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SPACING FOR DELINEATOR POSTS ON CURVES

**GENERAL NOTES**

1. **SPACING FOR CURVES**
   - The spacing of delineator posts shall be computed from the formula
     \[ S = \frac{300 \times R}{R - 50} \]
   - Spacing in the advance of and beyond the curve is first space, second space +5, and third space +5. Spaces shall not be less than 20 ft. or greater than 300 ft. Residual space after "On Curve" spacing is applied, shall be divided equally among all of the "On Curve" spaces so that the last delineator falls at the P.T. or C.S. of the curve.

2. **TYPICAL INSTALLATION**
   - For all Type I delineators on tangent sections, the delineator shall be installed on the side of the traveled way parallel to the outer edge of the pavement or shoulder. Delineators shall be spaced so that the last delineator falls after the last 200 feet of alignment.
   - For all Type II delineators, the delineator shall be installed at a point 200 feet away from the P.T. or C.S. of the curve.
   - For all Type III delineators, the delineator shall be installed in the center of the nearest lane of approaching traffic at a point 200 feet away from the P.T. or C.S. of the curve.

3. **ALLOWABLE TOLERANCE**
   - In the case of delineator post installation, the tolerance shall be within ± 50 percent of the specified post position.

4. **WEIGHT**
   - The weight of any one post shall be at least 35 pounds.

5. **DOUBLE HEIGHT POSTS**
   - The lower section of the 2-post combination shall be installed according to the same delineator placement specifications as a typical single post.
   - The upper post shall be set in the drilled or excavated holes, use plumb and plumb points in place, or may be driven plumb.

6. **AN ADDITIONAL HOLE IS REQUIRED WHEN THE ADJUSTABLE REFLECTOR BRACKET IS USED.**

**DELINEATOR INSTALLATIONS**

**STANDARD PLAN NO.** S-612-1

**DELINEATOR POSTS ON CURVES**

1. **POST NOTES**
   - Posts shall be a uniform flanged channel section O-1/4" thick from hot rolled structural steel, or rolled rail steel, or new hot steel, having a minimum yield strength of 50,000 psi and a minimum tensile strength of 65,000 psi.
   - Posts shall be set in drilled or excavated holes, placed plumb and plumb points in place, or driven plumb.
   - A minimum of 3 holes of 1/2" diameter, spaced as shown, are required for all delineator posts.
   - An additional hole is required when the adjustable reflector bracket is used.

2. **DOUBLE HEIGHT POSTS**
   - The lower section of the 2-post combination shall be installed according to the appropriate placement specifications as a typical single post.
   - The upper post shall be set in the drilled or excavated holes, use plumb and plumb points in place, or may be driven plumb.
   - The length of the upper extension piece shall not exceed 7 feet.
DELINETER SYMBOLS AND TYPICAL CONFIGURATION

- **TYPE I** (CRYSTAL)
- **TYPE I** (YELLOW)
- **TYPE I** (RED)
- **TYPE I** (GREEN) (MAINTENANCE MARKER)
- **TYPE I** (BLUE) (MAINTENANCE MARKER)
- **TYPE II** (CRYSTAL) (BACK-TO-BACK)
- **TYPE II** (YELLOW) (BACK-TO-BACK)
- **TYPE II** (YELLOW-YELLOW, BACK-TO-BACK)
- **TYPE II** (CRYSTAL-RED, BACK-TO-BACK)
- **TYPE II** (YELLOW-RED, BACK-TO-BACK)
- **TYPE II** (3 YELLOW)
- **TYPE III** (2 CRYSTAL-RED, BACK-TO-BACK)
- **TYPE III** (2 YELLOW-RED, BACK-TO-BACK)
- **TYPE III** (GREEN)
- **TYPE III** (BLUE)
- **TYPE III** (BLUE-2 YELLOW)
- **TYPE III** (YELLOW-BLUE-YELLOW)

**TYPICAL INSTALLATION FOR TANGENT SECTION AND CURVES**

- WIDTH REDUCTION ON LEFT SIDE
- WIDTH REDUCTION ON RIGHT SIDE
- DETAIL ALLOWS TO MILL CLIMBING LANE TRANSITION

**TYPICAL INSTALLATION FOR LANE TRANSITION**

- **CONVENTIONAL ROADWAY**
- **EXPRESSWAY ROADWAY**

**TYPICAL INSTALLATION FOR BRIDGE APPROACHES**

**BRIDGE NOTES**

1. WHERE CURB TO CURB WIDTH OF BRIDGE IS LESS THAN ROADWAY WIDTH PLUS (SIDE SHOULDER WIDTH USE THE TYPE III DELINETER (3 YELLOW) ONLY AND OMIT ALL THE TYPE I DELINETERS.
2. FOR GUARD RAIL INSTALLATIONS WHERE APPROACH END IS NOT FLARED PLACE A TYPE III DELINETER (3 YELLOW) IMMEDIATELY IN ADVANCE OF APPROACH END.
3. ALL TYPE I DELINETERS ARE TO BE MOUNTED ABOVE OR IMMEDIATELY BEYOND GUARD RAIL, AND ARE NOT A CONSTANT DISTANCE FROM THE ROADWAY.
TYPICAL INSTALLATION FOR INTERCHANGES

NOTE
"SPACING IN ADVANCE OF AND BEYOND CURVE" (FIRST & SECOND SPACES) AS SHOWN IN THE SPACING TABLE ON SHEET I SHALL NOT APPLY TO RAMP CURVES

TYPICAL INSTALLATION FOR RAMP CURVES

MAINTENANCE MARKER LOCATIONS FOR OBSTRUCTIONS

DELINEATOR INSTALLATIONS

STANDARD PLAN NO. S-612-1

Colorado Department of Transportation
Traffic & Safety Engineering
MKB

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STANDARD PLAN NO.

STANDARD PLAN NO.
### Typical Adjustable Reflector Bracket

**Bracket Notes:**

1. The adjustable reflector bracket is to be used to traffic orient back-to-back delineators used on curves.
2. Reflector brackets shall be fabricated from either galvanized steel not less than 16 gauge or aluminum not less than 0.100 inch thickness.
3. Bolts, nuts, and washers shall be galvanized or cadmium plated.
4. All bracket holes are 1/16 inch diameter and delineator posts require an additional hole 2 inch below the top hole provided in the post.
5. Shop bend the bracket approach to degrees as shown, attach to the delineator feet with 1/8 inch bolts and field bend as necessary to traffic orient. Then the bracket reflector can be attached with a 9/16 inch blind expansion rivet or a bolt.
6. Burr the threads of all bolts to prevent nut loosening or vandalism.

### Typical Bracket Fabrication Details

**Bracket Fabrication Details:**

1. The adjustable reflector bracket is to be used to traffic orient back-to-back delineators used on curves.
2. Reflector brackets shall be fabricated from either galvanized steel not less than 16 gauge or aluminum not less than 0.100 inch thickness.
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6. Burr the threads of all bolts to prevent nut loosening or vandalism.

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**Barrier Reflector Notes:**

1. Barrier reflectors, regardless of type, shall meet the retroreflective qualities specified in Section 713 of the Standard Specifications for Delineator reflectors and be paid for as delineator (Type _) (Barrier) (Each). Use of these reflectors is mandatory.
2. The color of reflective surface shall match the color of the adjacent edge line.
3. Concrete surface preparation, adhesive, and methods of application shall be as recommended by the reflector manufacturer.
4. Unless otherwise noted in the plans or directed by the Engineer, a 200 foot maximum tangent and curve spacing applies to barrier reflectors.
5. Top mount reflectors are standard. Sidemount barrier reflectors or 6 inch wide reflector strips may be required if specified in the plans.
6. Median barrier reflectors shall be Type II (Yellow-Yellow, back-to-back).
7. For a two-way roadway barrier, reflectors shall be Type II (Crystal-Crystal, back-to-back).
8. For temporary concrete barrier, reflectors shall be installed that meet the minimum requirements of standard typical delineator installations, except the maximum spacing shall be 50 feet, and they will not be paid for, but are included in the work.

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**Typical Reflectors Details for Concrete Barrier**

**Typical Guardrail Post Mount Delineators**

Post mounts shall be attached by a method approved by the engineer or a method required by the device manufacturer.

**Typical Sleeve Installation for Median Delineator Posts**

**Plan View**

- 3/8" dia holes for post attachment
- 3/16" hole for reflector attachment
- 1/8" dia holes for bolt & binding line

**Reflective Tab**

- Rounded corners 1/4" ±
- 7/16" dia holes for bolt & binding line

**Mounting Position on Guard Rail Type 3**

- POST BOLT
- REFLECTOR TAB
- MOUNTING POSITION ON GUARD RAIL TYPE 3

**Typical Guardrail Reflector Tab**

- See the M-605-1 standard plan for reflector tab fabrication and placement details. Retroreflective sheeting shall conform to ASTM D4956 Type IV.

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**Colorado Department of Transportation**

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**Traffic & Safety Engineering**

MKB

**Delineator Installations**

Issued by: Traffic & Safety Engineering Branch July 31, 2019

**STANDARD PLAN NO.**

**S-612-1**

**Standard Sheet No.** 4 of 8

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**DELINEATOR INSTALLATIONS**

**Issued By:** Traffic & Safety Engineering Branch July 31, 2019

**Project Sheet Number:**
TYPICAL REFLECTOR STRIP INSTALLATION

1. REFEREOR STRIPS SHALL BE SPACED AT INTERVALS OF 20 FEET OFF-CENTER FOR TANGENT SECTIONS OF BARRIER AND 10 FEET OFF-CENTER FOR CURVED SECTIONS OF BARRIER.

2. THIS DEVICE SHALL BE INSTALLED PER MANUFACTURER'S RECOMMENDATIONS. IT IS THE RESPONSIBILITY OF THE INSTALLER TO CONTACT THE MANUFACTURER REPRESENTATIVE WHENEVER THERE IS A QUESTION REGARDING APPLICATION PROCEDURES OR SUBSTRATE CONDITIONS.

3. THE COLOR OF THE REFLECTIVE SURFACE SHALL MATCH THE COLOR OF THE ADJACENT ROADWAY EDGE LINE.

4. AT THE TIME OF INSTALLATION, THE CONTACTING SURFACE SHALL BE DRY AND MOISTURE-FREE.

5. AFTER REFLECTOR STRIP INSTALLATION, SURFACES SHOULD STAY DRY WITHOUT RAIN IN THE FORECAST FOR AT LEAST 8 HOURS.

6. SURFACE PREPARATION, BRACKETS, BOLTS, AND GLUE (OR EQUIVALENT) SHALL BE INCLUDED IN THE COST OF EACH DELINEATOR STRIP.

CONCRETE BARRIER NOTES

1. CONCRETE SURFACE PREPARATION, ADHESIVE, AND METHOD OF APPLICATION SHALL BE AS RECOMMENDED BY THE REFLECTOR MANUFACTURER.

2. TO ACHIEVE A STRAIGHT, LEVEL APPLICATION, SNAP A CHALK LINE ACROSS THE BARRIER.

3. FOR MOUNTING THE REFLECTOR STRIP TO CONCRETE BARRIER, INCLUDING THE BRACKETS, THE USE OF 3M WIND-WELD SUPER FAST URETHANE GLUE OR EQUIVALENT APPLIED AT 60 DEGREES FAHRENHEIT IN DRY WEATHER IS RECOMMENDED. THIS PRODUCT IS AVAILABLE IN A STANDARD CAULKING TUBE AND SHOULD BE APPLIED TO THE BRACKETS AND PANELS WITH A CONSTRUCTION STYLE CAULKING GUN, AND/OR USE 1/4" X 1" STAINLESS STEEL ANCHOR WITH 1/8" NYLON WASHERS, AS SPECIFIED IN 3M PRODUCT BULLETIN 340.

4. UNLESS OTHERWISE NOTED IN THE PLANS OR DIRECTED BY THE ENGINEER, A 200-FDOT MAXIMUM TANGENT AND CURVE SPACING APPLIES TO BARRIER REFLECTORS ALONG THE TOP OF THE BARRIER.

GUARDRAIL TYPE 3 NOTES

1. THE USE OF REFLECTOR STRIPS ON GUARDRAIL TYPE 3 IS SUPPLEMENTAL TO THE REFLECTOR TAB.

2. TWO DIFFERENT STYLES OF MOUNTING BRACKETS ARE AVAILABLE. THERE IS ONE STYLE FOR THE 4-INCH REFLECTOR STRIP AND ANOTHER FOR THE 6-INCH REFLECTOR STRIP. THE BRACKETS MUST BE MATCHED TO THE EXACT 4-INCH OR 6-INCH REFLECTOR STRIP PANEL. THE 4-INCH REFLECTOR STRIP SIZE IS TYPICAL, HOWEVER, 1.5-INCH OR 6-INCH REFLECTOR STRIP PANELS MAY BE INSTALLED AS SPECIFIED IN THE PLANS.

3. METAL GUARDRAIL SHALL BE WIRE BRUSHED/SANDED, THEN CLEANED WITH ISOPROPYL ALCOHOL WHERE THE BRACKETS WILL ADHERE TO THE GUARDRAIL.

4. FOR MOUNTING THE REFLECTOR STRIP TO GUARDRAIL, INCLUDING THE BRACKETS, THE USE OF 3M WIND-WELD SUPER FAST URETHANE GLUE OR EQUIVALENT APPLIED AT 60 DEGREES FAHRENHEIT IN DRY WEATHER IS RECOMMENDED. THIS PRODUCT IS AVAILABLE IN A STANDARD CAULKING TUBE AND SHOULD BE APPLIED TO THE BRACKETS AND PANELS WITH A CONSTRUCTION STYLE CAULKING GUN, AND/OR USE 1/4" INCH X 1" INCH STAINLESS STEEL ANCHOR WITH 1/8" NYLON WASHERS, AS SPECIFIED IN 3M PRODUCT BULLETIN 340.

5. INSTALLATION REQUIRES THE USE OF THREE BRACKETS (MINIMUM) PER REFLECTOR STRIP CORRESPONDING TO THE PRE-DRILL REFLECTOR STRIP HOLES.

TYPICAL INSTALLATION DETAIL FOR GUARDRAIL TYPE 3

TYPICAL INSTALLATION DETAIL FOR CONTINUOUS CONCRETE BARRIER
BUFFER PANEL ATTACHMENT DETAILS

SUPPLEMENTAL PANEL NOTES

1. ALL SUPPLEMENTAL DELINEATION PANELS SHALL BE SINGLE SHEET ALUMINUM, 0.080" MINIMUM THICKNESS.
2. A) PANELS SHALL BE FASTENED DIRECTLY TO THE IMPACT ATTENUATOR WITH 2 OR 4-1/4" DIAMETER BLIND EXPANSION RIVETS, OR 2 OR 4-1/4" INCH BOLTS, NUTS AND WASHERS.
   B) EXPANSION RIVETS SHALL BE DOMED-HEAD ALUMINUM WITH ALUMINUM BREAK STEM MANDREL, AND SHALL HAVE A BACK-UP WASHER WHEN USED WITH PLASTIC MATERIALS.
   C) BOLTS, NUTS AND WASHERS SHALL BE GALVANIZED OR CADMIUM PLATED.
   D) SPACERS, OR SPACING WASHERS SHALL BE USED AS NECESSARY FOR SAND FILLED ATTENUATORS.
3. OM-3BT DECAL BUFFER TERMINAL OBJECT MARKER SHALL BE PRESSURE SENSITIVE REFLECTIVE SHEETING AND SHALL BE APPLIED DIRECTLY TO THE GUARDRAIL END TREATMENT (FLARED OR NON-FLARED).
4. RETROREFLECTIVE SHEETING SHALL CONFORM TO ASTM D4565, TYPE IV. THE SHEETING SHALL BE YELLOW FOR PERMANENT INSTALLATIONS:
   OM-3BT DECAL AND OM-3aR(L)(C) PANELS SHALL HAVE YELLO SHEETING BACKGROUND WITH STENCIL BLACK STRIPES.
   THE SHEETING FOR TEMPORARY (CONSTRUCTION ZONE) INSTALLATIONS SHALL BE AS FOLLOWS:
   OM-3BT DECAL AND OM-3aR(L)(C) PANELS SHALL HAVE ALTERNATING ORANGE AND WHITE REFLECTORIZED STRIPES.
5. SUPPLEMENTAL DELINEATION PANELS OR PRESSURE SENSITIVE RETROREFLECTIVE SHEETING DECALS SHALL BE INCLUDED IN THE COST OF THE GUARDRAIL END ANCHOR OR THE IMPACT ATTENUATOR ITEM.
6. REFERENCE SHEET S-612-1 SHEET 7 OF 8 FOR BASE DETAIL.
FLEXIBLE DELINEATOR INSTALLATIONS

**TYPICAL CONDITIONS**

- 3" x 3" REFLECTORS
- 48" POST
- 2" x 12 x 24 GA. SQUARE PERFORATED TUBING
- 3" x 3" REFLECTORS
- MULTI-HIT INSERT
- FINISHED GRADE
- APPROX. 1'
- 1/4" CONCRETE RIVET ANCHORS
- HDPE WHITE PLASTIC CUP
- 5/16" L-PIN
- 2 - 13/16" BEAM CLAMPS
- DIRECTION OF TRAFFIC

**SOFT SOIL CONDITIONS**

- 3" x 3" REFLECTORS
- POST MOUNTED GUARDRAIL
- CABLE RAIL
- CONCRETE BARRIER

**GENERAL NOTES**

1. IMPACT RESISTANT, DELINEATOR POSTS, COMPRISING OF HIGH DENSITY THERMOPLASTIC, CONSISTING OF A MINIMUM OF 70% BY VOLUME, POST CONSUMER RECYCLED HDPE, WITH AN INTERSTATE GREEN, PREMIUM U.V. INHIBITED, CO-EXTRUDED HDTP SHELL AND A FLEXIBLE INSERT WHICH TRANSITIONS FROM SQUARE TO ROUND.

2. THE TOP OF TUBULAR POSTS SHALL BE PERMANENTLY CLOSED TO PREVENT MOISTURE OR DEBRIS FROM ENTERING.

3. THE SIDE OF THE POST FACING TRAFFIC, UPON WHICH THE DELINEATOR IS TO BE MOUNTED, SHALL HAVE A FLAT SURFACE WITH MINIMUM DIMENSIONS OF 3.25 INCHES IN WIDTH BY 13 INCHES IN LENGTH. THE TEXTURE OF THE PROJECTED SURFACE SHALL BE SMOOTH AND SUITABLE FOR THE ADHEREANCE OF REFLECTIVE SHEETING WITHOUT PREPARATION OTHER THAN WIPING WITH A CLEAN CLOTH DAMPENED WITH MINERAL SPIRITS TO REMOVE OIL-TYPE CONTAMINANTS.

4. FOR POST MOUNTED AND CLAMP MOUNTED DELINEATORS, THE BOTTOM OF THE POST SHALL HAVE A MINIMUM OF 13 INCHES LENGTH FLAT MOUNTING SURFACE WITH THE MINIMUM DIMENSION OF 3.25 INCHES IN WIDTH.

5. THE WIDTH OF THE POST AT ANY POINT (EXCLUDING THE BASE, IF ANY) SHALL BE A MAXIMUM OF 4 3/4 INCHES.

6. THE OUTSIDE DIAMETER OF THE TUBULAR POST SHALL BE A MAXIMUM OF 2 3/4 INCHES.
MEDIAN CROSSOVER INSTALLATIONS

1. MOUNTING HEIGHT TO BOTTOM OF R3-50, "EMERGENCY AND AUTHORIZED VEHICLES ONLY" SIGN, SHALL BE 7 FEET FROM ORIGINAL GROUND.
2. SEE TUBULAR STEEL SIGN SUPPORT DETAILS (S-614-8) FOR CONCRETE FOOTING INFORMATION FOR SOCKET SYSTEM INSTALLATIONS AND ADDITIONAL POST INSTALLATION REQUIREMENTS.
3. PLACE SIX (6) CROSSTOVER MARKERS, ONE 500 FEET IN ADVANCE OF MEDIAN CROSSOVER AND ONE ON EACH SIDE OF CROSSOVER AS SHOWN ON DETAIL.
4. CROSSTOVER MARKERS SHALL BE LOCATED IN-LINE WITH DELINEATOR POSTS.
5. FOR VISUALLY CONSTRAINED MEDIAN CROSSOVERS, MULTIPLE SIGN PANELS (R3-4 AND R3-50) MAY NEED TO BE PLACED WITHIN THE CROSSOVER ON SEPARATE POSTS, AS DIRECTED BY THE ENGINEER.
6. THE POLYETHYLENE PLASTIC PANEL MAY BE USED ON EITHER POLYPROPYLENE BLEND POST AND/OR P-POST INSTALLATIONS. IN CONTRAST, THE CLASS 1 SIGN PANEL SHALL ONLY BE USED ON P-POST INSTALLATIONS.
GENERAL NOTES

1. Luminaires with light sources rated more than 3200 lumens shall have U0 ratings per ES TM-15-11.
2. All luminaires shall be equipped with an ANSI C136.41 7-Pin receptacle and wireless control node.
3. All LED luminaires shall be 3000K nominal, or less, per and CULSTI-2011 standard and equipped with a single suppression device with a minimum level of 13VDC. All LED luminaires shall be equipped with a 2-0" or 3-0" knockouts.
4. Light standards shall not be placed in streets or other low areas unless alternative location is not possible.
5. Snap-off shall be compacted in accordance with Section 210.
6. Pole caps and base plate covers (or optional nut covers) are required.
7. Coordinate wireless control node location with luminaire manufacturer.
8. All electrical components shall be UL listed for the appropriate UL equipment, including but not limited to 300V industrial control panels.
9. Final location of the luminaires shall be approved by the engineer.
10. Where foundation is located in sidewalk, fences or other hazards, the top of foundation shall be flush with the top of sidewalk conforming to ADA requirements.

NOTE: COST REGIONAL ENGINEER SHALL APPROVE ALTERNATIVE SETDOWNS ON STEEP SLOPES.
TYPICAL BREAKAWAY TYPE TRANSFORMER BASE DETAIL

1. ALL BREAKAWAY TRANSFORMER BASES SHALL CONFORM TO AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS".
2. ANCHOR BOLT SPACING, HARDWARE AND TORQUE CONFORMING TO MANUFACTURER RECOMMENDATIONS.
3. BREAKAWAY BASES OF ANY TYPE ARE FOR USE INSIDE CLEAR ZONES ONLY. BREAKAWAY BASES SHALL NOT BE USED WHERE LIGHT STANDARD IS LOCATED AT LEAST 0.5X MOUNTING HEIGHT AWAY FROM PEDESTRIAN OCCUPIED AREAS.
4. ALL CONDUCTORS SHALL BE SIZED IN CONFORMANCE WITH N.E.C. REQUIREMENTS 590.3 W 3/8 STRANDED COPPER CONDUCTOR OR 1/2 AWS MIN. COLOR CODE BLACK, WHITE, GREEN.
5. LIGHT STANDARDS SHALL BE GROUNDED IN ACCORDANCE WITH N.E.C. ARTICLE 250 "GROUNDING AND BONDING".
6. LIGHT STANDARD FOUNDATIONS MAY BE PRECAST CONCRETE OR CAST-IN-PLACE CONCRETE.
7. BREAKAWAY TRANSFORMER BASES MAY BE OMITTED AND THE POLES MOUNTED DIRECTLY ON THE LIGHT STANDARD FOUNDATION AS APPROVED BY THE ENGINEER OR SHOWN ON THE PLAN. POLES WITHOUT BREAKAWAY TRANSFORMER BASES MUST HAVE HAND HOLE.

TYPICAL NON-BREAKAWAY BASE DETAIL

- Bond one #4 Stranded/Insulated Copper Ground Wire at Grounding Lug in Base and Exothermic Weld or Underground Rated Lug Connect to Ground Rod.
- Ground Lug shall be within sight from the Handhole.
- Breakaway Submersible In-Line Fuse Holder and Fuse for Each Hot Conductor and a Breakaway Submersible Connector on Neutral (if required).
- Pole Base Cover (or Nut Covers).
- Provide 2'-0" Level Compacted Shoulder Around Foundation Where Possible. Steep Slopes Exempted - See Steep Slope Detail on Sheet 3.
FOUNDATION REQUIREMENTS FOR STEEP SLOPES

FLUSH-IN-GRADE POLYMER CONCRETE
FULL BOX, INCIDENTAL TRAFFIC RATED
22,500 (MIN) PSI LOAD TEST WITH HEAVY DUTY TIER 22 RATED BOLTED COVER

CONCRETE SUPPORT RING
FINAL GRADE

12'-0" (MIN) DEEP
1" (MIN) CRUSHED DRAINAGE ROCK FOR GRAVEL BED WITH CONCRETE SUPPORT RING

1" SCHEDULE 80 PVC
DESIGNATED ON PLANS
CONNECT TD CIRCUIT AS FINAL GRADE

DIRECT CONTACT WITH THE EARTH AT A 2" CLEAR (MIN)
( MIN) CONDUITS IN AND OUT
( MIN) PVC ABSORBED CONCRETE IN AND OUT

SUBSTITUTED FOR A GROUND ROD. REFER TO CODE.
20'-0" OF BARE COPPER CONDUCTOR NOT CONNECTED TO GROUNDING LUG IN POLE BASE HAND HOLE.

ALL PVC CONDUIT ENDS SHALL HAVE END BELLS OR MALE ADAPTOR, Threaded Terminal Ends With Screw On Bushing.

6-#4 @ 1'-0" OVERLAP
1-#5 REBAR AT 1'-0"

3/4" CHAMFER ALL EXPOSED EDGES
11 #4 TIES AT 1'-0"
1-#8 REBAR CENTERS

ANCHOR BOLT CIRCLE SHALL MATCH THE LIGHT STANDARD BASE PLATE AND BE CENTERED ON FOUNDATION.
3/4" CHAMFER ALL EXPOSED EDGES

FOUR ANCHOR BOLTS, ASTM A 307 5/8" Dia. WITH TOP 8" OR MORE GALVANIZED. ANCHOR BOLT CIRCLE SHALL MATCH THE LIGHT STANDARD BASE PLATE AND BE CENTERED ON FOUNDATION.
1" SCHEDULE 80 PVC (MIN). CONNECT TO CIRCUIT AS DESIGNATED ON PLANS

FOUNDATION HEIGHT ABOVE GRADE IS IN ADDITION TO THE REQUIRED FOUNDATION EMBRACE DEPTH

FOUR ANCHOR BOLTS, ASTM A 307 1" Dia. WITH TOP 8" OR MORE GALVANIZED. ANCHOR BOLT CIRCLE SHALL MATCH THE LIGHT STANDARD BASE PLATE AND BE CENTERED ON FOUNDATION.
1" SCHEDULE 80 PVC (MIN).

TYPICAL STREET LIGHT SPLICE BOX PLACEMENT

NOTES
2. CONCRETE SHALL BE CLASS 'B' AND SHALL CONFORM TO SECTION 601 FOR CONCRETE AND SECTION 602 FOR REINFORCING STEEL.
3. WHERE LIGHT STANDARD FOUNDATION OCCURS IN HARDSCAPE AREAS, WHERE AN EXPOSED FOUNDATION COULD CREATE A TRIPPING HAZARD, THE TOP OF FOUNDATION SHALL BE FLUSH TO THE FINISHED SURFACE TO MEET ADA REQUIREMENTS. WHERE EXPOSED LIGHT STANDARD FOUNDATION COMPLIES WITH ADA REQUIREMENTS, FOUNDATION SHALL BE INSTALLED 2" ABOVE HARDSCAPE WITH COTD APPROVAL.
4. BOND (#4 STRANDED/INSULATED COPPER TO GROUND ROD IN FULL BOX, A SPLICE BOX AND GROUNDING LUG IN POLE BASE HAND HOLE.
5. PROVIDE 4 TERMINAL UNDERGROUND RATED LUG CONNECTIONS TO FIT #4 AWG AND #4 AWG COPPER WIRE.
6. ALL PVC CONDUIT ENDS SHALL HAVE END BELLS OR MALE ADAPTOR, Threaded Terminal Ends With Screw On Bushing.
7. FOUNDATION DIMENSIONS PER FOUNDATION SCHEDULE BELOW.
LIGHT STANDARDS HIGHER THAN 50'-0" OR WITH MULTIPLE LUMINAIRES OR BANNERS, OR VARYING SOIL OR WIND CONDITIONS, SHALL BE DESIGNED BY A STRUCTURAL ENGINEER LICENSED IN THE STATE OF COLORADO AND SHOWN ON THE PLANS.

FOUN DATION SCHEDULE

<table>
<thead>
<tr>
<th>POLE HEIGHT</th>
<th>FOUNDATION DEPTH</th>
<th>FOUNDATION DIAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>0'-0&quot;</td>
<td>6'-0&quot;</td>
<td>3&quot;</td>
</tr>
<tr>
<td>10' - 20'</td>
<td>6'-0&quot;</td>
<td>3&quot;</td>
</tr>
<tr>
<td>20' - 40'</td>
<td>6'-0&quot;</td>
<td>3&quot;</td>
</tr>
<tr>
<td>40' - 50'</td>
<td>2'-6&quot;</td>
<td>2'-6&quot;</td>
</tr>
</tbody>
</table>

P.S.E. (PER STRUCTURAL ENGINEER)

MAXIMUM POLE HEIGHT OF 50' -0" IN CLAY OR STIFF CLAY WITH X > 15 AS DETERMINED BY ASTM D 1586 STANDARD PENETRATION TEST.

EXCEPTION NO. 6: WHERE LIGHT STANDARD FOUNDATION DEPTH IS BASED ON A MAXIMUM POLE HEIGHT OF 60'-0" IN CLAY OR STIFF CLAY WITH X > 15 AS DETERMINED BY ASTM D 1586 STANDARD PENETRATION TEST.

TRAFFIC FLOW

TOTAL EAGLE LIGHTING

ROADWAY LIGHTING

S-613-1
Sheet No. 3 of 8

Issued By: Traffic & Safety Engineering Branch July 31, 2019
Project Sheet Number: MKB
DETAIL NOTES
1. ALL PULL BOXES SHALL BE INCIDENTAL TRAFFIC RATED 22,500 PSI LOAD TEST (MIN) WITH HEAVY DUTY TIER 22 RATED COVERS.
2. ALL PULL BOXES SHALL BE 11" X 10" X 12" (MIN) DEEP UNLESS NOTED OTHERWISE ON PLANS. REFER TO N.E.C. SECTION 314.28A FOR BOX SIZE REQUIREMENTS. REFER TO COTD STANDARD PLAN NO. S-614-04 FOR TYPICAL PULL BOX SIZES.
3. ONE CONDUIT PER BUNDLE SHALL HAVE ONE #12 AWG LOCATE WIRE AND A NYLON OR POLYESTER PULL CONNECTOR.
4. INSTALLING CONDUIT IN ANY METHOD OTHER THAN TRENCHING OR DIRECTIONAL BORING, THAT MAY CAUSE DAMAGE TO THE EMBANKMENT OR HIGHWAY AREA, OR BE HAZARDOUS TO THE TRAVELING PUBLIC WILL NOT BE PERMITTED. WHEN JACKETING IS SPECIFIED, DISRUPTION OF HIGHWAY TRAFFIC WILL NOT BE PERMITTED.
5. REFER TO N.E.C. ARTICLE 314 “PULL AND JUNCTION BOXES AND CONDUIT BODIES MINIMUM SIZE” FOR BOX SIZE REQUIREMENTS.
6. ALL PVC CONDUIT ENDS SHALL HAVE END BELLS OR MALE ADAPTOR, TERMINATED ENDS WITH SCREW ON BUSHING.

SECTION-TYPICAL CONDUIT BURIAL

1. CONTRACTOR SHALL COORDINATE TRENCHING WITH OTHER UNDERGROUND UTILITIES, RAMP METERING AND IRRIGATION. CONTRACTOR SHALL USE COMMON TRENCHES AT ALL ROAD CROSSINGS WHERE POSSIBLE.
2. ONE CONDUIT PER BUNDLE SHALL HAVE ONE #12 AWG LOCATE WIRE AND A NYLON OR POLYESTER PULL TAPE WITH 1,250 LBS TEST STRENGTH AND FOOTAGE MARKINGS IN ALL EMPTY CONDUITS. LOCATE WIRES SHALL NOT BE INSTALLED IN FIBER OPTIC CONDUITS.
3. ELECTRICAL CONDUIT (BURIED) SHALL BE UL LISTED HERE AND INSTALLED USING TRENCHLESS TECHNOLOGY OR EITHER JACKED OR DIRECTIONAL BORING. IF TRENCHED CONDUIT IS SPECIFIED ON PLANS, BURIED CONDUIT OF EQUAL OR GREATER SIZE MAY BE SUBSTITUTED FOR TRENCHED CONDUIT IF PAID FOR UNDER THE ORIGINALY DESIGNED TRENCHED CONDUIT PAY ITEM AND AT NO ADDITIONAL COST TO THE CONTRACTOR. ELECTRICAL CONDUIT (BURIED) SHALL CONFORM TO THE SAME MINIMUM DEPTH REQUIREMENTS.
4. INSTALLING CONDUIT IN ANY METHOD OTHER THAN TRENCHING OR DIRECTIONAL BORING, THAT MAY CAUSE DAMAGE TO THE EMBANKMENT OR HIGHWAY AREA, OR BE HAZARDOUS TO THE TRAVELING PUBLIC WILL NOT BE PERMITTED.
5. ELECTRICAL CONDUIT (BURIED) SHALL BE UL LISTED HERE AND INSTALLED USING TRENCHLESS TECHNOLOGY OR EITHER JACKED OR DIRECTIONAL BORING. IF TRENCHED CONDUIT IS SPECIFIED ON PLANS, BURIED CONDUIT OF EQUAL OR GREATER SIZE MAY BE SUBSTITUTED FOR TRENCHED CONDUIT IF PAID FOR UNDER THE ORIGINALY DESIGNED TRENCHED CONDUIT PAY ITEM AND AT NO ADDITIONAL COST TO THE CONTRACTOR. ELECTRICAL CONDUIT (BURIED) SHALL CONFORM TO THE SAME MINIMUM DEPTH REQUIREMENTS.
6. ALL PVC CONDUIT ENDS SHALL HAVE END BELLs OR MALE ADAPTOR, TERMINATED ENDS WITH SCREW ON BUSHING.

DETAIL NOTES
1. BURIED SPLICE BOXES SHALL ONLY BE USED WHERE APPROVED BY COOT.
2. BOX COVERS SHALL BE LABELED AS FOLLOWS: "UTILITY ELECTRIC" ON ALL PULL BOXES CONTAINING UTILITY OWNED ELECTRICAL SERVICE “ELECTRIC” OR “STREET LIGHTING” ON ALL PULL BOXES CONTAINING COOT OWNED ELECTRICAL SERVICE.
3. REFER TO N.E.C. "PULL AND JUNCTION BOXES AND CONDUIT BODIES MINIMUM SIZE” FOR BOX SIZE REQUIREMENTS.
4. CONTRACTOR SHALL USE COMMON TRENCHES AT ALL ROAD CROSSINGS WHERE POSSIBLE.
5. REFER TO N.E.C. ARTICLE 314 “PULL AND JUNCTION BOXES AND CONDUIT BODIES MINIMUM SIZE” FOR BOX SIZE REQUIREMENTS.
6. THE WIRE TERMINATIONS IN PULL OR SPLICE BOXES SHALL BE MADE USING URO, SUBMERSEABLE INSULATED PEDESTAL LUG CONNECTIONS. PROVIDE ONE MULTI-LUG CONNECTOR FOR EACH PHASE, NEUTRAL AND GROUND CONDUCTOR TO BE SPICED IN THE IN-GRADE SPLICE BOX.
7. PROVIDE ONE MULTI-LUG CONNECTOR FOR EACH PHASE, NEUTRAL AND GROUND CONDUCTOR TO BE SPICED IN THE IN-GRADE SPLICE BOX.

TYPICAL PULL OR SPLICE BOX

1. BOX COVERS MUST BE POLYMER CONCRETE WITH FIBERGLASS REINFORCEMENT, INCIDENTAL TRAFFIC RATED TO TIER 22 AND BOLTED WITH A 60 LOAD RATING OF 22,500 PSI (MIN).
2. BOX COVERS SHALL BE LABELED AS FOLLOWS: "UTILITY ELECTRIC" ON ALL PULL BOXES CONTAINING UTILITY OWNED ELECTRICAL SERVICE “ELECTRIC” OR “STREET LIGHTING” ON ALL PULL BOXES CONTAINING COOT OWNED ELECTRICAL SERVICE. LABELING MUST BE CAST INTO THE COVER AND NOT A SEPARATE INDEPENDENT TAG.
3. REFER TO COTD STANDARD PLAN NO. S-614-43, SHEET 8 FOR TYPICAL PULL BOX SIZES.
4. REFER TO N.E.C. ARTICLE 314 “PULL AND JUNCTION BOXES AND CONDUIT BODIES MINIMUM SIZE” FOR BOX SIZE REQUIREMENTS.
5. ELECTRICAL CONDUIT (BURIED) SHALL BE UL LISTED HERE AND INSTALLED USING TRENCHLESS TECHNOLOGY OR EITHER JACKED OR DIRECTIONAL BORING. IF TRENCHED CONDUIT IS SPECIFIED ON PLANS, BURIED CONDUIT OF EQUAL OR GREATER SIZE MAY BE SUBSTITUTED FOR TRENCHED CONDUIT IF PAID FOR UNDER THE ORIGINALY DESIGNED TRENCHED CONDUIT PAY ITEM AND AT NO ADDITIONAL COST TO THE CONTRACTOR. ELECTRICAL CONDUIT (BURIED) SHALL CONFORM TO THE SAME MINIMUM DEPTH REQUIREMENTS.
6. INSTALLING CONDUIT IN ANY METHOD OTHER THAN TRENCHING OR DIRECTIONAL BORING, THAT MAY CAUSE DAMAGE TO THE EMBANKMENT OR HIGHWAY AREA, OR BE HAZARDOUS TO THE TRAVELING PUBLIC WILL NOT BE PERMITTED. WHEN JACKETING IS SPECIFIED, DISRUPTION OF HIGHWAY TRAFFIC WILL NOT BE PERMITTED.
7. THE WIRE TERMINATIONS IN PULL OR SPLICE BOXES SHALL BE MADE USING URO, SUBMERSEABLE INSULATED PEDESTAL LUG CONNECTIONS. PROVIDE ONE MULTI-LUG CONNECTOR FOR EACH PHASE, NEUTRAL AND GROUND CONDUCTOR TO BE SPICED IN THE IN-GRADE SPLICE BOX.

SECTION A-A

1. REFER TO N.E.C. "PULL AND JUNCTION BOXES AND CONDUIT BODIES MINIMUM SIZE” FOR BOX SIZE REQUIREMENTS.
2. THE WIRE TERMINATIONS IN PULL OR SPLICE BOXES SHALL BE MADE USING URO, SUBMERSEABLE INSULATED PEDESTAL LUG CONNECTIONS. PROVIDE ONE MULTI-LUG CONNECTOR FOR EACH PHASE, NEUTRAL AND GROUND CONDUCTOR TO BE SPICED IN THE IN-GRADE SPLICE BOX.
**LIGHTING CONTROL CENTER PLACEMENT**

**DETAIL NOTES**

1. PREPRINTED NEMA 3R LIGHTING CONTROL CENTER CABINET (LCC) REFER TO LIGHTING CONTROL CENTER DETAIL FOR MORE INFORMATION.

2. REINFORCED CONCRETE (CAST-IN-Foundation PAD, PER STRUCTURAL ENGINEER LICENSED IN THE STATE OF COLORADO WITH 1" CHAMFER ON ALL EXPOSED EDGES OF CONCRETE TO EXTEND 5" (MIN) OR 6" (MAX) FROM EDGE OF CABINET.

3. THE LCC SHALL NOT BE LOCATED IN ANY INTERSECTION. SEE INTERSECTION SIGHT TRIANGLES. PLACEMENT SHALL CONFORM TO ALLOWABLE ENCROACHMENTS IN THE PUBLIC ROW.

4. 36" CLEAR ZONE (MIN) ON ALL SIDES OF CONCRETE PAD.

5. 1/2" SLOPE (MAX) IN CLEAR ZONE AREA.

**COMPONENT LIST**

1. NEMA 1, SERVICE ENTRANCE RATED, SINGLE PHASE LOAD CENTERS (SEE PANEL SCHEDULE FOR QUANTITY AND SIZE OF MAIN AND BRANCH BREAKERS).

2. GFCI MANT. RECEPTEACLE IN A 1-GANG BACK BOX WITH COVER.

3. 200A, 1 PH, NEMA 3R, METER HOUSING MOUNTED ON BACK SIDE OF NEMA 4 ENCLOSURE W/ LEVER BYPASS TO UTILITY COMPANY SPECIFICATIONS. PAINT TO MATCH NEMA 4 ENCLOSURE.

4. 100A, 2 POLE, 250V, HEAVY DUTY NEMA 3R, Fuse Disconnect UL Listed FOR SERVICE EQUIPMENT AND FINISH FUSES AS SHOWN ON ONE-LINE DIAGRAM NEUTRAL & GROUND BARS; MOUNTED ON BACK SIDE OF NEMA 4 ENCLOSURE. PAINT TO MATCH NEMA 4 ENCLOSURE. MAY BE OMITTED BY UTILITY COMPANY SPECIFICATIONS NOT SEQUENCE REQUIREMENTS.

5. 1 POLE, 30A, 120/240V ELECTRICALLY HELD LIGHTING CONTACTORS W/ 120V COILS. (2) REQUIRED.

6. 1 POLE, 30A, Fuse Blocks W/30A, FINISH FUSES TO THE LIGHTING CONTACTORS AS REQUIRED BY UL 508A (2001 STANDARD FOR INDUSTRIAL CONTROL PANELS). (2) REQUIRED.

7. 3/4" x 10'-0" Lg; COPPER-CLAD DRIVEN GROUND ROD WITH GROUND CONDUCTOR EXOTHERMIC WELD UNDERGROUND RATED LUG CONNECT GROUND CONDUCTOR TO GROUND ROD.

8. HOA SWITCH - HAND OFF/ AUTO W/ 15A 120V CONTACTS, BACK BOX, COVER, KNOB & LEGEND AND THE PHOTOCELL CONTROL WIRED IN THE AUTO POSITION.

9. PHOTOCONTROL W/ TWIST-LOCK RECEPTEACLE BASE MOUNT ON NORTH SIDE OF NEMA 4 ENCLOSURE.

10. SURGE PROTECTION DEVICE-120/240VAC SINGLE PHASE, 3W, 20KA, PROTECTION MODES L-G, N-G, L-N OR L-L. STANDARD OPTIONS RED & GREEN LEDS, AUDIBLE ALARM WITH ENABLE/DISABLE FEATURES (WEA 9870-00-7000 INTERNATIONAL OR APPROVED EQUIVALENT).

11. OPTIONAL CABINET HVAC PER MOUNTAIN REGIONS.

12. OPTIONAL 18" HIGH SKIRT PER MOUNTAIN REGIONS.

13. BRANCH RACEWAYS - PROVIDE BRANCH CIRCUIT RACEWAY TO ALL LIGHTING FED FROM THIS LCC. SEE PLAN AND FEEDER SCHEDULE FOR SIZE AND QUANTITY.

14. TERMINAL STRIP - 600V RATED, LUGS TO ACCEPT #10 AWG COPPER WITH MARKING STRIP, END CAPS AND MOUNTING HARDWARE. PROVIDE THE NUMBER OF TERMINAL POINTS AS REQUIRED, MINIMUM OF 36 POINTS.

15. ONLY REQUIRED FOR LOADS NOT CONTROLLED BY LOCAL NODES.

**TYPICAL CABINET TYPE LIGHTING CONTROL CENTER DETAIL**

**STANDARD PLAN NO.**

**ROADWAY LIGHTING**

**S-613-1**

**Sheet No. 5 of 8**

**Issued By:** Traffic & Safety Engineering Branch July 31, 2019
CABINET COMPONENT LIST

A. FULLY HINGED METER/TEST SECTION LOCKABLE COVER WITH HOLD-OPEN ARM TO KEEP COVER FROM BLOWING SHUT PER UTILITY SPECIFICATION. COMBINATION ALL-IN-ONE COMMERCIAL METER POWER PEDESTAL IN A NEMA 3R STAINLESS STEEL ENCLOSURE.

B. UTILITY METER INSIDE NEMA 3R ENCLOSURE METER SHALL HAVE LEVER BYPASS AND INTERNAL LOCKING TAB ON METER COVER PER LOCAL UTILITY COMPANY SPECIFICATIONS.

C. SEI MAINTENANCE RECEPTACLE FLUSH MOUNTED IN PANEL DEAD FRONT INSIDE OF THE NEMA 3R ENCLOSURE.

D. HAND-OFF-AUTO SWITCH - LSA-2P, HOA SWITCH WITH LEGEND FLUSH MOUNTED IN PANEL DEAD FRONT INSIDE OF THE NEMA 3R ENCLOSURE.

E. UTILITY TERMINATION LANDING LUGS.

F. LOAD CENTERS WITH SERVICE MAIN AND BRANCH BREAKERS. ENGINEER SHALL PROVIDE PANEL SCHEDULE FOR BREAKERS REQUIRED.

G. PROVIDE NEUTRAL TO GROUND BONDING JUMPER.

H. LIFT OFF SERVICE COVER WITH PAD LOCK HASP.

I. CABINET GROUND BOND #8 BARE COPPER CONDUCTOR.

J. NEMA 3R 120V PHOTOELECTRIC CONTROL WITH 3-PRONG TWIST-Lock RECEPTACLE BASE WIRED THROUGH THE H.O.A. SWITCH. THE PHOTOELECTRIC CONTROL SHALL BE MOUNTED ON THE NORTH SIDE ON ENCLOSURE TO MINIMIZE THE SUN'S INTERFERENCE.

K. REINFORCED CONCRETE (CLASS B) FOUNDATION PER STRUCTURAL ENGINEER LICENSED IN THE STATE OF COLORADO 2" (MIN) ABOVE GRADE, 3/4" CHAMFER ALL EXPOSED EDGES, 3" (MIN), 6" MAX OVERLAP ON ALL SIDES.

L. 3/4" X 10'-0" LG COPPER CLAD DRIVEN GROUND ROD. EXOTHERMIC WELD DR UNDERGROUND LUG CONNECT CONDUCTOR TO GROUND ROD. (2) REQUIRED - 8'-0" APART (MIN).

M. T-HANDLE, PULL-DOWN FUSE HOLDER WITH FRN-R FUSES, METER DISCONNECT FOR METER PROTECTION PER UTILITY SPECIFICATION, COLD SEQUENCE METER AND WEATHERPROOF COVER WITH TAB LOCKABLE. THIS ITEM MAY BE OMITTED BY LOCAL UTILITY COMPANY SPECIFICATIONS HST SEQUENCE REQUIREMENTS.

TYPICAL CABINET REQUIREMENTS:

1. LOAD CENTER ENGINEER SHALL PROVIDE SCHEDULE FOR # OF CIRCUITS FOR "ALWAYS ON" LOADS THAT INCLUDE:

   SERVICE ENTRANCE M.O.B. ENGINEER TO PROVIDE SIZE ON THE PANEL SCHEDULE.
   CONTROL POWER CIRCUIT BREAKER - ENGINEER TO PROVIDE SIZE ON THE PANEL SCHEDULE.
   SWITCHES LOAD CENTER MAIN BREAKER - ENGINEER TO PROVIDE ON THE PANEL SCHEDULE.
   BRANCH BREAKERS AS SHOWN - ENGINEER TO PROVIDE SIZE AND QUANTITY ON THE PANEL SCHEDULE.
   CIRCUIT DIRECTORY TO DOCUMENT CONFIGURATION IN POCKET ON HINGED DOOR. MAINTENANCE RECEPTACLE FLUSH MOUNTED IN DEAD FRONT INSIDE ENCLOSURE.

2. CONTROL CIRCUIT INCLUDING:

   ONLY APPLIES TO PEDESTRIAN LIGHTS OR OTHER LIGHTS THAT DO NOT HAVE INDIVIDUAL ANSI 7-PIN RECEPTACLES.

   PHOTOCELL RECEPTACLES MOUNTED EXTERNALLY ON NEMA 3R ENCLOSURE.
   ONE HAND-OFF-AUTO SWING SWITCH FLUSH MOUNTED IN DEAD FRONT.
   ONE LIGHTING CONTROLLER ON ONE LOAD CENTER IN THIS SECTION.
   ONE 12-CIRCUIT LOAD CENTER PHOTOCELL ON/Off CONTROLLED.
   A CIRCUIT DIRECTORY TO DOCUMENT CONFIGURATION IN POCKET ON HINGED DOOR.

NOTE: ALL COMPONENTS LISTED SHALL BE INCLUDED IN THE LIGHTING CONTROL CENTER PAY ITEM. ALL ELECTRICAL COMPONENTS SHALL BE UL LISTED PER THE APPROPRIATE UL REQUIREMENTS. INCLUDING BUT NOT LIMITED TO 508A INDUSTRIAL CONTROL PANELS.
FLUSH TO GRADE
SCHEDULE 80 PVC
GROUND WELL
ACCESS BOX
12"
20"
50"
13"
24" CONCRETE POLYMER
PEDESTAL EXPOSED 4" ABOVE
GRADE WITH 12" OF CRUSHED
ROCK INSIDE, SITTING ON 6" OF CRUSHED ROCK.
FLUSH TO GRADE
SCHEDULE 80 PVC GROUND
WELL ACCESS BOX
BRANCH FEEDER(S) TO
CCTV CAMERA(S), LIGHTING
LOADS, ETC. SEE PLANS
FOR QUANTITY.
INCOMING
FEEDER FROM
TRANSFORMER
8'-0" APART MIN)
LIGHTING CONTROL CENTER (PEDESTAL ONLY) DETAIL

COMPONENT LIST
A) STAINLESS STEEL, 100A, 120/240V, NEMA 3R COMBINATION, SERVICE ENTRANCE RATED, COLD SEQUENCE, METER/POWER
PEDESTAL, W/LEVER BYPASS, LOAD CENTER, MCB AND FUSED TEE-HANDLE PULL OUT DISCONNECT AHEAD OF METER TO LOCAL
UTILITY SPECIFICATIONS. SEE PANEL SCHEDULE FOR SIZE OF MAIN AND NUMBER AND SIZE OF BRANCH BREAKERS REQUIRED.
SET ENCLOSURE ON CONCRETE PAD PLUMB AND LEVEL.
B) TEE-HANDLE PULL-OUT FUSE TYPE DISCONNECT FLUSH MOUNTED IN THE BACK SIDE OF THE ENCLOSURE WITH TAB FOR
SEAL. THIS ITEM MAY BE OMITTED BY UTILITY COMPANY SPECIFICATIONS HOT SEQUENCE REQUIREMENTS.
C) SERVICE ENTRANCE PANEL BREAKER SECTION, FOR CUSTOMER LOADS. SEE PANEL SCHEDULES FOR SIZE OF BREAKERS AND
NUMBER OF POLES REQUIRED.
D) OPTIONAL BUILT-IN GFCI NEMA 5-20R, DUPLEX, GFCI MAINTENANCE RECEPTACLE FLUSH MOUNTED IN PANEL DEAD-FRONT.
E) PROVIDE RECESSED CONCRETE PAD MOUNTING PLATE WITH L-BOLTS TO MATCH THE ENCLOSURE BASE BOLT PATTERN.
F) OPTION 1: POLYMER CONCRETE PEDESTAL FOUNDATION WITH FIBERGLASS REINFORCEMENT. THE PAD SHALL BE CONTINUOUS
CLOTH REINFORCEMENT ON THE INSIDE AND OUTSIDE PERIMETER. WEIGHT OF THE FOUNDATIONS SHALL BE STENCILLED ON THE
SIDEWALL OF THE FOUNDATION.
OPTION 2: PROVIDE 4500 PSI, RE-BAR RE-ENFORCE, CONCRETE WITH A DIRECT EARTH BURY DEPTH OF 18" (MINIMUM), 2"
OVERLAP OF THE ENCLOSURE IN ALL SIDES FRONT AND BACK AND 2" EXPOSURE ABOVE GRADE. PROVIDE 7° CHAMFERED
EDGES. PROVIDE STRUCTURAL ENGINEERED STAMPED DRAWING FOR PAD.
G) 3/4"x10'-0" LG COPPER-CLAD DRIVEN GROUND RODS, EXOTHERMIC WELD OR UNDERGROUND LUG CONNECT CONDUCTOR TO
GROUND ROD TO BE LOCATED IN SCHEDULE 80 PVC GROUND WELL ACCESS WITH BOLT DOWN COVER AND "GROUND" CAST INTO LID.
NOTE: ALL COMPONENTS LISTED SHALL BE INCLUDED IN THE LIGHTING CONTROL CENTER PAY ITEM. ALL ELECTRICAL
COMPONENTS SHALL BE UL LISTED PER THE APPROPRIATE UL REQUIREMENTS. INCLUDING BUT NOT LIMITED TO 508A
INDUSTRIAL CONTROL CENTER.
LUMINAIRES USED FOR OPTIONAL TWIN LUMINAIRES ASSEMBLY

- TEMPORARY LIGHTING MAY VARY PER APPLICATION REQUIREMENTS.

- LUMINAIRE TYPE 'B' (OUTBOARD) COBRA HEAD STYLE LED LUMINAIRE INSTALLED
- LEVEL AND PLUMB

- LUMINAIRE RE TYPE 'B' (OUTBOARD) COBRA HEAD STYLE LED LUMINAIRE INSTALLED

- 2" GRC RISER CONDUIT
- 2" GRC RISER CONDUIT

- 2-HOLE 2" CONDUIT STRAPS 5'-0" ON CENTER (TYP)

- 12" (MIN)
- 30" (MIN)

- LEVEL AND PLUMB

- OVERHEAD ELECTRIC

- DRIP LINE

- TIMBER POLE

- 24'-0" (MIN) OVER ROADWAY TEMPLATE OR 20'-0" (MIN) OUTSIDE ROADWAY TEMPLATE

- 30'-0" (MIN) ABOVE ROADWAY SURFACE

- GENERAL CONDITIONS

- LIGHT STAND AND ARM TIMBER (TEMPORARY)
- NOT TO SCALE

- 4'-0"

- 2" VV£ATHER HEAD TRANSITION TD OVERHEAD LINE

- 2" GRC RISER CONDUIT

- 2-HOLE 2" CONDUIT STRAPS 5'-0" ON CENTER (TYP)

- 12" (MIN)

- 30" (MIN)

- 4'-0"

- 2" VV£ATHER HEAD TRANSITION TD OVERHEAD LINE

- 2" GRC RISER CONDUIT

- 2-HOLE 2" CONDUIT STRAPS 5'-0" ON CENTER (TYP)

- LIGHT STANDARD TIMBER (TEMPORARY)

- LIGHT STAND AND ARM TIMBER (TEMPORARY)

- INSTALLATION NOTES:

1. THE CONTRACTOR SHALL PROVIDE INSTALLATION, MAINTENANCE, AND REMOVAL OF ALL TEMPORARY LIGHTING EQUIPMENT AND LUMINAIRES.

2. TEMPORARY LIGHT STANDARD SHALL BE PROTECTED. PROTECTION SHALL MEET THE RECOMMENDATIONS OF AASHTO ROADWAY DESIGN GUIDE. SPEED LIMIT LESS THEN 40MPH:
   - LOCATED 6'-0" (MIN) FROM THE FRONT FACE OF CURB.
   - MOUNTED ON BARRIER.
   - LOCATED BEHIND BARRIER OR APPROPRIATE IMPACT ATTENUATOR.
   - MOUNTED ON BARRIER.
   - LOCATED BEHIND BARRIER.

3. TEMPORARY LIGHTING DESIGN SHALL PROVIDE LIGHTING LEVELS EQUAL TO OR EXCEEDING THE EXISTING LIGHTING LEVELS AND QUANTITY.

4. EXISTING LUMINAIRES WHICH ARE BEING REMOVED MAY BE USED FOR TEMPORARY LIGHTING.

5. THE TEMPORARY LIGHT POLES AND LUMINAIRES SHALL BE LOCATED ALONG ALL TRAFFIC DETOUR ROUTES WITH THE LUMINAIRES POSITIONED OVER THE EDGE OF THE TRAVEL LANE.

6. OVERHEAD ELECTRICAL CONDUCTORS SUPPLYING POWER TO THE LUMINAIRES SHALL BE LOCATED 24'-0" (MIN) CLEARANCE OVER THE ROADWAY TEMPLATE AND 20'-0" (MIN) OUTSIDE THE ROADWAY TEMPLATE.

7. OVERHEAD ELECTRICAL SHALL NOT BE MOUNTED ON BREAKAWAY POLES.

8. THE POWER FOR TEMPORARY LIGHTING SHALL BE METERED. ALL UTILITY BILLS FOR TEMPORARY LIGHTING SHALL BE PAID FOR BY THE CONTRACTOR.

9. TEMPORARY LIGHTING SYSTEM SHALL BE PAID FOR ON A LUMP SUM BASIS WHICH INCLUDES THE LUMINAIRE, ARM, POLE AND ALL NECESSARY ELECTRICAL FOR A COMPLETE AND OPERATIONAL LIGHTING SYSTEM.

10. LUMINAIRES OPTICS ORIENTED AWAY FROM MAINLINE

11. PROVIDE LUMINAIRE WITH HORIZONTAL SLIP FITTER FOR USE WITH 2" D. O. PIPE TENON.

12. LUMINAIRE OPTICS SHALL BE AIMED TOWARDS TRUCK.

13. TYPICAL CHAIN STATION TWIN HEAD ASSEMBLY

14. LIGHT STAND AND ARM TIMBER (30-FOOT) (SPECIAL) (2 ARM)

15. NOT TO SCALE

16. INSTALLATION NOTES:

1. LIGHT STANDARD SETBACK WILL VARY PER SITE CONDITIONS. TWIN LUMINAIRES ON MAST ARM ARE INTENDED TO BE CENTERED OVER TRUCK PARKING LANE BELOW AND SPACED AS SHOWN ON PLANS. PARKING LANE SHALL BE DETERMINED BY STRIPING OR VERIFIED BY FIELD ENGINEER.

2. LUMINAIRE OPTICS ORIENTED AWAY FROM MAINLINE

3. PROVIDE LUMINAIRE WITH HORIZONTAL SLIP FITTER FOR USE WITH 2" D. O. PIPE TENON.

4. LUMINAIRE OPTICS SHALL BE AIMED TOWARDS TRUCK.
GENERAL NOTES

1. The engineer will establish grades and locations for all sign posts in accordance with details shown on the plans.

2. Special care shall be taken in sign location to ensure an unobstructed view of each sign.

3. Horizontal post placement shall be 3 ft for 2 in. posts and 4 in. x 4 in. timber posts, and 5 ft for 6 in. x 6 in. timbers. See applicable standards for footing heights.

4. If a shoulder is wider than 5 ft, the maximum lateral offset distance shall be 2 ft from the edge of shoulders, except for mile marker signs. See Figure 2B-2B(S) of the 2004 MUTCD.

5. Normal lateral placement is measured from the edge of the travel lane.

6. In urban areas, a lateral clearance of 6 ft from the curb face is permissible where sidewalk width is limited or where existing poles are close to the curb.

7. Typical post mounting heights from ground to bottom of sign panel are 2 ft for 8 in. other heights may be required when signs mounted on stepped full or curb slopes.

8. Educational plaque for minor signs will not be considered when determining vertical placement for information and educational plaques. See page 3 of the 2002 Cost Guide showing policies & procedures, and section 9-3 of the 2004 MUTCD.

9. When lateral placement is 30 ft or more for signs without a supplemental plaque, vertical placement may be reduced to 10 ft when lateral placement is 25 ft or more for signs with a supplemental plaque. Vertical placement if does not does not apply - use only vertical placement in urban areas.

10. Normal angular placement is 0 deg. Signs closer than 0 ft should be turned slightly slowly to reduce specular reflection. Signs placed 30 ft or more should generally be turned toward the street.

11. The exit panel is mounted on the right hand side for right hand exits and the left side for left hand exits.

12. Post shall be installed plumb. Vertical deviation shall not exceed +/-3 in. 15 ft.

13. On all two-lane undivided highways, the mile marker and post shall be installed on the right shoulder in the designating direction with the mile marker panels displayed on the front and back side of the post.

14. On all two-lane undivided highways and divided highways, and intersects, the mile marker and post shall be installed on the outside shoulder or sidewalk if applicable in both directions of travel.

15. Vertical spacing between sign panels shall be 110 ft. Typical.

PLACEMENT TABLES

<table>
<thead>
<tr>
<th>LATERAL PLACEMENT</th>
<th>VERTICAL PLACEMENT</th>
</tr>
</thead>
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<td>KEY</td>
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<td>C</td>
<td>2°</td>
</tr>
<tr>
<td>D</td>
<td>2°</td>
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WARNING SIGN PLACEMENT

REGULATORY, RECREATIONAL, AND CULTURAL INFORMATION SIGN PLACEMENT

ACUTE ANGLE INTERSECTION

CHANNELIZED INTERSECTION

DIVISIONAL ISLAND

WIDE THROAT INTERSECTION

MINER CROSSROAD

URBAN INTERSECTION

TYPICAL LOCATIONS-STOP SIGNS AND YIELD SIGNS
NOTE: MILE MARKERS SHALL BE LOCATED IN LINE WITH DELINERATOR POSTS.


Angular Placement

Special for small parking or stopping restriction signs with horizontal arrow

15° to 30°

10° to 15°

5° max.

See Note 10.
1. Timber sign posts may only be used for temporary signage during construction. Tubular steel shall be used for permanent installations.

2. Class I sign panels are all those that do not require backing Zees. Class I panels shall generally be 0.060" minimum thickness. Single sheet aluminum, but cold-rolled thickness may be used for sign panels where both the horizontal and vertical dimensions are less than 36 in.


4. A washer shall be placed between the bolt head and the face of the sign panel. A 1/4" dia. washer shall be placed under the nut on the back of the timber post.

5. Bolts, nuts and washers shall be galvanized or cadmium plated.

6. All signs shall be fabricated using retroreflective sheeting conforming to ASTM D4956. The type shall be as described in the cost standards specifications for road and bridge construction section 630.02 and as shown on the plans.

7. For sign placement see standard plan S-614-1.

8. U-2 posts may only be used for delineators, mile markers and structure number placards. "U" shape steel posts shall be a uniform flanged channel. Section made from hot rolled structural steel, hot-rolled or steel, or new rolled steel having a minimum yield strength of at least 30,000 psi, and a minimum tensile strength of at least 30,000 psi. U shape posts shall weigh 2 lb./ft. except that a mill tolerance of minus 3% of the weight of any one post will be allowed. "U" shape posts shall have 1/4" holes drilled or punched on 1/8" or 2" centers for the top 4 feet of the post as a maximum with the first hole 1 foot from the top of the post. Color of posts shall be Interstate Green.

9. Vertical spacing between panels on the same post shall be 1 in. to 1 in.
ONE POST - TWO ZEES

DATA C-TIMBER POSTS

CLASS II PANEL MOUNTING

SIZE

6" X 6"

DIAMOND, 36" SIDES

48" SIDES

60" SIDES

14 1/2"

21"

29" 1/2

25 1/2"

30" 1/2

1/4"

1/4"

1/4"

4" x 4" POST

1 1/2" DRILL FOR 1/4" BOLT

6" X 6"

1 1/2" DRILL AT 6" CENTERS

FDR ADDITIONAL CLASS II SIZES THAT UTILIZE STEEL POSTS, SEE STANDARD PLAN S-614-8.

SUPPLEMENTAL PANELS

RECTANGLE, 24" x 18" 18" 9" 12" 6" 4 x 4" or 6 x 6"

18" 9" 12" 6" 4 x 4" or 6 x 6"

BACKING ZEES

TYPICAL BACKING ZEES

1. TIMBER SIGN POSTS MAY ONLY BE USED FORTEMPORARY SIGNAGE DURING CONSTRUCTION. TUBULAR STEEL SIGN POSTS SHALL BE USED FOR PERMANENT INSTALLATIONS.

2. CLASS II SIGN PANELS ARE THOSE THAT REQUIRE AT LEAST ONE, BUT NO MORE THAN TWO BACKING ZEES (THESE WILL BE SIGN PANELS THAT ARE LESS THAN 72 INCHES IN HEIGHT), UNLESS THEY ARE ATTACHED TO A CLASS II ASSEMBLY. ALL CLASS II PANELS SHALL BE BACKED BY CONSTRUCTION PANELS.

3. 2-BAR LENGTH SHALL BE 3 INCHES (- 1/2 INCH) SHORT OF THE EDGE OF THE SIGN ON BOTH SIDES.

4. FOR TUBULAR STEEL POST INFORMATION SEE STANDARD PLAN S-614-08.

GENRAL NOTES

1. TIMBER SIGN POSTS MAY ONLY BE USED FOR TEMPORARY SIGNAGE DURING CONSTRUCTION. TUBULAR STEEL SIGN POSTS SHALL BE USED FOR PERMANENT INSTALLATIONS.

2. CLASS II SIGN PANELS ARE THOSE THAT REQUIRE AT LEAST ONE, BUT NO MORE THAN TWO BACKING ZEES (THESE WILL BE SIGN PANELS THAT ARE LESS THAN 72 INCHES IN HEIGHT), UNLESS THEY ARE ATTACHED TO A CLASS II ASSEMBLY. ALL CLASS II PANELS SHALL BE BACKED BY CONSTRUCTION PANELS.

3. 2-BAR LENGTH SHALL BE 3 INCHES (- 1/2 INCH) SHORT OF THE EDGE OF THE SIGN ON BOTH SIDES.

4. FOR TUBULAR STEEL POST INFORMATION SEE STANDARD PLAN S-614-08.

5. BACKING ZEES ARE 3 INCHES x 2 1/2 INCH x 3.33, 6061-T6 ALUMINUM WEIGHING 3.33 POUNDS PER FOOT.


7. ALL SIGNS SHALL BE FABRICATED USING RETRO-REFLECTIVE SHEETING CONFORMING TO ASTM D4956. THE TYPE SHALL BE AS DIRECTED IN THE STANDARD SPECIFICATIONS, SECTION 713 AND/OR AS SHOWN ON THE PLANS.

8. BOLTS, NUTS, AND METAL WASHERS SHALL BE GALVANIZED OR CADMIUM PLATED.

9. VERTICAL SPACING BETWEEN PANELS SHALL BE 1 INCH TO 1 1/2 INCHES.

10. WASHERS ON TIMBER POSTS SHALL BE 1 1/2 INCHES DIAMETER.
GENERAL NOTES

1. Timber sign posts may only be used for temporary signage during construction. Tubular steel shall be used for permanent installation.

2. Class III sign panels are all those where a single panel requires 3 or more backing zees (these will be sign panels that are 72 in or more in height) and any panels that are part of a Class III assembly, such as exit panels. All Class III panels shall be 0.125 in minimum thickness sheet aluminum.

3. See the applicable standards for sign placement, footing details and post spacing tables.

4. A flange in 60° countersunk head bolt and collar shall be used to fasten the sign panel to the backing zee. A 1/4 in. head bolt with nut and washers shall be used to fasten the backing zee to a timber post or to a steel post.

5. A flat washer shall be placed between the bolt head and the post plate. A lock washer shall be placed under the nut on a steel post of a backing zee. A 1/4 in. countersunk head bolt shall be placed under the bolt head on a timber post.

6. All exposed sign panel section joints, except the multi-vertical sections, shall be covered with the use of the standard section closure strips. Closure strips shall be riveted or taped, see fabrication notes.

7. Sections illustrated based on utilizing 32 ft x 8 ft stock. 4 ft wide stock may be used with appropriate adjustment in number of sections.

8. All sign shall be fabricated using retroreflective sheeting, containing at least one type I shall be as described in the standard specifications and as shown on the plans.

9. For the design of posts and footings, see Class III sign post and footing calculation spreadsheet on CD website.

EXIT PANEL NOTES

1. The exit panel shall be mounted with two supports. Right hand exits require the top of the exit panel to be mounted even with the right edge of the parent panel. Left hand exits require the left edge of the exit panel to be mounted even with the left edge of the parent panel.

2. The supports shall be square steel tubing with a minimum width of 2 1/2 in. with 1/4" holes punched or drilled on 1 in. centers along the length of each side, while maintaining a minimum section modulus of Class III design. The steel must have a minimum yield stress of 33 ksi. Alternately, 3/8" bar may be used for support members with 1/4" holes punched where needed.

3. The supports shall be fastened to the backing zee using 1/4 in. bolts.

4. The exit panel support may be moved 6 in. if it conflicts with the parent sign support.

5. Exit panel mounting will be paid for as part of the Class III sign panel.

6. Exit panel supports shall be attached to a minimum of three backing zees.

TYPICAL EXIT PANEL INSTALLATION FOR GROUND SIGNS

SUPPORT SPACING TABLE

<table>
<thead>
<tr>
<th>Exten Width</th>
<th>Overhang</th>
<th>Spacing</th>
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<tbody>
<tr>
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</tr>
<tr>
<td>12&quot;</td>
<td>2 1/2&quot;</td>
<td>7&quot;</td>
</tr>
</tbody>
</table>

TYPICAL EXITS PANEL INSTALLATION
TYPICAL DETAIL

SEAM CLOSURE ZEE
(MULTIPLE-VERTICAL SECTIONS, HORIZONTAL SEAMS)

1. In no case shall any portion of a sign panel or plaque be attached to a breakaway post below the fuse and splice plates.

2. Bottom plaque shall be fabricated with a minimum thickness of 0.125 in. MINIMUM THICKNESS.

3. Adhesives shall be class I or class II adhesives of ASTM C495.

4. Splice and fuse plates shall be fabricated with a minimum thickness of 0.062 in. MINIMUM THICKNESS.

5. Exit number without indentation.

6. Exit number with indentation.

7. Typical detail guide sign.

TYPICAL BOTTOM PLACARD INSTALLATION
(PARTIAL WIDTH PLACARD SUPPORT)

8. Panel fabrication and mounting details.

9. Steel post and panel installation.

10. Timber post and panel installation.

TYPICAL BOTTOM PLACARD INSTALLATION
(FULL WIDTH PLACARD SUPPORT)

11. Panel fabrication and mounting details.

12. Steel post and panel installation.

13. Timber post and panel installation.

TYPICAL BOTTOM PLACARD INSTALLATION
(PARTIAL WIDTH PLACARD SUPPORT)


15. Steel post and panel installation.

16. Timber post and panel installation.

TYPICAL BOTTOM PLACARD INSTALLATION
(FULL WIDTH PLACARD SUPPORT)

17. Panel fabrication and mounting details.

18. Steel post and panel installation.

19. Timber post and panel installation.

TYPICAL DETAIL

SEAM CLOSURE ZEE
(MULTIPLE-VERTICAL SECTIONS, HORIZONTAL SEAMS)

20. Panel fabrication and mounting details.

21. Steel post and panel installation.

22. Timber post and panel installation.

FABRICATION NOTES

1. Backing ZEE, see ZEE spacing table on sheet 2, aluminum alloy 6061-T6. Each ZEE to be provided with a 3/16 in. x 2 in. horizontal slot for each post mounting bolt.

2. 1/4-in hex-head bolt with nut and washer. 2 per backing ZEE per post required. Washers on post shall be 1/4-in diameter.

3. 1/4-in (No. 6) 90° countersunk head bolt with collar.

4. 2-in x 0.025-in aluminum closure strip riveted above the top Z and below the bottom Z or aluminum closure strips attached above, between, and below the ZEEs with a very high bond (VHB) double acrylic foam tape or approved equivalent. Manufacturer's recommendations shall be adhered to for this application.

5. Sheet aluminum: 0.125-in minimum thickness.

6. Adhesives shall be class I or class II adhesives of ASTM C495.

7. Backing ZEEs shall extend to the edge of the panel on 6 ft, 7 ft & 8 ft wide signs.

8. Sheeting shall be fabricated with a minimum thickness of 0.125 in. MINIMUM THICKNESS.

9. Adhesives shall be class I or class II adhesives of ASTM C495.

10. Splice and fuse plates shall be fabricated with a minimum thickness of 0.062 in. MINIMUM THICKNESS.

11. Exit number without indentation.

12. Exit number with indentation.


TYPICAL BOTTOM PLACARD INSTALLATION
(PARTIAL WIDTH PLACARD SUPPORT)


15. Steel post and panel installation.

16. Timber post and panel installation.

17. Panel fabrication and mounting details.

18. Steel post and panel installation.

19. Timber post and panel installation.

TYPICAL BOTTOM PLACARD INSTALLATION
(FULL WIDTH PLACARD SUPPORT)

20. Panel fabrication and mounting details.

21. Steel post and panel installation.

22. Timber post and panel installation.

TYPICAL DETAIL

SEAM CLOSURE ZEE
(MULTIPLE-VERTICAL SECTIONS, HORIZONTAL SEAMS)

23. Panel fabrication and mounting details.

24. Steel post and panel installation.

25. Timber post and panel installation.

FABRICATION NOTES

1. Backing ZEE, see ZEE spacing table on sheet 2, aluminum alloy 6061-T6. Each ZEE to be provided with a 3/16 in. x 2 in. horizontal slot for each post mounting bolt.

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9. Adhesives shall be class I or class II adhesives of ASTM C495.

10. Splice and fuse plates shall be fabricated with a minimum thickness of 0.062 in. MINIMUM THICKNESS.

11. Exit number without indentation.

12. Exit number with indentation.


TYPICAL BOTTOM PLACARD INSTALLATION
(PARTIAL WIDTH PLACARD SUPPORT)


15. Steel post and panel installation.

16. Timber post and panel installation.

17. Panel fabrication and mounting details.

18. Steel post and panel installation.

19. Timber post and panel installation.

TYPICAL BOTTOM PLACARD INSTALLATION
(FULL WIDTH PLACARD SUPPORT)

20. Panel fabrication and mounting details.

21. Steel post and panel installation.

22. Timber post and panel installation.

TYPICAL DETAIL

SEAM CLOSURE ZEE
(MULTIPLE-VERTICAL SECTIONS, HORIZONTAL SEAMS)

23. Panel fabrication and mounting details.

24. Steel post and panel installation.

25. Timber post and panel installation.

FABRICATION NOTES

1. Backing ZEE, see ZEE spacing table on sheet 2, aluminum alloy 6061-T6. Each ZEE to be provided with a 3/16 in. x 2 in. horizontal slot for each post mounting bolt.

2. 1/4-in hex-head bolt with nut and washer. 2 per backing ZEE per post required. Washers on post shall be 1/4-in diameter.

3. 1/4-in (No. 6) 90° countersunk head bolt with collar.

4. 2-in x 0.025-in aluminum closure strip riveted above the top Z and below the bottom Z or aluminum closure strips attached above, between, and below the ZEEs with a very high bond (VHB) double acrylic foam tape or approved equivalent. Manufacturer's recommendations shall be adhered to for this application.

5. Sheet aluminum: 0.125-in minimum thickness.

6. Adhesives shall be class I or class II adhesives of ASTM C495.

7. Backing ZEEs shall extend to the edge of the panel on 6 ft, 7 ft & 8 ft wide signs.

8. Sheeting shall be fabricated with a minimum thickness of 0.125 in. MINIMUM THICKNESS.

9. Adhesives shall be class I or class II adhesives of ASTM C495.

10. Splice and fuse plates shall be fabricated with a minimum thickness of 0.062 in. MINIMUM THICKNESS.

11. Exit number without indentation.

12. Exit number with indentation.


TYPICAL BOTTOM PLACARD INSTALLATION
(PARTIAL WIDTH PLACARD SUPPORT)


15. Steel post and panel installation.

16. Timber post and panel installation.

17. Panel fabrication and mounting details.

18. Steel post and panel installation.

19. Timber post and panel installation.

TYPICAL BOTTOM PLACARD INSTALLATION
(FULL WIDTH PLACARD SUPPORT)

20. Panel fabrication and mounting details.

21. Steel post and panel installation.

22. Timber post and panel installation.

TYPICAL DETAIL

SEAM CLOSURE ZEE
(MULTIPLE-VERTICAL SECTIONS, HORIZONTAL SEAMS)

23. Panel fabrication and mounting details.

24. Steel post and panel installation.

25. Timber post and panel installation.
### POST SPACING TABLE

FOR SHEET ALUMINUM SIGN PANELS

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<thead>
<tr>
<th>WIDTH OF SIGN</th>
<th>NO. OF POSTS</th>
<th>OVERHANG &quot;A&quot;</th>
<th>POST SPACING &quot;B&quot;</th>
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### ZEE SPACING TABLE

FOR 3" X 2\frac{1}{2}" X 0.05 ALUMINUM BACKING ZEES

<table>
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<tr>
<th>SIGN PANEL NUMBER</th>
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<th>OVERHANG &quot;A&quot;</th>
<th>SPACING &quot;B&quot;</th>
<th>OVERHANG &quot;C&quot;</th>
<th>SPACING &quot;D&quot;</th>
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<td>0'-0&quot;</td>
</tr>
<tr>
<td>12&quot;</td>
<td>5</td>
<td>0'-0&quot;</td>
<td>0'-0&quot;</td>
<td>0'-0&quot;</td>
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**NOTES:**
- For F, G & H. See details on Sheet 1.
- 6" x 6" x 6" Timber posts will not be used for these sizes of panel.
- Backing Zee shall extend to the edge of the panel, except for exit panels attached by square steel tubing.

---

**Typical Post Spacing**

1 POST

![Diagram of 1 Post](image1)

2 POST

![Diagram of 2 Post](image2)

3 POST

![Diagram of 3 Post](image3)

**CLASS III SIGNS**

**STANDARD PLAN NO.**

S-614-4

**Standard Sheet No.** 3 of 3

---

**Computer File Information**

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<tr>
<td>Colorado Department of Transportation</td>
<td>2829 W. Howard Pl.</td>
</tr>
<tr>
<td>Phone: 303-757-9436</td>
<td>FAX: 303-757-9219</td>
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**CLASS III SIGNS**

**STANDARD PLAN NO.**

S-614-4

**Standard Sheet No.** 3 of 3

**Issued By:** Traffic & Safety Engineering Branch July 31, 2019

**Project Sheet Number:**
DESIGN FORMS WITH AASHTO SPECIFICATIONS FOR THE DESIGN AND CONSTRUCTION OF STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS.

1. DESIGN CONFORMS WITH AASHTO SPECIFICATIONS FOR THE DESIGN AND CONSTRUCTION OF STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS.

2. ALL STRUCTURAL STEEL SHALL CONFORM TO AASHTO M270 (A36 AT04) GRADE 36 AND SECTIONS 508 AND 611 OF THE STANDARD SPECIFICATIONS.

3. STEEL FUSE PLATES AND SPlice PLATES shall conform to AASHTO M270 (A36 AT04) GRADE 36.

4. ALL STRUCTURAL STEEL INCLUDING FUSE AND SPlice PLATES shall be GALVANIZED in ACCORDANCE WITH AASHTO M233 AFTER FABRICATION. STEEL POSTS shall be STAMPED WITH THEIR SIZE.

5. ALL HIGH STRENGTH BOLTS, NUTS AND WASHERS shall CONFORM TO ASTM A490. WASHERS USED IN FUSE PLATE AND SPICE PLATE ASSEMBLIES shall be STAMPED WITH THEIR SIZE.

6. ALL BOLTS, NUTS, AND WASHERS shall be GALVANIZED AS PER ASTM A490 OR ASTM A491.

7. ALL HOLES IN FUSE PLATE AND POST FLANGES ON WHICH POSTS shall BE DRILLED. ALL OTHERS MAY BE DRILLED BY SUB-PUNCHES AND REMOVED.

8. ALL STEEL CUTS shall PREFERABLY BE SAW CUTS; HOWEVER, FLAME CUTTING shall BE PERMITTED PROVIDED ALL EDGES ARE GROUND. REMOVE ALL BURRS. METAL shall NOT PROJECT BEYOND THE PLANE OF THE PLATE FACE.

9. A "KEEPER PLATE" OF 32-GAUGE GALVANIZED SHEET METAL—FABRICATED TO MATCH BREAKAWAY PLATE COMBINATIONS shall BE USED TO HOLD RATHER THAN BOLTS. METAL shall NOT PROJECT BEYOND THE PLANE OF THE PLATE FACE.

10. HIGH STRENGTH BOLTS IN THE BREAKAWAY ASSEMBLY shall BE TIGHTENED ONLY TO THE TORQUE SHOWN IN THE TABLE.

11. ALL TIMBER POSTS shall BE IN ACCORDANCE WITH SECTION 614 OF THE STANDARD SPECIFICATIONS AS TO SIZE, ALTERNATE SIZE, SPICE, ALTERNATE SPICE, AND BREAKAWAY.


13. FOR ADDITIONAL INFORMATION, REFER TO STABILIZATION OF SIGN AND CROSS SECTIONS FOR CLASS III SIGNS INCLUDED IN THE PLAN.

14. TIMBER POSTS shall BE FLUSH WITH TOP OF SIGN PANEL FOR DIRECT MOUNT AND 3-3/8" MINIMUM ABOVE BOLT FOR SPOUT MOUNT.

15. TIMBER SIGN POST MAY ONLY BE USED FOR TEMPORARY SIGNAGE DURING CONSTRUCTION. TIMBER STEEL shall BE USED FOR PERMANENT INSTALLATIONS.

16. IN NO CASE SHALL A BACKING ZEE BE PLACED BELOW THE FUSE PLATES.

17. SIGN POST PAINT LENGTH IS FROM THE UPPER BREAKAWAY PLATE TO THE TOP OF THE "COLUMNS" ANY EXPOSED STEEL POSTS AND THE LOWER BREAKAWAY PLATE are PAINTED AS PART OF THE FOOTING. THE UPPER BREAKAWAY PLATE AND ALL NUTS, BOLTS, WASHERS AND SPICEPLATE FOR FASTENING THE BREAKAWAY PLATES are PAINTED AS PART OF THE POST.

GENERAL NOTES

SECTION A-A

BOLTING PROCEDURE FOR BREAKAWAY PLATE ASSEMBLY

1. ASSEMBLE THE POST TO THE STUB WITH BOLTS WITH ONE FLAT WASHER ON THE TOP OF THE UPPER BREAKAWAY PLATE AND ONE BELOW THE LOWER BREAKAWAY PLATE, AND ONE FLAT WASHER AND A KEEPER PLATE BETWEEN THE BREAKAWAY PLATES.

2. TIGHTEN ALL BOLTS TO A "SNUG TIGHT" CONDITION WITH A 1/2" TO 1" IN WRENCH TO REDUCE THICKNESS OF EACH BOLT IN TURN AND RETIGHTENED IN A SYSTEMATIC ORDER TO THE PRESCRIBED TORQUE (SEE BREAKAWAY PLATE DATA TABLE).

3. BURN THREADS AT JUNCTION WITH NUT TO PREVENT NUT LOOSENING.

BREAKAWAY PLATE ASSEMBLY

TYPICAL ELEVATION STEEL POST ASSEMBLY

TYPICAL PROJECTED VIEW STEEL POST ASSEMBLY

BREAKAWAY PLATE DATA TABLE

<table>
<thead>
<tr>
<th>DIMENSION</th>
<th>BOLT SIZE AND TORQUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>POST SIZE</td>
<td>A</td>
</tr>
<tr>
<td>M 12 X 26</td>
<td>3/4 &quot; X 1/2 &quot;</td>
</tr>
<tr>
<td>M 10 X 26</td>
<td>3/4 &quot; X 1/2 &quot;</td>
</tr>
<tr>
<td>M 10 X 22</td>
<td>3/4 &quot; X 1/2 &quot;</td>
</tr>
<tr>
<td>M 8 X 22</td>
<td>3/4 &quot; X 1/2 &quot;</td>
</tr>
<tr>
<td>M 8 X 18</td>
<td>3/4 &quot; X 1/2 &quot;</td>
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<tr>
<td>M 6 X 15</td>
<td>3/4 &quot; X 1/2 &quot;</td>
</tr>
<tr>
<td>M 6 X 12</td>
<td>3/4 &quot; X 1/2 &quot;</td>
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BREAKAWAY SIGN SUPPORT INSTALLATIONS

TYPICAL BREAKAWAY SIGN SUPPORT INSTALLATIONS

TYPICAL BREAKAWAY SIGN SUPPORT INSTALLATIONS

TYPICAL BREAKAWAY SIGN SUPPORT INSTALLATIONS

BREAKAWAY SIGN SUPPORT DETAILS FOR CLASS III SIGNS

STANDARD PLAN NO.

S-614-5

Standard Sheet No. 1 of 2

BREAKAWAY SIGN SUPPORT DETAILS FOR CLASS III SIGNS

ISSUED: Traffic & Safety Engineering Branch July 31, 2019

PROJECT SHEET NUMBER: 10000
**CONCRETE FOOTING ASSEMBLY**

**SECTION A-A**

**CONCRETE FOOTING TABLE**

<table>
<thead>
<tr>
<th>Size</th>
<th>Maximum Allowable Moment</th>
<th>Post To Base Plate Size</th>
<th>Anchor Bolts</th>
<th>Bolt Plates</th>
<th>Stirrups</th>
<th>Type</th>
<th>Rebar</th>
</tr>
</thead>
<tbody>
<tr>
<td>W 12OD</td>
<td>44.5 KIP FT.</td>
<td>20&quot;</td>
<td>14&quot;</td>
<td>18&quot;</td>
<td>+6-1/2@24&quot;</td>
<td>2-0@6</td>
<td>4&quot;</td>
</tr>
<tr>
<td>W 10OD</td>
<td>32.3 KIP FT.</td>
<td>16&quot;</td>
<td>14&quot;</td>
<td>18&quot;</td>
<td>+6-1/2@24&quot;</td>
<td>2-0@6</td>
<td>4&quot;</td>
</tr>
<tr>
<td>W 8OD</td>
<td>24.4 KIP FT.</td>
<td>14&quot;</td>
<td>14&quot;</td>
<td>18&quot;</td>
<td>+6-1/2@24&quot;</td>
<td>2-0@6</td>
<td>4&quot;</td>
</tr>
<tr>
<td>W 8OD</td>
<td>20.4 KIP FT.</td>
<td>12&quot;</td>
<td>14&quot;</td>
<td>18&quot;</td>
<td>+6-1/2@24&quot;</td>
<td>2-0@6</td>
<td>4&quot;</td>
</tr>
<tr>
<td>W 8OD</td>
<td>13.8 KIP FT.</td>
<td>10&quot;</td>
<td>14&quot;</td>
<td>18&quot;</td>
<td>+6-1/2@24&quot;</td>
<td>2-0@6</td>
<td>4&quot;</td>
</tr>
<tr>
<td>W 8OD</td>
<td>12.3 KIP FT.</td>
<td>8&quot;</td>
<td>14&quot;</td>
<td>18&quot;</td>
<td>+6-1/2@24&quot;</td>
<td>2-0@6</td>
<td>4&quot;</td>
</tr>
</tbody>
</table>

**CONCRETE FOOTINGS AND SIGN ISLANDS FOR CLASS III SIGNS**

*For multi-directional breakaway only Type 1 thru Type 6 footings require a 4 in increase in diameter (D) to accommodate anchors shown on the details included in the plans. All horizontal reinforcing hoop diameter will be increased to maintain a 2 in clearance from the footing sides. Vertical bars and other structural data remain the same. Type 7 footings require no changes.*

**Recruitment:**

- Anchor bolts shall be set in drilled or excavated holes. Depth shall be 3 ft for 4x4 posts and 1.5 ft for 6x6 posts unless otherwise noted on the tabulation of signs in the plans. Posts shall be placed plum and backfilled with excavated material, and thoroughly tamp the plumb into place.

**Exclusion Procedure:**

- Drill to O.D. of footing neat line and to depth shown in accordance with the standards specification for drilled caissons.
- Footings shall be cast in place against undisturbed material.

---

**TYPICAL FOOTING INSTALLATION**

---

**STANDARD PLAN NO.**

S-614-6

**Issued By:** Traffic & Safety Engineering Branch July 31, 2019

**Project Sheet Number:**
**GENERAL NOTES**

1. ALL CONCRETE IS TO BE CLASS "F" AIR ENTRAINMENT.
   GREATLY CONFORM TO "GREAT MORTAR".

2. USE 3/16" NUTS AND BOLTS 1/2" STAINLESS STEEL FOR BASE PLATES AND BOLTS.
   USE ASTM-515 B STAINLESS STEEL FOR ANCHOR BOLTS.

3. USE 3/16" NUTS FOR REINFORCING STEEL VERTICAL, BARS, HORIZONTAL, FRAMES, AND ANCHOR BOLT STIRRUPS.

4. FOR ALL STEEL WORK ABOVE THE BASE PLATE, AND FOR ANGULAR PLACEMENT OF SIGNS, SEE APPLICABLE STANDARDS INCLUDED IN THE PLAN.

5. FOR ADDITIONAL INFORMATION, REFER TO "TABULATION OF SIGNS" AND "CROSS SECTIONS FOR CLASS III SIGNS" INCLUDED IN THE PLAN.

6. FOR ADDITIONAL INFORMATION, REFER TO "TABULATION OF SIGNS" AND "CROSS SECTIONS FOR CLASS III SIGNS" INCLUDED IN THE PLAN.

7. FOR ADDITIONAL INFORMATION, REFER TO "TABULATION OF SIGNS" AND "CROSS SECTIONS FOR CLASS III SIGNS" INCLUDED IN THE PLAN.

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**CONCRETE FOOTINGS AND SIGN ISLANDS FOR CLASS III SIGNS**

**STANDARD PLAN NO. S-614-6**

**Sheet Revisions**

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Last Modification Date: 09/16/2013
Last Modified By: Creighton

**Issued By:** Traffic & Safety Engineering

**Project Sheet Number:**

**Traffic & Safety Engineering Branch July 31, 2019**
TUBULAR STEEL POSTS
(SOCKET SYSTEM) (FOR USE WITH ALL P-POST INSTALLATIONS)

(SIGNPOST SELECTION GUIDE (90 MPH WIND LOAD DESIGN)
(SEE SHEET 2 FOR P1 AND P2 POST INSTALLATIONS)

SIGNWIDTH 1° & " HO L E
(TO REMAIN ABOVE MOUNTING HEIGHT)
7' MOUNTING HEIGHT 8' MOUNTING HEIGHT

SIGN WIDTH (FT)
4 5 6 7 8 9

POST NOTES
THE POST MAY BE PRE-PUNCHED WITH 1" DIA HOLES AND THE SIGN MOUNTED DIRECTLY TO THE POST. ON AN APPROVED MOUNTING CLAMP MAY BE USED TO MOUNT THE SIGN TO THE POST. IF THE POST IS PRE-PUNCHED, THE HOLES SHALL BE SPACED THE FOLLOWING DISTANCES FROM THE TOP:
1", 2", 3", 4", 5", 6", 7", 8", 9" DIA HOLES (0.3" OR 0.595" WALL THICKNESS)

POST SPECIFICATIONS

COATING MAX ALLOW MAN T

STANDARD PLAN NO.
S-614-8

TUBULAR STEEL SIGN SUPPORT DETAILS

2829 W. Howard Pl.
Denver, CO 80204
Phone: 303-757-0436
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Traffic & Safety Engineering
MKB

Computer File Information

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CAD Ver.: MicroStation 9.0; Scales Not to Scale; Units: English

Traffic
Safety Engineering MKB

Issued By: Traffic & Safety Engineering Branch July 30, 2019
Project Sheet Number:
TUBULAR STEEL POST (WITH SLIPBASE)
(SEE SHEET 1 FOR P-POST INSTALLATIONS)

DIMENSIONS FOR MOUNTING CLAMP (ALL DIMENSIONS ARE IN INCHES)

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
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<td>2</td>
<td>3/8</td>
<td>3/4</td>
<td>1</td>
<td>11/4</td>
<td>1</td>
<td>11/4</td>
<td>1</td>
<td>11/4</td>
<td>1</td>
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</table>

- T AND U BRACKET ATTACHMENT
  - 1/2 x 36" x 1/4" H.D. BOLT
  - ASTM A325 OR A490
  - HD. BOLT TO BE MADE IN ACCORDANCE WITH STANDARD MANUFACTURING
  - PROCEDURE, 1/4" OR 5/16" DIAMETER STOCK IS PERMISSIBLE. AMERICAN
  - STANDARD REGULAR SEMI-FINISHED HEX NUTS AND SPRING LOCK WASHERS.
  - TYPICAL SINGLE BRACKET
    - 11/4" LONG, WITH FULL THREADS, A MEDIUM SECTION BOLT HEAD, AND GALVANIZED
    - STEEL OR ALUMINUM SELF-LOCKING HEX HEAD NUT. THE BOLT HEAD MUST NOT TURN IN
    - THE SLOTTED HEAD OF THE BOLT.
  - TYPICAL BACK TO BACK
    - 1/2" LONG, WITH FULL THREADS, A MEDIUM SECTION BOLT HEAD, AND GALVANIZED
    - STEEL OR ALUMINUM SELF-LOCKING HEX HEAD NUT. THE BOLT HEAD MUST NOT TURN IN
    - THE SLOTTED HEAD OF THE BOLT.

PIPE CLAMP CASTING
- PIPE CLAMP CASTING SHALL BE ASTM A-353 OR B108 ALUMINUM OR 356.0-F.
- ALL SIGN MOUNTING CLAMP PARTS NOT MADE FROM ALUMINUM SHALL BE GALVANIZED STEEL OR STAINLESS STEEL.

TUBULAR STEEL SIGN SUPPORT DETAILS

- TUBULAR STEEL SIGN SUPPORT DETAILS
- STANDARD PLAN NO. S-614-8
- Standard Sheet No. 2 of 7
- Issued By: Traffic & Safety Engineering Branch July 31, 2019
- Project Sheet Number: MKB
SURFACE MOUNT SLIPBASE FOR NEW INSTALLATIONS

SLIPBASE CASTING REQUIREMENTS

FOR 2-7/8 INCH POSTS (PI OR P2 POSTS)
GALVANIZED STEEL SLIPBASE CASTING ASTM A-536

MOUNTING HARDWARE
3 - EACH 3/4 x 2 1/4 INCH LONG HEX BOLT
3 - EACH 3/4 x 1 1/4 INCH LONG ZINC-PLATED, GRADE 5 SIZE #4 HEX BOLT
1 - EACH 3/4 x 1 1/4 INCH LONG ZINC-PLATED, GRADE 5 SIZE #4 HEX BOLT
1 - EACH 3/8 GAUGE STEEL BOLT RETAINING PLATE ASTM A-563, G-90 COATING

INSTALLATION REQUIREMENTS
ALL HEX BOLTS SHALL BE COATED WITH ANTI-SEIZE PRIOR TO INSTALLATION
ALL HARDWARE WILL BE GALVANIZED OR ZINC PLATED.

TUBULAR STEEL SIGN SUPPORT SLIPBASE NOTES

1. REFER TO SIGNING PLANS FOR SIGN LOCATIONS AND HEIGHT
2. MINIMUM ALLOWABLE TENSION CAPACITY FOR WEDGE ANCHORS = 3000 LBS.
3. MAXIMUM ALLOWABLE MOMENT FOR SIGN BASE = 5.13 kip-ft.
4. PAY ITEM "STEEL SIGN SUPPORT (1-INCH ROUND) SLIPBASE" SHALL INCLUDE STUB BASE, CASTING AND NECESSARY HARDWARE (CASTING MOUNTING HARDWARE AS SHOWN ON STANDARD PLAN NO. S-614-8, SHEET 3).
5. PAY ITEM "STEEL SIGN SUPPORT CASTING" SHALL INCLUDE CASTING AND NECESSARY MOUNTING HARDWARE (CASTING MOUNTING HARDWARE AS SHOWN ON STANDARD PLAN NO. S-614-8, SHEET 3).
6. PAY ITEM "STEEL SIGN GROUND STUB BASE" MAY SHALL INCLUDE SLIPBASE STUB BASE.

TUBULAR STEEL SIGN SUPPORT DETAILS

STANDARD PLAN NO. S-614-8
Project Sheet Number: 3 of 7

Colorado Department of Transportation
Traffic & Safety Engineering MKB

Traffic Safety Engineering Branch July 30, 2019

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Last Modification Date: 07/31/19
Last Modified By: AVU

Colorado Department of Transportation
2829 W. Howard Pl.
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Phone: 303-757-9436
Fax: 303-757-9219

Traffic Safety Engineering Branch
July 30, 2019

TYPICAL ASSEMBLY

SLIPBASE CASTING 1
SLIPBASE CASTING 2

TUBULAR STEEL SIGN SUPPORT DETAILS

2 1/2 IN. O.D. TUBULAR STEEL
POST SIZE SHEET 1 FOR
POST SPECIFICATIONS

GALVANIZED STEEL SLIPBASE CASTING ASTM A-536
6" x 6 1/2" ZINC-PLATED, GRADE 5 SIZE #4 HEX BOLT,
COATED WITH ANTI-SEIZE PRIOR TO INSTALLATION

2 1/2 IN. O.D. TUBULAR STEEL
POST SIZE SHEET 1 FOR
POST SPECIFICATIONS

GALVANIZED STEEL SLIPBASE CASTING ASTM A-536
6" x 6 1/2" ZINC-PLATED, GRADE 5 SIZE #4 HEX BOLT,
COATED WITH ANTI-SEIZE PRIOR TO INSTALLATION

(TIGHTEN ALL BOLTS TO MAXIMUM LOADEN EACH BOLT IN
SEQUENCE AND RETIGHTEN IN SYSTEMIC ORDER TO 60 FT-LB)

30 GA STEEL BOLT RETAINING PLATE
ASTM A-563, G-90 COATING

2 1/2" O.D. TUBULAR STEEL
POST (SEE SHEET 1 FOR
POST SPECIFICATIONS)

GALVANIZED STEEL SLIPBASE CASTING ASTM A-536

1 1/2" x 1 1/2" ZINC-PLATED, GRADE 5 SIZE #4 HEX BOLT,
COATED WITH ANTI-SEIZE PRIOR TO INSTALLATION

(TIGHTEN BOLTS IN SEQUENCE TO 40 FT-LB)

3.00" SLIPBASE CASTING REQUIREMENTS

FDR 2-7/8 IN C H POSTS (PI DR P2 POSTS)
GALVANIZE D STEEL SLIPBAS E CASTING ASTM-536

MOUNTING HARDWARE
1 - EACH 3/8 x 3 1/2 INCH LONG ZINC-PLATED, GRADE 5 SIZE #4 HEX BOLT
1 - EACH 3/8 GAUGE STEEL BOLT RETAINING PLATE ASTM A-563, G-90 COATING

INSTALLATION REQUIREMENTS
ALL HEX BOLTS SHALL BE COATED WITH ANTI-SEIZE PRIOR TO INSTALLATION
ALL HARDWARE WILL BE GALVANIZED OR ZINC PLATED.

TUBULAR STEEL SIGN SUPPORT SLIPBASE NOTES

1. REFER TO SIGNING PLANS FOR SIGN LOCATIONS AND HEIGHT
2. MINIMUM ALLOWABLE TENSION CAPACITY FOR WEDGE ANCHORS = 3000 LBS.
3. MAXIMUM ALLOWABLE MOMENT FOR SIGN BASE = 5.13 kip-ft.
4. PAY ITEM "STEEL SIGN SUPPORT (1-INCH ROUND) SLIPBASE" SHALL INCLUDE STUB BASE, CASTING AND NECESSARY HARDWARE (CASTING MOUNTING HARDWARE AS SHOWN ON STANDARD PLAN NO. S-614-8, SHEET 3).
5. PAY ITEM "STEEL SIGN SUPPORT CASTING" SHALL INCLUDE CASTING AND NECESSARY MOUNTING HARDWARE (CASTING MOUNTING HARDWARE AS SHOWN ON STANDARD PLAN NO. S-614-8, SHEET 3).
6. PAY ITEM "STEEL SIGN GROUND STUB BASE" MAY SHALL INCLUDE SLIPBASE STUB BASE.
SURFACE MOUNT SLIPBASE FOR RETROFIT INSTALLATIONS

SURFACE MOUNT SLIPBASE BASE PLATE FABRICATION REQUIREMENTS

- BASE PLATE - 5/8 INCH ASTM A-36 PLATE STEEL
- PIPE STUB - 3 INCH NOMINAL SCHEDULE 80, ASTM A-500 GRADE B

TOP PLATE - MEET REQUIREMENTS OF STD PLAN NO. S-614-8, SHEET 3

MEET ASTM A-663 GALVANIZING AFTER FABRICATION IS COMPLETE

SURFACE MOUNT SLIPBASE TUBULAR STEEL SIGN BASE REQUIREMENTS

FOR 2-7/8 INCH POSTS (P1 or P2 POSTS)
FOR CONCRETE SURFACES GREATER THAN 7 INCHES THICK
FOR CONCRETE SURFACES GREATER THAN 12 INCHES IN WIDTH

MOUNTING HARDWARE
- 8 - EACH 5/16 x 3-1/2 INCH LONG Malleable HOG-EZ
- SCREW ANCHORS
- 16 - EACH 1/4 INCH FLAT WASHERS
- 8 - EACH 1/4 INCH LIND WASHERS
- 8 - EACH 3/8 INCH NUTS

ALL HARDWARE WILL BE GALVANIZED OR ZINC PLATED.

INSTALLATION REQUIREMENTS:
- DRILL: 1/4 INCH HOLES 6 INCH DEEP, CLEAN HOLE PRIOR TO INSTALLING ANCHORS
- USE ADDITIONAL WASHERS FOR SHIMMING TO LEVEL BASE PLATE

TUBULAR STEEL SIGN SUPPORT SURFACE MOUNT SLIPBASE NOTES

1. REFER TO SIGNING PLANS FOR SIGN LOCATIONS AND HEIGHT
2. REFER TO STD PLAN NO. S-614-8, SHEET 3 FOR SLIPBASE CASTING INFORMATION
3. MINIMUM ALLOWABLE TENSION CAPACITY FOR WEDGE ANCHORS = 3000 LBS
4. MAXIMUM ALLOWABLE MOMENT FOR SIGN BASE = 5.13 kip-ft
5. PAY ITEM "STEEL SIGN SURFACE MOUNT BASE PLATE (SLIPBASE) SHALL INCLUDE BASE PLATE, CASTING AND ALL NECESSARY HARDWARE (SLIPBASE MOUNTING HARDWARE AS SHOWN ON STD 5-614-8, SHEET 3 AND SURFACE MOUNT SLIPBASE MOUNTING HARDWARE AS SHOWN ON STD 5-614-8, SHEET 4)
6. PAY ITEM "STEEL SIGN SURFACE MOUNT BASE PLATE" SHALL INCLUDE BASE PLATE AND NECESSARY HARDWARE (SURFACE MOUNT SLIPBASE MOUNTING HARDWARE AS SHOWN ON STD 5-614-8, SHEET 4)
CLASS I SIGN COMBINATIONS (DIRECT ATTACHMENT)

CLASS I SIGN COMBINATIONS USING U-BRACKETS

SEE NOTE 6 ON SHEET 5
1. Z-bar length shall be 3 in (1/2 in.) short of the edge of the sign on row of signs on both sides. The accompanying table gives the Z-bar length for most typical panel combinations.

2. First and last holes shall be 2 in. from edge of Z-bar. The holes in between shall be 6 in. to 8 in. apart.

3. T and U brackets shall terminate 2 in. to 3 in. from edge of sign panel. When a Z is connected to a T-bracket, they shall be the same length except when the Z must extend beyond the maximum length of a T-bracket.

4. Two mounting clamps are required on Zees where there is only one Zee for the panel and the Zee is attached to only one post.

5. Zees shall be attached to T-brackets and U-brackets with U-bolts or mounting clamps.

6. Vertical spacing between sign panels shall be 1 in. to 1.5 in. typical.

7. In special cases U-brackets may be used to mount signs that face different directions. The engineer shall determine the orientation of the sign panels and verify that the maximum allowable wind loads for the post are not exceeded.

---

**NOTES**

**CLASS II SIGN COMBINATIONS USING T-BRACKETS WITH Z-BAR**

**SINGLE POST CLASS II SIGNS USING Z-BAR**
ALUMINUM SIGN

REMEovable FRICTION CAP

PEDESTRIAN PUSH BUTTON (PUSH BUTTON AND SIGN TO BE ORIENTED AND ASSEMBLED, AS SHOWN ON THE PLAN, OR AS DIRECTED BY THE ENGINEER.)

TWO-CONDUCTOR WIRE, CONTINUOUS AND SPLICE FREE FROM PEDESTRIAN PUSH BUTTON TO CONTROLLER CAGE, OR NEAREST SIGNAL POLE HAND HOLE.

3'-6" TO 4'-0"

CONTINUOUS (AND SPLICES)

FROM PEDESTRIAN PUSH BUTTON TO CONTROLLER CABINET OR NEAREST SIGNAL POLE HAND HOLE.

SECTION A-B

SECTION B-C

4" X 8" X 1/4 " METAL PLATE FLANGE

GROUNDING LUG

GROUNDING WIRE - #10 AWG COPPER

GROUNDING WIRE LAID IN 1" CONDUIT, TERMINATED TO SIGNAL GROUNDING SYSTEM IN PULLBOX

2½" OD SCHEDULE 80 TUBULAR STEEL POST (SEE S-614-9 SHEET 1 FOR POST SPECIFICATIONS)

GENERAL NOTE

1. THE CONTRACTOR SHALL INSTALL THE POSTS PER THE MANUFACTURER'S RECOMMENDATIONS WITHOUT ADDITIONAL COMPENSATION.

2. ALL POST SHALL BE GALVANIZED AND PAINTED WITH THE COLOR SPECIFIED IN THE PLANS.

3. PUSH BUTTONS SHALL BE ADA COMPLIANT AND MEET THE PROVISIONS FOUND IN "SECTION 4-E.08 THROUGH 4-E.13 - PEDESTRIAN DETECTORS" IN THE 2009 MUTCD WITH REVISION 1 AND 2.

4. CONCRETE SHALL BE SAW-CUT TO A NEAT LINE, TO PLACE 1" CONDUIT, BACK FILL THE TRENCH WITH FLOW FILL. TOP OF TRENCH SHALL BE CONCRETE, CLASS B AT A DEPTH MATCHING SURROUNDING DEPTH OF CONCRETE.
**Base Plate Fabrication Requirements**

Base plate: 3/4" inner diameter schedule 80, ASTM A 500 B or C.

Pipe stub: 3 inch nominal schedule 80, ASTM A 500 B or C.


Meet ASTM A 123 galvanizing after fabrication is completed.

**Surface Mount Slipbase Tubular Steel Sign Base Requirements**

For 3-5/8 inch posts (P1 or P2 posts)

For concrete surfaces greater than 7 inches thick

For concrete surfaces greater than 12 inches in width

Mounting Hardware:

- 8 - Each 1/4" x 5/8" long "HIL TI KWIK KUS-EZ SCREW ANCHORS
- 16 - Each 1/4" INCH FLAT WASHERS
- 8 - Each 3/8" INCH LOCK WASHERS
- 8 - Each 3/8" INCH NUTS

All hardware will be galvanized or zinc plated.

**Surface Mount Slipbase Tubular Steel Sign Base Notes**

1. Refer to signing plans for sign locations and height

2. Minimum allowable tension capacity for wedge anchors = 3000 lbs

3. Maximum allowable moment for sign base = 5.13 kip-ft
GENERAL NOTES

1. TIMBER SIGN POSTS MAY ONLY BE USED FOR TEMPORARY SIGNAGE DURING CONSTRUCTION. TUBULAR STEEL SHALL BE USED FOR PERMANENT INSTALLATION.

2. FOR SIGN PLACEMENT, SEE STANDARD PLAN S-614-1.


4. ROUTE MARKERS SHALL BE SINGLE SHEET ALUMINUM, 0.100 INCH MINIMUM THICKNESS.

5. SHOCKING ZEES ARE 2-INCH X 2-INCH X 1/8-INCH 23.50-Hr-16 ALUMINUM ALLOY MEASURING 2.33 POUNDS PER FOOT.

6. ALL SIGNS SHALL BE FABRICATED USING RETRO-REFLECTIVE SHEETING CONFORMING TO ASTM D4956. THE TYPE SHALL BE AS DESCRIBED IN THE STANDARD SPECIFICATIONS AND/OR AS SHOWN ON THE PLANS.

7. VERTICAL SPACING BETWEEN PANELS SHALL BE 1 INCH MINIMUM TO 1/2 INCH MAXIMUM.

8. VERTICAL SPACING BETWEEN GROUPS OF PANELS SHALL BE 4 INCH.

9. BOLTS, NUTS, AND WASHERS SHALL BE GALVANIZED OR CADMIUM PLATED.

10. Z-BAR LENGTH AND HOLE SPACING FOR AUXILIARY MARKERS TO BE THE SAME AS CORRESPONDING ROUTE MARKERS.

11. WASHERS ON TIMBER POSTS SHALL BE 1 INCH DIAMETER.

12. TIMBER POST BACKING ZEES, USE ONE MACHINE BOLT WITH WASHER AND HEX NUT AND LOCK WASHER AT EACH ZEE.


14. ZEE COMBINATIONS LENGTH

   - 20", 24", 28", 35", 45"
   - 24" & 24"  43"  
   - 24" & 30"  49"  
   - 30" & 30"  55"
   - 36" & 36"  67"
   - 42" & 36"  59"
   - 24" & 24" & 24"  68"
   - 24" & 24" & 30"  74"
   - 30" & 24" & 30"  80"  
   - 30" & 30" & 30"  88"

15. NOTES:

   1. HOLES SPACING SHALL BE COUNTED FROM LEFT TO RIGHT LOOKING AT THE BACK OF SIGN WITH FIRST AND LAST HOLES 2-INCHES FROM EDGE OF THE 2-BAR. HOLES IN BETWEEN SHALL BE 6-INCHES TO 8-INCHES APART.

   2. * 2-BAR LENGTH SHALL BE 3-INCHES (± 1/8-INCH) SHORT OF THE EDGE OF THE SIGN ON BOTH SIDES.

   3. SUPPLEMENTAL PANELS MAY BE CENTERED RELATIVE TO THE PRIMARY PANELS. 2-BAR LENGTHS FOR SUPPLEMENTAL PANEL GROUPS MAY BE ADJUSTED TO FIT.
MILEPOST SIGN DETAIL FOR HIGH SNOW AREAS

1/8" G.A. NICKLE-PLATED STEEL
ASTM A-526 G-90

NOTE: WEDGE SHALL BE INSTALLED ON SIDE OF POST FACING TRAFFIC.

TUBULAR SOCKET
12 GA. GALVANIZED STEEL
ASTM A-526 G-90

CLASS B CONCRETE

8" G.A. MIN (12"
G.A. SHALL BE USED IN SANDY SOILS)

1.5" RADIUS, 0.5" BORDER, WHITE ON GREEN

TABLE OF LETTER AND OBJECT LEFTS:

Issued By: Traffic & Safety Engineering Branch July 31, 2019

STANDARD PLAN NO. S-614-11

Standard Sheet No. 1 of 1

Colorado Department of Transportation
Traffic & Safety Engineering

2829 W. Howell Pl.
Denver, CO 80204
Phone: 303-757-9436
Fax: 303-757-9219

MKB
**GENERAL NOTES**

1. Sign panels shall be fabricated from single sheet aluminum 0.030 inch minimum thickness.

2. When sign panels are not attached to the structure, they shall be fastened to uprights or to 2-inch tubular steel posts (P posts) in accordance with standards for Class I signs. See Standard Plans S-614-2 and S-614-6 for details.

3. The structure number is shown on the plans.

4. All signs shall be fabricated using retro-reflective sheeting conforming to ASTM D4956, Type IV (minimum). The sign shall have white reflective sheeting background with black letters, except as noted.

5. The structure number identification sign will not be paid for separately, but shall be included in the cost of the work.

6. In addition to the requirements stated above, structure numbers for highways passing under crossings are to be placed at the following points using two 1/2" wide stainless steel bands and stainless steel flamed leg brackets with hex head bolts (Band-IT 0315 or equivalent):

   a. For structures of three or more spans, the structure number shall be mounted facing traffic, on the outside face of the end column of the center pier.

   b. For two span structures, the structure number shall be mounted facing traffic, on the outside face of each end column of the center pier.

   c. For overhead signs, the structure number shall be mounted directly on the post or the outside post of a two-post structure visible from the highway. For structures supporting signage facing both directions, two signs shall be provided one for each direction.

7. The structure reference points (mile points) in the field log of structures show three places after the decimal point. The last digit is to be dropped off this panel. (Do not round off).

8. The structure identification shall be displayed on all state highways but not on off-system crossings.

9. Walls shall have structure numbers located at the beginning and end of the walls within 10 feet of the end of the structure. For walls less than 300 feet long, one sign at the beginning of the structure is sufficient. If final wall structure reference point is not available at the time of fabrication, the last two digits shall be left blank for completion by others. The sign shall be installed by the contractor.

10. Signs shall be visible from the highway in the direction of travel.
GENERAL NOTES

1. ALL SIGN PANELS USED ON FLASHING BEACONS ARE CLASS III AND SHALL BE FABRICATED IN ACCORDANCE WITH:
   - A. PANELS SHALL BE SINGLE SHEET ALUMINUM 0.025 MINIMUM THICKNESS.
   - B. BACKING ZEES ARE 3 IN X 20 IN ALUMINUM 0.025 MINIMUM THICKNESS.
   - C. ALL SIGNS SHALL BE FABRICATED USING REFLECTIVE SHEETING CONFORMING TO ASTM D4956. THE TYPE SHALL BE DESCRIBED IN THE STANDARD SPECIFICATIONS AND IS SHOWN ON THE PLANS.
   - D. BOLTS, SCREWS, NUTS AND METAL WASHERS SHALL BE GALVANIZED OR CADMIUM PLATED.

2. INSTALLATION DESIGN CONFORMS TO ASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL HIGHWAY SIGNS, LUMINARIES AND TRAFFIC SIGNALS" AND SHALL BE FABRICATED IN ACCORDANCE WITH:
   - A. STEEL PIPES, POST ANCHOR PLATES AND BREAK-AWAY PLATES SHALL CONFORM TO ASHTO A325.
   - B. HIGH STRENGTH BOLTS, NUTS AND WASHERS SHALL CONFORM TO ASTM A992.
   - C. HOLES SHALL BE DRILLED AND CUTS SHALL BE PREPARED. MACHINED Cutouts WILL BE PERMITTED PROVIDED ALL EDGES ARE ORCHIIAR METAL, SHALL NOT PROJECT BEYOND THE PLANE OF THE PLATE FACE.
   - D. ALL WELDS IS TO BE CONTINUOUS IN ACCORDANCE WITH CURRENT SPECIFICATIONS.
   - E. A "KEEPER PLATE" OF THICK GAUGE GALVANIZED STEEL, FABRICATED TO MATCH BREAK-AWAY PLATE DIMENSIONS BUT WITH HOLES RATHER THAN SLOTS, SHALL BE USED TO RESTRAIN BOLT LOSSENGE DUE TO WIND VARIATION.
   - F. PIPE LENGTH VARIES WITH VERTICAL PLACEMENT. MINIMUM GROUND CLEARANCE (1 FT) AND THE SIGN PANEL REQUIRED IS AS SHOWN ON THE PLANS OR AS DETERMINED BY CROSS-SECTION OR AS DIRECTED BY THE ENGINEER FOR EACH LOCATION. MAXIMUM LENGTH IS APPROX. 20 FT TO 25 IN AND MAXIMUM LENGTH IS APPROXIMATELY 24 IN X 48 IN NOT SPECIFIED SUPPLEMENTARY MINIMUMS MAY REQUIRE FOLDED CUT TO CONFORM TO TYPICAL SIGN PLACEMENT DETAILS.

3. CONCRETE FOUNDATIONS FOR FLASHING BEACON INSTALLATIONS SHALL CONFORM TO "CONCRETE CASTING" AND "CONSTRUCTION DETAILS - CLASS III".

4. ALL ELECTRICAL MATERIALS AND WORKSHOPS SHALL CONFORM TO THE LATEST REQUIREMENTS OF THE NEC, NEMA, UL OR CSA WHEREVER APPLICABLE.

5. PIPE LENGTH VARIES WITH VERTICAL PLACEMENT. MINIMUM GROUND CLEARANCE (1 FT) AND THE SIGN PANEL REQUIRED IS AS SHOWN ON THE PLANS OR AS DETERMINED BY CROSS-SECTION OR AS DIRECTED BY THE ENGINEER FOR EACH LOCATION. MAXIMUM LENGTH IS APPROX. 20 FT TO 25 IN AND MAXIMUM LENGTH IS APPROXIMATELY 24 IN X 48 IN NOT SPECIFIED SUPPLEMENTARY MINIMUMS MAY REQUIRE FOLDED CUT TO CONFORM TO TYPICAL SIGN PLACEMENT DETAILS.

6. WHEN SPECIFIED ON THE PLANS, DRAINAGE SYSTEMS MAY BE REQUIRED IN PLACE OF NO DRAINAGE SYSTEM SHOWN ON THIS SHEET.

7. FOR ADVANCED PLACEMENT OF WARNING SIGNS SEE MUTC SECTION 20.05 AND TABLE 20-4.
**BREAK-AWAY ASSEMBLY BOLTING PROCEDURE**

1. Assemble post to footing with bolts, one flat washer on each bolt top and bottom, and one flat washer and the keeper plate between the break-away plates. Use brass shims to plumb the post.
2. Tighten all bolts to maximum possible with a 12 to 15 inch pipe wrench to bed washers and shims to clean bolt threads. Then loosen each bolt in turn and retighten in a systematic order to 450 inch-pound torque.
3. Burr threads at junction with nut using a center punch to prevent nut loosening.

**TYPICAL BREAK-AWAY ASSEMBLY DETAILS**

- Furnish two (2) .012 in. thick shims.
- Furnish two (2) .032 in. thick shims.
- Shims shall be fabricated from brass shims stock or strip conforming to ASTM B 36.

**NOTES**

- **Location and Configuration of Electrical Equipment is Diagramatic Only (Use Any Method complying with the General Notes).**
- **Existing Ground at Service Pole; Otherwise pull thru conduit or attach to conduit and tap off underground.**
- **Drill and tap pipe for 1/2" round head brass screw, 1/2" long, for ground lug.**
- **Provide weep hole with aeral drop service.**
- **Drill and tap for 1/4" x 11/2" brass screw.**
- **Provide conduit for service line shall be placed in accordance with the National Electrical Code.**

**POST ANCHOR DETAILS**

**TYPICAL ELECTRICAL SERVICE DETAIL**

**UNDERGROUND VIEWS AT BEACON**

- **Minimum Depth 24" Underground 30" Under Roadway.**

**UNDERGROUND VIEWS AT POWER SOURCE**

- **1/4" minimum 12" under road.**

**TYPICAL PIPE ATTACHMENTS**

- **Pipe Clamp**
- **Locknut**
- **Bushing**
- **Enclosure (Note: Weld varies with conduit or nipple wall thickness.)**

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** Issued By: Traffic & Safety Engineering Branch July 31, 2019.**

**STANDARD PLAN NO.**

**Colorado Department of Transportation**

**S-614-14**

**Traffic & Safety Engineering**

**MKB**

**Standard Sheet No. 2 of 4**
GENERAL NOTES

1. THE RRFB SYSTEM SHALL CONFORM TO ALL ASPECTS OF THE FEDERAL HIGHWAY ADMINISTRATION, INTERIM APPROVAL 21-RECTANGULAR RAPID-FLASHING BEACONS AT UNCONTROLLED MARKED CROSSWALKS (FHWA A-21).

2. AN RRFB SHALL ONLY BE USED TO SUPPLEMENT A POST-Mounted W1-2, S1-5, OR W1-05 SIGN WITH 36-PH PLAQUE, LOCATED IMMEDIATELY ADJACENT TO AN UNCONTROLLED MARKED CROSSWALK.

3. PEDESTRIAN PUSHBUTTON AND SIGN ASSEMBLY MAY BE SEPARATE PARTS. USE CODE 25 (16" X 12") SIGN IN ACCORDANCE WITH 2009 MUTCD. SIGN MAY INCLUDE INTEGRATED WARNING LIGHTS.

4. TERMINATE RRFB CONNECTIONS PER MANUFACTURER'S RECOMMENDATION.

5. CONTROL CABINET ENCLOSURES SHALL BE SIZED BY THE RRFB MANUFACTURER.

6. BEACON ASSEMBLY MAY BE MOUNTED ON THE SIDE OF THE POLE AS SHOWN OR ON THE TOP OF THE POLE IF SPECIFIED.

7. RRFB DISPLAYS SHALL BE LED TYPE MEETING THE INTENSITY REQUIREMENTS OF SAE J670A FOR CLASS I YELLOW, BUT SHALL NOT EXCEED 1000 CANDLUMS DURING DAYLIGHT AND 500 CANDLUMS AFTER DARK.

8. SEE SHEET 1, 2 AND 4 FOR STANDARD BASE AND FOUNDATION DETAILS.

9. WHEN SPECIFIED IN THE PLANS, AC POWER SYSTEM AS SHOWN ON SHEET 3 MAY BE USED IN PLACE OF SOLAR POWERED SYSTEM SHOWN ON THIS SHEET.

10. FOR POSTED SPEEDS OF 35 MPH OR LOWER, THE W1-2 SIGNING SHALL BE 36" X 36" FOR POSTED SPEEDS OF 45 MPH OR HIGHER, THE W1-2 SIGNING SHALL BE 48" X 48".

11. PEDESTAL FOUNDATION MAY BE USED FOR BOTH UN-DIRECTIONAL AND BI-DIRECTIONAL CONFIGURATIONS. BREACHWAY BASE INSTALLATION AS SHOWN ON SHEET 3 SHALL BE USED FOR UN-DIRECTIONAL CONFIGURATION ONLY.

RECTANGULAR RAPID-FLASHING BEACON (RRFB)

SIGN W1-2
(SEE NOTE 3)

CONTROL CABINET ENCLOSURE
(SEE NOTE 3)

RECTANGULAR RAPID-FLASHING BEACON - SIDE OF POLE MOUNT SHOWN

SIGN W16-7 R
DR W16-7P
W16-7PL
W16-7PR
OR W1-1

SIDES ELEVATION VIEW UNI-DIRECTIONAL CONFIGURATION DETAILS

FRONT ELEVATION VIEW

SIGN W16-7 PR

SIDE ELEVATION VIEW BI-DIRECTIONAL CONFIGURATION DETAILS

MATCH LINE

4'=96" 12'=369.6"

3'-6"

3'-6"

8'-24"

8'-24"

SIDE ELEVATION VIEW UNI-DIRECTIONAL CONFIGURATION DETAILS

MATCH LINE

4'=96" 12'=369.6"

3'-6"

3'-6"

8'-24"

8'-24"
GENERAL NOTES

1. Pole and pedestal must be designed to meet the requirements outlined in the "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals," published by AASHTO, for a wind velocity of 100 MPH.

The contractor shall submit two sets of working drawings, signed and sealed by a professional engineer registered in the state of Colorado, in accordance with Section 105.02 of the Standard Specifications for Road and Bridge Construction.

DESIGN DATA

The designs herein assume that flashing beacons are installed within the roadway prism with the following soil parameters:

- Soil density \( \gamma = 110 \text{ LB./CF} \)
- Soil cohesion \( c = 750 \text{ LB./SF} \) for medium stiff cohesive soil
- Soil friction angle \( \phi = 30 \text{ DEG.} \) for medium dense cohesionless soil
- SF = 3.0 for flexural resistance

Contact the engineer if the flashing beacon will not be installed within the roadway prism or if any of the following soil conditions are encountered during drilling:

a) The soil has a high organic content or consists of saturated silt and clay.

b) The site won't support the weight of the drilling rig.

c) The foundation soils are not homogeneous.

d) Firm bedrock is encountered.

e) A high groundwater table is encountered.

f) Large boulders are encountered.

Footing design is based on 100 MPH wind load on a 48 in. x 48 in. diamond sign panel, mounted 9 ft. above the ground, with a 9 ft. x 9 ft. rectangular plaque underneath a flashing beacon 12 in. above. If a sign configuration is proposed that exceeds these dimensions, the footing design must be engineered and signed and sealed by a professional engineer registered in the state of Colorado.

FOOTING NOTES

1. Hex nuts
2. Square nuts
3. Hand hole shall be provided.
4. 4 in. non-shrinkable grout over rough foundation
5. Schedule 80 PVC (2 in. min. depth), 30 in. min. depth under roadway)
6. Conduit stub from pull box to pole shall be 2 in. min. diameter
7. Install anchor bolts (furnished with pole) per manufacturer's template print (furnished with poles)
8. Minimum overlap of 12 in.
9. 1-1/2 in. clearance for hoops

Cassion designs require that the cassion be founded in compact sand, clay or sandy clay. If, by visual inspection of the hole, other material is present, the cassion design shall be modified as determined by the engineer.
GENERAL NOTES

1. SIGNS SHALL BE LOCATED IN ACCORDANCE WITH THE DETAILS SHOWN ON THE PLANS. SPECIAL CARE SHALL BE TAKEN TO ENSURE AN UNOBSTRUCTED VIEW OF EACH SIGN.

2. BRAND-NAME ATTACHMENT HARDWARE AND BANDING MATERIAL TO BE APPROVED BY THE ENGINEER.

3. FOR SIGN PANEL FABRICATION, MOUNTING HEIGHT AND HOLE SPACING FOR BACKING ZEES, SEE APPLICABLE STANDARDS.

4. ALL BOLTS, NUTS AND METAL WASHERS, UNLESS MADE OF STAINLESS STEEL, SHALL BE GALVANIZED OR CADMIUM PLATED.

5. ALL HOLES SHALL BE DRILLED OR PUNCHED.

6. BANDING SHALL BE IN X .025 IN MINIMUM STAINLESS STEEL, ROUND-EDGE STRAP WITH AN ULTIMATE BREAKING STRENGTH OF 1500 LBS MINIMUM. THERE SHALL BE A MINIMUM OF TWO BANDS PER PANEL OR ASSEMBLY EXCEPT WHERE A SINGLE BACKING ANGLE IS USED.

7. PANELS OF 36 IN OR GREATER WIDTH MUST HAVE BACKING MEMBERS IN ADDITION TO BRACKETS. CLASS II PANELS OF LESS THAN 36 IN. WIDTH AND CLASS I PANELS OF GREATER THAN 24 IN. WIDTH SHOULD USE PRE-THREADED BRACKETS SIMILAR TO ALTERNATE SECTION C-C 2 SCREWS.

CLASS I AND II SIGN ASSEMBLY

FABRICATION NOTES

1. SHAPES OTHER THAN THE BRACKETS OR BACKING ANGLE SHOWN MAY BE USED.

2. MAXIMUM SPACING BETWEEN PANELS IN ONE ASSEMBLY SHALL BE 1 IN.

3. PANELS MAY BE INSTALLED BACK-TO-BACK ON THE SAME BANDS.

4. IN NO CASE SHALL BOLTS OF LESS THAN 3/16 IN. DIA. BE USED FOR ANY PORTION OF THE ASSEMBLY.

5. ONLY FIBER WASHERS MAY BE USED ON THE FACE OF THE SIGN PANEL.
GENERAL NOTES

1. FOR DETAILS OF CONCRETE BARRIER (CAST-IN-PLACE AND/OR PRECAST), SEE STANDARD PLANS M-606-12, M-606-13, M-606-14, AND M-606-15.


3. SOCKET SYSTEM AND SLIP BASES SHALL BE ASSEMBLED ACCORDING TO STANDARD PLAN S-614-8.

4. BARRIER WALLS SHALL BE SUPPORTED TO PREVENT DEFORMATION DURING PLACEMENT OF SLIP BASE OR SOCKET ON CAST-IN-PLACE INSTALLATIONS.

5. THE ENGINEER SHALL ESTABLISH LOCATIONS FOR ALL SIGN POSTS IN ACCORDANCE WITH DETAILS SHOWN ON THE PLANS.

6. ALL SIGN POSTS SHALL BE MOUNTED PLUMB.

7. BOLTS, NUTS, WASHERS, AND ANCHOR BOLTS SHALL CONFORM TO ASTM A320. THEY SHALL ALL BE GALVANIZED IN ACCORDANCE WITH ASTM A653 OR ASTM A59.

8. ALL STEEL CUTS SHALL PREFERABLY BE SAW CUTS; HOWEVER, FLAME CUTTING WILL BE PERMITTED PROVIDED ALL EDGES ARE GROUND.

9. MOUNTING SYSTEM FOR EACH SIGN LOCATION SHALL BE AS SHOWN ON THE PLANS.

10. ALL WELDING IS TO BE IN ACCORDANCE WITH AWS SPECIFICATIONS OF CURRENT ISSUE AND SHALL BE CONTINUOUS.

11. ANCHOR BOLTS FOR RETRO-FIT INSTALLATION SHALL BE 1/4-INCH HEX-HEAD SERRATED ANCHORS AND SHALL BE SKIDDED AND FIXED WITH APPROVED EPOXY GROUT IN 2 INCH HOLES FOR 1/4-INCH BOLTS AND 1 1/4-INCH HOLES FOR 5/16-INCH BOLTS.

12. RETRO-FIT INSTALLATION PROCEDURE SHALL NOT BE USED ON NEW CONSTRUCTION WITHOUT APPROVAL OF THE ENGINEER.

13. SIGN PANELS MOUNTED ON CONCRETE BARRIER SHALL NOT ENCROACH THE TRAVELED WAY.
SURFACE MOUNT SLIPBASE TUBULAR STEEL SIGN BASE REQUIREMENTS

FOR 2½ INCH POSTS (P1 OR P2 POSTS)
FOR CONCRETE SURFACES GREATER THAN 7 INCHES THICK
FOR CONCRETE SURFACES GREATER THAN 12 INCHES IN WIDTH

MOUNTING HARDWARE INSTALLATION REQUIREMENTS:
8 - EACH ½ x 5½ INCH LONG ‘HIL TI KWIK HUS-EZ’ SCREW ANCHORS
16 - EACH ½ INCH FLAT WASHERS
8 - EACH ½ INCH LOCK WASHERS
8 - EACH ½ INCH NUTS

DRILL: (8) - ½ INCH HOLES 6 INCH DEEP, CLEAN HOLE PRIOR TO INSTALLING ANCHORS
USE ADDITIONAL WASHERS FOR SHIMMING TO LEVEL BASE PLATE.

ALL HARDWARE WILL BE GALVANIZED OR ZINC PLATED.

SURFACE MOUNT SLIPBASE TUBULAR STEEL SIGN BASE NOTES
1. REFER TO SIGNING PLANS FOR SIGN LOCATIONS AND HEIGHT
2. MINIMUM ALLOWABLE TENSION CAPACITY FOR WEDGE ANCHORS = 3000 LBS.
3. MAXIMUM ALLOWABLE MOMENT FOR SIGN BASE = 5.13 kip-ft.

CAST-IN-PLACE CONCRETE BARRIER INSTALLATION

BASE PLATE FABRICATION REQUIREMENTS:
BASE PLATE ½ INCH ASTM A-36 PLATE STEEL
PIPE STUB: 3 INCH NOMINAL SCHEDULE 80, ASTM A 500 GR B
TOP PLATE MUST BE COMPATIBLE WITH SLIPBASE CASTING FROM STANDARD PLAN NO. S-614-8
MEET ASTM A 123 GALVANIZING AFTER FABRICATION IS COMPLETED.

RETRO-FIT CONCRETE BARRIER INSTALLATION

CONCRETE GLASS SCREEN INSTALLATION

SADDLE BRACKET (P1 & P2 POSTS)
GENERAL NOTES

1. TIMBER SIGN POSTS MAY ONLY BE USED FOR TEMPORARY STANDBY DURING CONSTRUCTION. TUBULAR STEEL SHALL BE USED FOR PERMANENT INSTALLATION.

2. FOR SIGN PLACEMENT SEE COLORADO STANDARD PLANS S-614-1.


4. IF THE BACK-SIZE OF ANY PANEL USED IN THE MULTI-SIGN INSTALLATIONS DOES NOT ENTER, WIND WAY, ETC. PROJECTS BEYOND THE EDGE OF ANOTHER PANEL THAT FACES TRAFFIC APPROACHING FROM A NORMAL OR PROPER DIRECTION, THE ENTIRE BACKSIDE OF THE PROTRUDING PANEL SHALL BE PAINTED FLAT BLACK.

5. A BACKING SIZE OF 3 IN. X 2 1/4 IN. SHALL BE USED FOR MOST GUIDE SIGN INSTALLATIONS.

6. 36 IN. X 48 IN. AND ALL SIGNS 30 IN. WIDE OR LESS BECOME CLASS II SIGNS WHEN THEY ARE MOUNTED ON THE SAME FACE AS A NORMAL CLASS II SIGN. ONE REGULAR 1 FT.-6 IN. ZEE WILL BE USED FOR THESE 36 IN. OR LESS IN HEIGHT AND 2 REGULAR 1 FT.-6 IN. ZEES FOR THOSE GREATER THAN 36 IN. IN HEIGHT.

7. OTHER MULTI-SIGN INSTALLATIONS NOT DETAILED ON THIS SHEET MAY BE REQUIRED BY THE PLANS AND ARE TO BE FACILITATED IN ACCORDANCE WITH THE GENERAL PRINCIPLES OF THIS STANDARD.

8. SPECIAL NON-STANDARD SPACING MAY BE REQUIRED TO FACILITATE ASSEMBLY OF MULTI-SIGN INSTALLATIONS.

FABRICATION LEGEND

1. 3/8 IN. COUNTERSUNK ALUMINUM LOCKBOLT FASTENER.
2. 3/8 IN. GALVANIZED OR CHROMIUM PLATED MACHINE BOLT, NUT AND WASHERS.
3. 3/8 IN. GALVANIZED OR CHROMIUM PLATED MACHINE BELT, NUT AND WASHERS.
4. 2-3/4 X 1/4 IN. X 1/4 IN. BACKING ZEE.
5. GUIDE SIGN DIMENSION VARIES.
6. DIMENSION VARIES PANEL SHALL NOT PROJECT BEYOND THE EDGE OF THE GUIDE SIGN.
7. THIS SPACE NOT TO EXCEED 1-1/2 IN. - 6 IN. OTHERWISE CENTER PANEL VERTICALLY ON THE GUIDE SIGN.

TYPICAL MULTI-SIGN INSTALLATIONS
24. All electrical connections to the signals shall be grounded in accordance with applicable electrical codes.

25. Traffic signal structures have been designed in accordance with the AASHTO standard specifications for structural supports for Highway signals, crosswalks, and traffic signals, Fourth Edition, 2001.

26. Design wind velocities of 100 MPH and one 12' lane with a 65 MPH truck induced gust loading have been used for the designs herein.

27. Certified mill test reports, including Charpy V-notch test results, weld inspection reports, and enhanced magnetic particle test reports submitted to the state, for approval, and certified quality inspections shall be performed on all steel used. All welds shall have a minimum value of 17 FT-Lbs at 20°F as per the frequency test requirements in section 2.5 of the AASHTO LRFD design manual.

28. Shop drawings shall be submitted to the engineer for review in accordance with subsection 10.50.2 of the standard specifications.


30. Traffic signals mounted on mast arms shall be furnished with a standard type mounting brackets.

31. All mast arms fabricated to accommodate 0.25-in. round-hole galvanizing thickness and weld profiles to provide the required minimum arm slip splice lengths and pole member overlaps.

32. Certified mill test reports, including Charpy V-notch test results, weld inspection reports, and enhanced magnetic particle test reports shall be submitted to the state as soon as they become available.

33. Leveling concrete shall be 3000 psi air entrained concrete vibrated in place below the pole base plate.

34. The designs herein assume that signals are installed within the roadway earthwork prism with the following soil parameters:

- Density: 1600 lbs/ft³ for medium density cohesive soil
- Strength: 3000 psi for medium dense cohesive soil
- Friction: 0.5 for frictional resistance
- Drift: 0.3 for lateral resistance

35. Contactor shall be considered if any of the following soil conditions are encountered during drilling:

- Soil will not be used for the installation of the signals
- The signals will be installed on too soft of support
- The signals will be installed on too hard of support
- The signals will be installed on soil that is too loose
- The signals will be installed on soil that is too dense
- The signals will be installed on soil that is too cohesive
- The signals will be installed on soil that is too cohesionless
- The signals will be installed on soil that is too fine-grained
- The signals will be installed on soil that is too coarse-grained
- The signals will be installed on soil that is too permeable
- The signals will be installed on soil that is too impervious
- The signals will be installed on soil that is too non-cohesive
- The signals will be installed on soil that is too cohesive
## MAST DATA

<table>
<thead>
<tr>
<th>TOP (IN)</th>
<th>BOTTOM (IN)</th>
<th>TOTAL (IN)</th>
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## WELD DETAILS

- **Tapered Washer Details**
  - Attach tapered washer to faceplate (TYP.)
  - Use 1/2" X 2" X 45° to clean weld

- **Faceplate**
  - TYPICAL TRAFFIC SIGNAL
  - STANDARD PLAN NO. S-614-40
  - June 23, 2019
  - Traffic & Safety Engineering Branch
  - Project Sheet Number: 4 of 5
  - Issued By: Traffic & Safety Engineering Branch July 31, 2019
**GENERAL NOTES**

1. REFER TO THEeway PLANs FOR THE ACTUAL CONFIGURATION AND LOCATION OF TRAFFIC SIGNAL HEADS AND SIGNS MARKED WITH **A**.
2. ALL POLES SHALL BE FABRICATED WITH ASTM A572 GRADE 65 STEEL.
3. ALL ANCHORS SHALL BE FABRICATED WITH ASTM A572 GRADE 65 STEEL OR ASTM A36 GRADE A STEEL WITH A MINIMUM YIELD POINT OF 55 KSI.
4. ALL POLES AND ANCHORS SHALL COMPLY WITH THE DIMENSIONAL TOLERANCES SPECIFIED IN ASTM A500, A25, OR A36.
5. ALL POLES AND ARMS SHALL BE ROUND OR CIRCULAR SECTIONS. 0.125 INCH TUBES WITH A 0.149 TAP TIER.
6. HARDENED WASHERS SHALL CONFORM TO ASTM F518.
7. ALL POLES AND ANCHORS SHALL BE GALVANIZED INSIDE AND OUTSIDE AFTER FABRICATION IN ACCORDANCE WITH ASTM A532, UNLESS PAINTING IS CALLED FOR ON THE PLANS. PAINTING SHALL CONFORM TO SECTION S22, DOUBLE COATING PROCESS.
8. POLE AND MAST ARM SPACES SHALL BE GROUNDING SCREW TO ACCOMMODATE ELECTRICAL WIRING.
9. ALL MAST PANELS AND ARMS SHALL BE cutting 30 FT IN LENGTH SHALL BE TWO PIECE CONSTRUCTION UP TO 14 FT LONG MAST ARMS.
10. GALVANIZED ASTM A522 ARMS SHALL BE USED FOR ATTACHING MAST ARMS A LUBRICATED TIGHTENING TORQUE OF 178 FT-LBS FOR 7/8 DIAMETER BOLTS AND 500 FT-LBS FOR 1 INCH DIAMETER BOLTS SHALL BE USED TO TIGHTEN ALL MAST ARMS. HARDENED WASHERS SHALL BE TEMPORARILY SEQUENTIALLY TIGHTENED UP TO 15/16 DIAMETER BOLTS.
11. ALL PLATES SHALL BE FABRICATED WITH ASTM A522 GRADE 36 STEEL AND SHALL COMPLY WITH THE DIMENSIONAL TOLERANCES SPECIFIED IN ASTM A500. ALL HANDLES SHALL BE FABRICATED WITH ASTM A572 GRADE 42 STEEL.
12. LEVELING CONCRETE SHALL BE 3000 PSI AIR ENTRAINED CONCRETE VIBRATED IN PLACE BELOW THE POLE BASE PLATE.
13. CASSETTE BASES SHALL BE PLACED INSIDE UNDISTURBED EARTH. WET OR CAVING HOLES SHALL BE BACKFILLED WITH FLOOD-FILL AND RECLUDED AFTER A THREE DAY CURING PERIOD WITHOUT THE USE OF A CASING.
14. CASSETTES SHALL BE GROUNDED WITH AIR ENTRAINED CONCRETE IN ACCORDANCE WITH SECTION 503 OF THE STANDARD SPECIFICATIONS. REINFORCING STEEL SHALL BE 7 SQ. FT.
15. CASSETTE CONCRETE MUST HAVE A MINIMUM COMPRESSIVE STRENGTH OF 2,700 PSI PRIOR TO INSTALLING THE SIGNAL STRUCTURE. VERIFY CONCRETE STRENGTH WITH NUT METER.
16. U-BOLTS AND ANCHOR BOLTS SHALL BE FABRICATED WITH A325 W 460 GRADE 55 STEEL.
17. ANCHOR BOLTS SHALL BE FABRICATED WITH HEAVY HEX NUTS AND FLAT WASHERS, AND EXTENDED A MINIMUM OF 4 INCHES ABOVE THE NUT AFTER COMPLETING THE TIGHTENING PROCESS. THREADS UP TO 1 INCHES AND GALVANIZED UP TO 13 INCHES OF THE ANCHOR BOLTS FIELD WELDING OF ARMS TO PETERS. SINGLE ENDED ENDS OF ARMS NOT TO BE WELDED ON LOCATION. ALL MAST ARMS SHALL BE SET WITH A STEEL PLATE. BOLTS SHALL BE TEMPORARILY TIGHTENED. THE CONCRETE HAS BEEN TREATED AND GROUNDED. THE U-BOLTS ARE TO BE TIGHTENED WITH A HYDRAULIC AIR IMPACT WRENCH. THE LARGER NUTS ARE TO BE TIGHTENED TO 1,225 FT-LBS AND THE SMALLER NUTS TO 100 FT-LBS.
18. CAST U-BOLTS END CAP TO BE SECURED IN PLACE WITH 3 SET SCREWS.
19. ALL SIGNAL HEADS, SIGNS, AND HARDWARE SHALL BE FIELD POSITIONED.
20. ALL PLATES SHALL BE FABRICATED WITH ASTM A572 GRADE 42 STEEL AND SHALL COMPLY WITH THE DIMENSIONAL TOLERANCES SPECIFIED IN ASTM A500. ALL HANDLES SHALL BE FABRICATED WITH ASTM A572 GRADE 42 STEEL.
21. LEVELING CONCRETE SHALL BE 3000 PSI AIR ENTRAINED CONCRETE VIBRATED IN PLACE BELOW THE POLE BASE PLATE.
22. ALL ELECTRICAL CONNECTIONS TO THE SIGNALS SHALL BE GROUNDED IN ACCORDANCE WITH APPLICABLE ELECTRICAL CODES.
23. CERTIFIED TEST REPORTS INCLUDING CHARGE V-NOCH (CT) TEST RESULTS, WOLP INSPECTION REPORTS AND ENHANCED MAGNETIC PARTICLE TEST REPORTS SHALL BE SUBMITTED TO COST STAFF BRIEFS, 400-K, AND ADDITIONAL PLANS AS SOON AS THEY BECOME AVAILABLE. FOR TEST RESULTS, PROBABLE STRAINS (ASD) (AND B) TENSILE (B) (ASD) AND B) STEELS SHALL HAVE A MAXIMUM VALUE OF 0.125 FEET AT 400 ASPD AS FOR THE H FREQUENCY TEST REQUIREMENTS IN ASTM A723/ ASTM A633.
24. STEEL EXAMINATION DATA FOR MAST ARMS SHALL BE SUPPLIED TO THE PROJECT MANAGER FOR REVIEW AHEAD OF THE SUBMISSION 105.02 OF THE STANDARD SPECIFICATIONS.
25. TRAFFIC Signals MOUNTED ON MAST ARMS SHALL BE FABRICATED WITH ASTRO TYPE MOUNTING BRACKETS.
26. ENDS SECTION DIAMETERS MUST BE INCREASED TO ACCOMMODATE OUT-OF-ROUNDNESS, GALVANIZING THICKNESS AND SEAM WELD PROFILES TO PROVIDE ENOUGH CLEARANCE TO ALLOW THE POLE BASE TO CLEAR THE MAST ARM.
27. SECURE ARMS FLANGE PLATE, POLE BASE PLATE, AND CONNECTION FACE PLATE DURING WELDING TO PREVENT DISTORTION.
29. ALL DRAWINGS SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW IN ACCORDANCE WITH SUBSECTION 105.02 OF THE STANDARD SPECIFICATIONS.
30. END DRAWINGS SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW IN ACCORDANCE WITH SUBSECTION 105.02 OF THE STANDARD SPECIFICATIONS.
31. TRAFFIC Signals MOUNTED ON MAST ARMS SHALL BE FABRICATED WITH ASTRO TYPE MOUNTING BRACKETS.
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35. END DRAWINGS SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW IN ACCORDANCE WITH SUBSECTION 105.02 OF THE STANDARD SPECIFICATIONS.
36. THREE ORED WITH A MAXIMUM DIAMETER OF 0.125 IS ALLOWED AT LOCATIONS MARKED WITH A TO ACCOMMODATE ELECTRICAL WIRING.
37. SEE 5-66-42 AND 5-66-43 FOR CABINET FOUNDATION DETAILS AND TRAFFIC LOOP AND WIRING DETAILS RESPECTIVELY.
### MAST ARM DATA

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- **BASE SECTION** LENGTH INCLUDES THE SPLICE LENGTH AS PER THE "MAST ARM SLIP SPLICE DETAIL" BELOW.
- **LIMITS** SEE GENERAL NOTE 26 ON SHEET 1 OF 4.
- **DEFLECTION TOO SMALL TO MEASURE.** STOP ALL WELDS SHORT OF PLATE EDGES AND BOLT HOLES.

### GALLOPING DEFLECTION LIMITS

- **Y** = DIAMETER OF A ROUND TUBE.
- **Z** = PERPENDICULAR DISTANCE BETWEEN FLATS.
- **Y** AND **Z** ARE OUTSIDE DIAMETER DIMENSIONS. **Z/Y** RATIO MUST BE ≥ 0.89 MINIMUM.

### LUMINAIRE ARM NOTES

1. 15' LUMINAIRE ARM SHAFT WALL THICKNESS = 0.1793"; LINEAR TAPER = 0.14 IN./FT.; DIAMETER AT ARM SIMPLEX PLATE = 4.679".
2. 25' LUMINAIRE ARM SHAFT WALL THICKNESS = 0.1793"; LINEAR TAPER = 0.14 IN./FT.; DIAMETER AT ARM SIMPLEX PLATE = 4.066".

### END CAP DETAIL

- **BASE SECTION** WITH 3/8" DIA HOLES
- **BASE SECTION WITH 3/8" DIA HOLES**
- **BASE SECTION WITH 3/8" DIA HOLES**
- **3/8" HOLE FOR 3/8" H.S. BOLTS WITH HARDENED WASHER (TYP.)**
- **ACCESS HOLE FOR SOCKET WELD DETAIL AND 3/8" FOR BACKING RING WELD DETAIL.**
- **PLATE AND ACCESS HOLE.**
- **ARM FLANGE PLATE THICKNESS = 3/8" FOR SOCKET WELD DETAIL**
- **HANDLED ONLY.**

### END CAP DETAIL

- **BASE SECTION WITH 3/8" DIA HOLES**

### ALTERNATE TRAFFIC SIGNAL

- **25' - 55' SINGLE MAST ARMS**

### STANDARD PLAN NO.

- **S-614-40A**
- **STANDARD SHEET NO. 2 of 4**

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**Computer File Information**

- **Creation Date:** 07/04/12
- **Created By:** LAW
- **Last Modification Date:** 07/31/19
- **Last Modified By:** MKB

**Department Information**

- **Department:** Colorado Department of Transportation
- **Division:** Traffic & Safety Engineering

**Project Information**

- **Project:** ALTERNATE TRAFFIC SIGNAL
- **Number:** S-614-40A
- **Sheet Number:** 2 of 4

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**Traffic & Safety Engineering**

- **MKB**

**Issued By:** Traffic & Safety Engineering Branch July 31, 2019

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**Traffic & Safety Engineering**

- **MKB**
Bend radius measured to the tip of each U-bolt. Increase radius as needed to accommodate out-of-roundness, galvanizing thickness and seam weld profiles. U-bolts shall be tightened by turning 150° to 180° past snug tight; peer threads after tightening. U-bolts and faceplate shall be mounted on base section prior to shipment.

Watch fit stop bar to side plate using tack welds to ensure uniform rearing.

Stop all welds 1/2" short of plate edges and bolt holes.

Match fit stop bar to side plate using tack welds to ensure uniform rearing.

Stop all welds 1/2" short of plate edges and bolt holes.

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Stop all welds 1/2" short of plate edges and bolt holes.

Match fit stop bar to side plate using tack welds to ensure uniform rearing.

Stop all welds 1/2" short of plate edges and bolt holes.
GENERAL NOTES:

1. THE CONTRACTOR SHALL FIELD VERIFY THAT THE HEIGHT OF THE SIGNALS ABOVE THE ROADWAY SURFACE MEETS THE CDOT CLEARANCE REQUIREMENTS AS SHOWN ON SHEET 2 OF THE DESIGNS HEREIN. ASSUME THAT SIGNALS ARE INSTALLED WITHIN THE ROADWAY PRISM WITH ROADWAY TRAFFIC SIGNAL PLANS SHALL SHOW:

2. ORIENT SPAN WIRE HOLES ON A STRAIGHT LINE BETWEEN POLES WITHOUT KINKS.

3. POLES SHALL BE HOT-DIP GALVANIZED IN ACCORDANCE WITH THE SECTION 509.24 OF THE STANDARD SPECIFICATIONS AS CALLED FOR ON THE ROADWAY PLANS.

4. SOIL DENSITY = 110 LB./CU.FT

SOIL ANGLE = 30 DEG. FOR MEDIUM DENSE COHESIONLESS SOIL

5. CAISSON CONCRETE SHALL REACH 80% OF THE REQUIRED STRENGTH PRIOR TO INSTALLING SPAN WIRE AND TETHER CABLES.

6. Poles, bars, and plates shall comply with the dimensional tolerances that are specified in ASTM A403, A569, or A615 as applicable.

7. CERTIFIED MILL TEST REPORTS INCLUDING CHARPY V-NOTCH (CVN) TEST RESULTS, WELD INSPECTION REPORTS AND ENHANCED MAGNETIC PARTICLE TEST REPORTS SHALL BE SUBMITTED TO CDOT STAFF BRIDGE, 2829 W. HOWARD PL., DENVER COLORADO 80204 AS SOON AS THEY BECOME AVAILABLE. CVN TEST RESULTS FOR ASTM A572 GRADES 42, 55 AND 65 STEEL SHALL HAVE A MINIMUM VALUE OF 15 FT-LBS AT 40°F.

8. WORKING DRAWINGS SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW IN ACCORDANCE WITH SUBSECTION 105.02 OF THE STANDARD SPECIFICATIONS.

INDEX:

1. SPAN WIRE GENERAL NOTES
2. SPAN WIRE DETAILS (1 OF 3)
3. SPAN WIRE DETAILS (2 OF 3)
4. SPAN WIRE DETAILS (3 OF 3)
5. FOUNDATION DETAILS
6. EXAMPLES
7. SINGLE SPAN SELECTION TABLES
8. DOUBLE SPAN STRAIN POLE SELECTION TABLES (1 OF 4)
9. DOUBLE SPAN STRAIN POLE SELECTION TABLES (2 OF 4)
10. DOUBLE SPAN STRAIN POLE SELECTION TABLES (3 OF 4)
11. DOUBLE SPAN STRAIN POLE SELECTION TABLES (4 OF 4)
12. DOUBLE SPAN SPAN-WIRE DIAMETER SELECTION TABLES (1 OF 2)
13. DOUBLE SPAN SPAN-WIRE DIAMETER SELECTION TABLES (2 OF 2)

ROADWAY TRAFFIC SIGNAL PLANS SHALL SHOW:

1. STRAIN POLE SIZES AND LOCATIONS (INTERSECTION, X & Y COORDINATES).
2. LENGTH OF SPAN WIRE BETWEEN EACH SET OF STRAIN POLES.
3. TRAFFIC SIGN AND SIGNAL SIZE AND LOCATIONS ALONG EACH SPAN WIRE.
4. SPAN WIRE AND TETHER CABLE SIZES.
5. LANE LINE LOCATIONS UNDER SPAN WIRE.
6. POLE HEIGHT AT EACH CORNER.
7. CAISSON PAY LENGTH.
8. LUMINAIRE LOCATIONS AND ORIENTATION ANGLES.
SPAN WIRE ORIENTATION
(Eyebolts and washers not shown for clarity)

SPAN WIRE CONNECTION TO STRAIN POLE

HANDHOLE DETAILS

STRUCTURAL WELDED SPLICE

SPAN WIRE CONNECTION TO STRAIN POLE

STRAIN POLE WITHOUT LUMINAIRE ARM EXTENSION

NOTES:
1. OPTIONAL FIELD WELD: REPAIR DAMAGED HOT-DIP GALVANIZING WITH ZINC-BASED ALLOY SOLDER AS PER ASTM A750 ANNEX A1 OR SPRAYED ZINC METALLIZING AS PER ANNEX A3 TO PROVIDE A MINIMUM COATING THICKNESS OF 3.0 MILLS IN ACCORDANCE WITH TABLE 2 FOR COATING GRADE 75.

HANDHOLE / PIPE

TEMPORARY SPAN WIRE SIGNALS

STANDARD PLAN NO.
S-614-41

Traffic & Safety Engineering

MKB

Issued By: Traffic & Safety Engineering Branch July 31, 2019
Project Sheet Number:
**EXAMPLE 1:**

SELECT THE STRAIN POLE SIZE, SPAN-WIRE DIAMETER, AND CAISSON DEPTH FOR A SINGLE SPAN INSTALLATION FOUND IN COHESIONLESS SOIL AS SHOWN ABOVE.

**SOLUTION:**

1. DETERMINE THE LOAD KEYS AS SHOWN HEREON OR ON SHEETS 7 TO 13.
   - 4 SIGNALS AND 4 SIGNS = 0 LOADS FOR 4 SIGNALS AND 4 SIGNS MAX.
2. DETERMINE THE SPAN POLE SIZE BY USING SINGLE SPAN STRAIN POLE SELECTION CHART ON SHEET 7.
   - FIND THE 143' SPAN LENGTH ON THE HORIZONTAL AXES OF THE CHART, THEN GO VERTICALLY TO MEET WITH LINE B. THE REQUIRED SPAN POLE SIZE IS 30" X 5" PIPE.
3. DETERMINE THE SPAN WIRE DIAMETER BY USING THE SINGLE SPAN SPAN-WIRE DiAMETER SELECTION CHART ON SHEET 7.
   - FIND THE 143' SPAN LENGTH ON THE HORIZONTAL AXES OF THE CHART, THEN GO VERTICALLY TO MEET WITH LINE B. THE REQUIRED SPAN WIRE DIAMETER IS 3/8".
4. DETERMINE THE CAISSON DEPTH BY USING THE TABLE ON SHEET 5.
   - LOOK UP THE CAISSON DEPTH FOR COHESIONLESS SOIL AND 18" # STRAIN POLE. THE REQUIRED CAISSON DEPTH IS 14.5'.

**EXAMPLE 2:**

SELECT THE STRAIN POLE SIZE, SPAN-WIRE DIAMETER, AND CAISSON DEPTHS FOR A DOUBLE SPAN 5-PLAN BOX FOUND IN COHESIONLESS SOIL AS SHOWN ABOVE.

**SOLUTION:**

1. DETERMINE THE LOAD KEYS AS SHOWN HEREON OR ON SHEETS 7 TO 13.
   - 3 SIGNALS AND 3 SIGNS = 0 LOADS FOR 3 SIGNALS AND 3 SIGNS MAX.
2. DETERMINE THE SPAN POLE SIZE BY USING THE DOUBLE SPAN STRAIN POLE SELECTION CHART ON SHEET 7.
   - FOR POLE A USING THE DOUBLE SPAN STRAIN POLE SELECTION CHART FOR 90° ≤ 180° ON SHEET 7.
   - EITHER THE HORIZONTAL OR THE VERTICAL CHART CAN BE USED FOR SPAN AB OR SPAN AC. USING THE HORIZONTAL CHART FOR SPAN AB, LOCATE THE 172' SPAN AB ON THE HORIZONTAL CHART, THEN GO VERTICALLY TO MEET WITH LINE B. LOCATE THE 120' SPAN AB ON THE VERTICAL CHART, THEN GO HORIZONTALLY TO MEET WITH LINE B. FROM THESE INTERCEPTION POINTS, GO HORIZONTALLY AND VERTICALLY TO THE SQUARE BOX. THE REQUIRED PIPE DIAMETER FOR POLE A IS 20" X 5" PIPE.
   - FOR POLE B AND C, USE THE SINGLE SPAN SPAN POLE SELECTION CHART ON SHEET 7 AND FOLLOW THE SAME LOGIC AS SHOWN ON STEP 2 OF EXAMPLE 1 TO DETERMINE THE POLE SIZE. USING THIS LOAD, THE REQUIRED POLE SIZE IS 18" X 5" PIPE FOR SPAN POLE B AND 16" X 5" PIPE FOR SPAN POLE C.
3. DETERMINE THE SPAN WIRE DIAMETER BY USING THE DOUBLE SPAN SPAN-WIRE DIAMETER SELECTION CHART FOR 20° θ ≤ 90° ON SHEET 7.
   - SPAN AC, LOCATE THE 172' SPAN LENGTH ON THE HORIZONTAL AXES, THEN GO VERTICALLY TO MEET WITH LINE B. THE REQUIRED SPAN WIRE DIAMETER IS 5/16".
   - SPAN AB IS THE SAME FOR THE 135' LONG SPAN AC. THE REQUIRED SPAN WIRE DIAMETER IS 3/8".
4. DETERMINE THE CAISSON DEPTHS BY USING THE TABLE ON SHEET 5.
   - LOOK UP THE CAISSON DEPTH FOR COHESIONLESS SOIL. THE REQUIRED CAISSON DEPTHS FOR SPAN POLE A IS 15.8', FOR SPAN POLE B IS 13.5', AND THE REQUIRED DEPTH FOR SPAN POLE C IS 15.6'.

**EXAMPLE 3:**

SELECT THE STRAIN POLE SIZES, SPAN-WIRE DIAMETERS, AND CAISSON DEPTHS FOR CAISSONS FOR A DOUBLE SPAN RECTANGULAR PLAN BOX FOUND IN COHESIONLESS SOIL AS SHOWN ABOVE.

**SOLUTION:**

1. DETERMINE THE LOAD KEYS AS SHOWN HEREON OR ON SHEETS 7 TO 13.
   - 3 SIGNALS AND 3 SIGNS = 0 LOADS FOR 3 SIGNALS AND 3 SIGNS MAX.
   - SPAN A: 3 SIGNALS AND 3 SIGNS = 0 LOADS FOR 3 SIGNALS AND 3 SIGNS MAX.
   - SPAN B: 3 SIGNALS AND 3 SIGNS = 0 LOADS FOR 3 SIGNALS AND 3 SIGNS MAX.
   - SPAN C: 3 SIGNALS AND 3 SIGNS = 0 LOADS FOR 3 SIGNALS AND 3 SIGNS MAX.
2. DETERMINE THE POLE SIZES, SPAN-WIRE DIAMETERS, AND CAISSON DEPTHS.
   - USING THE DOUBLE SPAN STRAIN POLE SELECTION CHART FOR 90° ≤ 180° ON SHEET 8.
   - EITHER THE HORIZONTAL OR THE VERTICAL CHART CAN BE USED FOR SPAN AB OR SPAN AC. USING THE HORIZONTAL CHART FOR SPAN AB, LOCATE THE 153' SPAN AB ON THE HORIZONTAL CHART, THEN GO VERTICALLY TO MEET WITH LINE B. LOCATE THE 120' SPAN AB ON THE VERTICAL CHART, THEN GO HORIZONTALLY TO MEET WITH LINE B. FROM THESE INTERCEPTION POINTS, GO HORIZONTALLY AND VERTICALLY TO THE SQUARE BOX. THE REQUIRED PIPE DIAMETER FOR POLE A IS 20" X 5" PIPE.
   - FOR POLE B USING THE DOUBLE SPAN STRAIN POLE SELECTION CHART FOR 180° ≤ 270° ON SHEET 10.
   - EITHER THE HORIZONTAL OR THE VERTICAL CHART CAN BE USED FOR SPAN AB OR SPAN AC. USING THE HORIZONTAL CHART FOR SPAN AB, LOCATE THE 135' SPAN AB ON THE HORIZONTAL CHART, THEN GO VERTICALLY TO MEET WITH LINE B. LOCATE THE 120' SPAN AB ON THE VERTICAL CHART, THEN GO HORIZONTALLY TO MEET WITH LINE B. FROM THESE INTERCEPTION POINTS, GO HORIZONTALLY AND VERTICALLY TO THE SQUARE BOX. THE REQUIRED PIPE DIAMETER FOR POLE B IS 20" X 5" PIPE.
   - FOR POLE C USING THE DOUBLE SPAN STRAIN POLE SELECTION CHART FOR 270° ≤ 360° ON SHEET 10.
   - EITHER THE HORIZONTAL OR THE VERTICAL CHART CAN BE USED FOR SPAN AB OR SPAN AC. USING THE HORIZONTAL CHART FOR SPAN AB, LOCATE THE 135' SPAN AB ON THE HORIZONTAL CHART, THEN GO VERTICALLY TO MEET WITH LINE B. LOCATE THE 120' SPAN AB ON THE VERTICAL CHART, THEN GO HORIZONTALLY TO MEET WITH LINE B. FROM THESE INTERCEPTION POINTS, GO HORIZONTALLY AND VERTICALLY TO THE SQUARE BOX. The REQUIRED PIPE DIAMETER FOR POLE C IS 20" X 5" PIPE.
   - LIKEWISE, STRAIN POLE C IS 24" X 5" PIPE AND STRAIN POLE D IS 20" X 5" PIPE.

3. DETERMINE THE CAISSON DEPTHS.
   - USING THE DOUBLE SPAN CAISSON DEPTH SELECTION CHART FOR 240° ≤ 360° ON SHEET 10.
   - FOR THIS CASE, THE DOUBLE SPAN STRAIN POLE A AND C CONTROL THE DESIGN.
   - SPAN AB: LOCATE THE 153' SPAN LENGTH ON THE HORIZONTAL LINE, THEN GO VERTICALLY TO MEET WITH LINE B. THE REQUIRED SPAN-WIRE DIAMETER IS 5/16".
4. DETERMINE THE CAISSON DEPTHS BY USING THE TABLE ON SHEET 5.
   - LOOK UP THE CAISSON DEPTHS FOR COHESIONLESS SOIL. THE REQUIRED CAISSON DEPTHS FOR 24° PLAN SPANS A AND C IS 35.5', AND THE REQUIRED DEPTH FOR 24° PLAN SPANS B AND D IS 14.9'.

**Computer File Information**

- Creation Date: 07/01/11
- Created By: LEC
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- Last Modified By: HHB
- CAD Version: MicroStation V8
- Scale: Not to Scale
- Unit: English

**Sheet Revisions**

- Revision Date: Comments

**Colorado Department of Transportation**

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**Traffic & Safety Engineering**

**STANDARD PLAN NO.**

- S-614-41
- Standard Sheet No. 6 of 13

**TEMPORARY SPAN WIRE SIGNALS**

- Issued By: Traffic & Safety Engineering Branch July 31, 2019
- Project Sheet Number
**DOUBLE SPAN STRAIN POLE SELECTION CHARTS (2 OF 4)**

**DOUBLE SPAN STRAIN POLE SELECTION CHART FOR 80° ≤ θ < 90°**

**DOUBLE SPAN STRAIN POLE SELECTION CHART FOR 90° ≤ θ < 100°**

- **LOAD KEY**
  - @ - 12" XS PIPE
  - # - 14" XS PIPE
  - ¥ - 16" XS PIPE
  - * - 18" XS PIPE
  - $ - 20" XS PIPE
  - ^ - 24" XS PIPE

**Example 2, Step 2**

1. For Span Pole (A):
   - Span Length (L) = 200 ft
   - Span Length (L') = 40 ft

2. For Span Pole (B):
   - Span Length (L) = 150 ft
   - Span Length (L') = 30 ft

- **SPAN LENGTH** (L) in FT
- **SPAN LENGTH** (L') in FT

---

**Computer File Information**

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**Traffic & Safety Engineering**

**S-614-41**

**STANDARD PLAN NO.**

**TEMPORARY SPAN WIRE SIGNALS**

**Issued By:** Traffic & Safety Engineering Branch July 31, 2019

**Project Sheet Number:**

**CAD Version:** MicroStation V8 Scale: Not to Scale Units: English
THE CONCRETE PAD SURROUNDING THE CABINET BASE SHALL BE CLASS B MIX. GLASS DR SYNTHETIC FIBERS SHALL BE INCORPORATED INTO THE CONCRETE MIX. THE DOSAGE RATE OF THE GLASS DR SYNTHETIC FIBERS SHALL BE THE DOSAGE RATE RECOMMENDED BY THE MANUFACTURER OF THE GLASS DR SYNTHETIC FIBERS. ALL WORK INVOLVING THE CONSTRUCTION OF THE CONCRETE PAD FOR THE SIGNAL CONTROLLER CABINET WILL NOT BE PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN COST OF THE CONTROLLER CABINET PAD ITSELF.

CONDUIT FOR POWER FEED FROM UTILITY COMPANY

ELECTRIC WIRE COIL

PULL BOX DETAIL (NOT TO SCALE)

PULL BOX NOTES

1. CABINET CENTERLINE SHALL BE ALIGNED TO TOP EDGE OF PULL BOX TO FACILITATE CABLE PULLING.
2. USE OF PEA GRAVEL OR CRUSHED STONE SHALL BE INCIDENTAL TO THE PULL BOX.
3. ALL PULL BOXES SHALL HAVE A PUSH OUT 12” OFF CENTER (SEE DETAIL BELOW) TO ALLOW FOR CABLE PULLING.
4. THE PULL BOX SHALL HAVE A GENERIC COVER WITH "CDOT COMM" PHYSICALLY IMPRESSED ON ITS TOP.
5. GIANT PIN NOTES:
   A. RADIUS MAY NOT BE LESS THAN 4.5’ (FOR CONCRETE CONTAINING FIBER)
   B. GREEN MAY NOT BE GREATER THAN 45 DEGREES

CAST-IN-PLACE FOUNDATION

PULL ROPE TIED TO GROUND ROOD ONE PER CONDUIT 5/8" X 8" GROUND ROOD MIN

12" (MIN) OF 1" PEA GRAVEL OR CRUSHED STONE

CROSS SECTION
CONCRETE PAD NOTES

1. CONTRACTOR SHALL INSTALL PRE-FABRICATED OR CAST-IN-PLACE FIBERGLASS CONCRETE PAD. SEE SPECIFICATION FOR MORE INFORMATION ON THE CONCRETE MATERIAL.

2. CONTRACTOR SHALL PLACE A 4-INCH THICK CONCRETE PAD (CAST-IN-PLACE OR PRE-FABRICATED), AS INDICATED IN THE PLANS, OR AS DIRECTED BY THE ENGINEER. THE CONCRETE PAD SHALL SLOPE AWAY FROM THE FIBERGLASS BASE AT A MAXIMUM 2% SLOPE.


4. PRE-FABRICATED CONCRETE BASE DIMENSIONS SHOWN VARY PER MANUFACTURER'S SPECIFICATIONS.

5. PRE-FABRICATED CONCRETE BASE MANUFACTURER SHALL PROVIDE CONNECTION POINTS IN THE BASE FOR THE SPECIFIC SIGNAL CONTROL CABINET SPECIFIED IN THE PLANS.
CONCRETE PAD NOTES

1. CONTRACTOR SHALL INSTALL PRE-FABRICATED OR CAST-IN-PLACE CONCRETE PAD SEE SPECIFICATION FOR MORE INFORMATION ON THE CONCRETE MATERIAL.

2. CONTRACTOR SHALL PLACE A 3/4-INCH THICK CONCRETE PAD (CAST-IN-PLACE OR PRE-FABRICATED), AS INDICATED ON THE DETAIL. OR AS DIRECTED BY THE ENGINEER. THE CONCRETE PAD SHALL SLOPE AWAY FROM THE FIBERGLASS BASE AT A MAXIMUM 2% SLOPE.


4. FOUNDATIONS SHALL BE LOCATED TO PROVIDE 34-INCH MINIMUM CLEARANCE BETWEEN FACE-OF-CURB AND ANY PORTION OF THE CONTROLLED CABINET.

5. IN IMPAIRED AREAS, THE TOP FOUNDATION FOR MODELS 332 - 334 CONTROL CENTER CABINETS SHALL BE THREE (3) INCHES ABOVE SURROUNDING GRADE.

6. FIBERGLASS BASE DIMENSIONS SHOWN VARY PER MANUFACTURER SPECIFICATIONS.
CONCRETE PAD NOTES

1. CONTRACTOR SHALL DETAIL PRE-FABRICATED OR CAST-IN-PLACE CONCRETE PAD SEE SPECIFICATION FOR MORE INFORMATION ON THE CONCRETE MATERIAL.

2. CONCRETE SHALL PLACE A 3 1/4-INCH THICK CONCRETE PAD (CAST-IN-PLACE OR PRE-FABRICATED), AS INDICATED IN THE DETAILS, OR AS DIRECTED BY THE ENGINEER. THE CONCRETE PAD SHALL SLOPE AWAY FROM THE GLASS BASE AT A MAXIMUM 2% SLOPE.


4. FOUNDATIONS SHALL BE LOCATED TO PROVIDE 34-INCH MINIMUM CLEARANCE BETWEEN FACE-OF-CURB AND ANY PORTION OF THE CONTROLLER CABINET.

5. IN UNPAVED AREAS, THE TOP FOUNDATION FOR MODELS 332D AND 333JP CONTROLLER CABINETS SHALL BE THREE (3) INCHES ABOVE SURROUNDING GRADE.

6. GLASS BASE DIMENSIONS SHOWN VARY PER MANUFACTURER'S SPECIFICATIONS.
**Advanced Detection Loop Distance Table**

<table>
<thead>
<tr>
<th>Approach Speed</th>
<th>Distance from Intersection</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPH</td>
<td>FEET</td>
</tr>
<tr>
<td>35</td>
<td>56</td>
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<tr>
<td>40</td>
<td>64</td>
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<tr>
<td>45</td>
<td>72</td>
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<td>50</td>
<td>80</td>
</tr>
<tr>
<td>55</td>
<td>88</td>
</tr>
</tbody>
</table>

**NOTES**

1. All Pull Boxes are not to be paid for separately, but shall be included in the cost of the Conduit, except for where called out in the Plans.
2. All Pull boxes placed for the “Advanced Detection Wiring” shall be placed approximately every 100 feet and shall be included in the cost of the Conduit.
3. For layout of Loop Detectors and Conduit, the Contractor shall notify the Design Region 6 Traffic Signal Shop, Jeff Lancaster, (303) 757-9511, two working days in advance.
4. See Plans for actual lane configurations.
LOOP INSTALLATION PROCEDURE

1. Cut slots in pavement to 3 in minimum depth.
2. Clean and dry slots with oil-free compressed air.
3. One continuous length of #1/0, #1, #2, #3, #4, #5 or thinner wire shall be used for each loop from signal base or pull box around the loop with the number of turns specified and back to the signal base or pull box. Loop wire shall be duct type.
4. Splice lead-in in first pull box on the side of the roadway.
5. Use a blunt, non-metallic instrument to push wire into slot, do not coil leads.
6. Connect detector and test loop.
7. Install loops before final lift of asphalt on mill and fill projects.
8. Seal slots as specified.

WIRE CONFIGURATION

- **SERIES**
  - Loop Width
  - Direction of Travel
- **PARALLEL**
  - Loop Width
  - Direction of Travel

LAUNCH POINT FOR DETECTOR LEAD-IN

SAW CUT DETAILS

- Min. Depth of Sealant
- Joint
- Detector Wire Across Bridge Joints
  - Dual loops shall be of the size shown unless otherwise on the plans.

DETECTOR WIRE ACROSS BRIDGE JOINTS

LOOP DETECTOR LEAD-IN

VEHICLE DETECTOR LOOP

SAW CUT DETAILS

FOR DETAIL, SEE SECTION C-C, SHEET 3

DRAIN "T" DR

WEEP HOLE

Sweeping "L"

MIN. 12" RADIUS

PORTAL DETECTOR WIRE ACROSS BRIDGE JOINIS

DUAL LOOPS SHALL BE OF THE SIZE SHOWN UNLESS OTHERWISE ON THE PLANS.

STANDARD LOOP - WIRING AND CONNECTION TABLE

<table>
<thead>
<tr>
<th>Width of Loop (Ft/C)</th>
<th>No. of Loops</th>
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<tr>
<td>6</td>
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<tr>
<td>8</td>
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<td>10</td>
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<td>24</td>
<td>15, 16</td>
</tr>
<tr>
<td>36</td>
<td></td>
</tr>
</tbody>
</table>

TRAFFIC LOOP AND MISCELLANEOUS SIGNAL DETAILS

STANDARD PLAN NO.

S-614-43

Traffic & Safety Engineering

MKB

Issued By: Traffic & Safety Engineering Branch July 31, 2019

Project Sheet Number:
TYPE 1 INDUCTION LOOP

NOTES

1. TWIST LEAD-IN CABLES ALL THE WAY TO PULL BOX.
2. SPLICE LEAD-IN IN FIRST PULL BOX ON SIDE OF THE ROADWAY.

STOP LINE

TYPE 1 STOP LINE LOOP WIRING DIAGRAM

SEE TYPE 1 STOP LINE LOOP WIRING DIAGRAM DETAIL BELOW

SEE CONDUIT STUB-OUT PLACEMENT DETAILS IN THE PLANS

SEE CONDUIT STUB-OUT DETAIL (TYP.)

SEE CONDUIT STUB-OUT DETAIL (TYP.)

LOOP SEALANT (PER PLANS OR "AS APPROVED BY THE ENGINEER")

LOOP SEALANT (PER PLANS OR "AS APPROVED BY THE ENGINEER")

SECTION C-C

SECTION D-D

STOP LINE - PLAN VIEW

TYPE 1 STOP LINE LOOPS

TOP OF EXISTING PAVEMENT OR LEVELING COURSE OF NEW PAVEMENT

2" LONG LOOP TOP

TOP OF EXISTING PAVEMENT OR LEVELING COURSE OF NEW PAVEMENT

RESULT: MARKING DETAIL

CUSHION SAND OR CONTROLLED DENSITY FILL

CUSHION SAND OR CONTROLLED DENSITY FILL

CORNER SAWCUT DETAIL

T - SAWCUT DETAIL

TRAFFIC LOOP AND MISCELLANEOUS SIGNAL DETAILS

STANDARD PLAN NO. S-614-43

Issued By: Traffic & Safety Engineering Branch July 31, 2019
NOTES

1. ALL OF THE LOOP LEAD-IN WIRES SHALL RETURN TO THE PULL BOX.

SECTION C-C

SECTION D-D

TRAFFIC LOOP AND MISCELLANEOUS SIGNAL DETAILS

STANDARD PLAN NO. S-614-43
Standard Sheet No. 4 of 8

Colorado Department of Transportation
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Traffic & Safety Engineering

MKB

Traffic Loop and Miscellaneous Signal Details

Type 2 Advance Loops

Type 2 Stop Line Loops

Ground Surface

Standard Pull Box (See Sheet 4)

Loop lead-in wires - twisted pair

Splice

Detector lead-in 20/80 cable

Gravel Pad

2" Conduit

To Cabinet

Pull Box Placement Detail

Corner Sawcut Detail

Type 2 Induction Loops (for Conventional Highways)

SECTION C-C

SECTION D-D

Traffic Loop and Miscellaneous Signal Details

STANDARD PLAN NO. S-614-43
Standard Sheet No. 4 of 8

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Traffic Loop and Miscellaneous Signal Details

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2" Conduit

To Cabinet

Pull Box Placement Detail

Corner Sawcut Detail

Type 2 Induction Loops (for Conventional Highways)
TYPE 2 STOP LINE LOOP WIRING DIAGRAM

TYPE 2 ADVANCE LOOP WIRING DIAGRAM

TYPE 2 SAMPLING LOOP WIRING DIAGRAM

TYPE 2 INDUCTION LOOP

NOTES

1. FOR WIRING AND CONDUIT LAYOUT, SEE CONDUIT STUB-OUT PLACEMENT DETAIL IN PLANS.

2. SPLICE LEAD-ON IN FIRST PULL BOX ON THE SIDE OF THE ROADWAY.
LIFTING BOLTS

TABLE OF DIMENSIONS (MINIMUMS)

<table>
<thead>
<tr>
<th>TYPE</th>
<th>DESCRIPTION</th>
<th>DIMENSIONS (IN.)</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>1</td>
<td>PULL BOX - (11&quot; X 18&quot; X 12&quot;)</td>
<td>55/8</td>
</tr>
<tr>
<td>2</td>
<td>PULL BOX - (13&quot; X 24&quot; X 12&quot;)</td>
<td>61/8</td>
</tr>
<tr>
<td>3</td>
<td>PULL BOX - (17&quot; X 30&quot; X 12&quot;)</td>
<td>66/8</td>
</tr>
<tr>
<td>4</td>
<td>PULL BOX - (24&quot; X 36&quot; X 24&quot;)</td>
<td>70/4</td>
</tr>
<tr>
<td>5</td>
<td>PULL BOX - (30&quot; X 48&quot; X 24&quot;)</td>
<td>74/4</td>
</tr>
</tbody>
</table>

NOTES

1. PULL BOXES, PULL BOX COVERS AND EXTENSIONS SHALL BE MADE OF FIBERGLASS REINFORCED POLYMER CONCRETE. PULL BOXES SHALL BE VERIFIED BY A THIRD PARTY NATIONALLY-RECOGNIZED INDEPENDENT TESTING LABORATORY AS MEETING ALL TEST PROVISIONS OF THE LATEST ANSI/SCTE 77 SPECIFICATION FOR UNDERGROUND ENCLOSURE INTEGRITY, TIER 22 RATING. CERTIFICATION DOCUMENTS SHALL BE SUBMITTED WITH MATERIAL SUBMITTALS. THE PULL BOX SHALL HAVE A DETACHABLE COVER WITH A SKID-RESISTANT SURFACE AND HAVE THE WORDS "CDD TRAFFIC" OR "COST COMM" CAST INTO THE SURFACE. PAINTING THE WORDS SHALL NOT BE ACCEPTED. MARKINGS SHOWING THE TIER 22 RATING MUST BE LABELED OR STENCILLED ON THE BOX AND OUTSIDE OF THE BOX AND ON THE UNDER SIDE OF THE COVER. THE COVER SHALL BE ATTACHED TO THE PULL BOX BODY BY MEANS OF A MINIMUM 7/8 UNIFIED NATIONAL COURSE (UNC) STAINLESS STEEL PORTA HEAD BOLTS AND SHALL HAVE TWO LIFT SLOTS TO ASSIST IN THE REMOVAL OF THE LID.

2. PULL BOXES SHALL BE RATED FOR A MINIMUM PULL OUT OF 3,000 POUNDS.

3. TYPE 4 AND 5 PULL BOX COVERS SHALL BE A TWO-PIECE COVER.

4. MAGNESIUM CHLORIDE TESTS SHOULD BE PERFORMED IN ACCORDANCE WITH THE LATEST ANSI/SCTE 77 SPECIFICATION FOR UNDERGROUND ENCLOSURE INTEGRITY, TIER 22 RATING.

5. PULL BOXES SHALL HAVE A CONCRETE APRON SLOPED AWAY FROM PULL BOX OPENING. THE COST OF THE CONCRETE APRON SHALL BE PAID FOR AS PART OF THE PULL BOX ITEM.
NOTES

1. SIGNAL HEAD CONFIGURATIONS SHALL BE AS SHOWN ON PLANS.
2. INSTALL MOUNTING BRACKETS ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS.
3. USE ASTRO-TYPE MOUNTING BRACKETS FOR MOUNTING EXCEPT FOR LIGHTED SIGNS ON MAST ARMS, SEE STANDARD PLAN 5-614-20, USING 1/2 INCH WIDE RAILING.
4. LIGHTED STREET NAME SIGNS SHALL UTILIZE ASTRO-TYPE DESIGNED FOR THE REQUIRED DESIGN LOADING AND BE FREE-SWINGING TO REDUCE WIND LOADING EFFECT.
5. THE CABLE INSIDE THE TOP HEAD MOUNT SHOULD BE INSIDE THE HEAD.
6. THE INSIDE OF THE VISOR IS TO BE POWDER COATED BLACK MOUNTING BRACKETS OVERHEAD SIGNS.
7. CABLE SUPPORT BRACKET AND SAFETY CABLE FROM MAST ARM TO HEAD SHALL BE PROVIDED.

ASTRO-TYPE MOUNTING BRACKET

EMERGENCY VEHICLE PRE-EMPTION DEVICE

MAST-ARM MOUNTING BRACKETS
-PEDESTAL POLE CONFIGURATIONS-

INDEX
1. PEDESTAL POLE INSTALLATION
2. PEDESTAL POLE FOUNDATION DETAILS

GENERAL NOTES
1. ALL PEDESTAL POLE STEEL SHALL BE ASTM A53 GR B AND SHALL BE HOT DIP GALVANIZED INSIDE AND OUTSIDE ACCORDING TO ASTM A123.
2. MOUNTING HARDWARE FOR EACH TRAFFIC SIGNAL WILL BE FURNISHED BY THE MANUFACTURER, INCLUDING POLE PLATES FOR SIDE POLE MOUNTING.
3. PEDESTAL POLES SHALL HAVE A FRANGIBLE BASE: AKRON FOUNDRY TB2-17 OR APPROVED EQUAL.
4. ALL POLES, PEDESTALS AND CABS SHALL BE PLACED A MINIMUM OF 2 FEET OFF THE ROADWAY MEASURED FROM THE EDGE OF SHOULDER OR FACE OF CURB.
5. 12-12-12 TRAFFIC SIGNAL FACES FOR RAMP METERING LOCATIONS SHALL BE ALUMINUM TYPE.
6. TWO-SECTION 12" RED AND GREEN SIGNAL HEADS SHALL BE "ANGLED IN" AND SHALL BE EQUIPPED WITH VISORS THAT MAY BE POSITIONED TO EITHER SIDE OF THE LENS, ALLOWING ONLY THE FIRST MOTORIST BEHIND THE STOP BAR TO SEE THE SIGNAL INDICATION.
7. REGULATORY SIGNING SHALL BE AS SHOWN ON THE PLANS. 24R10-6a FOR SINGLE-LANE METERED RAMPS, AND 24R10-6a FOR TWO-LANE METERED RAMPS.
8. ALL SIGNAL HEADS SHALL BE APPROVED LED TYPE.
9. IF THE PLACEMENT OF A PEDESTRIAN PUSH BUTTON ASSEMBLY ON A TRAFFIC SIGNAL MAST POLE WILL NOT BE WITHIN EASY REACH BY PEDESTRIANS (10" DISABILITIES ACT), THEN A SEPARATE PEDESTRIAN PUSH BUTTON POST ASSEMBLY (PPBPA) SHALL BE INSTALLED WITHIN EASY REACH. THE PPBPA SHALL MEET THE PROVISIONS FOUND IN CDOT STANDARD PLAN S-614-9 AND "SECTION 4E.08 THROUGH 4E.13 - PEDESTRIAN DETECTORS" IN THE 2009 MUTCD WITH REVISIONS 1 AND 2.

POLE AND CAISSON INFORMATION

<table>
<thead>
<tr>
<th>MEMBER</th>
<th>ATTRIBUTES AND LOADS</th>
<th>TRAFFIC SIGNAL POLE</th>
<th>RAMP METERING POLE</th>
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<tbody>
<tr>
<td>SIZE</td>
<td></td>
<td>1.36 kip</td>
<td>0.63 kip</td>
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<tr>
<td>ULT. SHEAR</td>
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<td>5.90 kft.</td>
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<td>SERVICE SHEAR</td>
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Computer File Information

Sheet Revisions

Colorado Department of Transportation
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Traffic & Safety Engineering

Issued By: Traffic & Safety Engineering Branch July 31, 2019

STANDARD PLAN NO. S-614-44

Standard Sheet No. 1 of 2
FOUNDATION NOTES

1. CAISSON CONCRETE SHALL BE AIR ENTRAINED CLASS BZ IN ACCORDANCE WITH SECTION 503 OF THE STANDARD SPECIFICATIONS.
2. REINFORCING STEEL SHALL BE GRADE 60 IN ACCORDANCE WITH SECTION 602 OF THE STANDARD SPECIFICATIONS.
3. ALL REINFORCING STEEL SHALL BE NON COATED.
4. CAISSON CONCRETE MUST HAVE A MINIMUM COMPRESSIVE STRENGTH OF 2,700 PSI BEFORE INSTALLING THE PEDESTAL POLE; VERIFY CONCRETE STRENGTH WITH MATURITY METER.
5. CAISSONS SHALL BE PLACED AGAINST UNDISTURBED EARTH.

DESIGN DATA

CAISSON CONCRETE:
CLASS BZ CONCRETE: $f'_c = 4,000$ psi
REINFORCING STEEL: $f_y = 60,000$ psi

DESIGN WIND SPEED = 90 mph

THE DESIGNS HEREIN ASSUME THAT THE PEDESTAL POLES ARE INSTALLED WITHIN THE ROADWAY PRISM WITH THE FOLLOWING PARAMETERS:

MEDIUM DENSE COHESIONLESS SOIL:
SOIL DENSITY, $\gamma = 110$pcf
SOIL ANGLE = 30°
$SF = 1.25$ FDR FLEXURAL RESISTANCE

MEDIUM STIFF COHESIVE SOIL:
SOIL DENSITY, $\gamma = 110$pcf
SOIL COHESION = 750 psf
$SF = 1.25$ FDR FLEXURAL RESISTANCE

CONTACT THE ENGINEER IF ANY OF THE FOLLOWING SOIL CONDITIONS ARE ENCOUNTERED DURING DRILLING:

(A) SIGNALS WILL NOT BE INSTALLED WITHIN THE ROADWAY PRISM.
(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 HDMDENDUS.
(E) FIRM BEDROCK IS ENCOUNTERED.

UNFACTORED GROUP LOAD II COMBINATION LOADS FOR THE DESIGN OF POLES WERE GENERATED WITH THE STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES, AND TRAFFIC SIGNALS 5TH EDITION INCLUDING THE 2010 & 2011 INTERIMS.

LOAD FACTORS FOR GENERATING ULTIMATE CAISSON LOADS ARE FOR THE STRENGTH III LOAD COMBINATION AS SPECIFIED IN THE 6TH EDITION OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS.
GENERAL NOTES

1. ALL STRUCTURAL STEEL SHALL CONFORM TO THE REQUIREMENTS SHOWN IN THE MATERIALS TABLE ON SHEET 1.

2. SIGN STRUCTURES SHALL BE CONSTRUCTED TRUE TO THE SPECIFIED DIMENSIONS, SHALL BE FREE FROM KINKS, TWISTS OR BENDS, AND SHALL BE UNIFORM IN APPEARANCE. THE COMPLETED STRUCTURES SHALL BE ASSEMBLED IN THE SHOP AND SHALL BE CHECKED FOR STRAIGHTNESS, ALIGNMENT, AND DIMENSIONAL ACCURACY. ANY VARIATIONS SHALL BE CORRECTED TO THE SATISFICATION OF THE ENGINEER.

3. MAST ARMS SHALL BE TEMORARILY SUPPORTED TO TAKE ALL LOAD OFF THE FIELD SPLICES WHILE BOLTS ARE BEING TIGHTENED IN ORDER TO FASTEN THE FLANGE PLATES.

4. POSTS FOR TUBULAR SIGN STRUCTURES SHALL BE TURNED TO THE RADIUS SHOWN ON THE PLANS BY HEAT TREATMENT OR BY FABRICATION TO SUCH RADII BY METHODS WHICH WILL NOT CRIMP OR BUCKLE THE INTERIOR RADIUS OF THE PIPE BEND.

5. CLIPS, EYES, OR REMOVABLE BRACKETS SHALL BE AFFIXED TO ALL POSTS AND MAST ARMS AS NECESSARY TO SECURE THE SIGN DURING SHIPPING AND FOR LIFTING AND MOVING DURING ERECTION. THIS IS TO PREVENT DAMAGE TO THE FINISHED GALVANIZED OR PAINTED SURFACES. BRACKETS ON TUBULAR SIGN STRUCTURES SHALL BE REMOVED AFTER ERECTION. DETAILS OF SUCH DEVICES SHALL BE SHOWN ON THE SHOP DRAWINGS.

6. HIGH-STRENGTH BOLTED CONNECTIONS SHALL CONFORM TO THE PROVISIONS IN SECTION 509.36 OF THE STANDARD SPECIFICATIONS. ASSEMBLY OF HIGH-STRENGTH BOLTED CONNECTIONS FOR SIGN STRUCTURES MAY BE MADE WITH GALVANIZING OR PAINT ON THE CONTACT (FAYING) SURFACES.

7. ALL SIGN STRUCTURES SHALL BE FABRICATED INTO THE LARGEST PRACTICAL SECTIONS PRIOR TO GALVANIZING. SPLICE LOCATIONS SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL, AND THE CONTRACTOR SHALL NOT COMMENCE FABRICATION UNTIL SUCH SPLICE LOCATIONS ARE APPROVED.

8. ALL PIPE MEMBERS SHALL BE HOT-DIP GALVANIZED INSIDE AND OUTSIDE AFTER FABRICATION AS PER ASTM A53, UNLESS PAINTING IS CALLED FOR ON THE PLANS. PAINTING SHALL CONFORM TO SECTION 522, DUPLEX COATING SYSTEM. WALKWAY GRATING, WALKWAY BRACKETS, SAFETY RAILINGS, WALKWAY BRACKETS, SAFETY RAILINGS, ACCESS LADDER AND CAGE, STEEL MOUNTINGS FOR LIGHT FIXTURES AND ALL NUTS, BOLTS AND WASHERS FOR SIGN STRUCTURES SHALL BE GALVANIZED AFTER FABRICATION PER ASTM A53 OR ASTM A53, AS APPROPRIATE AND SHALL NOT BE PAINTED. BOLTS SHALL BE LUBRICATED PRIOR TO INSTALLATION. TENSION CONTROL BOLTS OR DIRECT TENSION INDICATING WASHERS USED IN HIGH-STRENGTH BOLTED CONNECTIONS SHALL BE MECHANICALLY GALVANIZED PER ASTM A53, GRADE 55.

9. ALL CONCRETE SHALL BE CLASS BZ WITH AIR ENTRAINMENT; REINFORCING STEEL SHALL BE GRADE 60. CAISSON CONCRETE MUST HAVE A MINIMUM COMPRESSIVE STRENGTH OF 2,700 PSI BEFORE INSTALLING THE SIGN STRUCTURE; VERIFY CONCRETE STRENGTH WITH MATURITY METER.

10. STRUCTURES SHALL BE GROUNDED IN ACCORDANCE WITH APPLICABLE ELECTRICAL CODES. SUCH DEVICES SHALL BE SHOWN ON THE SHOP DRAWINGS.

11. SHEETS IN THE INDEX MARKED WITH A • PROVIDE INSTRUCTIONS TO DESIGNERS FOR THEIR USE IN THE PREPARATION OF THE SIGN X-SECTION SHEETS IN THE ROADWAY PLANS.

12. NPS = NOMINAL PIPE SIZE; O.D. = OUTSIDE DIAMETER.
18. WELDING. DF STEEL SHALL CONFORM TO THE REQUIREMENTS OF AWS D1.1. ALL AREAS TO BE WELDED SHALL BE GROUND TO BRIGHT METAL. NO BUTT WELD SPLICES WILL BE PERMITTED. ALL WELDING AND REQUIRED TESTING SHALL BE COMPLETE BEFORE ANY MATERIAL IS GALVANIZED.

ENHANCED MAGNETIC PARTICLE TESTING SHALL BE PERFORMED ON AREAS DEFINED IN AWS D1.1 AND HEREIN. ENHANCED MAGNETIC PARTICLE TESTING SHALL BE CONDUCTED IN ACCORDANCE WITH ASTM E709. ALL AREAS TO BE WELDED SHALL MEET THE REQUIREMENTS OF ASTM E709 SECTIONS 9 AND 10. EXCEPT WHERE NON-NEGATIVE DEVELOPER MEETING ASTM E100 TYPE 5, SHALL BE APPLIED TO THE TEST SURFACE PRIOR TO TESTING.

THE YOKES SHALL BE SET IN TWO POSITIONS WHEN TESTING THE WELD OR BASE METAL. THEY SHALL BE POSITIONED BOTH NORMAL AND PARALLEL WITH RESPECT TO THE WELD AXIS AND ROLLING DIRECTION OF THE BASE METAL.

ENHANCED MAGNETIC PARTICLE TESTING SHALL BE PERFORMED AT THE FOLLOWING LOCATIONS:

I. BASE METAL; ALL AREAS CONTACTED BY THE CARBON ARC GOUGE ELECTRODE, THE ELECTRODE CUP, AND THE WELDING ELECTRODE; ALL THREE CONDITIONS ARE ARC STRIKES.

II. FILLER WELDS. EACH DESIGN WELD SIZE ON MAIN MEMBER TO MAIN MEMBER AND SECONDARY MEMBER TO MAIN MEMBER WELDMENTS. ALL STOP-STARTS AND MELD TERMINI. ALL LINEAR INDICATIONS SHALL BE FURTHER EVALUATED WITH 4X OR 20X MAGNIFICATION. VERIFICATION SHALL BE RESOLVED BY EXCAVATION.

III. GROOVE WELDS. ALL THROUGH THICKNESS EDGES ON TRANSVERSE BUTT JOINT WELDMENTS IN TENSION AREAS.

IV. REPAIRS. ALL REPAIR WELDS TO CORRECT DEFECTS IN GROOVE AND FILLER WELDS, PLATE CUT EDGES, CORRECTION OF FABRICATION ERRORS IN CUTTING, PUNCHING, DRILLING, OR FITTING, AND MEMBERS WHICH ARE TACKED OR WELDED AND SUBSEQUENTLY CUT AWAY AND REWELDED.

19. ALL CIRCUMFERENTIAL AND ALL LONGITUDINAL PIPE SEAM WELDS WITHIN 5" OF FULL PENETRATION CIRCUMFERENTIAL GROOVE WELDS SHALL BE FULL PENETRATION GROOVE WELDS AND SHALL BE INSPECTED AS SPECIFIED HEREIN. THE ACCEPTABLE MAXIMUM WELD UNDERCUT IS 0.01".

OVERHEAD SIGN X-SECTION SHEET(S) SHALL SHOW:
1. SIGN STRUCTURE LOCATION (HIGHWAY, STATION AND DIRECTION)
2. LENGTH OF STRUCTURE SPAN
3. PANEL SIZE AND LOCATION ON STRUCTURE
4. OFFSET FROM SHOULDER
5. POST HEIGHT(S) FROM BOTTOM OF BASE PLATE TO MAST ARM
6. CAISSON DIAMETER AND MINIMUM EMBEDMENT
7. TOP OF CAISSON ELEVATION
8. CAISSON PAY LENGTH
9. SPOIL AND OFFSETS TO CAISSON
10. GUARDRAIL PROTECTION LIMITS
11. LANE LINE LOCATIONS
12. AS CONSTRUCTED BLOCK
13. PHOTOELECTRIC CELL LOCATION IF REQUIRED

OVERHEAD SIGN X-SECTION SHEET(S) SHALL SHOW:
1. SIGN STRUCTURE LOCATION (HIGHWAY, STATION AND DIRECTION)
2. LENGTH OF STRUCTURE SPAN
3. PANEL SIZE AND LOCATION ON STRUCTURE
4. OFFSET FROM SHOULDER
5. POST HEIGHT(S) FROM BOTTOM OF BASE PLATE TO MAST ARM
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9. SPOIL AND OFFSETS TO CAISSON
10. GUARDRAIL PROTECTION LIMITS
11. LANE LINE LOCATIONS
12. AS CONSTRUCTED BLOCK
13. PHOTOELECTRIC CELL LOCATION IF REQUIRED

DESIGN DATA

SPECIFICATIONS:

DESIGN "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS" AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO ADOPTE).


SUBSECTION 17.4, SIGNS, IN THE 2012 AASHTO BRIDGE MANUAL.

CONSTRUCTION: COST STANDARD SPECIFICATIONS, THESE STANDARD SHEETS AND THE PROJECT PLAN.

WIND LOADING: 80, 90 OR 100 MPH VELOCITY AS PER THE SELECTION TABLES.
CANTILEVER NOTES

1. The maximum sign panel overlap onto elbow shall not exceed 6'-0" from the field splice.

2. All posts between base plate and field splice shall have a tube wall thickness of 3/8". All mast arms shall have a tube wall thickness of 1/2".

3. See sheet 7 for field splice details.

PIPE POST

<table>
<thead>
<tr>
<th>PIPE OD (IN)</th>
<th>&quot;B&quot; (FT)</th>
</tr>
</thead>
<tbody>
<tr>
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<td>20</td>
<td>8</td>
</tr>
<tr>
<td>24</td>
<td>10</td>
</tr>
</tbody>
</table>
**NOTES**

1. The maximum sign panel overlap onto elbow shall not exceed 6'-0" from the field splice.

2. All posts between base plate and field splice shall have a tube wall thickness of 1/4". All mast arms shall have a tube wall thickness of 1/8".

3. Before any portion of the sign frames are assembled in their final positions, the contractor shall demonstrate to the Engineer by preassembly or other approved methods that the span lengths of the frames in the no load condition match within 1/2" of the field measured span lengths between foundations.

4. If the sign frames are erected as one unit, they shall be adequately supported to avoid distortions or changes in span length between base plates.

5. For mast arms with lengths between 40'-0" and 80'-0" a bolted field splice will be permitted at 1/4 of the arm to facilitate galvanizing and hauling operations for mast arms with lengths greater than 80'-0", two bolted field splices will be permitted at the 1/4 points to facilitate galvanizing and hauling operations.

6. See Sheet 7 for field splice details.

---

**SIGN BRIDGE INSTALLATION DETAILS**

**PIPE POST**

<table>
<thead>
<tr>
<th>PIPE OD (IN)</th>
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<th>6&quot;</th>
<th>TYPE</th>
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<td>CAI</td>
</tr>
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<td>CAI</td>
</tr>
<tr>
<td>24</td>
<td>12</td>
<td></td>
<td>CAI</td>
</tr>
</tbody>
</table>

**CAMBER**

Type | 1/2" | 1/4" | 1/8"
-----|------|------|------
A    | 5/4" | 2  " |      
B    | 3/4" | 3/8" |      
C    | 2/4" | 4/8" |      
D    | 1/4" | 5/8" |      
E    | 1/8" |      |      

**CAMBER DIAGRAM**

**PIPE POST**

<table>
<thead>
<tr>
<th>POST SPLIT DETAILS</th>
</tr>
</thead>
<tbody>
<tr>
<td>POST SPLIT DETAILS</td>
</tr>
<tr>
<td>POST SPLIT DETAILS</td>
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<td>POST SPLIT DETAILS</td>
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<tr>
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</tr>
</tbody>
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**Traffic & Safety Engineering**

2800 W. Howard Pl.
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**Traffic & Safety Engineering Branch**

July 31, 2019

**Issued By: Traffic & Safety Engineering Branch**

July 31, 2019

**Project Sheet Number:**

0000

**STANDARD PLAN NO.**

S-614-50

**MONOTUBE STRUCTURES**

Standard Sheet No. 4 of 12

**STATICAL SIGN**

---

**CAD View:** MicroStation V8

Scale: Not to Scale

Unleashed...
Lu

SIGN PANEL SHALL BE SHEET ALUMINUM MOUNTED SIGN PANEL. ALL DETAILS SHALL BE MADE USING ITEM 64, SIGN PANEL (CLASS III).

EXIT PANEL (INCLUDE WHEN SHOWN IN PROJECT PLANS)

WT 4 x 20
PL 1/4" CUT TO FIT PIPE CURVATURE. TOTAL 4 PER BRACKET ASSEMBLY.

DRILL AND TAP FOR 5/8" NPS SHORT NIPPLE AND PLUG WITH RECESSED PIPE PUG LOCATE AT MOUNTING BRACKET CLOSEST TO ELECTRIC SERVICE ON BOTTOM OF ARM.

SINGLE SIGN PANEL

WT 4 x 20
PL 1/4" CUT TO FIT PIPE CURVATURE. TOTAL 4 PER BRACKET ASSEMBLY.

PL 1/4"
PIPE WALL

MOUNTING BRACKET C 6 x 8.2

PL 1/4"

WT 4 x 20
PL 1/4" CUT TO FIT PIPE CURVATURE. TOTAL 4 PER BRACKET ASSEMBLY.

PL 1/4"

MOUNTING BRACKET C 6 x 8.2

NOTE
FOR DETAILS NOT SHOWN OR NOTED SEE "SINGLE SIGN PANEL" ASSEMBLY DETAILS SHOWN APPLY TO TANGENT PORTION OF PIPE ONLY, FOR MOUNTING BRACKET ON ELBOW SEE DETAIL 2.

BACK-TO-BACK SIGN PANELS

PIPE OUTSIDE DIAMETER

DISTANCE

T1
T2

12.75
45°
16°
14
50°
18°
16
60°
20°
18
75°
22°
20
90°
24°
24
105°
28°

NOTE
FOR DETAILS NOT SHOWN OR NOTED SEE VIEW "C".

VIEW

VIEW
**NOTES:**

1. Stiffeners are to be placed at the base of all posts. See Sheet 8 for the location of stiffeners. Stiffeners are not shown elsewhere in these sheets for clarity.

2. Terminate weld 2” short of the top of the stiffener plate. At the other 3 weld terminations on these two typical welds stop the weld 2” short of the end of the plate.

**HANDHOLE AND COVER DETAILS**

- Handhole = 4 Pipe
- 1/4" Backing Ring
- 1/4" Cover Pl
- Pipe OD = 3/4"
- Direction of Traffic
- Lift Eye Detail
- Post Base Elevation
- Post or Mast Arm
- 1/4" Neoprene Gasket Cemented to Cover Pl
- 1/4" Thick Cover Pl

**STIFFENER DETAILS**

- (Typ.) 6 x 4 x 1/2 x 0'-2"
- (Typ.) 4 x 1/4" Clip (Typ.)
- Mast Arm Pipe Wall
- Stiffener Plate Not Shown

**PHOTOELECTRIC CONTROL DETAILS**

- 3/4" NPS Chase Nipple
- Drill and Tap for 3/4" NPS Chase Nipple and Plug with Reeded Pipe Plug
- Drilled and Tapped for 3/4" NPS Standard Pipe Cut to Fit Mast Arm Curvature
- E Mast Arm
- EAXIS OF SIGN
- Photoelectric Control Mounting 3/4" NPS Standard Lock Plug Receptacle
- Photoelectric Control Mounting 3/4" NPS Standard Lock Plug Receptacle
FIELD SPLICE DETAILS

1) **BOLTS** (GALVANIZED EQUALLY SPACED) BOLTS SHALL BE SEQUENTIALLY TIGHTENED. ASSUMING 12 BOLTS AND A CLOCK FACE, THE TIGHTENING SEQUENCE WOULD BE 12, 6, 1, 7, ETC. THIS PROCESS SHALL BE CONTINUED UNTIL NO LOOSE BOLTS ARE FOUND AFTER ALL BOLTS HAVE BEEN INITIALLY TIGHTENED. SEE THE FIELD SPLICE TABLE FOR OTHER DETAILS.

FIELD SPLICE DETAILS

**PL ID** = PIPE ID-(TYP.)

**PL THICKNESS**

**BAR 3/8 ID**

**HOLE**

**PL THICKNESS**

**MAST ARM**

**ELBOW**

**HANDHELD**

**2'-0"**

**1'/4" BACKING RING. FOR WELDING DETAILS NOT SHOWN SEE SHEET 6.**

**SECTION A**

**VIEW**

**FIELD SPLICE DETAILS**

STIFFENERS SHALL BE LOCATED ON BOTH SIDES OF THE FIELD SPLICE. CLIP WASHERS AS NEEDED TO AVOID INTERFERENCE WITH STIFFENER WELDS.

### FIELD SPLICE TABLE

<table>
<thead>
<tr>
<th>PIPE DIAMETER (IN.)</th>
<th>PL ID (IN.)</th>
<th>DC THICKNESS (IN.)</th>
<th># OF STIFF.</th>
<th># OF BOLTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.75</td>
<td>1'/4</td>
<td>16</td>
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<td>16</td>
<td>1'/4</td>
<td>21</td>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td>18</td>
<td>1'/4</td>
<td>23</td>
<td>10</td>
<td>22</td>
</tr>
<tr>
<td>20</td>
<td>1'/4</td>
<td>25</td>
<td>10</td>
<td>24</td>
</tr>
<tr>
<td>24</td>
<td>1'/4</td>
<td>29</td>
<td>12</td>
<td>28</td>
</tr>
</tbody>
</table>

* Minimum thickness after machining as called for in Note 4.

### NOTES:

1. **STIFFENERS** ARE TO BE PLACED ON ALL FIELD SPLICES. STIFFENERS ARE NOT SHOWN ELSEWHERE IN THESE SHEETS FOR CLARITY.
2. TERMINATE WELD 1/4" SHORT OF THE TOP OF THE STIFFENER PLATE. AT THE OTHER 3 WELD TERMINATIONS ON THESE TWO TYPICAL WELDS, STOP THE WELD 1/4" SHORT OF THE END OF THE PLATE.
3. SPLICE DESIGN BASED ON ARM CAPACITY.
4. THE MACHINED SURFACES OF THE FLANGE SPLICE PLATES SHALL BE MACHINED TO A COMMON PLANE WITHIN A TOLERANCE OF 1/16" USING A PORTABLE FLANGE FACER AFTER WELDING AND PRIOR TO GALVANIZING.
**BASE PLATE/ANCHOR BOLT DETAILS**

### BASE PLATE DETAILS FOR SIGN BRIDGES

- **Pipe OD (in.)**
  - 12.75
  - 14
  - 16
  - 18
  - 20
  - 24

- **Bolt Circle (in.)**
  - 27
  - 29
  - 31
  - 33
  - 35

- **# of Anchor Bolts**
  - 4

### BASE PLATE DETAILS FOR CANTILEVERS

- **Pipe OD (in.)**
  - 12.75
  - 14
  - 16
  - 18
  - 20
  - 24

- **Bolt Circle (in.)**
  - 27
  - 29
  - 31
  - 33
  - 35

- **# of Anchor Bolts**
  - 4

### Notes

1. **Thread Upper 10" and Galvanize Upper 7-3/4" of the Anchor Bolts.**

2. **Anchor Bolts shall be set with a steel template until the concrete has cured at least two days.**

3. **There shall be no grout pad installed on top of the existing foundations.**

4. **The Anchor Bolts shall be tightened using the turn-of-nut method. The bolts shall first be tightened to snug tight, which is defined as the tightness that exists when the upper and lower nuts are in firm contact with the base plate. With the mast arm free to deflect, the upper and lower nuts shall each then be rotated an additional 1/2 turn (30° ± 5°) using a slugging wrench.**

5. **Stiffeners are not shown elsewhere in these sheets for clarity. All post bases are to have stiffeners.**

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- **Units:** English

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- **Date:** July 31, 2019

**Static Sign Monotube Structures**

- **Standard Plan No.:** S-614-50
- **Standard Sheet No.:** 8 of 12
- **Project Sheet Number:** 0000
**SIGN LIGHTING DETAILS**

**LIGHTING NOTES**

1. FIXTURES SHALL BE WATERPROOF, DUSTPROOF AND DESIGNED FOR EASE OF LAMP AND BALLAST REPLACEMENT.

2. WHEN LIGHTS ARE REQUIRED, LAMP SHALL BE OF HIGH PRESSURE SODIUM TYPE (85 WATT OR 250 WATT AS DIRECTED BY THE ENGINEER). LAMPS AND BALLASTS SHALL BE DESIGNED TO OPERATE OVER AN AMBIENT TEMPERATURE RANGE OF -20°F TO +120°F.

3. BALLASTS SHALL BE OF THE MAGNETIC REGULATOR TYPE SPECIFICALLY MANUFACTURED FOR USE WITH HIGH PRESSURE SODIUM LAMPS, AND SHALL OPERATE AT A MINIMUM OF 90% POWER FACTOR. OPERATION SHALL BE SUITABLE WITH A LINE VOLTAGE VARIATION OF ±10%.

4. THE TYPE, NUMBER AND SPACING OF FIXTURES SHALL BE PER MANUFACTURER'S SPECIFICATIONS TO MAINTAIN A MAXIMUM INITIAL ILLUMINATION OF THE SIGN FACE OF 30 FOOTCANDLES TO 60 FOOTCANDLES WITH A MAXIMUM UNIFORMITY RATIO (MAXIMUM ILLUMINATION / MINIMUM ILLUMINATION) OF 5:1.

5. FIXTURE AND MOUNTING DETAILS WILL BE SUBJECT TO APPROVAL BY THE ENGINEER.

6. DRILL AND TAP 1/2" NPS CHASE NIPPLES AND PLUG WITH RECESSED PIPE PLUGS. PLACE PERPENDICULAR TO SIGN PANEL AXIS AND AWAY FROM APPROACHING TRAFFIC.

---

**MONOTUBE STRUCTURES**

**STATIC SIGN MONOTUBE STRUCTURES**

**STANDARD PLAN NO.**

S-614-50

**Standard Sheet No.** 9 of 12

**Issued By:** Traffic & Safety Engineering Branch July 31, 2019

**Project Sheet Number:**

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**Units:** English

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**Colorado Department of Transportation**

2829 W. Howard Pl.

Denver, CO 80204

Phone: 303-757-0436

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Traffic & Safety Engineering

MKB
**CANTILEVER SIGN PIPE SELECTION TABLES**

**Typical Vertical Post Cantilever**

**Pipe Selection Procedure for Vertical Post Cantilevers**

A. Coverage Percentage = Sign Panel Length for the Span / (Main Panel + Exit Panel + Exit Panel Width). The Coverage Percentage chosen should be high enough to include any sign panels which may potentially be placed on this sign in the future.

B. Pick the pipe outside diameter (OD) from the 0-50% or the 51-80% chart. The coverage percentage chosen should be high enough to include any sign panels which may potentially be placed on this sign in the future.

C. To determine OD for the selection charts, add the area of the exit panel, if present, to the total area of the exit panel and divide by the main panel length to obtain OD.

D. If no pipe is shown for a certain span, this indicates that this span exit panel/height combination exceeds the limits of this standard.

E. On the overhead sign x-section sheet, indicate the diameter of the pipe, the height H and the span SPAN.

F. Obtain the design wind speed from the overhead sign x-section sheets in the roadway plans.

### Pipe Selection Tables

#### Wind Speeds

- 90 MPH
- 80 MPH
- 100 MPH

#### Charts

- 10"
- 12"
- 14"

<table>
<thead>
<tr>
<th>SPAN (FT.)</th>
<th>90 MPH</th>
<th>80 MPH</th>
<th>100 MPH</th>
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<td>45</td>
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</table>

### Procedure to Determine the Design Wind Speed

1. Use the 90 MPH wind speed for locations within 4 miles of either side of the base of the foothills along the front range of the eastern slope.

2. Use the 100 MPH wind speed for locations in Boulder County.

3. If there are questions concerning the proper design wind speed contact the staff of the bridge branch.
TYPICAL VERTICAL POST SIGN BRIDGE

STRUCTURE SELECTION PROCEDURE FOR SIGN BRIDGES

A. DESIGN IS BASED ON A SIGN HEIGHT OF 15' WITH 50% OF THE SPAN LENGTH COVERED UP UNTIL THE CAPACITY OF THE LARGEST POLE SHOWN IS REACHED. BEYOND THIS POINT THE COVERAGE PERCENTAGE DECREASES.

B. THE MAXIMUM PRIMARY PANEL HEIGHT IS 14'. ADD THE AREA OF ALL EXIT PANELS TO THE AREA OF ALL PRIMARY PANELS TO CHECK AGAINST MAXIMUM SIGN PANEL AREA.

C. OBTAIN THE DESIGN WIND SPEED FROM THE OVERHEAD SIGN X-SECTION SHEETS IN THE ROADWAY PLANS.

D. PICK PIPE DIAMETER AND SPLIT SIZE FROM THE APPROPRIATE CHART. INCLUDE THE AREA OF ALL SIGN PANELS SHOWN IN THE OVERHEAD SIGN X-SECTION SHEETS WHICH MAY POTENTIALLY BE PLACED ON THE SIGN IN THE FUTURE.

E. IF NO PIPE POST/ARM SIZE IS SHOWN FOR A CERTAIN SPAN THIS INDICATES THAT THIS SPAN/SIGN PANEL/HEIGHT COMBINATION EXCEEDS THE LIMITS OF THIS STANDARD.

F. THE OVERHEAD SIGN X-SECTION SHEETS INDICATE THE HEIGHT "H", THE SPAN AND THE SIGN PANEL SIZES.

PROCEDURE TO DETERMINE THE DESIGN WIND SPEED

80 MPH IS THE STANDARD DESIGN WIND SPEED FOR THE STATE OF COLORADO. THE STANDARD DESIGN WIND SPEED OF 80 MPH IS TO BE USED AT ALL LOCATIONS EXCEPT THE FOLLOWING:

1. USE THE 90 MPH WIND SPEED FOR LOCATIONS WITHIN 4 MILES OF EITHER SIDE OF THE BASE OF THE FOOTHILLS ALONG THE FRONT RANGE OF THE EASTERN SLOPE.

2. USE THE 100 MPH WIND SPEED FOR LOCATIONS IN BOLUER COUNTY.

IF THERE ARE QUESTIONS CONCERNING THE PROPER DESIGN WIND SPEED CONTACT THE STAFF BRIDGE BRANCH.
CAISSON DRILLING AND INSTALLATION NOTES

1. CONTACT THE ENGINEER IF ANY OF THE FOLLOWING SOIL CONDITIONS ARE ENCOUNTERED DURING DRILLING:

   a) THE SOIL HAS A HIGH ORGANIC CONTENT OR CONSISTS OF SATURATED SILT AND CLAY.

   b) THE SITE MIGHT SUPPORT THE WEIGHT OF THE DRILLING RIG.

   c) THE FOUNDATION SOILS ARE NOT HOMOGENEOUS.

   d) FIRM BEDROCK IS ENCOUNTERED.

2. CAISSONS SHALL BE PLACED AGAINST UNDISTURBED EARTH. WET OR CAVING HOLES SHALL BE BACKFILLED WITH FLOW-FILL AND REDRILLED AFTER A THREE DAY CURING PERIOD WITHOUT THE USE OF A CASING.

3. THE FOLLOWING SOIL PARAMETERS WERE USED FOR DESIGN:

   a) LOOSE GRANULAR SOIL WITH A UNIT WEIGHT OF 100 PCF AND A 28 DEGREE ANGLE OF INTERNAL FRICTION (PHI ANGLE).

   b) SOFT COHESIVE SOIL WITH A UNIT WEIGHT OF 100 PCF AND A UNIT COHESION OF 500 PSF.


CAISSON FOUNDATION DETAILS

Roadside Shoulder Installation

Median Rail Installation

(See Roadside Shoulder Installation for Additional Information)

BRIDGES

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<tr>
<th>PIPE DIAMETER (INCHES)</th>
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<th>CAISSON DIAMETERS (INCHES)</th>
<th>CAISSON DEPTH (FEET)</th>
<th>VERTICAL REINF.</th>
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CANTILEVERS

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GENERAL NOTES
1. ALL STRUCTURAL STEEL SHALL CONFORM TO THE REQUIREMENTS SHOWN IN THE MATERIALS TABLE ON SHEET 2.
2. HIGH-STRENGTH BOLTED CONNECTIONS SHALL CONFORM TO THE PROVISIONS IN SECTION 205.28 OF THE STANDARD SPECIFICATIONS. ASSEMBLY OF HIGH-STRENGTH BOLTED CONNECTIONS FOR SIGN STRUCTURES MAY BE MADE WITH GALVANIZING OR PAINT ON THE CONTACT (FAYING) SURFACES.
3. ALL SIGN STRUCTURES SHALL BE FABRICATED INTO THE LARGEST PRACTICAL STRUCTURES PRIOR TO GALVANIZING. SPICE LOCATIONS SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL AND THE CONTRACTOR SHALL NOT COMMENCE FABRICATION UNTIL SUCH SPICE LOCATIONS ARE APPROVED.
4. ALL CONCRETE SHALL BE CLASS D1 WITH AIR ENTRAINMENT; REINFORCING STEEL SHALL BE GRADE 60. CASSON CONCRETE MUST HAVE A MINIMUM COMPRESSIVE STRENGTH OF 2,700 PSI.
5. A DISCONNECT FOR THE POWER SUPPLY TO THE DMS SHALL BE PROVIDED AS SHOWN IN THE ROADWAY PLANS.
6. STRUCTURES SHALL BE GROUND IN ACCORDANCE WITH APPLICABLE ELECTRICAL CODES.

GENERAL NOTES (CONTINUED)
7. SHEETS IN THE INDEX MARKED WITH A • PROVIDE INSTRUCTIONS FOR DESIGNERS FOR THEIR USE IN THE PREPARATION OF THE SIGN X-SECTION SHEETS IN THE ROADWAY PLANS.
8. NPS = NOMINAL PIPE SIZE; O.D. = OUTSIDE DIAMETER; DMS = DYNAMIC MESSAGE SIGN.
9. WELDING OF STEEL SHALL CONFORM TO THE REQUIREMENTS OF AWS D1.1 AND ALL AREAS TO BE WELDED ON SHEET 2. AND REQUIRED TESTING SHALL BE COMPLETE BEFORE ANY MATERIAL IS GALVANIZED.
10. CAISSONS, STEEL SUPPORTS AND SURVEY WORK SHALL BE PAID FOR IN ACCORDANCE WITH BID RED.
11. THERE SHALL BE NO PENETRATIONS OF MAST/CROSS ARMS OR POST OTHER THAN AS SHOWN ON THESE PLANS UNLESS APPROVED BY THE ENGINEER PRIOR TO FABRICATION.
12. ATTACH REMOTE ACCESS CABINET(S) TO POST WITH TWO 3/8" WIDE STAINLESS STEEL BANDS AND BE POSITIONED BOTH NORMAL AND PARALLEL WITH RESPECT TO THE WELD AXIS AND ROLLING DIRECTION.
13. BUTTERFLY POST DETAILS
14. MILLING OF STEEL SHALL CONFORM TO THE REQUIREMENTS OF AWS D1.1. ALL AREAS TO BE WELDED SHALL BE GROUND TO BRIGHT METAL. NO BUTT WELD SPACES WILL BE PERMITTED. ALL WELDING AND REQUIRED TESTING SHALL BE COMPLETE BEFORE ANY MATERIAL IS GALVANIZED.
15. ALL CIRCUMFERENTIAL AND ALL LONGITUDINAL PIPE SEAM WELDS WITHIN 5" OF FULL PENETRATION AROUND THE EDGE OF THE BASE PLATE SHALL BE FULL PENETRATION GROOVE WELDS AND SHALL BE INSPECTED AS SPECIFIED HEREIN. THE ACCEPTABLE MAXIMUM WELD UNDERCUT IS 0.01".
16. SEE TABLE ON SHEET 4 FOR CABINET ROTATION ADJUSTMENTS TO VERTICAL CLEARANCES MARKED WITH A •.

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STANDARD PLAN NO. S-614-60
Issued By: Traffic & Safety Engineering Branch July 31, 2019
Project Sheet Number: 1 of 14

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- SIGN NOTES (1 OF 2) -
CANTILEVER NOTES
1. SIGN STRUCTURES SHALL BE CONSTRUCTED TRUE TO THE SPECIFIED DIMENSIONS, SHALL BE FREE FROM KINKS, TWISTS OR BENDS, AND SHALL BE UNIFORM IN APPEARANCE. THE COMPLETED SECTIONS SHALL BE ASSEMBLED IN THE SHOP AFTER GALLVANIZING AS PER ASTM A123, UNLESS PAINTING IS CALLED FOR ON THE PLANS. PAINTING SHALL COMPLY TO SECTION 2829.4.1 OF THIS DESIGN MANUAL. MAST ARMS, SAFETY RAILINGS AND ALL NUTS, BOLTS AND WASHERS FOR SIGN STRUCTURES SHALL BE GALLVANIZED AFTER FABRICATION AS PER ASTM A53, GRADE B, ASTM A500 GRADE B, OR ASTl.i DESIGNATION: A325. INSTALL A307 BOLTS WITH COMMERCIAL QUALITY WASHERS. MECHANICALLY GALVANIZED PER ASTM 8695, COATING CLASS 55.

2. POST AND CROSS ARMS SHALL BE FABRICATED IN SINGLE SECTIONS PRIOR TO GALLVANIZING. SPlicing OF SECTIONS IS NOT PERMITTED.

3. CLIPS, EYES, OR REMOVABLE BRACKETS SHALL BE AFFIXED TO POST AND CROSS ARMS, AS NECESSARY, TO SECURE FOR SHIPPING AND FOR LIFTING AND MOVING DURING ERECTION IN ORDER TO PREVENT DAMAGE TO THE FINISHED GALLVANIZED SURFACES. TEMPORARY BRACKETS ON SIGN STRUCTURES SHALL BE REMOVED AFTER ERECTION. DETAILS OF SUCH DEVICES SHALL BE SHOWN ON THE SHOP DRAWINGS.

4. PIPE MEMBERS SHALL BE HOT-GALLVANIZED INSIDE AND OUTSIDE AFTER FABRICATION AS PER ASTM A252, UNLESS PAINTING IS CALLED FOR ON THE PLANS. PAINTING SHALL COMPLY TO SECTION 2829.4.1 OF THIS DESIGN MANUAL. ALL NUTS, BOLTS AND WASHERS FOR SIGN STRUCTURES SHALL BE GALLVANIZED AFTER FABRICATION AS PER ASTM A53, GRADE B, ASTM A500 GRADE B, OR ASTl.i DESIGNATION: A325. INSTALL A307 BOLTS WITH COMMERCIAL QUALITY WASHERS. MECHANICALLY GALVANIZED PER ASTM 8695, COATING CLASS 55.

5. POST AND CROSS ARMS SHALL BE WELDED OR SEAMLESS STEEL PIPE FOR BUTTERFLY SIGNS AND SEAMLESS FOR CANTILEVER SIGNS CONFORMING TO THE SPECIFICATIONS OF ASTM A53, GRADE B, ASTl.i DESIGNATION: A307. INSTALL A307 BOLTS WITH COMMERCIAL QUALITY WASHERS. MECHANICALLY GALVANIZED PER ASTM 8695, COATING CLASS 55.

6. WALKWAYS SHALL BE FIXED TO THE CROSS ARM WITH AERIAL POSTS OR PIERS AS SPECIFIED ON THE SIGN X-SECTION SHEETS IN THE ROADWAY PLANS.

7. CANTILEVER ARMS MARKED WITH A MUST BE LEVEL OR TILTED UPRIGHT NO MORE THAN 1° MAXIMUM AFTER INSTALLATION OF THE SIGN.

BUTTERFLY DESIGN DATA
SPECIFICATIONS:

WIND LOADING: 100 MPH VELOCITY

OVERHEAD SIGN X-SECTION SHEET(S) SHALL SHOW:
1. SIGN STRUCTURE LOCATION (HIGHWAY, STATION AND ELEVATION)
2. LENGTH OF STRUCTURE, SPAN
3. EMS SIZE (WIDTH, DEPTH, WEIGHT; TOP OF CAISSON ELEVATION, STATION AND OFFSET; OMS PANEL; LANE LINE LOCATION(S) IF STRUCTURE IS OVER TRAFFIC ACCESS;
4. SUPPORT POST HEIGHT, ANGLE & PROTECTION PLATE
5. OFFSET FROM SHOULDERS

7. ALL PIPE MEMBERS SHALL BE HOT-GALLVANIZED INSIDE AND OUTSIDE AFTER FABRICATION AS PER ASTM A252, UNLESS PAINTING IS CALLED FOR ON THE PLANS. PAINTING SHALL COMPLY TO SECTION 2829.4.1 OF THIS DESIGN MANUAL. MECHANICALLY GALVANIZED PER ASTM 8695, COATING CLASS 55.

8. PIPE POSTS AND MAST/CROSS ARMS SHALL BE WELDED OR SEAMLESS STEEL PIPE FOR BUTTERFLY SIGNS AND SEAMLESS FOR CANTILEVER SIGNS CONFORMING TO THE SPECIFICATIONS OF ASTM A53, GRADE B, ASTil.i DESIGNATION: A307. INSTALL A307 BOLTS WITH COMMERCIAL QUALITY WASHERS. MECHANICALLY GALVANIZED PER ASTM 8695, COATING CLASS 55.

9. ALL PIPE MEMBERS SHALL BE HOT-GALLVANIZED INSIDE AND OUTSIDE AFTER FABRICATION AS PER ASTM A252, UNLESS PAINTING IS CALLED FOR ON THE PLANS. PAINTING SHALL COMPLY TO SECTION 2829.4.1 OF THIS DESIGN MANUAL. MECHANICALLY GALVANIZED PER ASTM 8695, COATING CLASS 55.

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12. ALL PIPE MEMBERS SHALL BE HOT-GALLVANIZED INSIDE AND OUTSIDE AFTER FABRICATION AS PER ASTM A252, UNLESS PAINTING IS CALLED FOR ON THE PLANS. PAINTING SHALL COMPLY TO SECTION 2829.4.1 OF THIS DESIGN MANUAL. MECHANICALLY GALVANIZED PER ASTM 8695, COATING CLASS 55.

13. ALL PIPE MEMBERS SHALL BE HOT-GALLVANIZED INSIDE AND OUTSIDE AFTER FABRICATION AS PER ASTM A252, UNLESS PAINTING IS CALLED FOR ON THE PLANS. PAINTING SHALL COMPLY TO SECTION 2829.4.1 OF THIS DESIGN MANUAL. MECHANICALLY GALVANIZED PER ASTM 8695, COATING CLASS 55.
ANCHORAGE NOTES
1. AN OSHA COMPLIANT ANCHOR DEVICE SHALL BE MOUNTED TO THE OUTSTANDING LEG OF THE ANGLE AS DIRECTED BY THE ENGINEER. ANCHORAGE DEVICES SHALL NOT BE INSTALLED WHERE MINIMUM FALL PROTECTION CLEARANCE REQUIREMENTS BELOW THE SIGN ARE NOT MET. A MINIMUM UNOBSTRUCTED CLEAR DISTANCE OF 12 FEET BELOW THE SIGN CABINET IS REQUIRED FOR THIS INSTALLATION.

ANCHORAGE DEVICE ATTACHED TO OUTSTANDING LEG OF ANGLE. SEE DETAIL 1.

2. ANCHORAGE DEVICE SHALL BE MOUNTED WITH A MINIMUM OF TWO 1/2" DIAMETER STAINLESS STEEL BOLTS.

3. STAINLESS STEEL BOLTED CONNECTIONS SHALL CONFORM TO ASTM A962. STAINLESS STEEL BOLTS SHALL CONFORM TO ASTM F337, GROUP 1. STAINLESS STEEL NUTS SHALL CONFORM TO ASTM F593, GROUP 1. A HARDENED FLAT WASHER SHALL BE PROVIDED UNDER THE NUT. FLAT WASHERS SHALL BE FABRICATED FROM THE SAME MATERIAL AS THE NUTS.

4. ALUMINUM ANGLE SHALL CONFORM TO ASTM B338.

5. VERTICAL FRAME MEMBER SHALL BE A PRIMARY FRAMING COMPONENT, ADJACENT TO THE DOORWAY AND ON THE SUPPORT FACE OF THE CABINET.

OSHA COMPLIANT ANCHORAGE DETAILS

DYNAMIC SIGN MONOTUBE STRUCTURES

STANDARD PLAN NO. S-614-60
Standard Sheet No. 3 of 14

Issued By: Traffic & Safety Engineering Branch July 31, 2019

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- CANTILEVER SIGN MOUNTING BRACKETS -

DYNAMIC MESSAGE SIGN CABINET, TILTING BRACKET, AND MOUNTING BOLTS SUPPLIED BY OTHERS. BARRIER TAPE SHALL BE POLYETHYLENE PROTECTIVE TAPE (3M TYPE 8179 CLEAR, DR EQUAL). TAPE SHALL BE INSTALLED AT ANY POINT OF CONTACT BETWEEN ALUMINUM MOUNTING BRACKETS AND STEEL SIGN STRUCTURE.

SECTION A

DMS CABINET FABRICATOR SHALL FASTEN AN ALUMINUM ANGLE TO THE PRIMARY VERTICAL FRAME MEMBER ADJACENT TO THE DOOR AS SHOWN. ANGLE PLACEMENT SHALL PRESENT A BLANK VERTICAL FACE PARALLEL TO THE FRONT FACE OF THE DMS CABINET FOR FIELD MOUNTING AN OSHA COMPLIANT ANCHORAGE POINT. A MINIMUM OF TWO 3/4" DIAMETER STAINLESS STEEL BOLTS ARE REQUIRED TO FASTEN ANGLE TO FRAME AS SHOWN IN THE OSHA COMPLIANT ANCHORAGE DETAILS ON SHEET 3 OF 14.

NOTE:
DMS CABINET FABRICATOR SHALL FASTEN AN ALUMINUM ANGLE TO THE PRIMARY VERTICAL FRAME MEMBER ADJACENT TO THE DOOR AS SHOWN. ANGLE PLACEMENT SHALL PRESENT A BLANK VERTICAL FACE PARALLEL TO THE FRONT FACE OF THE DMS CABINET FOR FIELD MOUNTING AN OSHA COMPLIANT ANCHORAGE POINT. A MINIMUM OF TWO 3/4" DIAMETER STAINLESS STEEL BOLTS ARE REQUIRED TO FASTEN ANGLE TO FRAME AS SHOWN IN THE OSHA COMPLIANT ANCHORAGE DETAILS ON SHEET 3 OF 14.

SECTION B

SECTION C

DMS CABINET

DMS PRIMARY VERTICAL FRAMING MEMBER

PL PIPE WALL CURVATURE. TOTAL 4 PER BRACKET ASSEMBLY.

COPE 3/8" (TYP.)

STIFFENER PLATES

3/8" STIFFENER PLATES

SEE DETAIL 1

PL 3/8" PL SET VERTICAL AND CUT TO FIT PIPE

PL PIPE WALL CURVATURE. TOTAL 4 PER BRACKET ASSEMBLY.

MOUNTING BOLTS 5/8" ASW FAB14 ALLOY GROUP 304 STAINLESS STEEL BOLTS SPACE EVENLY AS SHOWN.

NOTE:
DMS CABINET FABRICATOR SHALL FASTEN AN ALUMINUM ANGLE TO THE PRIMARY VERTICAL FRAME MEMBER ADJACENT TO THE DOOR AS SHOWN. ANGLE PLACEMENT SHALL PRESENT A BLANK VERTICAL FACE PARALLEL TO THE FRONT FACE OF THE DMS CABINET FOR FIELD MOUNTING AN OSHA COMPLIANT ANCHORAGE POINT. A MINIMUM OF TWO 3/4" DIAMETER STAINLESS STEEL BOLTS ARE REQUIRED TO FASTEN ANGLE TO FRAME AS SHOWN IN THE OSHA COMPLIANT ANCHORAGE DETAILS ON SHEET 3 OF 14.

SECTION C

MOUNTING BRACKET ON CLEAN AND POLE

NOTE:
DMS CABINET FABRICATOR SHALL FASTEN AN ALUMINUM ANGLE TO THE PRIMARY VERTICAL FRAME MEMBER ADJACENT TO THE DOOR AS SHOWN. ANGLE PLACEMENT SHALL PRESENT A BLANK VERTICAL FACE PARALLEL TO THE FRONT FACE OF THE DMS CABINET FOR FIELD MOUNTING AN OSHA COMPLIANT ANCHORAGE POINT. A MINIMUM OF TWO 3/4" DIAMETER STAINLESS STEEL BOLTS ARE REQUIRED TO FASTEN ANGLE TO FRAME AS SHOWN IN THE OSHA COMPLIANT ANCHORAGE DETAILS ON SHEET 3 OF 14.
-CANTILEVER POST AND ARM DETAILS-

POST BASE ELEVATION
(FOR BASE PL DETAILS SEE SHEET 7)

POST & CAISSON

REMOTE ACCESS CABINET

AXIS OF ARM

DIA = PIPE OD + 1/4

1/4" COVER PL

HSS 6 x 4 x 1/2 x 0'-2" POST OR MAST ARM
1/4" NIPRENE GASKET CEMENTED TO COVER PL
1/4" THICK COVER PL

HANDHOLE

HSS 6 x 4 x 1/2 x 0'-2" PIPE WALL

HSS 6 x 4 x 1/2 x 0'-2"

HANDHOLE = E PIPE

TOP OF BASE PLATE

CAISSON

HOLE = PIPE WALL

PIPE WALL

TAPED VENT HOLE PLUGS AFTER GALVANIZING

MAST ARM END DETAIL

REMOTE ACCESS CABINET

TOP OF BASE PLATE

CONDUIT PENETRATION DETAILS

* PLUG WITH RECESSED PIPE PLUGS

* DISCONNECT CABINET FOR THE POWER SUPPLY SHALL BE LOCATED OUTSIDE OF THE CLEAR-ZONE.

STANDARD PLAN NO.
S-614-60

DYNAMIC SIGN MONOTUBE STRUCTURES

Issued By: Traffic & Safety Engineering Branch July 31, 2019

Traffic & Safety Engineering

Project Sheet Number:
FIELD SPlice

28" # BOLT CIRCLE

HORIZONTAL AXIS

* MINIMUM THICKNESS AFTER MACHINING AS CALLED FOR IN NOTE 4.

ALL BOLTS ARE 1" Ø (28 TOTAL)

PL 32º X 1/4" BACKING RING . SEE WELD DETAIL.

FIELD SPlice DETAILS

STIFFENER DETAILS

NOTES:
1. STIFFENERS ARE TO BE PLACED ON BOTH SIDES OF THE FIELD SPLICE.

2. TERMINATE WELD 1/4" SHORT OF THE TOP OF THE STIFFENER PLATE. AT THE OTHER 3 WELD TERMINATIONS ON THESE TWO TYPICAL WELDS, STOP THE WELD 1/4" SHORT OF THE END OF THE PLATE.

3. SPLICE DESIGN BASED ON ARM CAPACITY.

4. THE MATING SURFACES OF THE FLANGE SPLICE PLATES SHALL BE MACHINED TO A COMMON PLANE WITHIN A TOLERANCE OF 1/64" USING A PORTABLE FLANGE FACER AFTER WELDING AND PRIOR TO GALVANIZING.

STIFFENERS SHALL BE LOCATED ON BOTH SIDES OF THE FIELD SPLICE. CLIP WASHERS AS NEEDED TO AVOID INTERFERENCE WITH STIFFENER WELDS.

1" X 1/4" BACKING RING.

SEE WELD DETAIL.

FIELD SPlice DETAILS

STIFFENER DETAILS

1" H.S. BOLTS (GALVANIZED) EQUALLY SPACED. BOLTS SHALL BE SEQUENTIALLY TIGHTENED, ASSUMING 12 BOLTS AND A CLOCK FACE.

THE TIGHTENING SEQUENCE WOULD BE 12, 6, 1, 7, ETC. THIS PROCESS SHALL BE CONTINUED UNTIL NO LOOSE BOLTS ARE FOUND AFTER ALL BOLTS HAVE BEEN INITIALLY TIGHTENED.

THE tightening sequence would be 12, 6, 1, 7, etc. This process shall be continued until no loose bolts are found after all bolts have been initially tightened.

PL 32º = (PIPE OD-3")
-CANTILEVER BASE PLATE DETAILS-

POST BASE ELEVATION

STIFFENER DETAILS

BASE PLATE DETAILS

NOTES:
1. STIFFENERS ARE NOT SHOWN ELSEWHERE IN THESE SHEETS FOR CLARITY.
NOTES

1. MAINTAIN UNIFORM POST SPACING WHERE POSSIBLE.
2. MAXIMUM POST SPACING SHALL NOT EXCEED 6'-0".
3. SEE SHEETS 4 AND 9 FOR ADDITIONAL DETAILS NOT SHOWN HEREIN.
4. LENGTH OF BEAM SHALL BE BASED ON DMS WIDTH (W) TO PERMIT CLEARANCE BETWEEN RAILS FOR UNOBSTRUCTED OPENING OF DMS ACCESS DOOR.
   \( L_{min} = \frac{W}{2} + 7 \) INCHES.
5. SAFETY CHAIN SHALL BE 1/4'' GALVANIZED STEEL COIL CHAIN, APPROXIMATELY 36 LINKS PER YARD.
6. TOP OF HORIZONTAL W6x15 ELEVATION SHALL BE 8 1/2'' BELOW BOTTOM OF DMS CABINET WITH THE TILTING BRACKET IN THE 0° (UNROTATED) POSITION.

---

**DYNAMIC SIGN MONOTUBE STRUCTURES**

**S-614-60**

**STANDARD PLAN NO.**

**ISSUED BY:**
Traffic & Safety Engineering

**MKB**

**Issued By Traffic & Safety Engineering Branch July 31, 2019**

**STANDARD SHEET NO.**

8 of 14

**PROJECT SHEET NUMBER:**
WALKWAY DETAILS

1. WELDED TYPE GRATING SHALL HAVE 1/4" X 3/8" BEARING BARS AT 1 1/4" CENTERS WITH 1/4" DIAMETER (OR EQUAL) CROSS BARS AT 4" CENTERS. IF MECHANICAL LOCK GRATING IS USED, IT SHALL BE EQUAL IN STRENGTH TO THE WELDED TYPE. ALTERNATE HOLD-DOWN CLIPS MAY BE SUBMITTED FOR APPROVAL.

2. WALKWAY GRATING TO BE CONTINUOUS (NO SPLICES) OVER AS MANY WALKWAY BRACKETS AS PRACTICAL CONSISTENT WITH FABRICATION, EASE OF HANDLING AND ASSEMBLY.

3. ALL BOLTS SHOWN ON THIS SHEET SHALL BE ASTM A-307. THE TIGHTENING TORQUE IS 16 FT-LBS FOR 1/4" X 3/8" BOLTS AND 40 FT-LBS FOR 1/2" X 3/8" BOLTS. DO NOT OVER TIGHTEN BOLTS AT WALKWAY SADDLE ANCHOR LOCATIONS.

SAFETY RAILING ELEVATION (OUTSIDE SAFETY RAILING LOCATION - SAFETY ANGLES NOT SHOWN FOR CLARITY)

1 1/4" X Y2" SADDLE ANCHOR

1/2" # Hex head bolt with prevailing torque lock-nut

SAFETY RAILING ELEVATION (INSIDE SAFETY RAILING LOCATION - SAFETY ANGLES NOT SHOWN FOR CLARITY)

3/8" # hole in base pl and HSS beam (typ.)

8" x 3" x 6" base pl

W6x15 (typ.) and one prevailing torque lock-nut per bolt (typ.)

1/2" # hole in base pl and HSS beam (typ.)

NOTES

ALTERNATIVE VENTING METHODS MAY BE USED IF APPROVED BY THE ENGINEER.

Y2" 0 DRILL HOLES AS REQUIRED FOR GALVANIZING

1 1/4" X 1/4" HEX HEAD BOLT WITH ONE WASHER (NUT SIDE) AND ONE PREVAILING TORQUE LOCK-NUT (TYP.)

HSS 1 1/2" x 6" x 3/8"
TOP OF POST/BOTTOM OF REMOVABLE POST CAP
- DISCONNECT CABINET FOR THE POWER SUPPLY SHALL BE LOCATED OUTSIDE OF THE CLEAR-ZONE FOR NARROW MEDIAN AND ROADSIDE INSTALLATIONS. DISCONNECT CABINET MAY BE MOUNTED ON THE POLE FOR WIDE MEDIAN INSTALLATIONS.
- REMOTE ACCESS CABINET

TOP OF BASE PLATE
- CLEAR (MIN.)

DISCONNECT CABINET IN WIDE MEDIAN
- PROVIDED OSHA COMPLIANT ANCHORAGE POINT AS DIRECTED BY THE ENGINEER. SEE SHEETS 3 & 4 FOR MOUNTING INFORMATION.

OPTIONAL 2nd DMS ON MEDIAN INSTALLATION

TRALED LINE
- EDGE OF TRAVELLED WAY
- SHOULDER
- EDGE OF FIXED SHOULDER
- CLEAR (MIN.)

OPTIONAL FIELD SPLICE

GUARDRAIL PROTECTION REQUIRED PER CODE STANDARD M-606-1

ELEVATION (MEDIAN INSTALLATION)
- PROVIDE OSHA COMPLIANT ANCHORAGE POINT AS DIRECTED BY THE ENGINEER. SEE SHEETS 3 & 4 FOR MOUNTING INFORMATION.

MEDIAN INSTALLATION PLAN
- CONDUIT PENETRATION DETAILS
  - PLUG WITH RECESSED PIPE PLUGS

ROADWAY
- ROADWAY STATION AND OFFSET, SEE ROADWAY PLANS
- DYNAMIC MESSAGE SIGN SUPPORT STRUCTURE
- AXIS OF ARM
- DISCONNECT CABINET
- POST & CAISSON

ROADWAY
- ROADWAY STATION AND OFFSET, SEE ROADWAY PLANS
- DYNAMIC MESSAGE SIGN SUPPORT STRUCTURE
- AXIS OF ARM
- DISCONNECT CABINET
- POST & CAISSON

ROADWAY
- ROADWAY STATION AND OFFSET, SEE ROADWAY PLANS
- DYNAMIC MESSAGE SIGN SUPPORT STRUCTURE
- AXIS OF ARM
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ROADWAY
- ROADWAY STATION AND OFFSET, SEE ROADWAY PLANS
- DYNAMIC MESSAGE SIGN SUPPORT STRUCTURE
- AXIS OF ARM
- DISCONNECT CABINET
- POST & CAISSON

ROADWAY
- ROADWAY STATION AND OFFSET, SEE ROADWAY PLANS
- DYNAMIC MESSAGE SIGN SUPPORT STRUCTURE
- AXIS OF ARM
- DISCONNECT CABINET
- POST & CAISSON

ROADWAY
MOUNTING BRACKET SPACES 6'-0" (MAX.)

CROSS ARM COVER PLATE DETAIL

POST PIPE DATA

<table>
<thead>
<tr>
<th>PIPE D.O. (IN)</th>
<th>MIN. WALL THICKNESS (IN)</th>
<th>MAX. POST HEIGHT (FT/12&quot;)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20'-0&quot; x 8'-0&quot; x 4'-0&quot; D</td>
<td>24.0</td>
<td>0.50</td>
</tr>
<tr>
<td>18'-0&quot; x 8'-0&quot; x 4'-0&quot; D</td>
<td>16.0</td>
<td>0.375</td>
</tr>
</tbody>
</table>

CROSS ARM PIPE DATA

<table>
<thead>
<tr>
<th>PIPE D.O. (IN)</th>
<th>MIN. WALL THICKNESS (IN)</th>
<th>MAX. POST LENGTH (FT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20'-0&quot; x 8'-0&quot; x 4'-0&quot; D</td>
<td>16.0</td>
<td>0.50</td>
</tr>
<tr>
<td>18'-0&quot; x 8'-0&quot; x 4'-0&quot; D</td>
<td>12.75</td>
<td>0.375</td>
</tr>
</tbody>
</table>

POST TO POST CONNECTION

HOLE FOR CROSS ARM = CROSS ARM O.D. + ¾" W x 3'-0" (MAX.)

CROSS ARM FLANGE PLATE - PL 14" X (PIPE O.D. - ½") WITH ACCESS HOLE AND FOUR THREADED HOLES FOR COVER PLATE CAP SCREWS

COVER PLATE - PL 14" X (PIPE O.D./2 + 3") WITH ½" CAP SCREWS (TOTAL 4 PLACED AS SHOWN). PROVIDE NEOPRENE GASKET CEMENTED TO ¾" PLATE.

4 - ¾" DRILL HOLES FOR GALVANIZING. PLUG AS SHOWN. INSTALL ALUMINUM TAPERED VENT HOLE PLUGS AFTER GALVANIZING.

ACCESS HOLE - DIAMETER SHALL BE THE RADIUS OF THE CROSS ARM

NEOPRENE CASKET AFTER INSTALLATION OF CABINET (TYP.)

SILICONE SEAL AFTER INSTALLATION OF CABINET (TYP.)

SECTION

BUTTERFLY ASSEMBLY DETAILS

OPTIONAL FIELD SPLICE ARMS TO POST CONNECTION

POST PIPE

SEE SHEET 5 FOR HANDHOLE AND COVER DETAILS.

POST (PIPE)

POST O.D.

15/16" HOLE FOR 15/16" BOLT WITH WASHER & JAM NUT (TYP.)

COMPUTER FILE INFORMATION

STANDARD PLAN NO. S-614-60

DYNAMIC SIGN MONOTUBE STRUCTURES

Traffic & Safety Engineering

MKB

Issued By: Traffic & Safety Engineering Branch July 31, 2019

PROJECT SHEET NUMBER:

STANDARD SHEET NO. 11 OF 14

MKB
- BUTTERFLY SIGN MOUNTING DETAILS -

**SECTION**

**DETAILED**

1. **SECTION**
   - SEE DETAIL 2 FOR CLAMP DETAILS.

2. **SECTION**
   - SEE SHEET 4 FOR DMS CABINET MOUNTING DETAILS.

**DETAIL**

- **TYPICAL BRACKET CONNECTION**

- **SPHERICAL WASHER SET**
- **SPHERICAL COLLAR NUT, WASHER & JAM NUT**
- **7/4" X 3/8" CLAMP (MIN.)**
- **2½" THREAD LENGTH MINIMUM**
- **3/8" X 3/8" BOLT, DO NOT FULLY TORQUE THIS CONNECTION. COLLAR NUT SHALL BE SNUG TIGHT ONLY. PROJECT BOLT 3" BEYOND CLAMP. PROVIDE 5" THREAD LENGTH MINIMUM.**

**NOTES**

- **3/8" X 3/8" BOLT WITH HARDENED WASHER (TYP.)**
- **BRACKET PL 3/8" X 3/8" X 7 1/2" (TYP.)**

**DIMENSIONS**

- **PL 3/8" X 3/8" X 7 1/2" (TYP.)**
- **W 6 x 15 (TYP.)**
- **L 3 x 3 x 3/8" (TYP.)**
- **1 3/8" HOLE FOR 7/4" X 3/8" BOLT (TYP.)**

**Other Details**

- **5" # H.S. BOLT (TYP.)**
- **1 3/8" HOLE FOR 7/4" X 3/8" BOLT (TYP.)**
- **7/4" X 6" BENT PL (TYP.)**
- **7/4" X 3" BENT PL (TYP.)**
- **2" R (TYP.)**
- **2" R (TYP.)**
- **1 3/8" R (TYP.)**
- **2½" R (TYP.)**
- **2½" R (TYP.)**

**Other Notes**

- **SPHERICAL COLLAR NUT, WASHER & JAM NUT**
- **7/4" X 6" CLAMP (MIN.)**
- **2½" THREAD LENGTH MINIMUM**

**Issue**

- **DYNAMIC SIGN MONOTUBE STRUCTURES**
- **STANDARD PLAN NO. S-614-60**
- **Issued By: Traffic & Safety Engineering Branch July 31, 2019**

**Information Sheet**

- Computer File Information
- Sheet Revisions
- Colorado Department of Transportation
- Traffic & Safety Engineering
- MKB
- Computer File Information
**FOUNDATION & ANCHOR BOLT DETAILS**

**CAISSON DRILLING AND INSTALLATION NOTES**

1. Caissons shall be placed against undisturbed earth. Wet or caving holes shall be backfilled with flow-fill and redrilled after a three-day curing period without the use of a casing.

2. The design herein assumes that DMS supports are installed within the roadway prism with the following soil parameters:
   - Soil Density: 110 lb./cu. ft.
   - Soil Cohesion: 750 psi
   - Angle: 30°
   - SF: = 0.5 for flexural resistance.

3. Contact the engineer if any of the following soil conditions are encountered during drilling:
   - (A) DMS support will not be installed within the roadway prism.
   - (B) The soil has a high organic content or consists of saturated silt and clay.
   - (C) Firm bedrock is encountered.
   - (D) High groundwater is encountered.
   - (E) Large boulders are encountered.

4. The contractor shall provide a survey of the DMS foundation to verify placement. A draft survey is available in the project. The survey shall conform to the requirements of Section 6, Construction Surveying. The contractor shall submit to the engineer a copy of the survey notes detailing the foundation location and elevation and the anchor bolt locations. The elevation of the ground surrounding the foundation shall also be provided. The contractor shall compare the survey information with the project notes and reconcile any differences between them. The contractor shall submit all proposed adjustments or modifications to the engineer for approval.

**NOTES**

1. Thread upper 10" and galvanize upper 2-3" of the anchor bolts.
2. Anchor bolts shall be set with a steel template unit, the concrete has cured at least two days.
3. There shall be no grout pad installed on top of the existing foundations.
4. The anchor bolts shall be tightened using the turn-of-nut method. The bolts shall first be tightened to snug tightness, which is defined as the tightness that exists when the upper and lower nuts are in firm contact with the base plate, with the mast arm free to deflect. The upper and lower nuts shall each then be rotated an additional 1/4 turn (30° ± 5°) using a slugging wrench.

**Vertically Spaced**

**Median Rail Installation**

**Section A**

**Foundation Details**

**Caisson Foundation Details**

**Structure Type**  | **Pipe O.D. (in)**  | **Caisson Diameter (in)**  | **Caisson Depth (ft)**  | **Vertical Ref.**
--- | --- | --- | --- | ---
Cantilever | 24 | 48 | 20 | 18 - 5°
Butterfly | 24 | 48 | 21 | 18 - 5°
Butterfly | 18 | 42 | 18 | 14 - 5°

**Caisson Details**

**Cone and Concrete Barrier**

**Ground Surface**

**Concrete Barrier as shown in roadway plans**

**Foundation Anchor Bolt Details**

**Base Skirt Details**

**Notes: Use Band-It Straps to tighten skirt onto base plate prior to installing self-tapping screws.**

**Anchor Bolt Details**

**Power Conduct**

**Communications Conduct**

**Vertical Ref.**

**Roadside Shoulder Installation**

**Section B**

**Bolt Template**

**Dynamic Sign Monotube Structures**

**STANDARD PLAN NO.**

**S-614-60**

**Issued By: Traffic & Safety Engineering Branch July 31, 2019**
TYPICAL PAVEMENT MARKING AT RAILROAD CROSSING

**DETAIL A**

**TYPICAL SPEED MEASUREMENT MARKING**

- **Channelizing Lines:** White, 8" wide
- **Measurements:** 69 SQ. FT.
- **Note:** The warning sign shall be placed according to the warning sign placement table in the MUTCD (Chapter 2C, Table 2C-4). If conditions do not allow placement according to the table, it shall be as approved by the Engineer.

- **Notes:**
  1. The warning sign shall be placed according to the warning sign placement table in the MUTCD (Chapter 2C, Table 2C-4). If conditions do not allow placement according to the table, it shall be as approved by the Engineer.

**TYPICAL DOUBLE LEFT TURN MARKINGS**

**TYPICAL STOP LINE PLACEMENT**

**TYPICAL PAVEMENT MARKING AT RAILROAD CROSSING**

- **Dimensions:**
  - 20' APPROXIMATELY 15 FT. (STOP LINE SHOULD BE 8' IN ADVANCE OF ACTIVE TRAFFIC CONTROL SYSTEMS; I.E., AUTOMATIC GATES AND/OR FLASHING SIGNALS).
  - 24' LEFT TURNING POINT = THE DISTANCE FROM THE RAILROAD CROSSING MARKING TO THE NEAREST TRACK WILL VARY ACCORDING TO THE APPROACH SPEED AND THE SIGHT DISTANCE OF THE VEHICULAR TRAFFIC APPROACHING.

- **Notes:**
  - The warning sign shall be placed according to the warning sign placement table in the MUTCD (Chapter 2C, Table 2C-4). If conditions do not allow placement according to the table, it shall be as approved by the Engineer.
  - For RR symbol details, refer to "The Standard Alphabets for Highway Signs and Pavement Markings," adopted by the Federal Highway Administration.
**GENERAL NOTES**

1. THE SPACING IN THE TABLE APLIES TO LEFT & RIGHT TURN LANES.

2. **"ONLY" MARKING IS OPTIONAL CONTACT REGION TRAFFIC ENGINEER FOR DIRECTION.

3. WHEN ONE (1) ARROW IS USED, IT SHALL BE PLACED AT THE BEGINNING OF THE FULL WIDTH TURN LANE, OTHERWISE USE THE TABLE BELOW FOR ARROW PLACEMENT.

<table>
<thead>
<tr>
<th>LENGTH (L)</th>
<th>LEFT AND RIGHT TURN ARROW</th>
<th>NO. OF ARROWS PER LANE</th>
<th>SPACING (S)</th>
<th>NO. OF &quot;ONLY&quot; PER LANE</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 200'</td>
<td></td>
<td>NA</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>200' - 350'</td>
<td></td>
<td>1</td>
<td>EVENLY SPACED</td>
<td>1</td>
</tr>
<tr>
<td>350' - 650'</td>
<td></td>
<td>2</td>
<td>BETWEEN</td>
<td>2</td>
</tr>
<tr>
<td>650' - 950'</td>
<td></td>
<td>3</td>
<td>150'-300'</td>
<td>3</td>
</tr>
<tr>
<td>≥ 950'</td>
<td></td>
<td>4</td>
<td>150'-300'</td>
<td>4</td>
</tr>
</tbody>
</table>

* All lengths and # (space) provided in the table above will help determine the number of arrows and only markings needed per lane.

**LEGEND**

Direction of Travel

**ARROW PLACEMENTS AT INTERSECTIONS**
FULL WIDTH ACCESS ZONE

TRANSITION TAPER ___ 800' Minimum ___

ENTRANCE TAPER

LANE LINES
WHITE, 4" WIDE

WHITE, 8" WIDE

DOTTED LINES

VARIES
20'-30'

YELLOW, 4" WIDE EDGE LINES

See detail A

WHITE LINE, 8" WIDE

GENERAL NOTES

1. For transition taper use 25:1 ratio.
2. For access zone entrance taper length use:
   \[ L = S \times W \]
   \[ L = \text{MINIMUM LENGTH OF TAPER} \]
   \[ S = \text{DESIGN SPEED FOR NEW CONSTRUCTION OR NUMERICAL VALUE OF THE POSTED SPEED LIMIT} \]
   \[ W = \text{WIDTH TRANSITIONED} \]
3. If buffer space is wider than 4 feet, chevron markings are required (See MUTCD Section 38.24 and figure 3D.2(A)).
4. For contiguous preferential lane marking where enter/exit movements are prohibited see MUTCD Section 3D.02 and figure 3D-3.
5. For each section prohibiting entering and exiting movements, an EXPRESS ONLY marking should be placed within 50 feet of the start of the express lane.
6. EXPRESS ONLY markings should supplement the signs.

TOLL EXPRESS LANE PAVEMENT MARKINGS

WHITE LINE, 8" WIDE

WHITE LINE, 8" WIDE

24'

Detail A

Detail B

Traffic & Safety Engineering

MKB

Issued By Traffic & Safety Engineering Branch July 31, 2019

Project Sheet Number: DS-627-1

Standard Sheet No. 7 of 9

STANDARD PLAN NO.
TYPICAL APPROACH EDGE TAPERING VIEW

TYPICAL APPROACH EDGE TAPERING PROFILE VIEW

AREA = 16.1 SQ.FT.  AREA = 27.5 SQ.FT.

AREA = 12.1 SQ.FT.  AREA = 39.8 SQ.FT.

AREA = 58 SQ.FT.

STROKE = 8"  2-LANE SCHOOL

PAVEMENT MARKING WORDS AND SYMBOLS

WORD AND SYMBOL NOTES
1. If height is increased or decreased, then all measurements change proportionately; e.g., if measurement for stop is reduced to 4 ft. from 8 ft., then square feet is reduced by 50% (0.50 x 23.0 = 11.5).

2. Pavement word and symbols markings, transverse and longitudinal, directional, pedestrian, and stop lines will be paid for in square feet using their specific bid item.

3. Letter spacing shall be 8 in, except for "Letters" which are 1 in.

4. Use the marking word "bike" if 6 ft. to 8 ft. bike lanes are installed.

TAPERING NOTES
1. All pavement marking approach edges from the vehicle direction of travel shall be tapered using a putty knife or similar tool.

DESIGNATED PAYMENT AREAS
For the following L, W, and H dimensions pay:

<table>
<thead>
<tr>
<th>Designation</th>
<th>AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIKE - 5.5 SQ.FT.</td>
<td></td>
</tr>
<tr>
<td>LANE - 6.0 SQ.FT.</td>
<td></td>
</tr>
<tr>
<td>ONLY - 6.0 SQ.FT.</td>
<td></td>
</tr>
<tr>
<td>XING - 5.0 SQ.FT.</td>
<td></td>
</tr>
<tr>
<td>STOP - 23.0 SQ.FT.</td>
<td></td>
</tr>
<tr>
<td>ONLY - 22.5 SQ.FT.</td>
<td></td>
</tr>
<tr>
<td>AHEAD - 29.0 SQ.FT.</td>
<td></td>
</tr>
<tr>
<td>BIKE - 21.0 SQ.FT.</td>
<td></td>
</tr>
<tr>
<td>BUS - 18.5 SQ.FT.</td>
<td></td>
</tr>
<tr>
<td>HWY - 16.5 SQ.FT.</td>
<td></td>
</tr>
<tr>
<td>SCHOOL (1) - 33.0 SQ.FT.</td>
<td></td>
</tr>
<tr>
<td>SCHOOL (2) - 85.0 SQ.FT.</td>
<td></td>
</tr>
<tr>
<td>NORTH - 30.6 SQ.FT.</td>
<td></td>
</tr>
<tr>
<td>EAST - 22.1 SQ.FT.</td>
<td></td>
</tr>
<tr>
<td>X with RR - 69 SQ.FT.</td>
<td></td>
</tr>
<tr>
<td>YIELD - 23 SQ.FT.</td>
<td></td>
</tr>
<tr>
<td>EXPRESS - 41 SQ.FT.</td>
<td></td>
</tr>
</tbody>
</table>

TYPICAL LETTER MEASUREMENTS

H = 4" WORDS
BIKE - 5.5 SQ.FT.  LANE - 6.0 SQ.FT.  XING - 5.0 SQ.FT.
STOP - 23.0 SQ.FT.  LANE - 22.5 SQ.FT.  AHEAD - 29.0 SQ.FT.
XING - 20.0 SQ.FT.  BIKE - 18.5 SQ.FT.  BUS - 18.5 SQ.FT.

H = 8" WORDS
STOP - 23.0 SQ.FT.  LANE - 22.5 SQ.FT.  XING - 22.0 SQ.FT.
AHEAD - 29.0 SQ.FT.  BIKE - 21.0 SQ.FT.  BUS - 18.5 SQ.FT.
XING - 23.0 SQ.FT.  PED - 17.5 SQ.FT.  SOUTH - 28.5 SQ.FT.
X with RR - 69 SQ.FT.  EXPRESS - 41 SQ.FT.  WEST - 23.5 SQ.FT.

TYPICAL LETTER MEASUREMENTS

H = 4"  W = 8"  S = 6"

H = 8"  W = 11.5"  S = 8.5"

H = 11"  W = 14.5"  S = 11"

H = 14"  W = 17.5"  S = 14"

PAVEMENT MARKINGS

Colorado Department of Transportation
2929 W. Howard Pl.
Denver, CO 80204.
Phone: 303-757-9436
Fax: 303-757-9219
Traffic & Safety Engineering

STANDARD PLAN NO.
S-627-1

Project Sheet Number:

Standard Sheet No. 8 of 9

Traffic & Safety Engineering

MKB

Issued By Traffic & Safety Engineering Branch July 31, 2019
ELONGATED INTERSTATE ROUTE SHIELDS

DESIGNATED PAYMENT AREAS
FOR THE FOLLOWING ROUTE SHIELDS & CARDINAL DIRECTIONS DIMENSIONS PAY:

INTERSTATE
6' X 15' - 75 SQ.FT.
8' X 20' - 128 SQ.FT.

COLORADO STATE
6' X 15' - 90 SQ.FT.
8' X 20' - 160 SQ.FT.

US HIGHWAYS
7' X 16' - 112 SQ.FT.
9' X 21' - 189 SQ.FT.

CARDINAL
8' X 10' - 80 SQ.FT.
9' X 10' - 90 SQ.FT.

ELONGATED COLORADO STATE ROUTE SHIELDS

CARDINAL DIRECTIONS
(White Lettering on Blue Background)

CARDINAL DIRECTIONS
(Black Lettering on White Background with Black Border)

ELONGATED US HIGHWAY ROUTE SHIELDS

GENERAL NOTES
1. DIMENSIONS
ELONGATED ROUTE SHIELDS SHALL BE AT LEAST 8' x 20' WHEN USED ON HIGH SPEED ROADWAYS (55 MPH OR MORE).
PER FIGURE 3B-25 OF THE 2009 MUTCD ELONGATED ROUTE SHIELD COLORS SHALL CONFORM WITH THE STANDARD HIGHWAY SIGNS AND MARKINGS BOOK.

2. CARDINAL DIRECTIONS
USE CARDINAL DIRECTIONS WITH WHITE ON BLUE WHEN USING INTERSTATE ROUTE SHIELDS
USE CARDINAL DIRECTIONS WITH BLACK ON WHITE WHEN USING EITHER COLORADO OR US HIGHWAY ROUTE SHIELDS.
CARDINAL DIRECTION MARKING WORD SYMBOL FROM PAGE 7 OF 8 MAY BE USED INSTEAD OF PLAQUE.

ELONGATED ROUTE SHIELDS & CARDINAL DIRECTION MARKINGS

Computer File Information
Sheet Revisions
Creation Date: 02/08/17
Created By: MBhat
Last Modification Date:
Last Modified By:
CAD Version: MicroStation VB
Scale: Not to Scale
Units: English

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Safety & Traffic Engineering
MKB

PAVEMENT MARKINGS

STANDARD PLAN NO.
S-627-1

Project Sheet Number:

Issued By: Traffic & Safety Engineering Branch July 31, 2019
Standard Sheet No. 9 of 9
GENERAL NOTES

I. ALL CONSTRUCTION ZONE TRAFFIC CONTROL DEVICES, INCLUDING BUT NOT LIMITED TO

18. FOR DETAILS ON BARRICADES, CONCRETE BARRIER (TEMPORARY), VERTICAL PANELS, AND

DEVICES, SHALL BE FURNISHED, INSTALLED, MAINTAINED (INCLUDING WASHING), REPLACED

IF DAMAGED, REMOVED WHEN TEMPORARILY NOT IN USE AND RETURNED WHEN REQUIRED,

RESUBMITTED AS NECESSARY DURING THE PROGRESS OF CONSTRUCTION, AND REMOVED ENTIRELY

WHEN THE PROJECT IS COMPLETED. ALL DEVICES SHALL MEET THE REQUIREMENTS OF THE LATEST

EDITION OF THE ATSSA “QUALITY GUIDELINES FOR TEMPORARY TRAFFIC CONTROL

DEVICES & FEATURES”.

II. WORK ON THE PROJECT MAY NOT BE STARTED UNTIL ALL REQUIRED TRAFFIC CONTROL

DEVICES ARE IN PLACE, AND APPROVED BY THE ENGINEER.

3. WHEN SPEED LIMIT REDUCTION IS REQUIRED, SUCH REDUCTION SHALL BE IN ACCORDANCE

WITH THE APPLICABLE STANDARD PLAN “TYPICAL GROUND SIGN PLACEMENT” UNLESS OTHERWISE

APPLICABLE, BUT LAYING THE SIGN PANEL DOWN IN A HORIZONTAL

POSITION IS NOT PERMITTED.

4. ANY TRAFFIC CONTROL DEVICE THAT IS DAMAGED, WEATHERED, WORN, OR OTHERWISE DEEMED

UNACCEPTABLE BY THE ENGINEER, SHALL BE REPLACED.

6. CONSTRUCTION TRAFFIC SIGNS SHALL BE MEASURED BY THE FOLLOWING SIZES AND DESCRIPTIONS:

A. SIGN PANEL SIZE A

- 0.01 TD 9.00 SQ. FT. (INCLUDING TYPE I AND TYPE 2

BARRIACDES).

- 0.01 TD 9.00 SQ. FT.

B. SIGN PANEL SIZE B

- 36 INCHES WHEN THEY ARE USED ON

ROADWAY, USE THE ARROW BOARDS ONLY IN THE CAUTION MODE .

- 36 INCHES WHEN THEY ARE USED ON

HIGHWAYS (55 MPH OR MORE) .

- 36 INCHES WHEN THEY ARE USED ON

ROADWAYS (45 MPH OR MORE) WITH AN ADT OF 6,000 OR MORE.

- 36 INCHES WHEN THEY ARE USED ON

ROADWAYS (30 MPH OR LESS) WITH AN ADT OF 3,000 OR LESS.

- 36 INCHES WHEN THEY ARE USED ON

ROADWAYS (25 MPH OR LESS) WITH AN ADT OF 2,000 OR LESS.
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**Computer File Information**

Creation Date: 07/04/12
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Last Modification Date: 05/19/16
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**Sheet Revisions**

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**Colorado Department of Transportation**

Traffic & Safety Engineering

2829 W. Howard Pl.
Denver, CO 80204
Phone: 303-757-9436
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**TRAFFIC CONTROLS FOR HIGHWAY CONSTRUCTION**

MKB

**STANDARD PLAN NO.**

S-630-1

**Standard Sheet No. 2 of 24**

**Issued By:** Traffic & Safety Engineering Branch July 31, 2019

**Project Sheet Number:**
**Advance Sequence**

**Typical 2-Way Zone Stripping**

- **Channelizing Device:** For type of device to be used, see schedule of traffic control devices included in the plans. Drums or vertical panels shall be used to delineate the lane closure taper.

- **Type III Barricade**

- **Concrete Barrier (Temporary)**

- **Flagger**

- **Direction of Travel**

- **Work Area**

**Channelization Device (Fixed)**

- **Typical 2-Way Zone Stripping**

- **Speed Limit**

- **Advance Warning Flashing or Sequencing Arrow Panel**

- **Impact Attenuator (Temporary)**

- **Channelizing Device (Fixed)**

**Temporary Solid White 4" Edge Line**

**Temporary Solid Yellow 4" Edge Line**

**Case No. 1**

**Typical Application**

**Closure of One Roadway 4-Lane Divided Highway**

**Legend**

- Channelizing device for type of device to be used, see schedule of traffic control devices included in the plans. Drums or vertical panels shall be used to delineate the lane closure taper.

- Type III Barricade

- Concrete barrier (temporary)

- Flagger

- Direction of travel

- Work area

**Typical 2-Way Zone Stripping**

- These devices are optional, if the posted speed limit in the work zone is reduced.

- These items are not required when continuous concrete barrier is used for channelization.

- See general note 16 on sheet 1.

- G20-11 sign is required if section 626 "Public Information Services" project special provision worksheet specification is required with project.

- See fines double signing notes on sheet 12.

**Impact Attenuator as Detailed on the Plans**

**Flash beacon**

**Temporary Solid White 4" Edge Line**

**Temporary Solid Yellow 4" Edge Line**

**Computer File Information**

- Creation Date: 07/04/12
- Created By: Royal
- Last Modification Date: 07/31/19
- Created By Modified By: Roybal
- CAD Version: MicroStation V8, AutoCAD 2010
- Scale: Not to Scale
- Units: English

**TRAFFIC CONTROLS FOR HIGHWAY CONSTRUCTION**

- **Issued By:** Traffic & Safety Engineering Branch
- **July 31, 2019**

**STANDARD PLAN NO.**

- S-630-1

**STANDARD SHEET NO.**

- 3 of 24

**Traffic & Safety Engineering**

- MKB
CASE NO. 4  
TYPICAL APPLICATION  
ROAD CLOSURE, BYPASS DETOUR PROVIDED

CASE NO. 5  
TYPICAL APPLICATION  
LANE #1 CLOSURE, MULTI-LANE FREEWAY

LEGEND

- CHANNELIZING DEVICES FOR TYPE OF DEVICE TO BE USED, SEE SCHEDULE OF TRAFFIC CONTROL DEVICES INCLUDED IN THE PLANS, DRUMS OR VERTICAL PANELS SHALL BE USED TO DELINEATE THE LANE CLOSURE TAPER.

- TYPE III BARRICADE
- CONCRETE BARRIER (TEMPORARY)
- FLAGGER
- DIRECTION OF TRAVEL
- WORK AREA

L TRANSITION TAPER LENGTH  
L = MINIMUM LENGTH OF TAPER  
SPEED 45 MPH OR MORE: L = S x W  
SPEED 40 MPH OR LESS: L = W x S  
S = NUMERICAL VALUE OF SPEED LIMIT  
W = WIDTH OF OFFSET SHOULDER TAPER = 1/3 L

10 ADVANCE WARNING FLASHING OR SEQUENCING ARROW PANEL

12 CLEAR ZONE (SEE GENERAL NOTE 16 ON SHEET 12)

- THESE DEVICES ARE OPTIMIZATION NEED TO BE DETERMINED BY DETOUR DESIGN AND/OF CONSTRUCTION ACTIVITY, AND ARE REQUIRED WHEN THEY ARE INCLUDED IN THE SCHEDULE OF CONSTRUCTION CONTROL DEVICES.

- THESE DEVICES ARE NOT OPTIMIZATION IF THE POSTED SPEED LIMIT IN THE WORK ZONE IS REDUCED.

VARY BUFFER SPACE (SEE GENERAL NOTE 21 ON SHEET 12).  
- REQUIRED WHEN WORK OCCUPIES THE LOCATION FOR MORE THAN 3 DAYS.

G20-11 SIGN IS REQUIRED WHEN SECTION 626 "PUBLIC INFORMATION SERVICES" PROJECT SPECIAL PROVISION WORKSHEET SPECIFICATION IS REQUIRED WITH PROJECT.

** MOBILE ATTENUATOR

FLASHING BEACON

- SEE FINES DOUBLE SIGNING NOTES ON SHEET 12.
**LEGEND**

- Channelizing devices for type of device to be used, see schedule of traffic control devices included in the plans drawings or vertical panels shall be used to delineate the lane closure taper.
- **Type III barricade**
- Concrete barrier (temporary)
- **Flagger**
- Direction of travel
- Work area

**TRANSPORTATION TAPER LIMITS**

\[ L = \text{minimum length of taper} \]
\[ S = \text{speed 40 MPH or less} \]
\[ W = \text{width of offset} \]

- Shoulder taper = \( \frac{1}{3} L \)
- Variable buffer space (see general note 21 on sheet 1).

- **These devices are optional.** Their need shall be determined by detour design and/or scope of construction activity and are required when they are included in the schedule of construction control devices.
- These devices are not optional if the posted speed limit in the work zone is reduced.
- Required when work occupies the location for more than 3 days.
- G20-11 sign is required when section 626 "Public Information Services" project special provisions are included in the work zone.
- Mobile attenuator
- Flashing beacon

---

**TYPICAL APPLICATION**

**Case No. 6**

- Lane #2 closure, multi-lane freeway
- Temporary yellow edge line
- Barricades

**Case No. 7**

- Lane #3 closure, multi-lane freeway
- Temporary white edge line
- Type III barricades

**Case No. 8**

- Lane #4 closure, multi-lane freeway
- G20-11 sign
- Temporary yellow edge line
- Barricades

---

**TRAFFIC CONTROLS FOR HIGHWAY CONSTRUCTION**

**STANDARD PLAN NO. S-630-1**

Issued By: Traffic & Safety Engineering Branch July 31, 2019

Traffic & Safety Engineering

MKB

Project Sheet Number: Standard Sheet No. 6 of 24
**LEGEND**

- **CHANNELIZING DEVICE:** For type of device to be used, see schedule of traffic control devices included in the plans. Drums or vertical panels shall be used to delineate the lane closure taper.

- **TYPE III BARRICADE**

- **CONCRETE BARRIER (TEMPORARY)**

- **FLAGGER**

- **DIRECTION OF TRAVEL**

- **WORK AREA**

- **SPEED LIMIT**

- **FINES**

- **CONSTRUCTION**

- **DOUBLE SPEED LIMIT**

- **TRAFFIC ZONE**

- **EDGE LINE**

- **ADVANCE WARNING FLASHING OR SEQUENCING ARROW PANEL**

- **VARIES**

- **BUFFER SPACE (SEE GENERAL NOTE 21 ON SHEET 1)**

- **THESE DEVICES ARE OPTIONAL. THEIR NEED SHALL BE DETERMINED BY DETOUR DESIGN AND/OR SCOPE OF CONSTRUCTION ACTIVITY, AND ARE REQUIRED WHEN THEY ARE INCLUDED IN THE SCHEDULE OF CONSTRUCTION CONTROL DEVICES.**

- **THESE DEVICES ARE NOT OPTIONAL IF THE POSTED SPEED LIMIT IN THE WORK ZONE IS REDUCED.**

- **FLASHING BEACON**

- **CONCRETE BARRIER (TEMPORARY) WITH LIGHTS**

- **SEE FINES DOUBLE SIGNING NOTES ON SHEET 12.**

**TYPICAL APPLICATION**

- **CENTER LANE CLOSURE - MULTI-LANE FREEWAY**

- **ONE LANE CLOSED - 4-LANE DIVIDED HIGHWAY**

- **SHOULDER WORK - FREEWAY/EXPRESSWAY**

**CASE NO. 9**

**TYPICAL APPLICATION**

**CENTER LANE CLOSURE - MULTI-LANE FREEWAY**

**CASE NO. 10**

**TYPICAL APPLICATION**

**ONE LANE CLOSED - 4-LANE DIVIDED HIGHWAY**

**CASE NO. 11**

**TYPICAL APPLICATION**

**SHOULDER WORK - FREEWAY/EXPRESSWAY**

**TRANSITION TAPER LENGTH:**

\[ L = \text{MINIMUM LENGTH OF TAPER} \]

- **SPEED 45 MPH OR MORE:**
  \[ L = S \times W \]

- **SPEED 40 MPH OR LESS:**
  \[ L = W; 0 \]

- **SHOULDER TAPER:**
  \[ \frac{1}{3} L \]

- **BUFFER SPACE:**
  \[ V \times 100 \]

- **S = NUMERICAL VALUE OF SPEED LIMIT OR 85 PERCENTILE SPEED**

- **W = WIDTH OF OFFSET**

- **L = MINIMUM LENGTH OF TAPER**

- **P = WIDTH OF OFFSET**

- **SPEED RANGE:**
  - **45 MPH OR MORE:**
  - **40 MPH OR LESS:**

- **DOUBLE WIDTH:**
  - **45 MPH OR MORE:**
  - **40 MPH OR LESS:**

- **FINES DOUBLE SIGNING NOTES ON SHEET 12.**

- **REQUIRED WHEN WORK OCCUPIES THE LOCATION FOR MORE THAN 3 DAYS.**

- **G20-11 SIGN IS REQUIRED WHEN SECTION 626 SPECIAL PROVISION WORKSHEET IS REQUIRED WITH PROJECT.**

- **SHEET 1.**

- **ISSUED BY:** Traffic & Safety Engineering Branch July 31, 2019

- **PROJECT SHEET NUMBER:**
  - S-630-1
  - Standard Sheet No. 7 of 24

- **COLORADO DEPARTMENT OF TRANSPORTATION**

- **2829 W. Alameda Pl.**
  - Denver, CO 80204
  - Phone: 303-757-0436
  - Fax: 303-757-8219

- **TRAFFIC CONTROLS FOR HIGHWAY CONSTRUCTION**

- **STANDARD PLAN NO.: S-630-1**

- **CREATED BY:** Roybal

- **LAST MODIFIED BY:** McMillan

- **COMPUTER FILE INFORMATION**

- **CREATION DATE:** 07/04/12

- **LAST MODIFICATION DATE:** 05/19/16

- **CAD VER.: MicroStation V8 Scale: Not to Scale Units: English**

- **ISSUED BY:** Traffic & Safety Engineering Branch July 31, 2019

- **PROJECT SHEET NUMBER:** S-630-1

- **STANDARD SHEET NO.: 7 of 24**
TYPICAL APPLICATION - TRAFFIC CONTROL ON FREEWAY NEAR AN OFF-RAMP

CASE NO. 12
TRAFFIC CONTROL ON FREEWAY NEAR AN OFF-RAMP

TEMPORARY WHITE EDGE LINES

TEMPORARY YELLOW EDGE LINES

TYPE III BARRIENCES

TEMPORARY RESET WHEN REQUIRED TO MAINTAIN VISIBILITY

TO BE PROVIDED EVERY 2640' OR THE SPACING OF THE SIGNS MAY BE CHANGED AS DIRECTED BY THE ENGINEER BETWEEN RS2-6A AND RS6-6B SIGNS.

CASE NO. 13
TRAFFIC CONTROL ON FREEWAY BEFORE AN ON-RAMP

TEMPORARY WHITE EDGE LINES

TO BE PROVIDED EVERY 2640' OR THE SPACING OF THE SIGNS MAY BE CHANGED AS DIRECTED BY THE ENGINEER BETWEEN RS2-6A AND RS6-6B SIGNS.

CASE NO. 14
TRAFFIC CONTROL ON FREEWAY ALLOWING ACCESS FROM ON-RAMP

TEMPORARY WHITE EDGE LINES

TO BE PROVIDED EVERY 2640' OR THE SPACING OF THE SIGNS MAY BE CHANGED AS DIRECTED BY THE ENGINEER BETWEEN RS2-6A AND RS6-6B SIGNS.

LEGEND

• CHANNELIZING DEVICES - FOR TYPE OF DEVICE TO BE UTILIZED ON SCHEDULE OF TRAFFIC CONTROL DEVICES INCLUDED IN THE PLANS, DRUMS OR VERTICAL PANELS SHALL BE USED TO DELINIMATE THE LANE CLOSURE TAPER.

• TYPE III BARRIACADE

CONCRETE BARRIER (TEMPORARY)

FLAGGER

DIRECTION OF TRAVEL

WORK AREA

TRANSITION TAPER LENGTH:

L = MINIMUM LENGTH OF TAPER

= 5 x W

SPEED 45 MPH OR MORE:

= 5 x W

SPEED 40 MPH OR LESS:

= 5 x W

S = NUMERICAL VALUE OF SPEED LIMIT

= 85 PERCENTILE SPEED

W = WIDTH OF OFFSET SHOULDER TAPER = 1/3 L

ADVANCE WARNING FLASHING OR SEQUENCING ARROW PANEL

CZ CLEAR ZONE (SEE GENERAL NOTE 16 ON SHEET 1).

• THESE DEVICES ARE OPTIONAL, THEIR NEED SHALL BE DETERMINED BY DETOUR DESIGN AND/OR SCOPE OF CONSTRUCTION ACTIVITY, AND ARE REQUIRED WHEN THEY ARE INCLUDED IN THE SCHEDULE OF CONSTRUCTION CONTROL DEVICES.

• THESE DEVICES ARE NOT OPTIONAL IF THE POSTED SPEED LIMIT IN THE WORK ZONE IS REDUCED.

VARES BUFFER SPACE (SEE GENERAL NOTE 20).

• REQUIRED WHEN WORK OCCUPIES THE LOCATION FOR MORE THAN 3 DAYS.

• G20-11 SIGN IS REQUIRED WHEN SECTION 626 "PUBLIC INFORMATION SERVICES" PROJECT SPECIAL PROVISION WORKSHEET SPECIFICATION IS REQUIRED WITH PROJECT.

MOBILE ATTENUATOR

FLASHING BEACON

• SEE FINES DOUBLE SIGNING NOTES ON SHEET 13.

Traffic & Safety Engineering

Issued By: Traffic & Safety Engineering Branch July 31, 2019

Project Sheet Number: S-630-1

Standard Sheet No. 8 of 24
CASE NO. 15
TYPICAL APPLICATION
BLASTING ZONE

CASE NO. 16
TYPICAL APPLICATION
RAMP CONSTRUCTION WHERE PARTIAL RAMP IS CLOSED

CASE NO. 17
TYPICAL APPLICATION
LANE CLOSURE, 2-LANE HIGHWAY, AT CURVE
LEGEND

- DIRECTION OF TRAVEL

A. THESE DEVICES ARE OPTIONAL. THEIR NEED WILL BE DETERMINED BY THE DESIGNER BASED ON DETOUR DESIGN AND/OR SCOPE OF THE CONSTRUCTION ACTIVITY, AND ARE REQUIRED WHEN THEY ARE INCLUDED IN THE PLANS.

- CONNECTING SPEED LIMITS

G20-5P WORK ZONE ADDED AFTER ALL ACCESSES ON DETOUR DESIGN AND/OR SCOPE OF THE CONSTRUCTION ACTIVITY, AND ARE REQUIRED WHEN THEY ARE INCLUDED IN THE PLANS.

FINES DOUBLE SIGNING NOTES:

1. SIGNS SHALL NOT BE PLACED SOONER THAN FOUR HOURS BEFORE WORK IS TO BEGIN AND SHALL BE REMOVED AS SOON AS WORK ACTIVITIES ARE CONCLUDED. IF POTENTIAL HAZARDS INTRODUCED AS A RESULT OF THE WORK ARE STILL PRESENT AT THE END OF THE WORK DAY IF SIGNS ARE LEFT IN PLACE AFTER WORK ACTIVITIES, THE TRAFFIC CONTROL SUPERVISOR SHALL MAKE AN ENTRY IN THEIR DAILY DIARY TO JUSTIFY THEIR USE.

2. SIGNS SHOULD ONLY BE PLACED WHERE WORKERS ARE PRESENT IN THE ROADWAY OR CLEAR ZONE OR ARE AT RISK, OR WHERE THERE ARE HAZARDS IN THE TRAVELWAY, SHOULDERS OR CLEAR ZONE.

3. SIGNS SHOULD BE PLACED SO THAT MOTORISTS IMMEDIATELY ASSOCIATE THE SIGNS WITH PRESENT WORK ACTIVITIES. IF THE ZONE OF WORK ACTIVITY MOVES, THE SIGNS SHOULD BE MOVED ACCORDINGLY.

4. SIGNING SHOWN IS REQUIRED TO ENFORCE DOUBLE FINES IN A WORK ZONE. ADDITIONAL SIGNING SHOULD BE ADDED AS NEEDED TO PROVIDE A MINIMUM 250' SPACING BETWEEN OTHER SIGNING REQUIRED FOR THE SPECIFIC WORK ZONE SETUP.
**LEGEND**

- **CHANNELIZING DEVICES** for type of device to be used, see schedule of traffic control devices included in the plans. Drums or vertical panels shall be used to delineate the lane closure taper.
- **TYPE III BARRIERS**
- **CONCRETE BARRIER** (temporary)
- **FLAGGER**
- **DIRECTION OF TRAVEL**
- **WORK AREA**

**CASE NO. 26**

**TYPICAL APPLICATION**

**SHOULDER WORK - FREEWAY/EXPRESSWAY w/ 65 MPH SPEED LIMIT**

*When hazards (workers, equipment, or temporary barriers) are within 8 ft of travel way*

**CASE NO. 27**

**TYPICAL APPLICATION**

**SHOULDER WORK - FREEWAY/EXPRESSWAY w/ 75 MPH SPEED LIMIT**

*When hazards (workers, equipment, or temporary barriers) are within 10 ft of travel way*
**CASE NO. 28**

**TYPICAL APPLICATION**

**ROCK SCALING - ROAD CLOSURE, 4-LANE DIVIDED HIGHWAY**

**ROCK SCALING X MILES**

BE PREPARED TO STOP

W5

W22-5000

W22-500

GRS-6a shall be placed not more than 500’ before the first speed limit sign array. Placement of these signs are to be directed by the engineer.

**G20-11 SIGN IS REQUIRED WHEN SECTION 626 "PUBLIC INFORMATION SERVICES" PROJECT SPECIAL PROVISION WORKSHEET SPECIFICATION IS REQUIRED WITH PROJECT.**

**BUFFER SPACE**

A step-down speed limit is required when there is more than a 15 MPH difference between the normal speed limit and the construction zone speed limit. Otherwise, this G20-5/R2-6’s sign assembly is not required.

**MOBILE ATTENUATOR (AT THE DISCRETION OF THE ENGINEER)**

These devices are optional. Their need shall be determined by detention design and/or scope of construction activity, and are required when they are included in the schedule of construction control devices.

These devices are not optional if the posted speed limit in the work zone is reduced.

G20-5 sign is required when section 626 "Public Information Services" project special provision worksheet specification is required with project.

See general note 21 on sheet 1.

**FLASHING BEACON**

See fines double signing notes on sheet 12.
A STEP-DOWN SPEED LIMIT IS REQUIRED WHEN THERE IS MORE THAN A 15 MPH DIFFERENCE BETWEEN THE NORMAL SPEED LIMIT AND THE CONSTRUCTION ZONE SPEED LIMIT. OTHERWISE THIS G20-5P/R2-1(XX) SIGN ASSEMBLY IS NOT REQUIRED.

CASE NO. 29
TYPICAL APPLICATION
LATE MERGING - ONE LANE CLOSED, 4-LANE DIVIDED HIGHWAY
CASE NO. 30
TYPICAL APPLICATION
ROUNDABOUT - PARTIAL CLOSURE NEAR ONE-LANE ROUNDABOUT

LEGEND

- Channelizing device; for type of device to be used, see the schedule of construction traffic control devices included in the plans. If project is designated as a "significant project" (see general note 26), a concrete barrier shall be used for channelization devices (temp) as determined by the engineer.
  - TYPE III BARRIERS
  - DIRECTION OF TRAVEL
  - WORK AREA
  - ADVANCE WARNING FLASHING OR SEQUENCING ARROW PANEL.

- These devices are optional; their need shall be determined by detour design and/or scope of construction activity, and are required when they are included in the schedule of construction control devices.
  - These devices are not optional if the posted speed limit in the work zone is reduced.
  - G20-10-SIGN IS REQUIRED WHEN SECTION 626 "PUBLIC INFORMATION SERVICES" PROJECT SPECIAL PROVISION WORKSHEET SPECIFICATION IS REQUIRED WITH PROJECT.

- Flashing beacon
  - Required when work occupies the location for more than 3 days.
  - See fines double signing notes on sheet 12.

- Mobile attenuator
  - Transition taper length:
    \[ L = \text{minimum length of taper} \]
    \[ \text{speed} = 45 \text{ MPH OR MORE} = 5 \times W \]
    \[ \text{speed} = 40 \text{ MPH OR LESS} = 60 \]
    \[ S = \text{numerical value of speed limit OR 85 PERCENTILE SPEED} \]
    \[ W = \text{width of offset} \]
    \[ \text{shoulder taper} = 1/3 \times L \]
  - See general note 21 on sheet 1.

- Flagger

**ROAD TYPE DISTANCE BETWEEN SIGNS**

<table>
<thead>
<tr>
<th>ROAD TYPE</th>
<th>DISTANCE BETWEEN SIGNS</th>
</tr>
</thead>
<tbody>
<tr>
<td>URBAN (&lt;= 40 MPH)</td>
<td>A</td>
</tr>
<tr>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>URBAN (&gt;= 45 MPH)</td>
<td>350</td>
</tr>
<tr>
<td>RURAL</td>
<td>500</td>
</tr>
<tr>
<td>EXPRESSWAY/FREeway</td>
<td>1000</td>
</tr>
</tbody>
</table>
A truck detour route may be necessary to divert trucks away from the roundabout circle. Also necessary is a street name and/or route number sign informing motorists where they need to exit the roundabout circle to enter the desired street and/or route number.

Channelizing devices for type of device to be used, see the schedule of construction traffic control devices included in the plans. If the project is designated as a "significant project" (see General Note 24), concrete barrier shall be used for channelization devices (temp) as determined by the engineer.

Legend

- A truck detour route may be necessary to divert trucks away from the roundabout circle. Also necessary is a street name and/or route number sign informing motorists where they need to exit the roundabout circle to enter the desired street and/or route number.
- Channelizing devices for type of device to be used, see the schedule of construction traffic control devices included in the plans. If the project is designated as a "significant project" (see General Note 24), concrete barrier shall be used for channelization devices (temp) as determined by the engineer.
- Type II barricade
- Advance warning flashing or sequencing arrow panel.
- These devices are optional; their need shall be determined by detour design and/or scope of construction activity and may be required when they are included in the schedule of construction control devices.
- These devices are not optional if the posted speed limit in the work zone is reduced.
- G20-11 Sign is required when section 626 "Public Information Specification is required with Project.
- Flashing beacon
- Required when work occupies the location for more than 3 days.
- See fines double signing notes on sheet 12.
- Mobile attenuator

<table>
<thead>
<tr>
<th>ROAD TYPE</th>
<th>L</th>
<th>S (mph or km)</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban (&lt;= 40 MPH)</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Urban (&gt;= 45 MPH)</td>
<td>350</td>
<td>350</td>
<td>350</td>
</tr>
<tr>
<td>Rural</td>
<td>500</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>Expressway/Freeway</td>
<td>1000</td>
<td>1500</td>
<td>2640</td>
</tr>
</tbody>
</table>

NOTE: Additional flaggers may be necessary to provide work zone access for construction vehicles.

SIGN SEQUENCE IS THE SAME FOR THE OPPOSITE DIRECTION OF BOTH HIGHWAYS.

CASE NO. 31
TYPICAL APPLICATION
ROUNDABOUT - INSIDE LANE CLOSURE FOR TWO-LANE ROUNDABOUT
**LEGEND**

- A truck detour route may be necessary to divert trucks away from the roundabout circle. Also necessary is a street name and/or route number sign informing motorists where they need to exit the roundabout circle to enter the desired street and/or route number.

- Channelizing devices for a type of device to be used, see the schedule of construction traffic control devices included in the plans. If project is designated as a "significant project" (see general note 26), concrete barriers shall be used for channelization devices (temp.) as determined by the engineer.

- Type 2 barricade

- Direction of travel

- Work area

- Advance warning flashing or sequencing arrow panel

- These devices are optional. Their need shall be determined by detour design and/or scope of construction activity and are required when they are included in the schedule of construction control devices.

- These devices are not optional if the posted speed limit in the work zone is reduced.

- G20-12 sign is required when section 626 "Public Information Information Services" project special provision worksheet specification is required with project.

- Flashing beacon

- Required when work occupies the location for more than 3 days.

- See fines double signing notes on sheet 12.

- Mobile attenuator

- Transition taper length:
  - L = minimum length of taper
  - Speed 45 mph or more: \( s \times \frac{w}{2} \)
  - Speed 40 mph or less: \( s \)
  - \( s \) = numerical value of speed limit
  - \( w \) = width of offset

- Shoulder taper = \( \frac{1}{3} L \)

- Buffer space

- See general note 21 on sheet 1.

- Flagger

---

**CASE NO. 32**

**ROUNDABOUT - OUTSIDE LANE CLOSURE FOR TWO-LANE ROUNDABOUT**

---

**ROAD TYPE** | **G20-12** | **G20-66** | **G20-10**
---|---|---|---
Urban (35-45 MPH) | 350 | 350 | 350
Urban (<= 35 MPH) | 350 | 350 | 350
Rural | 500 | 500 | 500
Expressway/Freeway | 1000 | 1000 | 1000

Traffic & Safety Engineering

Issued By: Traffic & Safety Engineering Branch July 31, 2019

Project Sheet Number: S-630-I Standard Sheet No. 19 of 24

---

**Computer File Information**

Creation Date: 07/04/12
Created By: Nakao
Last Modification Date: 06/23/16
Last Modified By: Nakao

---

**Traffic Controls for Highway Construction**
CASE NO. 33

TYPICAL APPLICATION *

ROUNDABOUT - PARTIAL CLOSURE FOR ONE-LANE ROUNDABOUT
MOBILE ATTENUATOR VEHICLE, TWO 360-DEGREE YELLOW FLASHING BEACONS, AND YELLOW FLASHING VEHICLE LIGHTS OR STROBES.

Legend:

- **VMS**: Variable Message Sign (VMS)
- **QB**: Mobile Attenuator Vehicle

When VMS is used, the "Shoulder Closed" sign becomes optional.

- The "Pick-up Vehicles" or "Warning Vehicle" may encroach into the traffic lane when the shoulder is too narrow to drive on.
- The variable separation distance between the "cone placement vehicle" and "cone pickup vehicle" shall be determined by the track drying time of the pavement marking material.
- Optional

Follow this distance chart for warning and mobile attenuator or cone pickup vehicle:

<table>
<thead>
<tr>
<th>Speed Limit (mph)</th>
<th>Following Distance (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 30</td>
<td>250 - 500</td>
</tr>
<tr>
<td>35 - 40</td>
<td>325 - 700</td>
</tr>
<tr>
<td>45 - 50</td>
<td>600 - 900</td>
</tr>
<tr>
<td>55</td>
<td>750 - 1200</td>
</tr>
<tr>
<td>60 - 65</td>
<td>1000 - 1400</td>
</tr>
<tr>
<td>70 - 75</td>
<td>1200 - 1600</td>
</tr>
</tbody>
</table>

Case No. 34
Typical Application
Mobile Shoulder Closure on 2-Lane Undivided Highway

Case No. 35
Typical Application
Centerline Striping on 2-Lane Undivided Highway

Note:

- The variable separation distance between the "cone placement vehicle" and "cone pickup vehicle" shall be determined by the track drying time of the pavement marking material.

* Use Case 35 if shoulder in Case 34 is too narrow for group vehicle use.
FOR CASE #36, VEHICLE/SIGN SEQUENCE IS THE SAME FOR THE LEFT SIDE OF HIGHWAY, WHILE TAPER IS MIRRORED ABOUT THE CENTER LANE, WHEN MOBILE WORK ZONE IS LOCATED ON THE LEFT SIDE OF HIGHWAY.

LEGEND

- MOBILE ATTENUATOR VEHICLE, TWO 360-DEGREE YELLOW FLASHING BEACONS, AND YELLOW FLASHING VEHICLE LIGHTS OR STROBES.
- ADVANCE WARNING FLASHING OR SEQUENCING ARROW PANEL.
- PORTABLE VARIABLE MESSAGE SIGN (VMS).
- WHEN THE VMS IS USED, THE "SHOULDER CLOSED" (W21-5aX or W21-5aX), AND "RAMP CLOSED AHEAD" SIGNS BECOME OPTIONAL.
- IF TRACKING OF THE WET PAINT IS ANTICIPATED, THE USE OF CONES OR STATIONARY "WET PAINT" SIGNS SHALL BE POSTED.
- THE VARIABLE SEPARATION DISTANCE BETWEEN THE "CONE PLACEMENT VEHICLE" AND "CONE PICKUP VEHICLE" SHALL BE DETERMINED BY THE TRACK DRYING TIME OF THE PAINTING MATERIAL.
- OPTIONAL

FOLLOWING DISTANCE CHART FOR WARNING VEHICLE AND CONE PICKUP VEHICLES

<table>
<thead>
<tr>
<th>POSTED SPEED LIMIT (MPH)</th>
<th>FOLLOWING DISTANCE (FEET)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 30</td>
<td>250 - 500</td>
</tr>
<tr>
<td>35 - 40</td>
<td>500 - 700</td>
</tr>
<tr>
<td>45 - 50</td>
<td>600 - 900</td>
</tr>
<tr>
<td>55 - 60</td>
<td>700 - 1000</td>
</tr>
<tr>
<td>60 - 65</td>
<td>1000 - 1400</td>
</tr>
<tr>
<td>70 - 75</td>
<td>1200 - 1600</td>
</tr>
</tbody>
</table>

NOTES

1. THE SIGNING VEHICLES MAY ENCROACH INTO THE TRAFFIC LANE WHEN THE SHOULDER IS TOO NARROW TO DRIVE ON.
2. IF THE RAMP CANNOT BE REOPENED WITHIN 15 MINUTES, USE CASE NO. 22 OF THE S-630-1 STANDARD PLAN.
**NOTES**

1. In a roadway where the AADT is 2,000 or less, a single work vehicle with appropriate warning devices on the vehicle may be used.

2. Radio communications between the workcrew and the moving blockade are required to adjust the blockade to increase or decrease the closure time, release traffic only after confirmation that all workers and their vehicles are clear of the roadway.

3. If applicable, all ramps and access between the moving blockade and work operation area shall be temporarily closed using traffic control equipment and personnel. Each ramp must remain closed until the crew doing the work gives the "all clear" signal or until the front of the moving blockade passes the closed ramps.

**FOLLOWING DISTANCE CHART FOR WARNING VEHICLE AND SIGNING VEHICLES**

<table>
<thead>
<tr>
<th>POSTED MAX SPEED LIMIT (MPH)</th>
<th>FOLLOWING DISTANCE (FEET)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 30</td>
<td>250 - 550</td>
</tr>
<tr>
<td>30 - 40</td>
<td>325 - 750</td>
</tr>
<tr>
<td>45 - 50</td>
<td>450 - 900</td>
</tr>
<tr>
<td>55 - 60</td>
<td>550 - 1200</td>
</tr>
<tr>
<td>60 - 65</td>
<td>1000 - 1400</td>
</tr>
<tr>
<td>70 - 75</td>
<td>1200 - 1600</td>
</tr>
</tbody>
</table>
TYPICAL CONSTRUCTION ZONE SIGNS

**WIDTH OF WORK ZONE** - The width of the work zone may be extended under special circumstances.

**TYPICAL SIGNS**

- "ROAD/WORK/NEXT XX MILES" - This sign shall be erected at the limits of any road advancement of a bridge or any other roadway feature that results in a significant narrowing of the pavement.
- "ROAD/DEFINE" - This sign is intended for use in a work zone area just above the work zone area.
- "YIELD AHEAD" - This sign is intended for use where traffic continues through the work zone area.
- "ROAD WORK/X MILE" - This is an advanced warning sign.

**SIGNS OF INTEREST**

- "ROAD/CLOSED" - This sign is to be mounted on the barricade that is placed before the work zone area to prevent traffic from entering the work zone area.
- "ROAD/CLOSED/(DIST.)" - This sign is intended for use in advance of a point at which through traffic must detour to a different road.
- "ROAD/CLOSED/TD/THRU TRAFFIC" - This sign should be placed where through traffic must detour to avoid the closure of the road some distance beyond, but where the road is open to local traffic up to the point of closure.
- "ROAD/WORK/ADVANCED WARNING" - This sign is intended for use in the work zone area, past downstream taper section.
- "ROAD/WORK/X MILE" - This sign is intended for use in advance of the initial roadway condition signs recommended speed on the turn to be 30 MPH or less.
- "REVERSE TURN ARROW" - This sign is intended for use where two turns are performed in a single curve.
- "REVERSE CURVE ARROW" - This sign is intended for use where two curves in opposite directions are separated by a tangent of less than 100 feet.
- "ARMED" - This sign should be mounted just below the road closed sign at the point where the detour roadway or route has been established due to the closure of the street or roadway.
- "DECHOICE" - This sign is intended for use where choice of routes is possible and the detour route is the more direct route.
- "DECHOICE" - This sign is intended for use in advance of a point where two routes are being considered.
- "NO TRUCKS" - This sign is intended for use on highways where trucks are prohibited.
- "NO SUGGESTED DISTANCES ARE PROVIDED AT THESE SPEEDS, AS THE PLACEMENT IS DEPENDENT ON THE ROADWAY CONDITIONS." - This sign is intended for use where no suggested distances are provided.

**ADVANCE PLACEMENT OF WARNING SIGNS**

<table>
<thead>
<tr>
<th>MPH</th>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>225</td>
<td>210</td>
<td>200</td>
<td>195</td>
<td>190</td>
<td>185</td>
<td>180</td>
<td>175</td>
</tr>
<tr>
<td>30</td>
<td>450</td>
<td>425</td>
<td>400</td>
<td>375</td>
<td>350</td>
<td>325</td>
<td>300</td>
<td>275</td>
</tr>
<tr>
<td>40</td>
<td>675</td>
<td>650</td>
<td>625</td>
<td>600</td>
<td>575</td>
<td>550</td>
<td>525</td>
<td>500</td>
</tr>
<tr>
<td>50</td>
<td>900</td>
<td>875</td>
<td>850</td>
<td>825</td>
<td>800</td>
<td>775</td>
<td>750</td>
<td>725</td>
</tr>
</tbody>
</table>

**ADDITIONAL INFORMATION**

- "NO TRUCKS" - This sign is intended for use where trucks are prohibited.
- "NO SUGGESTED DISTANCES ARE PROVIDED AT THESE SPEEDS, AS THE PLACEMENT IS DEPENDENT ON THE ROADWAY CONDITIONS." - This sign is intended for use where no suggested distances are provided.

**SUPPLEMENTARIES**

A supplemental sign may be used with warning signs specifying the distance to the condition if there is an intersection that might confuse the motorist.

**PLACEMENT**

- "MAY BE PLACED IN CONJUNCTION WITH MINOR MAINTENANCE AND PUBLIC UTILITY OPERATIONS FOR THE PROTECTION OF MEN WORKING IN OR NEAR THE ROADWAY.

**PLACEMENT**

- "SHOULD BE IN ACCORDANCE WITH PLACEMENT WARNING TABLE."
GENERAL NOTES

1. THE VARIOUS TYPES, COMBINATIONS AND APPLICATIONS OF SIGNS AND WARNING LIGHTS FOR BARRICADES REQUIRED FOR EACH PROJECT SHALL BE:
   A. AS SPECIFIED OR DETAILLED IN THE PLANS.
   B. AS SHOWN IN APPROPRIATE TYPICAL ILLUSTRATIONS.
   C. AS CALLED FOR AND SUBJECT TO APPROVAL BY THE ENGINEER.

2. TEMPORARY AND PERMANENT TYPE 3 BARRICADES SHALL BE FABRICATED FROM APPROVED CRASH TESTED MATERIALS, SEE SECTION 614 AND 630 OF THE STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION FOR ADDITIONAL REQUIREMENTS.

3. ALL PAINTING SHALL CONFORM TO THE FOLLOWING:
   A. THE APPLICABLE SECTION OF THE COLORADO SPECIFICATIONS.
   B. ALL SIGNS, BRACKETS AND POSTS SHALL BE PAINTED WITH 2 COATS OF EXTERIOR WHITE PAINT.
   C. THE INDOCESSES OF RAILS AND REFLECTIVE PANEL, CHAMBERING DEVICES FACING ONE DIRECTION OF TRAFFIC ONLY SHALL BE PAINTED WITH EXTERIOR WHITE PAINT.
   D. ALUMINUM OR GALVANIZED STEEL, ROOF BRACED AND POSTS SHALL NOT BE PAINTED.

4. ALL SIGNS SURFACES SHALL CONFORM TO THE FOLLOWING:
   A. THE CREATIVE AREA OF ORANGE AND WHITE STRIPES SHALL BE FABRICATED AS ONE PIECE.
   B. HORIZONTAL RAILS, WING RAILS AND VERTICAL PANELS, CHAMBERING DEVICES SHALL HAVE ORANGE AND WHITE STRIPES ON THE FACE SIDES SLANTING DOWNWARD AT A 45° ANGLE TO THE GROUND, WHICH WILL SLIDE TO THE RIGHT OR TURN.
   C. PERMANENT BARRICADES SHALL HAVE REFLECTIVE ORANGE AND WHITE STRIPES. THEY MAY BE USED AT LOCATIONS TO MARK THE END OF A ROAD, STREET OR HIGHWAY THAT ENDS AT A "T" INTERSECTION, OR WHERE THERE IS NO CROSSWALK OR OUTLET.
   D. REFLECTIVE SHEETING SHALL BE USED.

5. 5'MIN-0 11

6. ALL SCREWS, BOLTS, NUTS AND WASHERS SHALL BE GALVANIZED OR GALVANIZED PLATED.

7. STABILITY OF BARRICADES AND CHAMBERING DEVICES SHALL CONFORM TO THE FOLLOWING:
   A. SIGNS ASSEMBLED TO BARRICADES SHALL BE WEIGHED WITH SANDBAGS ONLY WHERE NECESSARY TO PROVIDE STABILITY.
   B. NO MOBILE OR PORTABLE DEVICES SHALL BE INSTALLED ON ANY METHOD OR ANY MATERIAL THAT WOULD MAKE THEM HAZARDOUS TO MOTORISTS.

8. WARNING LIGHTS USED WITH BARRICADES, DRUMS AND VERTICAL PANELS SHALL CONFORM TO THE FOLLOWING:
   A. USE FLASHER WARNING LIGHTS WHEN DEVICES ARE USED SIMULTANEOUSLY.
   B. THEY SHALL BE POSITIONED ABOVE THE TOP RAIL OF BARRICADES OR ON TOP DEVICES AND VERTICAL PANELS.

9. CONCRETE BARRIER TYPICALS SHALL CONFORM WITH THE FOLLOWING:
   A. CONCRETE BARRIER DEVICES AS SHOWN ON COLORADO STANDARD PLAN - 5602-1.
   B. BARREIERS REFLECTORS SHALL BE INSTALLED THAT MEET THE REQUIREMENTS OF THE STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION.

10. SIGN PANELS MOUNTED ON BARRICADES WILL BE PAID FOR SEPARATELY.
GENERAL NOTES

1. ALL ELECTRICAL MATERIALS AND WORKMANSHIP SHALL CONFORM TO THE LATEST REQUIREMENTS OF THE RELEVANT CODES, STANDARDS, AND LOCAL CODES OR ORDINANCES WHICH MAY APPLY, AND THE FOLLOWING:

A. IT IS THE CONTRACTOR'S RESPONSIBILITY TO OBTAIN A POWER SOURCE.

B. THE CONTRACTOR IS TO PROVIDE ALL NECESSARY WORK WITHIN THE BEACON AND FROM THERE TO THE POWER SOURCE. THE UTILITY COMPANY WILL MAKE THE CONNECTION WITH THE CONTRACTORS WORKING.

C. THE ELECTRICAL SERVICE BETWEEN A REMOTE POWER SOURCE AND THE FLASHING BEACON SHALL BE UNDERTAKEN OR AERIAL DROPPED AS AUTHORIZED BY THE ENGINEER.

D. IF POWER IS SUPPLIED BY SOLAR PANELS, THE SOLAR PANELS AND POWER BOX SHALL BE MOUNTED ON A SEPARATE POST SETTING IN THE CLEAR ZONE. IF BEHIND GUARD RAILS OR BARRIERS, MADE TO BE NOT LESS THAN 36" HIGH AND 36" WIDE, THE POST AND SHAL FACE AWAY FROM TRAFFIC. POWER BOXES SHALL BE BURIED SO THAT NO MORE THAN 5 INCHES IN THE BED ROADS IN Ground.

E. THE "FLASHER" SHALL BE HOUSED IN A SUITABLE ENCLOSURE ON THE UTILITY POLE AT THE POWER SOURCE UNLESS THE ENGINEER DIRECTS THAT THE ENCLOSURE BE MOUNTED ON THE BEACON POLE OR THAT THE DEVICE MAY BE CONTAINED WITHIN THE SIGNAL HEAD ITSELF.

F. A SUITABLE ENCLOSURE FOR THE FLASHER SHALL BE PROVIDED TODAY AND CONTAINING THE MATERIALS AS APPROVED BY THE ENGINEER. ALL ELECTRICAL COMPONENTS SHALL BE PROVIDED.. THE ENCLOSURE OR ENCLOSURE AS DIRECTED BY THE ENGINEER SHALL BE MOUNTED ON THE BEACON POLE OR THE DEVICE MAY BE CONTAINED WITHIN THE SIGNAL HEAD ITSELF.

G. SUN AND SIDEWALL LOCKOUT DEVICES AND A PROTECTION MECHANISM FOR THE "FLASHER" ENCLOSURE SHALL BE PROVIDED FOR EACH FLASHING BEACON.

H. AN AUTOMATIC AND MANUAL MECHANISM FOR TURING OFF THE "FLASHER" APPROPRIATE FOR THE FIELD CONDITION MAY BE PROVIDED, BUT THE SIGN SHALL BE COVERED WITH THE APPROPRIATE MATERIAL AS APPROVED BY THE ENGINEER OR THE SIGN SHALL BE TURNED OFF AND THE SIGN SHALL BE COVERED WITH THE APPROPRIATE MATERIAL AS APPROVED BY THE ENGINEER OR THE SIGN MAY REMAIN IN PLACE WHEN NOT APPLICABLE BUT LAYING THE "FLASHER" PANEL DOWN IN A HORIZONTAL POSITION IS NOT PERMITTED. ALL OTHER SIGNS THAT ARE NOT IN USE SHALL BE REMOVED FROM THE CLEAR ZONE. OTHER SIGNS SHALL NOT BE PLACED ON TOP OF BARRIERS OR WITHIN A MEDIAN.

2. TERMINAL POSTS SHALL BE IN ACCORDANCE WITH SECTION 61 OF THE STANDARD SPECIFICATIONS AS TO SIZE, ALTERNATE SIZE, STORAGE, TRENCHING, AND TRENCHING HOLES.

3. FOR LATERAL AND VERTICAL PLACEMENT OF FLASHING BEACON (PORTABLE), SEE COLORADO STANDARD PLAN 6-64-3, ISSUE C.

4. SIGNS MOUNTED ON THE MEDIAN OF DIVIDED HIGHWAYS WHERE MEDIAN BARRIER IS IN PLACE SHALL NOT USE A MOUNTING THAT "STRADDLES" MULTIPLE BARRIERS. THEY MAY BE MOUNTED ON A SINGLE BARRIER WITH A "BROACR" TYPE BRACKET. IF THE BRACKET ALLOWS THE MEDIAN PANEL TO BE TURNED PARALLEL TO THE ROADWAY, THE MEDIAN PANEL MAY REMAIN IN PLACE WHEN NOT APPLICABLE, BUT THE MEDIAN PANEL MAY NOT BE TURNED. IT IS NOT FACED TOWARD TRAFFIC.

5. BACKING ZET PANEL ATTACHMENT IS NOT REQUIRED. IF USED, SEE COLORADO STANDARD PLAN S-630-3.

TYPICAL ELECTRICAL SERVICE DETAILS

A. TYPICAL SIGNAL HEAD - 12" LENS

B. TYPICAL SIGNAL HEAD - 150 WATT LAMP (TYP)

C. TYPICAL SIGNAL HEAD - LED (TYP)

D. TYPICAL SIGNAL HEAD - 150 WATT LAMP (TYP)

E. TYPICAL SIGNAL HEAD - LED (TYP)

F. TYPICAL SIGNAL HEAD - 150 WATT LAMP (TYP)

G. TYPICAL SIGNAL HEAD - LED (TYP)

H. TYPICAL SIGNAL HEAD - 150 WATT LAMP (TYP)

I. TYPICAL SIGNAL HEAD - LED (TYP)

J. TYPICAL SIGNAL HEAD - 150 WATT LAMP (TYP)

K. TYPICAL SIGNAL HEAD - LED (TYP)

L. TYPICAL SIGNAL HEAD - 150 WATT LAMP (TYP)

M. TYPICAL SIGNAL HEAD - LED (TYP)

N. TYPICAL SIGNAL HEAD - 150 WATT LAMP (TYP)

O. TYPICAL SIGNAL HEAD - LED (TYP)

P. TYPICAL SIGNAL HEAD - 150 WATT LAMP (TYP)

Q. TYPICAL SIGNAL HEAD - LED (TYP)

R. TYPICAL SIGNAL HEAD - 150 WATT LAMP (TYP)

S. TYPICAL SIGNAL HEAD - LED (TYP)

T. TYPICAL SIGNAL HEAD - 150 WATT LAMP (TYP)

U. TYPICAL SIGNAL HEAD - LED (TYP)

V. TYPICAL SIGNAL HEAD - 150 WATT LAMP (TYP)

W. TYPICAL SIGNAL HEAD - LED (TYP)

X. TYPICAL SIGNAL HEAD - 150 WATT LAMP (TYP)

Y. TYPICAL SIGNAL HEAD - LED (TYP)

Z. TYPICAL SIGNAL HEAD - 150 WATT LAMP (TYP)
GENERAL NOTES

1. ALL SQUARE TUBING SIGN POST REQUIREMENTS ARE BASED ON A 10 OR 12-GAUGE THICKNESS, ACTON 60 GRADE 50 STEEL, A MINIMUM YIELD STRENGTH OF 36000 PSI AND A 10 MILE WIND LOAD. ALL U-CHANNEL SIGN POSTS REQUIREMENTS ARE BASED ON A MINIMUM YIELD STRENGTH OF 22000 PSI AND 80 MILE WIND LOAD.

2. STEEL, POSTS, BASE POSTS, AND SLIP BASES FOR ALUMINUM PANEL SIGNS SHALL BE SELECTED FROM THE CORRECT APPROVED PRODUCT LIST.

3. BASE POSTS SHALL NOT EXTEND MORE THAN 4" ABOVE GROUND LEVEL AND SHALL BE OF THE SAME WEIGHT/ GAUGE AND TYPE AS THE SIGN POST.

4. INTERMITTENTAL U-CHANNEL AND SQUARE TUBING POSTS, POSTS OF DIFFERENT WEIGHTS/GAUGES OR PRODUCT BRANDS IS PROHIBITED.

5. SUPPLEMENTAL SIGNS SHALL NOT BE ATTACHED DIRECTLY TO PRIMARY PANELS.

6. SPACING BETWEEN SUPPLEMENTAL PANELS AND PRIMARY PANELS SHALL NOT EXCEED 18".

7. SIGN PANELS PLACED PARALLEL TO TRAFFIC SHALL BE MOUNTED ON A MULTI-DIRECTIONAL BREACHWAY SYSTEM (SEE STANDARDS PLAN S-630-4, SHEET 2).

8. AN APPROVED SLIP BASE IS REQUIRED WITH THE DOUBLE POST AND TRIPLE POST INSTALLATION (SEE STANDARD PLAN S-630-4, SHEET 2).

9. SEE MANUFACTURER'S DRAWINGS FOR SPECIFIC ASSEMBLY INFORMATION. POST-TO-TOP BASES, INCLUDING TYPES OF NUTS, BOLTS, WASHERS, AND OTHER PARTS REQUIRED FOR PRODUCT USE.

10. LAP-SPLICE OF MULTI-DIRECTIONAL SLIP BASE MAY BE USED. SEE STANDARD PLAN S-630-4, SHEET 2.

LEGEND

● SEE GENERAL NOTE 1.
▲ SEE GENERAL NOTE 4.
▲▲ SEE GENERAL NOTE 8.
Ο SEE GENERAL NOTE 10.

SIGN POST REQUIREMENTS

<table>
<thead>
<tr>
<th>POST TYPE</th>
<th>POST SIZE</th>
<th>MAX CLEAR HEIGHT (FT.)</th>
<th>MAX SIGN AREA (SF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SQUARE TUBING</td>
<td>2.25&quot; X 2.25&quot;</td>
<td>12 GA</td>
<td>9</td>
</tr>
<tr>
<td>SQUARE TUBING</td>
<td>2.00&quot; X 2.00&quot;</td>
<td>12 GA</td>
<td>7</td>
</tr>
<tr>
<td>SQUARE TUBING</td>
<td>1.75&quot; X 1.75&quot;</td>
<td>12 GA</td>
<td>5</td>
</tr>
<tr>
<td>SQUARE TUBING</td>
<td>1.50&quot; X 1.50&quot;</td>
<td>12 GA</td>
<td>3</td>
</tr>
</tbody>
</table>

SINGLE POST INSTALLATION

(TOTAL SIGN AREA NOT TO EXCEED 36" X 36")

DOUBLE POST INSTALLATION

(TOTAL SIGN AREA NOT TO EXCEED 36" X 36")

TRIPLE POST INSTALLATION

(TOTAL SIGN AREA NOT TO EXCEED 36" X 36")

STANDARD PLAN NO. S-630-4

Traffic & Safety Engineering

MKB

STEELE SIGN SUPPORT (TEMPORARY) INSTALLATION DETAILS

BASE POST INSTALLATION DETAILS FOR SQUARE TUBING AND U-CHANNEL SYSTEMS

(SEE STANDARD PLAN S-630-4, SHEET 2 FOR MULTI-DIRECTIONAL SLIP BASE SYSTEMS)
**SQUARE TUBING SLIP BASE**

- **2½" x 2½" SQUARE TUBING (TYP.)**
- **3/16 GRADE 8 SERRATED FLANGE NUT**
- **¾-16 GRADE 8 FLANGED BOLT**
- **¾-16 CORNER BOLT**
- **TEFLOM RETAINER GASKET**
- **COMBINATION ANCHOR**
- **FLAT WASHER**
- **SOCKET-HEX ATTACHMENT BOLTS**
- **LOCK NUT**

**MULTI-DIRECTIONAL SLIP BASE POST DETAILS**

**STEEL SIGN SUPPORT**

- **TOP OF LOWER SLIP PLATE**
- **KEEPER PLATE**
- **LOCK WASHER**
- **FLAT WASHER**
- **SLIP SAFE ATTACHMENT BOLTS**
- **LOCK NUT**

**NOTICE**: BOLTS SHOULD BE TIGHTEN ½ TO 3/4 TURN AFTER SNUG.

**U-CHANNEL SLIP BASE**

- **TOP POST**
- **FLAT WASHER**
- **SLOT HEAD ATTACHMENT BOLTS**
- **KEEPER PLATE**
- **CASTING**

**NOTE**: BOLTS SHOULD BE TIGHTEN ½ TO 3/4 TURN AFTER SNUG.

**GENERAL NOTE**: THE CONTRACTOR SHALL INSTALL THE SOIL ANCHOR AND SLIP BASE PER THE MANUFACTURER'S RECOMMENDATIONS WITHOUT ADDITIONAL COMPENSATION.
TEMPORARY PORTABLE RUMBLE STRIP ARRAYS

1. TEMPORARY PORTABLE RUMBLE STRIP ARRAYS SHALL BE PLACED IN ADVANCE OF EACH FLAGGING STATION WHEN CALLED FOR IN THE PLANS.
2. TEMPORARY PORTABLE RUMBLE STRIP ARRAYS ARE USED TO SUPPLEMENT A SERIES OF ADVANCED WARNING SIGNS AND SHALL BE INSTALLED AND REMOVED WHEN THE SIGNS ARE INSTALLED AND REMOVED.
3. REMOVE THE TEMPORARY PORTABLE RUMBLE STRIPS PRIOR TO REMOVING THE ADVANCED WARNING SIGNS.
4. LANE WIDTHS SHOULD BE MAINTAINED THROUGH WORK ZONE TRAVEL LINES WHEREVER PRACTICAL.
5. DO NOT USE TEMPORARY RUMBLE STRIPS ON SLIPPERY SURFACES, SUCH AS WET OR SANDY PAVEMENT.
6. DO NOT USE TEMPORARY RUMBLE STRIPS ON HORIZONTAL CURVES.
7. USE TEMPORARY PORTABLE RUMBLE STRIPS ON ROADWAYS WITH POSTED WORK ZONE SPEED LIMITS OF 70 MPH OR LESS.
8. FOR THE LOWEST AIR TEMPERATURE TO APPLY THE TEMPORARY PORTABLE RUMBLE STRIPS ON ROAD PAVEMENTS, CONTACT THE TEMPORARY PORTABLE RUMBLE STRIP MANUFACTURER.
9. INSTALL PER MANUFACTURER’S RECOMMENDATIONS.
10. OPTIONAL RUMBLE STRIP TO INSTALL, AS DIRECTED BY THE ENGINEER.

OPTIONAL RUMBLE STRIP (SEE NOTE 10)

CASE NO. 1
TYPICAL APPLICATION
TWO-LANE UNDIVIDED HIGHWAY

GENERAL NOTES

- CHANNELED DEVICES FOR TYPE OF DEVICE TO BE USED, SEE THE SCHEDULE OF CONSTRUCTION TRAFFIC CONTROL DEVICES INCLUDED IN PLANS.
- DIRECTION OF TRAVEL
  - FLAGGER
  - WORK AREA
  - T = TERMINATION TAPER = 100'
  - S = WORK ZONE SPEED LIMIT
  - W = LANE WIDTH
  - L = MERGING TAPER (S > 45 MPH) = W x S
  - N = NUMBER OF DEVICES
  - N = NUMBER OF DEVICES AT TERMINATION TAPER = 5 (MIN.)

KEY TO ADVANCE SIZING DISTANCES

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<thead>
<tr>
<th>ROAD TYPE</th>
<th>DISTANCE BETWEEN SIGNS (FT.)</th>
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<tbody>
<tr>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>URBAN (S ≤ 45 MPH)</td>
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</tr>
<tr>
<td>URBAN (S &gt; 45 MPH)</td>
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</tr>
<tr>
<td>RURAL</td>
<td>500</td>
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</tbody>
</table>

LEGEND

- VARIETY - TEMPORARY PORTABLE RUMBLE STRIP ARRAY
- L - MERGING TAPER (S > 45 MPH) = W x S
- N - NUMBER OF DEVICES
- T - TERMINATION TAPER = 100'
- S - WORK ZONE SPEED LIMIT
- W - LANE WIDTH
- W20-4
- W20-7
TEMPORARY PORTABLE RUMBLE STRIP ARRAYS
(SEE DETAIL BELOW)

CASE NO. 2
TYPICAL APPLICATION
MULTI-LANE DIVIDED HIGHWAY WITH RIGHT LANE CLOSED

GENERAL NOTES

1. TEMPORARY PORTABLE RUMBLE STRIP ARRAYS ARE USED TO SUPPLEMENT A SERIES OF ADVANCED WARNING SIGNS AND SHALL BE INSTALLED AND REMOVED WHEN THE SIGNS ARE INSTALLED AND REMOVED.

2. REMOVE THE TEMPORARY PORTABLE RUMBLE STRIPS PRIOR TO REMOVING THE ADVANCED WARNING SIGNS.

3. LANE WIDTHS SHOULD BE MAINTAINED THROUGH WORK ZONE TRAVEL LANES WHEREVER PRACTICAL.

4. DO NOT USE TEMPORARY RUMBLE STRIPS ON SLIPPERY SURFACES, SUCH AS WET OR SANDY SURFACES.

5. DO NOT USE TEMPORARY RUMBLE STRIPS ON HORIZONTAL CURVES.

6. USE TEMPORARY PORTABLE RUMBLE STRIPS ON ROADWAYS WITH POSTED WORK ZONE SPEED LIMITS OF 75 MPH OR LESS.

7. FOR THE LOWEST AIR TEMPERATURE TO APPLY THE TEMPORARY PORTABLE RUMBLE STRIPS ON ROAD PAVEMENT, CONTACT THE TEMPORARY PORTABLE RUMBLE STRIP MANUFACTURER.

8. INSTALL PER MANUFACTURER'S RECOMMENDATIONS.

9. OPTIONAL RUMBLE STRIP TO INSTALL, AS DIRECTED BY THE ENGINEER.

LEGEND

- CHANNELIZING DEVICES FOR TYPE OF DEVICE TO BE USED SEE THE SCHEDULE OF CONSTRUCTION TRAFFIC CONTROL DEVICES INCLUDED IN PLANS.
- DIRECTION OF TRAVEL

WORK AREA

T = TERMINATION TAPER = 30D
S = WORK ZONE SPEED LIMIT
W = LANE WIDTH
L = Merging Taper (W < 45 MPH) = W/5
L = Merging Taper (W > 45 MPH) = (W/10)/10
N = NUMBER OF DEVICES AT TERMINATION TAPER = 5 (MIN.)

KEY TO ADVANCE SIGNING DISTANCES

<table>
<thead>
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<th>ROAD TYPE</th>
<th>DISTANCE BETWEEN SIGNS (FT.)</th>
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<th>B</th>
<th>C</th>
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<tbody>
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</tr>
<tr>
<td>URBAN (W &gt; 45 MPH)</td>
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<td>250</td>
<td>250</td>
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<tr>
<td>RURAL</td>
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<td>500</td>
<td>500</td>
<td>500</td>
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<tr>
<td>EXPRESSWAY/INTERSTATE</td>
<td>1,000</td>
<td>1,000</td>
<td>2,000</td>
<td>2,440</td>
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Last Modified By: DiNardo

Traffic & Safety Engineering MKB

PORTABLE RUMBLE STRIPS (TEMPORARY)

STANDARD PLAN NO.
S-630-5

Issued By: Traffic & Safety Engineering Branch July 31, 2019
Standard Sheet No. 2 of 2

Traffic & Safety Engineering
1. Consider adding temporary emergency pull-off areas when any of the following conditions exist:
   A. Both left and right shoulders will be closed simultaneously for a distance greater than 0.50 miles.
   B. Projects have been identified as "significant projects" (see page 1 of the COOT Work Zone Safety and Mobility Rule Procedures Document - January 2000).
   C. On divided highways with three or more lanes in each direction, the left or right shoulder is to be open where the opposite shoulder is to be closed.
   D. High crash locations have been identified within or near the work zone limits.
   E. Alternate places of refuge do not exist nearby.

2. Shoulder closures and emergency pull-off area signs and plaques shall be mounted on the side of the roadway where the shoulder is affected. Usage of these signs on the opposite side of divided highways is optional. All other signs on both sides of the work-affected roadway on divided highways.

3. For work areas greater than 1 mile in length, multiple emergency pull-off areas may be used at a spacing of 0.50 mile minimum and 1 mile maximum, or where appropriate, as designated by the engineer.

4. Emergency pull-off areas should not be located where adequate sight distances for acceleration and deceleration maneuvers would not exist. The location of temporary concrete barriers and construction activities occurring on both sides of the work-affected roadway on divided highways.

5. When temporary emergency pull-off areas are intended to serve as an accident investigation area, law enforcement personnel should be involved early in creating the traffic control plan.

6. For shoulder closures greater than 0.50 miles in length, advanced warning signs should be placed as follows:
   A. The first "shoulder closed" advanced warning sign should be attached to the first "shoulder closed" advanced warning sign in sequence.
   B. The second "shoulder closed" advanced warning sign should be replaced with either:
      - A "no emergency pull-off area" if no pull-off areas are provided throughout the work area.
      - A "emergency pull-off area" advanced warning sign with a W16-2a plaque if emergency pull-off areas are provided throughout the work area.

7. The temporary concrete barrier shall be tied to an existing structure or guard rail or extends to meet clear zone requirements, or fitted with an impact attenuator device.
TYPICAL PLACEMENT OF VMS

SYMBOLS

- PORTABLE VARIABLE MESSAGE SIGN (VMS)
- LAW ENFORCEMENT VEHICLE WITH FLASHING RED AND BLUE LIGHTS
- DIRECTION OF TRAVEL
- CHANNELING DEVICES- FOR TYPE OF DEVICE TO BE USED SEE SCHEDULE OF TRAFFIC CONTROL DEVICES INCLUDED IN THE PLAN.
- WORK AREA
- LENGTH OF ROLLING ROADBLOCK OPERATION

GENERAL NOTES

1. ROLLING ROADBLOCK IS A TRAFFIC CONTROL TECHNIQUE TO SLOW (STOP, IF NEEDED) TRAFFIC TO FACILITATE SHORT DURATION WORK OPERATIONS WITHOUT AN ELABORATE AND DIFFICULT DETOUR. TRAFFIC CONTROL LAW ENFORCEMENT OFFICERS PACE OR SLOW THE TRAFFIC TO A SPEED THAT PROVIDES APPROXIMATELY 20-30 MINUTES TO PERFORM THE SPECIFIED CONSTRUCTION.

2. ON THE DAY OF THE ROLLING ROADBLOCK OPERATION THE VARIABLE MESSAGE SIGNS SHALL BE REVISED TO INDICATE THE ACTIVITY WILL OCCUR THAT NIGHT OR DAY. THE ROLLING ROADBLOCK OPERATION BEGINS WITH A TRAFFIC CONTROL SUPERVISOR AT THE WORK SITE INITIATING THE PACING OPERATION IN ACCORDANCE WITH PACING DETAILS SHOWN ON SHEET 2. THE INTENT IS TO KEEP TRAFFIC MOVING UNLESS THERE IS AN EMERGENCY.

3. TRUCK-MOUNTED ATTENUATORS WITH VARIABLE MESSAGE SIGNS SHALL BE USED TO PROTECT CONSTRUCTION WORKERS AND/OR EQUIPMENT POSITIONED IN A TRAVEL LANE AT THE WORK AREA DURING THE ROLLING ROADBLOCK OPERATION FROM AN ERRANT VEHICLE. IF NO WORKERS AND/OR EQUIPMENT ARE POSITIONED IN A TRAVEL LANE AT THE WORK AREA, TRUCK-MOUNTED ATTENUATORS SHALL NOT BE USED.

4. WHEN MORE THAN ONE ROLLING ROADBLOCK OPERATION IS REQUIRED IN ONE WORK PERIOD, THE CONTRACTOR SHALL ALLOW SUFFICIENT TIME BETWEEN ROLLING ROADBLOCK OPERATIONS TO PERMIT TRAFFIC TO RETURN TO NORMAL SPEEDS AND FLOW. ADDITIONAL TIME MAY BE REQUIRED BETWEEN ROLLING ROADBLOCK OPERATIONS TO ALLOW TRAFFIC TO RESUME NORMAL SPEEDS AND FLOW UPSTREAM OF THE WORK AREA, AS DETERMINED BY THE ENGINEER OR THE REGION TRAFFIC ENGINEER.
ONE LANE RAMP

STAGE 1

MINIMUM OF FOUR (4) LAW ENFORCEMENT VEHICLES LOCATED UPSTREAM OF THE WORK AREA AT THE BEGINNING LOCATION OF THE ROLLING ROADBLOCK OPERATION WITH FLASHING BLUE LIGHTS OFF.

STAGE 2 NOTE:


STAGE 3

1. THE TWO (2) PACE-SETTING LAW ENFORCEMENT VEHICLES SHALL BEGIN TO SLOW TO THE PACING SPEED (10 MPH MINIMUM) FOR THE DURATION OF THE ROLLING ROADBLOCK OPERATION.

STAGE 4 NOTES:

1. WHEN THE PACE-SETTING LAW ENFORCEMENT VEHICLES ARE WITHIN APPROXIMATELY TWO (2) MILES OF THE WORK AREA, THE LEAD LAW ENFORCEMENT VEHICLE SHALL CLEAR THE TRAVEL LANE OF ALL EQUIPMENT AND DEBRIS IN ORDER TO REOPEN ALL TRAVEL LANES.
2. IN CASE OF EMERGENCY THE PACE-SETTING LAW ENFORCEMENT VEHICLES SHALL COME TO A COMPLETE STOP ONLY IF THEY REACH THE LEAD LAW ENFORCEMENT VEHICLE IF AN EMERGENCY IS ENCOUNTERED, THE LEAD LAW ENFORCEMENT VEHICLE SHALL CONTINUE TO CLEAR THE WORK AREA AND IMMEDIATELY NOTIFY THE CONTRACTOR TO CLEAR THE TRAVEL LANE WITH THE LEAD LAW ENFORCEMENT VEHICLE TO TURN OFF THEIR FLASHING BLUE LIGHTS.

TYPICAL APPLICATIONS

ROLLING ROADBLOCK - MULTI-LANE MAINLINE PACING DETAILS

STAGE 2

LEAD LAW ENFORCEMENT VEHICLE LOCATED APPROXIMATELY 500 FEET BEFORE WORK AREA ON SHOULDER.

STAGE 3

LEAD LAW ENFORCEMENT VEHICLE LOCATED APPROXIMATELY 500 FEET BEFORE WORK AREA ON SHOULDER.

STAGE 4

LEAD LAW ENFORCEMENT VEHICLE LOCATED APPROXIMATELY 500 FEET BEFORE WORK AREA ON SHOULDER.

TYPICAL APPLICATIONS

ROLLING ROADBLOCK - RAMP CLOSURE DETAILS

RAMP CLOSURE NOTES:

1. ONCE NOTIFIED BY THE TRAFFIC CONTROL SUPERVISOR TO BEGIN THE ROLLING ROADBLOCK OPERATION, EACH LAW ENFORCEMENT OFFICER LOCATED UPSTREAM OF THE RAMP SHALL TURN THEIR FLASHING BLUE LIGHTS ON AND PLACE THE VEHICLES ACROSS THE RAMP LANE TO CLOSE RAMP ACCESS.
2. ONCE THE ROLLING ROADBLOCK OPERATION PASSES THE CLOSED END OF THE LAW ENFORCEMENT VEHICLES ON THE RAMP, THE LEAD LAW ENFORCEMENT VEHICLE SHALL CLEAR THE WORK AREA AND IMMEDIATELY MOVE TO THE RIGHT SHOULDER OR AN AREA DESIGNATED BY THE TRAFFIC CONTROL SUPERVISOR AND TURN OFF THE FLASHING BLUE LIGHTS.

GENERAL NOTES:

2. IN CASE OF EMERGENCY THE PACE-SETTING LAW ENFORCEMENT VEHICLES SHALL COME TO A COMPLETE STOP ONLY IF THEY REACH THE LEAD LAW ENFORCEMENT VEHICLE IF AN EMERGENCY IS ENCOUNTERED, THE LEAD LAW ENFORCEMENT VEHICLE SHALL CLEAR THE TRAVEL LANE OF ALL EQUIPMENT AND DEBRIS IN ORDER TO REOPEN ALL TRAVEL LANES.

TYPICAL APPLICATIONS

ROLLING ROADBLOCK - RAMP CLOSURE DETAILS

RAMP CLOSURE NOTES:

1. ONCE NOTIFIED BY THE TRAFFIC CONTROL SUPERVISOR TO BEGIN THE ROLLING ROADBLOCK OPERATION, EACH LAW ENFORCEMENT OFFICER LOCATED UPSTREAM OF THE RAMP SHALL TURN THEIR FLASHING BLUE LIGHTS ON AND PLACE THE VEHICLES ACROSS THE RAMP LANE TO CLOSE RAMP ACCESS.
2. ONCE THE ROLLING ROADBLOCK OPERATION PASSES THE CLOSED END OF THE LAW ENFORCEMENT VEHICLES ON THE RAMP, THE LEAD LAW ENFORCEMENT VEHICLE SHALL CLEAR THE WORK AREA AND IMMEDIATELY MOVE TO THE RIGHT SHOULDER OR AN AREA DESIGNATED BY THE TRAFFIC CONTROL SUPERVISOR AND TURN OFF THE FLASHING BLUE LIGHTS.

GENERAL NOTES:

2. IN CASE OF EMERGENCY THE PACE-SETTING LAW ENFORCEMENT VEHICLES SHALL COME TO A COMPLETE STOP ONLY IF THEY REACH THE LEAD LAW ENFORCEMENT VEHICLE IF AN EMERGENCY IS ENCOUNTERED, THE LEAD LAW ENFORCEMENT VEHICLE SHALL CLEAR THE TRAVEL LANE OF ALL EQUIPMENT AND DEBRIS IN ORDER TO REOPEN ALL TRAVEL LANES.

TYPICAL APPLICATIONS

ROLLING ROADBLOCK - RAMP CLOSURE DETAILS

RAMP CLOSURE NOTES:

1. ONCE NOTIFIED BY THE TRAFFIC CONTROL SUPERVISOR TO BEGIN THE ROLLING ROADBLOCK OPERATION, EACH LAW ENFORCEMENT OFFICER LOCATED UPSTREAM OF THE RAMP SHALL TURN THEIR FLASHING BLUE LIGHTS ON AND PLACE THE VEHICLES ACROSS THE RAMP LANE TO CLOSE RAMP ACCESS.
2. ONCE THE ROLLING ROADBLOCK OPERATION PASSES THE CLOSED END OF THE LAW ENFORCEMENT VEHICLES ON THE RAMP, THE LEAD LAW ENFORCEMENT VEHICLE SHALL CLEAR THE WORK AREA AND IMMEDIATELY MOVE TO THE RIGHT SHOULDER OR AN AREA DESIGNATED BY THE TRAFFIC CONTROL SUPERVISOR AND TURN OFF THE FLASHING BLUE LIGHTS.

GENERAL NOTES:

2. IN CASE OF EMERGENCY THE PACE-SETTING LAW ENFORCEMENT VEHICLES SHALL COME TO A COMPLETE STOP ONLY IF THEY REACH THE LEAD LAW ENFORCEMENT VEHICLE IF AN EMERGENCY IS ENCOUNTERED, THE LEAD LAW ENFORCEMENT VEHICLE SHALL CLEAR THE TRAVEL LANE OF ALL EQUIPMENT AND DEBRIS IN ORDER TO REOPEN ALL TRAVEL LANES.
BEGIN ROLLING ROADBLOCK OPERATION

**DESIGN NOTES:**

1. The design shall evaluate the actual distance required for the rolling roadblock operation based on site-specific features such as roadway geometrics, pacing speeds, regulatory speed, interchange spacing, work duration, availability of law enforcement officers, traffic volumes, and maximum queue length.

2. The starting point of a rolling roadblock operation shall consider the following factors: the speed of the pacing law enforcement vehicles, the location of emergency ramps, horizontal and vertical alignment of the facility.

3. In some instances, it may be necessary to close a lane at the work site to position a crane and the materials to be lifted.

4. All material to be installed shall be on-site before the rolling roadblock operation begins.

5. It may be necessary to install temporary barrier walls to protect pre-positioned and assembled materials in the right-of-way.

6. The minimum speed allowed for a pacing operation is 10 MPH.

---

SR = REGULATORY SPEED, MPH
Sp = PACING SPEED, MPH
Tw = WORK DURATION, MINUTES
L = TOTAL PACING DISTANCE, MILES
Lw = DISTANCE PACE-SETTING LAW ENFORCEMENT VEHICLES TRAVEL WHILE CONSTRUCTION WORK IS PERFORMED.

---

**PACING DISTANCES, L (MILES)**

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<th>Sp</th>
<th>Lw</th>
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<tbody>
<tr>
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<td>11.6</td>
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<tr>
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</tr>
</tbody>
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**PACING DISTANCES NOTES:**

Tw is the total time allowed for work activity, in minutes. This time starts just after the last vehicle traveling at the pre-pacing regulatory speed clears the work area and ends just as the rolling roadblock operation reaches the work area. Demand volume may not exceed 1,150 PCPL without a site-specific design. Traffic volumes must be converted to PCPL using the following equation:

PCPL = PASSENGER CARS PER HOUR PER LANE

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**SITESPECIFIC DESIGN REQUIRED**

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