NOTES:

1. Boxes shall not be installed in roadways or driveways.
2. Boxes shall be on the Approved Product List (APL).
3. Boxes shall be installed flush with the finished grade surface.
4. Fiber optic splice boxes shall be provided with cable hanger racks designed to support cables and splice enclosures. Cost of racks to be included in cost of splice box.
5. Fiber optic boxes shall contain only Fiber Optic Cable, Conduit, and Locate Wire.
6. Conduit center line shall be aligned to top edge of box to facilitate cable pulling.
7. All boxes shall have 1'-0" wide (Min.) concrete apron. Concrete for concrete aprons shall be Class NS with a minimum strength at 28 days of f'c=2.5 Ksi. Aprons shall be sloped away from box. Cost of apron to be included in the cost of each box.
8. Prevent the ingress of Water, Dirt, Sand, and other foreign materials into the conduit prior to, during and after construction using a foam-sealing material, rubber plug, or other device designed for this application.
9. Where multiple pull boxes are placed side by side, maintain at least 8" between the pull boxes.

Rectangular boxes are depicted. Round fiber optic splice boxes and fids are allowed.
**FIGURE A**

Note:
1. Sidewalk patches to match existing joints.
2. Entire sidewalk slab must be replaced when specified in the plans.
3. Backfill and tamp material with material from trench except at driveways. At driveways, backfill a length of trench within the driveway entirely with flowable fill.

---

**FIGURE B**

Note:
1. Trench not to be open more than 250' at a time when construction area is subject to vehicular or pedestrian traffic.
2. Asphalt to be sawcut to leave neat lines at the pavement cut.
3. See note 3 Figure C.

*May be adjusted due to field conditions upon approval of project engineer.

---

**FIGURE C**

Note:
1. Rigid conduit must be used when jacking under existing pavement at 36" minimum depth.
2. Asphalt to be sawcut at the edges of the trench.
3. The removal and replacement of the additional pavement width (6") will not be required when the trench can be constructed without disturbing the asphalt surface on either side.

---

**FIGURE D**

---

**FIGURE E**

---

**FIGURE F**

**FIGURE A**

**PULLBOX ENTRY OF CONDUIT UNDER SIDEWALKS**

Note:
- Ends of conduit shall be sealed in accordance with Section 630 of the Standard Specifications for Road and Bridge Construction.

**FIGURE B**

**SECTION**

**FIGURE C**

**FOR USE UNDER RAILROADS**

* Conduit depth to be at RR requirement but not less 4'.

**GENERAL NOTES:**

1. The contractor, with approval from the Engineer, may adjust the final burial depth of the conduit(s) in order to transverse nonmoveable object conflicts.

2. Backfill with excavated material and compact the soil until firm and unyielding. Remove rock and debris from backfill material.

3. Where conduits are to be installed over existing underground structures (e.g., drain pipes or utility lines) which are less than 30" deep, the contractor shall encase the conduit in 2500 PSI Class I concrete for the entire length of conduit that is installed at a depth of less than 30".

4. If the amount of cover over the encasement is less than 6", the contractor shall install the conduit to pass below the underground structures (e.g., drain pipes).
NOTES:

1. Work with Index 17727 for grounding and span wire details. See the Plans for clamp spacing, cable sizes and forces, signals and sign mounting locations and details.

2. Shop Drawings:
   This Index is considered fully detailed, only submit shop drawings for minor modifications not detailed in the Plans.

3. Materials:
   A. Strain Pole and Backing Rings:
      a. less than 50 ksi: ASTM A1011 Grade 50, 55, 60 or 65
      b. Greater than or equal to 50 ksi: ASTM A572 Grade 50, 55, 60 or 65
      c. ASTM A572 Grade A (55 ksi yield) or Grade B (80 ksi yield)
   B. Steel Plates: ASTM A36
   C. Bolt Metal: ASTM A193
   D. Nuts, Washers and Anchors:
      a. High Strength Bolts, ASTM F3125, Grade A225, Type 1
      b. Nuts: ASTM A325 Grade D HR Hex
      c. Washers: ASTM F136 type 1, one under turned element
   F. Anchor Bolts, Nuts and Washers:
      a. Anchor Bolts: ASTM F1554 Grade 55
      b. Nuts: ASTM A325 Grade A Heavy-Hex (5 per anchor bolt)
      c. Place Washers: ASTM A193 (2 per bolt), Split-lock washers and self-locking nuts are not permitted
   F. Handhole Cover: ASTM A5011 Grade D, 50, 50 or 60
   G. Aluminum Pole Caps and Nut Covers: ASTM B26 (319-H)
   H. Concrete: Class IV (Drilled Shaft) for all environmental classifications.

4. Fabrication:
   A. Pole Taper: Change diameter at a rate of 0.14 inches per foot, round or 12-sided (Min.)
   B. Uplight spirals are not permitted. Transverse welds are only permitted at the base.
   C. Provide bolt hole diameters as follows:
      a. Anchors (except Anchor Bolts): Bolt diameter plus \( \frac{3}{16} \) maximum
      b. Anchor Bolts: Bolt diameter plus \( \frac{1}{2} \) maximum
   D. Locate handhole 180° from 2" wire entrance pipe.
   E. Identification Tag: (Submit details for approval)
      a. T-4 \( \times \) A4 aluminum identification tag
      b. Locate on the Inside of the pole and visible from the handhole.
      c. Secure to pole with \( \frac{\sqrt{2}}{4} \) diameter stainless steel rivets or screws.
   F. Include the following information on the ID Tag:
      1. Financial Project ID
      2. Pole Type
      3. Pole Height
      4. Manufacturers' Name
      5. FY of Steel
      6. Basis Wall Thickness
   F. Identification Tag:
      a. Promote a "U" or "C" hook at the top of the pole for signal wiring support (See Sheet 3). Perform all welding in accordance with Specification Section 460-4.
      b. Hot Dip Galvanize after fabrication
   F. Anchor Bolts, Nuts and Washers:
      a. High Strength Bolts: ASTM F3125, Grade B325, Type 1
      b. Nuts: ASTM A563 Grade DH Heavy-Hex
      c. Washers: ASTM F436 Type 1, one under turned element
   F. Handhole Cover: ASTM A5011 Grade D, 50, 50 or 65

5. Coatings:
   A. All Steel Items: ASTM A123
   B. Stainless Steel Screws: AISI Type 316
   C. Reinforcing Steel: Specification Section 415
   D. Threaded Bars/Studs: ASTM A36 or ASTM A307
   E. Concrete: Class I (Drilled Shaft) for all environmental classifications.

6. Construction:
   A. Foundation: Specification Section 455, except that payment is included in the cost of the strain pole.
   B. After installation, place wire screen between top of foundation and bottom of baseplate in accordance with Specification Section 449-6.
   C. After installation, place wire screen between top of foundation and bottom of baseplate in accordance with Specification Section 449-6.
   D. All Steel Items: ASTM A123
   E. Concrete: Class I (Drilled Shaft) for all environmental classifications.

ELEVATION AND NOTES

STRAIN POLE ASSEMBLY

STEEL STRAIN POLE

INDEX NO. 17723

SHEET NO. 1 of 3

DESIGN STANDARDS

FY 2017-18

11/01/16

REV. 1 0/01/16

DESCRIPTION:

10/14/2016

11:47:16 AM

REV NO.

INDEX NO.

SHEET NO.
POLE ASSEMBLY

NOTES:
1. Clamps have been sized for Design Load Blocks shown in the Clamp Thickness Table, and a Maximum Pole Diameter at the Clamp location of 2'-1". Use one clamp per cable.
2. Install a properly sized Weather Head, fastened securely to the standard pipe for each pole location. At locations other than the wire entrance, the Weather Head Face is to be left closed to outside atmosphere. Wire entrance installed per Index 17727.
3. Any combination of Option 'a' or 'b' may be used provided both lifting and wiring is accommodated.

CLAMP THICKNESS TABLE

<table>
<thead>
<tr>
<th>Cable Diameter (in)</th>
<th>Minimum Breaking Strength (kip)</th>
<th>Plate Thickness (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2/16</td>
<td>25</td>
<td>7/8</td>
</tr>
<tr>
<td>3/8</td>
<td>37.5</td>
<td>7/8</td>
</tr>
<tr>
<td>5/16</td>
<td>50</td>
<td>7/8</td>
</tr>
</tbody>
</table>

1. Clamps have been sized for Design Load Blocks shown in the Clamp Thickness Table, and a Maximum Pole Diameter at the Clamp location of 2'-1". Use one clamp per cable.

2. Install a properly sized Weather Head, fastened securely to the standard pipe for each pole location. At locations other than the wire entrance, the Weather Head Face is to be left closed to outside atmosphere. Wire entrance installed per Index 17727.

3. Any combination of Option 'a' or 'b' may be used provided both lifting and wiring is accommodated.

---

Catenary and Messenger Wire Clamps

<table>
<thead>
<tr>
<th>Handhold Frame</th>
<th>Tack Weld Cover Clip</th>
<th>11 Gage Handhole Cover</th>
<th>1/2&quot; Stainless Steel Hex Head Screw (Typ.)</th>
<th>Weather Head (See Note #2)</th>
<th>2&quot; NPS, Sch. 40 Pipe</th>
<th>2 1/4&quot; Bolt For 2&quot; (Nominal) Ø Sch. 80 Pipe 20' Long, ASTM A500 Grade B</th>
<th>Steel Clamp, ASTM A500 Grade 50 (See Table For Thickness)</th>
<th>(See Note #1)</th>
</tr>
</thead>
</table>

Handhold Frame | Tack Weld Cover Clip | 11 Gage Handhole Cover | 1/2" Stainless Steel Hex Head Screw (Typ.) | Weather Head (See Note #2) | 2" NPS, Sch. 40 Pipe | 2 1/4" Bolt For 2" (Nominal) Ø Sch. 80 Pipe 20' Long, ASTM A500 Grade B | Steel Clamp, ASTM A500 Grade 50 (See Table For Thickness) | (See Note #1) |

Handhold Frame | Tack Weld Cover Clip | 11 Gage Handhole Cover | 1/2" Stainless Steel Hex Head Screw (Typ.) | Weather Head (See Note #2) | 2" NPS, Sch. 40 Pipe | 2 1/4" Bolt For 2" (Nominal) Ø Sch. 80 Pipe 20' Long, ASTM A500 Grade B | Steel Clamp, ASTM A500 Grade 50 (See Table For Thickness) | (See Note #1) |

---

HANDHOLE

WIRE ENTRANCE DETAIL

POLE TOP

ATTACHMENT DETAILS

DESIGN STANDARDS

FY 2017-18

STEEL STRAIN POLE
GENERAL NOTES:

1. Work these Index drawings with the Strain Pole Schedule in the Plans.
2. Shop Drawings: This Design Standard is considered fully detailed and no shop drawings are necessary.
3. Materials:
   A. Concrete: 
      - Class V Special or Class VI
   B. Prestress Strands & Spiral Reinforcing: 
      - Specification Section 641
   C. Hand and coupler cover plates: 
      - Non-corrosive material
   D. Screws:
      - Round headed, chrome plated
4. Fabrication:
   A. Pole Taper for pole width, strands, reinforcing and void: 0.081 in/ft per face.
   B. Concrete: 
      - Super-T minimum
   C. Spiral Reinforcing: As shown, plus one turn for splices and two turns at both the tip and butt ends of the pole.
   D. The design dimensions for Front Face (FF) and Back Face (BF) of the poles may vary transversely from the section shown by ± ¼" to assist with removal from forms. Balance addition and subtraction of pole dimensions to maintain section areas shown.
   E. Tie ground wires to the interior of reinforcing steel to prevent displacement during concreting operations.
   F. Cut the tip end of the prestressed strand first or simultaneously with the butt end.
   G. Provide cover plates and screws for hand hole and couplers. Attach cover plates to the poles using lead anchors or embedded threaded inserts.
   H. Provide aluminum identification tags on the poles with the following information:
      - Financial Project ID:
      - Pole Manufacturer:
      - Standard Pole Type Number:
      - Pole Length (L)
5. Support locations are for strand release, storage, lifting and transport. Keep BF oriented downward until final erection.
6. Pick-up and support locations shown may vary within a tolerance of ±3°.
7. Two point attachment: provide an eye bolt hole for the messenger wire.
8. Tether Wire: When required, field-drill the eyebolt hole prior to installation.
SERVICES POLE P-IIA (12 Ft.) & P-IIB (36 Ft.) ELEVATION
(Strands Not Shown)

PEDESTAL POLE P-IIC (12 Ft.) ELEVATION
(Strands Not Shown)

NOTE:
- Prestressed Strand: 0.5 in. – 24 kips Before Transfer or 0.75 in. – 14 kips Before Transfer (4 strands total)

STRAND LEGEND
- Optional for Pole P-IIA

TIP END SECTION (TOP)

SECTION A-A
(Typical Square Section)
Spiral reinforcing elevation
(Strands, Holes, and Fixtures Not Shown)

Pole Elevation
(Strands and Reinforcing Not Shown)

Tip End Section (Top)
(For Dormant Strand Locations, See Section A-A)

Section A-A
(Typical Square Section)

Notes:
Strands shown are continuous from Tip End to Butt End.
Elevation view scale is exaggerated vertically for clarity.
For final erection, tilt pole upright with single point attachment located a distance 12.5% L from the Tip End.
* Dimension may vary from 3/8" to 4" to accommodate smaller radius of optional stepped (PVC) void. The void diameter shall not be less than 4".

Strain Pole Type P-V
SPRAL REINFORCING ELEVATION
(Strands, Holes, and Fixtures Not Shown)

POLE ELEVATION
(Strands and Reinforcing Not Shown)

NOTES:

Strands shown are continuous from Tip End to Butt End.
Elevation view scale is exaggerated vertically for clarity.
For final erection, tilt pole upright with single point attachment located a distance 10% L from Tip End.

- Dimension may vary from 3' to 4½" to accommodate smaller radius of optional stepped (PVC) void. The void diameter shall not be less than 6½".

STRAND LEGEND

- Prestressed Strand 0.5 in. = 31 kips Before Transfer (8 strands total)
- Dormant Strand 0.5 in. (4 strands total)
  One 24" Splice Allowed Per Strand

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STRAIN POLE TYPE P-VI
**NOTES:**

1. Use only span wire mounting assemblies listed on the APL. For specific details and requirements, see the vendor drawings on the APL.

2. With the approval of the resident engineer, the service head hole for joint use poles may be drilled by the utility company at an angle of 90° but not less than 45° to the face of the pole.

3. Lashing wire should normally be used for distances of 12' or greater.

4. All hardware for signal attachment shall be stainless steel.

5. Hole for eye bolt will require field reaming for 1" & 1½" eye bolts.

6. Meet all grounding requirements of Specification 620.

---

**LOAD:** 4" x 12" x 12" Min.
**Notes:**

1. With the approval of the resident engineer, the service head hole for joint use poles may be drilled by the utility company at an angle of 90° but not less than 45° to the face of the pole.

2. Use only span wire mounting assemblies listed on the APL.
AERIAL INTERCONNECT FIGURE "8"

Notes:
1. The messenger wire of the interconnect cables shall be grounded to the copper ground wire of the pole or to the external wire extending down the pole.
2. When utilizing the external ground wire to the pole, a piece of 1/2" conduit shall extend up the pole externally to a point 8' above finish grade to provide grounding for the messenger wire to the ground rod.
3. Locking cable ties or lashing wire when used shall be placed no further than 12' apart except at the point of cable drop or terminations where one (1) shall be placed at the point where the cables separate from the messenger wire and another placed 6' (max) from that tie. When using Figure "8", interconnect cable only the locking cable ties shall be used.
4. If accessible the internal ground wire of the support pole may be used to ground the messenger wire.
5. Lashing wire should normally be used for distances of 12' or greater.
6. Meet all grounding requirements of Section 620 of the Standard Specifications.
**NOTES:**

1. The lightning arrester can be located on the side or bottom of the service disconnect enclosure at the Contractor's option.
2. Liquidtight flexible conduit is approved for use from the electrical disconnect to the cabinet when both are installed on the same pole.
3. Bond all elements together to form an Intersection Grounding Network in accordance with Section 620 of the Department's current Standard Specifications for Road and Bridge Construction. The bond wire shall be run in conduit with the Electrical Service Wire or Signal Cable.
4. Meet all grounding requirements of Section 620 of the Standard Specifications.
5. The Service Disconnect shall be lockable by padlock and four keys provided to the maintaining agency. The door shall have a minimum of three hinges and be lockable. No screws to be used to attach door.
6. The Service Disconnect shall be Nema 3R or better.
### ARM AND BASE PLATE

<table>
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<tr>
<th>Arm ID</th>
<th>Arm Ext Length (ft)</th>
<th>Total Arm Length (ft)</th>
<th>Arm</th>
<th>Arm Extension</th>
<th>Base Plate</th>
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#### NOTE:
1. Work this Index with Index 17746.

### POLE, BASE PLATE AND ARM CONNECTION

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<tr>
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</tr>
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</table>

### DRILLED SHAFT

Drilled Shaft ID:  
- DS/12/4.0  
- DS/12/4.5  
- DS/14/4.0  
- DS/14/4.5  
- DS/16/4.5  
- DS/16/5.0  
- DS/20/5.0  

### LUMINAIRE AND CONNECTION

Luminaire and Connection:  
- LA  
- LB  
- LC  
- LD  
- LE  
- LF  
- LG  
- LH  
- LJ  
- LK  
- LL  
- LS  

| LA (ft) | LB (ft) | LC (ft) | LD (in) | LE (in) | LF (in) | LG (in) | LH (in) | LJ (in) | LK (in) | LL (in) | LS (in) | US (in) |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 30      | 10      | 3       | 0.125   | 0.5     | 0.5     | 0.75    | 0.25    | 0.25    | 0       | 37.5    | 0       | 0       |
NOTE:
1. Install the ‘Slip Joint’ splice with a tight fit and no change in the Mast Arm taper due to the splice.
2. Details shown on this sheet are for 12 sided pole sections. However, sections with more than 12 sides and round sections are permitted provided outside diameter and wall thickness are not reduced.
3. Match mark the Arm and Connection Plates to ensure proper assembly and the seam weld is in the proper location (seam located at the bottom side of the Arm).
DOUBLE ARM CONNECTIONS & SPLICE DETAILS

1. Install the 'Slip Joint' splice with a tight fit and no change in the Mast Arm taper due to the splice.

2. Details shown on this sheet are for 12 sided pole sections. However, sections with more than 12 sides and round sections are permitted provided outside diameter and wall thickness are not reduced.

3. Match mark the Arm and Connection Plates to ensure proper assembly and the seam weld is in the proper location (seam located at the bottom side of the Arm).

4. 'UF' measured counter clockwise from § First Mast Arm Extension.

5. Adjust width of top and bottom Connection Plates to maintain minimum clearance shown.

NOTE:

1. Install the 'Slip Joint' splice with a tight fit and no change in the Mast Arm taper due to the splice.

2. Details shown on this sheet are for 12 sided pole sections. However, sections with more than 12 sides and round sections are permitted provided outside diameter and wall thickness are not reduced.

3. Match mark the Arm and Connection Plates to ensure proper assembly and the seam weld is in the proper location (seam located at the bottom side of the Arm).

4. 'UF' measured counter clockwise from § First Mast Arm Extension.

5. Adjust width of top and bottom Connection Plates to maintain minimum clearance shown.
**Mast Arm Assembly**

**Notes:**
1. Luminaire type and luminaire length may be found in the Lighting Plans.
2. Align Luminaire Arm with Single Mast Arm or First Arm of Double Mast Arm unless indicated otherwise in the plans.
3. The fabricator may substitute a 1/2" thick bent plate with the same flange width, height, and length as the MC 10x33.6 Channel section.
4. "L" measure counter clockwise from First Mast Arm.

**Section H-H**

**Section I-I**

**Luminaire Arm and Connection Details**

**Luminaire Connection Elevation**

**Luminaire Elevation**

**Luminaire Orientation**

**Luminaire Arm and Connection Details**
NOTES:

1. Handhole covers may be omitted when Terminal Compartment is provided.

2. Terminal Compartment is optional. See Mast Arm Tabulation to see if required and for locations.

3. Terminal Compartment Frame Height 2'-0" minimum to 2'-6" maximum. Align bottom of Terminal Compartment a minimum of 1" below the bottom of the Handhole Frame.

4. Any combination of Option 'a' or 'b' may be used, provided both lifting and wiring is accommodated.

---

**Cover**
- 11 Gage Mast Arm Handhole Cover
- Thick Std. Mast Arm Cover Clip (Typ.)
- Tack Welded Cover Clip (Typ.)
- Threaded Hole For 5/8" Hex Head Screw (Typ.)

**Frame**
- Mast Arm Handhole Frame
- 5/8" Ø Stainless Steel Hex Head Screw (Typ.)
- Full Penetration Weld

**Section J-J**
- Tack Welded Cover Clip (Typ.)
- Partial Penetration Weld

**Section K-K**
- 11 Gage Handhole Cover
- Tack Welded Cover Clip (Typ.)
- Full Penetration Weld

**POLE TOP**
- Flat Washer
- 5/8" Min. Bolt
- Pole Cap Plate
- 1 1/2" Thick
- Center Of Pole, Pole Cap And Lifting Bar
- 1/2" x 2" Lifting Bar With (Bolt Size + 5/8") Hole And Matching Nut Tack Welded To Underside Of Bar
- 1/2" Overhang (Min.)
- Lifting Bar
- Nut
- 1" Min.

**CUT-AWAY (Option 'a')**
- 1/2" Ø Commercial Grade Hot Rolled Bar Welded To Inside Of Pole
- Stainless Steel Screw (Typ.) (3 Req'd.)
- Cast Aluminum Pole Cap Plate
- 1/2" Min. Thick

**CUT-AWAY (Option 'b')**
- 1" Ø Hook For Wiring And Lifting. 1/2" Ø Commercial Grade Hot Rolled Bar Welded To Inside Of Pole

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**HANDHOLE AND POLE TOP DETAILS**

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**MAST ARM ASSEMBLIES**

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**INDEX NO.**

---

**SHEET NO.**

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**DESCRIPTION:**

**FY 2017-18 DESIGN STANDARDS**

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**LAST REV: 01/01/16**

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**REV: 01/01/16**

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**REV: 01/01/16**

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**REV: 01/01/16**

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1. Free-swinging, internally-illuminated street signs shall only be installed on the signal pole for span wire assemblies. For mast arm assemblies, the street sign may be installed on the arm or pole.

2. Free-swinging, internally-illuminated street signs shall meet the requirements of Section 700 of the Standard Specifications for Road and Bridge Construction.

3. Pole attachments and cantilever arm (or truss) assemblies may be accepted by Contractor certification provided the signs being supported meet the weight and area limitations included in Section 700 for "Acceptance by Certification".

4. Pole attachments and cantilever arm (or truss) assemblies supporting signs not meeting the weight or area limitations included in Section 700 for "Acceptance by Certification" require the submission of structural calculations and Shop Drawings that have been prepared by and sealed by the Specialty Engineer.
NOTES:
1. As an option, pedestrian signals may be installed on concrete poles and pedestals using lead anchors (two bolts same size per hub) in lieu of the stainless steel bands.
2. Repair drilled or punched holes in galvanized steel poles or pedestals in accordance with Specifications 562. Install grommets or bushings in each hole.
3. Meet grounding requirements of Specifications 620.
4. See APL for Department-approved Pedestrian Signal Assemblies and hardware.
5. Construct footing with Class I Concrete, footing may be Cast-In-Place (CIP) or Precast.
6. For Steel Strain Poles see Index 17723.
7. For Prestressed Concrete Poles see Index 17725.
8. Install 4-½” x 18” Anchor Bolts With Double Nuts (ASTM F1554 Grade 55)
9. Meet the requirements of Specifications 646 for aluminum poles and transformer bases.
**TWISTED PAIR AND LOOP LEAD-IN INSTALLATION WITH CURB & GUTTER**

**ALTERNATIVE 1**
Drill A Hole Through The Curb At The Point Where The Required Saw-Cut Depth Is Obtained Just Prior To Cutting The Top Inside Edge Of The Curb. Slide A Section Of Flexible Conduit At Least 6" Into The Hole From The Back Side Of The Curb But Not Within 2" Of The Top Of The Hole. The Conduit Shall Be Butt Jointed Within The Drilled Holes. Fill The Hole With Loop Sealant To The Level Of The Surface. A Nonmetallic Material Should Be Used To Prevent Excessive Loop Sealant From Entering The Flexible Conduit.

**ALTERNATIVE 2**
Drill A Hole 1" To 1" Larger In Diameter Than The Rigid Conduit To Be Used Through The Roadway Asphalt (or Concrete) Surface And Base At An Appropriate Angle To Intercept The Trench Or Pull Box Hole. Place A Predetermined Length Of Rigid Conduit In The Hole And Drive The Conduit Into The Trench Or Hole. Install A Molded Bushing (Nonmetallic) On The Roadway End Of The Rigid Conduit. The Top Of The Rigid Conduit Shall Be Approximately 2" Below The Roadway Surface. Fill The Hole With Loop Sealant To The Level Of The Roadway Surface. A Nonmetallic Material Should Be Used To Prevent Excessive Loop Sealant From Entering The Rigid Conduit.

**NOTE:**
Other alternatives may be approved by the State Traffic Operations Engineer.

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**TWISTED PAIR AND LOOP LEAD-IN INSTALLATION WITHOUT CURB & GUTTER**

Cut A Slot In The Edge Of The Roadway Of Sufficient Size And Depth To Snugly Place The End Of The Flexible Conduit. The End Of The Conduit Shall Be At Least 6" Into The Roadway And approximately 2" Below The Top Of The Roadway Surface. The Departure Angle Of The Conduit From The Roadway Shall Be 30° To 45°.

**GENERAL NOTES**
1. If the loop lead-in is 75' or less from the edge of the loop detector to controller cabinet, continue the twisted pair to the cabinet. If the loop lead-in is greater than 75' continue the twisted pair to the specified pullbox, splice to shielded lead-in wire and continue to the controller cabinet.
2. The width of all saw cuts shall be sufficient to allow unforced placement of loop wires or lead-in cables into the saw cut. The depth of all saw cuts, except across expansion joints, shall be 1' with a maximum of 6'.
3. On resurfacing or new roadway construction projects, the loop wires and lead-in cables will be installed in the asphalt structural course prior to the placement of the final asphalt wearing course. The loop wires and lead-in cables shall be placed in a saw cut in the structural course. The depth of the saw cuts below the level of the final surface shall comply with note 2.
4. A nonmetallic hold down material shall be used to secure loop wires and lead-in cables to the bottom of saw-cuts. Hold down material shall be placed at approximately 12" intervals around loops and 24" intervals on lead-ins.
5. The maximum distance between the twisted pairs of loop lead-in wire is 6' from the loop to 12' from the pavement edge or curb.
6. Splice Connections In pull boxes with UL listed, watertight, insulated enclosures. Place one enclosure over the end of each conductor and place a third enclosure over the exposed end of the shielded cable. As an alternate, a larger diameter enclosure that will accommodate both the splices of the conductors and the exposed end of the shielded cable may be used.
7. As an alternate, a larger diameter enclosure that will accommodate both the splices of the conductors and the exposed end of the shielded cable may be used.
8. The maximum area of asphalt to be disturbed shall be 6'x 6'. This area shall be restored as directed by the Engineer.

**NOTE:**
Other alternatives may be approved by the State Traffic Operations Engineer.
Loop lead-in wires should not be installed in the same pull box with signal power cable.

1. The "number of turns" indicated at the specified point on the loop refers to the number of passes of loop wires which are placed in the saw-cut forming the complete loop.
2. Loop types or details not drawn to scale.
3. Loop Types are centered in a single lane except Type E which is centered on two lanes.
4. The number of individual loops in the Type G loop may vary up to a maximum of four (4).
5. Lead-in may be connected to either end of loop.
6. The leading edge of loop Types A, C, D, & F may extend past the stop line a maximum of 10'. The length of these loops may be extended to a maximum of 60'. Each intersection should be individually designed and if the modifications noted above is required it must be noted or detailed in the plans.
7. Loop lead-in wires should not be installed in the same pull box with signal power cable.
**Note To Designers:**

The designer should ensure the distance to the Push Button in Figure A & B is maintained. This distance can vary depending on post or pedestal type or whether a frangible base is used and sidewalk configuration. This is specified to meet Americans with Disabilities Act.

1. Payment for sign is included in the price for the pedestrian detector.
2. Signs shall be mounted above detectors, explaining their purpose and use.
3. The positioning of pedestrian push button should clearly indicate which crosswalk signal is actuated by each push button.
4. Push buttons and signs are to be mounted in accordance with Standard Specifications, section 665.
5. Meet all grounding requirements of Section 670 of the Standard Specifications.
6. A 3' x 4' maneuvering area is required on each push button.

**Notes:**

1. Use FTP 25-06, or FTP 26-06, or FTP 68A-06, or FTP 68B-06.
2. Conduit Grade.
4. Pedestrian Actuated Signal Sign (See FIGURE D).
5. Concrete Pedestal.
6. 4" Aluminum Pedestal.
7. Pedestrian Actuated Signal Sign (See FIGURE D).
8. Metal Strain Pole.
9. Pedestrian Actuated Signal Sign (See FIGURE D).
11. Concrete Strain Pole.
13. Pedestrian Actuated Signal Sign (See FIGURE D).
14. Transformer Base.
15. Anchor Bolts.
16. Load Anchor Bolts.
17. 6' Aluminum Pedestal.
18. Pull Button.
19. Pedestrian Actuated Signal Sign (See FIGURE D).
20. Concrete Pedestal.
21. Pedestrian Actuated Signal Sign (See FIGURE D).
22. Concrete Pedestal.
23. Pedestrian Actuated Signal Sign (See FIGURE D).
24. Concrete Pedestal.
25. Pedestrian Actuated Signal Sign (See FIGURE D).
NOTE:
1. Refer to the MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES Figure 2B-26 Pedestrian Signs. The STANDARD HIGHWAY SIGNS MANUAL (English) Sign R10-3b for Text Size, Spacing and Symbol size. Also see DESIGN STANDARDS Index 17353 for details of FTP signs.
**METAL POLE**

**POLE MOUNTED CABINET**

- Pole Plate With Steel Band or Lead Anchors and Bolts
- Pulling Elbow Type LB

**CONCRETE POLE**

**POLE MOUNTED CABINET**

- Pole Plate With Steel Band or Lead Anchors and Bolts
- Pulling Elbow Type LB

- When a pole mounted cabinet is specified the 2½" hole for the cabinet shall be field drilled.

**WOOD POLE**

**POLE MOUNTED CABINET**

- Pole Plate With Steel Band or Lead Anchors and Bolts
- Pulling Elbow Type LB

**POLE MOUNTED**

**BASE MOUNTED**

**INTERCONNECT JUNCTION BOX**

**Notes:**

1. The number, size and orientation of conduit sweep will vary according to site condition or locations. Two spare 2" PVC conduits shall be provided in all bases. The spares shall exit in the direction of the center rear of the cabinet base, into a pullbox and capped with a weatherproof fitting. If obstructions prevent the spare conduit from exiting to the rear, or the rear of the cabinet is located on the R/W line, a side exit of the spare conduit will have to be approved by the project engineer. All spare conduit sweeps shall be capped with a weatherproof fitting.

2. Meet all grounding requirements of the Standard Specifications 678.

3. New Controller Cabinet installation shall meet the requirements of the Standard Specifications 676.

**NEW CONTROLLER CABINET**

- Service Slab (Slope ½" To 1" For Drainage) Not Required In Sidewalk Or Pavement Areas Or Where R/W Is Restricted
- 1" Chamfer
- 4" Max.
- 39" Max.
- Pull Box
- Conduit
- Ground Line Or Grade

**EXISTING CONTROLLER CABINET**

- Transfer Switch
- 24"
- 4" Min.
- Ground Line Or Grade

**Notes:**

1. Existing controller cabinets to be retrofitted shall meet the requirements of the Standard Specifications 678.

2. The signalized intersection controller cabinet retrofit installation procedures are located at: http://www.fdot.gov/Traffic/Doc_Library/Doc_Library.shtm For Generator Power for Signalized Intersection
Vehicle movements & signal head number assignments are not directionally oriented but shall maintain their relative orientation about the intersection (I.E., movements 7 and 4 are always to the right of movements 1 and 6 etc.).

**LEGEND**

1. Vehicle Movement Number
2. Pedestrian Movement Number
3. Timing Function Number
4. Phase Number
5. Green Arrow (Left or Right)
6. Red Arrow
7. Yellow Arrow

**SIGNALIZED INTERSECTION**

Vehicle movements & signal head number assignments are not directionally oriented but shall maintain their relative orientation about the intersection (I.E., movements 7 and 4 are always to the right of movements 1 and 6 etc.).

**SIGNAL CLEARANCE TABLE**

(Blank Indicates No Clearance Required)

<table>
<thead>
<tr>
<th>From</th>
<th>R</th>
<th>G</th>
<th>WALK</th>
<th>DON'T WALK</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Major Street**

**Minor Street**

**SIGNAL INDICATIONS**

- Walk
- Don't Walk
- Flash
- Green Arrow (Left or Right)
- Red Arrow
- Yellow Arrow

**STANDARD SIGNAL OPERATING PLANS**

**FY 2017-18 DESIGN STANDARDS**

**INDEX NO. 17870 SHEET NO. 1 of 2**

**REVISION NO.**

**REV IS IO N**

**DESCRIPTION:**

**LAST REVISION 07/01/05**
From Normal Operation (Dwell)  To Normal Operation (Track Clearance)  From Normal Operation (Dwell)  To Normal Operation (Track Clearance)  From Normal Operation (Dwell)  To Normal Operation (Track Clearance)  HIGH VOLUME

LOW VOLUME

NOTE: Only Ø2 or Ø4 Used, Not Both To Obtain ABC, or ACB Operation.

NOTE: Only Ø2 or Ø4 Used, Not Both To Obtain ABC, or ACB Operation.
1. The location of flashing warning devices and stop lines shall be established based on future (or present) installation of gate with appropriate track clearances.

2. Where plans call for railroad traffic control devices to be installed in curbed medians, the minimum median width shall be 12'-6".

3. Location of railroad traffic control device is based on the distance available between face of curb & sidewalk. 0 to 6'- Locate device outside sidewalk. Over 6'- Locate device between face of curb and sidewalk.

4. Stop line to be perpendicular to edge of roadway, approx. 15' from nearest rail; or 8' from and parallel to gate when present.

5. When a cantilevered-arm flashing warning device is used, the minimum vertical clearance shall be 12'-6" from above the Crown of Roadway to the Lowest Point of the Overhead Signal Unit.

**NOTES:**

- **Type I:**
  - For 2 lane roadways, one back-to-back flashing signal unit per crossing.
  - Minimum vertical clearance 5'-0".

- **Type II:**
  - For 2 lane roadways, one back-to-back flashing signal unit per crossing.
  - Minimum vertical clearance 5'-0".

- **Type III:**
  - For 2 lane roadways, one back-to-back flashing signal unit per crossing.
  - Minimum vertical clearance 5'-0".

- **Type IV:**
  - For 2 lane roadways, one back-to-back flashing signal unit per crossing.
  - Minimum vertical clearance 5'-0".

- **Type V:**
  - For 2 lane roadways, one back-to-back flashing signal unit per crossing.
  - Minimum vertical clearance 5'-0".

**TRAFFIC CONTROL DEVICES FOR CURBED ROADWAY**

**SIGNAL PLACEMENT AT RAILROAD CROSSING**

(2 LANES, CURB & GUTTER)
**NOTES:**

1. When computing pavement message, quantities do not include traverse lines.

2. Placement of W10-1 in a residential or business district where low speeds are prevalent, the W10-1 sign may be placed a minimum distance of 100' from the crossing. Where street intersections occur between the RR pavement message and the tracks, an additional W10-1 sign and additional pavement message should be used.

3. A portion of the pavement markings symbol should be directly opposite the W10-1 sign.

4. Recommended location for FTP-61-06 or FTP-62-06 signs, 100' urban and 300' rural. See Index 17355 for sign details.

5. Gate Length Requirements:
   - For Two-way undivided sections: The gate should extend to within 1' of the center line. On multiple approaches the maximum gate length may not reach to within 1' of the center line. For those cases, the distance from the gate tip to the inside edge of pavement is a maximum of 4'.
   - For one-way or divided sections: The gate shall be of sufficient length such that the distance from the gate tip to the inside edge of pavement is a maximum of 4'.

### SPEED LIMITS (mph)

<table>
<thead>
<tr>
<th>Speed</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>400</td>
</tr>
<tr>
<td>55</td>
<td>325</td>
</tr>
<tr>
<td>50</td>
<td>250</td>
</tr>
<tr>
<td>45</td>
<td>175</td>
</tr>
<tr>
<td>40</td>
<td>125</td>
</tr>
<tr>
<td>35</td>
<td>100</td>
</tr>
<tr>
<td>URBAN</td>
<td>85 M.</td>
</tr>
</tbody>
</table>

**Index No.:**

17882

**Sheet No.:**

3 of 4
**RAILROAD GATE ARM LIGHT SPACING**

<table>
<thead>
<tr>
<th>Specified Length Of Gate Arm</th>
<th>Dimension &quot;A&quot;</th>
<th>Dimension &quot;B&quot;</th>
<th>Dimension &quot;C&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>14 Ft.</td>
<td>6&quot;</td>
<td>30&quot;</td>
<td>5</td>
</tr>
<tr>
<td>15 Ft.</td>
<td>7&quot;</td>
<td>30&quot;</td>
<td>5</td>
</tr>
<tr>
<td>16-17 Ft.</td>
<td>8&quot;</td>
<td>30&quot;</td>
<td>5</td>
</tr>
<tr>
<td>18-19 Ft.</td>
<td>9&quot;</td>
<td>45&quot;</td>
<td>7</td>
</tr>
<tr>
<td>20-23 Ft.</td>
<td>10&quot;</td>
<td>45&quot;</td>
<td>7</td>
</tr>
<tr>
<td>24-28 Ft.</td>
<td>11&quot;</td>
<td>48&quot;</td>
<td>12</td>
</tr>
<tr>
<td>29-33 Ft.</td>
<td>12&quot;</td>
<td>48&quot;</td>
<td>12</td>
</tr>
<tr>
<td>32-36 Ft.</td>
<td>13&quot;</td>
<td>48&quot;</td>
<td>12</td>
</tr>
<tr>
<td>35-37 Ft.</td>
<td>14&quot;</td>
<td>48&quot;</td>
<td>12</td>
</tr>
<tr>
<td>38 Ft. And Over</td>
<td>16&quot;</td>
<td>10&quot;</td>
<td>10</td>
</tr>
</tbody>
</table>

**NOTE:**

**MEDIAN SIGNAL GATES FOR MULTILANE UNDIVIDED URBAN SECTIONS**
(THREE OR MORE DRIVING LANES IN ONE DIRECTION, 45 MPH OR LESS)
Variable Time Traffic Control Devices for Movable Span Bridge Signals

**NOTES:**

1. A bypass switch shall be installed to override each timing interval in case of a malfunction.
2. *STOP HERE ON RED* is omitted in Type I operation and *TRAFFIC SIGNALS* are omitted in Type II operation.
3. The time between beginning of flashing yellow on *Drawbridge Ahead* sign and the clearance of traffic signal to red, or beginning of flashing red, should not be less than the travel time of a passenger car, from the sign location to the stop line, traveling at the 85 percentile approach speed.
4. Beginning of operation of drawbridge gates shall not be less than 15 seconds after steady red, or 20 seconds after flashing red (actual time may be determined by the bridge tender).
5. Time of gate lowering and raising is dependent upon gate type.
6. Time of bridge opening is determined by the bridge tender.
7. Each gate shall be operated by a separate switch.
8. On each approach (Type II), all four red signals shall be on the same two circuit flashers, with the two top signals on one circuit, and the two bottom signals on the alternately flashing circuit.
9. A Drawbridge Ahead sign is required for both types of signal operation. However a flashing beacon shall be added to the sign when physical conditions prevent a driver traveling at the 85% approach speed from having continuous view of at least one signal indication for approximately 10 seconds.
10. Requirements on gate installation are contained in Section 4I of the *Manual on Uniform Traffic Control Devices*.
11. In accordance with Traffic Engineering Manual (Topic Number 750-000-005) Section 2.1, "Slippery When Wet Signs" shall be placed in advance of all MOVABLE and NONMOVABLE STEEL DECK BRIDGES. *(See Note 3)*

**SEQUENCE CHART**

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**LEGEND:**

- **TRAFFIC SIGNALS**
- **DRAWBRIDGE SIGN**
- **DRAWBRIDGE AHEAD SIGN**
- **STOP HERE ON RED SIGN**
- **ENTRANCE GATE**
- **EXIT GATE**
- **24" THERMOPLASTIC STOP BAR**

---

**TYPICAL BRIDGE MOUNTS**

**TYPE I**

TO BE USED WHERE BRIDGE OPERATORS ARE FULL TIME OR A DAILY BASIS.

**TYPE II**

TO BE USED WHERE TYPE I IS NOT APPLICABLE (USUALLY WHEN THE BRIDGE OPERATOR IS "ON CALL")

---

**NOTES:**

- A bypass switch shall be installed to override each timing interval in case of a malfunction.
- "STOP HERE ON RED" is omitted in Type I operation and "TRAFFIC SIGNALS" are omitted in Type II operation.
- The time between beginning of flashing yellow on "Drawbridge Ahead" sign and the clearance of traffic signal to red, or beginning of flashing red, should not be less than the travel time of a passenger car, from the sign location to the stop line, traveling at the 85 percentile approach speed.
- Beginning of operation of drawbridge gates shall not be less than 15 seconds after steady red, or 20 seconds after flashing red (actual time may be determined by the bridge tender).
- Time of gate lowering and raising is dependent upon gate type.
- Time of bridge opening is determined by the bridge tender.
- Each gate shall be operated by a separate switch.
- On each approach (Type II), all four red signals shall be on the same two circuit flashers, with the two top signals on one circuit, and the two bottom signals on the alternately flashing circuit.
- A Drawbridge Ahead sign is required for both types of signal operation. However a flashing beacon shall be added to the sign when physical conditions prevent a driver traveling at the 85% approach speed from having continuous view of at least one signal indication for approximately 10 seconds.
- Requirements on gate installation are contained in Section 4I of the *Manual on Uniform Traffic Control Devices*.
- In accordance with Traffic Engineering Manual (Topic Number 750-000-005) Section 2.1, "SLIPPERY WHEN WET SIGNS" shall be placed in advance of all MOVABLE and NONMOVABLE STEEL DECK BRIDGES. *(See Note 3)*
1. 12 volt flashing red lights shall be mounted on gate arm and shall operate in the flashing mode only when gate arm is in the lower position or in the process of being lowered. The number of lights shall vary accordingly to length of the gate arm.

2. Alternating 16" pattern of fully reflectorized red and white stripes shall vary accordingly to length of the gate arm.

Black opaque legend and border on reflectorized yellow background.

To be used with type I operation, as shown on previous sheet.

Monotube support mounting.

Class I or II (Length shall be shown on plan sheets).

RR & Drawbridge Arms 18' to 20' Min.

RR & Drawbridge Arms 32' And Over

NOTES:

1. Center Line Mast

1'-6" Center

8" 10'-6" Center

6'-0" RR & Drawbridge

2. Alternating 16" pattern of fully reflectorized red and white stripes.