NOTES:

1. The design of the Semi-Overhead Sign Support presented on this drawing meets the requirements of the AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, First Edition 2015 (LRFDLTS-1), and all interim releases prior to the bid date of the project.

2. Dimensions noted as required shall be as indicated on the drawing and shall not be altered.

3. Calculations are required for any modifications to the information shown on this drawing. Modifications shall meet the requirements of LRFDLTS-1 and the design criteria shown in Note 22. Calculations shall be stamped by a Professional Engineer registered in the State of Ohio and shall be submitted for review and approval with the shop drawings.

4. For sign attachment assemblies to be furnished with this support, construction details, and location of handholes, see Standard Construction Drawings (SCDs) TC-22.10 and TC-22.20.

5. For foundation details, see SCD TC-21.31.

6. Steel for round tube arms shall conform to CEMS 730.01.

7. Signs with arms may be adjusted eccentric to the pole; however, a minimum of 2' of sign length shall remain to one side of the pole center line.

8. For modification of pole to support roadway lighting, see SCD TC-18.13.

9. The pole attachment to the base plate shall be welded using a full penetration weld.

10. A minimum of one bolt thread shall remain above the anchor nut.

11. For pole and base plate dimensions, see Sheet 2.

12. The design was based on Fatigue Category II. See Note 21 for additional design criteria.

(cont'd - see Sheet 2)

(NEW)

04-17-2020

Duemmel

David L. Holstein
NOTES:  (cont'd from Sheet 1)

13. Tapered poles shall be one piece assemblies conforming to ASTM A 595 Grade A (minimum yield strength of 50,000 psi) with a constant taper rate of 0.14 inch/foot. See Note 14 for Tube Pole material requirements.

14. All material shall meet the requirements of C&MS 730 with the following additions:
   - Steel hardware - Galvanizing - ASTM A 153 (hot-dipped)
   - (Not ASTM B 695 Class 5)

15. Nuts shall meet the requirements of C&MS 730.06 and shall also meet the requirements of ASTM A 563 Grade EH or A 194 Grade 2H.

16. Flat washers shall meet the requirements of C&MS 730.06 and shall also meet the requirements of ASTM F 436.

17. Anchor bolts shall meet the requirements of C&MS 132, 711.02, 730.02 and 732.11 except that 730.02 shall be modified to require the galvanizing limits to be the full length of the anchor bolts not at least 2 inches beyond the threads.

18. Anchor bolt nuts shall meet the requirements of ASTM A 563 Grade DH or A 194 Grade 2H.

19. Anchor bolt washers shall meet the requirements of ASTM F 436 Type 1 (hot-dip galvanized) according to ASTM A 153.

20. Holes for high-strength bolts and bearing bolts shall meet the requirements of C&MS 513.19. Modifications to the holes must be approved by the Engineer. Enlarging or slotting holes to match mis-aligned anchor bolts will not be permitted.

21. All welds shall be inspected according to the requirements of C&MS 632, 711.02, 730.02 and 732.11 except that 730.02 shall be modified to require the galvanizing limits to be the full length of the anchor bolts not at least 2 inches beyond the threads.

22. Design Criteria:
   - Load Parameters:
     - Wind Load: 70-year MRI Back Wind Speed Map, 715 mph Design Wind Speed
     - Service Life: Infinite per LRFDLTS-1 11.9.3
     - Service I Wind Velocity: 76 mph per LRFDLTS-1 Table 3.4.1 and Figure 3.8-4c
     - ADT: Greater than 10,000

23. Sideroadway Parameters:
   - Rate (Pole 70): H/180 (H = pole height)
   - Horizontal Deflection at Top of Poles: maximum 1.5% of pole height
   - Slope at Top of Poles: maximum 0.35 inch/foot (1.67 degrees) per LRFDLTS-1 10.4.2.1

24. Fatigue Parameters:
   - Fatigue Category: II
   - Natural Wind Gust: Include
   - Truck-induced Gust: Include
   - Galloping: Do not include

LEGEND:

* = Required dimension see Note 2

THESE DESIGNS USE FULL PENETRATION WELDS AT THE BASE PLATE CONNECTIONS

ALL DIMENSIONS IN INCHES, UNLESS OTHERWISE NOTED

<table>
<thead>
<tr>
<th>DESIGN NO</th>
<th>POLE HEIGHT (FT)</th>
<th>MAXIMUM SIGN AREA (50 SQ FT)</th>
<th>TAPERED POLE (STANDARD)</th>
<th>TUBE POLE (ALTERNATIVE)</th>
<th>SIGNAGE RECOMMENDED</th>
<th>ARM</th>
<th>ARM ATTACHMENT</th>
<th>CRADLE</th>
<th>ANCHOR BASE</th>
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<tbody>
<tr>
<td>2</td>
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<td>9%</td>
<td>0.32</td>
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<td>12</td>
<td>2.5</td>
</tr>
<tr>
<td>3</td>
<td>17.5</td>
<td>150</td>
<td>12</td>
<td>239</td>
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<td>0.37</td>
<td>5 5/8 x 2.51</td>
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</table>

NOTE 6:
- Paint not crayon. (Typ.) (See Note 10)
- Anchor bolts with standard hex nuts and plain washers. Tighten nuts using turn-of-the-nut method according to C&MS 330.06 and 313.20. G
- Except that match-mark shall be paint not crayon. (Typ.) (See Note 10)

All material shall meet the requirements of C&MS 730 with the following additions:
- Steel hardware - Galvanizing - ASTM A 153 (hot-dipped)
- (Not ASTM B 695 Class 5)

All welds shall be inspected according to the requirements of C&MS 632, 711.02, 730.02 and 732.11 except that 730.02 shall be modified to require the galvanizing limits to be the full length of the anchor bolts not at least 2 inches beyond the threads.

Anchor bolts shall meet the requirements of C&MS 132, 711.02, 730.02 and 732.11 except that 730.02 shall be modified to require the galvanizing limits to be the full length of the anchor bolts not at least 2 inches beyond the threads.

Anchor bolt washers shall meet the requirements of ASTM F 436 Type 1 (hot-dip galvanized) according to ASTM A 153.

Holes for high-strength bolts and bearing bolts shall meet the requirements of C&MS 513.19. Modifications to the holes must be approved by the Engineer. Enlarging or slotting holes to match mis-aligned anchor bolts will not be permitted.

All welds shall be inspected according to the requirements of C&MS 632, 711.02, 730.02 and 732.11 except that 730.02 shall be modified to require the galvanizing limits to be the full length of the anchor bolts not at least 2 inches beyond the threads.
NOTES:

1. The design of the Center Mount Overhead Sign Support presented on this drawing meets the requirements of the AASHTO (2015) Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, First Edition 2015 (LRFD/LTS-1) and all interim releases prior to the bid date of the project.

2. Dimensions noted as required shall be as indicated on the drawing and shall not be altered.

3. Calculations are required for any modifications to the information shown on this drawing. Modifications shall meet the requirements of LRFD/LTS-1 and the design criteria shown in Note 22. Calculations shall be stamped by a Professional Engineer registered in the State of Ohio and shall be submitted for review and approval with the shop drawings.

4. For sign attachment assemblies to be furnished with this support, see SCD TC-22.20.

5. For foundation details, see SCD TC-22.20.

6. For pole and base plate dimensions, see Sheet 2.

7. Anchor bolts shall conform to C&MS 732.11.

8. Signs with arms may be adjusted eccentric to the pole; however, a minimum of 2' of sign length shall remain to one side of the pole center line.

9. For modification of pole to support roadway lighting, see SCD HL-10.12.

10. For modification of pole to support roadway lighting, see SCD HL-10.12.

11. The pole attachment to the base plate shall be welded using a full penetration weld.

12. The design was based on Fatigue Category II.

(continued - see Sheet 2)
THESE DESIGNS USE FULL PENETRATION WELDS AT THE BASE PLATE CONNECTIONS

ALL DIMENSIONS IN INCHES, UNLESS OTHERWISE NOTED

<table>
<thead>
<tr>
<th>DESIGN NO.</th>
<th>POLE HEIGHT (FT)</th>
<th>MAXIMUM SIGN AREA (SQ FT)</th>
<th>TAPERED POLE (STANDARDS)</th>
<th>TUBE POLE (ALTERNATE)</th>
<th>AIM</th>
<th>AIM ATTACHMENT</th>
<th>CRADLE</th>
<th>ANCHOR BASE</th>
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<tr>
<td></td>
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<td></td>
<td>BASE DIAMETER</td>
<td>MIN. WALL THICKNESS</td>
<td></td>
<td>MIN. WALL THICKNESS</td>
<td>MAX. DIAMETER</td>
<td>(FT)</td>
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<td>100</td>
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<td>18</td>
<td>3.4</td>
<td>11.1</td>
<td>11.9</td>
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</table>

NOTES:

(continued from Sheet 1)

15. Nuts shall meet the requirements of C&MS 730.08 and shall also meet the requirements of ASTM A 563 Grade DH or ASTM A 194 Grade 2H.

16. Pilot washers shall meet the requirements of C&MS 730.09 and shall also meet the requirements of ASTM F 436.

17. Anchor bolts shall meet the requirements of C&MS 632, 711.01, 730.12 and 732.11. Any anchor bolts that do not meet the requirements of C&MS 632, 711.02, 730.02 and 732.11 shall meet the requirements of C&MS 513.19. Modifications to the anchor bolts will not be permitted.

18. Anchor bolts shall meet the requirements of ASTM F 436 Type 1 as per C&MS 632.03.06 and A 595 Grade A (minimum yield strength of 55,000 psi) with a constant ultimate stress of 0.14 inch/foot. See Note 7 for Tube Pole material requirements.

19. Anchor bolts shall meet the requirements of ASTM F 436 as per C&MS 632.03.06 and A 595 Grade A (minimum yield strength of 55,000 psi) with a constant ultimate stress of 0.14 inch/foot. See Note 7 for Tube Pole material requirements.

20. Holes for high-strength bolts and bearing bolts shall meet the requirements of C&MS 313.18. Modifying the holes to meet the requirements of C&MS 313.18 shall be modified to require the galvanizing limits to be within the full length of the anchor bolts not at least 2 inches beyond the threads.

21. All welds shall be inspected according to the requirements of C&MS 630.06 and AWS D1.1. Structural Welding Code - Steel. A report of the welding inspection shall be submitted to the ODOT Office of Material Management Structural Welding Engineer.

LEGEND:

1. = Required dimension see Note 2

CENTER MOUNT OVERHEAD SIGN SUPPORT

DESIGN ENGINEERING

04-17-2020

Sheet 2

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1154/121

1144/670

1164/744

1154/661

Duemmel

David L. Holstein

STATE OF OHIO DEPARTMENT OF TRANSPORTATION

ENGINEERING ROADWAY OFFICE OF

04-17-2020 (NEW)
ELEVATION - STANDARD DESIGN

SECTION A-A

POLE BASE DETAIL

TRUSS JOINTS

LEGEND:

* = Required dimension. See Note 2 on Sheet

NOTES:
For Notes and Table see Sheet

Details Shown are Similar to LRPOLTS-1 Table 11.9.3.1-1
(5.4-Fillet-Welded Tube - to - Transverse Weld Shown is Similar to LRFDLTS-1 Table 11.9.3.1-1)
Details Shown are Similar to LRFDLTS-1 Table 11.9.3.1-1
(5.6 Fillet-Welded Gusseted Box Connections) (5.7-Fillet Welded Ring Stiffened Connections, also Permitted)

TYPICAL ARM TO UPRIGHT CONNECTION

See Weld Notes for Inspection

Anchor Bolt (Typ. of 6)
(See TC-21.21 for Anchor Bolt Dimensions)

Weld Shown is Similar to LRFDLTS-1 Table 11.6.3.1-1
(5.4-Fillet-Welded Tube - to - Transverse Plate Connection)
### NOTES:

1. The design of the Cantilever Overhead Sign Support meets the requirements of the AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signs, First Edition 2015 (LRFD-LTS-1) and all interim releases prior to the bid date of the project.

2. Dimensions marked as required shall be as indicated on the drawing and shall not be altered.

3. Calculations are required for any modifications to the information shown on the drawings. Modifications shall meet the requirements of LRFD-LTS-1 and the design criteria shown in Note 16. Calculations shall be stamped by a Professional Engineer registered in the State of Ohio and shall be submitted for review and approval with the shop drawings.

4. For sign attachment assemblies to be furnished with this support, construction details, and location of handholes, see Standard Construction Drawings (SCD) TC-23.10 and TC-23.20.

5. For foundation details, see SCD TC-21.21.

6. For modification of the pole to support roadway lighting, see SCD H/S-12.

7. Assure arm attachment bolts do not contact pole.

8. The arm shall be cambered and the upright shall be tilted to provide a horizontal arm and a plumb upright upon erection.

9. Structural steel plate shall meet the requirements of CMS 630 and 711.01 with the following limitations:

   - Structural Steel Plate - ASTM A 709 Grade 50 (ASTM)  
   - (Not Grade 36, 50W or 70W)

10. All material shall meet the requirements of CMS 730 with the following limitations:

    - Steel tube and pipe - ASTM A 500 Grade B  (Not ASTM A 500 Grade B and ASTM A 501)
    - Steel hardware - Galvanizing - ASTM A 153 (Hot-dipped)  (Not ASTM B 685 Class 50)

11. Nuts shall meet the requirements of CMS 730.09 and shall also meet the requirements of ASTM A 563 Grade DH or A 194 Grade 2H.

12. Flat washers shall meet the requirements of CMS 730.08 and shall also meet the requirements of ASTM A 438.

13. Anchor bolts shall meet the requirements of CMS 630, 711.02, 730.02 and 732.11 except that 732.11 shall be modified to require the galvanizing limits to be the full length of the anchor bolts not at least 2 inches beyond the threads.

14. Anchor bolt nuts shall meet the requirements of ASTM A 563 Grade DH or A 194 Grade 2H.

15. Anchor bolt washers shall meet the requirements of ASTM F 436 Type 1 (Hot-dip galvanized) according to ASTM A 153.

16. Nuts for high-strength bolts and bearing bolts shall meet the requirements of CMS 513.13. Modifications to the holes must be approved by the Engineer. Enlarging or slotting holes to match mis-aligned anchor bolts will not be permitted.

17. All welds shall be inspected according to the requirements of CMS 630.06 and AWS D1.1 Structural Welding Code - Steel. A report of the welding inspection shall be submitted to the ODOT Office of Material Management Structural Welding and Materials Engineer.

18. Design Criteria:

   **Load Parameters:**
   - Wind Load: 1700-year MRI Basic Wind Speed Map, 120mph Design Wind Speed  
   - Service Life: Infinite per LRFD-LTS-1 11.9.3  
   - Service Life Velocity: 76 mph per LRFD-LTS-1 Table 3.4.1 and Figure 3.8-4b
   
   - ADT: Greater than 10,000

   **Serviceability Parameters:**
   - Permanent Camber: L/1000 per LRFD-LTS-1 10.5  
   - Rise (Pole 730): H/180 maximum (H = pole height)
   - Horizontal Deflection at Top of Pole: maximum 1.5% of pole height
   - Slope at Top of Pole: maximum of 0.39 inch/foot (1.57 degrees) per LRFD-LTS-1 10.4.2.1

   **Fatigue Parameters:**
   - Fatigue Category: 1  
   - Natural Wind Gust: Include
   - Truck Induced Gust: Include
   - Galloping: Include

### ALL DIMENSIONS IN INCHES, UNLESS OTHERWISE NOTED

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<thead>
<tr>
<th>DESIGN NUMBER</th>
<th>OUTSIDE DIAMETERS</th>
<th>DESIGN MOMENT (SQ. FT)</th>
<th>DESIGN MOMENT (ARM FT)</th>
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<td>POLE SIZE</td>
<td>ARM SIZE</td>
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<tr>
<td>6</td>
<td>6 x .375 WALL x 32'-0&quot;</td>
<td>8 7/16 x .322 WALL x 26'-0&quot;</td>
<td>150 17</td>
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<td>8 x .500 WALL x 32'-0&quot;</td>
<td>10 5/16 x .355 WALL x 30'-0&quot;</td>
<td>225 20</td>
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<td>10 x .500 WALL x 32'-0&quot;</td>
<td>12 5/16 x .375 WALL x 30'-0&quot;</td>
<td>305 24</td>
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</table>

**NOTE:** See TC-21.21 for anchor bolt dimensions.
### NOTES:

1. The design of the Steel Truss Overhead Sign Support meets the requirements of the ASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, First Edition 2015 (LRFDLTS-1) and all interim releases prior to the last date of the project.

2. Dimensions marked as required shall be as indicated on the drawing and shall not be altered.

3. Calculations are required for any modifications to the information shown on the drawings. Modifications shall meet the requirements of LRFDLTS-1 and the design criteria shown in Note 19. Calculations shall be stamped by a Professional Engineer registered in the state of Ohio and shall be submitted for review and approval with the shop drawings.

4. For sign attachment assemblies to be furnished with this support, construction details, and function of fasteners, see Standard Construction Drawings (SCDs) TC-22.10 and TC-22.20.

5. For foundation details, see SCD TC-21.11.

6. For truss bracing members, one internal diagonal is required at each end of each section and at the panel joint nearest the centroid of the truss section when the section exceeds 25’ in length. Tube-to-tube type bolted connections are required. Tube-to-plate type connections are not permitted.

7. Camber the truss for full dead load including signs a minimum of 1” for a span of 50’ or less. Increase the camber ½” for each 5’ of span over 50’.

8. Incomplete diagonals only may be relocated from the indicated position to avoid weld joint overlap.

9. Structural steel plate and WT sections shall meet the requirements of CAMS 950 and 971.01 with the following limitations:
   - Structural steel - ASTM A 709 Grade 50 (A572) (Not Grade 36, 50W or 70W)

10. All material shall meet the requirements of CAMS 730 with the following limitations:
    - Steel tube and pipe - ASTM A 500 Grade B (Not ASTM A 53 Grade B and ASTM A 501)
    - Steel hardness - Galvanizing - ASTM A 153 (Hot-dipped)
    - Note: shall meet the requirements of CAMS 730 and shall also meet the requirements of ASTM A 583 Grade DHV or A 194 Grade 2H.

11. Note shall meet the requirements of CAMS 730.08 and shall also meet the requirements of ASTM A 583 Grade DHV or A 194 Grade 2H.

12. Flat washers shall meet the requirements of CAMS 730.08 and shall also meet the requirements of ASTM F 436 and ASTM A 194 Grade 2H or A 194 Grade 2.

13. Anchor bolt nuts shall meet the requirements of ASTM A 583 Grade DH or A 194 Grade 2H.

14. Anchor bolt washers shall meet the requirements of ASTM F 436 Type 1 (Hot-dip galvanized) according to ASTM A 153.

15. Holes for high-strength bolts and bearing bolts shall meet the requirements of CAMS 513.19. Modifications to the holes must be approved by the Engineer. Enlarging or slotting holes to match mis-aligned anchor bolts will not be permitted.

16. All welds shall be inspected according to the requirements of CAMS 630.06 and AWS DI 1 Structural Welding Code. A report of the welding inspection shall be submitted to the ODOT Office of Materials Management Structural Welding and Materials Engineer.

17. Saddle shims can be aluminum castings meeting the requirements of CAMS 730.14, perforated bearing pads meeting the requirements of CAMS 518 and 711.21 or ASTM A 105 Grade 36 steel galvanized according to CAMS 711.03.

18. Design Criteria:
   - Load Parameters:
     - Wind Load: 1700-year MRI Basic Wind Speed Map, 120 mph Design Wind Speed
     - Service Life: Infinite per LRFDLTS-1 11.3.3
     - Service I Wind Velocity: 76 mph per LRFDLTS-1 Table 3.4.1 and Figure 3.8-4b
     - ADT: Greater than 10,000

19. Serviceability Parameters:
   - Maximum Vertical Deflection of Horizontal Support Resulting from Service I Load Combination (Dead Load + Wind): L/150 per LRFDLTS-1 10.4.1

20. Fatigue Parameters:
   - Fatigue Category: I
   - Natural Wind Gust: Include
   - Truck-induced Gust: Include
   - Galloping: Do not include

### Design Parameters:

<table>
<thead>
<tr>
<th>Design</th>
<th>Maximum Span</th>
<th>Maximum Sign Area (ft²)</th>
<th>Chords</th>
<th>Vertical Diagonals</th>
<th>Horizontal Diagonals</th>
<th>Struts</th>
<th>End Frame Poles</th>
<th>End Frame Diagonal and Strut</th>
<th>Span Support</th>
<th>J</th>
<th>K</th>
<th>L</th>
<th>M</th>
<th>N</th>
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<td>10.05’ x 28’</td>
<td>2.675’ x 203’</td>
<td>W15x13</td>
<td>3-4’</td>
<td>9-1/2’</td>
<td>1/4’</td>
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<td>1’</td>
<td>9’</td>
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<td>2.375’ x 216’</td>
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<td>10.75’ x 26’</td>
<td>2.675’ x 203’</td>
<td>W17x15</td>
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<td>10.75’ x 266’</td>
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<td>5-0’</td>
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<td>30’</td>
<td>30’</td>
<td>1’</td>
<td>5’</td>
<td>6’</td>
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All members are HSS round sections (outside diameter x nominal wall thickness) unless otherwise noted.
Notes:

17. A Mitigator TR1 Traffic Damper manufactured by Valmont Structures or a Shockwave type damper shall be installed as close as possible to the end of the arm. Required on arms over 39’ in length, installed on arms 39’ or less as directed by the engineer or plans.

18. Actual pole height shall be calculated based off the critical pavement and foundation elevations, as outlined in Traffic Engineering Manual section 440.

19. Tapered steel tubes for the poles and arms shall meet the requirements of ASTM A 884 Grade A.

20. All material shall meet the requirements of CMS B 330 with the following limitations:

- Steel hardware - Galvanized - ASTM A 153 (Hot-dipped) (Not ASTM B 193 Class 50)

21. Hubs shall meet the requirements of CMS B 330.08 and shall also meet the requirements of ASTM A 563 Grade 60 or A 194 Grade 2H.

22. Flat washers shall meet the requirements of CMS B 330.08 and shall also meet the requirements of ASTM F 436.

23. Anchor bolts shall meet the requirements of CMS B 332, 710.02, 730.11 except that 730.02 shall be modified to require the galvanizing limits to be full length of the anchor bolts not at least 2 inches beyond the threads.

24. Anchor bolt nuts shall meet the requirements of ASTM F 436 Type 1 (Hot-dip galvanized) according to ASTM A 194 Grade 2H.

25. Anchor bolt washers shall meet the requirements of ASTM F 436 Type 1 (Hot-dip galvanized) according to ASTM A 194 Grade 60.

26. Holes for high-strength bolts and bearing bolts shall meet the requirements of CMS 613.08. Modifications to the holes must be approved by the Engineer. Emerging or slotting holes to match mis-aligned anchor bolts will not be permitted.

27. All welds shall be inspected according to the requirements of CMS 630.08 and AWS D1.1 Structural Welding Code - Steel. A report of the welding inspection shall be submitted to the ODOT Office of Materials Management Structural Welding and Materials Engineer.

28. Design Criteria:

- Load Parameters:
  - Wind Load: 700-year MRL Basic Wind Speed Map, 115 mph Design Wind Speed
  - Service Life: Infinity per LRFD LTS-1 11.6.3
  - Service / Wind Velocity: 75 mph per LRFD LTS-1 Table 3.4.1 and Figure 3.8-4
  - ADT: Greater than 10,000

- Serviceability Parameters:
  - Deflection: maximum of L/750 under Service Load
  - Permanent Camber: L/1500 per ODOT
  - Slope at Top of Pole: maximum 0.35% of pole height
  - Horizontal Deflection at Top of Pole: maximum 1.5% of pole height
  - Slope (Pole Tip): N/A
  - Fatigue Category: II
  - Natural Wind Gust: include
  - Truck-Induced Gust: include
  - Galloping: Do not include (since Mechanical Damping device is required)

These Designs Use Full Penetration Welds at the Arm and Base Plate Connections

All Dimensions in Inches, Unless Otherwise Noted

**Design Criteria:**

- Load Parameters:
  - Wind Load: 700-year MRL Basic Wind Speed Map, 115 mph Design Wind Speed
  - Service Life: Infinity per LRFD LOTS-1 11.6.3
  - Service / Wind Velocity: 75 mph per LRFD LTS-1 Table 3.4.1 and Figure 3.8-4
  - ADT: Greater than 10,000

- Serviceability Parameters:
  - Deflection: maximum of L/750 under Service Load
  - Permanent Camber: L/1500 per ODOT
  - Slope at Top of Pole: maximum 0.35% of pole height
  - Horizontal Deflection at Top of Pole: maximum 1.5% of pole height
  - Slope (Pole Tip): N/A
  - Fatigue Category: II
  - Natural Wind Gust: include
  - Truck-Induced Gust: include
  - Galloping: Do not include (since Mechanical Damping device is required)
NOTES:

1. This support is intended for use with concrete bridge railing parapet types shown on Standard Construction Drawings (SCDs) BR-1, BR-2-98, and SBR-1-99.

2. On pre-cast concrete beam bridges, attach the angle to beam with two ½" x 6" expansion double wedge anchor bolts. The proposed locations of anchors in prestressed beams shall be approved by the Engineer prior to any field drilling.

3. For sign attachment assemblies to be furnished with this support, see SCD TC-22.20.

4. All hardware, including expansion bolts, shall be stainless steel.

5. Prevent contact between aluminum and galvanized parts with a minimum ¼" thick chloroprene gasket or approved equal. Also install a gasket between galvanized steel and concrete.

6. Install all sign brackets at the same elevation by adjusting their position on Z-Brake "A" and "B", regardless of bridge slope.

7. For bridge clearance above roadway of less than 17', the clearance above button of bridge shall be 5" minimum without, or 15" minimum with, sign lighting fixtures.

8. The outer flange of the sign attachment assembly shall be oriented in either direction. However, at least one zee bracket per each individual sign shall be oriented with the outer flange in the opposite direction of the others.

9. Parapet design may vary.

DETAIL "1"

Z-BAR "A"
(GALVANIZED STEEL)

Z-BAR "B"
(GALVANIZED STEEL)
NOTES:

1. This support is intended for use with concrete bridge railing parapet types shown on Standard Construction Drawings (SCD) BR-1, BR-2-98, and SBR-1-99.

2. On pre-cast concrete beam bridges, attach the angle to the beam with two 3" x 3" expansion double wedge anchor bolts. The proposed locations of anchors in prestressed beams shall be approved by the Engineer prior to any field drilling.

3. For sign attachment assemblies to be furnished with this support, see SCD TC-22.20.

4. Only two 3" x 3" x 1/4" angle size horizontal diagonal braces are required per sign. Attach braces to the center bolt on Z-Bar "A" and the bottom bolt of Z-Bar "B", bolt the other end of the braces to the corresponding elevation on the front frame member.

5. All hardware, including expansion bolts, shall be stainless steel.

6. Diagonal bracing shall be 3" x 3" x 1/4" minimum angle for all frames.

7. Prevent contact between aluminum and galvanized parts with a minimum 1/4" thick chloroprene gasket or approved equal. Also install a gasket between galvanized steel and concrete.

8. Install all frames at the same elevation by adjusting their position on Z-Bar "A" and "B", regardless of bridge slope.

9. Bolt all diagonals with one 3/4" stainless steel bolt with washers and locknuts or weld 1/4" fillet weld, minimum 4" long at each end.

10. On slab bridges or with signs 6' or less in height, mount Z-Bar "B" as low as possible on the face of the concrete.

11. For bridge clearance above roadway of less than 11', the clearance above bottom of bridge shall be 3" minimum without, or 6" minimum with, sign lighting fixtures.

12. The outer flanges of the sign attachment assembly shall be bolted to the center bolt on Z-Bar "A" and the bottom bolt of Z-Bar "B", bolt the other end of the braces to the corresponding elevation on the front frame member.

13. Parapet design may vary.
Z-Bar "A"
(GALVANIZED STEEL)

Z-Bar "B"
(GALVANIZED STEEL)

4" x 3 1/2" x 1/4" Z @ 8.2 lb/ft

DETAIL "1"

DETAIL "2"

1/2" Stainless Steel Bolts, Washers and Locknuts

4" x 4" x 6" Expansion Anchor Bolts

(See Note 13)

NOTE 9

Gasket, See Note 5

NOTE 10

See Detail "1"

NOTE 11

See Detail "2"

NOTES:

1. See Drawing TC-18.26 - Skewed Structure Mount Sign Support

2. See Detail "2"

3. 3" x 3" x 1/4" Aluminum Angle (See Note 9)

4. 3" x 3" x 1/4" Aluminum Angle

5. Gasket, See Note 5

6. 1/2" Stainless Steel Bolts, Washers and Locknuts

7. Gasket, See Note 7

8. 4" x 3 1/2" x 1/4" Z @ 8.2 lb/ft

9. 4" x 4" x 6" Expansion Anchor Bolts

10. 1/2" Stainless Steel Bolts, Washers and Locknuts

11. GALVANIZED STEEL

12. Aluminum Angle 3" x 3" x 1/4"

13. Aluminum Angle 3" x 3" x 1/4"
NOTES

1. The design of the Sign Support Foundations presented on this drawing meet the requirements of the AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, First Edition 2015 (LRFDLTS-1), and all interim releases prior to the last date of the project.

2. Tie anchor bolts to mating cage near the top and bottom of the anchor bolts.

3. Dia. may be deeper as required in the plans.

4. When required by local conditions and approved by the Engineer, alternate foundation designs are acceptable. Alternate foundation design calculations and drawings shall be stamped by a Professional Engineer registered in the State of Ohio and shall be submitted to the Engineer for review and approval.

5. Anchor bolts shall meet the requirements of C&MS 430, 711.02, 730.02 and 732.11, except that 730.02 shall be modified to require the galvanizing limits to be full length of the anchor bolts, not at least 2 inches beyond the threads. Threads shall be UNC-2A, and may be either rolled or cut, and coarse threaded. The embedded end of an anchor bolt shall be headed or threaded with a heavy hex nut. Provide smooth steel or anchor bolts material threaded at the ends, or its entire length. Hex nuts shall be ASTM A563, American Standard heavy hex, Grade DH or A 194 Grade 2H, with UNC-2B threads. Plate washers shall be ASTM Grade 95 or Grade 50. All nuts and plate washers shall be galvanized per C&MS 711.00. Anchor bolt washers shall meet the requirements of ASTM A 199 Type 1 (highly galvanized) per AASHTO A 153.

6. All locations where the existing slope is 6:1 or greater, the buried depth of foundation shall apply to the low side of the slope. Set the top of the foundation 2" above the existing surface on the high side of the slope. The additional depth of foundation necessary to meet these requirements shall be added to the formed top.

7. Use 601 bars to tie the anchor bolts to the 603 bars.

8. A special foundation design shall be required when cohesive soil with an undrained shear stress of less than 2000 lb/sq ft or granular soil with an angle of internal friction less than 35 degrees and an earth density less than 70 lb/sq ft is encountered. Special foundation designs shall meet the requirements of Note 4.

9. All reinforcing steel shall be epoxy coated and comply with all and be placed in accordance with C&MS 509. Lap all rebars per the lap length table in C&MS 200. Tie bar hooks not required.

**Reinforcement Schedule for TC-21.11 Tie Beam and TC-21.50 - 42" Wall**

(For Each Foundation)

**Reinforcement Schedule for TC-21.50 - 57" Wall**

(For Each Foundation)
See vertical rebar diagrams for size and number of vertical (longitudinal) bars.

No. 5 Tie Bars, See Note 5

2 ¼" thick circular plates: washer, see tables for diameter. Assume washer is fixed to the bolt head by epoxy or similar means, to prevent movement during concrete pour.

BOLTS for size and number of 2" Conduit Ell(s)

Ground Rod

Grounding Conductor

Drilled shaft

Formed Top

1 ½" x 50 PVC

Heavy Hex Nut

Heavy Hex Nut

No. 6 Rods to Anchor Bolts to Rebar Cage

ANCHOAR BOLTS

ALL DIMENSIONS IN INCHES

<table>
<thead>
<tr>
<th>DIA</th>
<th>TOP THREAD LENGTH</th>
<th>THREADS PER INCH</th>
<th>PLATE WASHER DIAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 ½</td>
<td>12</td>
<td>6</td>
<td>3 ½</td>
</tr>
<tr>
<td>1 ¾</td>
<td>12</td>
<td>8</td>
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<td>2</td>
<td>10</td>
<td>4 ½</td>
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<tr>
<td>2 ½</td>
<td>12</td>
<td>4 ½</td>
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</tbody>
</table>

Vertical rebar - vertical (longitudinal) bars.

See Note 4

TC-9.11 TYPE SUPPORTS

No. 6 Rebar

Conduit Projection: 2" ± 1" to Rebar Cage

2 ¼" thick circular plates: washer, see tables for diameter. Assume washer is fixed to the bolt head by epoxy or similar means, to prevent movement during concrete pour.

Threaded Length

TOP THREAD

ANCHOR BOLTS

ALL DIMENSIONS IN INCHES

<table>
<thead>
<tr>
<th>DIA</th>
<th>TOP THREAD LENGTH</th>
<th>THREADS PER INCH</th>
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<td>12</td>
<td>4 ½</td>
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</tbody>
</table>

TC-16.22 & TC-81.22 TYPE SUPPORTS

Ground Rod

Grounding Conductor

Drilled shaft

Formed Top

1 ½" x 50 PVC

Heavy Hex Nut

Heavy Hex Nut

No. 6 Rods to Anchor Bolts to Rebar Cage

ANCHOAR BOLTS

ALL DIMENSIONS IN INCHES

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<thead>
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</tbody>
</table>

TC-17.11 & TC-81.11 TYPE SUPPORTS

Ground Rod

Grounding Conductor

Drilled shaft

Formed Top

1 ½" x 50 PVC

Heavy Hex Nut

Heavy Hex Nut

No. 6 Rods to Anchor Bolts to Rebar Cage

ANCHOAR BOLTS

ALL DIMENSIONS IN INCHES

<table>
<thead>
<tr>
<th>DIA</th>
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</tbody>
</table>

TC-21.21 TYPE SUPPORTS

Ground Rod

Grounding Conductor

Drilled shaft

Formed Top

1 ½" x 50 PVC

Heavy Hex Nut

Heavy Hex Nut

No. 6 Rods to Anchor Bolts to Rebar Cage

ANCHOAR BOLTS

ALL DIMENSIONS IN INCHES

<table>
<thead>
<tr>
<th>DIA</th>
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<th>THREADS PER INCH</th>
<th>PLATE WASHER DIAMETER</th>
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</tbody>
</table>

TC-81.22 TYPE SUPPORTS

Ground Rod

Grounding Conductor

Drilled shaft

Formed Top

1 ½" x 50 PVC

Heavy Hex Nut

Heavy Hex Nut

No. 6 Rods to Anchor Bolts to Rebar Cage

ANCHOAR BOLTS

ALL DIMENSIONS IN INCHES

<table>
<thead>
<tr>
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<td>2 ½</td>
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NOTES

1. The design of the foundations presented on this drawing meet the requirements of the ADHS10.90 Specifications for Structural Supports for Highway Signs, Structures, and Traffic Signals, First Edition 2015 (RODTS-1) and all interim releases prior to the bid date of the project.

2. A special foundation design will be required when cohesive soil with undrained shear strength less than 2000 psi, or gravel soil with an angle of internal friction less than 30 degrees and a wet density less than 120 lbs./cu.ft., is encountered. Special foundation design calculations and drawings shall be stamped by a Professional Engineer registered in the State of Ohio and shall be submitted to the Engineer for review and approval.

3. Anchor bolts shall meet the requirements of C&MS Items 630, 711.02, 732.02 and 732.11 except that the 732.02 bolt shall be modified to require the housing length to be at least 40" in length of the anchor bolt not at least 2 inches beyond the threads. Threaded shall be UNC-2B, and may be either rolled or cut, and coarse threaded. The embedded end of the anchor bolt shall be threaded or cast with a heavy hex nut. Provide smooth steel not anchorage bolt material thread at the ends or over its entire length. Hex nuts shall be UNS 438500, American Standard heavy hex, Grade DH or A 194 Grade 2H, with UNC-2B threads. Plate washers shall be galvanized per C&MS Item 711.02. Anchor bolt shall meet the requirements of ASTM F-436 Type 1 (non-galvanized), according to ASTM A 533.

4. Provide a minimum of one capped 2" rod with an Standard Construction Drawings (SCD) TC-81.11 and TC-81.22 foundations for future use. This rod is in addition to any other conduits specified in the plans.

5. The spacing, starting from the top of the drilled shaft, shall be 3 inches between the first two and 12 inch spacing thereafter.

6. An reinforcing steel shall be epoxy coated and comply with C&MS Item 150. Lap all steel per the Lap Length table in C&MS Item 603. Rebar and hangers not required. 3-inch minimum cover is required.

7. Use 1.5 inch preferred joint filler as per C&MS Item 705.03 between conduits and adjacent painter areas.

8. At locations where the existing slope is 6:1 or greater, the buried depth of foundation shall apply to the side of the slope. Set the top of the foundation 2 inches above the existing surface on the high side of the slope. The additional depth of foundation necessary to meet these requirements shall be added to the formed base.

9. In paved areas only, and only with permission of the Engineer, a construction joint may be placed to allow matching of the square, set the top of the foundation 2 inches above the existing surface on the high side of the slope. The additional depth of foundation necessary to meet these requirements shall be added to the formed base.

10. When two foundation diameters (W) are specified in the table, the Contractor may choose between them interchangeably.

When two foundation diameters (W) are specified in the table, the Contractor may choose between them interchangeably.

When two foundation diameters (W) are specified in the table, the Contractor may choose between them interchangeably.
1. Pillar 15" wall is required, the reinforcing shall be in the drilled shaft connecting wall shall remain in the same position, relative to the top of the wall, as in the 42" wall.

2. Refer to Standard Construction Drawings (SCDs) TC-21.11 and TC-21.21 for reinforcement specifications and details.

3. For information regarding the transition sections of the barrier wall, see SCD RM-4.4.

4. For single slope concrete barrier shapes, see SCD RM-4.3.

5. All reinforcing steel shall be epoxy coated, comply with and be placed in accordance with C&MS 509.

6. Provide all anchor bolts with standard steel hex nuts, leveling nuts, and plain washers. The nuts shall be capable of developing the full strength of the anchor bolts. Anchor bolts shall be Grade 105. Threads shall be UNC-2A, and may be either rolled or cut, and coarse threaded. The embedded end of the anchor bolt shall be headed or threaded with a heavy hex nut. Provide smooth steel rod anchor bolt material threaded at the ends or over its entire length. Hex nuts shall be ASTM A563, American Standard heavy hex. Grade DH, with UNC-2B threads. Plate washers shall be A709 Grade 36 or Grade 50. Anchor bolts shall be hot-dip galvanized over their entire length, with a minimum of 600,000 psi tensile strength. Provide all anchor bolts with standard steel hex nuts, leveling nuts, and plain washers.

7. See SCDs TC-21.11 and TC-21.21 for anchor bolt projection length, "P".

See vertical rebar diagrams for vertical bar size and number.

See diagrams for vertical bar size and number.

Notes:

- 402, 601, 602, and 603 bars not shown.

Vertical rebar:

- 511, 499 Concrete
- ¾" Sch. 40 PVC
- ¾" Sch. 30 PVC
- 2" Conduit
- 2" Conduit (if required)

See diagrams for vertical bar size and number.

Cantilever, butterfly, or center mount type:

- Hex Nut or Headed Anchor Bolt with Plate Washer
- Heavy Hex Nut
- Anchor Bolt
- Plate Washer
- 4" Raceway (if required)

Permissible construction joint:

- Permissible construction joint

Bolt option:

- Headed anchor bolt option
- Nuted anchor bolt option

Foundation diameter:

- 601
- 602
- 603

Anchor bolts:

- A601 (Typ.)
- A601 (Typ.)

Washer:

- 1" thick circular plate washer
- 1" thick circular plate washer

Heavy hex nut:

- 4" Raceway (if required)

Construction joint:

- Permissible construction joint

Pavement:

- Top of pavement
- Top of pavement

Note: All reinforcing steel shall be epoxy coated, comply with and be placed in accordance with C&MS 509.
NOTES:

1. U-bolts, nuts and washers shall be stainless steel for use with aluminum chords. When used with galvanized chords, the U-bolt only may be galvanized steel.

2. Prevent contact between aluminum and galvanized parts with a minimum 3/4" thick chloroprene gasket or approved equal. No gasket is required between stainless steel and aluminum.

3. When any sidewalk is within 5' of the pole base, increase the 54 1/2" dimension to 80'.

SWITCH ENCLOSURE BRACKET

Pole Extension for Lighting Luminaire

Disconnect Switch Enclosure and Handhole Orientation

4" x 8" Handhole
NOTES:

1. Sign brackets shall be a 4" x 3" x ¼" aluminum zee at 2.85 lb/ft².

2. Provide intermediate sign brackets if the sign extends more than 4' above or below an attachment point.

3. U-bolts, other bolts, nuts and washers shall be stainless steel for use with aluminum chords. When used with galvanized sign structures the U-bolts only may be galvanized steel.

4. The inside diameter of U-bolts used to attach the sign attachment assembly aluminum zee brackets to the overhead sign support horizontal member shall have a tolerance of ±0.5, ±0.03" relative to the outside diameter of the overhead sign support horizontal member at the attachment point.

5. Type B shall be for back-to-back mounted signs.

6. Type A shall be for supports where the sign height is less than 1" greater than the attachment point spacing.

7. Type B shall be for back-to-back mounted signs.

8. Detail "C" - fixture support arm mounting for lighted signs complying with Plan Insert Sheet 203121.

9. Attach gusset plates by bolting or welding.
NOTES:

1. Base plate weld size shall be equal to the beam flange and web thickness respectively, but no less than 3/4" in either instance.

2. With the 54 x 7.7 beam, use malleable iron beveled washers conforming to ASTM A47 grade 350B.

3. Tighten fuse and hinge plate connections in the shop following a method approved by the Engineer to produce the minimum bolt preload specified.

4. Use the following procedure in assembling the breakaway base plate:
   After all bolts, washers, standard nuts and bolt retainer plates are in place, tighten all standard nuts snugly with a 2" wrench. Loosen each bolt in turn and retighten in a systematic manner to the specified maximum torque. Calibrate wrenches at least once each working day for each bolt diameter being torqued. Burr threads of nut with not using a center punch.

5. For beams subject to impact from opposite directions, such as in freeway medians, provide fuse plates on both sides.

6. Notches are shown for the installation to the right of traffic, for installations to the left of traffic, fabricate with skewed edge of notches reversed from that shown.

7. Dimensions shown for alternate designs are approximate. Specified dimensions for alternate designs require prequalification. An approved list of suppliers can be provided by ODOT. Payment for alternate designs will be based on the plan quantities for embedded beams.
ALTERNATE DESIGN
(See Note 7)

ALL DIMENSIONS IN INCHES, UNLESS OTHERWISE NOTED

<table>
<thead>
<tr>
<th>Beam Size</th>
<th>Hinge Size</th>
<th>Concrete</th>
<th>Foundations</th>
<th>Base Plate Dimensions</th>
</tr>
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<tbody>
<tr>
<td>W6 x 8</td>
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<tr>
<td>W8 x 10</td>
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<td>8-1/8 x 5-1/4</td>
<td>10-1/8 x 5-3/4</td>
</tr>
<tr>
<td>W10 x 12</td>
<td>2.5</td>
<td>4 x 2-5/8</td>
<td>8-1/8 x 5-1/4</td>
<td>10-1/8 x 5-3/4</td>
</tr>
</tbody>
</table>

All dimensions in inches, unless otherwise noted.

Note: See Note 7 for additional details.
NOTES:

1. Install No. 4 type P and F posts, and No. 6 type P and F posts, only in protected locations (e.g., behind guardrail). Install two post installations of number 4 type S posts within 7 foot path only in protected locations.

2. Use of anchor base with No. 2 and No. 3 square post is optional. Use of anchor base with No. 4 square post is required.

3. Square post may have die-cut knockouts or open holes.

TYPICAL NO. 1, NO. 2 AND NO. 3 U-CHANNEL DRIVEN INSTALLATION

TYPICAL NO. 4 AND NO. 6 U-CHANNEL DRIVEN INSTALLATION

TYPICAL SQUARE POST DRIVEN INSTALLATION

TYPICAL SQUARE POST ANCHOR BASE INSTALLATION

SQUARE POST SIGN ATTACHMENT DETAIL

BEARING PLATE

U-CHANNEL SIGN ATTACHMENT DETAIL

SECTION A-A

ANCHOR DIMENSIONS

POST DIMENSIONS

TWO NO.2 POST LOCATIONS IN EXPOSED IN 7' PATH PERMITTED

NO. OF POSTS

A

B

C

A

B

C

No. 6 U-CHANNEL TYPICAL No. 4 AND NO. 6 U-CHANNEL DRIVEN INSTALLATION

TYPICAL SQUARE POST DRIVEN INSTALLATION

TYPICAL SQUARE POST ANCHOR BASE INSTALLATION

DETAIL "A"
1. Auger holes to required depth using 18" auger for the Type M and 24" auger for the Type L post.

2. Place 8" x 8" x 4" solid concrete block in the bottom of each augered hole.

3. Backfill with suitable material normally soil removed from hole is suitable for backfilling, backfill in 4" lifts and tamp the soil firmly around the beam with a hydraulic pole tamper after each lift.

4. For each beam, install two wood stabilizers flush to grade by carefully removing any amount of soil necessary to achieve their proper installation. Attach each stabilizer to the beam with four 16d common nails. Replace and firmly tamp the soil around the stabilizers with a hydraulic pole tamper. For three beam installations, install wood stabilizers on the middle beam perpendicular to traffic flow.

5. Install breakaway feature on both sides of each beam (see detail "B"), by drilling 1" diameter holes (total eight holes per beam), and connecting the holes with a reciprocating saw (total four cuts per beam).

6. Install a commercial quality 20 gauge galvanized steel sheet metal cap to the top of each beam. Wrap the cap around the four sides of the beam and securely fasten in place using hot-dipped galvanized nails.

7. Attach two No. 3 U-channel posts to each beam, equal to the height of the sign, (see 5/8" x 2" hex head lag bolts installed in drilled 5/8" pilot holes, install one lag bolt within 3" of the bottom of the post, and one within 3" of the top of the beam, install additional lag bolts along each post with a maximum spacing of 8")

8. U-channel posts may be extended above the top of the beam a maximum of 12" to achieve proper sign height and leveling of sign.

9. Attach extrusheet sign to outer flanges of the U-channel posts on each beam with mounting clips as shown in Standard Construction Drawings TC-51.11 and TC-51.12.

**Notes:**

- Beams must be perpendicular to traffic flow.
- Attach stabilizers perpendicular to beams nearest traffic flow.
- Attach stabilizers parallel to beams furthest from traffic flow.

**Diagram Notes:**

- Auger holes to required depth using 18" auger for the Type M and 24" auger for the Type L post.
- Place 8" x 8" x 4" solid concrete block in the bottom of each augered hole.
- Backfill with suitable material normally soil removed from hole is suitable for backfilling, backfill in 4" lifts and tamp the soil firmly around the beam with a hydraulic pole tamper after each lift.
- For each beam, install two wood stabilizers flush to grade by carefully removing any amount of soil necessary to achieve their proper installation. Attach each stabilizer to the beam with four 16d common nails. Replace and firmly tamp the soil around the stabilizers with a hydraulic pole tamper. For three beam installations, install wood stabilizers on the middle beam perpendicular to traffic flow.
- Install breakaway feature on both sides of each beam (see detail "B"), by drilling 1" diameter holes (total eight holes per beam), and connecting the holes with a reciprocating saw (total four cuts per beam).
- Install a commercial quality 20 gauge galvanized steel sheet metal cap to the top of each beam. Wrap the cap around the four sides of the beam and securely fasten in place using hot-dipped galvanized nails.
- Attach two No. 3 U-channel posts to each beam, equal to the height of the sign, (see 5/8" x 2" hex head lag bolts installed in drilled 5/8" pilot holes, install one lag bolt within 3" of the bottom of the post, and one within 3" of the top of the beam, install additional lag bolts along each post with a maximum spacing of 8")
- U-channel posts may be extended above the top of the beam a maximum of 12" to achieve proper sign height and leveling of sign.
- Attach extrusheet sign to outer flanges of the U-channel posts on each beam with mounting clips as shown in Standard Construction Drawings TC-51.11 and TC-51.12.
NOTES:

1. Fabricate sign post reflectors out of 0.080" thick flat sheet aluminum. Drill or punch 1/8" diameter bolt holes to a tolerance between holes of ± 1/32". Apply reflective sheeting to the surface of the aluminum.

2. Reflectorize the sign post within 1" of the bottom of the sign down to 24" above the near edge of pavement or curb, using any combination of the standard lengths shown in Table. Where this cannot be achieved due to the local ground profile, reflectorize the post to within 12" of the ground.

3. When using multiple sections of sign post reflector to achieve the required length of reflectorization, do not leave gaps between sections. The sign post reflectorization should appear as a continuous strip.

4. Do not allow the sign post reflector to overlap the sign.

5. For multiple post installations, install the same length sign post reflector on each post.

6. For back-to-back installations of signs requiring sign post reflectorization, install sign post reflectors on both sides of the posts.

7. Install sign post reflectors matching the background color of the sign, except that the color of the reflector for the YIELD (R1-2) and DO NOT ENTER (R5-1) signs shall be red.

---

**ACTUAL MOUNTING HEIGHT** | **MINIMUM LENGTH SIGN POST REFLECTORIZATION**
---|---
Up to 6' | 4"
Over 6' to 7' | 5"
Over 7' to 8' | 6"
Over 8' to 9' | 7"
Over 9' up to 10' | 8"
Over 10' | See note 3

* Not the minimum allowable sign mounting height

---

**SIGN POST ATTACHMENT DETAIL**

**U-CHANNEL ATTACHMENT DETAIL**

**SQUARE POST ATTACHMENT DETAIL**

---

**TYPICAL INSTALLATION DETAILS**

**INSTALLATION DETAILS FOR CUT SECTION** (See Note 3)
NOTES:

1. This support is intended for use with concrete bridge railing parapet types shown on drawings BR-1, BR-2-98, and SBR-1-99.

2. Use a minimum of 2 brackets located 6" from top and bottom of sign per installation with maximum spacing of 3'-0".

3. Street name sign supports shall be square tubular steel.

4. Parapet design may vary.

---

**Sign Support Assembly, Bridge Mounted, Type 1**

**Sign Support Assembly, Bridge Mounted, Type 2**

**Sign Support Assembly, Pole Mounted**

**Street Name Sign Support**
NOTES:
1. Use bearing plates conforming to details on Standard Construction Drawing TC-41.20.
NOTES:

1. In special situations, a 54" x 18" R6-1 sign may be used in lieu of the 36" x 12" R6-1 sign.

2. All supports shall be square tubular steel; however, in lieu of square tubular steel, U-channel supports may be used with the alternate ONE WAY sign attachment arrangement.

3. For post installation details, see Standard Construction Drawing TC-41.20.

SECTION A-A

ALTERNATE ONE WAY SIGN ATTACHMENT

SINGLE POST

TWO POST

See Note 1

See Note 2

36" See Note 1

36" See Note 1
NOTES:

1. See Standard Construction Drawing (SCD) TC-41.20 for details on yielding supports.

2. All signs shall be placed 90° to the roadway, except as described in notes 3 and 4 below.

3. Install chevron alignment and one-direction large arrow signs on the outside of a turn or curve in line with and at approximately 90° to approaching traffic flow.

4. Install parking signs with arrows at an angle of not less than 30° nor more than 45° with the line of traffic flow.

5. Install chevron alignment signs at a minimum mounting height of 4' above the near edge of the traveled way.

6. Install object markers at a minimum mounting height of 4' above the near edge of the traveled way for obstructions 8' or less from the edge of the shoulder or curb, install object markers at a minimum mounting height of 4' above the ground for obstructions more than 8' from the edge of the shoulder or curb.

7. Install signs with a minimum lateral offset of 1' from the face of curb where sidewalk width is limited or where existing poles are close to the curb.

8. On conventional roads where it is impractical to locate a sign with the lateral offsets shown, install signs with a minimum lateral offset of 2'.

9. See SCDs TC-52.10 and TC-52.20 for dimensions between supports.
1. Spot weld aluminum extrusions to flat sheet aluminum at a maximum center-to-center spacing of 6".

2. Use a combination of 12", 18" and 24" panels erected horizontally to attain required sign height. The use of 30", 36", 42" and 48" panels is optional.

3. Bolt panels together 6" from each end, and at a maximum center-to-center spacing of 24" between end bolts.

4. Fasten panels to each vertical structural beam support with mounting clips, alternately on each horizontal extrusion, both sides of each joint, and both sides of the top and bottom edges of the sign.

5. Fasten panels to each vertical T-bar support with mounting clips at each horizontal extrusion, at each joint, and at the top and bottom edges of the sign.

6. For a 6" glare shield extrusheet panel, change the 0" dimension in the 12" bolted extrusheet panel detail to 6". All other details remain the same.

### Table I

<table>
<thead>
<tr>
<th>Panel Height (Inches)</th>
<th>No. of STIFFENERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>18</td>
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<td>24</td>
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<td>42</td>
<td>6</td>
</tr>
<tr>
<td>48</td>
<td>7</td>
</tr>
</tbody>
</table>
1. Use a combination of 6" and 12" panels erected horizontally to attain required sign height.

2. Bolt panels together 6" from each end, and at a maximum center-to-center spacing of 24" between end bolts.

3. Fasten panels to each vertical structural beam support with mounting clips, both sides at each joint, and both sides at the top and bottom edges of the sign.

4. Fasten panels to each vertical z-bar support with mounting clips at each joint and at the top and bottom edges of the sign.

5. Standard commercial tolerances for extruded shapes apply.
MATERIAL ORDERING:

1. All bolt holes shall be …" in diameter and may be drilled or punched to finished size.

2. Dimensions between bolt holes shall be to tolerance ±0.002".

3. For back-to-back mounting of STOP (R1-1) and DO NOT ENTER (R5-1) signs, follow details shown on Standard 3.

NOTES:

- Dimensions between bolt holes shall be to tolerance ±0.002".
- When bolt holes are ordered for notching out for rivets, the holes shall be punched to finished size and may be increased 0.020" if necessary.
- No. Supports Required
- No. Bolts Required
- Area: 0.56
- Area (FT²): 2.25
### Notes:

- Dimensions between bolt holes shall be to tolerance 0.080 ± 0.025 inch. 
- All bolt holes shall be 0.33 inch in diameter and may be H-REC-2-4

### Dimensions:

- **H-REC-2-4**
  - Dimensions: 12.00 x 12.00 x 2.50
  - Material: Steel
  - Finish: Painted

- **H-REC-4-4**
  - Dimensions: 24.00 x 24.00 x 5.00
  - Material: Steel
  - Finish: Painted

- **H-REC-12-4**
  - Dimensions: 36.00 x 36.00 x 7.50
  - Material: Steel
  - Finish: Painted

- **H-REC-18-4**
  - Dimensions: 48.00 x 48.00 x 9.00
  - Material: Steel
  - Finish: Painted

### Additional Information:

- **SCD Number**: 00-23-2018
- **State of Ohio Department of Transportation Administrator**: Soisson
- **Office of Roadway Engineering**: David L. Holstein
- **Date**: 07-20-2018

---

### Table:

<table>
<thead>
<tr>
<th>Material</th>
<th>Finish</th>
<th>Dimensions</th>
<th>Notes</th>
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</thead>
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<tr>
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<td>H-REC-2-4</td>
</tr>
<tr>
<td>Steel</td>
<td>Painted</td>
<td>24.00 x 24.00 x 5.00</td>
<td>H-REC-4-4</td>
</tr>
<tr>
<td>Steel</td>
<td>Painted</td>
<td>36.00 x 36.00 x 7.50</td>
<td>H-REC-12-4</td>
</tr>
<tr>
<td>Steel</td>
<td>Painted</td>
<td>48.00 x 48.00 x 9.00</td>
<td>H-REC-18-4</td>
</tr>
</tbody>
</table>
TYPICAL DELINEATOR PLACEMENT

NOTES:

1. Type "C" delineators (rectangular white) shall be spaced on the right of the through roadway of 400' intervals; without regard to curves. Type "D" delineators (rectangular yellow), if used, shall be located on the left of the through roadway.

2. Delineators shall be provided on at least one side of interchange ramps. Delineator reflector and flexible post color shall conform to the respective edge line color.

3. No delineators shall be placed in a paved berm.

4. When the curve radius on ramps requires less than 200' spacing, the delineators shall be placed on the outside of the curve in relation to the flow of traffic.

5. Tamper resistant fasteners shall be used to attach delineators to brackets.

6. Omit delineators if within 50' of a mile marker.

DELINERATOR POST

HORIZONTAL CURVES

<table>
<thead>
<tr>
<th>RADII (FT)</th>
<th>DEG. OF CURVE MAX</th>
<th>SPACING ON CURVE (FT)</th>
<th>TRANSITION (FT)</th>
<th>SPACING (FT)</th>
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<td>5</td>
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<td>200</td>
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<td>10</td>
<td>100</td>
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<tr>
<td>475</td>
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<td>19</td>
<td>60</td>
<td>200</td>
</tr>
<tr>
<td>500</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* From tangent to 12° Curve, Transition spacing 200' to 140' to 70'
* From 12° Curve to tangent, Transition spacing 200' to 140' to 70'

DELINERATOR POST

LATERAL PLACEMENT

BRIDGE RAIL BRACKET

BRIDGE PARAPET BRACKET

DELINERATOR POST

LATERAL PLACEMENT

DELINERATOR POST

LATERAL PLACEMENT

DELINERATOR POST

LATERAL PLACEMENT

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LATERAL PLACEMENT

DELINERATOR POST
1. Guardrail blockout reflectors shall conform with CMS 726.01.

NOTES:

Spacing of 100' on Straight Sections and on Curves of Less Than 5°

Install a Reflector at the Beginning and End of Every Curve

50' Spacing on Curves of Greater Than 5°

GUARDRAIL BLOCKOUT REFLECTOR SPACING

REFLECTOR SPACING
GUARDRAIL BLOCKOUT

GUARDRAIL BLOCKOUT REFLECTOR POSITION
INSTALL PER CMS 626

SIDE-MOUNTED (TYPES 2, 4 & 5)

TOP-MOUNTED (TYPE 3)

Travel Direction of

Spacing at 100' on Straight Sections and on Curves of Less Than 5°
Transition Striping
Edge Line
6"
4"
4"
4"
12"
6"
…
12"

Crosswalk

Center Line
Double Yellow Line

No Passing Line

Center Line

Rumble Strips
Section A-A

No Passing Line

Single Line
Center Line

12"
7"
7"
12"

Rumble Strip Profile

Transition Stripping

Two-Way Left

12"

Center Line

Single Line

12"

Turn Lane Striping
NOTES:

1. Rumble stripes are defined as milled longitudinal rumble strips supplemented by the related longitudinal pavement markings. The markings are often applied in the same location such that the pavement marking material conforms to the grooved contours of the milled rumble strip.

2. Edge line rumble stripes require a paved shoulder width of 2 feet or greater.

3. Except where interrupted as described in note 4, install the milled portion of the center line rumble stripe in a continuous longitudinal line and install the milled portion of the edge line rumble stripe in a 60-foot cycle (48' long rumble strip - 12' gap).

4. Interrupt the milled portion of the center line or edge line rumble stripe for any of the following.
   A. Skip 2 miles for each raised pavement marker.
   B. 20 feet upstream and downstream of radii of intersecting roads and major driveways.
   C. 20 feet upstream and downstream of transverse markings (e.g., crosswalk lines, stop lines, yield lines, etc).

5. Discontinue milled portion 650 feet in advance of built-up areas, including municipal corporation limits and urban area boundaries unless otherwise shown in the plans or approved by the Engineer.

6. Preformed pavement markings (C&MS Item 645) and heat-fused preformed thermoplastic (C&MS Item 647) shall not be used.

7. Apply pavement marking material after milling in the rumble strip.

8. Coat both sides of the rumble profile with specified marking material. This may require striping operations to move at no more than 8 miles per hour.

9. Do not install rumble stripes on bridges unless otherwise shown in the plans or approved by the Engineer.

10. Pay item: Milled rumble strips shall be paid for in accordance with C&MS Item 618. Pavement marking material shall be paid for in accordance with C&MS Item 641.
NOTES:

1. Center line markers shall be placed between the lines when single or double solid lines are used. Markers installed along an edge line or channelizing line shall be placed so that the casting is no more than 1" from the rear edge of the line. Markers installed along a lane line or dashed yellow center line shall be placed between and in line with the dashes, however, despite these provisions, the markers shall also be placed a minimum of 2" away from a longitudinal or transverse joint.

If approved by the Engineer, markers may be placed on the lines where the lines deviate visibly from their correct alignment or the construction joint will be within 2" of the marker.

2. To facilitate the cutting of the two parallel slots and interfering concave surface simultaneously, it is recommended that an arbor and saw blade assembly be used. For additional details and tolerances of the casting and arbor-saw assembly, contact the casting manufacturer.


**EDGE LINE**

1-Way White with Right Edge Line or 2-Way (Yellow/Red) with Left Edge Line on Ramps, Yellow Side Facing Traffic

**CHANNELIZING LINE**

2-Way White/Red, White Side Facing Traffic

**LANE LINE**

1-Way White or 2-Way White/Red, White Side Facing Traffic

**CENTER LINE**

2-Way (Yellow/Yellow)
NOTES:
1. Raised pavement markers shall not be placed within the intersection area.
2. Raised pavement markers on lane lines on freeways shall be one-way white spaced at 80’ and 40’. All other raised pavement markers on lane lines on multi-lane roadways and ramps shall be two-way white/red spaced at 80’.
3. When a channelizing line is less than 80’ in length, one raised pavement marker shall be placed at each end of the line, and one shall be placed in the center of the line.
4. Raised pavement markers shall not be placed on edge lines on a through approach.
5. All approaches at a signalized intersection shall be treated as shown in the stop approach detail by adding edge line markers along the right edge line.

LEGEND
- 1-Way Reflectors
- 2-Way Reflectors
- Direction of Travel

ENTRANCE RAMP
EXIT RAMP
4-LANE DIVIDED TO 2-LANE TRANSITION
MULTI-LANE DIVIDED HIGHWAY
4-LANE UNDIVIDED TO 2-LANE TRANSITION
NOTES:

1. Raised pavement markers shall not be placed within the intersection area.

2. Raised pavement markers on lane lines on multi-lane roadways and ramps shall be two-way white/red spaced at 80'.

3. When a channelizing line is less than 80' in length, one raised pavement marker shall be placed at each end of the line, and one shall be placed in the center of the line.

4. Raised pavement markers shall not be placed on edge lines in a through approach.

5. All approaches of a signalized intersection shall be treated as shown in the stop approach detail by adding edge line markers along the right edge line.

6. The spacing for center line raised pavement markers shall be 80' except for the following:
   - For one-lane bridges, center line pavement markings, including raised pavement markers, shall be omitted 80' on each side and across the bridge.
   - For horizontal curves of 5° or greater, the spacing of the center line markers shall be reduced to 50' between P.C. or T.S. and P.T. or S.T.
   - For horizontal curves of 10° or greater, the spacing of the center line markers shall be reduced to 30' between P.C. or T.S. and P.T. or S.T.
   - When using 20' spacing, 0 raised pavement markers at 40' spacing shall be installed at each end of the 80' spacing.

7. Raised pavement markers:
   - a. Shall not be installed on bridges less than 400' on tangent alignments.
   - b. Shall be installed at twice the normal spacing on bridges longer than 400' on tangent alignments.
   - c. Shall be installed at the normal spacing on any length bridge on a curve.
**W4-2R**

**ENGINEERING ROADWAY OFFICE OF**

**1-3 WORD AND SYMBOL PAINTING MARKINGS**

---

**SCD NUMBER**

TC-71.10

```
```

**ENGINEER STDS.**

**REVISION DATE**

TRANSPORTATION ADMINISTRATOR

STATE OF OHIO DEPARTMENT OF

- **01-19-2018**

- **David L. Holstein**

- **P. Singh**

---

**THIS DRAWING REPLACES TC-71.10 DATED 01-20-2017.**

---

- **ARROW TYPE**
  - Turn Arrow: 9.50
  - Through Arrow: 9.50
  - Turn and Through Arrow: 2.25
  - Lane-Reduction Arrow: 9.80

- **AREA**
  - 6.5

- **SIZE**
  - Width: 9.50
  - Area (sq ft): 6.5

- **Distance (d) (FT)**
  - 100'

- **L - Taper length in feet for Speed > 45 MPH = WS**
  - **L - Taper length in feet for Speed < 45 MPH = WS /60**
  - **W - Lane width or offset, in feet**
  - **S - Posted, 85th-percentile or statutory speed, in MPH**

- **D - Advance Warning Distance, in feet**
  - 30
  - 35
  - 40
  - 45
  - 50
  - 55
  - 60
  - 65
  - 70

- **Area**
  - 12.75'
  - 5.25'
  - 7.50'
  - 7.75'
  - 5.00'
  - 8.00'

- **Element**
  - 1
  - 1 & 2
  - 1 & 3
  - 1, 2 & 3
  - 2
  - 3

- **Overall Dimensions**
  - 6.5'
  - 5.5'
  - 6.5'
  - 12.67'

---

**FISH-HOOK ARROW (ROUNDABOUTS)**

**L1**

---

**Lane-Reduction Arrow (Right)**

For Left Lane, Use Mirror Image

---

**Lane-Reduction Arrow Marking Detail**

(See Note 8)

---

**Table 1 - Lane-Use Arrows**

<table>
<thead>
<tr>
<th>Arrow Type</th>
<th>Size</th>
<th>Area (sq ft)</th>
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<tbody>
<tr>
<td>Turn Arrow</td>
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<td>17</td>
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<tr>
<td>Through Arrow</td>
<td>9.50</td>
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<tr>
<td>Turn and Through Arrow</td>
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<tr>
<td>Lane-Reduction Arrow</td>
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* - Indicates Station Reference Point
**TABLE 1 - LANE USE MARKINGS**

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<th>A MIN.</th>
<th>B</th>
<th>C</th>
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<tr>
<td>URBAN</td>
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<td>86</td>
<td>8</td>
</tr>
</tbody>
</table>

(See Note 1)

**TABLE 2 - HANDICAP, BIKE & CHEVRON MARKINGS**

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>HEIGHT (IN)</th>
<th>WIDTH (IN)</th>
<th>AREA (SQ FT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HANDICAP</td>
<td>41</td>
<td>36</td>
<td>2.7</td>
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<tr>
<td>BIKE</td>
<td>72</td>
<td>40</td>
<td>16</td>
</tr>
<tr>
<td>CHEVRON</td>
<td>40</td>
<td>40</td>
<td>3.3</td>
</tr>
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</table>

(See Table 5)

**TABLE 3 - WORDS (SQ FT)**

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<th>ONLY WORD MARKING</th>
<th>WIDTH (IN)</th>
<th>HEIGHT (IN)</th>
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<tbody>
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<td>ONLY (C)</td>
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<tr>
<td>SCHOOL (C)</td>
<td>27</td>
<td>55</td>
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</table>

(See Note 2)

**TABLE 4 - RAILROAD SYMBOL MARKINGS**

<table>
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<th>SYMBOL</th>
<th>WIDTH (IN)</th>
<th>HEIGHT (IN)</th>
<th>AREA (SQ FT)</th>
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</table>

(See Table 3)

**TABLE 5 - R X R SYMBOL**

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<th>AREA (SQ FT)</th>
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<td>12</td>
<td>72</td>
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</tbody>
</table>

(See Note 2)
NOTES:

**SCHOOL Marking**

14. The SCHOOL markings shall be installed on all paved approaches in advance of all School Zones.

15. The SCHOOL markings should be placed at least 100' in advance of the School Zone. The preferred placement of the SCHOOL marking is adjacent to the School Zone advance sign.

16. On two-way, two-lane highways the following shall apply:
   1. When the approach lane to the School Zone is 15' or more in width -
      a.) The SCHOOL word marking and transverse lines shall be contained in, and centered in, the lane.
      b.) The character height shall be 6' for urban areas and 8' for rural areas.
   2. When the approach lane to the School Zone is less than 11' in width -
      a.) One installation of the SCHOOL word marking and transverse lines shall extend across both lanes of traffic.
      b.) The characters shall be 10' in height.

17. On multi-lane approaches the following shall apply -
   1. When the approaches to the School Zone are 13' or more in width -
      a.) The SCHOOL word marking and transverse lines shall be contained in, and centered in, each lane.
      b.) The character height shall be 6' for urban areas and 8' for rural areas.
   2. When the approach lane to the School Zone is less than 11' in width -
      a.) One installation of the SCHOOL word marking and transverse lines shall extend across both lanes of traffic.
      b.) The characters shall be 10' in height.

18. The SCHOOL markings shall be installed on all paved approaches in advance of all School Zones.

**Railroad Crossing Markings**

24. On multi-lane approaches, markings shall be as follows -
   a.) The RR symbol shall be placed in each approach lane.
   b.) Transverse lines used with the railroad symbols shall extend across all approach lanes.

25. The railroad symbol should be located so that the Railroad Advance Warning (W10-1) sign is within the two transverse boundary lines of the railroad symbol.

26. The stop line shall be located for best sight distance between 15' - 30' of the near edge of the tracks.

27. The stop line shall be approximately 8' from a gate if present.

28. Width (W) of the "X" will vary according to the lane width.

29. The height of the "R" shall be 6'.

30. The area of the transverse lines and stop lines varies with the width of the pavement. Therefore, the area must be added to the value in Table 3 (sheet 2).

**Step Line Marking**

31. Exact as specified in Notes 32 and 33. The step line should be placed as follows:
   a.) The step line should be placed where cross-corner visibility is maximum.
   b.) In case no step line is placed more than 100' or less than 4' from the near edge of the intersecting roadway.
   c.) For normal intersections the maximum distance should be 10'.

32. If a marked crossing is present, the step line should be placed at a distance of 8' from the nearest edge of the crossing.

33. If a marked crossing is present, the step line should be placed at a distance of 8' from the nearest edge of the intersecting roadway.

**Lane-Reduction Arrow Markings**

41. Lane-reduction arrow markings may be placed for speeds of less than 45 mph, if determined to be appropriate based on engineering judgment.

42. Lane-reduction arrow markings should be placed at speeds greater than 45 mph.

43. Lane-reduction arrow markings may be placed in long acceleration lanes.

44. Lane-reduction arrow markings are used, they should be placed as follows:
   a.) First lane-reduction arrow 150' in advance of the "Begin Turn" point.
   b.) Second lane-reduction arrow placed at the 3/4d point.

45. Low-use arrow markings are optional except where a through traffic lane/approach an intersection becomes a mandatory turn lane(s).

46. Where used, the spacing between markings should be based on Table 4 (sheet 2). However, based on the turn lane length, the spacing between the markings may be adjusted.

**Two-Way Left- Turn Only (LTLTO) Arrows**

66. Arrow sets should be longitudinally spaced at intervals of:
   a.) 500' - 1000' for speeds less than or equal to 40 mph.
   b.) 3000' - 9000' for speeds over 40 mph.

67. In addition, an arrow set should be placed:
   a.) 50' - 200' from the near edge of an intersecting roadway.
   b.) Inside both ends of 14' 10" lanes.

**Sharrow Marking**

71. When chevron markings are used, its area must be added to the value of the bike symbol markings (see Table 2 on sheet 1).

72. When used, the shared lane marking should be placed immediately after an intersection and spaced at intervals not greater than 200' thereafter.

**Two-Way Left- Turn Only (LTLTO) Arrows**

82. Lane-reduction arrow markings may be placed for speeds of less than 45 mph, if determined to be appropriate based on engineering judgment.

83. Lane-reduction arrow markings should be placed at speeds greater than 45 mph.

84. Lane-reduction arrow markings may be placed in long acceleration lanes.

85. Lane-reduction arrows are used, they should be placed as follows:
   a.) First lane-reduction arrow 150' in advance of the "Begin Turn" point.
   b.) Second lane-reduction arrow placed at the 3/4d point.
CHEVRON MARKINGS SPACING TABLE

<table>
<thead>
<tr>
<th>SPACING (FT)</th>
<th>10 (FT)</th>
<th>CHEVRON MARKINGS SPACING (FT)</th>
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<tr>
<td>0</td>
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<td>22 on Centers</td>
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<tr>
<td>48</td>
<td>60</td>
<td>24 on Centers</td>
</tr>
<tr>
<td>&gt; 97</td>
<td>Measured from Theoretical Core</td>
<td></td>
</tr>
</tbody>
</table>

NOTES:
1. Chevron markings, when used in neutral areas of exit and entrance ramps, are 24" wide lines and are placed at the spacing shown in the Chevron Markings Spacing Table.
2. Dotted lines are white dotted line segments 3' in length separated by 9' gaps.

EXIT RAMP
(WITH PARALLEL DECELERATION LANE)

MULTI-LANE EXIT RAMP
ENTRANCE RAMP
(WITH TAPERED ACCELERATION LANE)

MULTI-LANE ENTRANCE RAMP
1. Wrong-way signs are placed as follows:
   a) Place the wrong-way sign (R5-1A, 42" x 30") 250' min. in advance of the stop line. The height of the sign shall be 3' above the nearest edge of the pavement.

2.私有交通标志牌置于路面。
NOTES:

1. The design of the Strain Poles presented on this drawing meets the requirements of the AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, First Edition 2015 (LRFDLTS-1) and all interim releases prior to the bid date of the project.

2. Dimensions noted as required shall be as indicated on the drawing and shall not be altered.

3. Calculations are required for any modifications to the information shown on this drawing. Modifications shall meet the requirements of LRFDLTS-1 and the design criteria shown in Note 23. Calculations shall be stamped by a Professional Engineer registered in the State of Ohio and shall be submitted for review and approval with the shop drawings.

4. Span wire clamp shall be a 3" blind half coupling provided in each pole.

5. Service wire entrance shall be a 1 ½" blind half coupling, when required by the plans. Orientation and height shall be as required by the plans.

6. Span wire clamp shall be galvanized steel, capable of resisting a load of 12,500 pounds minimum without permanent distortion. Alternate messenger wire assembly (wrapping) as shown on Standard Construction Drawing (SCD) TC-17.11 or TC-84.20 may be used in lieu of the span wire clamp if specified in the plans.

7. For foundation details, including anchor bolt details, see SCD TC-21.21.

8. Alternate messenger wire assembly (wrapping) as shown on Standard Construction Drawing (SCD) TC-17.11 or TC-84.20 may be used in lieu of the span wire clamp if specified in the plans.

9. The pole attachment to the base plate shall be welded using a full penetration weld.

10. A minimum of one full bolt thread shall remain above the anchor nut.

11. All unused couplings shall be provided with a removable galvanized cast iron plug.

12. For construction details and location of handholes, see SCD TC-22.15.

13. For pole and base plate dimensions, see sheet 2.

Legend:

* = Required dimension see Note 2

(See Sheet 2)
### Pole Details

**Material:**
- All material shall meet the requirements of C&MS 730 with the following limitations:
- Steel hardware - Galvanizing - ASTM A 153 (Hot-dip galvanized) (Not ASTM B 695 Class 50)
- Steel welds shall meet the requirements of C&MS 632, 711.02, 730.02 and 732.11 except that 730.02 shall be modified to require the galvanizing limits to be the full length of the anchor bolts not less 3 inches beyond the threads.
- Anchor bolt nuts shall meet the requirements of ASTM A 563 Grade DH or A 194 Grade 2H.
- Anchor bolts shall meet the requirements of C&MS 513.19. Modifications to the holes must be approved by the Engineer. Enlarging or slotting holes to match mis-aligned anchor bolts will not be permitted.
- Anchor bolts for high-strength bolts and bearing bolts shall meet the requirements of C&MS 513.19. Modifications to the holes must be approved by the Engineer. Drilling or existing holes to match mis-aligned anchor bolts will not be permitted.
- All welds shall be inspected according to the requirements of C&MS 630.06 and AWS D1.1 Structural Welding Code - Steel. A report of the welding inspection shall be submitted to the ODOT Office of Material Management Structural Welding and Materials Engineer.
- Design Criteria:
  - Materials Engineer.
  - ASTM A 153.
  - ASTM F 436 Type 1 (Hot-dip galvanized) according to ASTM A 153.
  - Anchor bolt washers shall meet the requirements of C&MS 730.08 and shall also meet the requirements of ASTM A 563 Grade DH or A 194 Grade 2H.
  - Anchor bolt nuts shall meet the requirements of C&MS 730.08 and shall also meet the requirements of ASTM A 563 Grade DH or A 194 Grade 2H.
  - Anchor bolt washers shall meet the requirements of ASTM F 436 Type 1 (Hot-dip galvanized) according to ASTM A 153.
  - Anchor bolt washers shall meet the requirements of ASTM F 436 Type 1 (Hot-dip galvanized) according to ASTM A 153.
  - Anchor bolt washers shall meet the requirements of ASTM F 436 Type 1 (Hot-dip galvanized) according to ASTM A 153.

**NOTES:**
- (cont’d from sheet 1)
- 18. Anchor bolts shall meet the requirements of C&MS 730.08 and shall also meet the requirements of ASTM A 563 Grade DH or A 194 Grade 2H.
- Anchor bolts shall meet the requirements of C&MS 513.19. Modifications to the holes must be approved by the Engineer. Enlarging or slotting holes to match mis-aligned anchor bolts will not be permitted.
- Anchor bolts for high-strength bolts and bearing bolts shall meet the requirements of C&MS 513.19. Modifications to the holes must be approved by the Engineer. Drilling or existing holes to match mis-aligned anchor bolts will not be permitted.
- All welds shall be inspected according to the requirements of C&MS 630.06 and AWS D1.1 Structural Welding Code - Steel. A report of the welding inspection shall be submitted to the ODOT Office of Material Management Structural Welding and Materials Engineer.

### Strain Pole Details

<table>
<thead>
<tr>
<th>DESIGN NO.</th>
<th>POLE HEIGHT (FT)</th>
<th>MAXIMUM FACTORED FLEXURAL RESISTANCE AT BASE (FT KIPS)</th>
<th>BASE DIAMETER</th>
<th>MINIMUM WALL THICKNESS</th>
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</table>

\* = Required dimension, See Note 2

- **Load Parameters:**
  - Wind Load: 750-year MII Basic Wind Speed Map, 115 mph Design Wind Speed
  - Service Life: Infinite per LRFD LTS-1 11.9.3
  - Service I Wind Velocity: 76 mph per LRFD LTS-1 Table 3.6.1 and Figure 3.6.4-B
  - ADT: Greater than 10,000
- **Serviceability Parameters:**
  - Rake (Pole Tilt): 1.21 degrees (1.67 degrees per LRFD LTS-1 10.4.2.1, except for slope at top of pole: maximum of 0.35 inch/foot)
  - Horizontal Deflection at Top of Pole: 2 inches (1.5% of pole height)

---

**Tables:**

- **Maximum Factored Flexural Resistance at Base (FT KIPS)**
- **Base Diameter (INCHES)**
- **Minimum Wall Thickness (INCHES)**
- **Number of Design (FT)**
- **Height (FT)**
- **Pole Details**

---

**Design Engineer:**
- Brenton Bogard
<table>
<thead>
<tr>
<th>DESIGN NO.</th>
<th>MAXIMUM DESIGN AREA SQ. FT. (NOTE A)</th>
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<th>SIZE</th>
<th>MAX LENGTH</th>
<th>BOLT CIRCLE</th>
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<th>J</th>
<th>H</th>
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**NOTES:**

A. Minimum design area is based on wind loads with a mean recurrence interval of 700 years.

B. These designs use full penetration welds at the arm and base plate connections

**Required dimension, see Note 2**

**See Note 3**
**ENGINEERING ROADWAY OFFICE OF INSTALLATION DETAILS**

**VEHICLE DETECTOR INSTALLATION DETAILS**

**VEHICLE DETECTOR INSTALLATION DETAILS**

1. Rectangular detector loops shall not be used at the stop line or for dilemma zone detector.

2. If a pullbox is not specified in the plans, the waterproof splice enclosure shall be located in the first entered pole or pedestal, except if the controller cabinet is mounted on that pole or pedestal, in which case the enclosure shall be soldered.

3. The enclosure shall not contain visible air bubbles (voids) greater than ".".

4. Loop detector sealant shall be a prequalified product in accordance with Supplement 1048.

5. Saw slots and probe holes shall be thoroughly cleaned and dried prior to installation of sealant.

6. Loop detector wire in tubing shall be routed directly into the cabinet.

7. Extension loops shall be tested using the motorcyle target.

8. All stop line loops shall be tested with standard ODOT motorcycle and bicycle targets (see TC Figure 498-21). Extension loops shall be tested along the motorcycle target.

**RECTANGULAR LOOP CONSTRUCTION**

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<thead>
<tr>
<th>LOOP PERIMETER</th>
<th>NUMBER OF TURNS</th>
</tr>
</thead>
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</tr>
<tr>
<td>40&quot; TO 60&quot;</td>
<td>3</td>
</tr>
<tr>
<td>OVER 60&quot;</td>
<td>2</td>
</tr>
</tbody>
</table>

**WINDING PATTERN**

1. Loop detector wire to lead-in cable splices within the encapsulated splice enclosure shall be soldered.

2. If a pullbox is not specified in the plans, the waterproof splice enclosure shall be located in the first entered pole or pedestal, except if the controller cabinet is mounted on that pole or pedestal, in which case the loop wires shall be routed directly into the cabinet.

3. The enclosure shall not contain visible air bubbles (voids) greater than ".".

4. Saw slots and probe holes shall be thoroughly cleaned and dried prior to installation of sealant.

5. Loop detector sealant shall be a prequalified product in accordance with Supplement 1048.

6. Loops detectors wire in tubing shall be routed directly into the cabinet.

7. Extension loops shall be tested using the motorcycle target.

8. All stop line loops shall be tested with standard ODOT motorcycle and bicycle targets (see TC Figure 498-21). Extension loops shall be tested along the motorcycle target.

9. There shall be one A.D.D. loop per travel lane.

10. The perimeter of an A.D.D. loop as shown above is 8.66 times the dimension "A".

**PLATE OUT**

1. Minimum saw slot depth: Asphalt 4" 
   Concrete 2" 
   Maximum saw slot depth: Concrete 2 1/2 "

2. Saw slots and probe holes shall be thoroughly cleaned and dried prior to installation of sealant.

3. Loop detector sealant shall be a prequalified product in accordance with Supplement 1048.

4. Saw slots and probe holes shall be thoroughly cleaned and dried prior to installation of sealant.

5. Wire installations in new asphalt may be sawed and embedded with sealant in sub-surface course with subsequent covering by the surface course, subject to approval of the Engineer.
4. Loops shall be centered in lane.

3. Stop line detector loops shall each be on a separate lane or lane marking if parallel to the joint.

2. All adjacent saw slots shall have a minimum distance of 1' between them. No saw slot shall be located within 1' of a longitudinal or transverse joint in P.C.C. pavements if the slot is parallel to the joint.

1. The drilled holes shall be located as shown above and within the full depth pavement. It shall not be drilled or cut through the paved berm, curb or curb and gutter section.

2. In areas of poor pavement condition, the saw slot depth shall be increased to ensure adequate wire embedment. All field adjustments shall be subject to the approval of the Engineer.

TYPICAL DRILLED HOLE LOCATIONS

1. Where multiple loops use a single lead-in cable, series connections shall be used.

2. A maximum of 3 loops in wire spliced shall be used in any encapsulated splice kit.

MULTIPLE LOOP LAYOUT

1. Only one set of loop wires shall be run in a saw slot over to the controller location.

2. All adjacent saw slots shall have a minimum distance of 1' between them. No saw slot shall be located within 1' of a longitudinal or transverse joint in P.C.C. pavements if the slot is parallel to the joint.

3. Stop line detector loops shall each be on a separate detector unit channel to enhance motorcycle detection.

4. Loops shall be centered in lane.
PREFABRICATED LOOP DETAILS

DETAIL "C"  
(Prefabricated Saw-Cut Loops Only)

NOTES:
1. Prefabricated loops are required in all asphalt and non-reinforced concrete pavements. Do not install prefabricated loops in bridge decks.
2. Install prefabricated loops manufactured by these A&B, NeverFail, or approved equal.
3. Follow loop manufacturer's installation procedures to locate cylinder hole.

1 1/4" Dia. Hole Drilled to 12" Deep

Drilled Loop Corner Hole: (See Detail B5)

12" (typ) Loop Saw Cut

To Conduit

Prefabricated Loop Cylinder

Notes:
1. All conduit fitting entries for controllers and power service equipment in proposed steel poles shall be attached by a blind half coupling welded into the pole prior to galvanizing.

2. Service cable attachment on wood poles shall be by a "M" thru-bolt and clevis on steel poles by a banded clevis.

3. If both the meter and disconnect switch are not required on a steel pole, the power cable shall enter the controller through a conduit riser, external to the pole. For underground power service, install meter base and disconnect on an adjacent pedestal (ISO TC-83.20J or strut frame ISO TC-83.20L) as directed in the plans.

4. The service cable and cable splices to the power cable for the incoming power supply shall be installed by the power supplying agency unless otherwise specified. The pole attachment hardware shall be furnished and installed by the Contractor.

5. Orientation of the controller, meter and disconnect switch enclosure shall be arranged to minimize exposure to the street side and also minimize encroachment on sidewalks, unless otherwise shown on the plans.

6. Power and controller service for metal poles shall be similar to that shown for the wood pole with the exception of the attachment hardware.

7. The top of the meter base shall not exceed 6' above the ground. The mounting height of the 1½" fitting may be decreased in order to accommodate a larger meter base.

8. Conduit attachment shall be by means of two hole conduit straps with a maximum spacing of 3'. Minimum fastener requirements are as follows: wood poles - 3/4' x 3' long lag screws No. M x 3½ long round head screws, or 205 spokes steel poles - 1/4' screws, self tapping or with drilled and tapped hole, in lieu of conduit clamps, 3/4' wide passivated stainless steel banding may be used on steel poles.

9. Conduit connections at the top and bottom of the controller enclosure and meter base shall be watertight and shall use the hubs listed on the enclosure and meter base U.L. labels. Conduit shall be bent to allow the conduit to enter straight into the enclosure or meter base, and to provide space for the weatherhead when the riser is pulled tight against the pole.

10. A 4½' x 36' x 4" work pad shall be located below each pole-mounted controller cabinet unless located in an otherwise paved area. When required, this item shall be paid for under item 3.1, controller work pads. In lever areas, the top of the pad shall be 18" above the ground line. In steeply sloped areas, the pad location shall be adjusted to provide access and drainage while complying with the required controller cabinet mounting height.

11. The horizontal orientation of the handhole relative to the 2½" blind half coupling for the controller shall be as required by the plans except they shall not be closer than 90° from fitting before erecting pole.

12. When conduit risers are required to be attached to utility company wood poles, and the utility company’s policy requires non-metallic conduit, the conduit risers shall conform with NEMA Standards publication No. TC-2 for PVC conduit type PVC-40.

13. All preformed joint filler as per AWS 70S.06 shall be used between foundations and adjacent paved areas.

14. Provide a separate disconnect and conduits for intersection lighting, do not route lighting circuits through controller cabinet.
1. ¾" preformed joint filler as per CMS 705.03 shall be used between foundations and adjacent paved areas.

2. For cabinets, 4" minimum, 2 required. For pedestals, as shown in the plans.

3. The size, number and location of anchor bolts shall be in accordance with the manufacturer’s recommendations.

4. All pedestals shall be provided with a method of securely attaching a AWG insulated copper grounding conductor to the pedestal or anchor bolt. No cables or connections shall be external to the pedestal.

5. The pedestal shaft length as shown in the plans includes the pedestal base height for either base design. The maximum Equivalent Physical Area EPA of pedestal-mounted signal devices shall be 8 square feet (3-section head with backplate) or a total mounting height of 12" or less. Larger devices should be mounted on 14 x 10 x 13 bases and plates.

6. The pedestal base shall be on the foundation top, with dry or preformed fillers or leveling nuts under the base. Steel shims may be used under the base for leveling the installation.

7. The foundation area of contact with the pedestal base shall be level. Adjacent paved areas, the remainder of the foundation top shall be beveled for leveling the installation.

8. A cast steel anchor base of equivalent strength may be used in lieu of the base plate.

9. A 4" thick work pad shall be provided unless in an otherwise paved area. When required, this item shall be paved. Steel shims may be used under the base for leveling the installation.

10. Ground mounted controller cabinets shall be sealed to the foundation with a flexible weatherproof clear, silicone caulking compound.

11. Threaded shaft connections into transformer-type pedestal bases shall resist rotation through the use of setscrews, a galvanized or stainless steel through-bolt shall be used with a minimum diameter of ¾" and utilizing nylock or deformed-thread nuts.

12. Alternate to through-bolt: provide a deep collar on top of transformer base with three set screws of ¾" stainless steel that engage the shaft above the threads after the shaft is threaded into the base.
332/336 CABINET FOUNDATION

CONDUIT BUSHING

GROUND LINING

499, 511 Concrete

332/336 CONTROLLER WORK PAD

See Note 1

(See Note 9)

NOTE: Pullbox Shall be Placed on Opposite Side of Door Hinge

TC-83.20
INTERCONNECT & LOOP DETECTOR
LEAD-IN ATTACHMENT DETAIL

NOTES:

1. Messenger wire pole attachment shall be by a pole clamp on steel poles and be a 3/8" thru-bolt or thimble-eye bolt with washers on wood poles.

2. The pole mounted type splice enclosure may be used as an alternative splice method unless otherwise specified in the plans. Pole attachment shall be by means of passivated stainless steel banding or tapped screws on steel poles and lag screws on wood poles. The box shall be gasketed and weathertight, and hot dipped galvanized if constructed of steel. Minimum box requirements shall be 8" x 8" x 4" with 2 terminal connections 30 amp.

3. The interconnect or loop detector lead-in cable shall have a gap between 3/8 and 5/8 or match existing utility lines.

4. The interconnect or loop detector lead-in messenger wire shall be grounded at the first and last poles in a cable run of interenate not to exceed 200'. When attached to wood poles, the messenger wire shall be grounded by bonding to an existing ground rod. The messenger wire shall be bonded to grounded steel poles by use of a 3/8" bolt drilled and tapped into the pole.

5. The minimum 3-bolt size clamp shall be 6" long with 3/8" diameter bolts. Preformed guy grips shall not be used to attach the messenger wire to the signal poles. Their use is limited to bulring attachments.

6. The alternate messenger wire attachment shall only be allowed on round, tapered steel straining poles and must be specified in the construction plans for use. Alternate wire attachment shall not be used for lateral wire attachment.
NOTES:

1. For angles of 166° through 180° use interconnect attachment details shown on Standard Construction Drawing (SCD) TC-84.20. Messenger wire pole attachment shall be by a pole clamp on steel poles and by a 3/8" thru-bolt or thimbleye bolt with curved washers on wood poles.

2. The interconnect or loop detector lead-in messenger wire shall be electrically grounded at the first and last poles in a cable run and at intervals not to exceed 1000'. When attached to wood poles, the messenger wire shall be grounded by bonding to existing ground wire or connection to a ground rod. The messenger wire shall be bonded to grounded steel poles by use of a 3/8" bolt, drilled and tapped into the pole.

3. The interconnect or loop detector lead-in cable shall have a sag between 3/8 and 7/8 or match the existing utility lines.

4. Grounding of poles shall be as shown on SCD TC-84.20.
**NOTES:**

1. Vehicular signal heads shall utilize mounting brackets similar to those shown for pedestrian signal heads.

2. Signal head conduit brackets and conduit fittings shall be galvanized and painted (except pole clamps or bands) to match the body of the signal head.

3. For embedded steel poles, external conduit shall be similar to that shown in wood pole detail. External grounding will not be required unless specifically noted on the plans.

4. The signal head bracket arms shall be attached to steel poles by one of the following methods:
   a. 1 1/2" blind half coupling welded into the pole prior to painting.
   b. Bracket arm hub plates attached to the pole as per note 7.
   c. Pole clamp with threaded hub.

Field installation of the wiring holes for signal heads and pushbuttons will be permitted provided that the holes are drilled or hole sawed. No torch cutting or field welding will be permitted. Cut surfaces shall be filed smooth and coated with two coats of anti-rust paint. Grommets or wiring guides shall be installed in the holes.

5. Vertical spacing between vehicular or pedestrian signal bracket fittings shall be determined by the Contractor, and shall be the dimension from centerline to centerline of the bracket arms necessary to accommodate the vertical height of the signal head plus not more than 10".

6. The following minimum size fasteners shall be used for the attachment of the indicated hardware to wood poles:
   a. CONDUIT BRACKET ARM HUB PLATES: 1/2" dia. x 3" long lag screws (two screws per hub plate).
   b. CONDUIT STRAPS (Two hoop): 5/8" x 3" long round head wood screws, or 20d spikes.
   c. PUSHBUTTON SIGN: with brackets - 5/8" x 3" long lag screws with 1/2" I.D. x 1" O.D. flat washer between the sign and pole (two per sign).
   d. PUSHBUTTON: #10 x 3" long round head wood screws, or 20d spikes.

7. The following minimum size fasteners shall be used for the attachment of the indicated hardware to steel poles:
   a. CONDUIT BRACKET ARM HUB PLATES: 1/2" dia. screw or 5/8" wide passivated stainless steel band (two fasteners or bands per hub plate).
   b. CONDUIT: Two hole conduit straps with 5/8" dia screws or 5/8" wide passivated stainless steel bands.
   c. PUSHBUTTON SIGN: with brackets - 5/8" dia. screws (two per sign).
   d. PUSHBUTTON: 1/2" dia. screws (two per pushbutton).

The screws shall utilize a drilled and tapped hole or be the self-tapping type.

8. The minimum clearance from face-of-curb shown is applicable to tangent segments. On curved segments (corners) the minimum clearance is greater. When clearance to curved curb face is less than 10", consult with the Engineer for possible alternate locations.
RIGID SIGNAL HEAD MOUNTING FOR MAST ARMS

1. Signal head conduit brackets and conduit fittings shall be galvanized. On span wire conduit signals, they shall be painted to match the body of the signal head. On mast arm mounted signals, they shall not be painted unless specified in the plans.

2. All signal head assemblies shall be installed in a plane position and perpendicular to the approach lane.

3. The mast arm clamp shall have a minimum strength of yield to support a 200 pound dead load and 90 mph design wind.

4. A minimum of 1" is required for optically programmed signal heads and a minimum of 6" for standard signal heads.

5. Alternate rigid signal head mounting devices (e.g., "Metro-Brac") for mast arms may be approved by the Engineer upon demonstration that they provide adequate rigidity, equal range of adjustment and can be tightened sufficiently to prevent movement and loosening under vibration.

6. All signal heads shall be installed with their lowest part including backbracing and backplates with a clearance above pavement elevation of the center of the roadway of 17' minimum. It is intended that this clearance be obtained without the use of drop pipes, but rather by the careful selection of foundation heights, attachment heights, arm rise, and other factors during the installation. The installation cannot be adjusted to the proper clearance the Contractor shall advise the Engineer of all signals which exceed the maximum. The Engineer will, in consultation with the maintaining agency, direct the use of drop pipes or waive the maximum clearance requirement for each head.

7. Cable entrance openings on disconnect hangers shall rigidly clamp cable to prevent movement of the cable within the enclosure.

8. Signal head rotation shall be prevented by the use of serrated rings, set screws, or other positive devices incorporated in the signal housing and all critical locations in the supporting hardware.

9. Cable entrance openings on disconnect hangers shall have adequate clearance between hangers, thinlines, bullrings, etc., in order to avoid damage from rubbing.

10. All backplates shall have a 2" fluorescent yellow reflective border.

11. Use nylon locking or deformed thread nuts.
NOTES:

1. S-Hook is matched to the strain pole design number (see table). S-Hook and turnbuckles are required only at one end of simple spans, at ends of complex spans. S-Hook shall be closed at pole end. If S-hook begins to yield during installation, it shall be removed and replaced. The wire tension shall be adjusted to minimize movement of signal heads in high winds. Typical tension is 650 to 850 lbs.

2. Lock wire shall be stainless steel, ⅛" soft temper, coated to prevent turning of the turnbuckle body. Finished span shall have at least 2" of space for turnbuckle adjustment. Turnbuckle shall not be over-tightened. See 8" hand tools, maximum.

3. If signal orientation is not perpendicular to span and tether wire, then use an alternate extension. Clamp assembly must be attached to the flat side of the extension bar.

4. Install safety tie at each turnbuckle. This wire shall be 1 x 19, ⅜" stainless steel. Provide slack in the tie without contacting the pole. Use 3 clips per end at 1½" spacing.

5. Tether wire shall be 7-strand ASTM A475 HS or EHS Grade ⅜". On all spans, install tether horizontally. Maximum clearance of 17" to 18" over roadway.

6. Span wire clamps per Standard Construction Drawing TC-81. If required for tether wire attachment or approved equal rated at 950 lbs or higher. Alternate attachment method shall not be permitted.

7. Safety tie anchor height above tether is adjusted in the foot before S-Hook is installed. Dimension X (Safety Tie height) shall be adjusted so that the minimum vertical clearance of the sagging tether wire above the pavement without the S-Hook installed is at least 14'. Minimum distance between the safety tie clamp and tether shall be 1½" and contain enough slack for head to sway in high winds. Safety tie anchor may be any galvanized or stainless steel pole clamp assembly rated at 3650 pounds or higher.

8. On spans with buildings, a tie shall be provided between messenger and tether hitches if a 14' clearance cannot be maintained after S-Hook opening. This vertical tie shall be 1 x 19, ⅛" stainless steel. Tie shall be slightly slack, tied back using cast wire rope clips as shown. Wire rope clips shall not be over-tightened.

9. All backplates shall have covers and 2" fluorescent yellow reflective border. Border shall not be applied over louvers. Grit surface to scoop air from the front side and with the openings facing alternate directions by groups as shown. Louver open area shall be at least 8% percent of the total backplate area.

10. Do not tether signs on signal spans.
1. Unless specified otherwise in the Plans, install the PROCESSOR INTERFACE, as shown on page 1 of this drawing. It is the standard.

2. The RELAY INTERFACE is an alternate method of construction to be used only when specified in the Plans.

3. Provide w/PS Confirmation module when specified in the Plans. Unless specified otherwise in the Plans, the confirmation light display will be as follows:
   A. AP-PR - all approaches flash 3 times over 600 ms followed by 600 ms off.
   B. AP-SP - selected approach - steady ON.
   C. AP-NC - non-selected approach - 50% duty cycle, 1-second period flash.

4. XR is not required when ARP is used, unless required in the Plans for asserting a blankout sign, as per Note 3, or similar application, or if XR is omitted. If XR is omitted, the 24 VDC connection to the Railroad Panel terminals shall remain. If XR is omitted, wire White/1 shall be connected to the head of ARP.

5. ISLR and APR/APP are optional unless called for in the Plans. If called for in the Plans, the railroad shall connect the APPR (Advance Pedestrian Preempt Relay) to be driven by the crossing controller circuit and output, providing the earliest possible notification to the traffic signal controller. The traffic signal controller then sets the PED phases indicated in the Plans. See also Note 7.

6. Use of TSBR by the railroad is optional. Active TSH and NTSH wires will be provided at the Interface Panel terminals.

7. Connect FLASH RED 120 Vac to any controller phase Field Terminal Pd or similar application, or if GDR is omitted. If XR is omitted, wire White/2 shall be connected to the head of ARP.

8. Label each wire with a number tag on each end of cable.

NOTES:

- These diagrams replace TC-86.10 dated 01-18-2019.
- Standard Roadway Construction Diagrams
- State of Ohio Department of Transportation Administrator
- Office of Office of Roadway Engineering
- Due "L. Holstein 07/19/2019"
NOTES:

1. Connections to relay pins 1 and 4 may be changed to accommodate specific controller units.

2. Indicator panel to be provided for each railroad preemption interface panel.

3. K7 is optional based on controller unit soft flash operation.

4. XR is not required when APR is used, unless required in the plans for asserting a blankout sign, as per Note 7, or similar application, or if GDR is omitted. If XR is omitted, the 24 VDC NEG connection to the railroad interconnect cable shall remain. When XR is omitted, wire White/4 shall be connected to Heel at APR.

5. ISLR and GPR/APP are optional unless called for in the plans. If called for in the plans, the railroad shall connect the APPR (Advance Pedestrian Preempt Relay) to be driven by the crossing controller motion detector output, providing the earliest possible notification to the traffic signal controller. The traffic signal controller then initiates the PED phases indicated in the plans. See also Note 7.

6. Use of TSHR by the railroad is optional. Active TSH and NTSH wires will be provided at the Interface Panel Terminals.

7. For crossings not equipped with GDR, ISLR or XR may be used in place of GDR for the purpose of terminating Track Clearance Green (TCG).

8. Label each wire with a number tag on each end of cable.