# 2022 Traffic Signal Standards

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**2022 Traffic Signal Standards**

**Approved:**

*Emily Gilmore, City Traffic Engineer*

2/24/2022

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2022 SIGN AND PAVEMENT MARKING STANDARDS

APPROVED:

[Signature]

DWAYNE GLOECKNER, CITY TRAFFIC ENGINEER

2/24/2022
TRAFFIC SIGNAL NOTES

GENERAL

1. This manual refers to the appropriate section of the standard specifications for road and bridge construction – Colorado Department of Transportation latest edition unless specified.

2. For work involving 1CSD, the contractor shall comply with the latest edition of the standard specifications for road and bridge construction – Colorado Department of Transportation.

3. For work involving ICS, the contractor shall comply with the latest edition of the standard specifications for road and bridge construction – Colorado Department of Transportation.

4. For work involving ICS, the contractor shall comply with the latest edition of the standard specifications for road and bridge construction – Colorado Department of Transportation.

5. For work involving ICS, the contractor shall comply with the latest edition of the standard specifications for road and bridge construction – Colorado Department of Transportation.

GENERAL (CONT.)

6. If a vehicle is not equipped with an airbag, the following additional equipment shall be required for all new traffic signals:

   a. Vehicle detection
   b. Pedestrian detection
   c. Pedestrian push buttons
   d. Pedestrian crossing signs
   e. Pedestrian crossing signals
   f. Pedestrian crossing signals

7. If a vehicle is not equipped with an airbag, the following additional equipment shall be required for all new traffic signals:

   a. Vehicle detection
   b. Pedestrian detection
   c. Pedestrian push buttons
   d. Pedestrian crossing signs
   e. Pedestrian crossing signals
   f. Pedestrian crossing signals

8. If a vehicle is not equipped with an airbag, the following additional equipment shall be required for all new traffic signals:

   a. Vehicle detection
   b. Pedestrian detection
   c. Pedestrian push buttons
   d. Pedestrian crossing signs
   e. Pedestrian crossing signals
   f. Pedestrian crossing signals

9. If a vehicle is not equipped with an airbag, the following additional equipment shall be required for all new traffic signals:

   a. Vehicle detection
   b. Pedestrian detection
   c. Pedestrian push buttons
   d. Pedestrian crossing signs
   e. Pedestrian crossing signals
   f. Pedestrian crossing signals

CONSTRUCTION

10. All conduit shall be schedule 80 PVC or HOPE. For all 3-inch conduit, shall be brought into the hole and 3-inch conduit shall be brought into the hole for all socket holes without 3-Inch.

11. For all conduit, the following additional equipment shall be required for all new traffic signals:

   a. Pedestrian push buttons
   b. Pedestrian push buttons
   c. Pedestrian push buttons
   d. Pedestrian push buttons
   e. Pedestrian push buttons
   f. Pedestrian push buttons

12. For all conduit, the following additional equipment shall be required for all new traffic signals:

   a. Pedestrian push buttons
   b. Pedestrian push buttons
   c. Pedestrian push buttons
   d. Pedestrian push buttons
   e. Pedestrian push buttons
   f. Pedestrian push buttons

13. For all conduit, the following additional equipment shall be required for all new traffic signals:

   a. Pedestrian push buttons
   b. Pedestrian push buttons
   c. Pedestrian push buttons
   d. Pedestrian push buttons
   e. Pedestrian push buttons
   f. Pedestrian push buttons

14. For all conduit, the following additional equipment shall be required for all new traffic signals:

   a. Pedestrian push buttons
   b. Pedestrian push buttons
   c. Pedestrian push buttons
   d. Pedestrian push buttons
   e. Pedestrian push buttons
   f. Pedestrian push buttons
TRAFFIC CONTROL DEVICE LEGEND

EXISTING

CONTROLLER CABINET
POWER SOURCE - ELECTRIC UTILITY
PULL BOX - TRAFFIC
PULL BOX - TRAFFIC COMMUNICATIONS
WATER VALVE PULL BOX
LOOP DETECTOR (LENGTH AS SPECIFIED)
POLE - WOOD, STEEL, ALUMINUM OR CAST
EMERGENCY VEHICLE PREVENTIVE SYSTEM
DOWN GUARD
UNDERGROUND CONDUIT
LUMINARIES
PEDESTRIAN PUSH BUTTON, "WAIT FOR WALK SIGNAL", INDICATES LEFT OR RIGHT ARROW, PLACE NOTE NEAR SIGNAL POLE
VIDEO DETECTION CAMERA
RADIO ANTENNA
MICROWAVE DETECTOR
BLUETOOTH TRAFFIC MANAGEMENT SYSTEM
IKE DEVICE

NEW

TRAFFIC CONTROL DEVICE LEGEND

EXISTING

POLE MOUNTED SIGN
POST MOUNTED SIGN
SPAN-WIRE MOUNTED SIGN
MAST ARM MOUNTED SIGN
CLOSED-CIRCUIT TELEVISION CAMERA
BLANK OUT SIGN
VARIABLE MESSAGE SIGN
ELECTRIC WATER

NEW

PEDESTAL OR SIDE BRACKET MOUNTED SIGNAL HEAD
PEDESTAL SIGNAL HEADS
MAST ARM MOUNTED LENGTH AND ORIENTATION AS NEEDED
SPAN-WIRE MOUNTED SIGNAL CLUSTER

"ALL SIGNAL HEADS ARE 12" UNLESS OTHERWISE NOTED"
KEY NOTES

REMOVALS
1. REMOVE SIGNAL HEAD
2. REMOVE SIGNAL POLE
3. REMOVE SIGNAL CABINET, CONTROLLER, PULL BOXES AND WATER VALVE PULL BOXES
4. REMOVE MAST ARM
5. REMOVE SPAN WIRE, CABLE AND ALL ATTACHED SIGNAL HEADS AND EQUIPMENT
6. REMOVE PUSH BUTTON
7. ELECTRIC UTILITY COMPANY TO REMOVE EXISTING POLE
8. ELECTRIC UTILITY COMPANY TO REMOVE, RELOCATE OR RAISE EXISTING OVERHEAD POWERLINE
9. REMOVE AND REPLACE COMMUNICATIONS PULL BOX SUCH THAT NEW LD IS SEATED FLUSH WITH PROPOSED SIDEWALK OR FINISH SURFACE
10. REMOVE AND SALVAGE DETECTION CAMERA
11. REMOVE EXISTING POLE FOUNDATION TO MINIMUM DEPTH OF 1' BELOW FINISHED GRADE
12. REMOVE EXISTING PULL BOX (SPECIAL) FOR SIGNAL SYSTEM COMMUNICATIONS

INSTALLATIONS
13. INSTALL SIGNAL HEAD OR HEADS
14. INSTALL SIGNAL CABINET, CONTROLLER AND ASSOCIATED EQUIPMENT
15. INSTALL PUSH BUTTON
16. INSTALL CONDUIT
17. (2) INSTALL TWO 3-INCH CONDUITS
18. INSTALL SIGNAL POLE
19. INSTALL MAST ARM — (LENGTH AS SHOWN)
20. INSTALL SPAN WIRE
21. (COMMA/ESPECIAL) INSTALL PULL BOX MARKED "TRAFFIC COMMA" ON LID
22. INSTALL ONE PULL BOX MARKED "TRAFFIC" ON LID
23. INSTALL LOOP DETECTOR
24. INSTALL CLOSED CIRCUIT CAMERA
25. ELECTRIC UTILITY COMPANY TO INSTALL POWER FEED, CONTRACTOR TO EXTEND TO SIGNAL CABINET
26. INSTALL LUMINARIE
27. INSTALL WATER VALVE PULL BOX
28. NO CHANGE
29. INSTALL STREET LIGHT STANDARD
30. INSTALL EMERGENCY VEHICLE PREDETECTION DETECTOR
31. INSTALL INTERCONNECT (SIZE & TYPE AS SHOWN)
32. INSTALL VIDEO DETECTION CAMERA (FLIR OR VIDEO)
33. INSTALL ELECTRIC METER
34. YOU ARE DETECTED (SIGN)
GENERAL NOTES

2. LOOP DETECTORS SHALL BE INSTALLED WITH THE NUMBER OF TURNS OF WIRE AND IN THE CONFIGURATION SHOWN ON SHEET 16.1.6.2. A COMPLETE LOOP DETECTOR UNIT SHALL BE INSTALLED IN THE ROADWAY, LEAD-IN CABLE, AND A DETECTOR UNIT INSTALLED IN A TRAFFIC SIGNAL CONTROLLER CABINET.

3. LOOP WIREs SHALL BE Brought OUT TO THE NEAREST SIGNAL POLE OR DURABLE BOX AND EXTENDING UNDERGROUND CONDUIT OR OVERHEAD WIRE CONDUIT WIRE USED FOR LEAD-IN CABLE TO CONTROL CABINET.

4. THE LOOP DETECTOR WIREs SHALL BE SPliced TO THE LEAD-IN CABLE USING APPROVED WATER PROOF SPICE DEVICES.

5. ALL LOOP WIREs SHALL BE CLEARLY IDENTIFIED AT THE CONNECTION POINTS AND AT THE ROADWAY END.

6. NO BACKER Rod OR FILLER MATERIAL SHALL BE USED IN THE SAW CUT.

7. THE SAW CUT SHALL BE MADE 3-INCHES wide AND A DEPTH OF 3 INCHES DEEP. THE SLOT SHALL BE AS STRAIGHT AS POSSIBLE AND SHALL NOT VARY MORE THAN 5-INCHES when measured with a 10 foot straightedge. NO SAWING SHALL BE STARTED UNTIL LAYOUT OF LOOP IS CHECKED AND APPROVED BY THE ENGINEER.

8. SAW CUTS SHALL BE WASHED AND BLOWN DRY AND CLEANED PRIOR TO PLACEMENT OF WIRE. CORNERS OF LOOPs SHALL BE DRILLED 3-INCHES DEEP WITH 2-INCH SQUARE. SEE CORNER PATTERN.

9. AFTER SAW CUT IS CLEANED OF DUSTS THE WIRE SHALL BE PLACED IN THE SLOT WITH A BLUNT NON-METALLIC OBJECT. A SOLDERWIRE or OTHER SIMILAR TOOL SHALL NOT BE USED.

10. BEFORE THE LOOP SYSTEM IS PLUGGED THE LOOP SHALL BE CHECKED FOR ELECTRICAL CONTINUITY BY TESTING FOR INDUCTED AC VOLTAGE, INDUCTANCE, AND RESISTANCE.

11. LOOPs SHALL BE DUCTED USING SEALER AS DESCRIBED IN THE MATERIAL REQUIREMENTS AND SHOWN IN THE DETAILS.

12. WHEN POSSIBLE INSTALL LOOP UNDER CONCRETE PAVING BY STAKING WITH PLASTIC TENT STAKES OR REBAR HARNESS AT THE DIRECTION OF THE ENGINEER.

13. LOOPs SHALL BE INSTALLED PRIOR TO FINAL LIFT OF ASPHALT.

14. PREFORMED LOOPs MAY BE USED AT THE DIRECTION OF THE ENGINEER.

15. BICYCLE DETECTION LOOPs SHALL BE Laid OUT AND INSTALLED IN THE SAME MANNER AS VEHICLE LOOPs.

MATERIAL REQUIREMENTS
1. THE LOOP WIRE SHELDED IN A 14 AWG, STRANDED SINGLE CONDUCTOR, CROSS-CONNECTED POLYETHYLENE INSULATION WHICH IS PROTECTED BY a CONTINUOUS FLEXIBLE VINYL OR POLYETHYLENE PLASTIC TUBING.

2. LOOP LEAD-IN CABLE SHALL BE A 4/0 GAUGED SECTIONS STYLE TWIRLED PART COPPER WIRE WITH POLYETHYLENE JACKET AND INSULATION IN ACCORDANCE WITH MIL SPECIFICATION NO. 33003 OR APPROVED EQUVALENT.

3. ROADWAY LOOP ENCAPSULATING SEALER SHALL BE USED TO ENCAPSULATE THE LOOP WIRE. THE SEALER SHALL BE ONE PART COMPONENT SYSTEM WHICH IS PLACED UNDER PRESSURE USING A CONVENTIONAL CARTRIDGE GUN or BULK HANDLING PUMP EQUIPMENT. SEALER SHALL HAVE A VISCOITY WHICH WILL COMPLETELY ENCAPSULATE THE WIRES AND WILL BE REMAIN PERMANENTLY FLEXIBLE WITH AGE. SEALER SHALL BE APPROVED BY THE ENGINEER PRIOR TO BEGINNING WORK.
ONE PART SEALER (NO FILLER)

SECTION A-A

SAWED SLOT DETAILS

ONE PART SEALER (NO FILLER)

SECTION B-B

TYPICAL LOOP WIRING SCHEMATIC

LEAD-IN WIRE
PULL BOX
WATERPROOF SPOUT OR CONNECT AT TERMINAL AT STRIP
WATER VALVE PULL BOX

Curb & Gutter

REPLACE PAVEMENT PER SPECIFICATIONS

2" PLASTIC CONDUIT

DETECTOR WATER IN SAW CUT

CONDUIT TO NEXT PULL BOX

2" CONDUIT

CONDUIT TO NEXT PULL BOX

FOR WATER VALVE PULL BOX

EACH PAIR OF LOOP LEAD-IN DETECTOR WIRE SHALL BE TWISTED 3 TIMES PER FOOT THROUGH CONDUIT.

LOOP DETECTOR LEAD-IN

DRILL DETECTOR LOOP CORNERS 3" DEEP THEN SAW PAVEMENT SLOTS TO FORM LOOP

OVERLAP THE SAWED SLOTS TO ENSURE EQUAL DEPTH AT DRILLED CORNERS

DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE
201 WEST COLfax AVENUE
DENVER, CO 80202
PHONE: (720) 913-4300 FAX: (720) 913-4344

LOOP DETECTION DETAILS

STANDARD DRAWING NO.
16.1.5.2

Sheet No. 09 of 39
ANCHOR BOLTS
1. (4) 2\" DIAMETER ANCHOR BOLTS PER CASSET WITH (2) 2\" HEX AND (2) 2\" WASHERS PER BOLT WITH THREADS END GALVANIZED TO AT LEAST 12" FROM END.
2. LENGTH, THREAD LENGTH, HOOK LENGTH, AND DIAMETER OF EACH ANCHOR BOLT SHALL BE PER DETAIL 13 ON SHEET 16.1.10.2.
3. ANCHOR BOLTS SHALL BE MEDIUM STRENGTH, WROTT STEEL OR ALLOY STEEL WITH MINIMUM YIELD STRENGTH OF ASTM A36 GRADE 50, OR 65 KSI ALLOY STEEL ANCHOR BOLTS SHALL COMPLY WITH THE REQUIREMENTS OF ASTM A325 GRADE B7, MEDIUM STRENGTH, AND STEEL ANCHOR BOLTS SHALL COMPLY WITH THE REQUIREMENTS OF A MODIFIED ASTM A325 (WITH 55 KSI YIELD STRENGTH), OR ASTM A490 GRADE 55.
4. WELDED SPOOLING OF A 600 MATERIAL FOR ANCHOR BOLTS WILL NOT BE PERMITTED.
6. ALL THREADS FOR BOLTS AND NUTS SHALL HAVE CLASS 2 PT TOLERANCES IN ACCORDANCE WITH ANSI B1.1.
7. NUTS AND WASHERS
   7. NUTS FOR ALLOY STEEL ANCHOR BOLTS SHALL COMPLY TO ASTM A563 GRADE 2H OR ASTM A563, HEAVY HEX, GRADE 3M CLASS 12. NUTS FOR MEDIUM STRENGTH, WROTT STEEL ANCHOR BOLTS SHALL COMPLY TO ASTM A325 GRADE B7 OR ASTM A325 GRADE 55. NUTS FOR MEDIUM STRENGTH, WROTT STEEL ANCHOR BOLTS SHALL BE GALVANIZED OR COATED WITH A ZINC-RICH COATING IF THE ANCHOR BOLTS ARE NOT GALVANIZED.
8. WASHERS INSTALLED WITH ANCHOR BOLTS OF ANY TYPE SHALL COMPLY TO THE REQUIREMENTS OF ASTM A568 AND SHALL HAVE THE SAME FINISH OR COATING AS THE BOLT AND NUT.

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<td>W20 ARM LENGTH (FT)</td>
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<tr>
<td>20-60</td>
</tr>
<tr>
<td>45-55</td>
</tr>
<tr>
<td>60-70</td>
</tr>
<tr>
<td>75</td>
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<tr>
<td>40 (CABLE ARM)</td>
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GENERAL NOTES
1. DESIGN OF FOUNDATIONS IS BASED ON TRAFFIC SIGNAL POLE CONFIGURATIONS AND LOADS AND REACTIONS PROVIDED BY THE MANUFACTURER FOR THE CITY & COUNTY OF DENVER, REFER TO CITY & COUNTY OF DENVER TRAFFIC STANDARD DRAWINGS FOR ANY ADDITIONAL TRAFFIC POLE INFORMATION.
2. DESIGN CRITERIA: 2015 ASME "USEF SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINARIES AND TRAFFIC SIGNS, FIRST EDITION.
3. AN ULTIMATE WIND VELOCITY OF 120 MPH HAS BEEN USED FOR THE DESIGNS HEREBIN.
4. ALL FOUNDATIONS ON THIS SHEET ARE FOR SINGLE MAST ARM POLES, EXCEPT AS NOTED.
5. THE DESIGNS HEREBIN ASSUME THAT SIGNS ARE INSTALLED WITHIN THE ROADWAY PREMIS WITH THE FOLLOWING SOIL PARAMETERS:
   SOIL DENSITY: 1.10 G/CM3
   SOIL CONSISTENCY: 750 D464/500FT LAB PERCUSSION CONCEAL SOIL
   SOIL 6 ANGLE: 30° FOR MEDIUM DENSITY CONSOLIDATED SOIL
   SF: 1.25 FOR TORSIONAL RESISTANCE AND 3.0 FOR FEDERAL RESISTANCE
6. CONTACT THE ENGINEER IF ANY OF THE FOLLOWING SOIL CONDITIONS ARE ENCOUNTERED DURING DRILLING:
   (A) SOILS ARE NOT CONSOLIDATED IN THE ROADWAY PREMIS
   (B) THE SOIL HAS A HIGH ORGANIC CONTENT OR CONSISTS OF SATURATED SILT AND CLAY
   (C) THE SITE WON'T SUPPORT THE WEIGHT OF THE DRILLING RIG
   (D) THE FOUNDATION SOILS ARE NOT HOMOGENEOUS
   (E) PUMPED SOILS ARE ENCOUNTERED
   (F) CAVING SOILS
   (G) GROUNDWATER
   (H) EXPANSIVE SOILS
   (I) SOILS WITH A HIGH DRIFT CONTENT
   (J) BOTTOM OF CASSET WILL EXTEND BELOW BOTTOM OF ANY ADJACENT BUILDING OR RETAINING WALL FOUNDATION
   (K) SLOPES GREATER THAN 10% IN
7. CASSETS SHALL BE PLACED AGAINST UNDISTURBED EARTH.
8. CASSET CONCRETE SHALL BE CONSTRUCTED WITH AIR ENRICHED COST CLASS B CONCRETE IN ACCORDANCE WITH SECTION 503 OF THE STANDARD SPECIFICATIONS. REINFORCING STEEL SHALL BE GRADE 60.
9. CASSET CONCRETE SHALL BE PLACED THE DAY PREDICTED STRENGTH TO INCREASE THE SIGNAL STRUCTURE.
10. FOUNDATION TO BE PROVIDED OF CONCRETE STUB OUTS (2-3), DIRECTION TO BE DETERMINED BY CITY & COUNTY OF DENVER ENGINEER AND IS TO BE CONSIDERED AS PART OF THE FOUNDATION BID FOR.
11. BASE PLATE, NUTS AND NUT COVER TO BE FURNISHED BY MANUFACTURER. ANCHOR BOLTS ARE TO BE FURNISHED BY THE CONTRACTOR AND ARE INCLUDED IN THE COST OF THE FOUNDATION.
12. FOUNDATION SHALL BE PADDED WITH A FEET OF MEDIUM DRIED, USE OF THE HOMOGENEOUS FOUNDATION SHALL BE ALLOWED ONLY BY APPROVAL OF THE CITY & COUNTY TRAFFIC ENGINEER.
13. PLUMBING OF POLES SHALL BE ACCOMPLISHED BY ADJUSTING NUTS AFTER LOADING OF CASSET.
14. EACH END OF CASSET TO BE TERMINATED WITH A 1 1/2" HEX AROUND A LONGITUDINAL BAR.
15. DESIGN IS BASED ON A HORIZONTAL GROUND SURFACE CONDITION IN THE VENITY OF THE CASSET. CASSET CONCRETE SHOULD NOT BE INSTALLED AT SITES WITH A SLOPE EXCEEDING 10 PERCENT.
16. LEVELING CONCRETE SHALL BE 4,000 PSI CLASS B AIR ENRICHED CONCRETE.
17. FIELD STRESS OF REINFORCING STEEL SHALL BE MINIMUM 60,000 PSI.
18. COLD Joints IS NOT ALLOWED UNLESS PRE-APPROVED BY THE CITY ENGINEER. COLD Joints IS CONSIDERED INCIDENTAL TO THE WORK.

DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE
201 WEST COLfax AVENUE
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SIGNAL POLE FOUNDATION

STANDARD DRAWING NO.
16.1.8

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**MATERIAL DATA**

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<td>SIGNAL ARM ATTACHMENT</td>
<td>A572</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Column Arm Attachment</td>
<td>A235</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>CONNECTING BOLTS</td>
<td>A325</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>ANCHOR BOLTS</td>
<td>F1551</td>
<td>55</td>
<td></td>
</tr>
<tr>
<td>GALVANIZING HARDWARE</td>
<td>Z323</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**DESIGNATION EXAMPLE**

- **DC15-2-35-(35)-(35)-10-W/O**
- **FIRST MAST ARM DESIGNATION**
- **SECOND MAST ARM DESIGNATION**
- **LUMINARE MOUNTING HEIGHT: 35'-0''**
- **DESIGN NUMBER**

**ENGINES**

- **DENVER COLORADO POLE SERIES 2015 ASHMO**

**DESIGNATION EXAMPLE**

- **E ANCHOR BOLT HOLE**
- **Q HANGHOLE**
- **Q UPPER HANGHOLE**

**SINGLE AND DOUBLE MAST ARM RADIAL INDEX**

**STANDARD DESIGN CRITERIA:**

The standard design, mast arm traffic structures shown in these drawings have been designed in accordance with the loading and nominal strength requirements of the 2015 ASHMO LRFD specifications for structural supports for highway signs, luminaires, and traffic signals, first edition: 5.75-1 incorporating latest interim changes.

**MATERIALS:**

- Structures have been designed for wind loads using an ultimate wind velocity of 120 MPH with a mean recurrence interval of 750 years.
- All structures have been designed for a fatigue natural wind gust mean wind velocity of 112 MPH and a truck induced gust pressure of 18.8 psf.

**DESIGN CRITERIA:**

- Structures with mitigation devices have been designed for fatigue category II loading without galling loads.
- Fatigue category II:
  - Structures without a mitigation device have been designed for fatigue category II with galling loads. A mitigation device is not required for single and double mast arms on structures meeting all of the following conditions:
    - Arm lengths less than or equal to 55 feet
    - Curve running with posted speed limits less than or equal to 35 MPH

**GENERAL NOTES:**

- Detailed numbers refer to standard drawings 16.1.10.1 and 16.1.10.2.
LOAD NOTES:
1. Design and details included in these standards are based on the device sizes, weights, and locations shown on this drawing. Actual spacing device numbers and spacing shall be per approved shop drawings if device sizes or weights are increased or signal head spacing is reduced below 8'. Then a special design by the contractor will be required.

2. Camera 3 is located between end of arm signal 2 or 3 and preciding around signal 3.

3. A blank out sign on the mast arm may be used in substitution for one or two 10 sign within 5 feet of the blank out sign location.

<table>
<thead>
<tr>
<th>DEVICE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>12&quot;-4 SEC. SIGNAL WITH RETROLECTIVE BACKPLATE</td>
<td>11.00</td>
</tr>
<tr>
<td>30&quot; X 36&quot; REGULATORY SIGN</td>
<td>7.50</td>
</tr>
<tr>
<td>12&quot;-3 SEC. SIGNAL WITH RETROLECTIVE BACKPLATE</td>
<td>8.67</td>
</tr>
<tr>
<td>30&quot; X 36&quot; REGULATORY SIGN</td>
<td>7.50</td>
</tr>
<tr>
<td>22&quot; X 108&quot; STREET NAME SIGN</td>
<td>19.50</td>
</tr>
<tr>
<td>DUAL 12&quot;-3 SEC. SIGNAL WITHOUT BACKPLATE</td>
<td>6.50</td>
</tr>
<tr>
<td>SINGLE 18&quot; PED SIGNAL</td>
<td>4.50</td>
</tr>
<tr>
<td>K Camera</td>
<td>1.00</td>
</tr>
<tr>
<td>M Mitigator Damper Device</td>
<td>1.20</td>
</tr>
<tr>
<td>N Blank Out Sign</td>
<td>12.70</td>
</tr>
</tbody>
</table>

▲ NOT REQUIRED FOR ARMS LESS THAN OR EQUAL TO 65 FEET WITH DESIGN SPEEDS LESS THAN OR EQUAL TO 35 MPH (SEE STANDARD DESIGN CRITERIA ON SHEET 1.)
### TABLE 1: POLE DATA

<table>
<thead>
<tr>
<th>POLE SERIES</th>
<th>DESIGN NUMBER</th>
<th>SINGLE ARM SPAN (Ft)</th>
<th>DOUBLE MAST ARMS</th>
<th>POLE TUBE</th>
<th>POLE BASE</th>
<th>ANCHOR BOLT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1st ARM SPAN (Ft)</td>
<td>2nd ARM SPAN (Ft)</td>
<td>BASE D. O. (IN)</td>
<td>TOP D. O. (IN)</td>
<td>LENGTH (Ft)</td>
</tr>
<tr>
<td>DC15</td>
<td>1</td>
<td>22, 25, 30, 35, &amp; 40</td>
<td>N.A.</td>
<td>19.50</td>
<td>10.60</td>
<td>16.00</td>
</tr>
<tr>
<td>DC15</td>
<td>2</td>
<td>45, 50, &amp; 55</td>
<td>N.A.</td>
<td>19.50</td>
<td>14.60</td>
<td>14.60</td>
</tr>
<tr>
<td>DC15</td>
<td>3</td>
<td>60, 65, &amp; 70</td>
<td>N.A.</td>
<td>19.50</td>
<td>14.60</td>
<td>14.60</td>
</tr>
<tr>
<td>DC15</td>
<td>4</td>
<td>20 THRU 40</td>
<td>N.A.</td>
<td>19.50</td>
<td>14.60</td>
<td>14.60</td>
</tr>
<tr>
<td>DC15</td>
<td>5</td>
<td>75&quot;</td>
<td>N.A.</td>
<td>19.50</td>
<td>14.60</td>
<td>14.60</td>
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</tbody>
</table>

### TABLE 2: SIGNAL ARM DATA

<table>
<thead>
<tr>
<th>MAXIMUM ARM SPAN (Ft)</th>
<th>FIXED END DIA. (IN)</th>
<th>SMALL END DIA. (IN)</th>
<th>GAUGE</th>
<th>A X B (IN)</th>
<th>C X D (IN)</th>
<th>THICKNESS &quot;E&quot; (IN)</th>
<th>BOLT SIZE &quot;F&quot; (IN)</th>
<th>GUSSET THICKNESS &quot;H&quot; (IN)</th>
<th>ANGLE OF RISE &quot;I&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>9.00</td>
<td>6.20</td>
<td>7</td>
<td>21.75 X 21.75</td>
<td>18.00 X 18.00</td>
<td>2.00</td>
<td>1.50 X 3.75</td>
<td>0.375</td>
<td>0.07°</td>
</tr>
<tr>
<td>25</td>
<td>10.00</td>
<td>6.50</td>
<td>7</td>
<td>21.75 X 21.75</td>
<td>18.00 X 18.00</td>
<td>2.00</td>
<td>1.50 X 3.75</td>
<td>0.375</td>
<td>0.50°</td>
</tr>
<tr>
<td>30</td>
<td>12.00</td>
<td>7.80</td>
<td>5</td>
<td>21.75 X 21.75</td>
<td>18.00 X 18.00</td>
<td>2.00</td>
<td>1.50 X 3.75</td>
<td>0.375</td>
<td>0.50°</td>
</tr>
<tr>
<td>35</td>
<td>12.50</td>
<td>7.80</td>
<td>5</td>
<td>21.75 X 21.75</td>
<td>18.00 X 18.00</td>
<td>2.00</td>
<td>1.50 X 3.75</td>
<td>0.375</td>
<td>1.00°</td>
</tr>
<tr>
<td>40</td>
<td>13.00</td>
<td>8.90</td>
<td>3</td>
<td>21.75 X 21.75</td>
<td>18.00 X 18.00</td>
<td>2.00</td>
<td>1.50 X 3.75</td>
<td>0.375</td>
<td>1.50°</td>
</tr>
<tr>
<td>45</td>
<td>14.00</td>
<td>8.06</td>
<td>3</td>
<td>21.75 X 21.75</td>
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<td>2.00</td>
<td>1.50 X 4.25</td>
<td>0.500</td>
<td>1.50°</td>
</tr>
<tr>
<td>50</td>
<td>15.00</td>
<td>8.36</td>
<td>3</td>
<td>21.75 X 21.75</td>
<td>18.00 X 18.00</td>
<td>2.00</td>
<td>1.50 X 4.25</td>
<td>0.500</td>
<td>1.50°</td>
</tr>
<tr>
<td>55</td>
<td>15.00</td>
<td>7.66</td>
<td>3</td>
<td>21.75 X 21.75</td>
<td>18.00 X 18.00</td>
<td>2.00</td>
<td>1.50 X 4.25</td>
<td>0.500</td>
<td>2.00°</td>
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<tr>
<td>60</td>
<td>15.75</td>
<td>7.71</td>
<td>3</td>
<td>21.75 X 21.75</td>
<td>18.00 X 18.00</td>
<td>2.00</td>
<td>1.50 X 4.25</td>
<td>0.500</td>
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<tr>
<td>65</td>
<td>16.50</td>
<td>7.76</td>
<td>3</td>
<td>21.75 X 21.75</td>
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<tr>
<td>70</td>
<td>17.25</td>
<td>7.81</td>
<td>3</td>
<td>21.75 X 21.75</td>
<td>18.00 X 18.00</td>
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<td>18.00 X 18.00</td>
<td>2.00</td>
<td>1.50 X 4.25</td>
<td>0.500</td>
<td>3.00°</td>
</tr>
</tbody>
</table>

Maximum arm length combination for dual configuration are 40°-0° / 40°-0°. Arm lengths exceeding these will require a special pole design.

When a mitigation device is required by these standards (see Sheet 16.1.9.1), the following table shall be followed:

**Detail 15: DAMPER TYPE MITIGATOR**

To be installed per manufacturer's installation instructions near the last signal mounted on the arm. See Sheet 16.1.9.2.
DETAIL 1  POLE TOP

DETAIL 2  LUMINARIE ARM ATTACHMENT

DETAIL 3  LUMINARIE ARM ATTACHMENT

DETAIL 4  HANDHOLE

DETAIL 5  POLE BASE

DETAIL 6  NUT COVER

DETAIL 7  ANCHOR BOLT

NOTE: SEE POLE DATA ON SHEET 16.1.12.1 FOR DIMENSIONS.

DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE
DENVER, CO 80202

PHONE (720) 913-4501 FAX (720) 913-4544

SIGNAL POLE DETAILS
NO MAST ARM

SHET 2

STANDARD DRAWING NO. 16.1.12.2

Sheet No. 19 of 39
NOTE:
ANCHOR BOLTS SHALL BE PER DETAIL 3 ON SHEET 20

DETAIL 4 FOUNDATION BASE – 10' PEDESTAL POLE

NOTE:
ANCHOR BOLTS SHALL BE PER DETAIL 3 ON SHEET 20

DETAIL 5 FOUNDATION BASE – 15' PEDESTAL POLE
DETAIL 6  
CONCRETE FOUNDATION FOR EMBEDDED STEEL POLE

DETAIL 7  
FOUNDATION - PEDESTAL MOUNTED PEDESTRIAN PUSH BUTTON POLE DETAIL

CONSTRUCTION NOTES:
1. ALL SEPARATELY GROUNDING ELEMENTS AT AN INTERSECTION SHALL BE BONDED TOGETHER TO FORM AN INTERSECTION GROUNDING NETWORK.
2. GROUND WIRE SHALL BE #6 STRANDED.
3. REFERENCE LATEST MUTCD FOR GUIDELINES FOR PUSH BUTTON PLACEMENT, POLE HEIGHT, REACH DISTANCE, AND ADDITIONAL FEATURES.

ANCHOR BOLT SET OF 4 4-1/2" INCH DIAMETER BY 18 INCH LENGTH (PELCO PB-5350 OR APPROVED EQUIVALENT).
2" PVC SCHEDULE 40 CONDUIT (30' DEPTH).
24 INCH DIAMETER 24 INCH DEPTH: PRE-CAST OR CAST-IN-PLACE FOUNDATION.

CONCRETE POLE, ALUMINUM (PELCO OR APPROVED EQUIVALENT)  
PEDESTRIAN ACTUATED SIGNAL SIGN R10-3E  
PEDESTRIAN PUSH BUTTON  
POLE, SPUN ALUMINUM SCHEDULE 40. 49" O.D. X .237" WALL (PELCO PS100 OR APPROVED EQUIVALENT)  
ALUMINUM SQUARE BASE ASSEMBLY WITH ALUMINUM DOOR AND GROUNDING LUG (PELCO PB-5335 OR APPROVED EQUIVALENT). SEE DETAIL 2 SHEET 16.1.13 1" FLOOR BASE PLATE DETAILS.
NOTES:
1. SUBMIT ONLY THE XCEL ENERGY OWNED AND MAINTAINED STREET LIGHT POLES TO XCEL. ENERGY FOR APPROVAL. ALL OTHER FOUNDATION DETAILS SHALL BE SUBMITTED TO THE CITY & COUNTY OF DENVER. SSTI
TRANSPORTATION DEPARTMENTS. NO FOUNDATIONS SHALL BE INSTALLED UNTIL SUBMITTALS HAVE BEEN ACCEPTED.
2. ALL FOUNDATIONS INSTALLED FOR STREET LIGHT POLES BECOME THE PROPERTY OF XCEL ENERGY UPON ACCEPTANCE OF THE PROJECT.
3. ALL STREET LIGHT POLE (NO MAST ARM) FOUNDATIONS CAN BE PRECAST OR CAST-IN-PLACE PER THE DETAILS PROVIDED AS PER THE ENGINEER OR PROJECT SPECIFICATION.

1. TO BE USED ONLY ON XCEL OWNED TRAFFIC STREET LIGHT POLE (NO MAST ARM) AT A SIGNALIZED INTERSECTION. CITY OWNED TRAFFIC STREET LIGHT POLE (NO MAST ARM) FOUNDATION MUST FOLLOW STANDARD DETAIL SHEET 16.1.18.

DEPARTMENT OF TRANSPORTATION
& INFRASTRUCTURE
201 WEST CONFIDENTIAL AVENUE
DENVER CO 80205
PHONE: (720) 303-4001 FAX: (720) 313-4544
Issued By:

STANDARD DRAWING NO.
16.1.15

Sheet No. 23 of 39
All conductors shall be size in accordance with NEC requirements. Use 14 AWG minimum.

In-line fuse holders and fuses acceptable connectors. Use point clamp with rubber boot or 11/4 in. long temmey connector with covered lug. Note: Wires nuts and slip bolts are not acceptable.

Bond one #6 bare copper ground wire from grounding lug at base of pole to ground rod. 3/8" PVC sleeve installed in pole base as shown for grounding conductor. 1/4" chamfer on all exposed edges.

Final grade (typ.)

4" maximum

Foundation:

6" max

Foundation depth:

6 ft

7 ft

Maximum pole height (ft)

20

40

Factored foundation capacity (kF)

20

.35

Factored shear capacity (kS)

2

3.5

Notes:

1. All foundation components shall fit and accommodate the requirements of the street light standard as per standard sheet 16.1.12.1 and 16.1.12.2.

2. Foundation shall be 7 ft. for light standards 20 ft. thru 40 ft. and 6 ft. for less than 20 ft.

3. Concrete shall be of an expanded cement II concrete in accordance with section 503 of the standard specifications. Reinforcing steel shall be grade 60.

4. Foundations for light standards higher than 40 ft. or light standards with multiple luminaries or hanging, or having soil on wind conditions, shall be designed by the contractor's engineer and shown on the plans.

5. Where foundation is located in the sidewalk, the top of the foundation shall be flush with the top of the sidewalk conforming to ADA requirements.

Traffic signal light pole - Steel (no mast arm)

Typical foundation section

Department of Transportation & Infrastructure
201 West Colfax Avenue
Denver, CO 80202
Phone: (720) 913-4001 Fax: (720) 913-4344

Foundation for no mast arm traffic signal pole

Foundation drawing no. 16.1.16

Sheet No. 24 of 39
NOTES:
1. BASE DETAILS ARE FOR A NEMA P-44 CABINET ONLY.
2. BASE SHALL BE CONSTRUCTED FROM LIGHTWEIGHT POLYMER CONCRETE ONLY.
3. BASE SHALL MEET OR EXCEED ASTM D-2444 IMPACT RESISTANCE TESTING.
4. BASE SHALL MEET OR EXCEED ASTM METHOD D-543, SECTION 7, PROCEDURE 1 FOR CHEMICAL RESISTANCE.
5. BASE SHALL BE "UL" LISTED.
METER PEDESTAL CONSTRUCTION NOTES:
1. METER PEDESTAL SHALL BE UL LISTED "INDUSTRIAL CONTROL PANEL" PER UL 508.
2. METER PEDESTAL SHALL MEET THE ELECTRIC UTILITY SERVICE EQUIPMENT REQUIREMENTS COMMITTEE (EUSRC) GUIDELINES.
3. CONSTRUCTION SHALL BE NEMA 3R AND 12, RAIN TIGHT AND DUST TIGHT, ELECTRICALLY WELDED AND REINFORCED WHERE REQUIRED.
4. ALL NUTS, BOLTS, SCREWS AND HINGES SHALL BE STAINLESS STEEL.
5. NUTS, BOLTS AND SCREWS SHALL NOT BE VISIBLE FROM OUTSIDE OF METER PEDESTAL.
6. PHENolic NAME PLATES SHALL BE PROVIDED AS REQUIRED.
7. CIRCUIT BREAKERS SHALL BE CABLE IN-CABLE OUT WITH LINE ON TOP AND LOAD ON THE BOTTOM, HANDLE POSITION UP="ON", DOWN="OFF".
8. A PLASTIC COVERED WIRING DIAGRAM SHALL BE ATTACHED TO THE INSIDE OF THE FRONT DOOR.
9. METER PEDESTAL SHALL BE FACTORY WIRED AND CONFORM TO REQUIRED NEMA STANDARDS.
10. 0.125" ALUMINUM SHEET.
11. CONCRETE FOUNDATION INCLUDING EXCAVATION, BACKFILL, CONCRETE AND ANCHOR BOLTS, COMPLETE IN PLACE, WILL BE CONSIDERED INCIDENTAL TO THE METER PEDESTAL.
12. ELECTRIC METER SHALL BE USED FOR TRAFFIC SIGNAL AND XCEL OPERATED STREET LIGHTS.
13. ELECTRIC METER INSTALLATION INSPECTION REQUIRED FOR COLD FRAME AND PUMP HOUSE.
METER PEDESTAL CABINET FOUNDATION DETAIL

NOTES:
1. ALL MATERIALS AND CONSTRUCTION SHALL CONFORM TO THE REQUIREMENTS OF THE SPECIFICATIONS.
2. UNSTABLE SOIL OR STEEP SLOPE MAY REQUIRE DEEPER FOUNDATIONS. SEE SPECIFICATIONS. CABINETS SHALL NOT BE LOCATED IN DRAINAGE AREAS, UNLESS THEY ARE ELEVATED.
3. CONDUIT SIZE SHALL BE 2" SCHEDULE 80 PVC.
4. ANCHOR BOLTS SHALL BE GALVANIZED, 1/2" x 18" x 4" COMPLETE WITH NUTS AND WASHERS.
5. CONDUIT PROJECTS ABOVE FOUNDATION SHALL BE 2" MIN. TO 4" MAX. CONDUITS SHALL BE CAPRED.
6. 1" SLEEVE FOR GROUND ROD, EXACT LOCATION PER CABINET MANUFACTURES REQUIREMENTS.
7. IN UNPAVED AREAS A RAISED PCC PAD 36" x 4" x 36" SHALL BE PLACED IN FRONT OF THE CABINET. THE PAD SHALL BE SET 2" BELOW THE FOUNDATION ELEVATION AND SLOPED AWAY FROM CABINET.
8. CONFIRM ACTUAL ANCHOR BOLT LAYOUT DIMENSIONS AS SHOWN PER THE TABLE ON THIS DRAWING PRIOR TO CONSTRUCTION.
9. A METER PEDESTAL SHALL BE PROVIDED FOR ELECTRICAL SERVICES FOR TRAFFIC SIGNALS WHEN A SEPARATE SERVICE CABINET IS SPECIFIED. THIS CABINET CAN BE USED FOR OTHER PURPOSES AS WELL, SEE PLAN.
10. CABINETS SHALL BE OFFSET A MINIMUM OF 6 FT FROM ANY ROADWAY AND 5 FT FROM CONTROLLER CABINET. UPS CABINET, SERVICE POLE OR PAD MOUNTED TRANSFORMER.
11. PRECAST CONCRETE BASE FOR THE METER PEDESTAL SHALL BE USED ONLY WITH THE ENGINEER’S APPROVAL.
GENERAL NOTES

1. INSTALLATION DESIGN CONFORMS WITH ASHRAE "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORT FOR HIGHWAY SIGNS, LUMINARIES AND TRAFFIC SIGNALS" AND SHALL BE FABRICATED IN ACCORDANCE WITH:

   A. STEEL PIPE, POST ANCHOR PLATES AND BREAK-AWAY PLATES SHALL CONFORM TO ASHRAE No.270 (ASTM A123) GRADE 36.

   B. HIGH STRENGTH BOLTS, NUTS AND WASHERS SHALL CONFORM TO ASTM-A 325 AND SHALL BE GALVANIZED OR CHROMIUM PLATED.

   C. PLATES SHALL BE DRILLED AND CUTS SHALL BE SAW CUT. METAL SHALL NOT PROJECT BEYOND THE PLATE OF THE PLATE FACE ON BREAK-AWAY PLATES.

   D. ALL WELDING IS TO BE CONTINUOUS AND IN ACCORDANCE WITH CURRENT AWS SPECIFICATIONS. A RIFFLE PLATE OF THIN (29 GAUGE) GALVANIZED STEEL, COATED TO MATCH BREAK-AWAY PLATE DIMENSIONS BUT WITH HOLES RATHER THAN SLOTS, SHALL BE USED TO RESTRAIN BOLT LOOSENING DUE TO WIND VARIATION.

   E. DRIVER FEEDBACK SIGN POLE SHALL BE MOUNTED ON THE CITY AND COUNTY OF DENVER CMU TRANSITATION OPERATIONS STANDARD PEDESTAL POLE. POLE SHALL BE STANDARD 12 POLE FEDERAL POLE BARE AND SHALL BE THE 9 DEEP POLES POSTING FOR 10 PEDESTAL POLE (SEE DETAIL 5 IN SHEET 16.13).

   F. BOLTS, U-COMBS, NUTS AND METAL WASHERS SHALL BE GALVANIZED OR CHROMIUM PLATED.

2. DESIGN WIND VELOCITY = 120 MPH

3. AS DETERMINED AT EACH SPECIFIC SITE LOCATION, FOR POWER, EITHER SOLAR PANEL OR HARD-WIRE ELECTRICAL CONNECTION SHALL BE MADE.

4. DRIVER FEEDBACK SIGN MESSAGE, COLORS AND PROGRAMMING SHALL CONFORM TO MUTCD.
TYPICAL ELEVATION FACING TRAFFIC

SOLAR P-NEL (ORIENTATION
V-RIES BY SITE CONDITION)
(SEE NOTE 1)
N-ARROW P-NEL SIZE = 40" X 60"

(2) TYPICAL SIGNS-1 HE-DS
12" YELLOW HE-D
FRONT -ND B-CK OF POLE
SEE STD Dwg NO 16.2r.7
FOR TRAFFIC SIGN
MOUNTING DETAIL

TYPICAL SIGNS-1 HE-D
12" YELLOW HE-D
FRONT OF POLE ONLY

FL-SHEX/BATTERY C-BINET
LOCATED ON B-CK OF POLE

POLE, SPRAY-LUMINUM. SEE DESIGN
T-ILE SHEET 16.1.1.1.1

COLL-N. = LUMINUM (PELCO)
OR-APPROVED EQUIV-LNT
-LUMINUM SQUARE B-5E, ASSEMBLY WITH
LUMINUM DOOR NO GROUNDING LUG. (PELCO
PREF-SIVEN OR APPROVED EQUIV-LNT).
SEE DET-6.2 SHEET 16.1.1.3.1

2-12 ELECTRIC-L CONDUITS (SEE NOTE 1)
FULL SIZE NEED NO LOC-ATION TO BE DETERMINED
-1 TYPICAL SITE LOCATION
SEE DET-6.5
STD Dwg NO 16.1.1.3.2 FOR
10" PEDESTAL POLE FOUND-TION

TYPICAL SIGNAL HEAD SECTION = 12" LENS

NOTES
1. -S DETERMINED BY THE ENGINEER - T-E-C-H SPECIFIC SITE
LOCATION FOR POWER. EITHER SOLAR P-NEL OR M-RD-WIRE
ELECTRIC CONNECTION SHALL BE M-OE
2. -S DETERMINED - T-E-C-H SPECIFIC SITE LOCATION. SIMILAR
LOCATION-L INTERM. ON M-RD-WIRE Trick-SIGNAL
CONNECTION SHALL BE M-OE
3. TEMPORARY SIGN FL-C-AR TO BE INSTALLED OVER 35'-1 WHEN
FLASHERS TEST UNTIL RECOGNIZE PIPELINE
4. THIS SIGN INST-ALLATION HAS BEEN DESIGNED FOR ~ 120 MPH
WIND VELOCITY

12" YELLOW HE-D

VEOR

12" YELLOW HE-D
WHEN FLASHING RIGHT TURNS AND ONLY BUSES

INST-LL SIGN TO THE CENTER OF BUS LANE FOR DET-L, SEE INSERT

FRONT SIDE BACK

LED LUMIN-IRE - NO - RM
M-ST - RM VS-RIES (3"-20" MIN)
BUSES NOT STOPPING ONLY M/PASSING
BRIGHTNESS - 200,000 incoming Cand.
INST-LL SIGN TO M-ST - RM WITH MINIMUM THREE STRUTS - TT-CHED BY S-COUL B-CHETS B-NOED TO - RM.

SEE NOTE 7

SEE INSERT FOR DET-L

BUS LANE SIGN & SIGNAL FLASHER:
20-35' M-ST - RM DESIGN
N.T.S.

BUS FLASHER SIGN & SIGNAL NOTES:
1. INST-LL C-ILE (5 CONDUCTOR #4 - WOR) W/O TO SIGN-ller BOX, CM. (BY CCD)
2. FL-SHER WORK SH-LLE BE PERFORMED BY Q-LIFIED SIGN-L CONN-CTOR
3. INST-LL NEW 12" YELLOW LED FL-SHERS (2 E-CH)
4. CONT-TR TR-FFIC OPER-TIONS - T 720-865-4000 FOR SIGN SPECIFIC-TIONS
5. CONTR-CTOR TO FURNISH - NO INST-LL POLES
6. DURING MOUNTING OF SIGN P-TEL, NO TR-FFIC WILL BE -LOWED IN THE -FFECTED L-NE
7. REFER TO ST-NO-DO BR-WING NUMBERS 161.9 THROUGH 161.11 FOR FOUND-ION POLE, NO M-ST - RM DET-L pulls, FL-SHERING BE-CON & SIGN POLE, NO M-ST - RM ARE DESIGNED FOR F-TIQUE C-TEORY 1 WITH C-LAPPING (WITHOUT - WITG-ION DEPLOY)

BUS FLASHER SIGN DETAIL

BUSES AND RIGHT TURNS ONLY WHEN FLASHING

BUS FLASHER SIGN DETAIL

DEPARTMENT OF TRANSPORTATION
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Computer File Information

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STANDARD DRAWING NO.

BUS FLASHER SIGN DETAIL

16.1.24.1

Sheet No. 33 of 39

Issued By:
VARIABLE MESSAGE SIGN DETAIL (VMS)

1. INSTALL CABLE (3 CONDUCTOR #14 AWG) NOSA TO SIGNAL BOX WM (BY COD)
2. CONTACT TRAFFIC OPERATIONS AT 720-885-4000 FOR SIGN SPECIFICATIONS.
3. CONTRACTOR TO FURNISH AND INSTALL POLES
4. DURING MOUNTING OF SIGN PANEL, NO TRAFFIC WILL BE ALLOWED IN THE AFFECTED LANE
5. REFER TO STANDARD DRAWING NUMBERS 16.1.18 THROUGH 16.1.11 FOR FOUNDATION POLE AND MAST ARM DETAILS. VARIABLE MESSAGE SIGN POLE AND MAST ARM ARE DESIGNED FOR FATIGUE CATEGORY I WITH GALLOPING (WITHOUT A MITIGATION DEVICE)
TYPICAL PULL OR SPlice BOX

**NOTES:**
1. ALL PULL OR SPICE BOXES SHALL BE TRAFFIC RATED 22,500 PSI MINIMUM.
2. BOX DIMENSIONS SHOWN ARE FOR 2 INCH CONDUITS MAXIMUM. FOR CONDUITS LARGER THAN 2 IN. REFER TO N.E.C. SECTION 314.26A FOR BOX SIZE REQUIREMENTS.
3. PULL BOX SHALL BE PER DETAIL 16.1.7.

**NOTE:**
LIGHTING CONTROL CABINET SHALL BE FOR LIGHTING CONTROL ON DECORATIVE/PEDESTRIAN LIGHTING AND STREET LIGHTS OPERATED BY A BUSINESS IMPROVEMENT DISTRICT.

**CABINET COMPONENT LIST**

- 30 IN. W. X 48 IN. H. X 12 IN. D. NEMA 3R HINGED ENCLOSE WITH 6 IN. LESS ANCHORED TO THE CONCRETE FOUNDATION PAD. THE BACK OF THE CABINET SHALL BE LOCATED 6 IN. MAXIMUM FROM THE EDGE OF THE CONCRETE PAD.
- NEMA 1, 100A, 400, 120/240V-120V, 2-Pole fused disconnect, UL listed for service equipment and pin fuses as shown on one-line diagram with neutral and ground bars. Mounted on back side of enclosure.
- 1/4" X 8-1/2" COPPER-CLAD GROUND ROOF WITH APPROVED GROUND ROOF CLAMP.
- ELECTRICALLY GROUNDED LIGHTING CONTRACTOR FURNISHED WITH 120-VOLT COIL AND NUMBER OF POLES REQUIRED. INSTALL INSIDE CABINET.
- 30-Amp GFCI MOUNT RECEPTACLE IN A 1-GANG BACK BOX WITH COVER. INSTALL INSIDE THE CABINET.
- 125A, 120/240V, METER HOUSING CONFORMING TO THE UTILITY PROVIDER'S REQUIREMENTS.

**NOT SHOWN IN THE DETAIL:**
1. VOLTAGE SURGE ARRESTOR, 500V A.C. TO GROUND MAX.
2. "HAND-OFF-AUTO" KEY SWITCH. KEVED FOR AGENCY RESPONSIBLE FOR THE MAINTENANCE OF THE SYSTEM.
NOTES:
1. HARD-WIRE ELECTRICAL CONNECTIONS SHALL BE MADE FOR POWER.
2. SINGLE SIDED INSTALLATION DETAILS ARE SHOWN IN THESE DRAWINGS. BACK-TO-BACK SIGNS ARE PERMISSIBLE.
3. DESIGN EXTREME FEAR WHO VELOCITY = 120 MPH @ 1700 YEARS RECURRENT.
4. STANDARD BLANK OUT SIGN DESIGN IS BASED ON THE MAXIMUM SIGN DIMENSIONS AND MINIMUM SPACING SHOWN ON THESE DRAWINGS. ADDITIONAL SIGNS, LARGER SIGNS, OR REDUCED SPACING WILL REQUIRE A SPECIAL DESIGN BY THE CONTRACTOR.

TYPICAL ATTACHMENT DETAILS

SINGLE BLANK OUT SIGN DETAIL

DOUBLE BLANK OUT SIGN DETAIL
TYPICAL CROSSWALK LAYOUT PROCEDURES

1. SETBACK SIDEWALKS
   CENTER ON SIDEWALK

2. SETBACK SIDEWALK ONE SIDE
   ATTACHED SIDEWALK OTHER SIDE
   ALIGNED WITH CURB
   CENTER ON SIDEWALK

3. ATTACHED SIDEWALK
   5' TO 15' CORNER RADIUS
   ALIGNED WITH CURB
   LINE EXTENDED

4. ATTACHED SIDEWALK
   20' TO 30' CORNER RADIUS
   5' FROM CURB-LINE EXTENDED (TYP.)

5. ATTACHED SIDEWALK WIDER THAN 10'
   ALIGNED WITH BACK OF SIDEWALK

6. MID-BLOCK CROSSWALK
   CENTER ON SIDEWALK OR PEDESTRIAN RAMPS
   MARK WITH CHALK LINES

7. INSTALL STOP LINE 4' IN ADVANCE OF AND PARALLEL TO THE NEAREST CROSSWALK LINE UNLESS OTHERWISE SHOWN

NOTES:

1. CROSSWALK BAR DIMENSIONS

2. KEEP BARS PARALLEL TO LANE LINES EVEN IF THE CROSSWALK IS SHARED. (SEE EXAMPLE FAR LEFT)

3. ALL BARS IN EACH CROSSWALK MUST BE SAME WIDTH.

4. ADJUST ALIGNMENT IF NECESSARY TO ALIGN PROPERLY WITH PEDESTRIAN RAMPS. CROSSWALKS SHOULD CENTER ON PEDESTRIAN RAMPS WHEN POSSIBLE.

5. CROSSWALKS SHOULD NOT EXTEND PAST THE CURB LINE OF ADJACENT ROADWAY.

6. DIRECTION RAMPS SHALL BE USED ON ALL NEW RAMPS UNLESS APPROVED BY THE CITY ENGINEER.
PAVEMENT MARKING LEGEND AND NOTES

A. TRANSVERSE MARKINGS ONLY TO BE USED IN SITUATIONS WHERE STANDARD CONTINENTAL CROSSWALKS CANNOT BE INSTALLED SUCH AS IN AREAS OF BICYCLE/SPECIALTY PAVEMENT DOWNTOWN.

B. TRAFFIC LANE MARKINGS - MATERIAL SHALL BE MODIFIED EPOXY MARKING MATERIAL UNLESS OTHERWISE SPECIFIED:
   (a) 4" SNAP WHITE LANE LINE, 1" LINE, 2" GAP
   (b) 8" SOLID WHITE RIGHT EDGE LINE OR TURN LANE LINE

C. SPECIALTY MARKINGS - MATERIAL SHALL BE REREFLECTIVE PREFORMED THERMO-PLASTIC FULL WIDTH WITHOUT SEAMS UNLESS OTHERWISE SPECIFIED
   (a) 18" WHITE TRANSVERSE CROSSWALK LINE
   (b) 24" WHITE STOP LINE, ONLY WHEN SHOWN ON PLANS.

D. ANY FINAL PAVEMENT MARKING QUANTITIES SHALL INCLUDE REMOVAL OF ANY CONFLICTING PREVIOUS OR SET-IN MARKINGS AS NECESSARY.

E. ALL OTHER PROVISIONS OF "STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION," STATE DEPARTMENT OF HIGHWAYS, STATE OF COLORADO, CURRENT EDITION SHALL APPLY.

F. ALL REMOVALS SHALL BE BY GRINDING, SANDBLASTING OR WATER (BRUSHING METHODS PROVIDED THAT THE PAVEMENT SURFACE SHALL NOT BE MATERIALLY DAMAGED. THE PAVEMENT MARKINGS SHALL BE REMOVED TO THE EXTENT THAT THEY SHALL NOT BE VISIBLE UNDER DAY OR NIGHT CONDITIONS.

TURN LANE LINE SHOULD INTERSECT THE LANE LINES WHICH WILL PROVIDE THE TURN LANE WITH TWO LANES GOING AWAY FROM THE INTERSECTION, EXCEPT WHERE ONLY TWO THROUGH LANES ARE AVAILABLE.
SPEED LIMIT 30

ELEVATION
OTHER REGULATORY OR WARNING SIGNS

NOTE:
SIGNS: ALL SIGNS SHALL BE FABRICATED FROM ASTM TYPE XL 4000 SERIES SIGN FACE SHEETING MATERIAL. ALL SIGNS ARE 0.080 INCH, 5001-70 OR 5002-75 ALUMINUM ALLOY. TREATED WITH ALDONGE 1200 CONVERSION COATING. 3/8 INCH DIAMETER HOLES PUNCHED, CENTERED ON TOP AND BOTTOM HORIZONTAL AXIS WITH STANDOFFS 1/2 INCH RADIUS CORNERS. ALL SIGNS SHALL BE ACCOMPANIED WITH A WATER COMPONENT SYSTEM WITH ACRYLIC FILM THAT MATCHES THE WARRANTY OF THE BASE REFLECTIVE SHEETING. SIGNS SHALL NOT BE PERMITTED FOR INSTALLING.

ROADSIDE SIGN INSTALLATION

TELESPAR POST (OR APPROVED EQUAL)

NOTE:
POSTS SHOULD BE INSTALLED TO PROVIDE 4" MINIMUM CLEAR WIDTH ALONG EXISTING SIDEWALK PATH FOR ADA COMPLIANCE.

TELESPAR SLEEVE (OR APPROVED EQUAL)

DETAIL 1
MOUNTED IN DIRT

DETAIL 2
MOUNTED IN SOIL/VEGETATION

DETAIL 3
MOUNTED IN SIDEWALK/HARDSCAPE

SLOPE FLOWFILL TO DRAIN
2" ROTATED HOLE THROUGH SIDEWALK
CAP WITH 3" CONCRETE
4" SIDEWALK

FILL BOLT:

2" TELESPAR TUBING
SQUARE 12 GAUGE STEEL
(OR APPROVED EQUAL)

2" TELESPAR TUBING
SQUARE 12 GAUGE STEEL
(OR APPROVED EQUAL)

NOTE:
MOUNTING IN SOIL OR DIRT REQUIRES APPROXIMATELY 2.0 CU. FT. OF CONCRETE OR AS APPROVED.

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SINGLE SIGN POST MOUNTING DETAILS

STANDARD DRAWING NO.
16.2.5

Sheet No. 06 of 18
NOTE: ALL SIGNS SHALL BE FABRICATED FROM ASTM TYPE XL 4000 SERIES SIGN FACE SHEETING MATERIAL. ALL SIGNS ARE 0.080 GAUGE, 5052-T6 OR 5052-H32 ALUMINUM ALLOY, TREATED WITH ALUMINUM 7000 CONVERSION COATING. 3/8 INCH DIAMETER HOLES PUNCHED, CENTERED ON TOP AND BOTTOM, HORIZONTAL AXIS WITH STANDARD 1 1/2 INCH RADIUS CORNERS. ALL SIGNS SHALL BE ACCOMPANY WITH A WATER COMPONENT SYSTEM WITH ACRYLIC FILM THAT MASTERS THE WARRANTY OF THE BASE REFLECTIVE SHEETING. SIGNS SHALL NOT BE PERMITTED FOR REUSING.

NOTE: POSTS SHOULD BE INSTALLED TO PROVIDE 4" MINIMUM CLEAR WIDTH ALONG EXISTING SIDEWALK PATH FORADA COMPLIANCE.

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STANDARD DRAWING NO.
16.2.6

Sheet No. 07 of 18
STANDARD SIGN PLACEMENT FOR STOP CONTROLLER INTERSECTIONS ALONG (EAST-WEST) ONE WAY STREETS

NOTES:
1. ONE WAY AND STREET NAME SIGNS SHOULD BE INSTALLED WITH BACK TO BACK SIGN PANELS.
   (STOP SIGNS ARE NOT REQUIRED TO BE BACK TO BACK - SEE SHEET 16.2.10)

STANDARD SIGN PLACEMENT FOR STOP CONTROLLER INTERSECTIONS ALONG (NORTH - SOUTH) ONE WAY STREETS
MOUNTING DETAIL FOR ADDING SIGNS TO EXISTING UTILITY POLES

PLAN VIEW

1.5" x 1.25"

1"

3/4" GALVANIZED STRAPPING

STEEL ALUMINUM OR WOOD POLE

SIGN MOUNTING SADDLE BRACKET

1"

3/4" GALVANIZED STRAPPING

SIGN BOLT

SIGN
CONNECT END TOGETHER WITH THRU KNOTS OR 10-24 x 3' PANHEAD SCREWS WITH 2 WASHERS AND NYLON LOCK NUTS (TYP 4 PLACES)

ATTACH SIGNS WITH ¾" x 2½" BOLTS AND NUTS (TYP 4 PLACES) USE POP RIVETS WHEN AVAILABLE TO REDUCE LIKELIHOOD OF SIGNS BEING STOLEN

6" INSERT INTO MAIN POST SECURED WITH THRU BOLT AND NUT (1 PLACE)

1 ¾" SQUARE TELESCOP INSERT (OR APPROVED EQUAL) USE WHEN SIGNS ARE TO BE ADDED TO AN EXISTING POST

2" SQUARE TELESCOP OR APPROVED EQUAL MAIN POST (POST MAY BE EXTENDED TO INSTALL STREET NAME SIGNS)

TOP = ________________ - NORTH-SOUTH (STREETS) (E-W BLOCK NUMBERS)

BOTTOM = ________________ - EAST-WEST (Avenues) (N-S BLOCK NUMBERS)

NOTE:
1. STREET NAME SIGN ASSEMBLIES TO BE PLACED ABOVE STOP SIGNS PER FOLLOWING CRITERIA:
   - 1 ASSEMBLY PER LOCAL/LOCAL INTERSECTION
   - 2 ASSEMBLIES PER ALL OTHER STOP CONTROLLED INTERSECTIONS (LOCAL/COLLECTOR, LOCAL/ARterials, Etc.)
GROUNDMOUNT STREET NAME SIGN NOTES:

1. All ground mount street name signs shall be fabricated from ASTM type XI, 4000 series sign face sheeting material or approved equal. All sign plates shall be 0.08 gauge 5052-H32 aluminum alloy, treated with aluminum 1200 conversion coating, and with 0.375 inch diameter holes punched centered on top and bottom of mounting holes and 0.25 inches from the top and bottom edges (measured to center of holes), sign panels shall have rounded corners (1.5 inch radius on outside corners and 0.875 inch on inside corners). All mounting shall be accomplished with a watch component system with acrylic film matching the warrant of the base reflective sheeting.inking shall not be permitted for imaging.

2. All sign posts for installing ground mount street name signs shall be minimum 2.0 inch by 2.0 inch dimensioned square steel posts with pre-drilled 3/8" mounting holes, telescopic or approved equal.

3. All mounting bolts shall be zinc or cadmium plated.

4. All ground mount street name signs shall be mounted so as to have 7.0 feet minimum vertical clearance above sidewalk grade and 2.0 feet minimum lateral clearance from Face of curb or edge of roadway.

5. Ground mount street name signs may be installed above existing stop signs or one-way signs on utility pole with the condition that street name sign mounting height does not exceed 12.5 feet above grade.

6. All sign face sheeting material shall be反射orized and adhered to one side of sign blank only. Sheetig material shall comply with FMVSS standards established for MUTCD type XI sheeting. A high intensity sheeting with encapsulated lens (Hi-Intensity Grade) All manufacturer's standards for surface preparation, sheeting adhesion, and edge sealing shall be met.

7. A minimum 10-year manufacturer's warranty for the retro-reflectivity and performance of the sign face sheeting materials shall be provided to the city traffic engineer.

8. The Prefix E and W (for streets east and west of Broadway) and N and S (for streets north and south of Ellsworth Avenue) shall be used on all street name signs. The Prefix shall be centered between the Edge of the Green Field and the street name.

9. On numbered streets, the suffix following the number shall be lower case letters.

10. All text shall utilize standard highway Gothic font or approved equivalent.
OVERHEAD STREET NAME SIGN NOTES:

1. ALL OVERHEAD STREET NAME SIGNS SHALL BE FABRICATED USING WHITE RETRO-REFLECTIVE SHEETING MATERIALS AS BACKGROUND WITH LETTERS AND BORDER FORMED BY GREEN TRANSPARENT ELECTRO-CUT FILM APPLIED OVER THE BACKGROUND MATERIAL THROUGH A PRESSURE SENSITIVE ADHESION PROCESS. THE CITY OF DENVER "D" LOGO IS TO BE MADE USING THE SAME SHEETING MATERIAL. THE LOGO MAY BE FABRICATED SEPARATELY AND THEN ADDED TO THE SIGN AS AN OVERLAY USING THE SAME ADHESION PROCESS APPROVED BY THE SHEETING MATERIAL MANUFACTURER. THE SHEETING MATERIAL AND TRANSPARENT ELECTRO-CUT FILM SHALL CONFORM TO THE FOLLOWING PRODUCT SPECIFICATIONS:

   A. U.S. DEPARTMENT OF TRANSPORTATION, FEDERAL HIGHWAY ADMINISTRATION, STANDARD SPECIFICATIONS FOR TYPE XI SIGN FACE SHEETING, A VERY-HEAT INTENSITY MICRO-PRismatic SHEETING DESIGNED TO PROVIDE REFLECTIVE HIGH SIGN FACE RETRO-REFLECTIVITY FOR OVERHEAD SIGNS THAT ARE TO BE VIEWED BY DRIVERS AT DISTANCES OF 1000 FEET OR LESS. ELECTRO-CUT FILM USED IN CONJUNCTION WITH THE TYPE XI SHEETING MATERIAL SHALL BE ELECTRO-CUT FILM #1177C OR AN EQUIVALENT APPROVED BY THE ENGINEER.

   B. THE ASTM TYPE XI SHEETING MATERIAL AND TRANSPARENT ELECTRO-CUT FILM USED SHALL INCLUDE A WARRANTY WHICH GUARANTEES AN EFFECTIVE FIELD PERFORMANCE LIFE OF AT LEAST 12 YEARS.

   2. THE PREFIX E AND W (FOR STREETS EAST AND WEST OF BROADWAY) AND N AND S (FOR STREETS NORTH AND SOUTH OF ELLSWORTH AVENUE) SHALL BE USED ON ALL STREET NAME SIGNS. THE PREFIX SHALL BE CENTERED BETWEEN THE DENVER "D" LOGO AND THE STREET NAME.

   3. STREET NAME SIGNS TO BE BOLTED ON TELEPIAR OR APPROVED EQUAL, EXTENSION WHICH CONNECTS TO WAST ARM BY USE OF ADAPTER SCREWED INTO COUPLING. SIGN SHALL BE INSTALLED LEVEL TO THE GROUND. SIGN SHALL BE FREE OF ANY HORIZONTAL OR VERTICAL DEFORMATION OR DISTORTIONS.

   4. ALL STREET NAME SIGNS SHALL USE THE DENVER "D" LOGO EXCEPT IN NEIGHBORING LITERATIONS AT TYPICAL CITY LIMIT INTERSECTIONS OR AS APPROVED BY DDOT ENGINEER. SEE TYPICAL SIG LOCATIONS DETAILS.

   5. ALL MOUNTING BOLTS FOR STREET NAME SIGNS SHALL BE ZINC OR CADMIUM PLATED.

   6. USE PARA STANDARD HIGHWAY FONT

   7. PLATE LENGTH MAY BE EXTENDED TO MAXIMUM LENGTH OF 108" FOR LONGER STREET NAMES.

   8. ON NUMBERED STREETS, THE SUFFIX FOLLOWING THE NUMBER SHALL BE LOWER CASE LETTERS.
KNOX CT
NEIGHBORHOOD BIKEWAY

NOTES:
1. STREET N-WE TEXT SHALL BE 2.75 POINT HIGHWAY “O” FONT.
2. ALL OTHER TEXT SHALL BE 2.75 POINT HIGHWAY “O” FONT.
NOTES:
1. DESIGN AND MANUFACTURER SHALL BE IN ACCORDANCE WITH THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC).
2. INVERTED-U SHAPE SHALL BE FORMED FROM ONE SEGMENT OF STEEL PIPE USING WELDING METHODS THAT MAINTAINS THE STRUCTURAL INTEGRITY OF THE STEEL PIPE.
3. ALTERNATE BIKE RACKS SHALL BE ACCEPTED BY DENVER DEPARTMENT OF TRANSPORTATION AND INFRASTRUCTURE (DOTI) PRIOR TO INSTALLATION.

INSTALLATION NOTES FOR BIKE RACKS MOUNTED TO CONCRETE OR CONCRETE PAVERS:
1. BIKE RACK SHALL BE MOUNTED TO FINISHED CONCRETE SURFACE USING POST-INSTALLED WEDGE ANCHORS WITH TAMPER-RESISTANT SECURITY NUT OR ACCEPTED ALTERNATE.
2. BIKE RACK SHALL BE SET FLAT AND INSTALLED WITHIN A VERTICAL TOLERANCE OF 1/4-INCH FROM PLUMB. STEEL SHAWS MAY BE INSTALLED TO ACHIEVE VERTICAL TOLERANCE.

INSTALLATION NOTES FOR BIKE RACKS MOUNTED TO CONCRETE FOUNDATION BENEATH MASONRY PAVERS:
1. REMOVE MASONRY PAVER AND REEDING MATERIAL AND PRESERVE FOR REINSTALLATION.
2. CONSTRUCT UNREFINISHED CONCRETE FOOTING ON UNREFINISHED CONCRETE SLAB TO SUPPORT BIKE RACK.
   a. CONCRETE FOOTING SHALL BE 12-INCHES DIAMETER AND 10-INCHES DEEP (MINIMUM). ONE CONCRETE FOOTING SHALL BE CONSTRUCTED FOR EACH BIKE RACK BASE PLATE.
   b. ALTERNATIVELY, CONSTRUCT A 4-INCH-THICK UNREFINISHED CONCRETE SLAB THAT EXTENDS 1-FOOT (MINIMUM) OUTSIDE FOOTPRINT OF BIKE RACK ON ALL SIDES.
   c. EXCAVATE SURFACE AS NECESSARY TO MAINTAIN TOP OF CONCRETE FOUNDATION AT BOTTOM OF REEDING MATERIAL. DISPOSE OF EXCESS EXCAVATED MATERIAL AT ACCEPTED OFF-SITE LOCATION.
3. MOUNT BIKE RACK TO CONCRETE USING INSTRUCTIONS PROVIDED THIS SHEET.
4. REPLACE REEDING MATERIAL.
5. REINSTALL MASONRY PAVERS. MASONRY PAVERS SHALL BE CUT TO ACCOMMODATE BIKE RACK (1/2-INCH INSTALLATION TOLERANCE).
NOTES:

1. **Five Inverted U Racks May Be Installed In One Basewear Array.**

2. **Inverted U Bike Rack Shall Be Consistent With 16.2.15 Except Base Plate Shall Be Mounted To Accommodate Rail Installation (See Detail This Sheet), Inverted U Bike Rack Shall Be Mounted To Basewear With 5/8-Inch Diameter Galvanized Steel Carriage Bolts With Nut And Washer Installed On The Underside Of The Basewear.**

3. **Basewear Array Shall Be Firmly Mounted To Asphalt Or Concrete Using 6 4-Inch Long 5/8-Inch Diameter Bolts And Female Threaded Drop-In Anchor Sleeves. Space Anchors Equally Along Basewear.**

4. **Basewear Shall Comprise Of Mild Steel Structural C-Shape (Channel Shape) 2.5x1.5x0.18 Basewear Shall Be Hit-and-Run Galvanized Following Fabrication.**

5. **Signs Shall Be Installed In Accordance With Denver Standard Drawing 16.2.5 And Be Mounted On A 3-Inch Telescoping Pole With A 7-6/16-Inch Minimum Clearance To Finished Grade. Legend And Border Of The Bicycle Parking Area Sign Shall Be Green On A Reflectorized White Background.**

6. **Installation Of Bike Parking Below The Curb Is Acceptable At The Following General Locations:**
   - Central Business District Downtown Streets
   - Roadways Classified As Collector Streets That Are Designated Bikeways
   - Roadways Classified As Local Streets

7. **Installation Of Bike Parking Below The Curb Shall Adhere To The Following Site-Specific Requirements:**
   - **Travel Lane Width (Bus And Heavy Truck Routes) - Installation Of Bike Parking Shall Not Reduce Travel Lane Width Below 11 Feet, A Truck Route Is Considered Any Roadway With At Least 2 Percent Truck Use.**
   - **Travel Lane Width (Other) - Installation Of Bike Parking Shall Not Reduce Travel Lane Width Below 11 Feet.**
   - **RTD Bus Stop - Bike Parking Shall Be At Least 20 Feet Ahead Of Sign And 45 Feet Behind Sign Or 65 Feet Behind Sign Where Articulated Buses Are Used.**
   - **Intersections - Bike Parking Shall Not Be Installed Within 20 Feet Of Sign Ramps, Stop Signs, Or Intersections Without Written Permission Of Denver Department Of Transportation And Infrastructure (DOT) Transportation Design.**
   - **Driveways - Bike Parking Shall Not Be Installed Within 5 Feet Of Driveways Or Alleys.**
   - **Fire Hydrants - Bike Parking Shall Not Be Installed Within 10 Feet Of A Fire Hydrant.**
   - **Row Infrastructure - Bike Parking Shall Not Be Installed Within 5 Feet From Traffic Control Cabinets, Utility Box Covers, Manhole Covers, Valve Box Covers, Pole/Fire Call Box, Or Other Emergency Facilities.**
   - **Existing Curbleane Use - On-Street Bike Parking Shall Not Conflict With Loading Zones, Car Share, Deaccess Parking Spaces, Or Other Permitted Curbleane Uses.**

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**BASE PLATE DETAIL FOR
INSTALLATION ON BASERAIL**

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**BIKE CORRAL INSTALLATION DETAIL (BELOW CURB)**