMC threaded couplings. Ensure conductors extend into pole base. Do not splice conductors in conduit.

21. Provide duct cable and HDPE conduit in accordance with Departmental Material Specification (DMS) 11060 "Duct Cable" and Item 622 "Duct Cable." Provide duct cable as listed on the Material Producer List (MPL) on the Department web site under "Roadway Illumination and Electrical Supplies" Item 622.

22. Provide high-density polyethylene (HDPE) conduit in accordance with DMS 11060 and Item 622 "Conduit." Provide HDPE as listed on the MPL on the Department web site under "Roadway Illumination and Electrical Supplies." Item 622.

23. Supply duct cable with a minimum 2 in. diameter, unless otherwise shown in the plans. Provide duct cable and HDPE conduit as shown by descriptive code or on the plans. Bend duct cable and HDPE conduit as recommended by the manufacturer, with a minimum bending radius of 26 in. For 2 in. duct, follow manufacturer's recommendations when handling duct cable and HDPE conduit reels and during installation of duct cable and HDPE conduit.

24. Do not splice conductors within duct cable or HDPE conduit. Couple duct cable and HDPE entering a ground box or foundation to a PVC elbow. When galvanized steel RMC elbows are called for in the plans and any portion of the RMC elbow is buried less than 18" from possible contact, ground the RMC elbow.

25. Furnish and install duct cable with factory installed conductors, sized as shown in the plans and as required by the National Electrical Code (NEC). The NEC contains specific requirements for duct cable in Articles, "Nonmetallic Underground Conduit with Conductors: Type NUCC."

26. When conduit casing is called for in the plans, extend duct cable or HDPE conduit through the conduit casing in one continuous length without connection to the casing.

27. Seal the ends of duct cable or HDPE conduit with duct seal, expandable foam, or other approved method after completing the pull tests required by Item 622.

28. Provide a minimum cover of 24 in. under roadways, 18 in. in other locations, or as shown on the plans.

29. Furnish and install listed fittings to couple duct cable or HDPE conduit to other types of ducts. Duct cable and HDPE conduit may be field-threaded and gelled with PVC or RMC threaded couplings. Connected with listed field-threaded fittings connected using listed coupling made of HDPE with stainless steel external bonding clamps and locking rings connected with approved electrofusion joint couplings or connected using an approved chemical fusion method using an epoxy or adhesive specifically designed for HDPE. Couplings and connectors are listed in accordance with their manufacturer's instructions. Do not use PVC glue on HDPE. Do not use water pipe fittings, or connect conductors with non SHPIP coupling.

30. Provide duct cable and HDPE conduit as shown by descriptive code or on the plans. Duct cable and HDPE conduit may be field-threaded and spliced with PVC or RMC threaded couplings. Ensure conductors extend into pole base. Do not splice conductors in conduit.
BATTERY BOX GROUND BOXES NOTES

A. MATERIALS
1. Provide polymer concrete or fiberglass reinforced plastic (FRP) battery box ground box and cover in accordance with Departmental Material Specification (DMS) 11071 "Battery Box Ground Boxes." Battery box will accommodate up to 3 batteries, each measuring 8 in. x 12.5 in. x 10 in. (W x L x D). Label battery box ground box cover in accordance with DMS 11071.
2. Supply a marine grade batteries with covers. Secure the marine grade batteries with covers to the stainless steel rack in the bottom of the ground box with tie down straps.

B. CONSTRUCTION METHODS
1. Ensure conduit entry will not interfere with placement of the batteries in the battery box ground box.
2. Remove all gravel and dirt from conduit. Cap all conduit prior to placing aggregate and setting battery box ground box. Provide Grade 3 or 4 coarse aggregate as shown on Table 2 of Item 302 "Aggregates for Surface Treatments." Ensure the aggregate bed is in place and is a minimum of 9 in. deep prior to placing the box. Install battery box ground box on top of aggregate.
3. Cast battery box aprons in place. Reinforcing steel may be field bent. Ensure the depth of concrete for the apron extends from finished grade to the top of the aggregate bed under the box. Battery box ground box aprons, including concrete and reinforcing steel, are subsidiary to battery box ground boxes when called for by descriptive code.
4. Bolt covers down when not working in battery box ground boxes. Keep bolt holes in the box clear of dirt.

APRON FOR BATTERY BOX GROUND BOXES

1. Place aggregate under the box and not in the box. Aggregate should not encroach on the interior volume of the box.
2. Install bushing or bell end fitting on the upper end of all ells.
3. Install all conduits in a neat and workmanlike manner.

PLAN VIEW

SECTION A - A

SECTION X-X

SECTION Y-Y

BATTERY BOX TOP VIEW

FIG. 1 A

FIG. 1 B

FIG. 1 C

FIG. 1 D

FIG. 1 E

FIG. 1 F

FIG. 1 G

FIG. 1 H

FIG. 1 I

FIG. 1 J

FIG. 1 K

FIG. 1 L

FIG. 1 M

FIG. 1 N

FIG. 1 O

FIG. 1 P

FIG. 1 Q

FIG. 1 R

FIG. 1 S

FIG. 1 T

FIG. 1 U

FIG. 1 V

FIG. 1 W

FIG. 1 X

FIG. 1 Y

FIG. 1 Z

FIG. 1 AA

FIG. 1 BB

FIG. 1 CC

FIG. 1 DD

FIG. 1 EE

FIG. 1 FF

FIG. 1 GG

FIG. 1 HH

FIG. 1 II

FIG. 1 JJ

FIG. 1 KK

FIG. 1 LL

FIG. 1 MM

FIG. 1 NN

FIG. 1 OO

FIG. 1 PP

FIG. 1 QQ

FIG. 1 RR

FIG. 1 SS

FIG. 1 TT

FIG. 1UU

FIG. 1VV

FIG. 1WW

FIG. 1XX

FIG. 1 YY

FIG. 1 ZZ

FIG. 1AAA

FIG. 1 BBB

FIG. 1 CCC

FIG. 1 DDD

FIG. 1 EEE

FIG. 1 FFF

FIG. 1 GGG

FIG. 1 HHH

FIG. 1 IJJ

FIG. 1 KK

FIG. 1 LL

FIG. 1 MM

FIG. 1 NN

FIG. 1 OO

FIG. 1 PP

FIG. 1 QQ

FIG. 1 RR

FIG. 1 SS

FIG. 1 TT

FIG. 1 UUU

FIG. 1 VVV

FIG. 1 WWW

FIG. 1 XXX

FIG. 1 YYY

FIG. 1 ZZZ

FIG. 1 AAAAA

FIG. 1 BBBB

FIG. 1 CCCC

FIG. 1 DDDD

FIG. 1 EEEE

FIG. 1 FFFF

FIG. 1 GGGG

FIG. 1 HHHH

FIG. 1 IJJJ

FIG. 1 KKK

FIG. 1 LLL

FIG. 1 MMMM

FIG. 1 NNN

FIG. 1 OOO

FIG. 1 PPP

FIG. 1 QQQ

FIG. 1 RRR

FIG. 1 SSS

FIG. 1 TTT

FIG. 1 UUUU

FIG. 1 VVVV

FIG. 1 WWVV

FIG. 1 XXXX

FIG. 1 YYYY

FIG. 1 ZZZZ

FIG. 1 AAAAAA

FIG. 1 BBBBBB

FIG. 1 CCCCCC

FIG. 1 DDDDDD

FIG. 1 EEEEEE

FIG. 1 FFFFFF

FIG. 1 GGGGGG

FIG. 1 HHHHHH

FIG. 1 IJJJJJ

FIG. 1 KKKK

FIG. 1 LLLL

FIG. 1 MMMMM

FIG. 1 NNNN

FIG. 1 OOOO

FIG. 1 PPPP

FIG. 1 QQQQ

FIG. 1 RRRR

FIG. 1 SSSS

FIG. 1 TTTT

FIG. 1 UUUUUU

FIG. 1 VVVVVV

FIG. 1 WWVVVV

FIG. 1 XXXXXX

FIG. 1 YYYYYY

FIG. 1 ZZZZZZ

FIG. 1 AAAAAAA